The Coniferous Forest Bird Conservation Plan

A Strategy for Protecting and Managing Coniferous Forest Habitats and Associated Birds in California

Version 1.1
March 2002

A project of California Partners in Flight
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Klamath Bird Observatory
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Financial Contributors:
USDA Forest Service
Packard Foundation
National Fish and Wildlife Foundation
PRBO Conservation Science
Klamath Bird Observatory

Acknowledgements:
California Partners in Flight wishes to thank everyone who helped write, promote, and produce this document. Special thanks to Laurie Fenwood, Geoffrey Geupel, Aaron Holmes, Genny Wilson, Ryan Burnett, and Doug Wallace, and to Sophie Webb for her cover illustration.

Recommended Citation:
CalPIF (California Partners in Flight). 2002. Version 1.1. The coniferous forest bird conservation plan: a strategy for protecting and managing coniferous forest habitats and associated birds in California (J. Robinson and J. Alexander, lead authors). PRBO Conservation Science, Petaluma, CA. http://www.prbo.org/calpif/plans.html.

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Executive Summary

The California Coniferous Forest Bird Conservation Plan (Conservation Plan) has been developed to help guide conservation policy and action on behalf of coniferous habitats and associated landbirds throughout California. The Conservation Plan is a synthesis of the current state of knowledge concerning birds in California's coniferous forests and the problems they face. Recommendations presented here can be used by land managers to support viable populations of birds that depend on these forests for breeding.

The Conservation Plan is the first iteration of a continuous process of developing and updating habitat conservation recommendations for coniferous forests based on the latest available scientific monitoring and research data. This plan provides the foundation for adaptive conservation planning in California's coniferous forests. The adaptive management process encourages land managers to implement science-based recommendations through restoration and management activities, and scientists to monitor the consequent effects on wildlife. As new data become available through these monitoring efforts, scientists revise recommendations and managers amend their work plans accordingly. Thus, scientists and managers create a steady feedback loop and consistently improve their methods for conserving native habitats and wildlife species.

This is not a regulatory document, nor does it represent the policies of any agency or organization. An associated GIS database of bird monitoring records in coniferous forests catalogues new information and provides new analyses for updating conservation recommendations and goals. Analyses of bird data and species maps will be posted on PRBO Conservation Science's website (http://www.prbo.org/calpif/plans.html), periodically updated, and made available for use by the public. This Conservation Plan is therefore a dynamic, "living" document.

Biological Need

Many of California's birds and other wildlife depend upon coniferous forests. A large array of such forests exists within the state, encompassing a number of habitat types. Associated bird communities are also quite varied, with some species quite specialized in the forest type required for breeding, and others that are generalists and can be found in numerous coniferous forest habitats across the state. In California, where approximately 45% of the landmass is covered with coniferous forests (Davis et al. 1998), a century of intensive resource extraction and forest management has led to major changes in the amount and quality of such habitat. Problems that the forests have faced include loss of habitat to logging, lack of replacement of old-growth stands due to harvest rotations of insufficient length in time; changes in forest structure due to fire suppression; elimination of snags and dead trees, and fragmentation. Bird and other wildlife populations have subsequently been altered by such changes; declines and extirpations have been observed in a number of species, some of which are now afforded special status at the federal or state level. Others will likely require such protection in the future, if efforts are not employed to curb these declines.

Many public land managers are currently restoring or mimicking natural processes in order to return some of the California's forests to their proper state. It is crucial that such practices are encouraged on both public and private lands and that the effects on birds and other wildlife are monitored. Because birds respond so quickly to changes in their environment, they are great indicators of the success (or failure) of restoration and management practices. However, the time scale required to reinstate these natural processes and sustainable changes to coniferous habitats may exceed the expediency necessary for reversing songbird declines. In the interim it may be necessary to artificially recreate ideal attributes of the forest (e.g., artificial perches and nest boxes for Great Gray Owls, girdling of large trees in forests which lack snags to provide nest sites for Pileated Woodpeckers or Vaux's Swifts, thinning of dense forests to create a more open canopy and allow resurgence in understory growth) to stem the further decline of many coniferous forest breeding birds.

California Partners in Flight

This plan is a product of the California chapter of Partners in Flight (Cal PIF), established in 1992. Partners in Flight (PIF) is an international initiative designed to coordinate non-game landbird conservation efforts with the objective of stopping and reversing population declines noted in many species of non-game landbirds. It is a voluntary, international coalition of governmental agencies, conservation groups, academic institutions, private businesses and individuals dedicated to "keeping common birds common.

Why A Statewide Coniferous Forest Conservation Plan?

A number of coniferous forest plans have been created to better manage these forests for wildlife. Most of these plans have targeted specific regions or specific forest types. Management plans incorporating an avifaunal component have been written for the Sierra Nevada mountain range; these include the Avian Conservation Plan for the Sierra Nevada Bioregion (Siegel and DeSante 1999), the Sierra Nevada Ecosystem Project (Davis and Stoms 1996), and the subsequent Sierra Nevada Forest Plan Amendment Final Environmental Impact Statement (USDA 2001). However the need remains for a reference resource encompassing the entire state of California, inclusive of all coniferous habitat types and bioregions.

Birds are excellent indicators of ecosystem health. By designing a conservation plan based on avian habitat requirements, planners also conserve many other elements of the ecosystem. Different bird species have a wide variety of nesting and foraging needs, filling every niche of a forest system, and each type of coniferous habitat has an associated suite of species dependent upon it. Natural processes such as fire are responsible for the forest condition but many such processes have been dramatically altered by a century's worth of intensive land management practices. Monitoring the responses of bird species to management techniques and changes is an extremely effective way of monitoring changes to the habitat.

The Planning Process

Conservation planners have found it useful to concentrate on a few "focal" species, whose requirements represent a spectrum of habitat characteristics and types. These species help define which spatial and compositional attributes characterize a healthy ecosystem and guide the development of appropriate management regimes. A landscape designed and managed to meet the focal species' needs encompasses the requirements of other species (Lambeck 1997). Because coniferous forests are so varied - in both habitat type and age of stand - it is necessary to look at bird species with specialized needs for specific habitat parameters as well as those which are generalists across forest types. The presence of birds with specific needs in an appropriate habitat will reflect the quality and attributes of that habitat. Conversely, the absence of such species in an otherwise appropriate habitat is reflective of a problem within that habitat or stand (e.g., Black-backed Woodpeckers missing in a yellow pine forest due to an insufficient number of dead trees present). By recognizing the minimum acceptable requirements for the species with the most extreme needs, managers will more effectively conserve all species using the habitat by targeting that need with their management practices.

The Coniferous Forest Bird Conservation Plan synthesizes and summarizes the current scientific knowledge of the requirements of birds in coniferous habitats of California. It includes species-specific recommendations for special status species or those with specialized requirements that breed in California's coniferous forests, and it also includes population targets to achieve healthy, sustainable populations of these species. However, the emphasis of the Coniferous Forest Bird Conservation Plan is on multiple-species management; therefore over 40 conservation recommendations apply to overall habitat protection, restoration management, monitoring, and policy. This plan also provides an overview of issues of particular importance in each of California's 10 bioregions, as defined by the California Biodiversity Council.

The conservation recommendations describe desired habitat characteristics, the natural community, and possible factors influencing birds during the nesting season. They serve as flexible guidelines, helping land managers and landowners to develop work plans that accommodate their needs while enhancing habitat characteristics that best benefit wildlife.

We recognize that discussing issues of public and private land management is often a contentious undertaking. This may be particularly true in coniferous forests, which are heavily managed and highly valued for timber resources. The development of this Conservation Plan depends on a philosophy of open-minded inquiry into effective land use from the standpoint of landowners, land managers, and wildlife. Solutions benefiting all parties involved are the most likely to be implemented and sustained. California Partners in Flight strongly supports projects that work with private landowners and public land managers to improve land management schemes for both wildlife and resource-dependent economies.

Chapter 1. Introduction

This Conservation Plan is one of many to be created under the aegis of the national organization known as Partners in flight (PIF), which seeks to protect North American landbirds throughout their ranges. The California chapter of Partners in Flight (CPIF) seeks to promote the conservation and restoration of coniferous forests in order to support the long-term viability and recovery of native bird populations and associated species.

Goals of the CPIF Coniferous Forest Bird Conservation Plan
The goals of the Coniferous Forest Bird Conservation Plan are five-fold:

- **Highlight the need for conservation of California's coniferous forests and the bird species that use them.** This will include identifying many of the problems that currently affect birds which breed in coniferous forest habitats.
- **Bring clarity to the complexity of managing California's diverse array of coniferous forest habitats.** Sawyer and Keeler-Wolf (1995) identified at least 37 distinct vegetation series within California where one conifer species dominates the community. This astounding statistic highlights the difficulty involved with preparing a single conservation plan that spans the breadth and scope of coniferous forest habitats in California. Chapter 3 covers the diversity of California's coniferous forest habitats in depth.
- **Identify conservation objectives and management actions that may be used to conserve key, focal species.** For many of the focal species identified, population targets and species-specific recommendations are presented (Chapter 5) and specific conservation actions are recommended (Chapter 7).
- **Provide a template that facilitates the use and implementation of this conservation plan.** The conservation planning process is summarized in Chapter 2 and specific implementation tools and resources are presented in Chapter 8.
- **Summarize outreach and education opportunities that may exist beyond this conservation plan.** Outreach and educational opportunities, tools, and resources are covered in detail in Chapter 9.

The Rationale for Conservation
The rationale for conservation can be articulated from an ecological, intrinsic value or utilitarian perspective. The ecological perspective emphasizes the critical role that birds play in ecosystems, which implies that the effects of declining bird abundance in coniferous forests would extend far beyond the loss of bird species. The intrinsic perspective recognizes the intrinsic value of plants, animals, and the inanimate environment above and beyond the material value of those components. The utilitarian, or humanist, perspective focuses on direct, tangible benefits that people and society derive from ecosystem "services," such as the role that neotropical migrants play in control of forest insect pests.

Regardless of one's philosophical bent, it is undeniable that California's coniferous forests have been heavily impacted by resource extraction industries such as timber

harvest, grazing and mining, and by long-term fire suppression practices. For example, California timber production from 1995 to 1999 hovered at just over 2 billion board feet per year, with the vast majority of this being softwoods (State Board of Equalization, www.countingcalifornia.cdlib.org). Strong evidence suggests that logging practices have decreased the abundance of almost all permanent resident bird species and half the migrants in coniferous forests (Hejl 1994). However, forests are also experiencing the effects of increasing recreational demands, encroaching urbanization and rural sprawl, which all stem from a burgeoning populace. Well-known for their towering redwoods, California's forests also supply recreation in the form of hiking, camping, skiing, snowmobiling, mountain biking, off-road vehicles, wildlife viewing and hunting.

With sufficient effort to monitor birds in key areas of California's forests, it is likely that the effects of all these growing uses on birds can be quantified, and land management improved accordingly. Because birds often make good ecosystem indicators, this information will have far-reaching implications for maintaining the overall health of California's coniferous forest.

Chapter 2. Conservation Planning Process

Partners in Flight - Keeping Common Birds Common
Partners in Flight (PIF) is an international initiative designed to coordinate non-game landbird conservation efforts with the objective of stopping and reversing population declines noted in many species of non-game landbirds. It is a voluntary, international coalition of governmental agencies, conservation groups, academic institutions, private businesses and individuals dedicated to "keeping common birds common."

The California chapter of Partners in Flight (Cal PIF) was established in 1992. The first phase of this initiative called for the completion of scientifically based bird conservation plans for every physiographic area or state in North America. An impressive collaborative effort across the country has brought this phase close to completion. Current phases call for the transition from planning to implementation, which is well under way in many regions, including California, thanks to financial support received from the Packard Foundation and the National Fish and Wildlife Foundation, as well as contributions of staff time and money from many partner agencies and organizations.

Coordinated Conservation Planning
The PIF process involves an unprecedented level of voluntary cooperation and coordination among state and federal agencies, private organizations, industry, and the public. The power in this process lies in the synergy that builds when such diverse and committed groups work together for a common goal. It lays the groundwork for international cooperation on long-term conservation of all birds throughout this hemisphere. The PIF approach differs from many existing federal and state-level listing processes in that it (1) is voluntary and nonregulatory, and (2) focuses proactively on relatively common species in areas where conservation actions can be most effective, rather than the frequent local emphasis on rare and peripheral populations. PIF Bird Conservation Plans therefore provide the framework to develop and implement habitat conservation actions on the ground that may prevent the need for future species listings.

The North American Bird Conservation Initiative
In 1998, participants at a meeting of the International Association of Fish and Wildlife Agencies developed a vision to link all of the major bird conservation initiatives in Canada, the U.S. and Mexico (CEC 1998). This program, known as the North American All Bird Conservation Initiative (NABCI), seeks to achieve regionally based, biologically-driven, landscape-oriented partnerships that deliver the full spectrum of bird conservation across the North American continent and that support simultaneous, on-the-ground delivery of conservation for all birds.

The purpose of the North American Bird Conservation Initiative (NABCI) is to ensure the long-term health of North America's native bird populations by:

- increasing the effectiveness of existing and new initiatives,
- enhancing coordination,
- fostering greater cooperation among the nations and peoples of the continent; and

- building on existing structures such as joint ventures, and stimulating new joint ventures and mechanisms as appropriate.

NABCI encourages development, completion of, and linkages among North American bird conservation efforts that are guided by frameworks enabling coordinated planning, implementation, and evaluation. These frameworks include:

- the Mexican Bird Conservation Strategy
- the North American Waterfowl Management Plan
- the Western Hemisphere Shorebird Reserve Network
- in Canada and the United States,
  - Partners In Flight
  - National Shorebird Conservation Plans
  - National Colonial Waterbird/Seabird Conservation Plans
- new bird conservation initiatives as they emerge

In 1999, at the North American Wildlife and Natural Resources Conference, an Interim NABCI-U.S. Steering Committee was created to help guide the development of the U.S. component of the overall NABCI, and to draft a vision document for bird conservation in the United States. State, provincial, federal, and non-governmental representatives from Canada, Mexico, and the U.S. have adopted an ecological framework that facilitates coordinated conservation planning, implementation, and evaluation among major bird initiatives. These **Bird Conservation Regions (BCRs)** were defined by adopting the hierarchical framework of nested ecological units delineated by the Commission for Environmental Cooperation (CEC).

California is encompassed within five BCRs: the Pacific Northwest region, the Sierra Nevada region, the Coastal California region (which includes the Central Valley), the Great Basin region, and the Sonoran and Mojave Deserts region. Conservation in priority habitats of California will be encouraged by enlarging the efforts of existing joint ventures under the North American Waterfowl Management Plan, by creating new joint ventures, organized regionally around specific habitats and habitat conservation goals, and through other creative collaborative efforts.

The following is only a partial list of the programs and agencies with which Cal PIF intends to interface in implementing this plan:

Northwest Forest Plan (President's Forest Plan)
Sierra Nevada Forest Plan Amendment (Sierra Nevada Framework)
The California Biodiversity Council
The Coordinated Resource Management Plan Council
Natural Communities Conservation Planning Program
Natural Resources Conservation Service
Regional Council of Rural Counties

The Coniferous Forest Bird Conservation Plan

The Coniferous Forest Bird Conservation Plan is one of a series of scientifically based bird conservation plans produced by California Partners in Flight (Cal PIF) for every major habitat type in California. This series of conservation plans is the foundation for PIF's long-term strategy for bird conservation. The Coniferous Forest Bird Conservation Plan has been developed cooperatively by leading bird researchers in California through a process designed to:

- Capture the conservation needs of the complete range of coniferous habitat types throughout the state.
- Develop, by consensus, biological conservation objectives for selected coniferous forest bird species.

Basic Principles of PIF Bird Conservation Planning

- conservation when it should be done -- before species become endangered
- conservation based on sound science
- conservation that stresses both healthy ecosystems and wise management of natural resources
- local and timely conservation within the context of large-scale objectives and long-term plans
- conservation of habitats in breeding, migration, and wintering areas
- an informed constituency of people concerned about bird conservation
- groundbreaking partnerships that foster voluntary cooperation among public and private landowners

Prioritizing Habitats

The national PIF program requested that state working groups define and prioritize the most threatened habitat types in each region, weighted by their importance to birds. In California, riparian habitats were unanimously chosen as the top priority because they provide the richest habitats for both breeding and wintering birds (Miller 1951, Cogswell 1962, Gaines 1977, Manley and Davidson 1993). Other high priority habitats were outlined and included coniferous forests, oak woodlands, coastal scrub and chaparral, and grasslands. One bioregion, the Sierra Nevada, was also identified as a priority for this conservation planning effort.

Focal Species

Because birds occupy a wide diversity of ecological niches, they serve as useful tools in the design of conservation efforts (Martin 1995, Askins 2000). Birds are relatively easy to monitor in comparison with other taxa and can serve as "focal species", whose requirements define different spatial attributes, habitat characteristics and management regimes representative of a healthy system.

For example, the bird that requires the largest area to survive in a certain habitat will determine the minimum suitable area for that habitat type. Likewise, the requirements of non-migratory birds that disperse short distances to establish new territories will define

the attributes of connecting vegetation. The species with the most demanding or exacting requirements for an ecological characteristic such as territory size determines its minimum acceptable value in an area that is protected or managed for biodiversity. Therefore, the assumption is that a landscape designed and managed to meet the focal species' needs encompasses the requirements of other species (Lambeck 1997).

Our strategy for achieving functioning coniferous forest ecosystems for land birds is described through the habitat requirements of 13 "focal species". By managing for a group of species representative of important components in a functioning coniferous forest ecosystem, many other species and elements of biodiversity will also be conserved.

The following 13 focal species were selected based on their conservation need and/or degree of association with important habitat attributes in coniferous forests of California. A species-specific conservation plan has been prepared for each of these species:

Black-backed Woodpecker
Black-throated Gray Warbler
Brown Creeper
Dark-eyed Junco
Flammulated Owl
Fox Sparrow
Golden-crowned Kinglet
MacGillivray's Warbler
Olive-sided Flycatcher
Pileated Woodpecker
Red-breasted Nuthatch
Vaux's Swift
Western Tanager

Secondary Species
These species will have a *species account summary* written up and be included in considerations of the recommendations presented in Chapters 5 and 7 of this plan.

Cassin's Finch
Chipping Sparrow
Clark's Nutcracker
Gray Flycatcher
Gray Jay
Mountain Quail
Purple Finch
Spotted Owl
Steller's Jay
Yellow-rumped Warbler

Bioregional Notes
It was decided that some species are very important in certain bioregions (such as the Varied Thrush in coastal redwoods) and deserved mention in various parts of the Coniferous Forest Bird Conservation Plan. However, a species-specific conservation plan has not been prepared for most of these species. These species (and their associated habitats) include:

Great Gray Owl— Douglas-fir
Marbled Murrelet— coastal redwoods
Pinyon Jay— pinyon juniper
Plumbeous Vireo— pinyon juniper
Townsend's Solitaire— pinyon juniper
Varied Thrush— coastal redwoods

Achieving Results
California's forests are managed by a wide variety of public agencies and private industry. An implementation plan would be useful to achieve the goals set forth in this Conservation Plan. The implementation plan included herewith will provide a framework for partners to set bioregional coniferous forest habitat conservation priorities that benefit forest-associated species.

The implementation plan should define the specifics of local, bioregional conservation efforts and will define bioregional priorities for acquisition, restoration, and more focused conservation efforts. The implementation process will include a series of local workshops designed to:

- Familiarize local organizations with the Conservation Plan
- Identify local initiatives, projects, and organizations capable of working as local partners to achieve habitat and population targets
- Develop conservation/restoration acreage objectives based on inventory, assessment and biological need

Chapter 3. Coniferous Forest Habitats

This chapter of the Coniferous Forest Bird Conservation Plan strives to place the discussion of coniferous forest bird species within the context of landscape habitat types. Six habitat accounts are used to describe the variety of coniferous forests that occur in California. Within each account we list the Conservation Plan Focal Species that are found within the respective habitats. Following the habitat accounts is a general discussion of the specific conservation issues that face coniferous forest habitat types in California. A seventh, non-coniferous forest habitat is introduced in this section, that of montane shrublands occurring within the elevational zone of coniferous forests. The management issues and ecological processes of this habitat are most directly affected by coniferous forest management.

Developing a system to identify and describe habitat types in a way that is familiar to most land managers within California is a complex task in that there is a diversity of both habitats and habitat classification systems in California. With standardized classification systems we can describe vegetation associated with many aspects of bird biology and conservation (e.g., reproductive success) across space and time. A single, widely accepted terminology provides land managers, natural resources specialists, and conservationists with a common language that promotes clear communication and better informed decisions. In this chapter we introduce a terminology that will be consistently used throughout this plan to address habitat specific conservation issues and focal bird species.

California Partners in Flight (CalPIF) has chosen to categorize coniferous forests into six conifer habitat types. This approach allows both the inexperienced landowner as well as the technical professional to understand the intent and focus of the species accounts and management recommendations in this plan. In an effort to ensure efficient communication of the contents of this plan, while maintaining a strong scientific validity to the bird species management recommendations contained herein, we describe and cross-reference the conifer habitat types using three widely accepted vegetation classification systems. These classification systems, and associated references are:

- SAF - Society of American Foresters Forest Cover Types; *Forest Cover Types of the United States and Canada: Society of American Foresters* (Eyre 1980)
- SKW - Sawyer and Keeler-Wolf Vegetation Series; *A Manual of California Vegetation* (Sawyer and Keeler-Wolf 1995), and
- WHR - Wildlife Habitats Relationships Habitat Types; *A Guide to Wildlife Habitats of California* (Mayer and Laudenslayer 1988).

The six conifer habitat types correspond to the major forest type groups described in the Society of American Foresters (SAF) System. The SAF scheme combines similar forest cover types into the major forest type groups that relate to the U.S. Geological Survey's forest cover map of the United States (USGS 1970). The SAF major forest type groups are used across the world for comparisons and to determine trends in area, volume, growth, removals, mortality, and land-use; and are one of the unifying themes between

forest industry, environmental organizations, and federal, state, and local government agencies.

Each conifer habitat type is made up of one or more vegetation series, as described in the Sawyer and Keeler-Wolf (SKW) system. The SKW system is the most detailed of the three systems and allows for classification at a more specific level, floristically based on lower units of plant associations (Sawyer and Keeler-Wolf 1995). Sawyer and Keeler-Wolf identify at least 37 distinct vegetation series within California where one conifer species dominates. The SKW system ties in with continental planning efforts of The Nature Conservancy and is compatible with most previous schemes used in California, such as that of the California Biodiversity Council (RAC 1998).

The SKW system fits into the two additional classification systems used in this document. The SKW vegetation series that make up each conifer habitat type are cross referenced with corresponding Wildlife Habitat Relationships (WHR) habitat types and the SAF forest cover types (Table 3-1).

The Wildlife Habitat Relationships system, as its name implies, is a system that attempts to classify vegetation based on its value to vertebrate animals (Mayer and Laudenslayer 1988). Many important statewide wildlife research and management projects tie into this system, including the California Gap Analysis Project (Davis et al. 1998). Current WHR maps for CalPIF focal species have been provided to the Partners in Flight planning effort courtesy of California Department of Fish and Game and the California Interagency Task Group and are available at http://www.prbo.org/CalPIF/Consplan.html.

The SKW system includes a field sampling protocol, data from which can be used to classify a specific site into its corresponding vegetation series. As Coniferous Forest Bird Conservation Plan objectives are considered for implementation at specific on-the-ground locations, vegetation data should be collected using this or similar methods so that sites can be classified to their SKW vegetation series, allowing the sites to be cross referenced with the SAF and WHR classification schemes as well.

Habitat Accounts

A step-down approach is used to describe the vegetation accounts in this plan. Vegetation accounts are based on six conifer habitat types. These groups, which make up the first level of classifications used in this plan, include:

- spruce-fir,
- lodgepole pine,
- Douglas-fir,
- pine,
- redwood/sequoia, and
- pinyon-juniper.

A list of the dominant trees associated with each habitat type is included at the beginning of each account. Additionally, Coniferous Forest Bird Conservation Plan focal species and secondary species that occur within each habitat are included in each account. Bioregional note species are also listed in the appropriate accounts. The detailed SKW vegetation series are used to describe the variety of forests within each of the six habitat types and each series is cross-referenced with its corresponding SAF forest cover type(s) and WHR habitat types(s) (Table 3-1).

Additionally, the discussion of montane shrublands is introduced here. This habitat type was not formally incorporated throughout this coniferous forest bird conservation plan, but the authors recognize the relevance and importance of placing the discussion of montane shrublands within the context of coniferous forest management.

Spruce-Fir Habitat Type

Primary tree species: Engelmann spruce (*Picea engelmannii*), red fir (*Abies magnifica*), white fir (*Abies concolor*), subalpine fir (*Abies lasiocarpa*), Pacific silver fir (*Abies amabilis*), western hemlock (*Tsuga heterophylla*), Sitka spruce (*Picea synthesis*), Santa Lucia or bristlecone fir (*Abies bracteata*), and grand fir (*Abies grandis*).

Coniferous Forest Bird Conservation Plan focal species: Black-backed Woodpecker, Brown Creeper, Dark-eyed Junco, Flammulated Owl, Fox Sparrow, Golden-crowned Kinglet, MacGillivray's Warbler, Olive-sided Flycatcher, Red-breasted Nuthatch, and Western Tanager.

Coniferous Forest Bird Conservation Plan secondary focal species: Yellow-rumped Warbler, Steller's Jay, Spotted Owl, Cassin's Finch, Clark's Nutcracker, Gray Jay, Mountain Quail, and Purple Finch, and Chipping Sparrow.

<u>High Elevations</u>

Engelmann spruce SKW vegetation series has a limited distribution in California, occurring in the montane and subalpine areas of the Klamath Ranges (Klamath Bioregion) at elevations ranging from 1200-2100 m. The series is found in six isolated stands, the southernmost of which is in Shasta County. The series occurs in intermittently flooded soils on bottoms and streamsides. Engelmann spruce occurs as a tree < 55 m in height, with a continuous canopy with Engelmann spruce as the sole or dominant tree. Shrubs are common or infrequent with sparse or abundant ground layer. Other species may be present, including Brewer Spruce (*Picea breweriana*), Douglas-fir (*Pseudotsuga menziesii*), incense-cedar (*Libocedrus decurrens*), lodgepole pine (*Pinus contorta*), mountain hemlock (*Tsuga mertensiana*), Pacific Yew (*Taxus brevifolia*), ponderosa pine (*Pinus ponderosa*), Shasta fir (*Abies magnifica* var. *shastensis*), sugar pine (*Pinus lambertiana*), western white pine (*Pinus monticola*) and/or white fir.

