The Draft Grassland Bird Conservation Plan:

A Strategy for Protecting and Managing Grasslands and Associated Birds in California

Version 1.0
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A Project of California Partners in Flight and
Point Reyes Bird Observatory

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Executive Summary

This Draft Grassland Bird Conservation Plan is a collaborative effort of California Partners in Flight. It has been developed to guide conservation policy and action on behalf of grassland habitats and birds. The geographic scope of this plan is the distribution of annual and native perennial grasslands in the state, which are found predominantly along the coast and in California's Great Central Valley. The plan has focused on data concerning seven focal grassland bird species that are dependent on these habitat types. A primary finding of this plan, and therefore its most important recommendation, is the paucity of data concerning grassland bird species and the need to collect basic information concerning species distribution, productivity and survival before extensive conservation recommendations can be made.

This conservation plan, along with the associated Geographic Information System (GIS) database of bird monitoring data obtained in grassland habitats (maintained at the Point Reyes Bird Observatory, PRBO), is the first iteration of a continuous process of updating habitat conservation recommendations based on the latest scientific monitoring and research data. This is not a regulatory document, nor does it represent the policies of any agency or organization. The GIS database, in particular, is used for cataloguing new information and new analyses and for updating conservation recommendations and goals. Analyses of bird data will be posted on the PRBO website (www.prbo.org), periodically updated, and made available for use by the public. Therefore, this conservation plan is a dynamic, "living" document.

Biological Need

Conflicting estimates of the current extent of grassland coverage in the state of California make it difficult to judge the amount of habitat loss since European settlement. However, it is estimated that historically 8 million hectares of grassland carpeted the state, most of it concentrated in the Central Valley. Current estimates put the amount of grassland remaining today at about 36%. This includes native perennial grasslands, annual grasslands (most of which are dominated by introduced species) and pasture.

For the purposes of this conservation plan, grasslands are defined as all habitats dominated by grasses and/or by forbs. This enables the plan to cover habitats ranging from sparsely vegetated alkali flats to annual and perennial grasslands to tall, dense forblands and row crops. Also included are grasslands where shrubs make up less than 50% of the total canopy cover (Vickery et al 1999a).

Grassland conversion occurred early in the history of the state: by 1880, 75% of the Great Central Valley had already been altered to improved farmland (Hewes and Gannett 1883 *as cited in* Huenneke 1989). Smaller but still significant areas of grassland existed in northeastern California and in several coastal counties (Heady 1977). Much of what is grassland today was not grassland historically (Hamilton 1997). Shrub and oak woodlands of the foothills regions (Huenneke 1989) were cleared and modified over time as competitive agricultural interests pushed ranchers off the valley floor. These areas became dominated by open grasslands (Preston 1981), which today constitute the major

portion of grassland acreage. Moreover, these grasslands are dominated by invasive annual species introduced, inadvertently and deliberately, from the Mediterranean region.

Current problems afflicting California's grasslands include the widespread replacement of native perennial and annual grasses and forbs with exotics. This process probably includes a combination of competitive advantages by exotic species, overgrazing, droughts, and other unknown factors that have quickly led (within 100 years) to almost a complete overhaul of native plants with introduced varieties (Heady 1979, Fredrickson and Laubhan 1995).

Loss of habitat and habitat fragmentation, a theme of California's Bird Conservation Plans overall, may be especially acute in grasslands. What was once the largest swath of grassland is now some of the most productive farmland in the world, and remaining grasslands in the valley floor tends to be in areas of poor productivity. Coastal prairies have also been converted to farms and, especially in the Bay area, rapidly urbanized.

With loss of habitat, the patch size of remaining grasslands has decreased and continues to do so. Grasslands around the Great Central Valley are becoming increasingly fragmented by urbanization and, in some areas, encroaching woody vegetation (Fredrickson and Laubhan 1995). This has unknown but potentially highly significant ramifications for native grassland bird species. Research from other regions with grasslands in North America has demonstrated that grassland bird species (including ones that breed in California) can be sensitive to grassland patch size: i.e. some grassland bird species are only found in grassland patches that are 100 times the size of an average territory of a given species (Herkert 1994, Vickery et al. 1994, Bock et al. 1999).

Finally, with over 86% of grasslands in private hands, grasslands today continue to be managed as such, largely due to the economic viability of grazing resulting in part from agricultural subsidies (Davis et al. 1998). Although this ownership pattern presents an opportunity for CPIF to forge innovative research and management partnerships with a diverse array of private landowners, the drawback is that very little permanent protection exists and economic changes can cause loss of habitat.

Mission and Objective

The mission of Partners in Flight (PIF) is to stop the decline of, maintain or increase populations of landbirds in North America. This mission translates into identification of habitat conservation and management priorities for bird species at risk in California. By developing the Grassland Bird Conservation Plan, California PIF seeks to promote conservation and restoration of grassland habitats to support long-term viability and recovery of both native bird populations and other native wildlife species. The objective in developing a Grassland Bird Conservation Plan is to synthesize and summarize, in one place, current "state of the science" knowledge concerning the requirements of birds in grassland habitats, and provide recommendations for habitat protection, restoration, management, and monitoring to ensure long-term persistence of birds and other wildlife dependent on grassland ecosystems.

California PIF recognizes that the subject of land management and land use, whether on private or public lands, can be contentious. In the case of California's grasslands, partnerships to foster the development of a greater pool of knowledge from which to devise and implement land management recommendations is needed.

Findings and Recommendations

This Conservation Plan has been developed collaboratively by the leading bird researchers in California through a process designed to

- capture the conservation needs of the complete range of native and introduced annual grassland habitat types throughout the state, and

- develop biological conservation objectives based on the current state of knowledge of grassland birds.

Current monitoring data for grassland bird species is relatively unavailable compared with other habitat types. More work is needed to establish new monitoring areas. This document places an emphasis on a suite of seven bird species chosen because of their conservation interest and to serve as focal species representative of the full range of grassland habitats in the state. Preliminary analysis of the seven focal species' habitat requirements yield the following:

- In California's grassland habitats, there is a critical lack of information on which to base land management and species conservation recommendations. For example, most habitat models are based on research that was done outside of California, but territory and nest characteristics may vary dramatically between regions as dissimilar as California and Wisconsin.

- Because we lack information on the distribution of grassland birds, and the habitat characteristics to which they respond, and because few grassland bird species are in immediate danger, investment in research and monitoring is not only feasible, but absolutely essential to future grassland conservation efforts in the state of California.

- The most important data gathering efforts that should be instituted include a state-wide point count to determine distribution and habitat associations; development of feasible methods for estimating productivity and survivorship in grassland birds (traditional mist-netting methods are useless in open grassland areas); and studies to determine the sensitivity of California's grassland birds to patch size.

- A series of hands-on management projects that are monitored as experiments should focus on the issue of how grassland birds respond to various grazing, burning, mowing, and disking regimes. An emphasis should be placed on working with ranchers to develop methods for (a) improving bird species richness, productivity, and survivorship, (b) decreasing the presence of aggressive

exotics (e.g. Yellow Star Thistle and Medusahead), and (c) improving forage quality for livestock while increasing the presence of native vegetation.

