DEVELOPING AND IMPLEMENTING AN ADAPTIVE CONSERVATION STRATEGY:

A guide for improving adaptive management and sharing the learning among conservation practitioners

developed by PRBO Conservation Science
with resource management partners

By Gregg Elliott, Mary Chase, Geoff Geupel, and Ellie Cohen

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PRBO Conservation Science

PRBO is a non-profit, membership organization dedicated to conserving birds, other wildlife and ecosystems through innovative scientific research and outreach. Working throughout the West, over 120 staff scientists and seasonal biologists study birds and ecosystems to protect and enhance biodiversity. Founded in 1965 as Point Reyes Bird Observatory, PRBO is an active leader in several national and international initiatives working to protect birds and ecosystems, including Partners in Flight, the US Waterbird Conservation Plan, the US Shorebird Conservation Plan, the North American Waterfowl Management Plan regional Joint Ventures, and the North American Bird Conservation Initiative.

PRBO was recently honored with the 2003 Partners In Flight "Leadership Award" from the US Fish and Wildlife Service (FWS) as well as the 2002 national "Conservation Partner Award" from the USDA Forest Service (USFS) and the Bureau of Land Management (BLM).

This Guide

This guide to *Developing and Implementing an Adaptive Conservation Strategy* is based on the collective experience of conservation scientists and land and ocean managers working in California and other places in the American West over the last 30 years (a list of more recent partners is included in Appendix 1). It will be of interest to anyone striving to achieve tangible conservation results, including conservation groups, land trusts, watershed groups, conservation science organizations, private landowners, research stations, and natural resource management agencies at the local, state, national and international levels.

PRBO produced this guide because we have been leaders in developing **Adaptive Conservation Strategies** through our participation in the continental bird conservation plans of North America. While PRBO's original research efforts were focused on conserving bird populations, our research results over the years have demonstrated the value of birds as ecosystem indicators. From restoring wetlands to managing fisheries, bird science provides insights to help assess and promote effective wildlife and habitat management—management that results in and supports fully functioning ecosystems to sustain the greatest diversity and abundance of birds and other wildlife.

For example, PRBO conducted studies of birds in riparian habitat that was regenerating as a result of levee breaks in the Cosumnes floodplain/Central Valley, California, which led to a series of recommendations for riparian habitat restoration published as part of our research and the Riparian Bird Adaptive Conservation Plan in 2000 (see Appendix 2). Recommendations promote the use of natural processes, such as flooding, and planting restored sites in patches to mimic habitat structure that results from flooding. Riparian habitat created since then at Cosumnes and elsewhere (based on recommendations from both the Riparian Plan and PRBO's research there), has now been observed to contribute critical food resources to adjacent open floodplains that help sustain native fishes, including special-status species like Chinook salmon (Oncorhynchus tshawytscha) and Sacramento splittail (Pogonichthys macrolepidotus).

Executive Summary

From a conservation perspective, scientific data are only as valuable as the extent to which they are applied—whether to shed new light on key questions about the environment or to guide actual conservation projects. Among resource managers, there is a growing consensus about the need to identify management/restoration successes and mistakes and to learn from them. An **Adaptive Conservation Strategy** is a two-pronged approach that can help both conservation scientists and resource managers achieve these goals: it fosters applied science through true adaptive management on-the-ground and fosters "learning organizations" through the development of Adaptive Conservation Plans.

An Adaptive Conservation Strategy consists of adaptive management at the site-specific level and, in addition, Adaptive Conservation Plans that provide a systematic means of synthesizing data, sharing learning, and influencing policy across sites and ecosystems. In other words, an Adaptive Conservation Strategy recognizes that *we all learn best by doing and by learning from the experience of others.*

Adaptive Conservation Strategy = adaptive management + Adaptive Conservation Plans for sharing learning

An Adaptive Conservation Strategy emphasizes science-management teams practicing adaptive management. This approach means resource managers and scientists work together closely to identify important resource management questions and the monitoring regimes that are most likely to provide answers. Teams conduct standardized monitoring of bird species and associated habitat features to evaluate conservation practices, results, and goals at multiple sites.

Next, in a process that is more formal but nonetheless akin to the tradition of meeting face-to-face to "kick dirt," science-management teams meet with one another and with others working on similar projects and in similar habitats. This process of systematically sharing learning includes pooling standardized data from many sites, then sharing what has been learned with an even wider circle of conservation practitioners through the creation of Adaptive Conservation Plans (ACPs). ACPs are kept "alive" by regularly updating them with new data and analyses.

Birds as Indicators

PRBO's approach to adaptive conservation planning has focused on the science and monitoring of bird populations because many bird species make excellent indicators of ecosystem health and integrity, and they are relatively easy to study. Internationally recognized protocols for measuring reproductive success and survival in birds means that bird monitoring programs can provide direct measures of the causes of population change, which can then be compared across sites. Moreover, many bird populations are still large enough to provide sufficient sample sizes for statistical analysis across sites and/or regions. Bird monitoring in general is also cost-effective and can be conducted with low impact to birds and their habitats.

The Adaptive Conservation Strategy Defined

The steps of implementing an Adaptive Conservation Strategy are:

(1) **Use adaptive management**, stressing science-management teams at multiple sites within an ecosystem or with similar natural resources across ecosystems (e.g., riparian habitat).

a. Identify assumptions and set management goals (captured in site-specific adaptive resource management plans).
b. Implement management actions.
c. Monitor and analyze response to management.
d. Revise management, goals, or monitoring regime as indicated, and repeat the process.

(2) Share learning through **Adaptive Conservation Plans**.

a. Synthesize findings from multiple adaptively managed projects.
b. Develop an Adaptive Conservation Plan focused on the species, habitat, or ecosystem of interest. The plan incorporates findings from step 1, as well as peer-reviewed literature, gray literature, and expert opinion. Conservation plans advance recommendations to guide resource management and policy and are available on-line as well as in hard copy.
c. Disseminate and incorporate plan recommendations into resource management and/or policy by partnering with or conducting outreach to appropriate audiences.
d. Reassess and revise both site-specific resource management plans/practices and Adaptive Conservation Plans, and repeat the process.

Adaptive management is a decades-old method of natural resource management that integrates design, management, and monitoring to systematically test assumptions in order to adapt and learn from experience (Salafsky et al 2001). True adaptive management is rarely implemented even though many resource planning documents call for it and numerous resource managers refer to it.

Adaptive Conservation Planning produces updateable web-based conservation plans and databases for wide dissemination. ACP recommendations address habitat management, restoration, protection, monitoring, research, policy, and education. Conservation practitioners are given a powerful tool that allows them to avoid making others' mistakes so they can begin generating new knowledge.

An Adaptive Conservation Strategy can also be applied as a means of evaluating the success of conservation efforts in biological terms. The goal of the relatively recent "conservation accounting" movement is to develop a process and set of measures that can be used to audit not only the financial, but also the ecological results of conservation projects. Organizations are applying bird science to audit if and how management and restoration efforts are succeeding in their conservation goals.

The Adaptive Conservation Strategy Applied

Chapter 2 presents five case studies chosen to illustrate some of the best examples of how an Adaptive Conservation Strategy has been applied in the field. They focus on illustrating science-management partnerships and conservation results at adaptively managed projects. The case studies presented include

- The Sacramento River Restoration Feedback Loop
- The Eastern Sierra – Bridging Jurisdictional Boundaries
- Shrubsteppe Habitat – Gaining a Wildlife Perspective
- San Francisco Bay – Predicting the Effects of Management
- Developing an ACP - Seabirds of the California Current System

Chapter 3 provides a list of suggestions and tips for conservation practitioners on how to maximize the benefits of implementing an Adaptive Conservation Strategy, with a focus on process and building partnerships. The material in this chapter is drawn from interviews of land management partners, PRBO project leaders, and the combined experience of the authors. Pointers cover the following topics: (1) achieving conservation results (2) the special case of long-term monitoring (3) partnership building (4) communication (5) fundraising and (6) improving the Adaptive Conservation Strategy approach. Appendix 3 provides a detailed step-by-step description of the process that has been successfully used to develop Adaptive Conservation Plans for multiple habitat types in the state of California.

Song Sparrow, a Riparian Bird Conservation Plan focal species. Photo by Eric Preston.

After more than 30 years, hundreds of partnerships, and regional leadership roles in each of the four major continental bird conservation plans, PRBO Conservation Science and partners believe we have created a novel approach to conservation planning and assessment. Development of an Adaptive Conservation Strategy is a collaborative process. While it includes an adaptive management approach, it is more than that. It synthesizes and fully

integrates scientific knowledge into resource management across regions and ecosystems—from planning to monitoring measures of conservation success.

The crucial components of a successful Adaptive Conservation Strategy are collaboration, team work at the project level, keeping data current, information sharing, effective communication, flexibility (from all sides, including funders), and a results-oriented applied focus in monitoring, research, and management. The most fundamental point is that both conservation scientists and natural resource managers serve the same mission: facilitating and advancing successful, cost-effective conservation of the world's precious natural heritage. An Adaptive Conservation Strategy provides a win-win approach for achieving this mission.

Chapter 1. What is an Adaptive Conservation Strategy?

Science and Practice: Fostering Conservation Results

In a world of diminishing natural resources, expanding human population, and limited budgets, it is essential that efforts to conserve biodiversity and manage wildlife habitats be guided by the best available scientific knowledge. This notion may seem self-evident. It is, nonetheless, an aspect of conservation practice that is constantly in need of improvement[14,17,21]. Science at its best uses experimental methods and shares results widely. An **Adaptive Conservation Strategy** is designed to foster precisely this approach.

An Adaptive Conservation Strategy includes adaptive management at the site-specific level combined with a process of Adaptive Conservation Planning across sites to more fully integrate scientific knowledge into resource management and share learning among conservation practitioners. Adaptive management is a decades-old method of natural resource management that integrates design, management, and monitoring to systematically test assumptions in order to adapt and learn[20]. Adaptive Conservation Planning is the process of synthesizing monitoring and assessment data from many projects to develop science-based conservation recommendations that can then be shared across projects. Adaptive Conservation Strategies have focused on monitoring of bird populations because many bird species make excellent indicators of ecosystem health and integrity.

Adaptive Conservation Strategy = Adaptive Management + Adaptive Conservation Plans

definition: an **Adaptive Conservation Strategy (ACS)** consists of **adaptive management** at the site-specific level and, in addition, **Adaptive Conservation Plans** that provide a systematic means of synthesizing data, sharing learning, and influencing policy across sites, regions, and/or ecosystems.

An Adaptive Conservation Strategy emphasizes science-management teams practicing adaptive management. Teams conduct standardized monitoring of bird species and their habitats to evaluate conservation practices, results, and goals at multiple sites. To systematically share learning, data from many adaptively managed sites are then pooled, synthesized, and disseminated by creating *species, habitat, or ecosystem* Adaptive Conservation Plans. Adaptive Conservation Plans (ACPs) are regularly updated with new data and analyses. ACPs contain recommendations for habitat management, restoration, and protection as well as monitoring, research, policy, and education. An important goal is to implement recommendations at additional sites located throughout the habitat or ecosystem of interest. Plan data and recommendations are also used to improve conservation programs, guide funding allocation, and refine resource management policies.

An ACS stresses recognition of the assumptions that underlie resource management; continual reassessment and broad sharing of conservation practices and results; and a collaborative multi-disciplinary approach that seeks to constantly improve and build upon our knowledge of ecosystem function.

Birds as Indicators

What is the justification for developing an Adaptive Conservation Strategy based on birds? Many bird species make excellent indicators of various parameters of ecosystem health and ecological integrity. PRBO Conservation Science (PRBO) views bird population health as both a conservation goal in itself, and an indicator of the success of wildlife/habitat management and restoration.

The Laysan Albatross, a marine predator and indicator species. Photo by Eric Preston.

Good indicator species are those that are more sensitive to environmental change than others, and respond quickly and consistently to environmental stresses or enhancements[4,5,15]. Birds make good indicators of habitat quality in a variety of ecosystems because they may be sensitive to a variety of physical and biological factors, including levels of primary and secondary productivity in the system, the structural and species diversity of vegetation, and the size and connectivity of habitat patches[11]. They are numerous and conspicuous predators near the top of the food chain. In the marine environment, they feed on the same prey as many other top predators, including large fish, sea turtles, seals, sea lions, and whales[13].