Red fir SKW vegetation series includes the California red fir and the distinct variety called Shasta red fir. In California, red fir is found in montane areas on the North Coast,

and in the Klamath, Cascade, and Sierra Nevada Ranges (Klamath, Modoc and Sierra Bioregions), at elevations of 1400-2700 m. It occurs on upland slopes, raised stream benches and terraces in shallow soils. Red firs average < 60 m in height, with a continuous or intermittent canopy with noble fir (*Abies procera*), red fir or Shasta fir as sole or dominant species. Shrubs are infrequent or common and groundcover is sparse or abundant. Lodgepole pine, Jeffrey pine (*Pinus Jeffreyi*), mountain hemlock, sugar pine, western white pine, and/or white fir may be present.

White fir SKW vegetation series is found in montane areas on the North Coast, and in the Klamath, Cascade, Sierra Nevada, Transverse, Peninsular, Warner, and Desert Ranges, and in eastside Sierra and valleys (Klamath, Modoc, Sierra, and South Coast Bioregions). This species occurs at elevations ranging from 1400-2700 m, on upland slopes, raised stream benches and terraces in well drained soils. They average < 60 m in height. Canopy may be continuous or intermittent with white fir as sole or dominant tree. Shrubs are infrequent or common and groundcover is sparse or abundant. Black oak (*Quercus kelloggii*), Douglas-fir, incense-cedar, Jeffrey Pine, lodgepole pine, ponderosa pine, red fir, Shasta fir, singleleaf pinyon (*Pinus monophylla*), and/or sugar pine may be present.

Red fir and white fir series dominate more than 4 million acres (1.6 million ha) of commercial forest land at the higher elevations in California and southern Oregon. On the basis of current environmental and biological information, silvicultural practices for the two types are generally the same. Between the elevational levels where red fir and white fir form nearly pure stands, the species are found in mixture, with either one dominant (Laacke and Fiske 1983).

Management practices for red and white fir vary, but can be grouped generally into two categories on average quality sites: a short rotation of 70 years and a long rotation of 125 years (USDA/USEPA 1981). Seed and cone insects that affect the two fir species are not unusual, but insects significantly damage regeneration only locally and periodically. White fir in the central and southern Sierra Nevada is subject to infection by true mistletoe (*Phoradendron bolleanum* [Seem.] Eich. Subspecies *pauciflorum* [Torr.] Fosb.), which results in top-killing of old trees and reduced seed production (Laacke and Fiske 1983). Almost all land in the red and white fir types that is currently managed for timber is under, or is being converted to, even-aged management (Laacke and Fiske 1983).

Subalpine and Pacific silver fir SKW vegetation series have limited geographic distributions in California. These species are found in montane and subalpine areas of the Klamath Ranges (Klamath Bioregion), at elevations ranging from 1700-2200 m. Both series are considered rare in California (Skinner and Pavlik 1994); only five stands of subalpine fir have been identified in California, and only two populations of Pacific silver fir have been confirmed. The series occurs on intermittently flooded streamsides and on raised terraces, morainal rocks and boulders and ridges. They usually make-up continuous canopies as the sole or dominant tree, and grow as tall as 50 m (75 m for Pacific silver fir). Shrubs are infrequent or common and groundcover is sparse or

abundant. Brewer spruce, Engelmann spruce, lodgepole pine, mountain hemlock, Pacific yew, Shasta fir, western white pine and/or white fir may be present.

Low Elevations

Western hemlock SKW vegetation series occurs along the outer North Coast and at low elevations in the Klamath Range (Klamath Bioregion), from sea level to 400 m. They grow on upland slopes, raised stream benches and terraces in sandstone and schist derived soils. Trees are usually < 60 m tall, and are the sole or dominant species in continuous canopy. Shrubs are common or infrequent and groundcover is abundant or sparse. Stands in California are mainly represented by stands logged 2 or more times. California bay (*Umbellularia californica*), Douglas-fir, madrone (*Arbutus menziesii*), Port Orford-cedar (*Chamaecyparis lawsoniana*), redwood (*Sequoia sempervirens*), and/or tanoak (*Lithocarpus densiflora)* may be present.

Sitka spruce SKW vegetation series occurs in the central and northern areas of the outer North Coast (Klamath Bioregion), at elevations ranging from sea level to 20 m. Sitka spruce occurs in stream and river backwaters, bottoms, floodplains, and raised maritime terraces with perched watertables where soils are seasonally flooded or saturated, or permanently saturated. Trees are usually < 75 m in height as the sole or dominant tree in intermittent or continuous canopies. Shrubs are infrequent or common and groundcover is abundant, especially with ferns. Most stands in California are in shrub or young forest stages; old-growth stands of Sitka spruce are rare. Grand fir, red alder (*Alnus rubra*), redwood, and/or western hemlock can be present.

Santa Lucia fir SKW vegetation series (also known as bristlecone fir) is limited in distribution to montane areas of the Central Coast, primarily in Monterey County (Central Coast Bioregion). It is found at elevations ranging from 250-1400 m on steep north and east facing upland slopes and ridges, in canyon bottoms, and on raised stream benches and terraces. In sandstone and shale-derived soils trees are usually < 50 m in height, and are the sole or dominant species in continuous canopies or co-dominate with canyon live oak (*Quercus chrysolepis*) in two-tiered canopy. Shrubs are infrequent and ground cover is sparse. Talley (1974) notes that this species is best developed on fire-protected sites. Coulter pine (*Pinus coulteri*), madrone, ponderosa pine, sugar pine, and/or tanoak may be present.

Grand fir SKW vegetation series is common outside of California, however it is limited within the state to the outer North Coast (Klamath and Bay Delta Bioregions), at elevations ranging from sea level to 50 m. It can be found dominating certain forest stands in Humboldt, Mendocino, and Sonoma Counties. Grand fir occurs in upland shallow sandstone derived soils on slopes and maritime terraces. Trees average < 70 m in height. Grand fir is the sole or dominant species in a continuous canopy. Shrubs are infrequent or common and groundcover is sparse or abundant. Bishop pine (*Pinus muricata*), red alder, redwood, Sitka spruce, and/or western hemlock may be present.

Lodgepole Pine Habitat Type

Primary tree species: lodgepole pine (*Pinus contorta*)

Coniferous Forest Bird Conservation Plan focal species: Black-backed Woodpecker, Brown Creeper, Dark-eyed Junco, Flammulated Owl, Fox Sparrow, Olive-sided Flycatcher, Red-breasted Nuthatch, and Western Tanager.

Coniferous Forest Bird Conservation Plan secondary focal species: Yellow-rumped Warbler, Steller's Jay, Cassin's Finch, Mountain Quail, and Purple Finch.

Lodgepole pine SKW vegetation series occurs in low, montane and subalpine areas of the Klamath Range, montane and subalpine areas of the Cascade and Sierra Nevada Ranges, subalpine areas of the Transverse, Peninsular, Warner, and White, Inyo, Sweetwater Ranges, Modoc Plateau, and eastside Sierra and valleys (Klamath, Modoc, Sierra, and South Coast Bioregions). The series occurs on upland slopes at elevations ranging from 1500-3400 m. It is found as the sole or dominant tree in continuous, intermittent or open canopies as a shrub or tree ranging in height up to 40 m. Shrubs are usually infrequent and the ground layer can be sparse or abundant. Lodgepole pine does well in disturbed habitats, especially habitats that have been altered by fire. Slow growing, overly dense stands of this species often results from its high seed viability (Earle 2000). Foxtail pine (*Pinus balfourniana*), limber pine (*Pinus flexilis*), mountain hemlock, red fir, Shasta fir, western white pine, white fir and/or whitebark pine (*Pinus albicaulis*) may be present.

Douglas-fir Habitat Type

Primary tree species: Douglas-fir (*Pseudotsuga menziesii*), bigcone Douglas-fir (*Pseudotsuga macrcarpa*), ponderosa pine (*Pinus ponderosa*), tanoak (*Lithocarpus densiflora*)

Coniferous Forest Bird Conservation Plan focal species: Black-backed Woodpecker, Black-throated Gray Warbler, Brown Creeper, Dark-eyed Junco, Flammulated Owl, Fox Sparrow, Golden-crowned Kinglet, MacGillivray's Warbler, Olive-sided Flycatcher, Pileated Woodpecker, Red-breasted Nuthatch, Vaux's Swift, and Western Tanager.

Coniferous Forest Bird Conservation Plan secondary focal species: Spotted Owl, Mountain Quail, Purple Finch, and Chipping Sparrow.

Bioregional note species: Great Gray Owl

Douglas-fir SKW vegetation series can be found in montane areas of the North and Central Coasts, Klamath, Cascade and Sierra Nevada Ranges, and Modoc Plateau (Central Coast, Bay Delta, Klamath, Modoc and Sierra Bioregions). It ranges from 700-2700 m in elevation. The series occurs on raised stream benches and terraces in granite, sandstone, serpentine, schist and volcanic-derived soils. The series is typically found on

southerly exposures in the northern part of its range, and on northerly slopes in the southern part of its range (Earle 2000). Trees are generally < 75m, though they can reach 100 m. Douglas-firs are sole or dominant species developing continuous and intermittent canopies. Shrubs and ground cover can be sparse and abundant. Canyon live oak, chinquapin (*Chrysolepis chrysophylla*), incense-cedar, ponderosa pine, sugar pine and/or white fir can be present.

Douglas-fir – ponderosa pine SKW vegetation series can be found in montane area of the North Coast, and Klamath, Cascade and northern Sierra Nevada Ranges (Klamath, Modoc, and Sierra Bioregions) from 600-1800m in elevation. Growing in granite, schist, and ultramafic derived soils Douglas-firs and ponderosa pines form continuous or intermittent canopies ranging to 75 m. Shrubs can be infrequent or common with a sparse ground layer. Black oak, canyon live oak, incense-cedar, Oregon white oak (*Quercus garryana*) and/or sugar pine may be present.

Douglas-fir – tanoak SKW vegetation series can be found in the outer North Coast, in lower elevations of the Klamath Range, and montane areas in the Sierra Nevada Range (Klamath and Sierra Bioregions) between 100-1500m in elevation. Occurring on raised stream benches and terraces, mostly in sandstone or schist-derived soils, Douglas-fir and ponderosa pine form continuous canopies ranging to 75 m and forming two-tiered canopies in older stands. Shrubs are infrequent or common with a sparse or abundant ground layer. California bay, black oak, canyon live oak, madrone, ponderosa pine and/or sugar pine may be present.

Bigcone Douglas-fir and **Bigcone Douglas-fir – canyon live oak** SKW vegetation series cans be found in montane areas of the Central Coast and in the Transverse and Peninsular Ranges (Central Coast and South Coast Bioregions) at elevations between 275-2400 m. Within California it can also be found in the Klamath, Modoc, Sierra, and Bay/Delta Bioregions (Davis et al. 1998). Both series occur in upland areas in shallow well drained soils. The Big-cone Douglas Fir series occurs in sandstone, schist-derived soils, usually on North facing slopes. Trees are usually < 30 m forming continuous canopies. In the Big-cone Douglas fir series this species is the sole or dominant tree in the canopy, however in the Bigcone Douglas Fir – canyon live oak series they co-dominate with canyon live oak forming two-tiered canopies in older stands. Shrubs are infrequent and the ground layer is sparse. Black oak, canyon live oak, Coulter pine, and/or single leaf pinyon may be present. Sugar pine and/or white fir may be present in the Bigcone Douglas Fir series and California bay, California Walnut (*Juglans californica*), foothill pine (*Pinus sabiniana*) and/or knobcone pine (*Pinus attenuata*) in the Bigcone Douglas Fir – canyon live oak series.

Pine Habitat Type

Primary tree species: ponderosa pine (*Pinus ponderosa*), Jeffrey pine (*Pinus jeffreyi*), western white pine (*Pinus monticola*), Monterey pine (*Pinus radiata*), and Coulter pine (*Pinus coulteri*).

Coniferous Forest Bird Conservation Plan focal species: Black-backed Woodpecker, Black-throated Gray Warbler, Brown Creeper, Dark-eyed Junco, Flammulated Owl, Fox Sparrow, Golden-crowned Kinglet, Olive-sided Flycatcher, Pileated Woodpecker, Red-breasted Nuthatch, Vaux's Swift, and Western Tanager.

Coniferous Forest Bird Conservation Plan secondary focal species: Yellow-rumped Warbler, Steller's Jay, Spotted Owl, Cassin's Finch, Clark's Nutcracker, Purple Finch, and Chipping Sparrow.

Ponderosa pine SKW vegetation series occurs on the North and Central Coasts, in the Klamath, Cascade and Sierra Nevada Ranges, in montane areas of the Transverse and Peninsular Ranges, and in the Great Basin (Central Coast, Bay Delta, Klamath, Modoc, Sierra Nevada, South Coast Bioregions) between 300-2100 m in elevation. The series is found on upland slopes, raised stream benches and terraces and the intolerant, slow-growing species grows in well drained soils. Ponderosa pines are the sole, dominant or important tree, forming intermittent or open canopies ranging to 70 m in height. Black oak and incense-cedar can accompany ponderosa pines in the canopy. Shrubs are infrequent or common with a sparse, abundant and/or grassy ground layer. Canyon live oak, Coulter pine, Douglas-fir, interior live oak (*Quercus wislizenni*), Jeffrey pine, sugar pine and/or white fir may be present.

Jeffrey pine SKW vegetation series can be found in montane areas of the North and Central Coasts, in montane and subalpine areas of the Cascade, Sierra Nevada, Transverse and Peninsular Ranges, in lower elevation, montane and subalpine areas of the Klamath Range, and in the Great Basin (South Coast, Central Coast, Bay Delta, Klamath, Modoc, and Sierra Bioregions) between 60-2900 m in elevation. Although Jeffrey pine may be mixed with ponderosa pine, it is able to survive in greater extremes of climate than ponderosa pine. Jeffrey pine occurs in well drained soils. In the North Coast, Central Coast and Klamath Ranges the series is most commonly found on ultramafic derived soils and in other regions on productive or harsh soils. As the sole or dominant tree in the canopy Jeffrey pines form intermittent or open canopies ranging to 60 m in height. Shrubs are infrequent or common with a sparse, abundant or grassy ground layer. Black oak, canyon live oak, foxtail pine, incense cedar, interior live oak, knobcone pine, lodgepole pine, ponderosa pine, Port-Orford cedar, red fir, Shasta fir, Washoe pine (*Pinus washhouses*), western juniper (*Juniperus occidentalis* spp. *Occidentalis*), western white pine, and/or white fir may be present.

Jeffrey pine – ponderosa pine SKW vegetation series occurs in montane areas of the Cascade and Sierra Nevada Ranges and in the Modoc Plateau (Modoc and Sierra Bioregions) between 1000-2400 m in elevation. The series is found in well drained soils on upland slopes, raised benches and terraces. Jeffrey and Ponderosa pines are the important species forming intermittent or open canopies ranging to 60 m in height. Shrubs are infrequent or common with sparse or abundant ground layer. Black oak, incense-cedar, western juniper, and/or white fir may be present.

Coulter pine and Coulter pine – canyon live oak SKW vegetation series can be found in montane areas of the Central Coast, and Transverse and Peninsular Ranges with the Coulter pine series also occurring on the inner South Coast. The series occur between 700-2000 m in elevation. Both series occur in shallow soils, the Coulter pine series in well drained soils and the Coulter pine – canyon live oak series in sandstone or schist-derived soils. Coulter pines range in height to 30 m. They are the sole or dominant tree in the Coulter pine series and are important along with canyon live oak in the Coulter pine – canyon live oak series. Canopies are continuous and in older Coulter pine – canyon live oak stands can be two-tiered. The ground layer is sparse and shrubs are infrequent, however in the Coulter pine series shrubs can be frequent. Bigcone Douglas-fir, black oak, canyon live oak, coast live oak (*Quercus agrifolia*), foothill pine, and/or ponderosa pine may be present with interior live oak occurring in the Coulter pine series.

Monterey pine SKW vegetation series occurs on the outer Central Coast and on the Channel Islands (Central and South Coast Bioregions) between sea level and 300 m. The series occurs on maritime terraces and headlands in excessively drained soils. Monterey pines is the sole or dominant tree species forming continuous or intermittent canopies in which coast live oak may also be important. Canopies range to 30 m in height. Shrubs can be absent, infrequent or common with a sparse or abundant ground layer. Bishop pine, Douglas-fir, knobcone pine, madrone, and/or redwood may be present.

Western white pine SKW vegetation series occurs in montane and subalpine areas of the Klamath Range, at lower elevations in western parts of the Klamath Range, and in subalpine areas of the Cascade and Sierra Nevada Ranges (Klamath Modoc and Sierra Bioregions) between 200-2300 m. Western white pine is considered by some to be an associate of a variety of forest cover types in the Cascades and Sierra Nevada Ranges of California (Boyd 1980). The series can be found on raised streambeds and terraces and is most extensive on plateaus and upper slopes where granitic or ultramafic-derived soils occur. Western white pine is the sole or dominant tree making up intermittent or open canopies ranging in height to 70 m. Shrubs are common with a sparse or abundant ground layer. Douglas-fir, foxtail pine, Jeffrey pine, red fir, Shasta fir, and/or white fir may be present.

Redwood Habitat Type

Primary tree species: coast redwood (*Sequoia sempervirens*) and giant sequoia (*Sequoiadendron giganteum*)

Coniferous Forest Bird Conservation Plan focal species: Brown Creeper, Golden-crowned Kinglet, MacGillivray's Warbler, Olive-sided Flycatcher, Pileated Woodpecker, Red-breasted Nuthatch, Vaux's Swift, and Western Tanager.

Coniferous Forest Bird Conservation Plan secondary focal species: Yellow-rumped Warbler, Steller's Jay, Gray Jay, Spotted Owl, and Purple Finch.

Bioregional note species: Varied Thrush and Marbled Murrelet.

Redwood SKW vegetation series can be found on the outer North and Central Coasts (Klamath, Bay Delta, and Central Coast Bioregions) between 10 and 600 m in elevation. The series occurs where moisture from summer fog and heavy rain provide redwoods with the supply of water they need. The southernmost portion of this habitat is found along Salmon Creek Canyon in the Santa Lucia Mountains of Monterey County (Olson et al. 1990). Redwoods grow on raised stream benches and terraces mostly in sandstone and schist derived soils. They are the sole, dominant or important tree forming continuous or intermittent canopies, which may be two-tiered, and range to 120 m in height. Shrubs are infrequent or common with an absent or abundant ground layer. California bay, Douglas-fir, madrone, tanoak, and/or western hemlock may be present.

Giant sequoia SKW vegetation series occurs in montane areas of the Sierra Nevada Range (Sierra Bioregion) between 1400-2600 m. There are approximately 75 giant sequoia groves on the west slope of the Sierra Nevada Mountains, most of which are protected. The majority of these groves (including all the large ones) are concentrated south of Kings River. Limiting factors to their distribution appear to be low temperatures at higher elevations, and insufficient soil moisture at lower elevations (Rundel 1972, Weatherspoon 1990). Sequoias commonly grow in uplands in well-drained granitic-derived soils as the sole dominant or important species in continuous or intermittent canopies ranging in height to 95 m. Shrubs are infrequent or common with a sparse or abundant ground layer. Black oak, Douglas-fir, incense-cedar, Jeffrey pine, lodgepole pine, ponderosa pine, red fir, sugar pine, and/or white fir may be present.

Pinyon-Juniper Habitat Type

Primary tree species: California Juniper (*Juniperus californica*), Mountain Juniper (*Juniperus occidentalis* spp. *Australis*), Western Juniper (*Juniperus occidentalis* spp. *Occidentalis*) singleleaf pinyon (*Pinus monophylla*), Parry pinyon (*Pinus quadrifolia*)

Coniferous Forest Bird Conservation Plan focal species: Black-throated Gray Warbler, Dark-eyed Junco, Flammulated Owl, and Western Tanager.

Coniferous Forest Bird Conservation Plan secondary focal species: Yellow-rumped Warbler, Cassin's Finch, Clark's Nutcracker, Gray Flycatcher and Chipping Sparrow.

Bioregional note species: Townsend's Solitaire, Pinyon Jay, Plumbeous Vireo

California juniper SKW vegetation series occurs in the interior Central Coast, in montane areas of the Transverse and Peninsular Range, and in the Mojave Dessert (Central and south Coast and Mojave Bioregions) between 1000-2450 m in elevation. The series occurs on ridges and slopes and in valleys in bedrock or alluvium-derived soils. California juniper is the sole or dominant tree emerging over a shrub canopy. Scattered trees grow to 5 m over intermittent to open shrubs. The ground layer is sparse or grassy. Desert scrub oak (*Quercus turbinella*), Joshua tree (*Yucca brevifolia*), Parry pinyon, and or singleleaf pinyon (*Pinus monophylla*) may be present along with big

sagebrush (*Artemisia tridentata*), black brush (*Coleogyne ramosissima*), cliffrose (*Purshia mexicana*), ephedra (*Ephedra* spp.), Mojave yucca (*Yucca schidigera*) and/or chaparral yucca (*Yucca whipplei*).

Mountain juniper SKW vegetation series occurs in montane and subalpine areas of the Sierra Nevada Range, montane areas of the Transverse Range, the Modoc Plateau and the eastside Sierra and Valleys (South Coast, Sierra and Modoc Bioregions) between 900-3000 m. The series occurs on gentle slopes, sloping alluvial fans, canyon slopes, and steep rocky escarpments, commonly in shallow bedrock, eolian, colluvial or alluvial derived soils. Mountain junipers grow to 20 m as the sole or dominant tree scattered or in intermittent or open canopies. Shrubs are common or infrequent with a sparse or grassy ground layer. Black oak, canyon live oak, Jeffrey pine, singleleaf pinyon, and or white fir may be present with big sagebrush, antelope bitterbrush (*Purshia tridentata*), choke cherry (*Prunus virginiana*), and/or curlleaf mountain-mahogany (*Cercocarpus ledifolius*).

Western juniper SKW vegetation series can be found in montane areas of the Sierra Nevada and eastern Klamath Ranges, in the Modoc Plateau, in montane areas of the Warner Range, and in the eastern Sierra and valleys (Klamath, Modoc, and Sierra Bioregions between 900-1700 m. The series occurs on gentle slopes and in valleys growing in bedrock basalt, eolian, colluvial, or alluvial derived soils where indurated layers and rock fragments may be present. Western juniper is the sole or dominant tree growing to 20m as scattered emergent trees over a shrub canopy. The ground layer is grassy. Black oak, Jeffrey pine, Oregon white oak, ponderosa pine, Washoe pine, and/or white fir may be present with antelope bitterbrush, big sagebrush, black sagebrush (*Artemisia nova*), curlleaf mountain-mahogany, and or rabbitbrush (*Chrysothamnus nauseosus*).

Singleleaf pinyon SKW vegetation series occurs in montane areas of the Transverse and Peninsular Ranges, in the eastern Sierra and valleys, in the White, Inyo and Sweetwater Ranges and in the Mojave Desert. (Sierra, South Coast, Sierra and Mojave Bioregions) between 1000-2800 meters. The series can be found on alluvial fans, pediments, slopes and ridges in well-drained soils. Singleleaf pinyon is the sole or dominant tree forming intermittent or open canopies. Growing as scattered trees over a shrub canopy they reach 15m in height. Shrubs are common and the ground layer is absent, sparse, or grassy. California juniper, canyon live oak, Jeffrey pine, mountain juniper, Tucker oak (*Quercus john-tuckeri*), and/or Utah juniper (*Juniperus osteosperma*) may be present with bitterbrush, big sagebrush, black sagebrush, green ephedra (*Ephedra viridis*), and/or low sagebrush (*Artemisia arbuscula*).

Parry pinyon SKW vegetation series occurs in montane areas of the Peninsular Range (South Coast Bioregion) between 900-1800 m in elevation. The series can be found on north-facing slopes and ridges in well-drained soils. Parry pinyon is the sole or dominant tree in an intermittent or open canopy that ranges to 15 m in height. Shrubs are common and the ground layer is sparse. California juniper, singleleaf pinyon, and/or Jeffrey pine may be present.

Montane Shrublands

Primary shrub species: deerbrush (*Ceanothus integerrimus*), mountain whitethorn (*Ceanothus cordulatus*), tobacco brush (*Ceanothus velutinus*), wedgeleaf ceanothus (*Ceanothus cuneatus*), greenleaf manzanita (*Arctostaphylos patula*), whiteleaf manzanita (*Arctostaphylos viscida*), ocean spray (*Holodiscus discolor*), rock-spiraea (*Holodiscus microphyllus*), mountain heather (*Phyllodoce* spp.), or bilberry (*Vaccinium caespitosum*), among others.

Coniferous Forest Bird Conservation Plan focal species: Fox Sparrow, MacGillivray's Warbler.

Coniferous Forest Bird Conservation Plan secondary species: Chipping Sparrow

Montane shrublands occur within the elevational zone of coniferous forests and experience a climate of variable summer rain and winter snow. Although montane shrubland habitat currently only has a minor role in this bird conservation plan, it is directly affected by coniferous forest management. California Partners in Flight recognizes the relevance and importance of placing the discussion of montane shrublands within the context of coniferous forest management. Such habitats are often regarded ecologically as "communities" of conifer forests rather than belonging to independent chaparral formations (McMinn 1939), and for this reason were excluded from the coastal scrub and chaparral bird conservation plan for California (CalPIF 2000a). However, during initial development of this bird conservation plan, discussion focused only on strict coniferous forest habitats. While shrub loss and shrub-dependent birds in coniferous forests are a component of the plan, the expansion of specific issues and the inclusion of new focal species whose nesting ecology is dependent upon such areas, clearly needs to occur in the future. The nature and gravity of the issues facing montane shrublands today, and the lack of attention they have received thus far in the CalPIF bird conservation planning process, warrant the revision of this conservation plan once financial resources have been identified. This revision should more thoroughly incorporate this habitat throughout the plan, and should detail the current issues surrounding montane shrublands of which landowners and land managers in coniferous forests need be aware.

SKW vegetation series that may be considered "montane shrublands" include: **deerbrush**, which occurs at 300-2100 m in elevation within the North and Central Coasts, and in the Klamath, Cascade, Sierra Nevada, Transverse and Peninsular Ranges; **holodiscus**, dominated by ocean spray or rock-spiraea and occurring from 700-2800 m in the North and Central coasts, and the Klamath, Cascade, Sierra Nevada, Transverse and Peninsular Ranges; **mountain heather-bilberry**, occurring from 1800-3600 m in the subalpine realms of the Klamath, Cascade, Sierra Nevada and Peninsular Ranges; **mountain whitethorn**, from 900-2900 m in the North Coast and the Klamath, Cascade, Sierra Nevada, Transverse, and Peninsular Ranges; **tobacco brush**, occurring up to 3000 m in the North Coast, Klamath, Cascade, Sierra Nevada, Transverse and Warner Ranges; **wedgeleaf ceanothus**, up to 1800 m in the North and Central Coast, and the Klamath, Transverse, Cascade, Sierra Nevada, and Peninsular Ranges; and **whiteleaf manzanita**,

which occurs up to 1850 m in the North Coast and the Klamath, Cascade, and the Sierra Nevada Ranges.