- Determine whether native grass restorations restore native grassland birds. Although this assumption may often be made, no bird data for grasslands exists before the great invasion of exotic annuals that occurred in the 1800's. Accordingly, it is important to determine the value of restored native grasslands for remaining grassland species, especially as many refuges and parks move toward managing for native perennial grasses, often at great expense.

- Finally, with respect to current management, disturbance to grasslands should be avoided to the maximum extent possible during breeding season.

- Protected status for the remaining large, quality grassland areas is important, and stands of native vegetation should be targeted for protection first.

Chapter 1. Introduction

Partners in Flight

California Partners in Flight (CPIF) was formed in 1992 with the participation of the state's land and wildlife managers, scientists and researchers, and private organizations interested in the conservation of non-game landbirds. Noting that the major cause of population declines in California appeared to be habitat degradation, CPIF began identifying critical habitats important to birds and worked cooperatively to protect and enhance remaining habitat fragments.

The Riparian Bird Conservation Plan

The first habitat to be addressed was California's dwindling riparian habitats. Eighteen federal, state, and private organizations formed the Riparian Habitat Joint Venture (RHJV) in 1993 which focused on (1) collecting data and analyzing existing information to promote a broad understanding among land managers; (2) doubling riparian habitat in California by funding and promoting on-the-ground conservation projects; and (3) providing guidance for land managers, funders, agencies, and conservation organizations to assist in selecting and implementing the highest priority conservation/land management projects. To fulfill the RHJV's first goal, CPIF and RHJV produced the Riparian Bird Conservation Plan. The Riparian Bird Conservation Plan was created by (1) identifying 14 focal riparian bird species; (2) writing detailed species accounts for each bird species; (3) identifying elements of similarity and differences in the habitat needs and concerns for each species; and (4) summarizing this information into a straightforward report that provides recommendations to managers and other interested parties for habitat protection, restoration, management, monitoring, and policy.

Conservation in California's Other Habitats

After the creation of the Riparian Bird Conservation Plan, CPIF decided to enlarge its scope and examine other habitats of interest: Coastal Scrub/Chaparral, Sierra Nevada, Oak Woodlands, Coniferous Forests, and Grasslands. This Grassland Bird Conservation Plan seeks to mimic the focus of the Riparian Bird Conservation Plan; namely, coalescing available grassland bird information into a straightforward "state of the science" report that summarizes available information and provides recommendations to managers and other interested parties for habitat protection, restoration, management, monitoring, and policy.

Objective of Grassland Bird Conservation Plan

The objective in developing a Grassland Bird Conservation Plan is to synthesize and summarize, in one place, current "state of the science" knowledge concerning the requirements of birds in grassland habitats, and provide recommendations for habitat

protection, restoration, management, and monitoring to ensure long-term persistence of birds and other wildlife dependent on grassland ecosystems.

California Partners in Flight Partners:

California Department of Fish & Game (CDFG)
California Department of Water Resources (DWR)
California State Lands Commission (SLC)
Ducks Unlimited
Kern River Research Center (now defunct)
National Audubon Society (NAS)
National Fish & Wildlife Foundation (NFWF)
National Park Service
Point Reyes Bird Observatory (PRBO)
Sacramento River Partners
Southern Sierra Research Station (SSRS)
The Nature Conservancy (TNC)
U.S. Bureau of Land Management
U.S. Bureau of Reclamation
U.S. Fish & Wildlife Service
U.S. Geological Survey
U.S.D.A. Forest Service
Wildlife Conservation Board (WCB)

Chapter 2. Grasslands in California

Grassland Types

There are two major grassland habitat types in California: annual and perennial. Kie (1988) recognized coastal perennial grasslands in the coastal prairie form (Monterey northward along the California coast below 100 meters and usually within 100 kilometers of the coast) and as relic perennial grasslands. Coastal prairie is found in northern areas of California under maritime influence, while the relic perennial forms occur scattered throughout the annual grasslands - these are generally small enough not to be considered a separate type. The majority of the state's grasslands are annual. Vickery et al. (1999a) recognized the California annual grassland as one of the eight major grassland types in North America. All of the California annual grassland falls within the state boundaries and it is the grassland towards which this plan is targeted. There is no good evidence that perennial grasses ever dominated California grasslands except in the North Coast Ranges (Blumer 1993).

Shrubsteppe vegetation communities also occur in California, although this habitat is outside the scope of this plan. Shrubsteppe in California is limited to the northeastern portion of the state. For more information on shrubsteppe habitat see the Conservation Strategy for Landbirds in the Columbia Plateau of Eastern Oregon and Washington (Altman and Holmes 2000), prepared for Oregon-Washington Partners in Flight, available at http://www.gorge.net/natres/pif/conservation.html.

California Grassland Coverage

Grasslands are thought to have historically covered about 8 million hectares in California (Burcham 1957). Grasslands were estimated to cover only half that amount in the 1950's (Biswell 1956). However in the late 1970's, California's Department of Forestry used LANDSAT data to map California's habitats and estimated 7 million hectares of grassland, excluding the oak woodland-grassland mosaic that covers much of the foothills bordering the Great Central Valley (California Department of Forestry 1979 *as cited in* Huenneke 1989). GAP analysis completed in 1998 shows only 2.88 million hectares of grassland in California (Davis et al. 1998). It is unclear whether these very different estimates reveal true changes in grassland coverage, different definitions of grassland, changes in the accuracy of mapping methods, or a combination of these causes. Distribution in California, according to GAP analysis, of three types of grasslands (annual, perennial, and pasture) can be seen in Figure 1-1. The map only denotes areas where grassland is the dominant feature (>50%) of a given polygon.

Assuming Burcham's historical estimate to be correct, roughly 36% of California's grasslands remain today. The largest swath of grassland in California was the Great Central Valley, where grasslands covered most of the land surface of the valley and were broken only by scattered wetland and riparian areas (Heady 1977; but see Hamilton

1997). However, by 1880 75% of the Great Central Valley had already been converted to improved farmland (Hewes and Gannett 1883 *as cited in* Huenneke 1989). Smaller but still significant areas of grassland existed in northeastern California and in several coastal counties (Heady 1977).

Much of what is classified as grassland today was not grassland historically (Hamilton 1997). For instance, much of the foothills that surround the Great Central Valley as well as portions of the South Coast ranges were dominated by shrub and oak woodlands (Huenneke 1989). Over time, ranchers that were pushed off the valley floors by more competitive agricultural interests cleared and modified the foothills and so the area became dominated by open grasslands (Preston 1981). This non-historical grassland constitutes the major portion of the present grassland acreage.