Valuable indicators are also those that directly indicate a cause of change rather than simply the existence of change[8,9], i.e., demographic measures such as rates of reproduction or mortality. By monitoring demographic parameters of a wildlife population, some causes of declining trends or extirpated populations may often be identified, which can lead directly to the development of appropriate management actions to stop those declines. For this reason, an assessment of reproductive success and survival are important components of many bird monitoring programs. Reproductive success can be monitored through nest searching, which is also combined with detailed habitat features in the vicinity of the nest. Individuals can be captured, marked,

released, and re-sighted for survival analyses. The methods for collecting such data for birds are well-established and internationally standardized. The most useful indicator species are also those that have populations large enough to be easily monitored and to provide sufficient samples sizes for statistical analysis across sites and/or regions[5].

Numerous bird species have many of the characteristics of efficient and effective indicators as defined by The Nature Conservancy's "Measures of Conservation Success" framework[17]:

- *Biologically relevant* (i.e., represent an accurate assessment of biodiversity health)
- *Socially relevant* (i.e., value is recognized by stakeholders)
- *Anticipatory*, providing early warning (i.e., indicate degradation before serious harm has occurred)
- *Sensitive to anthropogenic stress* and reflective of changes in stress without extreme variability
- *Measurable* (i.e., capable of being operationally defined and measured using a standard procedure)
- *Cost-effective* (i.e., inexpensive to measure, providing the maximum amount of information per unit effort).

Finally, indicators must be cost-effective and require low impact to the resource[17, 21]. Birds fit this bill, as few organisms are more amenable to observation and identification (to species, sex, and/or age) by sight and sound. Birds often provide scientists with the best evidence of how humanity's actions affect the world's ecosystems and wildlife[25].

> *"A very positive aspect of the monitoring program . . . is the fact that the link between habitat changes caused by restoration and the response of the riparian bird community is being evaluated. In fact, the songbird monitoring on Lower Clear Creek is the best example of an attempt to link restoration actions with a biological response of the target organisms that the Panel has seen during the Adaptive Management Forum."* - California Bay-Delta Authority (CALFED) Adaptive Management Forum Scientific and Technical Panel, 2003[1].

The Adaptive Conservation Strategy

The steps of implementing an Adaptive Conservation Strategy are:

(1) **Use adaptive management**, stressing science-management teams at multiple sites within an ecosystem or with similar natural resources across ecosystems (e.g., riparian habitat).

e. Identify assumptions and set management goals (captured in site-specific adaptive resource management plans).
f. Implement management alternatives.
g. Monitor and analyze response to management.
h. Revise management, goals, or monitoring regime as indicated, and repeat the process.

(2) Share learning through **Adaptive Conservation Plans**.

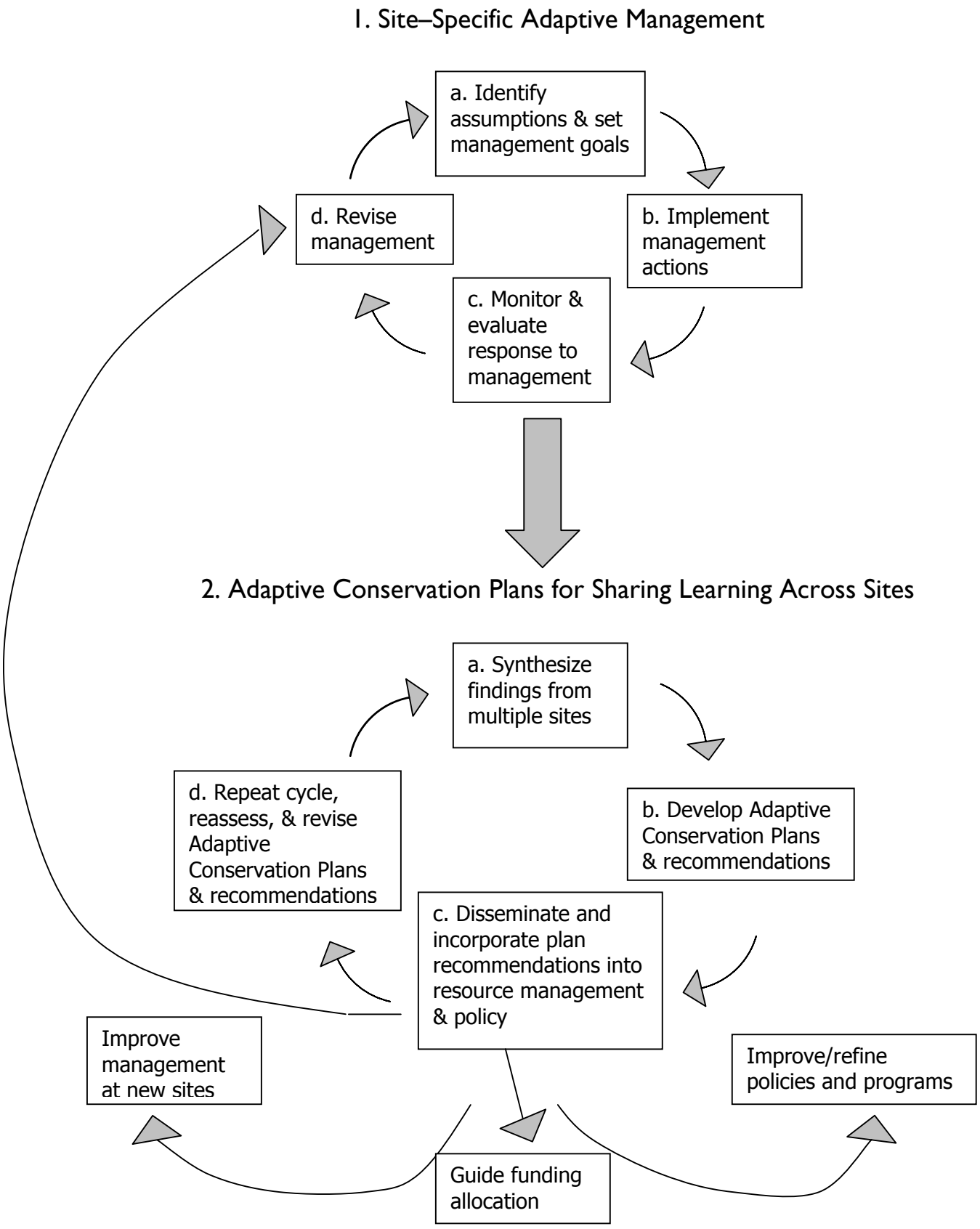
a. **Synthesize findings** from multiple adaptively managed projects.

b. **Develop an Adaptive Conservation Plan** focused on the species, habitat, or ecosystem of interest. The plan incorporates findings from step a, as well as peer-reviewed literature, gray literature, and expert opinion. Conservation plans advance recommendations to guide resource management and policy and are available on-line as well as in hard copy.
c. **Disseminate and incorporate plan recommendations** into resource management and/or policy by partnering with or conducting outreach to appropriate audiences.
d. **Reassess and revise** both site-specific resource management plans/practices and Adaptive Conservation Plans, and repeat the process.

The Adaptive Conservation Planning cycle (Fig. 1) can be conceptualized as two separate iterative cycles that regularly exchange information and expertise: (1) the site-specific adaptive management cycle, where monitoring data are collected and Adaptive Conservation Plan (ACP) recommendations are implemented, and (2) the plan cycle, which develops ACPs with general goals of species, habitat, or ecosystem conservation and which cover a region containing many site-specific projects and their associated data.

Useful indicator species are those that have populations large enough to be easily monitored and to provide sufficient samples sizes for statistical analysis across sites and/or regions. Photo by Eric Preston.

Figure 1: Components and Process of an Adaptive Conservation Strategy



Adaptive Management

The approach to developing an Adaptive Conservation Strategy outlined in this guide is based on the general principles of adaptive management, a process for the management of natural resources that emphasizes interaction between managers and scientists. Because there is so much uncertainty inherent in our understanding of ecological systems,[3,19,20] management practices require continual monitoring and adaptation[12]. Adaptive management involves the evaluation of alternative management actions through quantitative model building and/or experimentation, in which the results of previous actions are monitored and used to modify future management[12, 19]. It emphasizes the need to treat policies and decisions explicitly as hypotheses and opportunities for learning rather than as final solutions[2].

Passive adaptive management does not include controls, replication, or randomization. Active adaptive management employs management programs that are designed to experimentally compare selected policies or practices by evaluating alternative hypotheses about the system being managed[3, 23, 24]. Active adaptive management is a valuable component of an Adaptive Conservation Strategy; however, an ACS also incorporates ecological insights gained from non-experimental monitoring projects (passive adaptive management) and basic research as well.

True adaptive management is rarely implemented even though many resource planning documents call for it and numerous resource managers refer to it. "There are startlingly few examples in wildlife management in which the adaptive management 'loop' has been completed[9]." The reasons for this are many: an eagerness for quick "on-the-ground" results to the exclusion of the effort and time required to assess long-term results; a focus on simple measures of success (for example, using seedling survival alone to measure the success of a forest restoration project planted to benefit wildlife); and the "build it and they will come" school of thought, which assumes that wildlife will respond favorably to most kinds of habitat restoration. An unwillingness to raise funds to cover the costs of monitoring and assessment is also sometimes a factor.

Perhaps the most important reason has been the breakdown of information sharing between scientist and manager. This breakdown may occur because managers and scientists do not view themselves as part of the same management team; because scientists have not sought to tie monitoring and assessment programs directly to resource management[9]; and because many managers think monitoring means only tracking population trends.

Science and Management Teams

A key premise of Adaptive Conservation Planning is that conservation practitioners and conservation scientists must work together as a team to ensure that questions and answers obtained from monitoring are relevant to natural resource management issues. From a conservation perspective, scientific data are only as valuable as the extent to which they are applied—whether to shed new light on key questions about the environment or to guide actual conservation projects.

Benefits to Conservation Biologists of the Team Approach[26]

- Every conservation scientist has a vested interest in working with land and ocean managers to ensure that their data are integrated into natural resource management decisions.
- Public land and ocean managers, in particular, can generate public outreach and conservation education opportunities otherwise unavailable to scientists, by providing controlled public access and interpretation of applied conservation science.
- Land and ocean management partners can help generate a source of matching funds, as well as testimonials on the value of scientific work, to assist private scientists and organizations in fundraising efforts. Fundraising may often be more successful with collaborative proposals that cover multiple jurisdictions.

Natural resource managers also benefit in many ways by teaming with science organizations to conduct adaptive management.

Benefits to Resource Managers of the Team Approach[26]

- Science partners can provide "turn-key" programs that supply expertise complementary to that of a particular land or ocean management agency. Science organizations can also train land management staff in standardized monitoring and data analysis protocols.
- Science partners can tailor their monitoring and evaluation programs to answer questions of particular interest to habitat managers and to address new questions of interest as they arise.
- Several years of comprehensive ecological surveys can provide a huge increase in knowledge about birds and other wildlife.
- Science partners may be able to provide continuity over the long-term by maintaining datasets and enabling data sharing with a wider audience (i.e., they are not subject to the same shifting political winds). Since many Department of Interior agencies are now under a mandate to outsource whenever possible, science partners with established records of success are a logical choice for outsourcing.
- Partnerships between scientists and natural resource management agencies who have jurisdiction over broad or adjoining areas can result in a wider context for interpreting research and monitoring results. Regional perspectives, landscape analyses, and greater statistical power can result when data are shared, compared, and analyzed across projects.

Adaptive Conservation Planning

The development of Adaptive Conservation Plans (sometimes titled Bird Conservation Plans), is actually an attempt to foster "learning projects" and "learning organizations." i.e., to capture and share project learning with other practitioners so that they can avoid making the same mistakes over again and can begin generating new knowledge[20,21]. The ACP process makes this possible by developing updateable conservation plans that pool the results of many adaptively managed projects, as well as the latest scientific literature and expert opinion, to develop a set of science-based conservation recommendations for specific habitat types or ecosystems.