Table 3-1. Correspondences of six forest groups among major forest types and among three vegetation classification schemes (SKW- Sawyer and Keeler-Wolf 1995; SAF- Eyre 1980; and WHR- Mayer and Laudenslayer 1988).

Spruce-Fir Habitat Type **SAF Major Forest Type Group(s): Hemlock-sitka spruce (12), Fir-spruce (17)**		
SKW Vegetation Series	**SAF Forest Cover Type**	**WHR Habitat Type**
High Elevation:		
Engelmann Spruce	Engelmann spruce- subalpine fir (206)	
Red fir	Red fir (207)	Red fir (RFR)
White fir	White fir (211)	White fir (WFR)
Subalpine fir and Pacific silver fir	Engelmann spruce-subalpine fir (206)	Sub-alpine Conifer (SCN)
Low Elevation:		
Western Hemlock	Western Hemlock (224)	
Sitka spruce	Sitka spruce (223)	
Santa Lucia fir		
Grand fir	Grand fir (213)	
Lodgepole Pine Habitat Type **SAF Major Forest Type Group(s): Lodgepole pine (15)**		
SKW Vegetation Series	SAF Forest Cover Type	WHR Habitat Type
Lodgepole pine	Lodgepole pine (218)	Lodgepole pine (LPN)
Douglas Fir Habitat Type **SAF Major Forest Type Group(s): Douglas-fir (11)**		
SKW Vegetation Series	SAF Forest Cover Type	WHR Habitat Type
Douglas-fir	Interior Douglas Fir (210), Pacific Douglas-fir (229), Douglas-fir-western hemlock (230)	Sierra mixed conifer (SMC), Klamath Mixed Conifer (KMC), Douglas-fir (DFR)
Douglas-fir-Ponderosa pine	Pacific Ponderosa pine-Douglas-fir (244)	Douglas-fir (DFR)
Douglas-fir-tanoak	Douglas-fir-tanoak-Pacific madrone (234)	Montane hardwood conifer (MHC), Douglas-fir (DFR)
Bigcone Douglas-fir		
Bigcone Douglas-fir-canyon live oak		Douglas-fir (DFR)

Table 3-1 (continued).

Pine Habitat Type **SAF Major Forest Type Group(s): Ponderosa pine (13), Western white pine (14)**		
SKW Vegetation Series	SAF Forest Cover Type	WHR Habitat Type
Ponderosa pine	Interior ponderosa pine (237), Pacific ponderosa pine – Douglas-fir (244), Pacific ponderosa pine (245)	
Jeffrey pine	Jeffrey pine (247), Western juniper (238)	Jeffrey pine (JPN)
Jeffrey pine-ponderosa pine	Jeffrey pine (247), Western juniper (238), Knobcone pine (248)	Eastside pine (EPN)
Coulter pine, Coulter pine-canyon live oak	California black oak (246)?	
Monterey pine		
Western white pine	Western white pine (215)	Sierran mixed conifer (SMC)
Redwood/Sequoia Habitat Type **SAF Major Forest Type Group(s): Redwood (18)**		
SKW Vegetation Series	SAF Forest Cover Type	WHR Habitat Type
Redwood	Redwood (232)	Redwood (RDW)
Giant Sequoia		Sierran mixed conifer? (SMC)
Pinyon-Juniper Habitat Type **SAF Major Forest Type Group(s): Ponderosa pine (13), Noncommercial (19)**		
SKW Vegetation Series	SAF Forest Cover Type	WHR Habitat Type
California juniper	Pinyon-Juniper (239)	Pinyon-Juniper (JPN)
Mountain juniper	Western Juniper (238)	
Western juniper	Western Juniper (238) Interior ponderosa pine (237)	
Singleleaf pinyon	Pinyon-Juniper (239)	Pinyon-Juniper (JPN)
Parry pinyon	Pinyon-Juniper (239)	Pinyon-Juniper (JPN)

Coniferous Forest Conservation Issues

This section introduces some of the conservation issues that face the various coniferous forest habitats and drive species specific and habitat specific conservation objectives that are outlined in this document. Most of the coniferous forest focal species, secondary species and bioregional note species are impacted by one ore more of the following conservation issues, and their occurrence within the forest habitats of California can be used to determine which issues are of concern for each habitat. These issues are covered in more detail in the later chapters of this conservation plan, and in the focal species accounts that are available at http://www.prbo.org/CalPIF/Consplan.html.

Many conservation issues facing conifer habitats that occur across a multitude of bioregions in California can be classified into three groups that are based on the following post-settlement management practices:

- timber harvest,
- fire suppression, and
- livestock grazing.

The forested landscape of California has changed from that of pre-settlement conditions, most notably as a result of management practices that were associated with the production of commercial timber. The current conditions of coniferous forests, which are a result of commercial timber harvest practices and are issues facing the conservation of forest birds, include:

- reduced amounts of mature and old-growth forests;
- increased forest fragmentation;
- reduced amounts of large standing snags; and
- increases in early- and mid-successional even-aged stands dominated by a single species.

Several coniferous forest focal species - including Marbled Murrelet, Spotted Owl, Gray Jay, Golden-crowned Kinglet and Brown Creeper - are associated with mature and old growth forests, and their populations have likely decreased as the majority of mature and old-growth coniferous habitats have been lost (Table 3-2). These birds occur in the Spruce Fir, Lodgepole Pine, Douglas-Fir, Pine and Redwood habitat types where the protection and enhancement late-seral forests will be a conservation objective. Great Gray Owls are associated with older forest stands that are adjacent to wet meadows, and in the Douglas-Fir habitat type cutting of such forests is an issue facing the protection of this species, and others which depend on similar habitat characteristics.

Commercial timber harvesting practices have increased the amount of edge habitat that occurs in forested landscapes. This has become an issue for conservation plan species such as Brown Creeper, Gray Jay, Golden-crowned Kinglet and Varied Thrush, which prefer forest interior habitats. Additionally, increased edge habitats provides increased access to bird nests for Brown-headed Cowbirds and becomes of issue for cowbird hosts which include Brown Creeper, Dark-eyed Junco, Fox sparrow, Golden-crowned Kinglet, MacGillivray's Warbler, Western Tanager, Plumbeous Vireo, Purple Finch, and Chipping Sparrow. The increase of edge habitats across California's coniferous forests is an issue that will need to be addressed in all of the six habitat types (Table 3-2).

Several conservation plan species, including Vaux's Swift, Olive-sided Flycatcher, Brown Creeper, and Flammulated Owl depend on the presence of large snags for nesting, perching and/or foraging, and additionally Pileated Woodpeckers require dead and downed woody materials for foraging. Commercial logging practices have greatly reduced the amount of large snags and dead and downed woody material available for these species. Additionally the amount of larger live trees, which are important for the recruitment of large snags in the future, have been reduced. The conservation issues

surrounding the presence of snags and dead and downed woody materials will need to be addressed in all of the coniferous forest habitat types (Table 3-2).

Both commercial timber harvest, and fire suppression have resulted in the reduction of structural diversity in California's coniferous forests. Foraging and nesting habitat for the Golden-crowned Kinglet has been reduced as even aged monoculture stands increase in abundance. Species including Olive-sided Flycatcher, Fox Sparrow, and Townsend's Solitaire depend on structurally diverse forest habitats that include more open areas and, for Fox Sparrows, areas with dense shrub; such habitats are becoming limited with prolonged fire suppression practices. The lack of structural diversity in coniferous forests is a conservation issue facing all six of the forest habitat types (Table 3-2).

Livestock grazing practices in California's coniferous forests have caused reduced herbaceous layers and has been detrimental to species that nest on or close to the ground, including Chipping Sparrows and Fox Sparrows. Grazing is a conservation issue that faces all but the Redwood habitat type, where one or both of these species occur (Table 3-2).

It is clear that the conservation issues associated with timber harvest, fire suppression, and livestock grazing are widespread and affect a variety of species occurring in all of California's coniferous forest habitat types. By having a better understanding of the distribution of habitat types and the birds which occur within each type managers and conservationists using this plan will have a better knowledge of the conservation opportunities that exist in their areas. This knowledge will help to guide which conservation recommendations within this plan are appropriate for a given area. Additionally, as conservation actions are planned and implemented, increases of bird species likely to be effected by the issue that an action addresses can be used as an indicator of the effectiveness of conservation efforts.

TABLE 3-2. Primary conservation issues facing California's coniferous forest habitats, conservation plan focal species, secondary species, and bioregional note species likely to be affected, and habitat types where effects are likely to occur.

Conservation Issue	Conservation Plan Species	Habitat Type
Fewer large tracks of closed canopy mature and old-growth stands.	Marbled Murrelet	Redwood
	Spotted Owl	Spruce-Fir, Douglas-Fir, Pine, Redwood
	Gray Jay	Spruce-Fir, Lodgepole Pine, Douglas-Fir, Redwood
	Golden-crowned Kinglet	Spruce-Fir, Douglas-Fir, Pine, Redwood
	Brown Creeper	Spruce-Fir, Lodgepole Pine, Douglas-Fir, Pine, Redwood
	Pileated Woodpecker	Douglas-Fir, Pine, Redwood
Fewer mature and old-growth stands adjacent to wet meadows.	Great Gray Owl	Douglas-Fir
Increased edge in forested habitats.	Brown Creeper	Spruce-Fir, Lodgepole Pine, Douglas-Fir, Pine, Redwood
	Gray Jay	Spruce-Fir, Lodgepole Pine, Douglas-Fir, Redwood
	Golden-crowned Kinglet	Spruce-Fir, Douglas-Fir, Pine, Redwood
	Varied Thrush	Redwood
	Dark-eyed Junco	Spruce-Fir, Douglas-Fir, Pine, Pinyon-Juniper
	Plumbeous Vireo	Pinyon-Juniper
	MacGillivray's Warbler	Spruce-Fir, Lodgepole Pine, Douglas-Fir, Redwood
	Fox Sparrow	Spruce-Fir, Lodgepole Pine, Douglas-Fir, Pine
	Western Tanager	Redwood, Pinyon-Juniper
	Purple Finch	Spruce-Fir, Lodgepole Pine, Douglas-Fir, Pine, Redwood
	Chipping Sparrow	Spruce-Fir, Douglas-Fir, Pine, Pinyon-Juniper
Fewer amounts of large snags and dead and downed materials.	Vaux's Swift	Douglas-Fir, Pine, Redwood
	Olive-sided Flycatcher	Spruce-Fir, Lodgepole Pine, Douglas-Fir, Pine, Redwood
	Brown Creeper	Spruce-Fir, Lodgepole Pine, Douglas-Fir, Pine, Redwood
	Flammulated Owl	Spruce-Fir, Douglas Fir, Pine, Pinyon Juniper
	Pileated Woodpecker	Douglas-Fir, Pine, Redwood
Fewer structurally diverse habitats.	Olive-sided Flycatcher	Spruce-Fir, Lodgepole Pine, Douglas-Fir, Pine, Redwood
	Crowned-crowned Kinglet	Spruce-Fir, Douglas-Fir, Pine, Redwood
	Fox Sparrow	Spruce-Fir, Lodgepole Pine, Douglas-Fir, Pine
	Townsend's Solitaire	Pinyon Juniper
Reduced herbaceous layer from livestock grazing.	Fox Sparrow	Spruce-Fir, Lodgepole Pine, Douglas-Fir, Pine
	Chipping Sparrow	Spruce-Fir, Douglas-Fir, Pine, Pinyon-Juniper

Chapter 4. Problems Affecting Birds in Coniferous Forests

California's coniferous forests have been severely altered by forest management practices over the previous century and continue to remain under threat of further degradation and development. While some western coniferous forests have been developed for agricultural or housing purposes, the primary threats to our forests have been fire suppression and logging (i.e., activities associated with the timber industry). Forest management practices during the past century have included major fire suppression, clearcutting, salvage logging, thinning, livestock grazing and short rotations. Such practices have resulted in highly altered, and often simplified, forests. Prior to such management, natural processes including fire, floods, insects, winds, and disease helped shape our coniferous forests (Pickett and White 1985).

Fire suppression may reduce the abundance of open forest bird species as forests close in, as well as the abundance of ground or shrub-foragers. Silvicultural practices alter landscape structure, forest age and structure, and create edges, causing concern for the impacts of these practices on landbirds including Neotropical migrants". Other ways in which humans have affected forest composition and structure in recent history are livestock grazing, introduction and spread of exotic species (including plants, insects, and diseases), development, and application of chemicals (Hejl 1994).

Timber harvesting and other human-induced disturbances have resulted in severe changes to the forest structure, likely resulting in serious impacts upon the birds that breed there. Strong evidence suggests that logging practices have decreased the abundance of almost all permanent residents and half the migrants in coniferous forests (Hejl 1994). However, current forest management practices are focusing more on "ecosystem management", in which sustainable resource management is balanced with the maintenance of the ecological values and functions of the forests (Altman 1999).

Concern about bird population declines and habitat loss have led to state or federal listing of several coniferous forest nesting species and the designation of others as species of special concern. Unfortunately, information on population trends of many coniferous forest birds is lacking, with many habitats and species having yet to be adequately censused. Despite the need to fill in these data gaps, enough is currently known about the principle requirements to maintain healthy coniferous forests suitable to breeding birds, and these must be applied to current management strategies (Hejl 1994).

Current State of Knowledge

The Coniferous Forest Bird Conservation Plan, like other bird conservation plans in California, addresses high priority species and habitats based on specific review criteria. Hejl (1999) notes that in order to ensure the maintenance of healthy populations of these forest birds, land managers would need to know the following:

1. The current distribution of each species;
2. The current distribution of vegetation characteristics important to each species; and
3. The effects of all disturbance regimes on the distribution and demographics of each bird species within each habitat and in various parts of its geographic range.

Unfortunately, for some species our knowledge of these parameters can be characterized as rudimentary, and the quality of this knowledge varies among areas. In particular, there is much more to learn about the effects on bird populations resulting from silvicultural treatments on the forested landscape; distinguishing the effects of logging from the effects of changes in landscape pattern or fragmentation can be difficult. Some recent and current ornithological studies have begun to examine such questions, and more are needed. The individual species accounts written for coniferous forest focal species (http://www.prbo.org/calpif/htmldocs/conifer.html) summarize the current state of knowledge of these birds in California, and in many cases outline the areas where such knowledge is still grossly lacking.

Forest fires, as mentioned above, comprise one of the primary agents of natural disturbance in western forests; yet, again, our ability to understand the effects of fire on birds is difficult due to the paucity of studies conducted in burned habitats and the variation in duration, intensity, frequency, location, shape, and extent of fires. Due to the fire suppression management philosophy of the 20th century, the overall acreage of burned habitat has declined, leading one to assume that bird species associated either directly with fires or with fire-maintained forest structures have also been negatively affected.

Although population trend data from the nationwide network of Breeding Bird Survey (BBS) routes indicate that forest species likely have declined in the past 24 years, these data are not able to explain why or how these birds have declined. This points out an inherent weakness in the BBS survey methodology, which is that substantive information has been obtained for only 50% (57 of 113) of western coniferous forest birds. Moreover, BBS data are not collected in a habitat-specific format; therefore, we cannot connect trends to specific coniferous forest habitat types. As a result, many of the species that we are interested in are inadequately sampled by the BBS and therefore are not properly monitored. When all of our monitoring programs are considered as a whole, we often find that habitats or species about which we are most concerned are not adequately monitored (Ibid).

In summary, we need all three sets of information (distribution, habitat use, and demographics) to know how to maintain bird species, and we have little information on distribution and habitat use, and almost none on demographics, for most western coniferous forest birds (Ibid).

Loss of Old-growth Forests

The logging of old-growth forests is a major issue in California's forests. A number of bird species, for example, rely on old-growth habitats for breeding. These include Marbled Murrelets, Spotted Owls, Gray Jays, Brown Creepers, and Pileated Woodpeckers. Many of these species require a relatively closed canopy and a complex forest structure, including an abundance of trees of different age-classes as well as dead, dying, and downed trees. Such birds can often not adapt to the changes that have taken place in many of our state's forests. Some bird species, including Marbled Murrelets (Ralph et al. 1995a), require tracts of old-growth forests that have been largely unmodified by logging.

The lack of replacement of old-growth stands due to too-short rotations, and replacement with even-aged forestry management or monocultures, do not provide adequate habitat for breeding

birds that need complex old-growth forests. These practices result in simplified forests that are structurally homogeneous, and therefore do not contain the characteristics required by many species for breeding. Short rotation periods do not allow the replaced forests to develop into a mature or old-growth stage and appropriate characteristics that would otherwise be associated with such forests.

One study that examined the effects of various harvesting techniques on nongame bird populations in ponderosa pine forests found that all of the foraging guilds (except for the ground feeders) were virtually eliminated from the severely thinned and clearcut plots. Moreover, even when less severe prescriptions are applied (e.g., an irregular strip shelterwood), the quality of the bird community will still be affected, favoring those species that respond to openings in the forest (Szaro and Balda 1979).

Fire Suppression

Perhaps the most significant factor affecting coniferous forests in the west has been the exclusion of fire (Hejl 1994). Fire suppression has been a forest management technique that has been to the detriment of the forests as it has resulted in decreased structural diversity, often producing a dense homogeneous forest with closed canopy and little shrub cover. Bird species that require openings in the canopy (e.g., Olive-sided Flycatcher) and high shrub cover (e.g., Green-tailed Towhee, Fox Sparrow, Townsend's Solitaire) are declining, with local extirpations having been observed in some areas. Observations of such declines and extirpations will only increase with continued fire suppression. The issue of decreased shrub cover is compounded in forests which are managed for the timber industry, as the early-seral stage in which the forest floor would historically have been shrub-dominated is cut short under traditional logging practices in order to quickly establish the next tree crop (Altman 1999). Fires also create suitable habitat for primary and secondary cavity nesters through the killing of trees or limbs. Additionally, fire suppression has not only resulted in less frequent fires, but when fires are not controlled they burn at a higher intensity due to the increased fuel load. Recently, land managers have allowed some fires to burn on federal lands while other controlled fires have been prescribed.

Fragmentation

Another issue within old-growth forests is fragmentation. Tracts of continuous forest are required by some species, including the federally threatened and state endangered Marbled Murrelet and the federally threatened Northern Spotted Owl. A related problem is proximity to an edge. As logging and fragmentation continue, the amount of edge habitat increases, creating unsuitable habitat for some birds even if the unlogged forest nearby is in relatively good condition otherwise. Brown Creepers generally require at least an 80 m buffer zone between their nest site and the edge of the logged area (Hagar 1999). Other birds (including Gray Jays, Winter Wrens, Varied Thrushes, Band-tailed Pigeons, and Chestnut-backed Chickadees) have also been found to be less abundant along forest edges than in the interior while others may be less abundant in fragmented landscapes (e.g., Golden-crowned Kinglet) (Hejl 1994, McGarigal and McComb 1995).

The increase in the amount of edge habitat resulting from forest fragmentation has two potential impacts upon the birds that continue to breed within those forests. As the amount of edge increases, accessibility of the forest by both nest parasites and predators also may increase. This

allows areas that were not previously accessible to Brown-headed Cowbirds or predator species to be occupied by such species.

Elimination of Snags

Traditional logging practices generally result in the elimination or the reduction in the number of dead trees, snags, or downed logs present in forest stands. Such dead trees are important to birds for a variety of reasons. Many birds require large snags (Vaux's Swift) or dead trees (Brown Creeper, Black-backed Woodpecker) for nesting; others require downed wood or dead trees for foraging (Pileated Woodpecker). Olive-sided Flycatchers require the presence of very tall, dead trees in their territories for perching. However, downed wood is removed and large snags are unavailable in intensively managed forests precluding the occurrence of many coniferous forest bird species. Dead trees and downed wood are removed to increase the cost-effectiveness of timber extraction and if they are considered a safety hazard to the logging operation (Cline et al. 1980). Downed wood can be an important food source for many insects which are the prey base for some bird species. In intensively managed forests rotation ages are often too short (<80 years) as it takes more than 80 years for large snags (>50 cm) to develop (Cline et al. 1980, Mannan et al. 1980). Large snags will not be a part of such managed forests unless recruitment snags (live large trees) are maintained (Altman 1999) and managers modify their policies of cutting down trees once they have died. Fire suppression also reduces the creation of new snags.

Studies have shown cavity-nesting birds to decline 53-77% after snag removal (Scott and Oldenmeyer 1983, Raphael and White 1984, Hejl 1994). In Arizona, a cavity-nesting bird population declined by 52% on a ponderosa pine plot where conifer snags were removed, even though quaking aspen (*Populus tremuloides*) snags were left standing (Scott 1979). On this same study area, the characteristics of ponderosa pine snags that were most used by cavity-nesting birds include: 1) snags had been dead more than 5 years; 2) snags were over 15" dbh; and 3) snags had at least 40% bark cover remaining (Ibid).

Livestock grazing

Grazing is frequently the primary land use in meadows and understory habitats associated with montane conifer forests (Bock et al. 1993). Evidence suggests that livestock grazing has contributed to increases in the distribution and density of woody species (for review see Ellison 1960, Archer and Smeins 1991, Belsky and Blumenthal 1997). This is due to livestock consuming and consequently lowering the density of grasses that compete with tree seedlings for space, water, and nutrients; and to the removal through grazing of the herbaceous understory that would otherwise provide fuel for surface fires that kill regenerating trees (Belsky and Blumenthal 1997). The result is often difficult to separate from the effects of direct fire suppression - dense stands filled with fire-sensitive and disease susceptible species.

Effects of livestock use are dictated by an interaction of factors including topography, vegetation type, availability of water and livestock behavior (Roath and Krueger 1982). Exclosure studies have shown that livestock alter ecosystem processes by reducing herbaceous plant and litter cover, disturbing and compacting soils, reducing water infiltration rates, and increasing soil erosion (Belsky and Blumenthal 1997).

While little is known about the effects of grazing on coniferous forest habitat, even less is known about the effects of livestock grazing on bird species in western coniferous forests (Bock et al. 1993). Bock et al. (1993) speculate that those coniferous bird species that have most likely been negatively affected by grazing include species depending on herbaceous and shrubby ground cover for nesting and/or foraging, and species requiring open savannah instead of closed-canopy forests. Such species probably include Lewis' Woodpecker, Violet-green Swallow, Nashville Warbler, Fox Sparrow, and Mountain Bluebird. In southwestern and western ponderosa pine forests, grazing has led to an increase in the density of ponderosa pine, and may indirectly increase the occurrence of cowbirds in such forests (Bock et al. 1993, Finch et al. 1997).

Cicero (1997) studied Lincoln's Sparrow in forest meadows of eastern California and Oregon, and concluded that meadow damage from livestock grazing increases the probability of local extirpation. Verner et al. (1997) conducted a study in Madera County, which sought to attain some insights into the possible impacts that long-term grazing has on bird communities in oak-pine woodlands of the western Sierra Nevada. Although mean species richness on the ungrazed plot was significantly greater than that on the grazed plot, there was little difference between the abundance of individual species on the two plots. In this study, the most obvious effects of grazing on the oak-pine community were the reductions in shrub cover and in grass and forb biomass. California Thrashers and Wrentits, species that prefer dense chaparral habitats, were only found on the ungrazed plot in the study. Verner et al. (1997) caution that their study needs to be replicated so that their findings can be corroborated.

Chapter 5. Species-specific Recommendations and Population Targets

California Partners in Flight recognizes the difficulty involved in developing a management plan that addresses different types of coniferous forest habitats. In preparation for this conservation plan, CalPIF developed a series of detailed species accounts on a suite of coniferous forest associated bird species in California. These thirteen focal species were chosen because they were representative of major coniferous forest habitat types or were affected by different management practices, with the rationale that they represent other species with similar requirements. These detailed species accounts describe historical and current ranges, life history traits, habitat needs, and management concerns for each species. All information in the recommendations below is derived from these accounts unless otherwise cited. In addition, abbreviated *species account summaries* were written for some species that were chosen as secondary species due to their specific requirements. Focal species accounts and species account summaries (for secondary species) are an electronic appendix to this document and may be found at http://www.prbo.org/CalPIF/Conifer/Conifer.html. Some secondary species summaries were not completed by publication of the first draft of this Bird Conservation Plan but will be incorporated into future versions of this document.

Although CalPIF strongly endorses the concept of multiple-species management, it recognizes that the needs of select focal and secondary species, representative of different aspects of California's coniferous forests, may need to be specifically addressed. It also recognizes that managing for the requirements of some species is likely to affect, in either positive or negative ways, other species in the community. The challenge is that conservation actions must attempt to benefit multiple species while simultaneously tailoring their management activities for birds with very specific requirements. Of course, conservation planners must also bear in mind that population dynamics are influenced by many factors other than breeding habitats (e.g., overwintering survival or juvenile recruitment into the breeding population) and may result in population declines even as efforts increase available quality habitat.

CalPIF also recognizes that special-status species often receive more careful management than unlisted species due to legal mandate. Because such species are already carefully managed for, and because federal and state documents already exist that address their specific needs, we generally focus on unlisted species in this conservation plan. However we recognize that managers will have to deal with these species while addressing species which lack special status within the state, and therefore we briefly detail the population status, habitat needs, and management issues of bird species of special status in California in this chapter.

Species Specific Recommendations

The following species summaries and species-specific recommendations were taken from the species accounts written for this plan (http://www.prbo.org/CalPIF/Conifer/Conifer.html) unless otherwise noted. Please see the individual species accounts for specific references.

Black-backed Woodpecker

Status No special status.

Population Little data exist on trend. While BBS data indicates an increase, the BBS caution that the credibility standard is poor for this species. Several authors have cited logging and fire suppression to be the major threats to this species, although specific data supporting these theories are generally lacking.

Habitat Nests primarily in snags, but also in live trees or trees in early stages of decay. In California breed in relatively xeric conifer forests such as ponderosa or Jeffrey pine forests. This species is strongly associated with natural perturbations such as wildfire, insect outbreaks, and windthrow.

Management

Restore fire cycle: Management strategies that emphasize the conservation of ecological processes associated with natural disturbance regimes (e.g. wildfire and cyclic populations of native forest insects and pathogens) would likely benefit Black-backed Woodpecker. Traditional management practices that focus solely on snag density targets for a given area may meet short-term objectives, but they may fail to promote the dynamic creation and long-term maintenance of snag populations. A more holistic approach that maintains ecological processes responsible for various snag decay pathways and successional stages could potentially provide a greater temporal and spatial distribution of snags and associated woodpecker habitats.

Prioritize monitoring and research: Despite the knowledge of the strong association between this species and disturbance regimes such as wildfire, there remains a paucity of information regarding the explicit habitat requirements of Black-backed Woodpecker. Concern exists regarding the threat of fire suppression on this species.

Black-throated Gray Warbler

Status No special status

Population No BBS trend for 1966-2001 in California (Sauer et al. 2001).

Habitat Habitat is characterized by brushy understory beneath oak and coniferous trees, open conifer forests interspersed with shrubs or forest edges, or shrubby stands of trees. Typically limited to dry slopes. Inhabits dry oak woodlands, oak and pine mixed forests, pinyon-juniper woodlands, Douglas-fir (in north), or oak forests mixed with chaparral (at lower elevations).