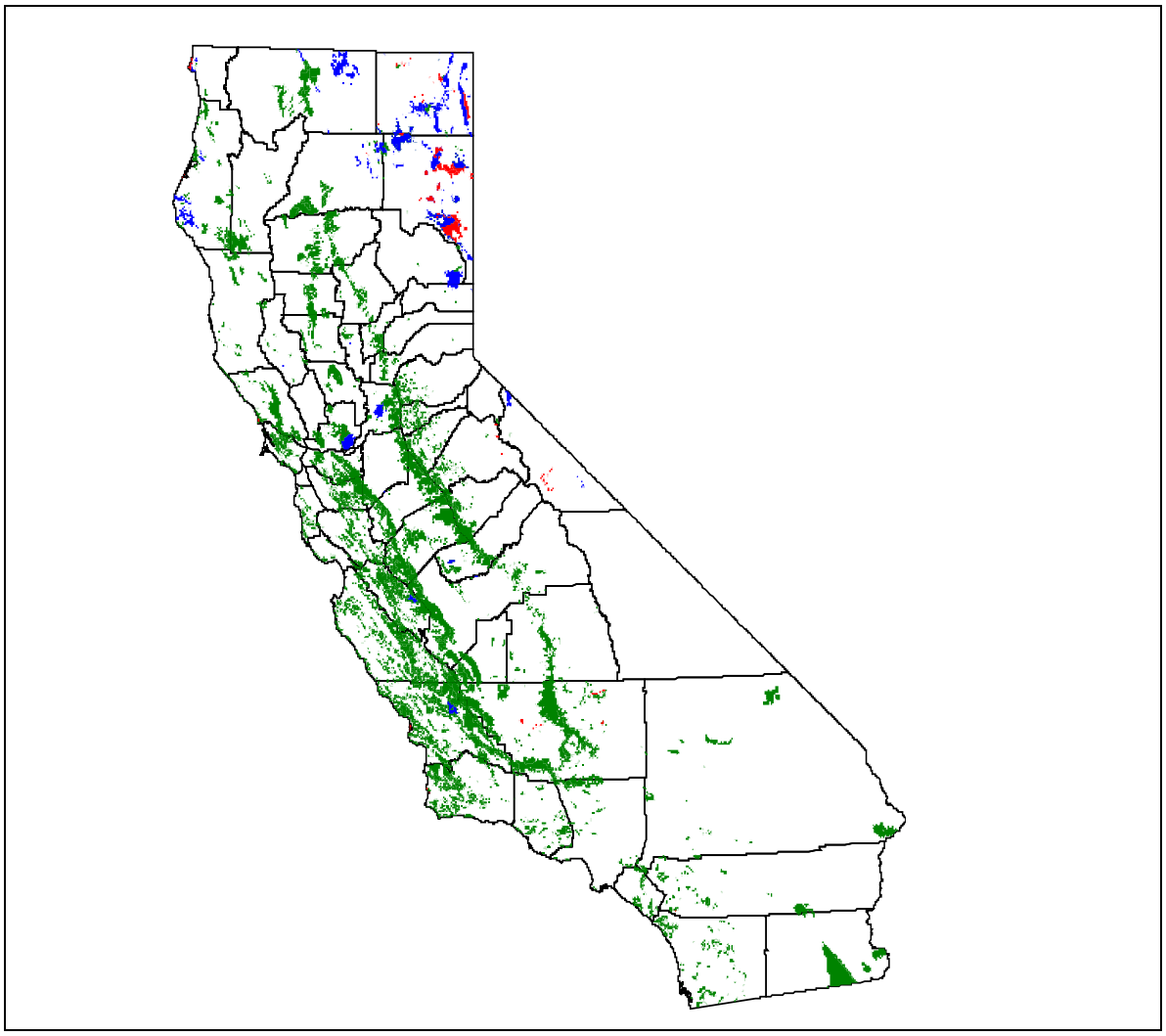

Figure 1-1. Distribution of grassland in California.
Colored areas are those where grasslands are the dominant habitat in a ≥100-ha polygon. Green denotes annual grassland, red is perennial grassland, and blue is pasture.

Grassland Habitat

For purposes of this conservation plan, grasslands will be defined as all habitats dominated by grasses and/or by forbs. This will enable the plan to cover habitats ranging from sparsely vegetated alkali flats, to annual and perennial grasslands, to tall, dense forblands and row crops. We also include grasslands where shrubs make up less than 50% of the total canopy cover (Vickery et al 1999a). CPIF has recently adopted the Sawyer and Keeler-Wolf system for classifying assemblages of vegetation. Grass or sedge (*Carex*) dominated herbaceous vegetation assemblages are classified into 31 categories based on the dominant plant species. However, most records of grassland bird distribution do not classify grassland vegetation at such a specific level; for this reason, it was felt that the California Wildlife Habitat Relationships system (CWHR) provides more suitably general grassland types to which we can link bird distribution. Furthermore, by using the CWHR system, we can also identify the distribution, acreage, ownership, and protection status of such grasslands by using the recently completed GAP analysis for California.

The CWHR system of classification provides general descriptions of wildlife habitats in California. Below are brief descriptions on the major grassland habitats in California. For complete accounts see Mayer and Laudenslayer (1988).

Annual Grasses

Annual grasslands occur throughout California and today are dominated by exotic annual grasses. Species present and structure can change dramatically with alterations in precipitation and management activities such as grazing.

Perennial Grasses

Perennial grasses occur in small remnants in the Central Valley and along the coast. Dominant vegetation can include (depending on geographic location, soils, etc.) Purple Needlegrass, Creeping Wild Rye, Alkali Sacaton, and Saltgrass.

Pasture

Pastures are generally found in agricultural areas. Most pastures are grazed. Plant species present varies tremendously depending on geographic location, soil, the pasture mixes utilized, and so on, but tend to be dominated by perennial grasses and annual forbs. Many pastures are irrigated.

Wet Meadow

Wet meadows occur from northwest California to the southern Sierra Nevada. These meadows are generally defined by poorly drained soils and often contain sedge, rush and bent grass species (*Carex*, *Juncus*, and *Agrostis*). Wet meadows often occur as ecotones between Perennial grasslands and adjacent wetlands.

Irrigated Row Crops, Dry-farmed Row Crops, and Grain Crops

Cropland can be composed of annual crops such as Cotton and Corn or perennial crops such as Asparagus and Alfalfa. Over 80% of California's 6.2 million acres of cropland is irrigated (Natural Resources Conservation Service, 1999).

Chapter 3. Conservation Planning Process

Criteria for selecting grassland focal species

We chose seven focal species in order to capture the variation present in grasslands across California. Each required a different type of grassland (e.g. vegetation structure or patch size) and, therefore, we hope they will represent the range of habitat needs demonstrated by most or all birds that use California's grasslands. In addition, four of the seven species are species of concern at the state and/or federal level. Species and authors of accounts follow.