An important assumption in creating ACPs is that management recommendations generated from pooled datasets can be applied in other similar habitats or sites within the bioregion and across bioregions (within reason—taking into account altitude, historic use, species occurrence, and biogeographic differences, for example)[10]. In this way, habitat managers who lack the resources for monitoring and assessment programs can still take advantage of a wealth of knowledge from similar sites and from the literature. On the other hand, the recommendations can and should be tested at new sites whenever possible through monitoring of birds and other wildlife response. As new data are generated at the project level, they are used to update and revise conservation plan recommendations as necessary. Plans also acknowledge the gaps in current knowledge and emphasize the need to test hypotheses and assumptions involved in conservation planning. Managers have access to all of this information, and much of the supporting data, online.

Standardized monitoring for all birds, including colonial nesters such as this Great Blue Heron, is a crucial component of ACP. Photo by Kim Kreitinger.

Standardized monitoring methodology of birds and associated habitat parameters is thus a crucial component of an Adaptive Conservation Strategy[6]. Internationally standardized techniques for landbirds, as well as seabirds and colonial nesters, have been defined[18, 22]. Standardized monitoring allows for comparison and analysis of data across time and space (locally, regionally, and continentally), which is essential for the analyses of combined datasets that characteristically support ACPs. Standardized monitoring provides the "common language" for evaluating and guiding management actions at multiple sites.

Programmatic/Policy Applications of Adaptive Conservation Plans

Increasingly, those who manage funding programs for conservation, whether in the private sector or in government, are seeking to ensure the best possible expenditures of scarce conservation dollars. For example, the National Fish and Wildlife Foundation requests that bird habitat restoration and management proposals include information on how the proposed project addresses recommendations in the applicable Bird Conservation Plans developed by California Partners in Flight, PRBO, and other organizations. This information helps the

National Fish and Wildlife Foundation ensure that funded projects are contributing to broader conservation priorities[27].

A priority for the WHIP program is the conservation of riparian habitat. Photo by Eric Preston.

The Natural Resources Conservation Service (NRCS) in California, which is slated to receive millions of dollars annually for habitat conservation programs on private lands, has been partnering with PRBO and California Partners in Flight in the development of criteria for its Wildlife Habitat Incentives Program (WHIP). WHIP program objectives and funding criteria have incorporated key conservation principles and recommendations from three ACPs, the *Riparian Bird Conservation Plan,* the *Grassland Bird Conservation Plan*, and the *Southern Pacific Shorebird Conservation Plan*. The top priority WHIP program objective in California is conservation of riparian habitat, with an emphasis on restoration and management of declining or threatened native habitats. Additionally, WHIP project ranking criteria based on adaptive conservation plan recommendations include (1) an emphasis on restoration plantings establishing more than 2 species, with higher ranking for 5 or more species; (2) an emphasis on benefits to neotropical migrants, grassland birds, and shorebirds; (3) an emphasis on a landscape perspective in which WHIP projects are ranked higher if located nearer to areas that are already under conservation management; (4) and an emphasis on habitat management practices during nesting season that do not disturb nesting birds[28].

Conservation Accounting

Unprecedented levels of federal, state, and local dollars are being spent on ambitious ecosystem restoration and management projects, including the California Bay-Delta Ecosystem, Central Valley wetlands, San Francisco Bay, the Salton Sea, and the Channel Islands Marine Reserve. This level of investment, combined with the new era of fiscal accountability and scarce conservation dollars, has spurred major environmental organizations and funders to begin developing a system of "conservation accounting" to measure the success of conservation efforts in biological terms[7,17,21]. The ultimate goal is to develop a process and set of measures that can be used to audit not only the financial, but also the ecological results of conservation projects, thereby ensuring the most biodiversity bang for each conservation buck invested[7].

It is imperative that managers continually ask, and answer, the question, "Are our efforts improving native wildlife values?" If this question is not regularly addressed, then well-

intentioned conservationists may not only waste scarce funds but may inadvertently contribute to wildlife and ecosystem decline[6]. An Adaptive Conservation Strategy provides a means of "auditing" results of conservation investments by (1) using standardized monitoring across multiple projects; (2) focusing on bird species that are generally good indicators of ecosystem health and integrity; (3) providing a means of sharing and analyzing pooled datasets across multiple spatial and temporal scales; and (4) disseminating results widely to promote learning and greater success in conservation.

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Personal Communications

27. Peter Stangel, Southeast Office Regional Director, National Fish and Wildlife Foundation, 5-03.

28. Alan Forkey, Natural Resources Conservation Service, 4-03.

CHAPTER 2. Case Studies of ACS Applied

Real life tends to be more complex and interesting than theory. The case studies presented here were chosen to illustrate some of the best examples of how Adaptive Conservation Strategies have been applied in the field. Case studies involved interviews with partners as well as PRBO project leaders (see Appendix 4 for a list of case study interview questions). These case studies focus on illustrating science-management partnerships at the project level. They illustrate how monitoring and stewardship at specific sites have improved or seek to improve conservation *results* and how project learning is shared through Adaptive Conservation Plans.

The "Pointers for Practitioners" provided in Chapter 3 were also gleaned from these same case studies. However, the pointers concentrate on the *process* of establishing an Adaptive Conservation Strategy, particularly high-functioning science-management teams, that will facilitate results such as those cited here.

The case studies presented include:

- The Sacramento River Restoration Feedback Loop
- The Eastern Sierra – Bridging Jurisdictional Boundaries
- Shrubsteppe Habitat – Gaining a Wildlife Perspective
- San Francisco Bay – Predicting the Effects of Management
- Developing an ACP - Seabirds of the California Current System

Spotted Towhee, a nesting species along the Sacramento River. Photo by Steve Zack, Wildlife Conservation Society.

CASE STUDY:
The Sacramento River Restoration Feedback Loop

by Gregg Elliott, Joanne Gilchrist, and Stacey Small

> *"PRBO has helped us to better understand the ecosystem needs of the avian community such that by implementing their management recommendations we were able to promote the recovery of a wide assemblage of species[10]."* –Greg Golet, Senior Project Ecologist, The Nature Conservancy of California

The leafy, shaded stretches of California's biggest river are making a comeback as a result of the largest riparian planting projects undertaken in the West. Recognition of the importance of riverine vegetation to fish, birds and other wildlife has fostered unprecedented public investments to address extensive losses of the shady zones along the Sacramento River. These investments are supporting the relatively new science of riparian habitat and floodplain restoration, which includes planting of habitat, setting back levees, and restoring topography. PRBO has conducted landbird monitoring in Sacramento River riparian forest and restoration sites annually since 1993, in cooperation with The Nature Conservancy (TNC), U.S. Fish and Wildlife Service (USFWS) at the Sacramento River National Wildlife Refuge (NWR), and California Partners In Flight (CPIF)[5,9]. Sacramento River Partners approached PRBO to monitor additional restoration sites in 1999, and the California Department of Parks & Recreation added more sites in 2000[6,7,9]. The overarching goal of this program is to collect species, diversity, and nest success data in remnant, various-aged stands and restored riparian habitat patches.

This effectiveness monitoring documents baseline conditions against which to measure future changes in habitat and bird populations, while facilitating the assessment of habitat restoration efforts. These data then provide a feedback mechanism for modifying and adapting new restoration techniques to achieve conservation success[5].

> *"Simply making trees grow is not a successful restoration project. We are trying to make wildlife habitat. As one of the first creatures to respond to new habitat, birds are an important indicator of project success. We hope to get both short-term and long-term knowledge from PRBO's involvement. The benefit to conservation is that if we have a link between restoration project implementation and bird response, we can improve future projects and become more targeted in our planting designs[6]."* –Daniel Efseaff, Restoration Ecologist, Sacramento River Partners

Monitoring and Assessment Results

- Point count data analyses indicate that bird communities are responding favorably to horticultural-based restoration efforts on the Sacramento River through recolonization of sites within the first eight years after planting. As Sacramento River riparian restoration sites have matured, native riparian bird species diversity has increased[5].

- Results indicate specific responses of birds to habitat features that managers may use to direct conservation efforts. Optimizing habitat features that positively influence bird populations can help maintain remaining populations and perhaps restore extirpated populations[1]. Older, taller trees with good structure and high shrub and tree diversity positively influenced bird diversity. High bird diversity was significantly correlated with box elder (in all years), valley oak, Fremont Cottonwood, elderberry, Gooding's and sandbar willow, mugwort, wild grape, and black walnut.
- Results have shown that many species, primarily open cup nesting species and neotropical migrants, are extirpated or occur in precariously low numbers. Demographic information suggests that these species have experienced unprecedented rates of cowbird parasitism (over 85% of Lazuli Buntings) and exceptionally low nest survivorship rates (less than 20% surviving to fledge young, about half of the national average for open-cup nesting species). Conversely, populations of all cavity nesters appear to be relatively healthy with high productivity[1].
- Data analyses indicate that poor productivity may well be the demographic factor driving population declines of many open-cup nesting species in the Sacramento Valley[5].
- Nest success was similar on both restoration and forest sites for three open-cup nesting species analyzed in depth: Lazuli Bunting, Spotted Towhee, and Black-headed Grosbeak (2 ground/shrub nesters and one mid-canopy nester, respectively). PRBO attributes low nest success on the Sacramento River to nest predation for most species and a combination of nest predation and Brown-headed Cowbird parasitism for Lazuli Bunting[1,5].
- Results indicate that landbirds respond to restoration conducted on a large spatial scale. The amount of riparian habitat surrounding a point (within 500 meters) had a significant effect on riparian bird diversity, while absolute patch size had no significant effect. In addition, very long, linear patches that encompass many acres of habitat but are confined to narrow strips along the banks of the river did not draw in the diversity of birds that smaller patches blocked together did. The implication for managers is clear: blocks of riparian habitat are more attractive to breeding birds than strings of habitat[5].

Black-headed Grosbeak, an open-cup nester, is vulnerable to nest predation along the Sacramento River. Photo by Brian L. Sullivan.

- To date, the program has documented the importance of nine different units of the Sacramento River NWR both as breeding areas and as a migratory flyway for many species of songbirds[5].
- Migration monitoring has established the importance of the Sacramento River to migrating landbirds, both adult and young[1,5].
- Data from the Sacramento River has contributed to two revisions of the Riparian Bird Plan, including updating management recommendations based on results from earlier management trials[3,9].

> *"PRBO provides sensible recommendations for management of wildland habitats based on rigorous data collection and analysis. PRBO provides a qualified presence that will be consistently available through the years that bird surveys are needed[7]."*
> –Woody Elliott, District Resource Ecologist, California Department of Parks and Recreation

Adaptive Management Recommendations and Implementation

- PRBO has submitted at least 23 recommendations to land managers along the river concerning restoration planting design, invasive exotic species control, physical processes, timing of management activities, and adjacent agricultural land management[5,4].
- Initially, trees and shrubs were planted in a random layout, with every plant being different from its neighbor. PRBO suggested the importance of clumped planting distributions and the introduction of forbs to increase structural complexity for breeding birds, with the goal of increasing nest cover for open-cup nesters[5,12].
- Conservation recommendations highlighted timing of mowing for weed control on the restoration site is critical for ground- and shrub-nesting species. The Sacramento River NWR, TNC, and Sacramento River Partners now follow new guidelines whenever possible[5,4,6,7,10,11,12].
- The Sacramento River NWR and partners contact PRBO for specific land management projects that involve large-scale ground disturbance during the nesting season. Special surveys have been conducted in these cases[11].
- By 1999, TNC restoration plans incorporated many PRBO recommendations, including guidance related to establishing a native understory, richness and density of shrub plantings, reconnecting floodplains to rivers, road removal, and the location and shape of restoration sites[4,10].