Management

Examine impacts from timber harvest and grazing activities: Such impacts are mostly unknown, with little information available on how the species responds to habitat alterations.

Prioritize monitoring and research: Little information exists on population changes, brood parasitism, and demographics.

Brown Creeper

Status No Special Status

Population BBS data indicate a non-significant decline in California between 1966 and 1998 (Sauer et al. 1999). However as the amount of mature and old-growth forests have been reduced in California, the availability of appropriate habitat for breeding Brown Creepers has also decreased. Christmas Bird Counts show a significant increase.

Habitat Prefers old-growth forests, including Douglas-fir, redwood, and mixed conifer. Require large snags and deeply-furrowed trees for foraging.

Management

Protect old-growth habitat: The amount of late-successional forest within California's national forest lands is considerably less than it would be if not managed for timber. Since Brown Creepers are most abundant in mature forests, protecting remaining suitable habitat is a top priority. Efforts should be made to increase patch size of contiguous old-growth.

Manage actively-logged forests for old-growth characteristics: Management of logging areas to decrease negative effects of logging would include retaining large diameter trees, snags and diverse tree structure. Logged areas should be replanted with mixed non-monoculture forests and rotation periods should be increased. Monotypic ponderosa pine stands that sometimes replace logged forests are unsuitable for Brown Creepers. Additionally it has been found that Brown Creepers require a buffer of at least 80m from logged areas. Management for bark gleaning birds, because of their dependence on certain sizes and species of trees for foraging, will benefit old-growth and snag requiring species. Some species that would benefit from Brown Creeper habitat protection include the Red-breasted Nuthatch, Hairy Woodpecker, Pileated Woodpecker, Red-breasted Sapsucker, and other cavity-nesting birds.

Prioritize monitoring and research Healthy populations should be identified, habitat suitability determined, productivity and seasonal movements studied, and role of fire examined.

Dark-eyed Junco

Status No special status.

Population Significant national and California decline shown in BBS data (1966-1996).

Habitat Preferred breeding habitat is moist coniferous forest edge with an herbaceous understory that remains green throughout the breeding season.

Management

Examine impacts from timber harvest and grazing activities: As a ground-nesting species dependent upon an herbaceous layer for cover, certain activities may have a deleterious affect on this species and require further examination. Additionally, mechanical destruction of the herbaceous layer should be avoided during the breeding season (April through August). Possible benefits of alternative logging and grazing regimes should be assessed. Intensive cattle grazing should be avoided during the breeding season.

Prioritize monitoring and research: Despite widespread distribution and common occurrence of this species in appropriate habitat, declines in population are being documented without any good understanding of the causes. Large gaps exist in our knowledge of range, demographics, productivity and nest parasitism for this species. Winter studies would also help elucidate the what is responsible for their decline.

Flammulated Owl

Status No Special Status

Population Little reliable baseline information, and thus little trend information, exists. Due to their secretive habits, Flammulated Owls were considered rare until 1970 when appropriate detection techniques for the species were developed. However issues of fire suppression and loss of mature forests through timber extraction practices are likely to have had an effect on the species (McCallum 1994).

Habitat Found in ponderosa pine forests, where the owls selectively nest in dead pine snags. In California, Flammulated Owls occur as breeding birds throughout the Cascades, Sierra Nevada, forested parts of the coast ranges from Del Norte County south to Monterey County, the Transverse Ranges, the Peninsular Ranges, the Klamath Ranges, and all national forests where suitable habitat exists. In general, the breeding range is limited to the higher parts of the yellow or ponderosa pine belt, between elevations of 366 m (1200 ft) to 1676 m (5500 ft) in the north, and up to 2743 m (9000 ft) in the southern part of its range.

Management

Protect pine forests: Breeding range is restricted to pine forests of high commercial value. Therefore they are likely affected by timber management practices that either eliminate habitat or alter it so that it is no longer suitable.

Preserve snags and ensure snag recruitment in pine forests: Flammulated Owls are cavity nesters and the loss of potential nest trees, due to low recruitment rates of snags in managed forests and the cutting of dead trees for firewood, is the primary threat to their populations in

California today. Low reproductive success may compound the threats. When managing for Flammulated Owls in pine forests, recruitment snags (dead or mature live trees) should be retained.

Explore the use of nest boxes: Once more is learned about the response of Flammulated Owls to nest boxes and their appropriate design and placement, such structures may become a useful management tool (McCallum 1994).

Monitor effects of European Starling on cavity-nesting birds: European Starlings often have deleterious effects on many native cavity-nesting bird species. Increases in populations of this non-native species, resulting in local extirpations or declines of woodpeckers, would be seriously damaging to Flammulated Owls and other secondary cavity nesters which depend on woodpeckers to create the cavities that they utilize for nesting.

Fox Sparrow

Status No Special Status

Population No trends for Fox Sparrows have been detected with BBS data (Sauer et al. 1999). However, studies in the Lassen and Yosemite areas (Modoc and Sierra bioregions) have reported local declines and even extirpations. Because this species has received little study and attention within California, it is likely that other local declines and/or extirpations have occurred but have not been documented.

Habitat Mixed conifer forest with shrubby understory. Appropriate habitats range from continuous montane chaparral to open mixed conifer forests with shrubby understory and, to a lesser extent, open yellow pine, black oak, and red fir forest. Shrub cover is the main prerequisite for this species.

Management

Restore fire cycle: Changes to forests that render habitats inappropriate for Fox Sparrows are the primary concerns for this species. The forest management practice of fire suppression, widely practiced across California, has been to the detriment of the Fox Sparrow. Local declines and extirpations are likely a result of such management practices. With the removal of natural fire cycles, forest habitats have been dramatically altered, primarily through changes in forest structure (e.g., increased density and homogeneity of trees and a closed canopy cover) and reduction in shrub cover. Fox Sparrows and associated species require open forests with dense shrub cover. In a system lacking fire, essentially the opposite structure develops.

Many agencies have already established the objective of restoring natural fire cycles and forest structure, though the importance of this goal should be stressed. It will likely be a very long process, but one which will benefit Fox Sparrows and many other bird species in the long run. Species like Fox Sparrows that require such processes would be good to use as indicators for assessing the response of forests and of wildlife to prescribed burns and managed fire cycles.

Protect and enhance montane shrublands and other shrubby habitat: Loss of habitat is another primary concern for this species. Protection and enhancement of such habitat would also greatly benefit Dusky Flycatcher and Green-tailed Towhee. Practices that manage for montane shrublands and shrubby coniferous forests as integral components of the coniferous forest system would greatly benefit this species.

Prioritize monitoring and research: Another serious concern is simply the lack of information on Fox Sparrows. Due to the serious concerns facing their preferred habitats in California, it is likely that other extirpations have occurred and have simply gone undocumented, or that serious declines may be locally underway. An immediate need is to gain a better understanding of current breeding populations and the current status of historic breeding populations. This could be accomplished by comprehensive surveys at historical breeding sites and in other suitable habitat. Studies should relate Fox Sparrow productivity and survivorship to habitat and landscape characteristics.

Golden-crowned Kinglet

Status No Special Status

Population No clear trends in California population. Suggestions of decline according to BBS data are not significant (Sauer et al. 1999).

Habitat Breeds in subalpine spruce or fir forests and mixed coniferous-deciduous forests. Prefers cool, moist, fairly closed canopy sites. Along the coast, breeds in Douglas-fir and redwood forests; at inland sites, it generally breeds in red, white, and Douglas-fir forests, and less commonly in stands of pines or deciduous trees (Grinnell and Miller 1944).

Management

Minimize thinning in some coniferous forests: Timber harvest activities that fragment or open up appropriate coniferous forest stands may affect this species detrimentally. Stands where thinning practices have been applied may no longer be suitable to Golden-crowned Kinglets, as they prefer moderately dense to closed canopied forests.

Manage for and protect mature or old-growth forests: Management for stands of spruce or subalpine fir at least 150 years of age and with high canopy cover would be of benefit. Many mature or old-growth forest stands have been lost.

Manage for forest diversity Management practices that result in pure stands of pine are not recommended for the species. Such forests may host a reduced insect prey base.

Examine impacts from timber harvest: Evaluate benefits of alternative logging regimes to breeding populations.

Conduct research on wintering populations: Little is known about where California's wintering Golden-crowned Kinglet populations breed. Population and genetic studies could reveal such information.

MacGillivray's Warbler

Status No special status

Population No BBS trend for California overall (Sauer et al. 2001). May be increasing in some areas in California such as where forest harvest practices have resulted in an increase in younger seral stages and brushy second-growth.

Habitat Found in a variety of habitats that provide dense undergrowth and moderate cover, including riparian, Douglas-fir, redwoods, chaparral, and clearcut sites with mixed coniferous and deciduous trees. Require well-developed understories.

Management

Manage for coniferous habitats with developed shrub layer: Logging practices that destroy shrubby understory habitat are to the detriment of this species. Management for this species involves managing, where appropriate, for shrubby seral habitats. This includes avoiding management practices that involve mechanical shrub removal.

Reduce grazing pressure: Intensive cattle grazing can eliminate sapling vegetation, shrubs or willows, resulting in habitat with little understory structural diversity or density, rendering it inappropriate for MacGillivray's Warblers. Further study is necessary on the effects of different grazing regimes on this species and their habitat requirements.

Examine impacts of forest management techniques: Such studies are rare, and are especially needed in a species whose breeding biology has not been intensively studied in California.

Olive-sided Flycatcher

Status No Special Status

Population Populations in the western region are exhibiting sharp declines that have been intensifying over time. Significant BBS declines also found in the Sierra Nevada.

Habitat Olive-sided Flycatchers have been found in association with old-growth forests, post-fire habitats, and several timber harvesting techniques. Many of the habitats in which they are found have abundant high, open perches. They may be associated with habitats where late-seral stage forest and early-seral staged open-canopied habitat are juxtaposed. Generally, as canopy cover decreases in coniferous forests, Olive-sided Flycatcher densities increase.

Management

Apply fire management and reduce salvage logging: The use of fire as a management tool benefits this species, as frequent low intensity burns decrease canopy density. Olive-sided Flycatcher densities have been found to increase in habitats that have been opened up by fires. In some areas they have been found to be closely associated with post-fire habitat. Allowing fires to burn and refraining from salvage logging is recommended. The loss of natural forest processes has had a detrimental effect upon this species.

Careful use of clearcutting and selective logging: The Olive-sided Flycatcher's association with decreased canopy cover allows it to respond positively to timber management. Small clearcuts adjacent to mature forests, where snags and small clumps of trees are retained, would be ideal. However, while the immediate response to clearcutting is a positive effect on Olive-sided Flycatcher density, these habitats quickly become dense and unsuitable for them until the forest reaches a multi-layered stage. The result is an increasing proportion of the habitat in the dense, unsuitable, sawtimber stage, which is thought to be partially responsible for the decline of the Olive-sided Flycatcher. If selective cutting is being applied to an area, it should be practiced regularly to maintain suitability of the habitat. Implementation of selective logging may also benefit the species by keeping the habitat open. Pesticide application following clearcutting is discouraged.

Prioritize monitoring and research Determine optimal habitat for productivity, examine why productivity is low in managed forests, determine factors limiting or sustaining prey sources.

Protect or acquire old-growth with appropriate habitat parameters: Priority should not only focus on closed canopy old-growth forests but should encompass natural openings within old-growth, exposed rocks, south-facing slopes and other appropriate characteristics. Managing for a mosaic and diverse forest will benefit Olive-sided Flycatchers as well as many other species.

Pileated Woodpecker

Status No Special Status

Population No significant trend found in California, although Grinnell and Miller (1944) summarized the status of this species as "diminishing about commensurately with extension of lumbering operations".

Habitat Breeds in California's coniferous forests. Dependent on habitats with an abundance of standing live, dead, or dying trees, snags, and stumps. They prefer woodlands that have a tall, closed canopy and large diameter trees, and while favoring dense coniferous forests they will also use mixed forests, open woodland, or second growth. Nest is placed in cavities of conifers or aspens, generally in a dead tree or dead branch of a living tree. The same pair generally occupies a given territory year to year, and, as a new nest cavity is excavated each spring and multiple cavities are used by a pair within a year, a constant supply of snags is needed.

Management

Preserve mature or old-growth forests: Threats considered to be most important to this species include conversion of forest habitats to non-forested habitats; and silvicultural management practices such as short-rotation, even-age forestry management, monoculture forestry, and forest fragmentation. Although it will use and adapt to second growth forest, this species prefers characteristics of mature forests.

Retain logging residue and downed wood: Additional threats of forestry practices to Pileated Woodpeckers include the removal of logging residue and downed wood from the forest floor. In particular, the removal of logging residue and downed wood takes away the nutrients and foraging substrates for Pileated Woodpeckers and also reduces the overall water content of the forest floor, making it less suitable for the arthropod fauna that this species is dependent on.

Reduce fragmentation: Because of this woodpecker's preference for extensive forested areas, any adjacent land uses that would increase fragmentation of the landscape and further isolate remnant tracts of forest lands may negatively impact the species.

Prioritize monitoring and research: More information is needed on home range and patch size requirements. Demographic data should be collected and habitat suitability studied.

Red-breasted Nuthatch

Status No special status.

Population
Rangewide significant increases have been observed with BBS. However, local - albeit nonsignficant - declines have been documented in California.

Habitat Occur in mature to late-successional coniferous forests and require presence of old, diseased and dead trees. Breed in mixed stands that may include Douglas-fir, white fir, spruce, hemlock, cedar or pine trees, and may involve a deciduous component as well.

Management

Manage for presence of old, diseased and dead trees: Such trees are often lacking in managed or younger forests where larger trees have been removed as part of timber harvesting. Nuthatches require softer wood than woodpeckers (such as can be found in diseased or decaying trees) for excavating cavities. Forestry practices that serve to eliminate or reduce diseases such as root rot can negatively impact the species.

Maintain forest diversity: Loss of such diversity has been suggested to have negative impacts on this species. In addition, they require cone-bearing trees for sustenance and logging practices that remove such trees may be detrimental. Diverse, unmanaged forests will be more likely to contain forest diseases and multi-aged trees, thus providing the required conditions for excavation.

Vaux's Swift

Status California State Species of Special Concern

Population Little is known about population trend. Vaux's Swifts are common in the north and central coast areas of California, primarily in regions with old-growth or mature stands of redwood and other conifers. They are found less commonly at inland sites in the northern Coast Range, at mid-elevations of the Sierra Nevada (1,500 to 4,500 ft.), and east of the Sierra Nevada/Cascade divide in northeastern California. Also occur uncommonly in inland valleys from Santa Clara County north to Sonoma County where it nests in man-made chimneys.

Habitat Breeds in forested habitat varying from coastal redwood and Douglas-fir in the coast ranges to east-side ponderosa pine, Douglas-fir, and mixed-conifer in the Sierra Nevada. Requires the presence of large hollow snags, snags with broken tops, or old Pileated Woodpecker cavities for breeding. May also nest within some suburban areas, where it utilizes chimneys lacking insulated pipe inserts or screen spark-arresters. Close proximity to large bodies of water that attract concentrations of aerial insect prey may be important.

Management

Preserve snags and ensure snag recruitment: The primary concerns involve the effects of forest management on the availability of nest sites. If large snags are left during clear cutting Vaux's Swifts appear not to be immediately affected and will continue to breed in the clearcuts; however such clear cutting will generally result in increased vulnerability of snags to knockdown by winds and reduced snag recruitment. Selective harvesting of mature or old-growth trees or snag removal also reduces availability of suitable current and future nest sites for this species. Efforts to increase availability of suitable nesting snags and to retain mature or old-growth trees for later snag recruitment will benefit this and other primary and secondary cavity-nesting species (e.g., Pileated Woodpecker, White-headed Woodpecker, Purple Martin, White-breasted Nuthatch, Mountain Chickadee).

Suburban areas: Additionally, Vaux's Swifts that nest in man-made chimneys are vulnerable to human disturbance, especially from fires during the breeding season. Attention to these populations and increasing public awareness are necessary.

Future research: Also needed is the identification and subsequent protection of current nesting sites, especially in inland areas where breeding birds are uncommon to rare.

Western Tanager

Status No special status.

Population No significant BBS trends.

Habitat Breed in relatively open coniferous or mixed coniferous-deciduous forests. In some areas they favor openings, natural or man-made. May prefer old-growth in certain areas.

Management

Prioritize monitoring and research: Lack of demographic data, especially in southern portion of the state where effects of fragmentation and development may be great. Additionally, a clear understanding of habitat edge effects on a seemingly edge-tolerant species is necessary; data is lacking on the effects of predation and parasitism on Western Tanagers as edge increases.

Manage for a diverse coniferous forest system: Forest management should be varied and promote natural diversity. Such management will be beneficial for the widest variety of coniferous forest bird species, including Western Tanager.

Special Status Species

Great Gray Owl

Status California State Endangered Species.

Habitat In California Great Gray Owls breed in a variety of mature coniferous forest habitats, ranging from mixed conifer to red fir to lodgepole pine forests. They use nearby wet meadows for foraging.

Population The Great Gray Owl is a state endangered species and is believed to be declining. A recent estimate of only 100 individuals statewide (Gould et al. 1996) is thought to still be current. Within California they are only confirmed as breeding within the Yosemite area of the Sierra Nevada Range (Robinson 1998).

Management

Preserve mature forests near wet meadows: Great Gray Owls in California require conifer forests in the vicinity of wet meadows for nesting. At many existing and potential nest sites, few trees of sufficient size are present along forest/meadow margins to be candidate nest trees.

Preserve and protect wet meadows: The quality of montane meadows is a primary concern in the Sierra Nevada today, and is a concern for Great Gray Owls, which utilize it as foraging habitat. When montane meadows are unavailable, marginal foraging habitats include open forests, clearcuts and burned areas. The hydrologic condition of many montane meadows is deteriorating or at high risk. These risk factors need to be closely controlled through better management of water diversions, livestock grazing, roads and trail development, and off-highway vehicle use. Efforts should also be made to stabilize gully erosion (e.g., re-vegetate eroded banks, do repairs), which further reduces the hydrologic condition of the meadows. Livestock grazing has the additional effect of reducing the height of herbaceous vegetation in the meadows, reducing also the quality of the habitat for prey species of the Great Gray Owl (voles

and pocket gophers). Prescribed burning would also reduce the amount of encroachment by nearby conifers and shrubs into the meadows, which is decreasing the sizes of Sierra Nevada meadows. Active removal of encroaching trees and shrubs is another possible management technique. A further concern about the montane meadows used by Great Gray Owls is their ownership status. Many are on private lands, and the acquisition of such areas (or the use of conservation easements) has been recommended. Eight of 12 Great Gray Owl territories on the Stanislaus National Forest are primarily under private ownership.

Create artificial nest structures and perches: Also limiting is the availability of low perches (generally snags) used for foraging. Artificial nest structures and perches could be erected to stem the decline of this species while long-term management practices are implemented. Such nest structures are already being used today, and are described in detail by Bull and Henjum (1990).

Create late/seral old-growth conditions: Prescribed timber harvest and fire could be used to create late seral/old-growth conditions along the forest/meadow margins, and would also create burnt snags for foraging perches.

Reduce human disturbance: Factors related to human disturbances, such as proximity to roads and trails and accessibility by hikers and bird watchers, also need to be evaluated in the management of this species.

Marbled Murrelet

Status Federally Threatened Species; California State Endangered.

Habitat Old-growth coastal redwood and Douglas-fir forests.

Population The Marbled Murrelet is a federally threatened species and is listed as endangered within the state of California. A recent estimate of the population of Marbled Murrelets in California was 6560 individuals; of these 5700 were estimated to occur in northern California and 750 in central California (Miller and Ralph 1995). This unusual seabird spends most of its life at sea but relies upon old-growth forests for nesting habitat. Although they may nest further inland, in California most redwood stands used for nesting are within the first 10 km of the coast (Ralph et al. 1995a, Miller and Ralph 1995).

The majority of today's population breeds along the coasts of Alaska and British Columbia, but its range extends southward to central California. While population trends are likely negative in California, there is little to no historical data on the species and therefore the decline cannot be determined. However the large numbers and high densities of Marbled Murrelets in other areas where old-growth forests are still prevalent suggest that they were likely historically abundant along California's coast. The loss of the old-growth forests they rely upon for nesting habitat as well as the mortalities resulting from oil spills and fishing nets strongly suggests a decline in California's Marbled Murrelet population (Ralph et al. 1995a) and the likelihood of such a decline persisting unless such pressures are reduced and reversed.

Management

Marbled Murrelets require old-growth coastal forests that have been largely unmodified by logging (Ralph et al. 1995a). In California, nest stands predominantly consist of coast redwood and Douglas-fir, and characteristics found important to breeding murrelets include the presence of dense old-growth trees (especially redwoods), low elevation, and topography (Paton and Ralph 1990, Hamer and Nelson 1995, Miller and Ralph 1995, Ralph et al. 1995a). Despite the uniqueness of this species in its dependence both on old-growth forests and foraging habitat in the nearby ocean, Marbled Murrelets do not appear to be limited by foraging habitat (Ralph et al. 1995a). Therefore the issues affecting the species are the same as those affecting landbirds breeding in old-growth redwood forests along California's coast. See The Ecology and Conservation of the Marbled Murrelet (Ralph et al. 1995b) and the U.S. Marbled Murrelet Recovery Plan (USFWS 1993) for more information.

Protect and expand remaining suitable old-growth habitat: The Marbled Murrelet's breeding distribution is determined by the distribution and extent of adjacent old-growth forests. Along California's coast, gaps occur in the breeding distribution of this species, perhaps due to timber harvest practices (Ralph et al. 1995a). It is clear that only through protecting remaining suitable habitat and expanding such habitat will the population increase. The U.S. Marbled Murrelet Recovery Plan (USFWS 1993) outlines the need for such habitat protection and expansion, and suggests that within 50 to 100 years current stands of mature forests that are afforded protection and managed creatively would become at least marginally suitable as potential nesting stands for the species.

Conduct marine surveys: Marine surveys are a much more appropriate and practical method to estimate and monitor Marbled Murrelet populations (Ralph et al. 1995a) and should be prioritized.

Spotted Owl

Status Two subspecies breed in California. Northern Spotted Owl is a Federally Threatened Species and the California Spotted Owl is a federal and state Species of Special Concern.

Habitat Mature and old-growth forests. Breeds in a variety of habitat types, including Douglas-fir, redwood, mixed conifer, Douglas-fir/hardwood, and ponderosa pine forests. In general, selects complex mature and old-growth forests with structural diversity and high canopy closure (see Gutierrez et al. 1995 for review).

Population

Northern Spotted Owl

A conservative estimate of 1111 pairs of Northern Spotted Owls in California was made in 1992. The population has been determined to be declining (USDI 1992).

California Spotted Owl

A conservative estimate of 3050 individual California Spotted Owls was made in 1994 (Gutierrez 1994). Although no trends have been observed for the subspecies across its entire range, local declines have been observed. In fact, all demographic study areas within the Sierra Nevada are now showing significant population declines, including the Lassen National Forest beginning in 1995, 1996, and 1997; the Eldorado National Forest beginning in 1997, and the Sierra National Forest and Sequoia/Kings Canyon National Parks beginning as early as 1995 (USDA 1998).

Management

The Spotted Owl, which has been the center of much political controversy since the early 1980's, has been given much attention due to its association with mature and old-growth conifer forests that have high commercial value (Gutierrez et al. 1995). Loss of habitat due to logging, and degradation of existing habitat resulting from current and past forest management practices, are the primary threats to Spotted Owl populations.

Numerous management plans for the Spotted Owl and reviews of its ecological status have been developed. These include the U. S. Department of the Interior Recovery Plan for the Northern Spotted Owl (USDI 1992), an assessment of the current status of the California Spotted Owl with recommendations for management (Verner et al. 1992), and the recently completed Sierra Nevada Forest Plan Amendment Final Environmental Impact Statement, the Record of Decision for which outlined a conservation strategy for the California Spotted Owl (USDA 2001). We do not think it is appropriate or feasible to summarize the voluminous results and management recommendations of those plans in this document and instead refer land managers to those documents.

Population Targets

Partners in Flight seeks to develop avian population targets that will help guide conservation efforts and provide land managers with a gauge of success. Although ambiguous and hard to develop, numerical population targets provide a compelling means of communicating with the public and policy makers. In some cases, targets may simply require maintenance of populations at existing levels. However, targets for rare or declining species will encourage actions that increase existing populations to sustainable levels.

Bioregional and habitat-based population targets have been developed for some of the primary coniferous forest focal species using all available data (Table 5-1). These data are currently lacking for many bioregions, habitat types and species. More data likely exist for some of these species, and CalPIF encourages data contributions for incorporation into future versions of this incomplete "living" document.

Two types of target data are presented. The targets are simply the highest density indices (either directly through spot mapping or indirectly through point counts) found for that species within a given bioregion and habitat type. With the first type of data – spot maps – the number of territories per 40 hectares is estimated, often based on Breeding Bird Census plots of 40 hectares or less. The second type of data is point count data, in which the number of individuals detected within 50 meters of a point over a 5-minute period is presented. It is important to understand that these two types of data are not necessarily comparable to one another or convertible, and that the point count data reflect an index of abundance and is not a strict estimate of density.

Land managers should of course be aware that a high density does not necessarily translate into a healthy population (Van Horne 1983), and that other demographic factors may be at play. However, such reference estimates are useful as they can translate into habitat acreage protection or restoration goals and make use of monitoring methods that are standardized and repeatable. The high densities presented are the highest ones we found when compiling data for this bird conservation plan, but are not necessarily the highest ones documented. While additional data collection is certainly needed, we are also soliciting data from biologists who may already be able to provide some of this information that could be integrated into future versions of this plan. It should also be noted that in some species, high densities may be very different today than they were under historical habitat conditions.