Primary Focal Species

- **Ferruginous Hawk (*Buteo regalis*)** — Kevin Hunting, California Department of Fish and Game
- **Grasshopper Sparrow (*Ammodramus savannarum*)** — Victor Lyon, United States Fish and Wildlife Service
- **Mountain Plover (*Charadrius montanus*)** — Kevin Hunting, California Department of Fish and Game
- **Northern Harrier (*Circus cyaneus*)** — Kristi Cripe, California Department of Fish and Game
- **White-tailed Kite (*Elanus leucurus*)** — Jeffrey Moore, Humboldt State University
- **Western Meadowlark (*Sturnella neglecta*)** — Bob Allen, California Department of Fish and Game
- **Savannah Sparrow** (*Passerculus sandwichensis*) — Linda Moore, Humboldt State University

Table 1-1 shows information on status and habitat needs for these seven species. A Burrowing Owl account is in the process of being added. Secondary species for which we did not write species accounts, but nest and/or primarily forage (summer or winter) in grasslands include: Tricolored Blackbird, Horned Lark, wintering Sandhill Cranes, Swainson's Hawk, Song Sparrow, Blue Grosbeak, Mallard, Cinnamon Teal, Gadwall, and Ring-necked Pheasant.

Table 1-1. Focal species status and habitat needs.

Species	**Life History**	**State Status**	**Federal Status**	**Habitat Needs**
Ferruginous Hawk	Winters in California.	CSC	MNBMC FSC	Large patch size of grassland, has adapted to some forms of agriculture
Grasshopper Sparrow	Summer resident, may be year-round resident in some areas.	None	MNBMC	Less than 30% total shrub cover, large patch size, bunchgrasses
Mountain Plover	Winters in California.	CSC	FPT MNBMC	Sparsely vegetated or heavily grazed grasslands, disked agricultural lands, or nearly barren areas.
Northern Harrier	Year-round resident, numbers augmented by northern birds in winter.	CSC	MNBMC	Forb- or grass- dominated areas, may need nearby wetlands, will forage in certain types of agriculture
Western Meadowlark	Year-round resident, numbers augmented by northern birds in winter.	No	None	Grassland generalist
Savannah Sparrow	Dependent on subspecies, most remain in California year-round, numbers augmented by northern birds in winter.	Subspecies *beldingi:* SE	None	Dense vegetation in open country: meadows, pastures, fields, etc.
White-tailed Kite	Year-round resident, may be nomadic in search of prey	FP	None	Uses open areas (grasslands, oak woodland, savannah, riparian and some agriculture)

MNBMC: Fish and Wildlife Service Migratory Non-game Bird of Management Concern
FP: California Department of Fish and Game (CDFG) Fully Protected
CSC: CDFG California Species of Special Concern
SE: State listed as Endangered
FPT: Federally Proposed for listing as Threatened
FSC: Federal Special Concern Species

Chapter 4. Problems Affecting Grassland Birds

There are five primary problems affecting grassland birds today:

1. Replacement of native perennial and annual grasses and forbs with exotics

The replacement of the native grasslands began almost immediately after Spanish colonists arrived in California and has only accelerated since. The earliest pueblos built already contained seeds of exotic grasses - some of which still dominate the grassland landscape today (Hendry 1931 *as cited in* Fredrickson and Laubhan 1995). It was probably a combination of competitive advantages by exotic species, overgrazing, droughts, and other unknown factors that quickly (within 100 years) led to almost a complete overhaul of native plants with introduced varieties (Heady 1979, Fredrickson and Laubhan 1995). As early as 1830, beaver trappers in the Tulare Basin (southern San Joaquin Valley) were noting the disappearance of perennial grasses in areas surrounding Tulare Lake (Preston 1981). Various waves of exotics have swept across California as new grassland species were mistakenly or intentionally introduced. This process continues today, most notably with the extremely aggressive exotic forb Yellow Star Thistle (*Centaurea solstitalis*).

2. Loss of grassland habitat

Although the early colonists and livestock were responsible for the initiation of the changes in species composition in grasslands, very little grassland was lost to other uses except in areas immediately surrounding missions. The arrival of American farmers changed this situation quickly. In the Great Central Valley, farmers first farmed using dry farming techniques from the east ("sky-farming"), but gradually developed means of tapping California's waterways for irrigation purposes (Preston 1981). By 1880, 75% of the Great Central Valley had already been converted to improved farmland (Hewes and Gannett 1883 *as cited in* Huenneke 1989). What was once the largest swath of grassland is now largely some of the most productive farmland in the world. Remaining grasslands in the valley floors tend to be in areas of poor productivity: for example, extremely alkaline or serpentine soils. A similar pattern of conversion of grazed grassland to agriculture happened in other valleys (e.g. the Salinas Valley). Coastal prairies were also converted to farms and, especially in the Bay area, rapidly urbanized.

3. Decreased (and decreasing) patch size of remaining grasslands

As mentioned above, remaining grasslands on the Great Central Valley floor tend to be small patches on alkaline soils. Coastal prairies have also become greatly fragmented (Heady 1977). The remaining grassland around the Great Central Valley is becoming increasing fragmented by urbanization and, in some areas, encroaching woody vegetation (Fredrickson and Laubhan 1995). Research from other regions with grasslands in North America has demonstrated that grassland bird species (including species that breed in California) can be sensitive to grassland patch size. Some grassland bird species are only

found in grassland patches that are 100 times the size of an average territory of a given species (Herkert 1994, Vickery et al. 1994, Bock et al. 1999). Although no research in California has been directed towards determining what, if any, effects dwindling patch size may have on our grassland species, reductions in patch size has likely accelerated the decline of grassland birds.

4. Over 86% of grasslands are privately owned. This should be seen as an opportunity for CPIF to forge partnerships with not just agencies and research organizations, but a diverse array of private landowners.

The overwhelming majority of grasslands across the state are managed by ranchers (Davis et al. 1998). Most grasslands in California exist today not because of thoughtful conservation philosophy but because of the economic viability of grazing, resulting in part from agricultural subsidies. Although many ranches have been in family or corporate hands for many years, economic forces can cause sudden changes that can alter land use from one with a grassy cover to orchards, vineyards, or development. The drawback to habitat in the hands of private ownership is that no permanent protection exists and that economic changes can cause loss of habitats.

5. Paucity of critical information

Almost no solid information exists for most of California's grassland bird species. Descriptions of bird distributions are often vague and based on little data. Survivorship and productivity are completely unknown, and most habitat models are based on research that was done outside of California. For instance, the CWHR's life history, nest site, and territory description for the Western Meadowlark is based on 15 studies, of which 14 were done outside of California (the study from California is pre-1930). Although life history traits may very well be similar across the continent, there is no reason to assume territory and nest characteristics will be similar in California's annual grasslands as in the tallgrass prairie of Wisconsin (where much Western Meadowlark information comes from). This is no fault of the CWHR - information of this type simply does not exist for California. Good conservation cannot be practiced without valuable data that must be collected using good scientific design and analysis.

Chapter 5. Conservation Action Recommendations

A. Monitoring/Research

The monitoring/research section of the recommendations is presented first for several reasons. First, we do not know how grassland birds in California are distributed and to what habitat qualities they may be responding. Second, even when we determine what the bird distribution is, we still have very little knowledge of how to manage grasslands to their benefit. Grasslands are not a case where a vast amount of sound information exists already and the critical need is to get the word out. With the exception of Mountain Plover and Tricolored Blackbird, no grassland birds are in immediate danger. It would be well worth our while to invest several years in research before recommending significant actions for grassland birds as a whole that we may one day regret.