> *"PRBO has proven expertise and commitment to bird conservation and the National Wildlife Refuges. A natural partnership has developed and through this partnership we hope to improve the health and biodiversity of the Sacramento River ecosystem, and see the return of historic breeding birds at Sacramento River National Wildlife Refuge[11]."* –
> Joe Silveira, Wildlife Biologist, U.S. Fish and Wildlife Service

- TNC amended grazing plans to ensure that all cattle would be removed from more mature riparian restoration sites during the breeding season to protect nesting Spotted Towhees, Common Yellowthroats, and Lazuli Buntings[10,12].
- By 2003, Sacramento River Partners had followed numerous recommendations related to planting design and management during the nesting season at eight sites (comprising a total of 573 acres). In addition to the recommendations listed above, Sacramento River Partners began including herbaceous plantings between rows of woody species plantings and designing shrub clumps to increase habitat structure in the understory. California Department of Parks and Recreation monitoring also resulted in changes to riparian restoration plantings[6,7,12].
- In an effort to directly address low productivity by creating cover for ground- and shrub-nesting species, Sacramento River Partners and TNC now routinely incorporate native grasses and forb species into restoration plantings[6].

Bird response two years after riparian restoration

An example of the type of management give-and-take that results from a healthy adaptive management approach is TNC's Pine Creek restoration site where PRBO mapped individual species territories beginning in 1998. The partners worked together as a team to modify planting designs in a way that would be likely to increase the diversity of species breeding on the restoration sites during the early post-maintenance phase of restoration. Specifically, when TNC planted the site in 1999, they included dense shrub patches interspersed among vegetation plantings to increase structural complexity of the understory (vegetation from the ground to about 2 meters) for the benefit of shrub-nesting species. In addition, clumps of old almond trees (with non-invasive rootstock) were left standing among newly planted riparian species to provide nesting and feeding habitat for cavity nesters. PRBO subsequently reported a rapid increase in numbers of both open-cup and cavity-nesting breeding bird territories between the first and second years following planting: 12 new songbird species established territories in year 2, while the total number of territories more than doubled (from 14 to 33)[2].

"Our partners along the Sacramento River have been pioneers in making the connection between data collection and land management. They were among the very first who were innovative enough to actually take PRBO's riparian data and put it to use for conservation[7]." – Geoff Geupel, Director, Terrestrial Ecology Division, PRBO Conservation Science

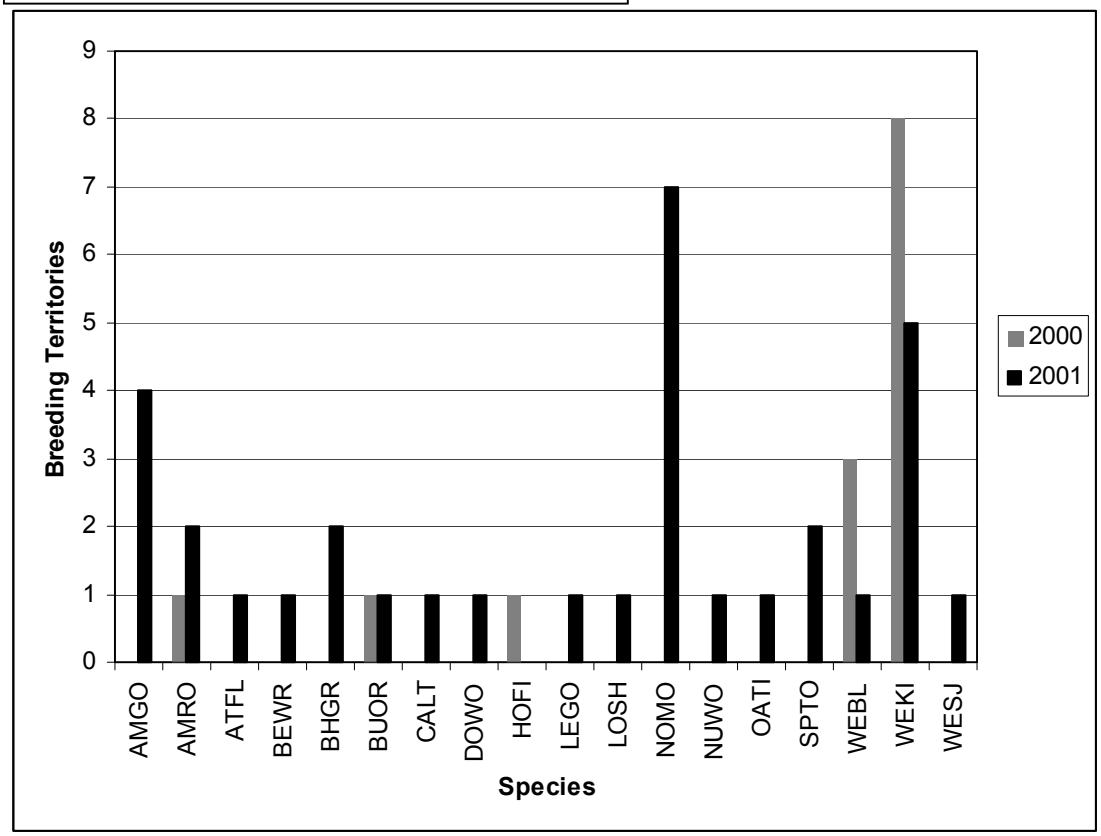

Figure 2. Number of bird breeding territories on TNC Pine Creek restoration site

(By species, years 2000 and 2001—restoration year 1 and 2—based on spot map surveys.)[1]

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7. Woody Elliott, District Resource Ecologist, California Department of Parks and Recreation, 2-13-03.

8. Geoff Geupel, Terrestrial Ecology Division Director, PRBO Conservation Science, 5-03

9. Joanne Gilchrist, Field Biologist, PRBO Conservation Science, 10-02.

10. Greg Golet, Senior Ecologist, The Nature Conservancy, 2-18-03.

11. Joe Silveira, Wildlife Biologist, Sacramento River National Wildlife Refuge, U.S. Fish and Wildlife Service, 2-3-03.

12. Stacey Small, Sacramento River Project Leader, PRBO Conservation Science, 5-03.

CASE STUDY:
The Eastern Sierra –bridging jurisdictional boundaries

by Gregg Elliott and Sacha Heath

"We have worked together to bring the first large-scale systematic study of songbird ecology to the eastern Sierra. Our relationship has led to an exponential increase in knowledge about birds and bird habitat throughout our region, and over time we'll be able to make much use of it. Also, PRBO's work here owes its great strength to the fact that it encompasses every major watershed and every major land management jurisdiction, so BLM can proudly take its share of credit for any PRBO-influenced improvement in [regional] bird conservation throughout the eastern Sierra.[2]."
– Joy Fatooh, Wildlife Biologist, BLM Bishop Field Office

When Joy Fatooh, wildlife biologist for the U.S. Bureau of Land Management's (BLM) Bishop Field office, began conducting bird censuses in 1995, she had no inkling that her project would become the catalyst for a vast partnership extending far beyond BLM's jurisdiction. In 1998, Joy began working with PRBO and the U.S. Forest Service (USFS) to obtain funding for a systematic survey of birds in riparian habitats[12,13,15]. The partners were successful, and by 2003, the Eastern Sierra Riparian Songbird Conservation Project had grown to encompass five major watersheds and every major land management jurisdiction within the Eastern Sierra, including federal, state, county, and some private lands. This project emphasizes coverage of riparian habitats on lands of the BLM, Inyo and Humboldt-Toiyabe National Forests (NF), Los Angeles Department of Water and Power (LADWP), Mono Lake Tufa State Reserve (MLTSR), California Department of Fish and Game (CDFG), and Mono County along a 320 – kilometer stretch of the eastern Sierra Nevada. Initiated in 1998, the first phase of the project emphasized Owens Valley alluvial fan habitats. The second phase, initiated in 2000, emphasized Mono Basin habitats. The newest phase, initiated in 2002, includes a 65-mile stretch of the Lower Owens River, which is scheduled to be rewatered in 2004[1,2,3,5,6,13]. The same standardized techniques and analyses are used in every case, which allows PRBO to examine pooled sets of data, greatly increasing the power to make scientifically valid management recommendations[11].

"Dedicated individuals within Eastern Sierra land management agencies assure that input from outside sources is incorporated into their decision-making. Despite having the responsibility of managing hundreds of thousands of acres of land, these individuals have supported PRBO's work and given it value[13]." – Sacha Heath, PRBO Biologist and Eastern Sierra Program Leader

The original objectives of the project were to collect baseline data in a relatively undocumented region by implementing a monitoring program utilizing standardized Partners In Flight (PIF) protocol to determine abundance, richness, diversity, breeding status, productivity, survivorship and habitat associations of songbirds in riparian habitats. Whenever possible, the data has been used to determine the effects of current management practices on riparian breeding songbirds in the region and to make recommendations that should enhance and protect bird populations. Another important element of the program was its emphasis on collaboration and training of

agency biologists and local groups, such as the Eastern Sierra Audubon Society, in bird monitoring techniques. The goal of this training is to facilitate ongoing data collection when initial projects are completed, or during times of inadequate funding. Objectives have changed slightly over the years to encompass new regions, new partners, more specific investigations, and a strong outreach and education component[12,13].

"PRBO has brought valuable information to the project that Inyo County would be hard-pressed to do on its own. PRBO will be measuring wildlife response where water flows are managed to encourage native revegetation. I was impressed with work that PRBO had already done. People don't always deliver what they are supposed to. In this world, it's not always easy to find people you can count on[14]." - Leah Kirk, Project coordinator, Inyo County Water Dept.

Monitoring and Assessment Results

- Three years of point counts in the Mono Basin and Owens Valley have highlighted that aspen is a significant conservation priority; it supports the most diverse songbird populations and the highest abundance for several species. Aspens are not regenerating due to grazing and conifer encroachment (caused by a combination of grazing and fire suppression). BLM and the Inyo and Humboldt-Toiyabe NF have since expanded monitoring in aspen to document the value of aspen habitats to birds and gain insight into how their management actions (e.g., ensuring a complex understory) are affecting habitat value for wildlife[6,12,13].

Aspen habitats are threatened by grazing and conifer encroachment, thus are a significant conservation priority. Photo by Eric Preston.

- A bird community and habitat approach to monitoring can provide crucial information to programs targeted at sensitive species:
    - 1998-2000 findings allowed PRBO to provide (1) Willow Flycatcher data to the USFS Sierra Nevada Framework for the Inyo National Forest, and (2) comments on the use of this and other Willow Flycatcher data Sierra Nevada-wide. In 2001, three Willow Flycatcher nests were located on restoration sites in the Mono Basin. Surveys of the same drainage in 2002 revealed 8 territories and 3 nests. These are the first nests found on Mono Lake's restoring tributary streams for this state endangered species since the early 1900s[9].
    - The collaborative efforts with Sierra Nevada Aquatic Research Laboratory on the West Walker River led to discovery of two new bank swallow colonies, a state threatened species with limited breeding distribution in California[13].
    - Discovery at Rush Creek on USFS and LADWP land of the densest breeding Yellow Warbler population documented for California. Project data contributed greatly to the California Species of Special Concern account for Yellow Warbler[6,13].
    - Observations of Sage Grouse using riparian areas in the Mono Basin have contributed to vital knowledge of habitat use by this isolated local population[13.]
- Eastside data established that mean breeding bird diversity was significantly higher in ungrazed riparian sites versus grazed sites on specific BLM streams[13].
- PRBO reported songbird and habitat findings to the Conway Ranch Evaluation Working group, a collaborative team of federal, state and county land agencies, non-profit conservation and historic preservation groups, and public utilities (Southern California Edison) in negotiations to settle pending decisions regarding proposed changes in water allocation in the northern Mono Basin[13].

> *"We can only improve by designing projects with a holistic approach to the ecosystems we study, and interacting with researchers from other disciplines encourages this. In another vein, partnering with other non-profit conservation organizations keeps PRBO informed on local issues and has allowed us to focus some of our attention on the most pressing conservation needs of the ared[13]."* – Sacha Heath, PRBO Biologist and Eastern Sierra Program Leader

Adaptive Management Recommendations and Implementation

> *"PRBO has helped tremendously in bringing groups together to take a larger look at conservation issues. They act as the central point to contact for developing a single large landscape level proposal for bird monitoring research. Having one central highly respected organization that takes on the role of coordinating the larger partnership—it's hard for any one agency to do that[15]."* Gary Milano, Wildlife Biologist, Inyo NF

- Songbird habitat recommendations provided in 2001 were well received by Mono Basin restoration ecologists, and influenced the 2002 planting design on Mono Basin creeks[6,13].
- 1998-2002 findings have provided PRBO with data to make recommendations and create dialogue with agency personnel regarding Brown-headed Cowbird trapping

in the Mono Basin. Specifically, gathering nest data was recommended before implementing a trapping program. Local preliminary results have since shown that parasitism alone may not be the largest threat to productive nesting and that not all species respond to parasitism equally; nest success of some species is actually higher for parasitized nests, while for others it is drastically reduced. Across the board, however, predation appears to be the greatest limiting factor to nest success, and monitoring and research efforts have expanded to address this[13].