Table 5-1. Suggested Population Targets by Species, Habitat and Bioregion [a]

		Bay-Delta		South Coast		Sierra		San Joaquin		Central Coast	
Species	**Vegetation Class**	Point Count [b]	Spot Map	Point Count	Spot Map	Point Count [f]	Spot Map	Point Count	Spot Map	Point Count [j]	Spot Map
Black-backed Woodpecker		0	0	0	0	-	-	0	0	0	0
Black-throated Grey Warbler	Redwood	0.01	-	-	-	-		0	0	-	-
	Pinyon-Juniper						27.3 [g]				
Brown Creeper	Lodgepole Pine			-	-		0.4 [h]	0	0		-
	Douglas-Fir	0.07	19.7 [d]								
	Pine	0.22				0.1					
	Redwood	0.38 [c]								0.25	
Dark-eyed Junco	Lodgepole Pine			-	-		12.4 [h]	0	0		-
	Douglas-Fir	0.28	36.1 [e]								
	Pine	0.28				0.33					
	Redwood	0.70 [c]								0.17	
Flammulated Owl		-	-	-	-	-	-	0	0	-	-
Fox Sparrow	Pine	0	0	-	-	0.13	-	0	0	-	-
Golden-crowned Kinglet	Lodgepole Pine			-	-	-	0.4 [h]	0	0	-	-
	Douglas-Fir	0.28	23.0 [d]								
	Redwood	0.40 [c]					7.0 [i]				
MacGillivray's Warbler	Lodgepole Pine	-	-	0	0	0.08	0.4 [h]	0	0		-
	Pine									0.06	
Olive-sided Flycatcher	Douglas-Fir	0.01	-	-	-	-		0	0	-	-
Pileated Woodpecker	Douglas-Fir	0.02	-	0	0	-	-	0	0	-	-
	Redwood	0.02 [c]									
Red-breasted Nuthatch	Douglas-Fir	0.04	6.6 [e]	-	-	-	-	0	0	-	-
	Redwood	0.04 [c]									
Vaux's Swift		-	-	0	0	-	-	0	0	-	-
Western Tanager	Pine	-	-	-	-	0.24	-	0	0	-	-

Table 5-1 (continued).		**Klamath**		**Modoc**		**Mojave**		**Colorado Desert**	
Species	**Vegetation Class**	Point Count	Spot Map	Point Count [n]	Spot Map	Point Count	Spot Map	Point Count	Spot Map
Black-backed Woodpecker	Spruce-fir	0	0	0.08 [p]	-	0	0	0	0
	Lodgepole Pine			0.07 [o]					
	Pine			0.04 [p]					
Black-throated Grey Warbler	Douglas-Fir	-	17.7 [k]	-	-	-	-	0	0
	Pine			0.21 [p]					
	Redwood		7.8 [l]						
Brown Creeper	Spruce-fir	-		0.22 [o]	-	0	0	0	0
	Lodgepole Pine			0.36					
	Douglas-Fir		10.1 [k]	0.17 [o]					
	Pine			0.57					
	Redwood		17.6 [m]						
Dark-eyed Junco	Spruce-fir			0.71 [p]	-	-	-	0	0
	Lodgepole Pine			0.9 [o]					
	Douglas-Fir		38.0 [k]						
	Pine			0.38 [p]					
	Redwood		7.8 [l]						
Flammulated Owl		-	-	-	-	-	-	-	-
Fox Sparrow	Spruce-fir	-	-	0.29 [p]	-	0	0	0	0
	(montane shrub)			2.6 [p]					
Golden-crowned Kinglet	Spruce-fir	-	-	1.08 [p]	-	0	0	0	0
	Lodgepole Pine			0.17 [o]					
	Douglas-Fir			0.08 [o]					
	Pine			0.09					
MacGillivray's Warbler	Spruce-fir	-	-	0.04 [p]	-	?	?	0	0
	Pine			0.21 [p]					
	(montane shrub)			0.88 [p]					
Olive-sided Flycatcher	Spruce-fir	-		0.15	-	0	0	0	0
	Lodgepole Pine			0.13 [o]					
	Redwood		2.0 [l]						
	(montane shrub)			0.5 [p]					
Pileated Woodpecker	Spruce-fir	-		0.03	-	0	0	0	0
	Pine			0.08 [p]					
Red-breasted Nuthatch	Spruce-fir	-		0.44	-	?	?	?	?
	Lodgepole Pine			0.43 [o]					
	Douglas-Fir		5.1 [k]						
	Pine			0.46					

Table 5-1 (continued).		**Klamath**		**Modoc**		**Mojave**		**Colorado Desert**	
Species	**Vegetation Class**	Point Count	Spot Map	Point Count [n]	Spot Map	Point Count	Spot Map	Point Count	Spot Map
Vaux's Swift		-	-	-	-	0	0	0	0
Western Tanager	Spruce-fir	-		0.34	-	0	0	0	0
	Lodgepole Pine			0.24					
	Douglas-Fir		10.1 [k]	0.33 [o]					
	Pine			0.25 [p]					
	Redwood		7.8 [l]						

[a] Numbers are derived from available point-count and spot-map data. Point count data provide an *index* of abundance, generally thought to be conservative; number provided is the average numbers of detections within 50 m of a point (5 min fixed-radius point counts, conducted during breeding season; n/ # points/ # visits). Numbers from spot mapping are the number of territories per 40 hectares during breeding season. Dashes represent lack of data for that bioregion; zeroes indicate unlikelihood that the species breeds in the bioregion (from Grinnell and Miller 1944; expert opinion). Bioregions taken from the California Biodiversity Council (RAC 1998). *Reference populations are taken from available literature or unpublished data and may not be representative of healthy populations or be ideal targets*.

[b] Except where footnoted taken from Flannery et al. 2001, Point Reyes National Seashore and Golden Gate National Recreation Area, Marin County, 1998-2000. Pine habitat is Monterey Pine.

[c] Holmes et al. 1998. Marin Municipal Water District, Marin County, 1996-1998

[d] Akers 1975, Marin County.

[e] Darling 1972, Marin County.

[f] PRBO unpublished data, Inyo and Mono Counties, Eastern Sierra Nevada, 1999-2000. Creekside coniferous-riparian, Jeffrey pine generally the dominant conifer, varying amounts lodgepole pine, aspen, white fir.

[g] Woodman 1978, Inyo County.

[h] DeSante 1986, Mono County.

[i] Kilgore 1971, giant sequoia forest (*in* Ingold and Galati 1997).

[j] PRBO unpublished data, Santa Cruz County, 1999-2000, 30 pts. Creekside redwood forest.

[k] Grantham et al. 1978, Mendocino County.

[l] Judah, 1983a, Mendocino County

[m] Judah 1983b, Mendocino County

[n] Except where otherwise footnoted, taken from Humple et al. 2001. Lassen Volcanic National Park, 1999 and 2000. Pine habitats are Jeffrey pine; spruce-fir are white or red fir.

[o] Burnett et al. 2001, Lassen National Forest, 2000. Fir habitats are white and red fir.

[p] Burnett and Geupel 2001, Lassen National Forest, 2000-2001. Pine habitat is mixed ponderosa pine and hardwoods (BTYW, PIWO, WETA, MGWA) and Jeffrey pine (BBWO, ORJU); spruce-fir habitat is white fir.

Chapter 6. Bioregional Conservation Objectives

In order to set conservation objectives for the variety of coniferous forests that occur in California, this chapter takes a bioregional approach to considering the issues facing coniferous forest landbirds. Additionally, the reader is introduced to the bioregion classification system used throughout this document. California harbors more naturally occurring species of plants, insects, vertebrates and other life forms than any comparable area north of the subtropics (Biosystems Analysis 1994), rendering state-wide conservation planning more difficult. Many organizations have embraced planning on a bioregional basis because bioregions facilitate an adaptable, site-specific focus for projects. Setting and achieving conservation goals by bioregion will:

- Ensure that a suite of ecological communities representative of California's diversity will be conserved throughout the state;
- Ensure that the broadest range of biodiversity and the locally adapted races of species will be conserved; and
- Facilitate action at the local level.

Figure 6-1. California's bioregions (RAC 1998).

Numerous authorities have divided the state into discrete geographical sections, or bioregions, based on natural communities, climate, topography, and soils. The California Biodiversity Council divided the state into 10 bioregions (RAC 1998) while others, including Biosystems Analysis (1994) and Sawyer and Keeler-Wolf (1995) recognize 11 discrete regions. California Partners in Flight followed the Biodiversity Council's 10-region scheme for the purposes of the bird conservation plans.

Following are descriptions for the nine of California's ten bioregions where coniferous forests occur (Sacramento Valley is excluded). They offer an overview of conservation issues and objectives; the concerns and needs may vary depending on particular sites within a bioregion. For more information on each bioregion, please consult the Resource Agency of California's *Preserving California's Natural Heritage* (RAC 1998).

The Modoc Bioregion

Coniferous forest habitat types: Spruce-Fir, Lodgepole Pine, Douglas-fir, Pine, and Pinyon/Juniper

Approximately 50% of the coverage in the Modoc Bioregion consists of coniferous forest with juniper woodland and mixed conifer forests occurring most commonly (Davis et al. 1998). The high desert areas in the eastern portion of the region are home to juniper woodland and sagebrush steppe. The landscape is characterized by extensively forested mountains, vast reaches of high desert, and volcanic uplands. Typical weather includes hot dry summers and cold, wet winters, with snow at higher altitudes. Of all the California bioregions, perhaps Modoc most resembles its historic state.

This bioregion includes Modoc and Lassen National Forests and part of the Klamath National Forest. It is also home to Lassen Volcanic National Park, a highly diverse preserve shaped by recent volcanism, glaciations and episodic wildfire.

It is host to the least number of human inhabitants of all ten bioregions, but continued growth is likely as pressures increase along with the growth of the rest of the state.

Fire suppression and timber harvesting practices remain the primary threats to the integrity of coniferous forests and their wildlife in this bioregion, as they do throughout much of California. In addition, the Modoc Bioregion is one of two California Bioregions where open grazing policies are still in place, adding additional threats to its avifauna. Rickets et al. (1999) identify the loss of old growth ponderosa pine habitats as being of particular concern in this area.

Conservation objectives that should be considered for the Modoc Bioregion include protecting and enhancing old-growth pine forests and decreasing the effects of edges in pine and juniper forests. Increasing large snag densities in pine forests and reintroducing natural disturbance regimes to increase the structural diversity should also be a conservation objective for the bioregion. Additionally, enhancing the herbaceous layers in pine and juniper forests by reducing

impacts from livestock grazing will likely benefit ground foraging and nesting species in the Modoc Bioregion.

Klamath Bioregion

Coniferous forest habitat types: Spruce-Fir, Lodgepole Pine, Douglas-Fir, Pine, Redwood/Sequoia, and Pinyon-Juniper

The Klamath Bioregion is California's most diverse bioregion with regards to coniferous forest types; the six primary habitat types and sixteen of the vegetation series considered in the plan occur in the Klamath Bioregion. Fifty percent of this bioregion consists of coniferous forests. The area is known for its steep, rocky shorelines, rich coniferous forests of coast redwoods and Douglas-firs, and salmon runs. No other bioregion in California receives as much rainfall as does Klamath, which is characterized by cool, foggy summers along the coast and rainy winters throughout.

Ranges in this mountainous region include the Klamath, Siskiyou, Marble, Salmon, Trinity, and Cascade Mountains, and the North Coast Range. The Klamath Bioregion is home to four national forests in California (Six Rivers, Klamath, Shasta-Trinity, and Mendocino). Also in this region are Redwood National Park, a network of state parks and wilderness areas; Jackson State Forest; and many forests on private land (such as the well-known Headwaters redwood forest in Humboldt County).

Ricketts et al. (1999) describe two ecoregions within the Klamath Bioregion, both recognized for their globally outstanding biodiversity. To the west, redwood forests are the focus of conservation issues. Less than 4% of the original extent of virgin redwood forests remains, and less than 3% of this amount is protected. The protection of large-track old-growth redwood forests is a conservation priority. Restoring degraded habitats and reducing the effects of edge in redwood stands will benefit conservation plan focal species.

In the east of the Klamath Bioregion is the Klamath/Siskiyou ecoregion, 25% of it remaining intact. Most of the blocks of intact habitat occur at higher elevations and therefore conservation objectives should focus on the protection of large blocks of coniferous forests in lower elevations. These low elevation areas are subject to open grazing policies and the function of these ecosystems has been seriously compromised by fire suppression. The re-introduction of fire in the interior portions of the Klamath Bioregion, the protection and enhancement of old-growth habitats, and the retention of large snags will benefit focal species in the Klamath/Siskiyou potion of the Bioregion.

Central Coast Bioregion

Coniferous forest habitat types: Spruce-Fir, Douglas-Fir, Pine, Redwood/Sequoia, and Pinyon-Juniper

A small portion of the Central Coast Bioregion of California (6%) includes coniferous forests. California's Central Coast is characterized by a mild climate, beautiful coastline, small mountain ranges that roughly parallel the coastline, and a wide variety of habitat types, from coastal redwood forests in the northwest portion of the bioregion to pinyon-juniper woodlands in the southeast. It is the only bioregion where the Santa-Lucia Fir vegetation series occurs.

The Los Padres National Forests occurs in this region. The favorable climate in this region supports a robust agricultural industry that includes vineyards, row crops and grazing. In recent years, the Central Coast has undergone a dramatic population increase, fueled largely by prosperous industries such as Silicon Valley's booming computer industry.

The sudden and expansive growth threatens the region's habitats through land conversion, water diversion, logging, resource extraction, grazing, and habitat clearing. Such changes have rendered the Central Coast one of the three most threatened ecoregions in the state (TNC 1996). Fire suppression and livestock grazing are two issues that should be the focus of conservation objectives for Central Coast coniferous forests.

Bay-Delta Bioregion

Coniferous forest habitat types: Spruce-Fir, Douglas-fir, Pine, and Redwood/Sequoia

Approximately 6% of the Bay Area-Delta Bioregion consists of coniferous forests. While the majority of the coniferous forests here are coast redwood (Davis et al. 1998) the bioregion is host to a great variety of other conifer habitat types, including mixed-conifer, yellow pine, and Douglas-fir forests.
The climate is relatively mild, with fog on the coast, warm summers inland, and wet winters.

The bioregion includes the San Francisco Bay area and spreads eastward to encompass the sprawling Sacramento-San Joaquin River Delta. Two national parks occur in this bioregion, the Point Reyes National Seashore and the Golden Gate National Recreation Area. The pressure for development in this very populous region is high. In areas of inland Sonoma and Napa counties, the wine-producing vineyards continue to expand.

The protection and enhancement of old-growth coniferous forests should be a primary conservation objective in the Bay-Delta Bioregion. The reduction of grazing impacts and the reintroduction of fire is of importance as well. With the proximity of metropolitan areas in this bioregion, there is an opportunity to showcase the benefits of such conservation objectives to increase public support for naturally functioning ecosystems within and outside of the urban interface.

South Coast Bioregion

Coniferous forest habitat types: Spruce-Fir, Lodgepole Pine, Douglas-Fir, Pine, and Pinyon-Juniper

In the South Coast Bioregion, only 6% of the area is today covered by coniferous forests, which are restricted to the mountainous areas. Jeffrey (yellow) pine forests and mixed conifer forests are the most common coniferous types (Davis et al. 1998). The South Coast Bioregion includes miles of sandy beaches and steep cliffs along the coast, small mountain ranges, and extensive conifer and scrub habitats. The climate is arid and warm throughout the year.

Four national forests are found in this region, the Angeles, Los Padres, Cleveland, and San Bernardino. Much land falls under the jurisdiction of state and local parks, state beaches, and federal wilderness, recreation areas and wildlife areas. The human population is very large and continues to expand rapidly, converting and fragmenting native landscapes at an alarming rate.

The protection of the remaining patches of coniferous forests with in this region is a priority conservation objective. Surrounded by shrublands where fire has been suppressed, these coniferous habitats are threatened by wildfire. Fuels reduction and the reintroduction of fire in south coast coniferous forests and adjacent shrublands is critical to the protection of these forests.

Sierra Bioregion

Coniferous forest habitat types: Spruce-Fir, Lodgepole Pine, Douglas-Fir, Pine, Redwood/Sequoia, and Pinyon-Juniper

The Sierra Bioregion spans a vast and mountainous area, characterized primarily by the extensive and rugged Sierra Mountains and the arid eastern portion of the state. It is a region rich in biodiversity, containing over half the plant species found in California and more than 400 of the state's terrestrial wildlife species (RAC 1998). Nearly half (44%) of this region consists of coniferous forests and woodlands, with mixed conifer and yellow pine forests occurring mostly commonly (Davis et al. 1998).

The Sierra Bioregion is home to a great variety of habitat types, including ponderosa pine, mixed conifer, red fir, and Jeffrey pine forests in the western portion of the bioregion as well as pinyon-juniper, which characterizes the basin areas. It is also home to the ancient bristlecone pine forest in the White-Inyo Mountain Range in the easternmost part of the state, in the rainshadow of the Sierra-Nevada Range. Within these forests are the oldest living organisms on the planet, the bristlecone pine trees.

The Sierra Nevada range is considered to be globally important for its biodiversity and is considered critically threatened or endangered (Olson and Dinerstein 1998). The Sierra Bioregion contains three national parks (Yosemite, Kings Canyon and Sequoia), eight national forests (Plumas, Tahoe, Sierra, Eldorado, Stanislaus, Sequoia, Inyo, and Toiyabe), and a number of state parks, wilderness areas, recreation and national scenic areas. Recreation land-use pressures are growing rapidly in this region, as is extensive land conversion due to accelerating population growth (Siegel and DeSante 1999, Duane 1996). A majority of the Sierra Bioregion lands are managed by public agencies. Resource managers and landowners appear willing to

invest time and money into finding more ecologically sound management practices and are incorporating conservation recommendations into work plans and project goals (Siegel and DeSante 1999).

An extensive review of the conservation needs and recommendations for much of this region has been provided in the Avian Conservation Plan for the Sierra Nevada Bioregion (Siegel and DeSante 1999), the Sierra Nevada Ecosystem Project (Davis and Stoms 1996), and the Sierra Nevada Framework (USDA 2001). The Sierra bioregion has faced over a century of land and water conversion, resource exploitation, exotic plant species invasion, and rural sprawl. Although relatively few critically at-risk bird species occur in this area compared to California's other bioregions (DeSante 1995), evidence suggests that many of the region's more common bird may be in decline (Siegel and DeSante 1999).

The Avian Conservation Plan for the Sierra Nevada Bioregion identified late-successional old-growth forests as one of the top priority habitats requiring immediate conservation efforts. Little high quality old-growth forests of any type remain in the region, as many are commercially important forest types; and much that does remain has been simplified and degraded. The major concentrations of higher quality old-growth forests are preserved within the region's national parks and much that occurs within national forests is unreserved and potentially available for harvest (Siegel and DeSante 1999). Problems familiar across California's coniferous habitats face the Sierras, such as the reduction of fire frequency resulting from logging and fire suppression, and the subsequent conversion of many forest communities to white fir dominated stands (for review see Siegel and DeSante 1999).

Conservation objectives for coniferous forests in the Sierra Bioregion should include the protection and enhancement of the region’s remaining old growth forests. Additionally, the reintroduction of fire should be considered a conservation objective for this region. Non-coniferous habitats of conservation priority that occur within the coniferous forest landscape in the Sierra Bioregion include montane meadows, non-meadow riparian, oak woodland, and montane shrublands.

San Joaquin Valley Bioregion

Coniferous forest habitat types: Pine and Pinyon-Juniper

The San Joaquin Bioregion contains some coniferous forest habitat, which covers approximately 2% of its total area (Davis et al. 1998, RAC 1998). The region contains some Jeffrey pine forests, and both juniper and pinyon-juniper woodlands.

The region is characterized by hot, dry summers and often by foggy winters. It is well-known for its agricultural and oil industries. Much habitat conversion has resulted from the growing agricultural industry. The protection of the remaining patches of coniferous forests with in this region is a priority conservation objective.

Mojave Bioregion

Coniferous forest habitat types: Spruce-Fir, Pine, and Pinyon-Juniper

Mojave, one of the state's largest bioregions, consists primarily of expansive deserts. Few people inhabit this bioregion but it is already growing as population pressures increase. Climate is characterized by hot, dry summers and fairly cold winters. Elevations range primarily from 2-7000 feet. It contains little coniferous forest (3%) except pinyon-juniper woodlands and the yellow pine, ponderosa pine, mixed conifer and subalpine habitats found at higher elevations (RAC 1998, Davis et al. 1998).

Issues associated with Pinyon-Juniper habitat should be considered conservation objectives in this region.

Colorado Desert Bioregions

Coniferous forest habitat types: Pine and Pinyon-Juniper

Only 2% of this Colorado Desert Bioregion consists of coniferous forests, predominantly juniper or pinyon-juniper woodlands, with mixed conifer and Jeffrey pine forests again occurring at higher elevation (Davis et al. 1998). This southeastern portion of the state consists of expansive semi-arid deserts, and consists of the western portion of the Sonoran Desert. Elevations are primarily low, and climate is characterized by hot, dry summers and cool winters.

These agriculturally rich lands are heavily irrigated. As with the Mojave Bioregion issues associated with the Pinyon-Juniper habitat type should be considered conservation objectives in this region. These include minimizing edge effects in remaining conifer stands, increasing the density of large standing snags and downed dead woody materials, increasing structural diversity, and increasing herbaceous layers by reducing impacts from livestock grazing.

Chapter 7. Conservation Recommendations

This chapter offers specific recommendations for coniferous forest habitat activities throughout California. These recommendations consider habitat protection, land management, research and monitoring, and policy action. Conservation organizations, agencies, scientific researchers and the public provided information used in developing this chapter. Recommendations were derived from the most recent scientific data and analyses available. We have drawn extensively from existing Bird Conservation Plans for coniferous forests in California, Oregon and Washington (Altman 1999, Siegel and DeSante 1999) and unless otherwise referenced, from focal species accounts for this plan (see http://www.prbo.org/CalPIF/Conifer/conifersp.html). Some recommendations, however, rely upon well-informed assumptions that require more scientific investigation. Standardized monitoring and adaptive management will test and develop these assumptions, continually improving our knowledge of conservation science.

These recommendations seek to reverse the current declines of many coniferous forest-associated bird populations, and to maintain stable conditions of others. By protecting, restoring and managing for healthy, stable populations, we will avoid the expensive and intrusive last resort of listing more species as threatened and endangered, and we will have succeeded in "keeping common birds common." We hope that these recommendations will galvanize and guide conservation organizations, project funding, and the actions of land managers and owners across the state.

Throughout the remainder of this chapter, please consult the following conservation objectives and management recommendations we have identified for select focal species (Table 7-1).

HABITAT PROTECTION RECOMMENDATIONS

Objective 1

Prioritize coniferous forest sites for protection.

Recommendations

1.1. Prioritize the protection of existing old-growth/late-successional coniferous forest habitats.

The loss of old-growth/late-successional stage forested habitats in California has placed a few high profile old-growth dependent bird species seriously at risk (e.g. Spotted Owl, Northern Goshawk and Marbled Murrelet). In the Sierra Nevada Bioregion alone, 28 landbird and 6 raptor species depend critically on or substantially utilize late-successional/old-growth forests (Siegel and DeSante 1999). Population trends for 13 of these species show decreasing tendencies, 7 species appear stable or have increasing tendencies and data are insufficient to detect trends for 14 others (Siegel and DeSante 1999).

It is the specific attributes of old-growth forests (e.g. large snags, large trees, complex forest structure and dense canopy cover) that are important to birds in all bioregions with coniferous habitats in California. For example, foraging efficiency and nesting requirements for the Brown Creeper require deeply furrowed bark and boles and peeling bark found in old large trees (Mariani and Manuwal 1990). The Golden-crowned Kinglet occupies forests with minimum tree heights of 33 feet, and nesting has been preferred in sites with dominant tree heights of 56-66 feet (Ingold and Galati 1997). Optimum canopy closure requirements for this species range from 49% to 70% (USDA 1994). The Pileated Woodpecker requires large snags (>20 " DBH) and tall closed canopy forests (60%), and budget their foraging time nearly equally between logs, live trees and snags (Schroeder 1982). Other landbirds that utilize attributes of late-successional/old-growth coniferous forests include Vaux's Swift, Red-breasted Nuthatch, Red-Crossbill, Winter Wren, Hermit Warbler, Band-tailed Pigeon, Hammond's Flycatcher, Chestnut-backed Chickadee, Varied Thrush, and White-headed Woodpecker to name a few (Altman 1999, Siegel and DeSante 1999).

Our suggestions supplement those provided for the Sierra Nevada bioregion by Siegel and DeSante (1999), recommending the creation of a Sierra-wide late-successional/old-growth reserve network as a workable means of safeguarding essential habitat for late-successional/old-growth dependent birds. The strategy, suggested by the Sierra Nevada Forest Protection Campaign (Britting et al. 1999) and endorsed by the SNEP Working Group on Late-Successional Conservation Strategies (Franklin et al. 1997), will create the reserve network using regions identified as Areas of Late-successional Emphasis in the SNEP report.

We recommend that similar inventories, explorations and network designs be considered for late-successional/old-growth habitats in other bioregions of California.

1.2. Prioritize protection sites to represent the diversity of coniferous forest types in California.

Coniferous forest sites should be prioritized by bioregion and habitat type in order to accommodate protection for the diversity of forest types in California. Landbird conservation planning has been largely limited to the Sierra Nevada bioregion (e.g., SNEP 1996, Siegel and DeSante 1999), which is not surprising as coniferous forests make up nearly half of the vegetative cover in this region (Davis et al. 1998). Additionally, threatened and endangered species protection has geared avian research and conservation efforts toward the ancient redwood and Douglas-fir forest haunts of the Marbled Murrelet and the Northern Spotted Owl in the Klamath Bioregion, which is also half comprised of coniferous forests (Davis et al. 1998).

The highest levels of coniferous forest protection in California have generally been limited to remnant patches of old-growth coastal redwoods in the form of State Parks and as higher elevation coniferous sites as part of the National Park and Wilderness systems. Habitats with limited protection include those that occur at lower elevations, or are comprised of tree species generally managed for timber production. Because fire suppression and harvest practices have dominated coniferous forest management for over a century, coniferous forest structure and species that depend on fire for regeneration have also been under-protected.

It is also important to consider the diverse habitat features, within the general habitat types, that are beneficial to landbirds. For example, within old-growth/late-successional forests, the Olive-sided Flycatcher requires natural openings in the form of meadows, down-fall, or rock outcrops while a Golden-crowned Kinglet requires a moderate to closed canopy. In the Conservation Strategy for Landbirds in Coniferous Forests of Western Oregon and Washington, Altman (1999) provides six forest conditions and three to nine associated habitat attributes and focal species. As an example, attributes of old-growth forest condition include large snags, large trees, and conifer cones. Managing for these attributes, and therefore old-growth conditions, will benefit Vaux's Swift, Brown Creeper, and Red Crossbill as well as a host of other species.

1.3. Prioritize potential protection sites according to current indicators of avian population health.

Conservation efforts should use the most recent information regarding the quality of existing habitat and wildlife populations to prioritize the acquisition and protection of sites. Reproductive success, in particular, is an important demographic parameter that provides an “anchor” around which to build coniferous forest conservation programs. See Recommendation 5.3. Standardized data collection during a single breeding season (approximately May through July) can provide a cursory assessment of important demographic parameters and habitat quality.

1.4. Prioritize sites according to management options.

Protection sites should be considered where forest disturbance and regenerative functions can be preserved through appropriate management. Many coniferous forest habitat requirements for landbird species will only be met with management geared toward the maintenance of those conditions. It may not always be practical or politically feasible to implement the most desired

management techniques (e.g. mimicking natural fire regimes) at sites that are otherwise ideal for protection, and this should be considered when prioritizing sites. (See management recommendations).

1.5. Ensure that patch size, configuration, and connectivity of coniferous habitats adequately support the desired populations of coniferous forest associated species.