1. Initiate statewide point count project.

A 3-5 year large-scale point count project that covers all of California's grassland distribution should be initiated to (a) determine the actual distribution of grassland birds and (b) determine the habitat associations of our grassland birds. We can no longer rely on vague and qualitative descriptions of distribution and relative abundance if we are to practice good conservation.

2. Develop methods to monitor productivity and survivorship for grassland birds.

Mist-netting is an effective method to gather data on the productivity and survivorship of forest and riparian birds. However, mist-netting in grassland has little to no value because of the visibility of the nets and corresponding difficulty of catching birds. Without this tool for grassland, we have only nest monitoring (to determine productivity) and color banding studies (to determine survivorship). Both are extremely costly and give us information on only a very limited scale. Vickery et al (1992) developed a protocol to monitor productivity of grassland bird pairs by assessing the visible behavior of territorial birds. This has the potential to be an excellent technique, but may not work for all grassland bird situations. It is imperative for us to develop effective grassland bird monitoring tools to assess the effects of habitat types, fragmentation and edge effects, and other management questions.

3. Determine sensitivity of California's grassland birds to grassland patch size.

Studies done in other grassland areas in North America have shown that some grassland species show sensitivity to the grassland patch size (e.g. Herkert 1994, Samson 1980, Vickery 1994, Bock et al. 1999). In Herkert's study in Illinois, he found that Grasshopper Sparrows were not present in grassland patches smaller than 30 hectares (74 acres) despite the fact that their published average territory size is only about 0.3 ha (0.75 acres). In other words, Grasshopper Sparrows needed a patch size some 100 times their average territory before settling. It is unknown if California populations respond in a similar manner, but determining this will clearly affect the outcome of the conservation strategies we ultimately pursue.

4. Determine grassland bird response to various grazing, burning, mowing, and disking regimes that occur in California.

Some 86% of grasslands lies in private hands. Much of this land is grazed. Grassland bird response to grazing in the Midwest has been shown to be complex and results between studies are often contradictory (Bock et al. 1984a, Bock et al. 1993, Bartelt 1997, Bowen and Kruse 1993, Crouch 1982). A review by Saab et al. (1995) found about half of grassland bird species showed a positive response and half a negative response. Much of the confusion probably stems from different definitions of light/medium/heavy grazing, intensity of grazing, and timing of grazing all of which occur in different types of grasslands (e.g. tallgrass, short grass, shrubsteppe) in different geographic areas (e.g. Great Plains versus Great Basin) and are measured by different methods.

For instance, the Grasshopper Sparrow has been found to respond positively to light or moderate grazing in tallgrass prairie (Risser et al 1981). However, it responds negatively to grazing in shortgrass, semidesert, and mixed grass areas (Bock et al 1984b). Presumably grasslands in California would more resemble grasslands from the latter group (as opposed to tallgrass prairie), but Grasshopper Sparrow response to grazing in California is at this time unknown. We must encourage careful design and analysis of data to truly assess the range of grazing conditions.

There is a pressing need to form partnerships with local ranchers in order to do this type of research. Although we should in no way overlook possibilities of research on public lands, I think this is an excellent opportunity to work with ranchers to see if together we can (a) improve bird species richness, productivity, and survivorship, (b) decrease the presence of aggressive exotics (e.g. Yellow Star Thistle), (c) improve forage quality for livestock, and (d) increase the presence of native vegetation. If some of the above stated goals turn out to be in conflict with one another, financial incentives for landowners may be required in order to meet bird conservation goals.

A similar situation exists with the effects of burning. We do not currently understand how the frequency and intensity of fire in grasslands has affected these ecosystems and their associated wildlife in California. Although we know that Native Americans burned grasslands and that it is likely that the grasslands burned naturally (lightning strikes), we

need to better understand this relationship. Since native plants are adapted to historic fire conditions, understanding the natural fire cycle is important to long-term management for the grassland ecosystem as a whole and for grassland birds. As an example from a similar habitat type, bunchgrasses in the shrubsteppe of the Great Basin are thought to have burned on a very approximate 70-year cycle (Rotenberry 1998); recent invasion by the exotic annual Cheatgrass (*Bromus tectorum*) has increased the frequency of fire in some areas to one fire every five years (Whisenant 1990). Such a rapid fire cycle selects heavily against sagebrush and perennial bunchgrasses and leads to stands of pure Cheatgrass (Rotenberry 1998). Clearly, before implementing fire as a management strategy, we need to understand what vegetation we are targeting for and against and whether fire can cause these changes.

Studies on the effects of burns on grassland birds in North American grasslands have shown similar results as grazing studies: namely, bird response is highly variable. Confounding factors include timing of burn, intensity of burn, previous land history, type of pre-burn vegetation, presence of fire-tolerant exotic vegetation (that may take advantage of the post-burn circumstances and spread even more quickly) and grassland bird species present in the area. It should be emphasized that much of the variation in response to grassland fires lies at the level of species, but that even at this level results are often difficult to generalize. For instance, Mourning Doves have been found to experience positive (Bock and Bock 1992, Johnson 1997) and negative (Zimmerman 1997) effects by fire in different studies. Similarly, Grasshopper Sparrow have been found to experience positive (Johnson 1997), negative (Bock and Bock 1992, Zimmerman 1997, Vickery et al 1999b), and no significant (Rohrbaugh 1999) effects of fire. Species associated with short and/or open grass areas will most likely experience short-term benefits from fires. Species that prefer taller and denser grasslands most likely will demonstrate a negative response to fire.

Mowing, irrigation, and disking are also used to manage grasslands in some areas. Although these management tools are probably not utilized as often as grazing and burning, investigations are needed to determine what effects these may have on grassland birds. We do know that mowing and disking during the breeding season cause direct nest mortalities. From these results, recommendations have been made to state wIdlife officials with the Department of Fish and Game in areas of the northern San Joaquin Valley to mow or disk only after July 1st, when the vast majority of breeding has finished. The date when most grassland bird breeding is completed varies across California, but in most areas birds finish breeding by the end of July.

5. Determine benefits / drawbacks of various agricultural regimes.

Birds such as the Tricolored Blackbird, Western Meadowlark, and Northern Harrier are regularly attracted to agricultural areas for nesting and/or foraging. As work with Tricolored Blackbirds demonstrates, this relationship can have devastating effects for nesting birds (Hamilton et al. 1999). As agriculture becomes increasingly intensive and more pastures are converted to orchards or vineyards, it is important to determine what benefits/drawbacks may exist in the agricultural landscape for grassland birds. As we

accomplish this, it is even more important to find methods by which both farmers and birds can survive. As with grazing, it is possible that conflicts will arise. Again, this is an excellent opportunity to work with private agricultural landowners to determine management regimes that will best benefit birds and landowners. Although we may not ever discover the perfect win-win situation, we can work to make agriculture (that is going to happen with or without biological input) more friendly to bird populations. Determining what specific factors affect grassland birds in agricultural areas is a good first step along this road.