- USFS, BLM, and CDFG use nest-timing data, specific to each watershed and derived from this project, when planning or authorizing any action (e.g., streambed alteration permits) that may disturb or remove vegetation or otherwise disrupt songbird breeding habitats [12,15,16].
- The collaborative relationships fostered by this project contributed greatly to the addition of a songbird monitoring component to the Lower Owens River Project – a restoration project slated to return water to 65 miles of the Owens River.[13,14]
- The USFS requested new assessments at important riparian areas designated within the Sierra Nevada Forest Plan and at areas critical for Lahontan cutthroat trout. Watershed management plans will incorporate bird monitoring program findings and recommendations, as will forest plan revisions[13,15].

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Maintaining the Riparian Bird Conservation Plan as a "living" document

> *"Working with several state, federal, and county agencies, non-profit conservation groups, other researchers and education professionals in the Eastern Sierra has been truly synergistic. Designing projects with them gives our work a sense of purpose beyond mere knowledge seeking[13]."* – Sacha Heath, PRBO Biologist and Eastern Sierra Program Leader

The Eastern Sierra project provides a good example Of how new findings from ongoing monitoring projects are incorporated into revised versions of CalPIF's Bird Conservation Plans, ensuring that they remain "living documents" and illustrating the iterative nature of the ACP process. In 2002-03, the *Riparian Bird Conservation Plan* (RBCP) version 2 was developed, using data from sites throughout the state (i.e., across ecosystems)[7]. In the Sierra Nevada bioregion, Eastside Project data were used to develop initial "optimal" targets for species populations in riparian habitats, measured by density. These data also contributed to an assessment of how regional habitat and landscape characteristics affect riparian songbird abundance, diversity and productivity. For example, the data show that focal species diversity and abundance correlate with riparian width; however, width has no effect on Yellow Warbler nest success[13].

Of equal importance, Eastside data is being contributed to national and state databases such as the Breeding Biology Research and Monitoring Database (BBIRD) the Monitoring Avian Productivity and Survival (MAPS) database, and the CalPIF Study Site and Focal Species database (http://www.prbo.org/calpif/maps.html). This sharing of data contributes to bird conservation efforts on a much larger scale than a local land management agency can achieve – assuring the implementation of bird conservation at multiple scales[13].

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12. Joy Fatooh, Wildlife Biologist, BLM Bishop Field Office, 3-19-03

13. Sacha Heath, Wildlife Biologist, Eastside Program Leader, PRBO, 9-02 and 3-19-03

14. Leah Kirk, Project Coordinator, Inyo County Water Dept., 2-25-03

15. Gary Milano, Wildlife Biologist, Inyo National Forest, 2-13-03

16. Denyse Racine, Sr. Wildlife Biologist, Eastern Sierra Inland Desert Region, California Dept. of Fish and Game, 2-18-03.

CASE STUDY:
Shrubsteppe Habitat – gaining a wildlife perspective

by Gregg Elliott and Aaron Holmes

> *"The BLM biologists with whom we work in eastern Oregon are making great strides in bird conservation planning. Their local knowledge of the landscape is key to the success of PRBO's projects and makes working with them a real joy. Perhaps for the first time ever, songbirds are being considered in Resource Management Plans that cover vast acreages of sagebrush habitat[8]!"* – Aaron Holmes, Shrubsteppe Monitoring Program Director, PRBO Conservation Science

Fred Taylor is thankful for any wildlife data he can get. That's because Fred, along with one other biologist, is responsible for providing input to land management decisions on over 1.7 million acres of land within Oregon's Three Rivers Resource Area[10].

> *"PRBO's highly qualified professionals produce high quality science-based information that BLM can use in our planning process. PRBO staff make every attempt to tailor projects to our needs and advise us when those requests would not result in sufficient scientific rigor[6]."* – George R. Buckner, Wildlife Biologist, BLM, Oregon/Washington State Office

Under the Bureau of Land Management's (BLM) Resource Management Plan for the Three Rivers Area, Fred has a mandate to "protect or increase native biodiversity". Data on the bird communities in shrubsteppe and riparian habitats have given Fred a greater ability to predict wildlife outcomes associated with changes in vegetation. For example, Fred now has better information on how long-term vegetation changes resulting from a prescribed burn are likely to impact bird species diversity and abundance. Such information not only improves Fred's recommendations, it makes his job easier, since the National Environmental Policy Act (NEPA) requires an environmental assessment (or formal decision) concerning the significance of almost all proposed ground-disturbing activities, including prescribed fires, grazing permits, seeding projects, and vegetation removal[11]. Armed with scientific data provided in the *Conservation Strategy for Landbirds in the Columbia Plateau of Eastern Oregon and Washington* (an ACP co-authored by PRBO) highlighting the value of aspen to bird species diversity, Fred has increased efforts over the last three years to stop conifer encroachment into aspen groves[1,11].

> *"PRBO has been a critical element in the development of bird conservation in the northwest and elsewhere[7]."* - Erick Campbell, former Wildlife Program Leader in the Oregon/Washington State Office of BLM (11 years)

Insufficient information is available to shrubsteppe managers to assess the effects of basic land management decisions. To address this problem, PRBO has been conducting research on shrubsteppe and riparian habitats and associated songbird populations in the Columbia Basin and northern Great Basin since 1995. These studies have focused on habitat associations,

species distribution, and most importantly, demographic processes such as reproduction and survivorship, which drive population changes. Because agency partners are responsible for making management decisions concerning livestock grazing, the dominant human use of this landscape, monitoring studies have also included evaluations of livestock grazing impacts where possible[2,3,4].

"At Boardman, PRBO supplied needed expertise in bird-census methods and abilities, and the dedication to carry out a 3-year study in a difficult location with hard-to-study species[9]." - Kent Livezey, former Navy Regional Wildlife Biologist (9 years) Service)

PRBO's first shrubsteppe project began at the request of the U.S. Navy and the Oregon Deparment of Fish and Wildlife. Three years of data were gathered at the Navy's Boardman Bombing Range to assist in the development of their Integrated Natural Resource Management Plan and improve management of the Bombing Range for wildlife[8]. After a wildfire burned much of the original study area, two years of follow-up research were conducted to assess the effects of the fire on the bird community[4].

In Wyoming, where over 60,000 permit applications for new natural gas wells are pending, a five-year project with assistance from the U.S. Fish and Wildlife Service, Wyoming Game and Fish, and the BLM will evaluate the effects of gas well infrastructure on songbird communitiess, including an assessment at the landscape scale[8].

In 2000, PRBO initiated a cooperative monitoring program with the BLM focused on sagebrush habitats in Oregon and Washington. The project grew directly out of Partners In Flight (PIF) conservation planning efforts and was designed to fill information gaps identified in the PIF Bird Conservation Plan for the Columbia Plateau of eastern Oregon and Washington[1,8]. Goals for the 2000-2002 phase of the project follow[3].

1. Establish a regionwide songbird and habitat monitoring program targeting shrubsteppe and riparian systems in eastern Oregon and Washington.

2. Develop habitat use models for PIF focal species and other species of management concern that incorporate vegetation, elevation, and landscape influences.

3. Evaluate the effect of understory degradation on bird populations in shrubsteppe habitat.

4. Evaluate the influence of annual grass invasion in shrubsteppe on songbird habitat use.

The sites to be monitored were carefully chosen to provide a baseline and framework with which to measure future changes in both vegetation and bird communities. For example, monitoring site selection ensured sampling across a range of big sagebrush canopy cover and understory conditions. Additionally, sites are fairly evenly distributed throughout the region such that differences in rainfall, soils, and elevation are represented in the sample. In January 2000, biologists from each of the BLM districts were asked to nominate sites they considered in good to excellent condition with respect to native bunchgrass and/or perennial forbs[3]. Such sites, unlikely to be selected using a strictly random selection procedure, can serve as a reference against which to compare sites with varying management regimes.

To ensure continuous feedback to the Shrubsteppe Conservation Plan, PRBO and partners will develop habitat use models that describe individual species' responses to discrete habitat variables.[3] Shrubsteppe Bird Conservation Plan management recommendations and conservation actions can then be refined using the results of these models.

Monitoring and Assessment Results

- Perennial grass cover is an important predictor of species abundance (Vesper Sparrow, Western Meadowlark, Horned Lark)[3,8].
- Livestock trampling of burrows in sandy soils results in a reduction of available nest sites and escape burrows for Burrowing Owls (a federal species of special management concern and an Oregon sensitive species)[2].
- Reductions in breeding birds on the Boardman Bombing Range are related to the loss of sagebrush[4].
- Increases in non-native cheatgrass (at the expense of bare ground or cryptobiotic crust) will result in reduced numbers of Sage Sparrow[3,8].
- Shrub loss due to recurrent cheatgrass-fueled wildfires will eventually render habitat unsuitable for shrub nesting species, including Sage Sparrow, Brewer's Sparrow, Sage Thrasher, Gray Flycatcher, and Loggerhead Shrike[3,8].
- Increased cover of perennial grasses and forbs with retention of shrub cover will result in increased grassland associated species (such as Vesper Sparrow, Horned Lark, and Western Meadowlark), while retaining populations of shrub-nesting birds[3,8].
- Brewer's Sparrow is sensitive to low densities of juniper trees, while other sagebrush associated species may not be affected until shrub cover diminishes as a function of tree canopy cover. These bird species will benefit when western juniper expansion into habitats dominated by sagebrush is controlled[3,8].
- Because mature (pre-settlement) juniper trees are important habitat for a variety of species, it is critical that control efforts do not target stands with pre-settlement trees[3,8].

Perennial grass cover is an important predictor of Western Meadowlark abundance. Photo by Kevin McKereghan.

- Although traditionally candidates for shrub control to promote foraging for livestock and for wildlife, sites with 20-30% live shrub cover (either Wyoming or basin big sagebrush species) provide valuable habitat for several sagebrush obligate bird species (Sage Thrasher, Sage Sparrow, Brewer's Sparrow, Gray Flycatcher), even when they do not support much herbaceous vegetation in the understory[3,8].

Adaptive Management Recommendations and Implementation

- At Boardman, the livestock stocking rate and season were adjusted to avoid damage to burrowing owl burrows within pastures determined important for nesting. Specifically, all grazing was eliminated during the owl-nesting season. Shortly thereafter, for a variety of reasons, all livestock grazing on the facility was suspended[4,5,9]. Shrubsteppe bird monitoring data is now being included in many new OR/WA BLM planning documents and environmental assessments. OR/WA BLM is anticipating that first analyses of the initial 2000-2003 shrubsteppe monitoring project will provide valuable guidance to various planning processes. Management plans at the resource area level undergo regular revision. The new data may validate some management actions or cause adjustments to others[3,6,7].
- Three Rivers Resource Area increased juniper removal to protect aspen groves from encroachment[11].
- New and revised management recommendations will be included in the PIF-sponsored *Conservation Strategy for Landbirds in the Columbia Plateau of Eastern Oregon and Washington*. An updated plan is being prepared for publication in December 2003[1,8].

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CASE STUDY:
San Francisco Bay – Predicting the effects of management

by Gregg Elliott and Diana Stralberg

"Using data collected collaboratively with the San Francisco Bay Bird Observatory and the U.S. Geological Survey, we have made substantial progress in developing the first phase Habitat Conversion Model. Agencies and organizations working to restore salt ponds and other habitats in San Francisco Bay are working collaboratively to maximize bird diversity and ensure no net loss of bird numbers[12]." – Nils Warnock, co-director Wetlands Ecology Division, PRBO Conservation Science

"*For environmentalists, [the salt ponds of San Francisco Bay] . . . represent the greatest single opportunity to return the shoreline to its natural state.*" --San Francisco Chronicle, 2001[2]

Whimbrels are one of many species of birds that use the San Francisco Bay. Photo by Eric Preston.