The size and connectivity of coniferous habitat patches may limit bird species' occupancy and population size. A habitat patch is a contiguous area of similar vegetation, usually defined by the dominant vegetation. Patch sizes must not fall below the minimum necessary to support populations based on:

- Territory size requirements.
- Community dynamics.
- Sensitivity of some species to fragmentation and edge effects.

When determining the minimum acceptable patch size for a site, managers should consider the mean territory size of their target species as a guideline. If they are considering a suite of species, they should use the species with the largest territory needs (e.g. Pileated Woodpecker) to set the minimum patch size requirement. Bird community dynamics indicate the need for patch size requirements larger than individual territories in order to support a productive population. Managing for the Pileated Woodpecker entails providing home range habitat needs across areas ranging in size from 600 to 900 acres.

When determining the acceptable configuration of a forest site, managers should consider the specific requirements for a host of species. For example, the Golden-crowned Kinglet, Brown Creeper and Pileated Woodpecker tend to be forest interior species while Dark-eyed Juncos and Great Gray Owls will utilize open grassy areas at forest edges. The Olive-sided Flycatcher also requires the juxtaposition of seral stages or natural openings. Fox Sparrows appear to show no preference for forested or open habitats, but require substantial shrub cover.

The impacts of fragmentation on songbirds appear to be different in western forests than in those found in the east (Hochachka et al. 1999, Askins 2000). Until recently, few studies on patch size or edge effect have been conducted in western forests and the results are somewhat inconsistent among the diverse forest types found there (Hochachka et al. 1999, Tewksbury et al. 1998, Brand and George 2000). There is strong evidence, however, that in western forests, the occurrence of nest predation and parasitism may depend more on large landscape characteristics than on local habitat characteristics such as patch size and edge effect (Tewksbury et al. 1998). The effects of fragmentation are dependent on the combination and interaction between habitat structure, landscape context, predator community, impacts of parasitism (Tewksbury et al. 1998) or the sensitivity of a particular species to any one of these factors (e.g. the Marbled Murrelet). These factors should be considered when prioritizing protection sites. (See Recommendation 4.2 and 4.3).

1.6. Prioritize protection sites according to their proximity to existing high quality sites.

Protection sites near existing high quality sites and avian population sources have a higher probability of being re-colonized by declining or locally extirpated species.

1.7. Protect coniferous forest habitats with intact adjacent habitats.

Protection of coniferous habitats should be done in conjunction with adjacent habitats (such as riparian, meadow, chaparral, shrub-steppe and oak woodland). Many coniferous forest breeding species utilize non-coniferous habitats for foraging, molting, migration and pre-migration staging areas. Population densities of many forest-inhabiting species are often found highest near meadow edges, even while some of these species never actually utilize the meadows (DeSante 1995). Similarly, Alexander (1999) found that combined Douglas-Fir and Oak Woodland habitats supported the highest abundance and diversity of birds in the Klamath/Siskiyou mountains. Although Brown Creeper and Pileated Woodpecker breed in coniferous forest interiors, their abundance has been correlated with riparian plant species (Alexander 1999).

While it is not uncommon to find higher indices of bird abundance and diversity in mixed or edge habitats, a number of coniferous species depend on attributes specific to the contrast provided by adjacent habitats. The Great Gray owl, for example, utilizes suitable nest structures in older and mature forest habitats adjacent to wet meadows (Duncan 1997, CWHR 7.0.) and montane meadows are the most important foraging habitat for this species in the Sierra Nevada (Winter 1981). The Red-breasted Sapsucker utilizes willows in montane meadows for a steady supply of sap during the breeding season (DeSante 1995). Many coniferous species also depend on water sources provided by adjacent riparian or meadow habitats (e.g. DeSante 1995).

California Partners in Flight Bird Conservation Plans for mountain meadow, riparian, coastal scrub and chaparral, grassland, and oak woodland, (Siegel and DeSante 1999, RHJV 2000, CalPIF 2000a, CalPIF 2000b, CalPIF 2000c), provide extensive discussion of important habitat conservation issues specific to these habitat types, and should be consulted for more detail. Plans are available for downloading at http://www.prbo.org/CalPIF/Consplan.html.

1.8. Prioritize sites according to surrounding land use.

Landscape-scale land use patterns may significantly affect the sustainability of coniferous forest bird populations over the long term (Petit et al. 1995; see also recommendations 4.2 and 4.3). Surrounding land uses may influence the population sizes of Brown-headed Cowbirds and predators such as domestic cats, jays, skunks, raccoons, ravens, and crows. For example in montane meadows adjacent to coniferous forests, the presence of cattle or pack stations may attract cowbirds, which parasitize nests of many bird species in the surrounding forest (Rothstein et al. 1980, Verner and Ritter 1983, Rothstein et al. 1984, Laymon 1987, Graber 1996, Siegel and DeSante1999). The landscape-scale abundance of human development (farms and houses) has been demonstrated to be among the highest predictors of parasitism in Montana hardwood forests (Tewksbury et al. 1998). In mature and old-growth redwood forests, nest predation rates were higher at sites adjacent to prairie than those next to suburbs, rivers, young forests, or roads (Brand and George 2000). It is known that Brown-headed Cowbirds may commute more than 12 kilometers between foraging grounds and the nest sites of their hosts (Mathews and Goguen 1997).

The following land uses within a coniferous forest buffer zone are listed in general order of preference. This list provides only rules of thumb and must be considered in context with many other factors when assessing each unique conservation opportunity.
The land uses generally beneficial with sustainable management are:

- Natural habitat not used for commodity production (e.g., wilderness).
- Unimproved parks/open space (provided substantial non-native species problems do not exist).

The land uses that can be beneficial, neutral, or detrimental depending on the wide variety of seasonal use, crops, cultivation, and pest control techniques used are:

- Commercially managed habitat (e.g., timber production forest).
- Campgrounds and picnic areas
- Horse/cow pasture.
- Row or permanent crops (e.g., orchards, vineyards).

The land uses within a coniferous forest patch or buffer zone that can be detrimental to birds because they support and attract cowbirds and predators are:

- Manicured parks and golf courses.
- Rural homes/ranchettes.
- Permanent and intensive feedlots.
- Intensive development (urban/sub-urban).

The land surrounding a proposed protection site should be assessed for its risk of change or conversion and how that may affect bird populations. For example, is the land available for conversion to other uses? Or, is it permanently prohibited from development (e.g., in public ownership; or protected through an agricultural conservation easement, a habitat conservation plan, local zoning, or an urban limit line)?

1.9. Prioritize protection sites with high tree species diversity.

The last century of coniferous forest management in California has generally resulted in the conversion of mixed conifer to monotypic stands. Due to silvicultural practices in the Sierra Nevada, mixed-conifer forest stands have been converted to Ponderosa Pine stands, or mixed stands of Ponderosa Pine and lesser amounts of Douglas-Fir and Fir. It has been suggested that this type of change likely alters the abundance of species such as Brown Creeper, Red-breasted Nuthatch, and Hairy, White-headed and Pileated Woodpeckers that, as a group, utilize a diversity of tree species for foraging (Morrison et al. 1987). Individuals may use a different tree species for foraging than that used for nesting, such as in the case of the Brown Creeper (Lundquist and Mariani 1991).

The combination of timber harvesting and fire suppression in Lassen National Forest and Lassen Volcanic National Park appears to have reduced the number of large trees and increased the density of small understory trees, which has favored the recruitment of white fir over pine and

oak (Agee et al.1978, Husari 1980, Chang 1996). As a result, there has been a gradual conversion to stands dominated by white fir and a subsequent change in the avian community associated with these forests (King et al. 2001).

As forests are managed for timber, deciduous and other non-timber tree species are generally cleared and not replanted. Sites that have retained these non-timber species should also be considered for protection as they host a different bird community than that found in purely coniferous stands. The combined Douglas-Fir/oak woodland habitats of the Klamath/Siskiyou mountains were found to support the highest abundance and diversity of birds (Alexander 1999). In the same study, Black-headed Grosbeaks, Black-throated Gray Warblers, Cassin's Vireos, Swainson's Thrush, Pacific-slope Flycatcher, Winter Wren, Nashville Warblers and Western Tanagers were all associated with hardwood species.

HABITAT MANAGEMENT RECOMMENDATIONS

Effective management of coniferous forest habitats is crucial to the survival and recovery of coniferous forest associated landbirds. Proper management increases habitat value to wildlife, arrests species declines, and contributes to the recovery of declining bird populations. Landscape-scale patterns of land use are of critical importance, influencing whether coniferous forest bird populations remain sustainable over the long term.

Objective 2

Manage for old-growth/late-successional conditions.

Mirroring the first two of SNEP's Goals of Late-successional Forest Strategies (SNEP 1996), we propose the following priorities for the management of old-growth/late-successional conditions in California: 1) Protect existing forest stands that have maintained late-successional/old-growth conditions (see Recommendation 1.1.). 2) Actively manage manipulated stands to create conditions occurring naturally in an old-growth/late-successional system and to ensure future old-growth conditions. The following recommendations assume active management for old-growth/late-successional structure and function.

Recommendations

2.1. Mimic natural fire regimes.

Prescribed fire and the management of naturally occurring fires, has been suggested as a strategy for promoting the long-term development of old-growth/late-successional conditions (SNEP 1996), which has clear long-term benefits for a host of birds dependent on this habitat type (Siegel and DeSante 1999 and see Recommendation 1.1.).

Due to its possible threats to humans and their property, the size and extent of fuel loads that have accumulated from decades of fire suppression may prohibit the use of fire as a management tool in many parts of California. As a possible solution, Siegel and DeSante (1999) suggest the

mechanical manipulation of vegetation to mimic forest conditions created by fire. (See also the following recommendations [2.2 thru 2.4[by Altman (1999)).

2.2. Manage for large trees.

A number of species are associated with and utilize large older trees for foraging and nesting. In redwood forests of Marin County's coast range, Golden-crowned Kinglet, Brown Creeper and Pileated Woodpecker occurrence was positively and significantly correlated with maximum tree DBH and maximum tree height. In the same region, but in evergreen forests dominated by Douglas-fir, Red-breasted Nuthatch occurrence was positively and significantly correlated with maximum tree DBH (Holmes et al. 1998).

Management strategies for the retention of large trees, presented by Altman (1999) as conservation options for the Brown Creeper include:

- Extend rotation age to >80 years, retain these trees and recruit replacements at each harvest entry.
- In conjunction with extended rotations, conduct early and frequent thinning to accelerate individual tree growth and faster development of large trees.

2.3. Manage for large snags.

Managing for the retention of large trees has the additional benefit of creating opportunities for large snags. Large snags are utilized by Pileated Woodpeckers, Vaux's Swift, Brown Creeper, Northern Pygmy-Owl, and Hairy Woodpecker to name a few. Large snags also benefit many other primary and secondary cavity nesters (Raphael and White 1984). Strategies for the management of large snags, presented by Altman (1999) as conservation options for the Vaux's Swift (VAUX) and Pileated Woodpecker (PIWO) include:

- Extend rotation ages to > 80 (PIWO) and > 100 (VAUX) years to provide snags of sufficient size and retain these snags and recruit replacement snags (large live trees) at each harvest entry.
- Retain the largest live trees, particularly dying or defective trees (e.g. broken tops, fungal conks, insect infestations) through rotations as recruitment snags for potential nest sites.
- If snags have not been retained (or insufficient in number), create snags through blasting tops or inoculation with heart rot if size of trees meets species requirements.
- Where possible, introduce fire into stands with large snags to enhance processes to create some hollow snags.

2.4. Manage for closed canopy.

A number of bird species are associated with and utilize forests with high tree cover. In Marin County's coastal redwoods, Brown Creeper occurrence was significantly positively correlated with redwood tree cover. In the same region, Golden-crowned Kinglet occurrence was significantly positively correlated with coniferous tree cover and Red-breasted Nuthatch occurrence with Douglas-fir cover (Holmes et al. 1998).

Canopy closure recommendations for species in late-successional/old-growth managed forests include >90% for Hermit Warbler (Altman 1999), >70% for the Golden-crowned Kinglet, and >60% for the Pileated Woodpecker. Strategies for the management of closed canopy, presented by Altman (1999) as conservation options for the Hermit Warbler include:

- Extend rotation ages to lengthen the period of time that stands are available as suitable habitat.
- Conduct light to moderate thinning early in stand development (<30 years old) to promote development of large crowns to increase habitat suitability later in stand development.
- Avoid understory thinning in stands >30 years to minimize short-term negative effect of reduced canopy closure.

Objective 3

Management should ensure that the diversity of coniferous forest types, processes and characteristics in California are represented.

Bird species depend on a variety of forest conditions and coniferous forest habitat types. Management should strive to create the conditions found not only in old-growth forests, but also those found in mature and young forests. Additionally, because some bird species utilize specific coniferous forest habitat types (e.g. Pinyon/Juniper, Pine, Douglas-fir), regional and local management efforts should seek to accommodate for a diversity of these habitat types where appropriate.

3.1. Revise fire management regimes to mimic natural fire patterns wherever possible.

Western forests historically grew in a patchwork of different successional stages, and fire played a primary roll in the development of the coniferous landscape. Aside from altitudinal differences, fire has been the most important factor influencing avian diversity in western forests (Askins 2000). An examination of the varied nesting and foraging niches that birds occupy in successionally complex forest systems (e.g., Bock and Lynch 1970, Franzeb and Ohmart 1978, Raphael et. al 1987) gives testimony to the benefit of these forests, and the roll that fire can play.

It has been demonstrated that the Olive-sided Flycatcher can be relatively restricted to post-fire habitat (Hutto 1995) and utilizes natural openings in the forest canopy, snags and a mosaic of differing stand heights that fire can provide (Raphael et. al 1987). The Great Gray Owl and Dark-eyed Junco benefit from meadow openings and increased herbaceous layer that fires maintain (Winter 1981). Understory maintenance is necessary for species such as Wilson's Warbler, Hermit Thrush, and Fox Sparrow that use the shrub layer as nesting substrate. Fires also create suitable habitat for primary and secondary cavity nesters through the killing of trees and limbs.

3.2. Manage for tree species diversity.

Managing for coniferous tree species diversity will provide habitat for birds of the insect-gleaning guild that have been demonstrated to utilize a variety of tree species for foraging

(Airola and Barrett 1985, Morrison et al. 1987). The Brown Creeper, for example, makes greater use of forest stands that are diverse in tree species composition. They may forage from a tree species as it occurs in mixed stands, but seldom forage in monotypic stands of the same species (Adams and Morrison 1993). Coniferous tree species richness was significantly positively correlated with Hermit Warbler and Nashville Warbler abundance in coniferous forests of the Lassen area (King et al. 2001).

Managing for deciduous trees within coniferous systems will also benefit bird species that utilize them for nesting and foraging. Deciduous trees provide fruits and foliage insects different than that of conifers, and have a higher density of cavities than conifers (Gumtow-Farrior 1991). Species that benefit from and are associated with deciduous trees in the canopy of conifer dominated forests include Pacific-slope Flycatcher, Warbling and Cassin's Vireo, Black-headed Grosbeak, Black-throated Gray Warbler, and Western Tanager to name a few (Alexander 1999, Altman 1999).

Based on their findings in the Sierra Nevada, Airola and Barrett (1985) recommend that in forests managed for timber, use of both even and uneven-aged forest management techniques would encourage the variety of tree species required by a host of bird species. In the case of clear cuts, they recommend the replanting of a mixture of tree species, and the retention of non-timber species such as oaks. Altman (1999) recommends the same for thinning projects.

Strategies for the management of a deciduous canopy, presented by Altman (1999) as conservation options for the Black-throated Gray Warbler and Pacific-slope Flycatcher include:

- In managed forests with a deciduous canopy component in stand, extend rotation age to >80 years to allow for development of canopy and sub-canopy gaps suitable for foraging habitat.
- Conduct conifer tree thinning where there is potential for understory development of deciduous trees, particularly in wet sites. Conduct thinning early in stand development (<20 years) to enhance competitive opportunities for deciduous trees, and minimize short-term effect of reduced canopy closure and suitability of habitat.
- Where deciduous trees have been retained from earlier successional stages, ensure release of these trees by thinning of conifers shading them out.
- If deciduous trees have not been retained from earlier successional stages and the site is suitable, conduct thinning in scattered patches (variable-spaced) to open-up the canopy and allow for understory development of deciduous trees adjacent to the closed-canopy dominated forest.
- Conduct repeated thinning as necessary in conjunction with a longer rotation to maintain a deciduous canopy component for a longer period of time.

3.3. Manage for structural diversity and diverse tree age.

Western forests historically grew in a patchwork of different successional stages, and fire played a primary roll in the development of the coniferous landscape (Askins 2000). For the Sierra Nevada, Siegel and DeSante (1999) recommend that fire regimes be revised to maintain historic levels of forest diversity and patchiness. (See Recommendation 2.1 and 3.1) In cases where

prescribed fires may pose substantial risk to humans, Siegel and DeSante (1999) recommend mechanical manipulation of vegetation to mimic fire-created forest structures.

Mechanical strategies for the management of mid-story tree layers in mature forests, presented by Altman (1999) as conservation options for the Varied Thrush, include:

- Extend rotation age to >80 years.
- To enhance layered development in forest stands, conduct light to moderate thinning early in stand development. This should include thinning in variable densities (spacing), variable intensities (amount), variable size classes (layering), and variable species to promote faster growth for some trees and reduced growth for others (McComb et al. 1993).
- As necessary, conduct thinning in conjunction with underplanting of a diversity of species to increase tree layering and species diversity.
- To enhance diversity in forest structure, conduct thinning from below to enhance survival of suppressed and intermediate trees and promote growth of conifers already present.

3.4. Manage for shrub understory.

The shrub component is generally associated with open canopy forests that are of diverse structure and age. However, even in old-growth conditions where canopy cover is high, shrub patches develop where the canopy has been ripped open by large tree deadfall. In wet forest types, ferns often persist as shrub story components even in closed canopy conditions. The shrub component benefits a variety of bird species that utilize it for nesting substrate (e.g. Fox Sparrow, Green-tailed Towhee, Spotted Towhee, White-crowned Sparrow, Wilson's Warbler, Hermit Thrush). In the Lassen area, MacGillivray's Warbler abundance was significantly correlated with shrub species richness in coniferous habitats (King et al. 2001).

The combined effect of fire suppression and logging has resulted in homogenous even-aged forests with little shrub cover. The reduction of the number of large trees and the increased density of smaller trees (particularly white fir) following timber harvests, or catastrophic crown fires, have excluded the development of shrub layers (Agee et al. 1978, Husari 1980, Chang 1996). Shrub and forb development do occur after clear cuts but this early successional stage, and the benefit it may bring to birds, is often cut short by the management strategy to quickly establish a dense cover of harvestable trees (Askins 2000).

In the area of Lassen National Forest and Lassen Volcanic National Park, it is speculated that the loss of shrub understory has resulted in a localized decrease in shrub-nesting species such as the Fox Sparrow and Green-tailed Towhee over the last 60 years (King et al. 2001).

3.5. Manage for forest floor complexity.

Components of forest floor complexity include downed logs, root wads and a deep litter layer. Orange-crowned Warblers utilize downed logs, sticks and leaf litter as nest sites, and Winter Wrens use cavities found in root wads, stumps and downed logs. Amphibian and small mammal

species have also been shown to increase in abundance with an increase in forest floor complexity (Butts and McComb 2000).

Forest floor complexity (in the form of downed logs and root wads) is often associated with the vegetative structure and habitat attributes unique to older forests (Altman 1999). In unmanaged forests, litter depth has been shown to be deeper in old growth than in mature or younger forests (Spies and Franklin 1991). Protecting old-growth forests would ensure forest floor complexity (see Recommendation 1.1.)

Strategies for conserving forest floor complexity in managed forests (which often lack downed logs and a litter layer) are provided by Altman (1999) and include:

- Retain down woody debris at initial harvest and site preparation, and supplement at later entries.
- If down woody debris has not been maintained at sufficient levels from earlier harvests, fell trees to create this attribute.
- Retain root wads where they occur.
- Create and retain slash piles of varying sizes at each harvest entry.
- Harvest entries should be carefully designed and logging systems tailored to site-specific conditions to minimize understory disturbance.

3.6. Manage for herbaceous understory.

Healthy herbaceous understory in coniferous forests provides cover for ground-nesting species such as Dark-eyed Junco and Orange-crowned Warbler. The presence of an herbaceous layer may also reflect other coniferous forest attributes important for tree and shrub nesting species. In coniferous habitats of the Lassen area, Hermit Thrush and Nashville Warbler abundance was significantly positively correlated with herb species richness (King et al. 2001). In Marin County's coastal mixture of redwoods, Douglas-fir, oak woodland and mixed hardwoods, Oregon Junco occurrence was significantly positively correlated with herb layer cover as well as grass cover (Holmes et al. 1998).

Managing for an herbaceous understory entails the limitation of livestock grazing. While the negative effects of livestock grazing in grassland, mountain meadow and riparian habitats has been documented, little is known of its effect on coniferous forest understory vegetation and the subsequent effect on birds. Bock et al. (1993) speculate that coniferous forest birds most likely negatively effected by grazing are those that are dependent on herbaceous and shrubby ground cover for nesting and foraging. In addition, livestock grazing has been implicated as a cause of increased tree densities in interior forests (Belsky and Blumenthal 1997). Livestock can also remove flammable understory vegetation, reducing the frequency of ground level fires needed to maintain open forests (Askins 2000).

RESTORATION RECOMMENDATIONS

Objective 4

Implement and time land management activities in coniferous forests to increase avian reproductive success and enhance populations.

The number of young produced in a bird population (reproductive success) may be the most important factor influencing a species' occurrence and persistence in an ecosystem. When less than 20% of nests survive to fledge young, nest success is considered poor and it probably indicates a nonviable population (Robinson et al. 1995, Geupel et al. 1998).

4.1. Limit restoration or management activities such as prescribed fire, forest thinning, firewood removal, livestock grazing and herbicide application to the non-breeding season (which varies by region, but typically September through February in California). When such actions are absolutely necessary during the breeding season, time disturbance to minimize its impacts on nesting birds.

The nesting season is a critical period for the maintenance of bird populations (Martin 1993). Some management activities, such as forest thinning or prescribed fires, can have serious consequences for breeding songbirds by destroying nests and nesting habitat or causing nest abandonment. Managers often have a degree of flexibility, allowing them to schedule these activities outside the breeding season while still achieving their management objectives. In general, the breeding season in California may begin as early as March and continue through August, depending on region, habitat type and elevation.

4.2. Manage or influence management at the landscape level (i.e., land surrounding coniferous forest patches or, preferably, the whole region).

Landscape-scale land use patterns significantly affect the population levels of Brown-headed Cowbirds and avian predators in an area. (See Recommendations 1.5 and 1.8). With increases in cowbird and predator populations, species often suffer poor reproductive success and, possibly, population declines. Eventually, local extirpation of the species may occur. Managers should discourage certain adjacent land uses that subsidize cowbirds and avian predators, including intensive livestock grazing, golf courses, human habitation and recreation areas, and pack stations. Livestock pastures bordering coniferous patches should avoid grazing during the breeding season (Goguen and Mathews 1999, Hochachka et al. 1999). When grazing constitutes a significant percentage of the landscape near the coniferous patch (particularly within a 1-12 km distance), the following are recommended:

- Eliminate, reduce, or closely manage grazing in spring and during the breeding season (April-July) to maximize the understory habitat value to wildlife and minimize foraging habitat for cowbirds.
- If grazing must occur in coniferous habitats, move cattle often to avoid the devastating impacts of year-round grazing.

4.3. Manage or create "soft" edges appropriate to historical vegetation patterns.

Western forests are generally managed to perpetuate commercially valuable forests and have historically been patchy due to natural fire patterns or elevational gradients. They generally lack hard edges with agricultural or urban areas and fragmentation may not have as much of an impact on bird populations as is shown in eastern forests (Tewksbury et al. 1998, Altman 1999, Askins 2000). Tewksbury et al. (1998) found that patch size and distance to edge did not influence nest predation rates, and predation rates were actually higher in hardwood forested landscapes than in fragmented landscapes due to native forest predators. (See Recommendations 1.5 and 1.8).

Conversely, in California's highly fragmented mature and old-growth redwoods, Brand and George (2000) found the probability of songbird nest predation to decrease with increasing distance from edge. Avian predator Steller's Jays demonstrated higher densities near redwood forest edges than in forest interior (Brand 1998). Birds including Gray Jays, Winter Wrens, Varied Thrushes, Band-tailed Pigeons, and Chestnut-backed Chickadees have been found to be less abundant along forest edges than in the interior and others (e.g. Golden-crowned Kinglet) may be less abundant in fragmented landscapes (Hejl 1994, McGarigal and McComb 1995).

Some species are clearly more sensitive to edge effect than others. For example, the Brown Creeper generally requires at least an 80m buffer zone between their nest site and the edge of the logged area (Hagar 1999). The Marbled Murrelet has been shown to be extremely sensitive to nest predation, specifically when nesting near clearcuts and other openings (Burger 1995, Nelson and Hammer 1995), and predation may be more frequent near campgrounds or picnic areas (Singer et al. 1991). The latter may be serious in California, where many of the ancient redwood forests are in state or national parks (Askins 2000).

4.4. Manage coniferous forest in conjunction with adjacent habitats.

Management of coniferous habitats should be done in conjunction with adjacent habitats (such as riparian, meadow, chaparral and oak woodland). (See Recommendation 1.7).

The Great Gray Owl provides an excellent example of a species that utilizes different and adjacent habitats. Old and mature coniferous forests provide suitable nesting structures for this species (Duncan 1997) while meadows adjacent to these forests provide the most important foraging areas (Winter 1981). Risk factors for the Great Gray Owl include the degradation of meadows and old forest edges by livestock, fire suppression and timber management (Winter 1986, Bull and Duncan 1993, Hayward and Verner 1994, Greene 1995, Duncan 1997).

Management strategies for the conservation of the Great Gray owl include:

- Eliminate, restrict, or better manage livestock grazing in mountain meadows.
- Repair the hydrologic condition of meadows by 1) Controlling or eliminating risk factors (such as water diversions, livestock grazing, packstock grazing, roads, trails, off-highway vehicle use, facility construction); and 2) Stabilize gully erosion with grade-stabilizers, revegetate eroded banks, apron headcuts.
- Prescribe timber harvest and fire to create late/seral old-growth conditions along forest/meadow margins.

- Prescribe fire to maintain forest or upland/meadow boundary, and burn pole size trees for perches.
- Remove encroaching conifers and upland shrubs within meadows.

California Partners in Flight Bird Conservation Plans for mountain meadow, riparian, coastal scrub and chaparral, grassland, and oak woodland (Siegel and DeSante 1999, RHJV 2000, CalPIF 2000a, CalPIF 2000b, CalPIF 2000c), provide extensive discussion of important habitat conservation issues specific to these habitat types, and should be consulted for more detail. Plans are available for downloading at http://www.prbo.org/CalPIF/Consplan.html.

4.5. Avoid the construction or use of facilities and pastures that attract and provide foraging habitat for Brown-headed Cowbirds.