6. Determine if grassland birds select for or have increased productivity / survivorship in native grasslands vs. non-native grasslands. "Do native grass restorations restore native grassland birds?"

No bird data for grasslands exists before the great invasion of exotic annuals occurred in the 1800's. Thus, we have little knowledge of what the grassland bird community may have looked like before the transformation. We do not know if any additional grassland species bred in pristine grasslands. However, it would be well worth our while to determine if native grasslands have any benefits for the remaining grassland species. Answering this question is especially important as many refuges and parks move towards managing for native perennial grasses, often at great expense. If grassland birds do show a positive response to native grasslands, this could add another line of evidence to justify expensive restoration projects across the state. With answers to these questions we will be able to better determine appropriate management regimes.

B. Habitat Restoration / Management

The birds chosen as focal species for this plan are thought to occupy a wide range of niches within grassland habitats. As a result, management recommendations can be quite disparate from species to species. Specific management recommendations for some species can be found in the individual species accounts completed for this plan. These plans are located online at www.prbo.org. This section of the plan will instead focus on general recommendations that are thought to benefit several or most of the grassland bird species of California.

1. Avoid mowing and disking during the breeding season.

Mowing and disking have both direct (destruction of birds and nests) and indirect (alteration of habitat) effects on nesting birds. Impacts on nesting grassland birds will be minimized if mowing and disking is delayed until after July. This date will be different across the state, with earlier dates in the southern half of California and perhaps later dates in extreme northern California.

2. Avoid burning during the breeding season.

Although fire may have long-term positive effects for some grassland species, burning during the breeding season certainly impacts any nesting efforts underway. Much like mowing and disking, how great this impact is on local population dynamics will depend greatly upon the amount of area affected, the availability of alternate suitable habitat, and the frequency of disturbance (e.g. every year vs every third year). If, in some situations, burning regimes can still be successful with burns that occur during the non-breeding season, then this option should be explored by managers.

Encroachment of woody vegetation in grassland areas will be detrimental to most grassland species. For instance, Grasshopper Sparrows have been found to be absent from areas with greater than 30% shrub cover. In areas of good grassland bird diversity and productivity, efforts should be made to keep woody vegetation from reducing open grassland habitat.

C. Habitat Protection

Although we still have much to learn about managing grasslands for the benefit of grassland birds, we do know several things that negatively affect grassland birds. Conversion of grasslands to most forms of agriculture, orchards, and vineyards, and increasing urbanization do not benefit grassland birds. Habitat protection is clearly something we can pursue as we untangle many of the intricacies of grassland bird response to various management options.

1. Identify remaining grassland areas of large patch size that have high species abundance and productivity for grassland birds.

Habitat protection measures can only proceed once we know where the birds are and how they are faring (see item 1 in Monitoring/Research Recommendations above).

2. Target unprotected areas that have been identified for protection as priority areas for (a) land purchases when possible, (b) conservation easements, and (c) the forging of partnerships with private landowners to create win-win situations.

For instance, there are several large grassland areas where Grasshopper Sparrow, Northern Harrier, and Western Meadowlark are predicted to breed, according to GAP analysis. Examples include the foothills east of Bakersfield and, in general, the eastern foothills of the Great Central Valley. These are merely suggestions for beginning the process by which we select areas to which we should direct more detailed investigations of bird status and productivity - we do not even know how common grassland birds are in these areas.

3. Target areas with quality grassland habitat for protection status before targeting at-risk or degraded habitat.

In many situations where a core refuge area for a given habitat already exists, the purchase of quality habitat that lies in private hands and seems at little risk of change in the future is bypassed in order to purchase and restore at-risk or degraded lands. However, since so little grassland in California has permanent protection status, quality grassland areas with high bird productivity and, where possible, remaining stands of native vegetation should be targeted for protection measures first. Such core areas spread around the state and surrounded by grasslands of limited extractive use (grazing in particular) could make excellent large-scale grassland conservation areas.

Chapter 6 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 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.

Project-Based Learning

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 conservation projects 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.).

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?

Education Opportunities

Historically, grassland habitats covered approximately 8 million acres of land in California (Burcham 1957). Based on this estimate, only 36% of California's grassland habitat remain. And much of what remains is of poor quality. Reasons for the loss and degradation of this habitat include: loss of native annual and perennial grasses and forbs, establishment of exotic species; conversion of grasslands to agriculture and urbanization; decreased patch size of existing grasslands to sizes that may be too small to support

healthy populations of birds and other wildlife, and a lack of sufficient information regarding grassland ecosystems and their importance to wildlife.

The following is a list of key topics to emphasize in grassland education projects:

- Grassland habitats are dominated by grasses and forbs. Grasslands can be either annual or perennial. Annual grasslands are dominated by annual grass species, and perennial grasslands are dominated by perennial species. In California annual grasslands are mostly dominated by exotic species.
- Annual grasses are grasses that live only one year and rely upon seed sources in the soil for re-generation the following year.
- Perennial grasses are grasses that live more than two years. The grass may die to the roots each year but re-sprouts the next year.
- Grassland birds are declining more rapidly than any other guild of birds.
- The variation in structure (heights and densities) of grasslands provides suitable locations for nesting and for foraging, and provides a diverse mixture of insects.
- Bare ground patches are another key component of grassland habitats for birds. Bare ground provides nesting sites for some species and dust bathing and foraging sites for others.
- Grasslands are not composed entirely of grasses. Wildflowers and forbs support insects that birds feed on. Shrubs add to the structure of grasslands by providing perching sites for male birds to sing from when defending territories and attracting mates.
- Grassland birds nest within the first meter or directly on the ground and thus are subject to threats such as predation and livestock trampling. Due to their vulnerability to predators, some species have developed unique adaptations such as cryptic coloration, skulking behavior and placement of nests in concealed spots such as within bunches of grass and low in shrubs.
- The majority of grassland habitats have been converted to agriculture and pastureland.
- Emphasize the focal and secondary species listed in the grassland conservation plan. Table 1, Chapter 3 contains status and habitat needs for the 7 focal species as well as a list of secondary species.

The concepts and guidelines outlined above and in the Conservation Education section can be presented to the public and to students through a variety of media. Following is a list of common education 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 studying birds in the field - whether in the backyard, on school grounds, or in a nearby natural area - and include keeping field notes and observing natural behaviors of birds. Field trips to sites with bird conservation and monitoring projects, fosters interest and enthusiasm for wildlife and teaches students the importance of conserving birds. 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 the Point Reyes Bird Observatory, 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 Partners In Flight 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.