Many people and organizations recognize that restoration of the recently acquired 6,110 hectares (15,100 acres) of Cargill salt ponds in south San Francisco Bay represents a tremendous opportunity to restore depleted tidal marsh habitat. At the same time, however, PRBO biologists fear that the restoration emphasis has been driven by a public misconception of salt pond habitat as being less valuable to wildlife since it is "man-made[8]." In reality, nothing could be further from the truth. The studies of PRBO and others have demonstrated that South Bay salt ponds provide excellent feeding, resting, and breeding habitat for quite a number of shorebirds and waterbirds[3,5]. In fact for many species, commercial salt evaporation ponds have filled a habitat void left by displaced natural saltpans and tidal flats. Today the San Francisco

Bay salt pond complex comprises one of the most important Pacific Coast sites for waterbirds[3], hosting millions of wintering, migrating, and breeding birds annually[5,8,9].

Implications of Habitat Conversion

Many expert reports support restoration of South Bay salt ponds to tidal marsh, including the San Francisco Bay Habitat Goals Report[1,4]. This is meant to redress the loss of over 80% of tidal marsh and 29% of tidal flat habitats that has occurred over the past 150 years with the influx of over 8 million people into the Bay area[1]. The Goals Report recommends a threefold increase in South Bay tidal marsh habitat (from 3,600 to about 12,000 hectares) to improve the quality, extent, and connectivity of natural wetland systems[1]. Such an expansion of marsh habitat is expected to benefit a host of threatened tidal marsh-dependent species, including three endemic Song Sparrow subspecies and the federally listed Clapper Rail. There is, however, also a danger that the hundreds of thousands of birds and other wildlife that are now dependent on salt ponds will be negatively affected by this habitat conversion.

The sad fact is that in a world where wildlife habitats are constantly whittled away by human development, the phenomenon of "conflicting species needs"—as illustrated here—becomes more common. Biologists who had devoted much of their lives to the study of marsh birds or shorebirds in the region were acutely aware of this conflict, and they realized they had the ability to contribute in a positive way to its resolution. They agreed that, quite simply, the following questions needed to be addressed:

What will happen to bird populations and communities in South San Francisco Bay (as reflected in species numbers and diversity) when salt ponds are converted to other habitats[7]*?*

Are there specific management recommendations we can make to ensure that wetland habitat in south San Francisco continues to maintain the globally important numbers and diversity of birds that rely on this region?[7]*?*

Modeling Habitat Conversion

Working in partnership with researchers at the U.S. Geological Survey and the San Francisco Bay Bird Observatory, PRBO began a systematic study of bird use in San Francisco Bay tidal marsh and salt pond habitats. Using a combination of standardized bird survey protocols, GIS habitat mapping, and statistical modeling, PRBO is developing a first generation Habitat Conversion Model (HCM). The goal is to develop a model that can be used to estimate the quantitative and qualitative effects of bayland habitat conversion on bird populations, initially with respect to tidal marsh and salt pond habitat, but eventually expanding to include tidal flats, bayland-adjacent uplands, and non-tidal wetlands[5].

The intent here is to develop a predictive tool that can be used by land managers to improve their ability to practice adaptive management. Specifically, the California Department of Fish and Game (CDFG), the U.S. Fish and Wildlife Service (FWS) and others, rather than "learning by doing," can use the model to "try things out." As actual restoration projects are implemented and data on bird use are incorporated, the Habitat Conversion Model will provide

guidance toward the value of large ponds and channels within marshes, as well as the appropriate size, shape and location of restored and managed habitat types. The ultimate goal is to increase the health of endangered and declining wildlife populations without exerting a negative influence on the numbers of Pacific Flyway shorebirds and waterfowl that rely on South Bay salt ponds—numbers that constitute one of the last truly breathtaking wildlife spectacles in the San Francisco Bay estuary.

> *"As the resource agencies develop restoration alternatives for the South Bay Salt Ponds, the Habitat Conversion Model will be an essential tool to analyze positive and negative impacts, determine whether project objectives are being met, and communicate trade-offs with stakeholders[10]."*–Amy Hutzel, Project Manager, California State Coastal Conservancy

In May 2002 the California State Coastal Conservancy recognized the value of this effort and began supporting development of the HCM. The Coastal Conservancy shares the lead in restoration planning for Cargill salt ponds with CDFG and FWS.

Specifically, the Habitat Conversion Model will[5]:

- Identify bird-related costs and benefits of habitat conversion, as a result of salt pond loss and tidal marsh gain.
- Develop a quantitative basis for guiding the design of restoration projects to maximize site-level habitat potential, and *future* acquisition priorities for optimal configuration of tidal marshes and salt ponds at the landscape level.
- Monitor and evaluate cumulative effects of restoration on birds (in partnership with land managers).

As always in Adaptive Conservation Planning, model development will be an iterative process, with increasing sophistication as data become available. Already, preliminary results indicate the following[11]:

- Although landbirds and rails will benefit greatly from creation of new tidal marsh habitat, loss of salt ponds may cause substantial reduction in waterbird numbers, especially shorebirds and diving ducks.
- There exists potential to increase waterbird numbers through design and on-going management of individual restoration sites to artificially retain a patchwork of young tidal marsh conditions (i.e., unvegetated areas).
- It is critical to retain some salt ponds in the South Bay habitat mosaic in order to avoid significant losses in waterbird numbers in San Francisco Bay.[5] Models showed that the retention of just a few salt ponds may provide more habitat benefit for waterbirds than designing restored tidal marshes to maximize habitat potential, especially for diving ducks.

> *"It's very rewarding to be conducting research with timely management implications. The Coastal Conservancy, California Department of Fish and Game, and U.S. Fish and Wildlife Service need to make imminent decisions about the fate of the salt ponds, and they are looking to PRBO for guidance on managing bird populations. With respect to our habitat conversion model, the agencies are beginning to provide us with real scenarios to model and evaluate, improving its ultimate utility[11]."*
> – Diana Stralberg, Landscape Ecologist / GIS Specialist, PRBO Conservation Science

Next steps include refining the models to predict bird densities in salt ponds under different management conditions, with the goal of guiding pond management to maximize habitat functions for shorebirds and waterfowl. For example, even with a reduction in the number of salt ponds, there is the potential for retaining an equivalent (or even increased) area of wildlife habitat by managing for an optimal range of pond depths, salinities, and resting areas. With respect to tidal marsh, restoration trajectories over time will be incorporated into the model, as well as habitat heterogeneity within tidal marshes[11]. The next major modeling goal is to determine the optimal amount, configuration, and management regime of salt ponds and newly restored tidal marshes to maximize bird species diversity and abundance[6].

San Francisco Bay habitats are changing quickly. Today, due to the efforts of many partners, it is more widely recognized that "restoration will involve many complex issues – such as determining the desired mix of managed pond and tidal marsh habitat[5]. . . " If the San Francisco Chronicle story quoted above touting a "return to nature" were written today, it might say that the aim of restoration advocates is to "restore and manage for a mosaic of habitats that will support the greatest abundance and diversity of wildlife." PRBO's Habitat Conversion Model is a tool designed expressly to help land managers and restorationists achieve this goal by improving the adaptive management of bayland habitats.

Salt ponds are utilized by numerous bird species including this Forster's Tern. Photo by Eric Preston.

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CASE STUDY:
Developing an ACP - Seabirds of the California Current System

by Gregg Elliott and Kyra Mills

> *"The U.S. Fish and Wildlife Service has long recognized seabird conservation as one of the most compelling migratory bird conservation needs in the Pacific Region. We consider partnerships at the international, national, and regional scales to be integral to effective implementation and we look forward to continuing our collaboration with PRBO in the development of the CCS Adaptive Conservation Plan[6]."* Maura Naughton, Regional Seabird Biologist, U.S. Fish and Wildlife

The North American Waterbird Conservation Plan (NAWCP) seeks to (1) ensure sustainable distributions, diversity, and abundance of waterbird species throughout their ranges and (2) protect, restore, or manage sufficient habitat throughout the year to meet species goals[1]. In leading the development of the Pacific region seabird conservation plan for the NAWCP, PRBO has used a collaborative approach to develop and disseminate an ecosystem-level plan for seabirds of the entire California Current marine ecosystem (CCS). Conservation of seabirds will also promote the conservation of other species, particularly the prey resources upon which they depend.

Black-footed Albatross, a seabird of the California Current marine ecosystem. Photo by Eric Preston.

The California Current System, stretching from southern British Columbia to Baja California (Figure 1) is one of five highly productive eastern boundary currents in the world. The CCS is the "feeding trough" of the northern Pacific Ocean for millions of marine birds, mammals, and fish, including many far-ranging, highly-migratory species from the southern hemisphere. Yet,

overfishing, bycatch, habitat destruction, climate change, and pollution seriously threaten the health and productivity of this vital marine ecosystem.

Initiating Conservation Planning

An initial version of the CCS Marine Bird Conservation Plan (CCS Plan) was completed in December 2003. The process was initiated against a political backdrop of accelerating interest and controversy in establishing "no-take" marine reserves; a new California Coastal National Monument managed by the U.S. Bureau of Land Management; and initiatives by the U.S. and Canadian national wildlife services to systematically address the needs of Pacific seabirds under their jurisdiction. The plan development strategy has been to host and coordinate collaborative exchanges with the goals of (1) strengthening existing partnerships and forming new ones, (2) ensuring a broad and comprehensive review of conservation and management issues, (3) building on existing knowledge and expertise, and (4) establishing a mechanism for implementing plan objectives.

PRBO and partners began plan development by organizing meetings in November 2001 and February 2002, each attended by seabird experts and managers from throughout the CCS who:

- agreed on a plan of action to coordinate seabird conservation planning in the California Current System;
- discussed what is needed in a regional waterbird plan, both from a conservation and an agency mandate perspective;
- reviewed other plans developed or in development and databases that can be used for seabird conservation planning; and,
- identified individuals and agencies interested in supporting the development of the CCS plan.

A CCS plan listserv was established (join-waterbird-pacific@rana.er.usgs.gov) and web page (http://www.prbo.org/cms/index.php?mid=66&module=browse) to aid in communication within this regional group and share ideas about the CCS Plan.

> *"We are excited to have PRBO on board as we begin developing a management plan and helping to set the future direction for the Monument. PRBO is uniquely positioned to help us develop partnerships for long-term monitoring and research, public education, and management of the Monument's resources[8]."* – Rick Hanks, California Coastal National Monument Manager, U.S. Bureau of Land Management

Perhaps the most significant immediate outcome of these meetings was a Memorandum of Understanding (MOU) between PRBO and the U.S. Bureau of Land Management to formalize a partnership in support of long-term management, protection, and education in the California Coastal National Monument (designated by presidential proclamation in 2000). This monument includes all unprotected islands, rocks, exposed reefs, and pinnacles above mean high tide within 12 nautical miles of the shoreline of California, many of which provide important nesting, roosting and haul-out areas for seabirds and marine mammals.

In addition, PRBO, the National Marine Protected Areas Center, and the National Fish and Wildlife Foundation (NFWF) convened a day-long workshop on January 17, 2002, with about

30 researchers and agency managers from Canada, Washington, Oregon and California to explore the scientific basis of pelagic marine reserves. This meeting included experts in physical oceanography, zooplankton, forage fish, marine mammals, sea turtles, and seabirds. The Pelagic Working Group, a loosely affiliated group of individuals interested in further exploring the feasibility and conservation need for pelagic marine reserves, resulted from this meeting[2].

While PRBO has been able to provide funding and expertise to develop new analyses on long-term datasets from seabirds nesting at the Southeast Farallon Islands, the resources and expertise of other organizations have provided the full range of information required for the development of the CCS Plan. For example, the U.S. Fish and Wildlife Service is nearing completion of a seabird conservation plan for their Pacific Region (which includes Washington, Oregon, California, Hawaii, and the U.S. Pacific islands). PRBO contributed to this plan by writing several of the sections, and much of the information prepared for this plan will be incorporated into the CCS Plan[3]. PRBO is also working closely with the Canadian Wildlife Service to incorporate information on seabird populations and ecology in the northern section of the CCS (British Columbia)[3]. Finally, PRBO contracted with the Island Conservation and Ecology Group (ICEG), and its Mexican equivalent (Grupo de Ecología y Conservación de Islas A.C.) to produce a portion of the plan addressing the important seabird colonies and populations found on and around the Pacific islands of Baja California.