Management should avoid aggregations of livestock and associated livestock facilities (e.g., corrals, pack stations, salting areas and feedlots) near coniferous forest nest sites during the breeding season whenever possible. Livestock, livestock facilities, and human habitation provide foraging areas for cowbirds (Rothstein et al. 1980, Verner and Ritter 1983, Mathews and Goguen 1997, Tewksbury et al. 1998), which feed in short stature vegetation within "commuting distance" of their laying areas.

The proximity of active livestock grazing may also determine the feeding distributions of cowbirds and the distances they will commute between foraging and laying areas (Mathews and Goguen 1997). Grazing and human facilities within one kilometer of breeding sites affect reproductive success more negatively than facilities located farther away. Establishing cowbird buffer zones around coniferous forest sites during the avian breeding season may reduce the impact of cowbirds on host species. The creation of such buffers may be difficult, however, since cowbirds may regularly commute up to 12 km between foraging and laying areas (Mathews and Goguen 1997).

In the Bitteroot River Valley of Montana, cowbird abundance declined significantly with increasing distance from agriculture (Tewksbury et al. 1998). Additional feeding areas (i.e., agriculture, livestock) located farther than 1 km from a laying area have no apparent additional impact on the density of cowbirds or brood parasitism. However, this study did not assess the effect of facilities located at greater than 1 km from hardwood forest sites in the absence of facilities located within a 1-km range.

4.6. Utilize selective cutting silvicultural techniques rather than clear cutting of managed forests.

Species such as the Olive-sided Flycatcher show an immediate increase in abundance after clearcutting (Hagar 1960, Evans and Finch 1994). However, Raphael et al. (1988) suggests that the immediate benefits of clearcuts are only temporary. Coupled with even aged timber management is the increase of coniferous forests in the sawtimber stage. Raphael et al. (1988) further suggests that Olive-sided Flycatchers may decline by as much as 37% as a result of the long-term effect of unsuitable, even-aged habitat after a clearcut. Additionally, bird density does not necessarily correlate with habitat quality or bird species persistence (Van Horne 1983).

Other species that may temporarily benefit from clearcuts include those that nest or forage in the herbaceous and shrub layers of a regenerating forest. However, early successional stages are often cut short to accommodate for the quick establishment of a dense cover of harvestable trees (Askins 2000).

Cavity nesting species, old-growth/late-successional species and species requiring diverse forest structure clearly do not benefit from clearcutting techniques.

4.7. Retain decaying or dead trees, limbs and snags.

Decaying or dead trees, limbs and snags are utilized by many coniferous-dwelling birds, including six of the coniferous focal species. Snags also benefit many other primary and secondary cavity nesters (Raphael and White 1984).

In the last 15 years, management strategies for cavity-nesting birds have been developed for public lands. Implementation of these strategies (e.g. retention of snags in clearcuts) has improved the status of cavity-nesters in early-successional forests (Altman 1999).

4.8. Avoid attracting or supporting non-native animal species.

Non-native animals can have a severely negative impact on songbirds. Invasive bird species such as European Starlings and House Sparrows often out-compete native birds for nest sites and have been known to destroy active nests and even kill nesting adults. Introduced animals, such as domestic cats, kill millions of birds every year.

To reduce the effects of non-native animals on native birds:

- Avoid establishing human habitat near coniferous forest patches.
- Do not feed or otherwise encourage populations of feral animals.
- Keep cats indoors.
- Do not put bird feeders in a yard where a cat might ambush feeding birds.
- Humanely control non-native species when necessary.

4.9. Work cooperatively with forest and park contractors to encourage recreational and other activities in and around coniferous forests to be more "bird friendly".

Managers should encourage contractors and leaseholders to consider bird populations when conducting their activities.

Examples of easy "bird friendly" strategies are discussed in Recommendations 4.1, 4.5, 4.6, 4.7, 4.8 and 4.9.1.

Examples of more intensive bird conservation strategies include those discussed in Recommendations listed under Objective 3.

4.9.1. If utilizing nest boxes or nest perches to temporarily provide nesting sites for coniferous forest nesters, follow guidelines to increase the likelihood of occupation of native species.

Ideally, managers should strive to maintain decaying or dead trees, limbs and snags for nesting sites of cavity nesting birds. In cases where the retainment of proper nesting substrate is not possible, nest boxes can be used if carefully constructed and maintained. The main threats that nest boxes pose to cavity nesting birds are 1) their ability to attract non-native breeding birds such as House Sparrows and European Starlings and 2) their susceptibility to predators. Exotic species are extremely aggressive competitors for nesting cavities and their presence can easily discourage native species from occupying certain sites. Domestic and feral cats and even native predators such as raccoons have been known to treat known nest boxes as "lunch boxes" once they learn of their locations. The following steps can be taken to deter non-native species and predators and to attract the desired species:

- Boxes with entrance hole diameters of less than 1 9/16" will prevent starlings from entering. House sparrows cannot enter boxes with openings less than 1 1/8".
- Place predator guards on all nest boxes.
- Each species has its own unique nesting criteria, the entrance hole diameter is critical to a successful nest box.

Refer to The Cavity Nesting Bird Education and Enhancement Project (CRP 1999) for nest box dimensions for several cavity nesting species, and important nest box building and maintenance guidelines. Booklets are available at www.crpinc.org/eco/education.html or 707-838-6641.

Low foraging perches near meadows are required by Great Gray Owls. Because low perches are probably less abundant than conditions under which the species evolved, the use of artificial perches may be a short-term solution.

MONITORING AND RESEARCH RECOMMENDATIONS

Objective 5

Recommendations

Provide data on pressing conservation issues affecting birds.

In order to successfully protect and expand native bird populations, managers must have the most recent data available on populations and their habitat needs. Standardized scientific monitoring of populations will provide decision-makers with these essential tools.

5.1. Gain a better understanding of the current breeding status and distribution of historic breeding populations of coniferous birds in California.

Of the 13 coniferous forest focal species, 4 species demonstrate significant declining BBS trends in California (1966-1999) (Sauer et al. 2000). While extremely valuable, the BBS protocol has substantial limitations, especially for coniferous forest dwelling species in California. Because BBS surveys are restricted to roadside survey points, and differences in avian community composition by habitat or management regimes are indistinguishable, coniferous forest habitats and specifically late-successional/old-growth habitats are poorly sampled (Siegel and DeSante 1999).

Similarly, BBS trends often miss localized declines or extirpations of the seemingly more common species. Trends for the Fox Sparrow, for example, show non-significant but increasing trends in California and the Sierra Nevada region (Sauer et al. 2000). Yet, recent results from historic breeding sites in Yosemite and Lassen areas indicate that populations in these areas have declined markedly (Grinnell et al. 1930, Beedy 1982, King et al. 2001). Other declines and possible localized extirpations in the Lassen area have been demonstrated for the Green-tailed Towhee, Ruby-crowned Kinglet, and Pygmy Nuthatch (King et al. 2001).

Proper current coverage of actual breeding status and distribution of coniferous birds in California could be accomplished by comprehensive surveys at historical breeding sites and in other suitable habitat. A large-scale point count project that covers all coniferous habitat types and across bioregions should be initiated. Vegetation data to determine habitat associations of our coniferous birds should coincide with point counts. The design and implementation of a long-term, off-road, habitat-specific avian monitoring program has already been recommended for the Sierra Nevada bioregion (Siegel and DeSante 1999) in response to the limitations of the BBS program.

Examples of large-scale avian point count and habitat assessment projects in coniferous habitats are those found in the Klamath and Modoc bioregions (Hollinger and Ralph 1995, Alexander 1999, Humple et. al 2001, King et. al 1999). RHJV (2000) and Ballard et al. (1999) provide examples of the use of point counts for conducting a large-scale quick assessment of breeding status and distribution for riparian birds in California.

5.2. Statewide, specialized distributional surveys should be conducted for species not properly censused by Point Counts or BBS.

Distributional information for species such as Pileated Woodpecker, Great Gray Owl, Vaux's Swift and Flammulated Owl should be gathered with specialized methodologies more suitable than point counts or BBS. Survey work for these species is often incomplete and standardized protocols have not been used consistently (e.g. Gould et al. 1996).

Recommendations for the Great Gray Owl include the statewide application of a new protocol commissioned by Forest Service Region 5 and developed by Beck (2000).

5.3. Consider reproductive success and survival rates when monitoring populations, assessing habitat value, and developing conservation plans.

The number of young produced in a bird population (reproductive success) critically influences a population's presence, health and sustainability in an area. When fewer than 20% of nests survive to fledge young, nest success is considered poor and probably indicates a nonviable population.

Year-to-year survival rates give us an indication of what may be occurring for a species during the non-breeding season. Low survival rates indicate a problem on the wintering grounds, during migration or with post-fledgling survival. Survival can only be confidently calculated for adults for one year after at least three years of mark/recapture data (such as mist netting) have been obtained (Nur et al. 1999).

Research seeking to determine productivity and survival for a breeding population should include at least three years of nest searching and/or mist netting.

5.4. Conduct selective monitoring at critical sites to determine the factors influencing nest success of representative open cup nesters (such as the coniferous forest focal species).

Definite localized declines have been documented for some of the coniferous forest focal species (Siegel and DeSante 1999, King et al. 2001). Localized extirpations have also been demonstrated for other coniferous-associated species such as the Ruby-crowned Kinglet and Pygmy Nuthatch (King et al. 2001). In riparian habitats in California, localized population declines and extirpations of focal species (RHJV 2000) appear to be caused by low productivity (Johnson and Geupel 1996, Chase et al. 1997, Gardali et al. 1998, Gardali et al. 2000). Local extirpation may signal the early stages of a process of species extinction. By determining the factors associated with low reproductive success, research may identify which management actions will help reverse songbird population declines. Land managers, owners and regulatory agencies gain greater freedom in their decision-making if they conserve bird species before special-status listing becomes necessary. Monitoring key species provides gauges that allow management changes before it is too late.

5.5. Conduct intensive, long-term monitoring at selected sites. In order to analyze trends, long-term monitoring should continue for more than 5 years.

With a few exceptions, little comprehensive demographic data exist for coniferous-associated birds in California. Conservationists should conduct long-term monitoring at reference sites that embody the characteristics management efforts strive to recreate. Additionally, long-term monitoring at key experimental sites can test the assumptions that currently drive restoration and management practices.

Intensive monitoring includes collecting data on primary demographic processes and associated habitat characteristics and seeks to identify causal connections between habitat variables and species viability. Biologists collect data on reproductive success, breeding densities, parasitism, predation, survival, vegetation data, suitable habitat requirements, and general life-history information. Conservationists can employ these data to make well informed, adaptable management plans.

Specifics to this recommendation include those provided for the Sierra Nevada bioregion by Siegel and DeSante (1999) : "Recommendation 7-3. Deploy additional MAPS stations throughout the Sierra to better understand the primary demographic parameters for Sierra-wide population trends of numerous species."; "Recommendation 8-2. Deploy nest monitoring studies throughout the Sierra to provide a mechanistic understanding of how various habitat variables and land management practices affect nesting productivity."; and "Recommendation 7-2. Design and implement a long-term, off-road, habitat specific avian monitoring program."

5.6. Identify winter range, habitat, and possible overwintering conservation issues for coniferous forest focal species.

Wintering grounds play a significant role in the life cycles of all bird species, be they Neotropical migrants or year-round California residents. If a population is declining primarily due to low overwinter survival, no amount of effort to restore or protect breeding grounds will suffice to conserve the species. Additionally, recent research implies that declines in habitat quality on wintering or migratory stopover grounds may lead to lower productivity on breeding grounds (Marra et al. 1998). Conservationists would learn much from solving such questions regarding overwintering habitats.

Objective 6

Maximize the effectiveness of ongoing monitoring and management efforts.

Recommendations

6.1. Increase communication and coordination between land managers and specialists hired to implement specific projects or conduct monitoring.

Adaptive management is given much attention and is widely discussed, but land managers rarely have adequate time to evaluate the effects of their projects. When managers work with specialized experts, they have an excellent opportunity to conduct “adaptive management” on an informal basis. Experts, such as those conducting endangered species or biodiversity inventories, should be consulted and included as part of project implementation teams. By doing so, managers can quickly and easily access a wealth of detailed information on local birds and their response to management activities.

6.2. Use standardized monitoring protocols.

By standardizing monitoring techniques, researchers ensure that results can be compared across space and time. The USDA Forest Service published guidelines for standardized monitoring techniques for monitoring birds (Ralph et al. 1993). Please refer to Appendix A for more information.

6.3. Maximize the cost effectiveness and value of existing specialized monitoring programs for listed species (e.g. Northern Spotted Owl, Marbled Murrelet, Northern

Goshawk) by collecting standardized data on multiple species (such as point counts) in addition to any specialized protocols aimed at one species.

Many state and federal sponsored surveys only monitor special-status species. By adding a standard protocol that provides information on multiple species while conducting special-status species surveys, researchers could rapidly expand their knowledge of California's birds. Such data could be shared and analyzed and results would be added to conservation plans and incorporated into management regimes. Even if resources are not immediately available for analysis, the information will provide a baseline or historical perspective on bird distribution and abundance.

Objective 7

Use information gathered in avian monitoring programs to test specific coniferous forest habitat needs for bird species, and the effects of management practices.

Recommendations

7.1. Study the effects of mechanical manipulation of vegetation (in efforts to mimic forest structure created by fire) on avian community composition and nesting success (Siegel and DeSante 1999).

In cases where prescribed fires are unfeasible, because they may pose threats to humans and their property, mechanical manipulation of vegetation may create desired conditions. The effects of this on avian populations are unknown and should be considered by concurrent monitoring.

7.2. Conduct replicate studies on the impacts of long-term livestock grazing on bird communities in coniferous forests as was conducted in oak-pine woodlands by Verner et al. (1997).

POLICY RECOMMENDATIONS

Conservation efforts will make little headway without effective policy development. The future of habitat conservation in the West lies not only in the activity of scientists and restoration experts in the field, but also within the walls of statehouses and the pages of law. Policy makers need to examine and appropriately amend statutory and regulatory programs that endanger native habitats or that unnecessarily impede restoration actions. Whenever possible, policy should encourage governmental support of innovative local conservation and sustainable-growth projects.

To achieve conservation and management goals, diverse interests must effectively combine their skills and financial resources. California Partners in Flight embodies this kind of cooperative effort. In this groups, scientists, governmental agencies, nonprofit organizations and private citizens share information and concerns, and collaborate on solutions. The biological

recommendations in this Conservation Plan are readily available to policy-makers, public land managers and private landowners. Furthermore, the findings described here will be incorporated into the national Bird Conservation Plan, enhancing conservation efforts throughout the country.

Funding from the National Fish and Wildlife Foundation, derived from the Neotropical Migratory Bird Conservation Initiative, and the USDA Forest Service Partners in Flight awards continue to catalyze conservation activity across the country. Government agencies participating in CalPIF intend to utilize this Conservation Plan to guide their coniferous forest conservation projects. These agencies include the USDA Forest Service and Bureau of Land Management.

The Implementation Plan associated with this Conservation Plan includes more outreach to other agencies, conservation planning projects and potential funding sources for conservation efforts. Bioregional workshops, meetings and conferences form the backbone of these outreach efforts. CalPIF seeks to find common interests and potential for collaboration while minimizing duplication of effort. See Chapter 8: *Implementation of Conservation Plan Recommendations* for more information.

The following recommendations seek to assist policy advocates and decision-makers as they shape the regulations and procedures that affect avian conservation in the West.

Objective 8

Encourage regulatory and land management agencies to recognize that avian productivity is a prime criterion for determining protected status of specific habitats, mitigation requirements for environmental impacts, and preferred land managed practices.

Recommendations

8.1. Land managers should consider avian population parameters, such as reproductive success, as important criteria when designating priority or special-status sites, such as Areas of Critical Environmental Concern (BLM), Research Natural Areas (BLM, USFS) and other publicly-owned areas specially managed for biodiversity.

Few data regarding avian reproductive success at many important coniferous forest sites are available. Government land managers should consider reproductive success data when designating and managing areas in support of biodiversity, including state wildlife areas and ecological reserves.

8.2. When developing management practices for natural areas, government agencies, such as the USFWS and CDFG, should consider environmental impacts on local bird populations. Such evaluations should also occur when developing plans for habitat mitigation, habitat conservation, multi-species conservation, and natural community conservation.

The California Department of Fish & Game estimates that more than 89 habitat conservation plans, natural community conservation plans, and resource management plans were ongoing in California in 1998. Of these, 33 addressed the needs of one or more bird species. Additionally,

the U.S. Fish & Wildlife Service constantly makes decisions regarding mitigation requirements for private and federally sponsored projects that affect the habitats of threatened or endangered species. By incorporating the conservation, management and monitoring recommendations of this Conservation Plan into their regulatory plans, agencies can implement the most effective conservation actions.

8.3. Integrate components of this avian conservation plan into management plans developed by federal agencies for their landholdings and into plans being created by counties and communities to guide growth and residential and commercial development.

This recommendation, originally developed for the Sierra Nevada (Siegel and DeSante 1999), can be extrapolated to California and each of its bioregions.

The rapid growth of human population in the Sierra, which involved a doubling in the twenty years between 1970 and 1990, is expected to accelerate over the next few decades (Duane 1996). This will not only involve greatly increased residential and commercial development of the lower elevations of the Sierra, but vastly increased pressure on all elevations for recreational use and water resources. This growth will place further demands on the public as well as private lands of the Sierra. It is imperative that this growth be planned and regulated in ways that preserve the ecological integrity and aesthetic values of the entire range. Comprehensive range-wide planning is already underway on lands managed by the USDA Forest Service and these plans are being integrated with planning processes for the individual national parks. It is crucial that the plans being developed by federal agencies take into account the human population growth that is inevitable, but it is equally critical that important management concepts developed in public plans be included in the planning process for private lands. Moreover, it is essential that the underlying concepts developed in this avian conservation plan filter into subsequent plans for both private and public lands.

Chapter 8. Implementation

Implementation of land bird conservation will require a broad range of partnerships, an extensive amount of cooperation, and considerable financial resources. Participation will be necessary from federal and state natural resource agencies, forest products industry, academia, private environmental organizations, etc.

Conservation of land birds will require not only strategies and management actions by land managers but also increased public awareness, commitment, and political support. This means information must be communicated to the public about the benefits of conservation.

The tasks identified below are intended to provide an outline of action items that can be used to help achieve the population target and habitat protection/restoration goals set forth in this Conservation Plan. One key part of this implementation process will be the delivery of a set of local workshops throughout California designed to:

1) Familiarize local organizations and individuals with the Conservation Plan and the Implementation Plan;
2) Identify local initiatives, projects, and organizations capable of working as local partners to achieve habitat and population targets; and
3) Develop bioregional conservation/restoration acreage objectives based on inventory, assessment, and biological need.

The tasks identified here are but one part of the overall implementation plan being developed for the Coniferous Forest Bird Conservation Plan. The implementation plan will ultimately provide a framework for land managers and partners to set bioregional coniferous forest habitat conservation priorities that benefit coniferous forest-associated species. It is anticipated that this Conservation Plan will be implemented in close coordination with other statewide conservation efforts that have overlapping goals.

Implementation Tasks

- Interface With Other Conservation and Planning Efforts. This conservation strategy has broad applicability to many other conservation planning efforts. Information supplied in this document should be used in development of site-specific conservation plans such as State and private Habitat Conservation Plans, agency and inter-agency Management Plans, and local land use planning strategies. Areas designated for conservation or management in other conservation plans (e.g., the Sierra Nevada Forest Plan Amendment) may provide for conservation as directed in this document. For example, the establishment of a network of old forest emphasis areas on 40% of the National Forest System lands could function as the "Sierra-wide late-successional/old-growth reserve network" described in this document.
- Community Communication Workshops. This plan recognizes that more coniferous forest habitat occurs on lands owned by the U.S. Forest Service than on lands owned by any other agency, conservation group, or private citizens. For this reason, it is envisioned that three Community Communication Workshops (CCWs) would be held in Redding,

Sacramento, and Fresno to provide Forest Service managers an opportunity to become familiar with the contents of the plan and to identify opportunities where elements of the plan could be integrated into ongoing or planned land management activities. Private landowners and other conservation groups would be invited to the CCWs to foster partnerships at all levels.

- Briefing for Regional Forester and PSW Station Director. A briefing outlining the land bird conservation program and the Coniferous Forest Bird Conservation Plan in particular would be prepared and delivered to the Regional Forester of the Forest Service for the Pacific Southwest Region. The Director for the Forest Service's Pacific Southwest Forest and Range Experiment Station would also be invited to the briefing. This task provides yet another opportunity to place institutional commitment to the Partners in Flight program at various levels of the Forest Service, one of the primary landowners of coniferous forest habitat in California.
- Include Coniferous Forest Bird Conservation Goals into the Forest Plan Revision Process. Over the next 5 to 10 years, many of the National Forest Service offices in California will be revising their Land and Resource Management Plans. As the plan revision process gets underway, regional wildlife program managers and key Forest Service partners must continue to emphasize the importance of the need to incorporate land bird interests into the Forest Plan revisions.
- Monitor the Effectiveness of the Coniferous Forest Bird Conservation Plan. Monitoring, and the closely related concept of adaptive management, are two key elements of any plan's implementation, including the Coniferous Forest Bird Conservation Plan. The Feedback Form found at the end of this chapter is to be used to acquire important information from land managers and partners relative to the usefulness and practicality of the various management recommendations contained in this conservation plan. This form will be widely distributed to encourage its use and it is envisioned that other bird conservation efforts can utilize it for their monitoring and adaptive management efforts.
- North American Bird Conservation Initiative. Implementation of the Coniferous Forest Bird Conservation Plan will be integrated with the larger North American Bird Conservation Initiative. A more complete discussion of the relationship between these two efforts is provided below.

North American All Bird Conservation Initiative

In 1998, participants at a meeting of the International Association of Fish and Wildlife Agencies developed a vision to link all of the major bird conservation initiatives in Canada, the U.S., and Mexico (CEC 1998). This program, known as the North American All Bird Conservation Initiative (NABCI), seeks to create "regionally based, biologically driven, landscape-oriented partnerships delivering the full spectrum of bird conservation across the entirety of the North American continent, including simultaneous on-the-ground delivery of conservation for both game and nongame birds."

State, provincial, federal, and non-governmental representatives from Canada, Mexico, and the U.S. adopted an ecological framework that facilitates coordinated conservation planning, implementation, and evaluation among major bird initiatives. These Bird Conservation Regions

(BCRs) were defined by adopting the hierarchical framework of nested ecological units delineated by the Commission for Environmental Cooperation (CEC).

California is encompassed within five BCRs: the Pacific Northwest region, the Sierra Nevada region, the Coastal California region (which includes the Central Valley), the Great Basin region, and the Sonoran and Mojave Deserts region. Conservation in priority habitats of California (such as coniferous forests) will be encouraged either by enlarging the efforts of existing joint ventures under the North American Waterfowl Management Plan or by creating new joint ventures, organized regionally around specific habitats and habitat conservation goals. See Chapter 2 for a partial list of the programs with which the CalPIF Coniferous Forest Bird Conservation Plan intends to interface during its implementation.

California Partners in Flight
Conservation Plan Feedback Form

This form is intended for use in gathering feedback from you on the usefulness of the management recommendations contained in the Bird Conservation Plans that have been prepared by California Partners in Flight. To read more about Partners in Flight and the various conservation plans, please visit PRBO Conservation Science's web site at **www.prbo.org**.

To use this form, simply fill in your **contact information**, the **name of the conservation plan** you are commenting on, and any **specific comments on the management recommendations** that are of interest to you. If you have tried implementing a management recommendation and wish to share any positive or negative experiences, this is the place to do it! You may attach continuation sheets as needed.

Contact Information

Your Name: _____ .

Your Phone Number: _____. Your Affiliation: _____.

Your Email Address: _____.

Name of Bird Conservation Plan (e.g., Coniferous Forest Bird Conservation Plan): _____.

Date or Version Number of Conservation Plan: _____.

Management Recommendation (e.g., 2-3): _____.

Your Comments on this Management Recommendation:

Management Recommendation (e.g., 2-5): _____.

Your Comments on this Management Recommendation:

If you have ideas about new Management Recommendations that you feel should be included in the Plan, please describe them in detail here:

Chapter 9. Outreach and Education

Defining Outreach And Education

Scientific efforts for conservation have little impact without the support of affected local communities, including private landowners, government land managers, and the general public. To gain crucial support, research and management programs must share their findings and involve the interested parties at all levels of the conservation enterprise.

For the purposes of this report, *Outreach* refers to communication with land managers, agencies, planners, business interests, nonprofit organizations, academia, and volunteers. Outreach activities include conferences and workshops that facilitate communication among experts, participation in land use planning, volunteer or government-sponsored restoration and monitoring programs, field trips and classes for school children, and ecotourism.

Education, an important component of outreach, refers to the range of activities that educate and involve students and adults. Education activities include visits for classes and groups to field sites, interpretive displays, specialized curricula, and participation in festivals or symposiums.

One method of educational outreach, called *project-based learning*, allows an open-ended approach to solving a conservation problem. Students identify a conservation issue in their community and plan and implement work from beginning to end. Teachers and students make the important decisions, while working with biologists, business people, private landowners and others in the community. Because of this investment, students take ownership of their work, and the lessons learned are profound and long-lasting (Rogers, pers. comm.).

Future Outreach Priorities

Outreach activities must maintain and build interest in conservation and restoration efforts in the state. To this purpose, outreach efforts should develop:

- **Greater collaboration** between forest managers and biologists to examine wildlife response to forest management practices throughout California's varied coniferous habitats.
- **More contact with resource-based constituencies**, such as the logging industry, to foster collaboration in land management in order to improve habitat for birds while ensuring that landowners can make a sustainable living. California Partners in Flight intends to work closely with the Forest Service and state agencies to improve coniferous forest habitat in California.
- **Partnership with the National Association of Service and Conservation Corps** (NASCC), of which the California Conservation Corps is a part. The California Association of Local Conservation Corps also has 11 members throughout the state with a trained labor force capable of restoring habitat. These programs improve environmental quality while providing opportunities for young people to learn and develop new skills.

- **Further educational outreach**, particularly the promotion and support of volunteer monitoring programs. Volunteer monitoring programs are most needed at reference sites and others that will require long-term monitoring.
- **Coniferous Forest conferences and symposia**. These will highlight recent developments in restoration biology, innovative government programs and public and private partnerships. They will also facilitate communication among restoration biologists, regulatory agencies, land managers, and landowners throughout the state.

Conservation Education

Conservation education sensitizes people to environmental problems and encourages them to seek solutions. As they become involved, people develop a greater connection to issues such as habitat degradation and loss, songbird declines, and species extinction. Conservationists have little hope of achieving their goals without cultivating this interest in the public.

Education programs engage participants most effectively when they involve hands-on activities. Conservation education has the whole of the outdoors as a classroom - what better way to elicit the interest and enthusiasm of students and the public?