Other Grassland Educational Resources

California Native Grass Association -California Native Grass Poster Color pencil renderings of 25 native grasses, proportionate to each other. English and Latin names of native grasses. Native grass range maps for each species and text highlighting the benefits of native grass restoration. Order online at http://www.essexenv.com/cnga/ or call 1-800-31-3086
Educational materials coming soon from the California Native Grass Association-see their website *at http://www.essexenv.com/cnga/*

Volunteer Involvement

Enlisting volunteers to aid in data collection and restoration is an excellent way to gain additional help. It is 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 participate in counting and studying 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.

Interpretation at Natural Areas

Interpretation at natural areas is an excellent way to disseminate key concepts about bird conservation to the public. Displays at 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.

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 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 *IMBD@fws.gov*.

Grassland Outreach

Many groups are already working together on projects to preserve and educate people about Grassland habitats. Activities ranging from workshops, management guidelines, new partnerships, and removal of exotic species. The groups and their activities are summarized below:

The California Native Grass Association (CNGA) brings together conservationists, naturalists, resource managers, horticulturists, seed producers, scientists, consultants and others in California with an interest in native grasses. All promote native grasses and associated species for restoration and maintenance of California's grassland ecosystems and for use in urban and agricultural areas. The CNGA members promote increased use of quality native grasses from appropriate genetic sources, and their production to increase availability. CNGA is co-sponsoring production of a new handbook for agronomic and horticultural uses of native grasses, with an accompanying digital database. CNGA is also developing educational materials, has established native grass gardens for review and reference, sponsors grass identification workshops, pamphlets on selected grasses, hands on restoration workshops, field trips and technical conferences. http://www.essexenv.com/cnga/

Cooperative Weed Management Areas is a basic organization widely recognized as a model for carrying out a comprehensive and effective weed management program on the ground. The intent is to bring together landowners and managers from various private, non-profit, county, state, and federal agencies combining their expertise, energy, and resources to deal with a common problem. Contact your county agricultural commissioner for information on weed management areas in your county.

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 private landowners and biologists to examine wildlife response to management practices throughout California's grassland habitats.
- **More contact with resource-based constituencies**, such as the agricultural industry, to foster collaboration in land management, in order to improve habitat for birds while ensuring that landowners can make a sustainable living.
- **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.

- **Grassland and grassland related issues 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.

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 available food resources 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 population

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

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 in habitats throughout the state. (See the PRBO web site http://www.prbo.org for ways to get involved. Appendices A and B provide information on bird monitoring techniques and the types of information they provide.)

If you own a cat, help reduce the impact of cats on bird populations.

Domestic cats kill hundreds of 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 at the American Bird Conservancy's web site at *http://www.abcbirds.org.*

Other actions that cat owners can take to help birds:

- **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 who 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 tend to benefit disproportionately from human habitation, and as their populations expand

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, artificial sweeteners or red dye.** Place the feeders in the shade and change the 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 and return them 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.**

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 riparian 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, and 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 many 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 balance, 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 (most songbirds feed their young insects). 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.

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Appendix A. Resources

A. Programs for Landowners and Managers:

The following programs are designed to benefit landowners and wildlife. By combining participation in the following programs with bird monitoring we can gain knowledge about wildlife response to a variety of different management practices.

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

The Wildlife Habitat Incentives Program (WHIP)
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.

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.

Objectives of the program are to:

- Assist individual land-users, communities, conservation districts, and other units of State and local government and Federal agencies to meet their goals for resource stewardship and assist individuals to comply with State and local requirements. NRCS assistance to individuals is provided through conservation districts in accordance with the memorandum of understanding signed by the Secretary of Agriculture, the governor of the state, and the conservation district. Assistance is provided to land users voluntarily applying conservation and to those who must comply with local or State laws and regulations.

- Assist agricultural producers to comply with the highly erodible land (HEL) and wetland (Swampbuster) provisions of the 1985 Food Security Act as amended by the Food, Agriculture, Conservation and Trade Act of 1990 (16 U.S.C. 3801 et. seq.) and the Federal Agriculture Improvement and Reform Act of 1996 and wetlands requirements of Section 404 of the Clean Water Act. NRCS makes HEL and wetland determinations and helps land users develop and implement conservation plans to comply with the law.

- Provide technical assistance to participants in USDA cost-share and conservation incentive programs. (Assistance is funded on a reimbursable basis from the CCC.)

- Collect, analyze, interpret, display, and disseminate information about the condition and trends of the Nation's soil and other natural resources so that people can make good decisions about resource use and about public policies for resource conservation.

- Develop effective science-based technologies for natural resource assessment, management, and conservation.

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.

Environmental Quality Incentives Program (EQIP)
The Environmental Quality Incentives Program provides technical, educational, and financial assistance to eligible farmers and ranchers to address soil, water, and related natural resource concerns on their lands in an environmentally beneficial and cost-effective manner. The program provides assistance to farmers and ranchers in complying with Federal, State, and tribal environmental laws, and encourages environmental enhancement. The program is funded through the Commodity Credit Corporation. The purposes of the program are achieved through the implementation of a conservation plan that includes structural, vegetative, and land management practices on eligible land. Five to ten-year contracts are made with eligible producers. Cost share payments may be made to implement one or more eligible structural or vegetative practices, such as animal waste management facilities, terraces, filter strips, tree planting, and permanent wildlife habitat. Incentive payments can be made to implement one or more land management practices, such as nutrient management, pest management, and grazing land management. *http://www.nrcs.usda.gov/enhancement*.

Conservation Farm Option (CFO)
The Conservation Farm Option is a pilot program for producers of wheat, feed grains, cotton, and rice. The program's purposes include conservation of soil, water, and related resources, water quality protection and improvement, wetland restoration, protection and creation, wildlife habitat development and protection, or other similar conservation purposes. Eligibility is limited to owners and producers who have contract acreage enrolled in the Agricultural Market Transition Act program, i.e. production flexibility contracts. The CFO is a voluntary program. Participants are required to develop and implement a conservation farm plan. The plan becomes part of the CFO contract that covers a ten-year period. CFO is not restricted as to what measures may be included in the conservation plan, so long as they provide environmental benefits. During the contract period the owner or producer (1.) receives annual payments for implementing the CFO contract and (2.) agrees to forgo payments under the Conservation Reserve Program, the Wetlands Reserve Program, and the Environmental Quality Incentives Program in exchange for one consolidated payment.

Conservation of Private Grazing Land Initiative (CPGL)
The Conservation of Private Grazing Land initiative will ensure that technical, educational, and related assistance is provided to those who own private grazing lands. It is not a cost share program. This technical assistance will offer opportunities for: better grazing land management; protecting soil from erosive wind and water; using more energy-efficient ways to produce food and fiber; conserving water; providing habitat for wildlife; sustaining forage and grazing plants; using plants to sequester greenhouse gases and increase soil organic matter; and using grazing lands as a source of biomass energy and raw materials for industrial products. More information can be found at the Grazing Lands Technology Institute at http://www.ftw.nrcs.usda.gov/glti/homepage.html.