> *"ICEG, and their contacts in Baja, have been invaluable in developing recommendations for seabird conservation in Mexico. We plan on continuing our partnership with ICEG and expanding our outreach to Mexican agencies and biologists throughout the implementation of the CCS Plan[5]."* – Kyra Mills, Seabird Biologist, PRBO Conservation Science

Integration with other conservation initiatives

A focus on seabird conservation demands an ecosystem perspective to succeed. Seabirds are wide-ranging, and many species are migratory. They are top predators in an ocean environment that cannot be protected by fee-title. Seabird conservation collaborators are already well prepared, through the various seabird conservation planning efforts currently underway, to articulate a vision for ecosystem management of the CCS. In addition, the Pelagic Working Group is interested in testing the concept of pelagic marine reserves to foster biodiversity conservation and protection of the marine food webs that are so vital to seabirds and other top marine predators.

How do all of these pieces fit together? At the 2003 Pacific Seabird Group meeting, seabird biologists and managers from throughout the CCS expressed the general consensus that a partnership with a formal structure would be most effective in obtaining resources and political support for seabird conservation. Participants expressed support for the concept of a "California Current Joint Venture," (CCJV) modeled after successful joint ventures of the North American Waterfowl Management Plan[7], to pioneer this approach in the marine realm. A CCJV would seek to address the many complex threats to wildlife and habitats in the CCS through a voluntary, non-regulatory, cooperative partnership of relevant government agencies, non-governmental groups, and the private sector. The primary function of a CCJV would be to

find common ground and to implement CCS Plan recommendations through workable, win-win conservation approaches among key decision-makers and regulatory agencies.

To more fully explore issues related to plan implementation, PRBO, the U.S. Fish and Wildlife Service, and others hosted two regional meetings (northern and southern CCS) in the fall of 2003. Each meeting resulted in a consensus that the model of a joint venture should be further developed and pursued as a means of ensuring that CCS Plan recommendations result in follow-up and, ultimately, conservation results. Most participants recognized the need for greater integration of information and action across jurisdictions, and many could cite specific examples of projects they would like to see promoted by a CCJV. For example, cooperating with fishers to develop innovative new ways of reducing bycatch or collaborating across international borders to ensure the long-term health of migratory seabird populations. With public attention increasingly focused on the health of the world's oceans, the future is alive with exciting possibilities for collaboration.

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CHAPTER 3. "Pointers for Practitioners"

This chapter provides a list of suggestions and tips for how to maximize the benefits of using an Adaptive Conservation Strategy. The emphasis here is on process, particularly the development of partnerships and teamwork between science organizations and natural resource managers. The material in this chapter is drawn from the observations of land management partners and PRBO project leaders interviewed for the case studies, combined with the experience of the authors. The terms "practitioner" and "partner" are used to refer to both natural resource managers and scientists.

Pointers for practitioners are provided in the following categories:

- Achieving Conservation Results
- The Special Case of Long-term Monitoring
- Partnership Building
- Communication
- Fundraising
- Improving the ACS Approach

I. Achieving Conservation Results

1. Maintain objectivity[1,2].

This applies to everyone, but in particular to conservation science organizations and scientists. There is a fine line between interpretation of data for use in management, and advocacy. By maintaining objectivity in reporting results; limiting management recommendations to those supported by data; and making clear the assumptions inherent in extrapolating results, science organizations will attract more partners and ultimately ensure conservation based on the best available information.

2. Standardize data collection[1,2]!

For resources concerning internationally standardized bird monitoring methodologies see www.prbo.org/tools. The references listed there include PRBO instructions, field data forms, database structures, links to online data entry and query tools, and other resources for people collecting data on songbirds[9]. The methods follow Partners In Flight standards as described in Field Methods for Monitoring Landbirds[11]. A resource on internationally accepted standards for waterbird monitoring should also be available soon.

3. Collect data at multiple sites in a region whenever possible, developing, if necessary, discrete projects with multiple landowners[1,2].

Collecting data from multiple sites creates more statistical power in analyses for everyone. All participating practitioners are benefiting by getting a larger dataset, which can provide a broader, landscape scale perspective to locally managed issues. The key to greater statistical power,

overall landscape perspective, and ability to compare results across projects is standardized methodology.

4. Initiate coordinated outreach to federal and state agencies with the goal of incorporating ACP goals and management recommendations into the resource management plans that govern public lands and oceans[1,2].

The integration of regional conservation plan recommendations developed under the continental bird conservation initiatives into natural resource management plans and Joint Venture work plans has been identified as a priority by (a) Executive Order 13186 mandating greater federal coordination to meet the requirements of the Migratory Bird Treaty Act[10] and (b) the draft *Partners in Flight U.S. Strategic Plan 2002-2012.* A consensus among California Partners in Flight and other practitioners in California is emerging that the most effective means of expanding the use of adaptive conservation plans and their underlying data in conservation planning and management will be a concerted campaign of outreach to appropriate audiences, whether local, state or federal government, conservation grant programs, or private landowners. Outreach should be tailored to deadlines for the development of specific land, ocean, or species management plans and funding programs.

Background
For each federal agency that governs a particular portion of public trust resources, there is at least one federal statute that defines the legal and procedural requirements for developing natural resource management plans. For example, the Bureau of Land Management (BLM) is governed by the Federal Land Policy and Management Act of 1976. The U.S. Forest Service (USFS) is governed by the National Forest Management Act of 1976. Statutorily required management plans lay the foundation for all permitted and required resource management activities on federal lands. Similar state statutes guide natural resource management of publicly held state lands.

5. Seek to share Adaptive Conservation Planning results with trustee agencies—at both the local level and higher up the echelon[1](this applies to everyone, but particularly science organizations).

Trustee agencies are those, such as the U.S. Fish and Wildlife Service (FWS) and California Department of Fish and Game (CDFG), who have a role as trustee of public resources that crosses all jurisdictional lines (including federal and state land management agencies, water districts, and county and city planning departments that affect private landowners and developers, etc.). Sharing monitoring data and resource management recommendations with trustee agency biologists will thus increase the potential for affecting a broad range of management activities throughout the region. The best way to ensure that agencies are aware of such data and making use of it is to contact regional biologists directly by calling the local or regional field office of the appropriate agency, and asking to speak to the wildlife biologist. Building these relationships should be a standard outreach component at the field level for all scientific monitoring/research projects.

Background
As trustee agencies, the FWS and the National Marine Fisheries Service (NMFS) at the federal level, and fish and game agencies at the state level provide input to other land/ocean management agencies on their management practices. For example, CDFG issues streambed alteration permits, reviews conditional use permits (required under the National Environmental Policy Act, or NEPA) on federal lands, and comments on proposed hydrological projects. For private projects on federal lands in California, CDFG also issues Incidental Take Permits for state-listed species pursuant to the California Endangered Species Act. Science-based management recommendations can be invaluable for designing "avoidance and/or mitigation measures" for such projects.

Under section 7 of the federal Endangered Species Act, the FWS and NMFS have authority to request amendments to projects proposed by other federal agencies that could have a detrimental impact to listed species. In the FWS, the greatest difficulty in writing Biological Opinions is to fill in the blanks concerning what is not known or immediately available to FWS biologists. The FWS constantly needs more information to assess the effects of projects on listed species, and how to minimize these effects. Standardized data that cover key habitats across a region can be invaluable in informing federal and state review of projects

6. Use focal species to obtain agreement among diverse partners concerning habitat management and conservation goals[1].

A vivid example of how focal species helped disparate partners overcome differences is the Memorandum of Understanding (MOU) between the City of Los Angeles Dept. of Water and Power, CDFG, Inyo County, the State Lands Commission, the Owens Valley Committee, and the Sierra Club concerning the Lower Owens River Project [8]. This project has a goal of rewatering fully 60 miles of a stream notorious for having all but disappeared in California's water wars of the early 1900's. While negotiating the MOU, the parties could not agree on acre or habitat objectives, but instead agreed to focus on a list of indicator species [16].

"…The goal is to create and maintain through flow and land management, to the extent feasible, diverse natural habitats consistent with the needs of the 'habitat indicator species'. These habitats will be as self-sustaining as possible[8]." The list of 24 indicator species for the Owens River Riverine-Riparian System includes 18 species or groups of birds, 7 of which are also focal species of the CalPIF Riparian Bird Conservation Plan.

7. Incorporate recorded wildlife response to ACP-recommended management actions into routine analyses of monitoring data[1,2].

This is "closing the feedback loop" of adaptive management, i.e., reassessing wildlife response, once initial data has been used to guide management actions. This does not always happen because such analyses often require a change/expansion in the scope of monitoring programs (because management actions are not always implemented at existing study sites) and additional funding. Therefore, partners should seek to build these future costs into their project budgets.

For example, the National Park Service "Vital Signs Monitoring Program" recommends 30% of funding is used on data management and reporting.

8. Refer to the appropriate regional conservation plan developed under the auspices of one of the four continental bird conservation movements to increase the legitimacy and weight of project management recommendations based on bird monitoring data[2].

The continental conservation plans are:
Partners in Flight: http://www.partnersinflight.org/;
the U.S. Shorebird Conservation Plan: http://www.manomet.org/USSCP/;
the North American Waterbird Conservation Plan: http://www.nacwcp.org/;
and the North American Waterfowl Management Plan: http://www.nawmp.ca/eng/index_e.html.

See Appendix 2 for a complete list of bird conservation plans developed for California habitats.

II. The Special Case of Long-term Monitoring

1. Designate strategically placed long-term monitoring sites for every major habitat or ecosystem type that requires stewardship or conservation[2].

Long-term wildlife monitoring is almost always undertaken as a partnership between scientists and resource managers. PRBO's 30+ year dataset from the Palomarin field station owes its existence to a long-term partnership with the National Park Service and Point Reyes National Seashore, and a similar partnership with the U.S. Fish and Wildlife Service at the Farallon National Wildlife Refuge has supported our 30+ year marine bird and mammal monitoring program, as well as a newer program monitoring the Farallon's white shark population. The advantages of long-term monitoring to science and to effective conservation are numerous and sometime subtle.

- Without long-term monitoring, one cannot answer most questions relating to long-term events such as possible effects of climate change, long-term effects of human activities, long-term effects of shifts in habitats and habitat types, or the cumulative effects of such changes.

- Long-term datasets capture both short-term fluctuations in wildlife populations and associated habitat parameters from year to year, while also helping to characterize variability over longer time scales (such as the Pacific Decadal Oscillation, which affects the Pacific Ocean and associated weather cycles).

- Monitoring is the only way to answer the frequently asked question "what is the status/health of wildlife populations?" (At least 10 years' worth of data are often required to calculate species population trends).

- By providing a picture of long-term natural variability in an ecosystem, long-term datasets help scientists to distinguish the effects of discrete or short-term human activities (such as pollution events) on the environment.

- Long-term datasets provide a baseline against which to measure future change over time. Such datasets are critical to distinguishing between anthropogenic and natural causes of change. They also eliminate any further "shifting of baselines." (The idea of shifting baselines is that if starting conditions, or baselines, against which ecologists measure environmental change have already shifted—usually in a negative direction due to human action—prior to their measurement, then society may ultimately accept a degraded environmental situation as "normal."[15]).

- Ongoing monitoring provides a greater opportunity for focus on in-depth research to answer specific questions that seek to illuminate the causes (and thus potential solutions) of important issues, such as low reproductive success. The research is strengthened when it is conducted within the context of a long-term dataset that shows trends or demographic status.

- Ongoing monitoring provides the opportunity to combine wildlife data (e.g., birds) with data on other taxa (e.g., aquatic invertebrates, fish, or mammals).

- A regular monitoring presence "on the ground" means more eyes to assist resource managers with compliance relative to, for example, grazing and recreational guidelines.