KEY CONCEPTS ABOUT BIRD CONSERVATION

The following list of key concepts for bird conservation should be communicated through education and outreach programs. These concepts are important to include in any program concerning conservation, and are indispensable in programs focusing on birds and coniferous habitats.

- **Reproductive success may be the most important factor influencing population health.** It contributes directly to a population's size and viability in an area. A number of factors influence reproductive success, including predation, parasitism, nest site availability, and food availability.
- **Nesting habitat requirements vary among species.** Different bird species place their nests in different locations, from directly on the ground to the tops of trees. Most birds nest within five meters of the ground. Managers should consider that habitat needs for different species vary. Leave grass and forbs greater than 6 inches in height for ground nesters, shrubs and trees for low to mid-height nesters, dead trees and snags for cavity nesters, and old, tall trees for birds that build their nests in the canopy.
- **The breeding season is a short but vital period in birds' lives.** Birds nest during the spring and early summer of each year and raise their young in a rather short period. Nestlings are particularly sensitive to changes in the environment and are sensitive indicators of ecosystem health. Disturbance, such as vegetation clearing, habitat restoration, and recreation may: result in nest abandonment, remove potential nest sites, directly destroy nests, expose nests to predators, or decrease food sources such as insects. Predators, such as domestic cats, skunks and jays, can decimate breeding populations, and managers should avoid subsidizing their populations.
- **Understory (the weedy, shrubby growth underneath trees) is crucial to birds.** A healthy and diverse understory with lots of ground cover offers well-concealed nest and foraging sites. Manicured parks and mowed lawns provide poor nesting conditions for all but a few bird species.
- **Native plants are important to birds.** Native bird populations evolved with the local vegetation, learning to forage upon and nest in certain species. Introduced plant species may not provide the same nutrition or nest site quality. Introduced plants can also quickly dominate an area, reducing the diversity of vegetation. Less diverse vegetation can lower the productivity and viability of a bird population.
- **Natural predator-prey relationships are balanced, but human disturbance creates an imbalanced system.** Interactions with predators are a natural and essential part of an ecosystem. However, a preponderance of non-native predators or a sustained surplus of natural predators severely affects the health and persistence of bird populations. Feeding wildlife, especially foxes, raccoons, and skunks, should be discouraged. Feeders that are frequented by jays and crows and cowbirds should not be maintained during the breeding season (besides which, most songbirds are not dependent on feeders during the breeding season since this is the time of year that they feed insects to their young). Domestic and feral cats are responsible for an estimated 4.4 million birds killed each day by cats (Stallcup 1991). It is not true that a well-fed cat will not hunt! In fact, a healthy cat is a more effective predator.
- **Natural processes, such as flood and fire, are integral to a healthy ecosystem.** They provide the natural disturbance needed in an area to keep the vegetative diversity high, an important factor for birds.

Education And Outreach Concepts And Guidelines

Opportunities for Involvement: What Can One Person Do?

An individual can have a profound impact on the life of a bird and the livelihood of a species. Human activities can encourage predation of adult birds and their nests by animals such as domestic cats, raccoons, and jays. They can alter the food resources available, by depleting local insects with pesticides. Finally, they can destroy or disrupt much-needed habitat for nesting and feeding young. But thoughtful activity by humans can limit these impacts and even encourage successful nesting by songbirds, contributing to the health of their populations.

The guidelines below can make a critical difference in enhancing the health of a songbird population. These recommendations apply to most bird species, including birds in coniferous forests.

If you are a bird watcher, volunteer for a monitoring program.

There are increasing opportunities for bird watchers of all skill levels to gain training and experience in various bird monitoring techniques. Participants gain knowledge in a subject area of interest, learn new skills, and can directly contribute to the science of conservation while enjoying birds in the outdoors. There are increasing opportunities to contribute to bird monitoring projects throughout the state. (See the PRBO website http://ww.prbo.org for ways to get involved; see also Appendix A for more information on bird monitoring techniques and the information they provide.)

If you own a cat, help reduce the impact of cats on bird populations.
Domestic cats kill millions of native birds, reptiles and small mammals every year. This unnecessary impact can easily be reduced if cat owners would keep their cats indoors. The American Bird Conservancy's *Cats Indoors!* campaign seeks to educate the public on the facts of cat predation on birds and other wildlife and the hazards to free roaming cats. This information is available on the American Bird Conservancy's website at http://www.abcbirds.org.

Actions that cat owners can take to help birds include:

- Keep cats as indoor pets.
- Spay and neuter your cats.
- Cats on ranches or farms, kept to control rodent populations, should be kept to a minimum. Spayed females tend not to stray or wander from the barn area. Keeping feed in closed containers also helps reduce rodent populations (Coleman et al. 1997). Trapping rodents can also be more effective than relying on cats to do the job.
- Don't feed stray or feral cat populations. A more humane alternative for cats and wildlife is to reduce the unwanted cat population by limiting reproduction and facilitating adoption by responsible pet owners.
- Remove food dishes or garbage that may attract stray cats.
- Support local efforts to remove feral cats.

If you camp, hike, or picnic in the outdoors help maintain the natural balance between predator and prey.

- Do not feed wildlife or allow wildlife access to your trash. This may lead to an increase in natural predators such as raccoons, fox, ravens, crows, scrub jays, and opossum. Increased numbers of these predators can depress bird populations.

If you feed birds, avoid doing more harm than good:

Feeding wildlife can be beneficial if properly done, but it always carries the potential for upsetting the natural balance between native predators and prey species. Improper feeding can help to spread disease, support predator populations that prey on birds and other organisms, or increase non-native populations that displace the natives.

- Feeder placement should be away from shrubs or bushes that provide places for cats to ambush birds (Coleman et al. 1997).
- Avoid feeding birds in the spring and summer. Feeding birds supplements their natural diet, but springtime feeding may encourage a lower quality diet for nestlings that need high-protein insects, which are naturally abundant throughout the breeding season.
- Do not supplement the diet of avian nest predators such as jays, magpies, crows and ravens by feeding them during the breeding season. These predators already tend to benefit disproportionately from human habitation, and as their population expands they are negatively affecting the health of other bird populations. The National Audubon Society produces bird feeders that discourage use by avian predators.
- Avoid supplementing the diet of Brown-headed Cowbirds, which parasitize songbird nests. If cowbirds come to your feeder, try eliminating millet from the birdseed you provide. Evidence indicates that Brown-headed Cowbirds are attracted to bird feeders primarily for millet. Sunflower seeds and other types of birdseed attract many songbird species, but may not attract cowbirds.
- When feeding birds in winter, feed them consistently. Some wintering birds may become dependent upon winter bird feeders, thus a consistent supply of food is important. Change birdseed if it gets wet from rain as the moisture may promote mildew or sprouting, which can cause birds to become ill.
- In feeding hummingbirds, use a solution of four parts water to one part sugar. Do not use brown sugar, honey, protein additives, or artificial sugars such as saccharine, as they can cause liver damage and may contribute to fungal infections. Place feeders in the shade and *do not use red dye*. Using red dye may be harmful to hummingbirds, may make the water turn sour more quickly and is redundant when using feeders that have red coloration. If you have a feeder that is not designed with red coloration, use red tape or paint a red flower on the feeder to attract hummingbirds. (Dennis and Murphy 1983) Change feeder solution every three to four days to avoid cultivating pathogens that can cause hummingbirds to become ill. In freezing weather, bring feeders indoors at dusk, return the feeders with lukewarm fluid at dawn. Clean feeders every 10 days using a few drops of bleach in the wash water and let stand before rinsing. Rinse thoroughly many times.

If you find an injured bird or a baby bird:

- Baby birds will often leave the nest before they look fully-grown. Such birds are often mistaken for "abandoned." Their parents, however, can find them on the ground and will feed them. Most fledglings will continue to be fed by their parents even after leaving the nest. It is therefore best to leave young uninjured birds alone, as it is likely their parents are nearby. It is not true that parents will avoid young after humans have handled them. Fledglings should not generally be returned to their nest, as this may disturb the nest site. Trampled vegetation and human activity can alert predators to the presence of the nest. Allowing baby birds to remain in the care of their parents provides them their best opportunity for survival.
- Injured birds can be taken to wildlife rehabilitation clinics and programs. It is best to keep injured birds in a warm, dry, quiet place free from disturbance (such as a shoebox with the lid on, and a few holes for air) until they can be transferred to a licensed wildlife rehabilitation facility. Call the facility before you visit.
- Be aware that it is against federal law to collect birds or their nests without a permit.

Education Outreach Opportunities

The concepts and guidelines outlined above can be presented to the public and to students through a variety of media. Following is a list of common education/outreach opportunities and some suggestions for content:

Classroom Education

Programs in the classroom should focus on communicating key concepts to students through hands-on activities. Lessons should stress simple identification and bird calls, combined with pictures and videos, particularly for younger students. Field trips to sites with bird conservation and monitoring projects fosters interest and enthusiasm for wildlife and teaches students the importance of conserving birds. Although limited access to binoculars may constrain student participation, the opportunity to examine birds up close (such as with mist-netting) and interact with biologists provides an invaluable experience that catches students' interest immediately.

A great way to get students interested in birds is to get them out looking at them. While access to binoculars is sometimes limiting, you can contact your local Audubon Society, nature center or other local wildlife education group to see if sets are available for check out. If you feel uncertain of your birding skills, contact your local Audubon Society or nature center to arrange for docents or naturalists who will be able to join your class for a day of birding in the field. An invaluable experience that catches students' interest immediately is to visit a mist-netting site where students will have the opportunity to examine birds up close and interact with biologists.

There are many excellent sources for curriculum and hands-on bird activities to be done in the classroom. Through PRBO Conservation Science, Teacher Resource Packets are available containing lesson plans and activities for students of all ages, geared towards teaching students how to observe and study birds. To acquire the PRBO Teacher Resource packets contact Melissa

Pitkin, 4990 Shoreline Hwy, Stinson Beach, CA 94970 (415) 868-1221 ext. 33, or email at mpitkin@prbo.org.

Each year PIF produces a resource directory containing bird related resources on education programs and materials, education web sites, activities for kids, workshops, and more. To acquire this guide contact Susan Bonfield, PO Box 23398, Silverthorne, CO 80498 or email Sbonfield@aol.com. Another useful source is *A Guide to Bird Education Resources* produced by Partners In Flight and National Fish and Wildlife Foundation. Copies of this book are available from American Birding Association Sales, PO Box 6599, Colorado Springs, CO 80934, phone 1-800-850-2473, member@aba.org.

Below are a few websites containing resources for teachers and students regarding coniferous forest habitats:

Poster depicting NW coniferous forest trees
http://www.goodnaturepublishing.com/conifers.htm

Thinkquest Library- more information on coniferous forests
http://library.thinkquest.org/17456/conifer1.html

Images of California's coniferous forests
http://geoimages.berkeley.edu/GeoImages/BainCalif/subjects/VegetationConifers.html

Website for kids about coniferous forests:
http://lsb.syr.edu/projects/cyberzoo/coniferous.html

World Wildlife Fund information on coniferous forests:
http://www.panda.org/kids/wildlife/idxcfmn.htm

Volunteer Involvement

Using volunteers to aid in data collection and restoration is an excellent way to gain additional help, and is also one of the best ways to teach people about conservation. Increasingly, families and school groups have opportunities to participate in cultivated habitat restoration projects at local parks or nature preserves. Volunteers that get to count and study birds quickly develop a connection to them, which intimately involves the volunteer in the conservation effort. Furthermore, volunteers provide additional support and resources that make long-term monitoring of songbirds viable. To ensure reliable data collection, supervisors must match monitoring techniques with the skill level of the volunteer.

Volunteer nest box projects are an excellent way to ensure that nest boxes are monitored as well as providing a wonderful opportunity for volunteer involvement. If you are coordinating a nest box project please follow the guidelines listed in section 4.9.1 above.

Interpretation at Natural Areas

Displays
Interpretation is an excellent way to disseminate key concepts about bird conservation to the public. Displays at Forest Service and National Park visitor centers, preserves, nature trails, picnic areas, and other natural areas should highlight the birds using the habitats and show the specific features of the habitat that are critical to bird reproduction and survival, including native plants. Some effective displays illustrate how individuals can make a difference at home, by planting native plants in their yards or restraining cats from killing birds. These displays should be aimed at the general public, emphasizing the causes of the decline of songbirds. Again, integrating people as part of the solution encourages their support for conservation issues.

Campfire Programs
Campfire talks are another excellent forum for engaging the public with the concepts of bird conservation in forested habitats. Visitors who are hiking and camping in California's National Forests, National Parks, and other public forested lands, are generally already engaged with their surroundings. Campfire talks that 1) focus on bird identification for the species that visitors are likely to encounter; 2) discuss conservation issues faced by these species; and 3) identify what visitors can do as individuals, can be effective in educating and inspiring the public to be good stewards and citizens.

Participation in Birding Festivals and Environmental Fairs

Birding festivals are becoming a popular means of increasing ecotourism, which can help to promote local support for conservation of natural areas - a requirement for long-term sustainability of conservation actions. Festivals also present an excellent opportunity to further educate people already familiar with birds about the scientific reasons behind bird conservation. Birders already recognize and love birds and can easily be taught the reasons for bird conservation and what a healthy population of birds needs to survive. They also constitute a pool of experienced observers who may volunteer for monitoring programs.

Representation of bird conservation at environmental fairs is another way to reach large numbers of people and convey the key concepts behind bird conservation. Booths displaying information on how individuals can help birds along with interactive games or activities for children engage families and visitors in bird conservation topics.

The second Saturday in May is International Migratory Bird Day and National Keep Your Cat Indoors day. Creating a display or festival in honor of these days is a great way to spread the word about bird conservation. The National Fish and Wildlife Foundation has published *Bridges to Birding*, an interactive program for introducing birds bird watching and bird conservation to your community. It contains step by step instructions on how to put on a festival or fair focusing on birds. To obtain a copy contact IMBD Information Center at (703) 358-2318 or visit IMBD@fws.gov. For more information on National Keep You Cats Indoors Day contact the American Bird Conservancy or visit their website at www.abcbirds.org/cats/catsindoors.htm. Here you can download teachers' guides and posters to display at fairs, booths, and nature centers.

Resources For Conservation Education And Outreach

The Sierra Nevada Ecosystem Project
http://ceres.ca.gov/snep/pubs/web/v1/v1_default.html
The Sierra Nevada Ecosystem Project (SNEP 1996) was a congressionally mandated 3 year study of the entire Sierra Nevada range. The study was managed by the University of California Centers for Water and Wildland Resources, Davis, CA under a research agreement with the U. S. Forest Service, Pacific Southwest Research Station, Albany, CA. Posted on this web are the final reports from this intensive study by an independent science team. Formal release of the report to Congress occurred on June 7, 1996.

The Sierra Nevada Framework for Conservation and Collaboration
http://www.r5.fs.fed.us/sncf/framework/overview.html

In early 1998, the USDA Forest Service Pacific Southwest Region, the Pacific Southwest Research Station and the Intermountain Region renewed their efforts to work with tribes, county governments, state and federal agencies, interest groups and individuals interested in improving the health of Sierra Nevada ecosystems and communities. The effort integrates recent science into natural resource management through a variety of approaches and at a variety of geographic scales. It also works toward more effective means of coordination, cooperation and collaboration among the various parties.

A Record of Decision amending eleven National Forest plans was released on 12 January 2001. The Sierra Nevada Forest Plan Amendment Final Environmental Impact Statement is but one of several Framework activities. At this site, you will also find links to several other projects and activities going on in the Framework. For example, the Design Paper outlines many of the commitments the Forest Service is making as part of its contribution toward improving natural resource management and collaboration among tribes, agencies, local governments, and citizens.

US Department of Agriculture - Natural Resources Conservation Service Programs

While there are a variety of USDA programs available to assist people with their conservation needs, the following primarily financial assistance programs are the principal programs available. Locally led conservation groups are encouraged to contact the State offices of the appropriate agency for specific information about each program.

For more information about any of the following NRCS programs:
http://www.nrcs.usda.gov/
Natural Resources Conservation Service
Attn: Conservation Communications Staff
P.O. Box 2890
Washington, DC 20013

Forestry Incentives Program

http://www.ct.nrcs.usda.gov/landscp/fip/fipindex.htm

The 1996 Farm Bill extends the Forestry Incentives Program (FIP), which was originally authorized in 1978 to share up to 65 percent of the costs of tree planting, timber stand improvements, and related practices on non-industrial private forest lands. FIP's support for forest maintenance and reforestation provides numerous natural resource benefits, including reduced wind and soil erosion and enhanced water quality and wildlife habitat as well as helping to assure a reliable future supply of timber. Improving timber stands, which help to sequester greenhouse gases, also contributes to the President's Climate Change initiative.

FIP is administered by the U.S. Department of Agriculture's (USDA) Natural Resources Conservation Service (NRCS) and the U.S. Forest Service. The FIP Program is available on a nationwide basis in counties designated via a Forest Service survey of total eligible private timber acreage that is potentially suitable for production of timber products. Federal cost-share money is available - with a limit of $10,000 per person per year with the stipulation that no more than 65 percent of the cost may be paid. To find out if your county participates in FIP, check with your local USDA office, State forester, conservation district, or Cooperative Extension office.

The Wildlife Habitat Incentives Program (WHIP)
http://www.nhq.nrcs.usda.gov/PROGRAMS/whip/

This is a voluntary program for people who want to develop and improve wildlife habitat primarily on private lands. It provides both technical assistance and cost-share payments to help establish and improve fish and wildlife habitat.

Participants who own or control land agree to prepare and implement a wildlife habitat development plan. The U.S. Department of Agriculture's (USDA) Natural Resources Conservation Service (NRCS) offers participants technical and financial assistance for the establishment of wildlife habitat development practices. In addition, if the landowner agrees, cooperating State wildlife agencies and nonprofit or private organizations may provide expertise or additional funding to help complete a project.

Conservation Technical Assistance (CTA)
The purpose of the program is to assist land-users, communities, units of state and local government, and other Federal agencies in planning and implementing conservation systems. The purpose of the conservation systems are to reduce erosion, improve soil and water quality, improve and conserve wetlands, enhance fish and wildlife habitat, improve air quality, improve pasture and range condition, reduce upstream flooding, and improve woodlands.

Conservation Reserve Program (CRP)
The Conservation Reserve Program reduces soil erosion, protects the Nation's ability to produce food and fiber, reduces sedimentation in streams and lakes, improves water quality, establishes wildlife habitat, and enhances forest and wetland resources. It encourages farmers to convert highly erodible cropland or other environmentally sensitive acreage to vegetative cover, such as

tame or native grasses, wildlife plantings, trees, filterstrips, or riparian buffers. Farmers receive an annual rental payment for the term of the multi-year contract. Cost sharing is provided to establish the vegetative cover practices.

General Information

The Information Center for the Environment, at http://ice.ucdavis.edu/, is a cooperative effort of environmental scientists at the University of California, Davis and collaborators at over thirty private, state, federal, and international organizations interested in environmental protection.

Within this site, find the **California Ecological Restoration Projects Inventory (CERPI)** (direct link: http://endeavor.des.ucdavis.edu/cerpi/) and the **California Noxious Weeds Projects Inventory (CNWCPI)**. (direct link: http://endeavor.des.ucdavis.edu/weeds/)

- **CERPI** is a combined private/non-profit/government effort to establish a database, accessible through the Internet, containing information on restoration projects in California. This information will further the practice and science of restoration and assist agencies and practitioners during restoration planning and implementation.
- **CNWCPI** is a combined government/private/non-profit effort to establish a database, accessible through the Internet, containing information on noxious weed control in California. This information will further the practice and science of noxious weed control and assist agencies and practitioners doing noxious weed control throughout the state.

CERPI and CNWCPI are both programs of the Natural Resource Projects Inventory (NRPI)

The California Environmental Resources Evaluation System
http://www.ceres.ca.gov/index.html

CERES is an information system developed by the California Resources Agency to facilitate access to a variety of electronic data describing California's rich and diverse environments. The goal of CERES is to improve environmental analysis and planning by integrating natural and cultural resource information from multiple contributors and by making it available and useful to a wide variety of users.

California Wildlife Habitat Relationships
http://www.dfg.ca.gov/whdab/html/cwhr.html

California Wildlife Habitat Relationships (CWHR) is a database of California's wildlife, operated by the California Department of Fish and Game and the California Interagency Wildlife Task Group. The database contains information on the life histories, management, and habitat relationships of hundreds of species of California's birds, mammals, amphibians and reptiles; it is based on published and unpublished data and expert opinions. Several types of output reports may by purchased by those interested in natural history, conservation or wildlife management.

A Manual of California Vegetation (Sawyer and Keeler-Wolf 1995) is available on line at http://endeavor.des.ucdavis.edu/cnps/. This is the indispensable reference on California's vegetation that is cited throughout the Coniferous Forest Bird Conservation Plan.

Forest Service Technical Reports can be ordered from 970-498-1392.

Wildlands Project Conservation Planning Efforts
http://www.twp.org/
The mission of the Wildlands Project conservation effort is to protect and restore the natural heritage of North America through the establishment of a connected system of wildlands. Current planning efforts can be found at http://www.twp.org/aboutus/aboutus.html

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Appendix A. How to Monitor Bird Populations

Adaptive management requires the periodical gathering of information to ascertain whether management actions are achieving desired results. The most comprehensive and rigorous way of collecting this information is through a strategic program of monitoring using standardized methods that can be compared between years and between regions. Restoration and land stewardship programs need to build in longterm monitoring programs to assess the effectiveness of their activities. Without such data in the long term, such programs will ultimately have little on which to base claims of success or the need for continued funding.

Research and Monitoring

If habitat restoration or management is undertaken to benefit wildlife species, wildlife monitoring becomes the ultimate measure of success. There are many reasons that bird monitoring should be adopted as a basic component of longterm stewardship in preserves with significant riparian habitats or significant bird populations:

•Birds are highly visible and cost effective to monitor.

•Birds can show relatively quick response in abundance and diversity to restored habitats (35 years).

•Many Neotropical migrants are dependent on early successional development in riparian habitats; therefore, they are good indicators of the success of natural recruitment restoration on an ecosystem scale.

•As secondary consumers (i.e., insectivores), birds are sensitive indicators of environmental change.

•By managing for a diversity of birds, most other elements of biodiversity are conserved.

•Bird monitoring can avoid future listing of declining species by identifying problems and solutions early.

•The only way to measure special-status bird species response to management and restoration is by monitoring bird populations.

•Because of the increasing popularity of birdwatching, there is great potential for public participation in bird monitoring.

•Birds are tremendously important culturally and economically and their popularity can help raise awareness of land-stewardship needs.

Monitoring Strategically

Monitoring can be conducted at varying levels of intensity, depending on the objectives to be achieved and the resources available. The standardization of protocols is critical to comparing results across space and time. Many recent programs (Ralph et al. 1995c, Martin et al. 1997, DeSante et al. 1999a) and publications (Ralph et al. 1993, Geupel and Warkentin 1995, DeSante et al. 1995, 1998, 1999b, Nur et al. 1999) have summarized methods, objectives, and how to use results.

Monitoring programs should always include an analysis plan and identification of issues or site-specific projects to be assessed. The primary purpose of site-specific monitoring is to assess the effects on wildlife of natural and anthropogenic stressors or disturbances in the environment. This knowledge is critical in determining the relative priority of identified conservation problems and in developing effective measures to address those problems. Monitoring is an integral component of the adaptive management feedback loop, allowing land managers, conservation groups, and land owners to assess the effectiveness of their habitat management and restoration programs.

Standardized monitoring across many sites at varying scales can be analyzed to highlight broad changes or trends in species presence, diversity, abundance and productivity. Ideally, a series of reference sites with long-term monitoring, using most if not all protocols below, will be developed for each California bioregion. Other sites will be monitored more opportunistically, depending on the objectives of the landowner.

The following is a list of common monitoring regimes from least to most intensive.

1) Rapid assessment of habitat or designation of Important Bird Areas based on general vegetation characteristics and presence/absence of indicator species.
Method: area search or point count as little as one census per site per year.

2) Determine breeding status, habitat association, restoration evaluation and/or evaluation of changes in management practices.
Method: area search or point count two or more times per year for 3 years. For restoration evaluation every other year, censusing should continue for at least 10 years.

3) Determination of population health or source/sink status.
Method: census combined with demographic monitoring for a minimum of 3 years (4 years preferable).

4) Reference site.
Method: point count census, constant effort mist netting and nest monitoring at a minimum of every other year for 10 years.

Long-term Monitoring

Long-term monitoring provides a wealth of useful information about bird populations. In addition to parameters that can be determined by both short- and long-term monitoring (such as annual productivity, abundance, and diversity), patterns of variation in reproductive success and trends in abundance and diversity may also be described. Long-term monitoring is also the only method to monitor natural and human-induced changes in bird populations.

The Palomarin Field Station of PRBO Conservation Science provides an excellent example of the utility of a long-term monitoring program. Biologists have conducted mist-netting at the site for over twenty years. With the data collected, they have documented a population decline of Warbling Vireos and linked it to reproductive failure on the breeding grounds (Gardali et al. 2000).

Standardized Methods Adopted by the Western Working Group and Monitoring Working Group of Partners in Flight

These are listed from least to most intensity of effort. All are described in detail in Handbook of Field Methods for Monitoring Landbirds (Ralph et al. 1993).

Area Search

The Area Search, adopted from the Australian Bird Count, is a habitat specific, time constraint census method to measure relative abundance and species composition. It may also provide breeding status. While still quantitative, this technique is ideal for volunteers as it mimics the method that a birder would use while searching for birds in a given area, allowing the observer to track down unfamiliar birds.

Point Count

The point count method is used to monitor population changes of breeding landbirds. With this method, it is possible to study the yearly changes of bird populations at fixed points and differences in species composition between habitats and assess breeding status and abundance patterns of species. The objective of point count vegetation assessment is to relate the changes in bird composition and abundance to differences in vegetation. These vegetation changes can either be over time or differences between habitats or study sites.

Mist Netting

Mist netting provides insight into the health and demographics of the population of birds being studied. Mist nets provide valuable information on productivity, survivorship, and recruitment. With these data, managers will have information on the possible causes of landbird declines or their remedies. This method is currently being used nationwide in the Monitoring Avian Productivity and Survivorship (MAPS) program (DeSante 1992).

Territory Mapping
Also known as "spot mapping," based on the territorial behavior of birds, where locations of birds are marked on a detailed map during several visits (a minimum of eight) in the breeding season. By counting the number of territories in an area, this method estimates the density of birds. Distribution of territories, species richness, and diversity is also documented. This is an excellent method for assessing areas with limited habitat. Standard methods are described by Robbins (1970) and used by The Cornell Laboratory of Ornithology's resident bird counts.

Nest Monitoring
Also called nest searching, this technique measures nesting success in specific habitats and provides information on trends in recruitment; measurement of vegetation associated with nests may identify habitat influences on breeding productivity. Examination of nests also allows collection of life-history data (e.g., clutch size, number of broods, numbers of nesting attempts), which provide important insight into vulnerability of species to decimation or perturbations (Martin and Geupel 1993).