Conservation Plant Material Centers
The purpose of the program is to provide native plants that can help solve natural resource problems. Beneficial uses for which plant material may be developed include biomass production, carbon sequestration, erosion reduction, wetland restoration, water quality improvement, streambank and riparian area protection, coastal dune stabilization, and other special conservation treatment needs. Scientists at the Plant Materials Centers seek out plants that show promise for meeting an identified conservation need and test their performance. After species are proven, they are released to the private sector for commercial production. The work at the 26 centers is carried out cooperatively with state and Federal agencies, commercial businesses, and seed and nursery associations.

US Fish and Wildlife Service—Partners for Fish and Wildlife

The mission of the U.S. Fish and Wildlife Service is, by working with others, to conserve, protect, and enhance fish and wildlife and their habitats for the continuing benefit of the American people. The Service's Partners for Fish and Wildlife program, formerly named the Partners for Wildlife program, helps accomplish this mission by

offering technical and financial assistance to private (non-federal) landowners to voluntarily restore wetlands and other fish and wildlife habitats on their land. The program emphasizes the reestablishment of native vegetation and ecological communities for the benefit of fish and wildlife in concert with the needs and desires of private landowners.

For more information about any of the following US Fish and Wildlife programs:
http://partners.fws.gov/index.htm
Partners for Fish and Wildlife
State Coordinator
2800 Cottage Way W-2610
Sacramento, CA 95825
916-414-6446

The assistance that the U.S. Fish and Wildlife Service offers to private landowners may take the form of informal advice on the design and location of potential restoration projects, or it may consist of designing and funding restoration projects under a voluntary cooperative agreement with the landowner. Under the cooperative agreements, the landowner agrees to maintain the restoration project as specified in the agreement for a minimum of 10 years.

Restoration projects may include, but are not limited to:
- planting native grasslands and other vegetation
- planting native trees and shrubs in formerly forested wetlands and other habitats
- prescribed burning as a method of removing exotic species and to restore natural disturbance regimes necessary for some species survival
- removal of exotic plants and animals which compete with native fish and wildlife and alter their natural habitats

The California Department of Fish and Game

The Department provides information and recommendations to private landowners on programs and activities for the protection, management, and enhancement of native wildlife, fish, plants, and habitats.

For more information on any of the following California Dept. of Fish and Game programs:
http://www.dfg.ca.gov/habitats.html
Branch Chief
1416 9th Street
Sacramento, Ca 95814
(916) 653-4875

Central Valley Habitat Joint Venture (CVHJV): The California Central Valley Habitat Joint Venture is a cooperative effort of state and federal agencies, and private

organizations to implement the North American Waterfowl Management Plan. Habitat joint venture actions include protection, restoration, and enhancement of wetland and associated upland habitats. Protection strategies include habitat acquisition, conservation easements, leases, and management agreements with private landowners.

The Inland Wetlands Conservation Program of the Wildlife Conservation Board has made significant contributions toward achieving the specific objectives outlined in the CVHJV Plan. These contributions will ultimately result in the restoration, enhancement and protection of critical habitat necessary to support the millions of migratory waterfowl dependent upon the Central Valley of California. The language establishing the program is available. A similar program, focusing specifically on riparian areas is the WCB's recently established California Riparian Habitat Conservation Program (CRHCP).

Natural Communities Conservation Program (NCCP): The Natural Community Conservation Planning (NCCP) program of the California Resources Agency and the Department of Fish and Game is an unprecedented effort by the State of California, and numerous private and public partners, that takes a broad-based ecosystem approach to planning for the protection and perpetuation of biological diversity. An NCCP identifies and provides for the regional or areawide protection of plants, animals, and their habitats, while allowing compatible and appropriate economic activity. The program seeks to involve public and private landowners/administrators in large-scale conservation planning efforts to ensure the long-term integrity of natural communities and accommodate compatible land use. The pilot program involves coastal sage scrub habitat in Southern California, home to the California gnatcatcher and approximately 90 other potentially threatened or endangered species.

Programs and Information of the Yolo County Resource Conservation District:
For more information on any of the following Yolo County RCD programs and publications:
http://www.yolorcd.ca.gov/programs/
221 W. Court Street, Ste. 1
Woodland,CA 95695
530/662-2037 ext. 202

Farming with Wildlife: funded by US EPA, 1993 to 1996. Sponsored a number of annual Farming for Wildlife Workshops, produced professional video "Working Habitat for Working Farms" and slide show presentations on local practices and achievements, funded printing of comprehensive, lucidly written "Farming for Wildlife" manual for statewide distribution.
Irrigation Ecosystem and Water Quality Grant: funded by US EPA through the State Water Resources Control Board, 1995 - Fall of 1997. Revegetating canal banks, natural sloughs, and county roadsides, and building irrigation tailwater ponds—all aiming to decrease erosion and sediment loss, improve water quality, groundwater recharge and water flow, and increase biological diversity.
IPM-Hedgerow Grant: funded by the state Department of Pesticide Regulation, 1996-98, with a third year likely. Designing and creating five disparate, native plant Hedgerow

systems to harbor beneficial insects and pest predators (bats, owls, and raptors), control erosion and noxious weed growth, reduce chemical spraying and stray drift, labor costs, and accidents from working awkward set-asides.

Operation Greenstripe: Monsanto Corporation began the Greenstripe program in the mid-west to encourage use of vegetated filter strips along waterways to block damaging sediments from entering creeks and lakes. The Yolo RCD was the first organization in the western U.S. to partner with Monsanto on this important project. In our case, the company will give $100 to any FFA or 4-H chapter whose members assist in vegetating each irrigation tailwater pond.

Bringing Farm Edges Back to Life: A publication of the Yolo County RCD Presents ways that local farmers and landowners can implement conservation practices on their farms that will enable them to meet the multiple objectives of conserving soil and water and improving wildlife habitat while maintaining intensive agricultural production.

Information from the Oregon Department of Fish and Wildlife:
P.O. Box 59/2501 SW First Ave.
Portland, OR 97201
503/229-5410

Landowner's Guide to Creating Grassland Habitat for the Western Meadowlark and Oregon's Other Grassland Birds:
A publication that discusses biology, habitat needs for songbirds, management actions to improve existing habitat, creating habitat, and more.

B. General Information

An extremely useful source of information on grassland birds can be found at: *http://www.npwrc.usgs.gov/resource/literatr/grasbird/grasbird.htm*

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, at
http://www.dfg.ca.gov/whdab/cwhr/whrintro.html,
California Wildlife Habitat Relationships (CWHR) is a state-of-the-art information system for California's wildlife. CWHR contains life history, management, and habitat relationships information on 675 species of amphibians, reptiles, birds, and mammals known to occur in the state. CWHR products are available to purchase by anyone interested in understanding, conserving, and managing California's wildlife.

A Manual of California Vegetation (Sawyer and Keeler-Wolf) on line at
http://endeavor.des.ucdavis.edu/cnps/

Wildlands Project Conservation Planning Efforts: *http://www.twp.org/*
The mission of the Wildlands Project 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***

Appendix B. 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. 1995, 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 the Point Reyes Bird Observatory 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 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).