III. Partnership Building

1. Use training programs and/or workshops as excellent vehicles for relationship-building[2].

Training and workshops can be used to start relationships and to identify conservation objectives, data needs, and personnel needs. This approach has worked particularly well for PRBO in Latin America, where we have identified partners and begun new projects as a result of workshops convened for the purpose of training biologists. Local conferences and workshops are often the best venues for the dissemination of Adaptive Conservation Plans (ACPs) or project results. Regional membership organizations are also an excellent means for reaching local organizations and individuals (for example, the Sacramento River Conservation Area for the lower Sacramento region or the Bay-Delta Science Consortium for San Francisco Bay and Delta).

2. Foster the incorporation of scientific monitoring results into ongoing land or ocean management programs by organizing multi-state or regional meetings including scientific organizations, agency biologists, and public land/ocean managers[1].

The goals of such a meeting (held annually or at least regularly) would be to (a) provide an overview of what new monitoring data says about the resource; (b) get feedback from natural resource managers on how scientific data have been used; and (c) discuss "where to go from here." Such a meeting would generate enthusiasm for more scientific monitoring. An indirect benefit to agency managers would be to help chart an integrated regional path for conservation

science and management. For example, consistency for special status species management needs to be maintained across states within any given federal agency.

3. Ensure consistent, timely submission of site-specific reports by science organizations, which include both data and qualitative observations[1,2].

The use of standardized methods and web-based data entry greatly speeds up analyses and interpretability of results, and thus reporting. In some cases, land management partners have been able to incorporate monitoring findings from site-specific reports into their own final reports to funders. This serves to highlight for funders the value of the Adaptive Conservation Planning relationship.

4. Seek a science partner that is able and willing to train land/ocean management biologists in appropriate field methodologies for monitoring target wildlife species[1,2].

This is an advantage when an agency desires to set up a long-term monitoring and evaluation program that staff biologists can implement. It can also facilitate continuity after short-term monitoring and analysis programs set up in partnership with science organizations have been completed.

5. Locate scientific monitoring and evaluation staff on-site whenever possible[2].

When conservation science field teams are located on site, it enhances the probability that they will be included as part of the resource management team. This also provides opportunities for ad-hoc project consultation.

6. Maintain flexibility (on the part of science partners) to go wherever a resource manager needs to go to answer specific management questions[1,2].

Recognize that needs related to the scientific goals of a monitoring program may not always coincide with compelling local needs of resource managers—find the balance. Land managers and conservation scientists need to show the relevancy of monitoring and science to decision-makers, otherwise they will be "out of business." Be responsive too: the value of both data and relationships is greatly enhanced when questions related to specific wildlife, habitats, or management are answered quickly and well.

7. Recognize that over the course of a partnership, there will sometimes be tension between scientific versus management goals [1,2].

There is a need for transparency in establishing long-term as well as year-to-year goals for adaptive conservation projects, to ensure that management goals are achieved at the same time that monitoring program designs provide sufficient scientific rigor.

8. Make this *Guide to Developing an Adaptive Conservation Strategy* required reading for those who are part of a new science-management partnership[2].

Starting with a common frame of reference can greatly increase the efficiency of communication and facilitate greater understanding of partnership needs, goals, and processes.

IV. Communication

1. Strengthen the feedback loop between scientific monitoring and management teams by regularly communicating and meeting[1,2].

Conduct pre- and post-season meetings! These meeting(s) serve three purposes: (a) a forum for discussion of regional issues among all project partners, including upper level staff; (b) a review and discussion of the past season's results, with interpretation of key data and issues by scientists; and (c) a discussion of next season's needs including funding requirements and changes to scope of work. Pre-season meetings can serve in lieu of c above. Such meetings should include briefings from resource managers on management or project design changes implemented as a result of the previous season's scientific findings and recommendations.

Create other traditions for meeting and communication appropriate to your projects[1,2].

2. Invite project partners to attend "field days" with scientific staff at least once per season[1,2].

This allows managers to interact with scientific monitoring staff in a relaxed setting and to privately discuss the details of each individual organization's monitoring and analysis needs.

3. Take advantage of web-based communication as much as possible[2].

The web is a powerful tool for disseminating information and gathering data from partners. Determine which partners have the most developed web capability to take the lead in this.

4. Present findings at scientific and natural resource management meetings to foster replication of successful models for collaboration and monitoring[2.]

An example of this occurred when National Park Service personnel from Devil's Post Pile National Monument learned about the Eastern Sierra Project while attending a Partners in Flight meeting in 2001. They approached PRBO, and by 2002 a meadow restoration monitoring program with a bird education component had been initiated in the monument.

5. Be aware that staffing turnover contributes to communications problems and can slow down the "learning" process of an organization[1,2].

Extra effort should be made to record the lessons and history of resource management projects; to orient new staff; and to foster renewed working relationships with partners when staff change.

V. Fundraising

1. Design projects, to the extent possible, that cross jurisdictional boundaries and include many partners; these are seen as more effective[1,2].

Such projects can provide landscape perspective and greater statistical power in analyses for everyone.

2. Seek and justify the need for greater flexibility from funding sources when necessary[1,2].

Examples of funding issues that regularly affect science-manager partnerships include:

- Lack of flexibility to allow for a pilot year(s) in long-term or multi-year projects. Such flexibility is often required to adequately tailor a long-term project to local conditions and local needs. One or more pilot years of familiarization with an area, including data collection, can greatly facilitate advance planning for multi-year projects.
- Lack of recognition of the benefits of monitoring. Perceptions are still common that monitoring results will not be available in a timely fashion or that monitoring funds would be better spent implementing projects. These issues should be addressed in proposals.
- Lack of recognition of the costs of "conservation accounting." Money is required to provide ongoing evaluation through project monitoring and to maintain and update ACPs.
- Funding cycles do not match field seasons. This can result in inadequate time to prepare proposals.

3. Seek to improve and streamline the funding process for monitoring and evaluation[1,2].

The year-to-year contracting process with long-term partners could be improved by negotiating 5- to 20-year agreements. This process would require developing a common vision of where the project is going, long-term goals, and defined stepwise products. Such a step would save a significant amount of staff time and resources spent in developing year-to-year contracts. An effort to collaboratively ensure better long-term funding would also improve project effectiveness. Long-term funding would free up staff time by lessening fundraising duties, and more importantly would allow practitioners to learn if their restoration designs and conservation practices are actually benefiting wildlife over the long term.

VI. Improving the ACS Approach

1. Improve tracking of (a) resource managers' use of wildlife monitoring data and (b) implementation of management recommendations[1,2].

From the outset, working relationships with natural resource management partners should be structured to include a request for feedback on how monitoring data and management recommendations are used. It is necessary to formally request this information, since

management agencies and organizations really have no requirement to report how and when they use data supplied by other organizations. An effort should be made to track management practices or permits, management plans, and other project-specific actions. Managers and their partners will more easily track such information on an on-going basis when both sides recognize the value of tracking this information *from the beginning*. The incentives for such an approach include documenting improved performance by demonstrating the extent to which natural resource management decisions are supported by data, and improved fundraising by demonstrating the utility of the ACS in achieving conservation results.

The following are three suggestions for methods to achieve this goal.

(a) Resource management biologists could use email to transmit to scientists, in "real time," details of a decision or issue whenever bird data is involved. (For example, when restrictions are added to a special use permit to protect wildlife, or when a specific land management prescription related to wildlife conservation is incorporated into a resource management plan on the basis of data provided by the science organization.) The science organization would be responsible for maintaining its own comprehensive list of how its data is used.

(b) Resource managers could maintain a list of decisions or documents that incorporated data or recommendations supplied by their science partners. This information could be shared and discussed regularly with science partners.

(c) Science partners could develop a broad outreach campaign and survey instruments seeking feedback from government agencies and other partners concerning how monitoring information and conservation recommendations have been applied. (See #4 under "Achieving Conservation Results" and #2 below).

2. Ensure a concerted outreach effort by science partners to decision-makers within natural resource agencies[1].

Decision-makers in resource management agencies and organizations tend to be less aware of the value of scientific monitoring data to adaptive management, and the value of partnerships with science organizations. Seek to highlight the role of the decision-makers' own agency in adaptive management and the contributions of science partners in helping to achieve the agency's mission. This will help to increase decision-makers' support of the collaboration. (Power point presentations work well for this purpose.) Furthermore, information in ACPs can be extremely valuable to staff responsible for preparing and responding to Environmental Assessments and Impact Reports. One of the best ways to ensure ACP data are used to guide such decisions is to raise the profile of the Plans through concerted agency outreach.

3. Recognize, highlight, and expand scientists' role in the burgeoning movement toward "auditing" of conservation projects[1,2].

A consensus is emerging that conservationists need something akin to the generally accepted accounting principles that govern financial reporting[4]. Organizations such as The Nature Conservancy, the World Wildlife Fund, the Wildlife Conservation Society, and Conservation International as well as major funders of conservation have all begun working toward this goal [7,12]. In addition, the Government Performance and Review Act of 1993 requires that

measurable performance indicators be established to measure progress toward the achievement of strategic goals, such as conservation of wildlife populations. The Fish and Wildlife Service's 2003 Annual Performance Plan stresses that "successful migratory bird conservation depends on assessment of how populations respond to their environment" [13]. Therefore, any researchers collecting standardized data about the environment, working in partnership or with the permission of land/ocean managers, should seek to make their data available for the purposes of improving management practices. Such cooperation could run the gamut from collaboration with a specific goal of measuring conservation success to simply using recognized standards in collecting data and making the extra effort to share data with resource managers subsequent to publication.

4. Investigate the potential for establishing Memoranda of Understanding (MOU) with resource management agencies to reinforce the use of monitoring data and ACP recommendations[1].

This suggestion came from an agency staffer who cited MOUs developed by Bat Conservation International (BCI) with the USFS and BLM. The BCI MOU formalizes cooperation with the agencies in conducting surveys of old mining caves prior to their permanent closure. The intent of an ACP MOU would be to reinforce the agency mandate to make land/ocean management decisions using the best available scientific data (for example, by incorporating conservation plan recommendations, bird or other wildlife monitoring data into development of resource management plans/revisions). The MOU could also seek to formalize the necessity of providing feedback to scientific monitoring organizations on the use of their monitoring data.

5. Seek to incorporate "all birds" (including, where appropriate, waterbirds, shorebirds, raptors, and waterfowl) and other species in monitoring programs[1,2].

Expanding the focus of bird conservation programs nationwide to a more "all bird" perspective is one of the primary goals of the North American Bird Conservation Initiative (NABCI)[14]. NABCI has brought together the four major continental bird conservation plans (for waterfowl, landbirds, shorebirds and waterbirds) in an effort to increase the effectiveness of existing and new initiatives, enhance coordination, and foster greater cooperation among the nations and peoples of the continent [14]. In the case of bird monitoring, inclusion of other bird species, as appropriate, often requires very little extra time and expense, but can generate vastly improved levels of information. California Partners In Flight has long been an advocate of expanding single-species focused monitoring programs (such as for endangered species) to include all birds or at least a more representative suite of species. Monitoring of other taxa in addition to birds is increasingly required to accurately capture ecosystem responses to management, such as changes in river water levels and dam releases.

6. Seek to test the effectiveness of birds as indicators of the health of other species populations[1,2].

For reasons discussed in Chapter 1, birds generally make excellent indicators of ecosystem health and ecological integrity. However, this hypothesis bears more study to show explicitly whether "healthy systems" for birds are also "healthy systems" for other taxa. In addition, the relationship between bird populations and specific populations of other wildlife taxa requires

more study. Partnerships between resource managers and multiple science institutions may be a useful avenue for such research. For example, in the Eastern Sierra PRBO has begun working on streams where the Sierra Nevada Aquatic Research Laboratory is also monitoring aquatic invertebrate populations. The two institutions intend to compare what they consider to be a "healthy" stream, based on their different indicators. That is, how much do assessments of habitats using birds as indicators overlap and complement assessments using aquatic invertebrates as indicators? Results from study sites in other parts of California show that birds can be good indicators for some fish species in both freshwater and marine habitats[5].

7. Increase emphasis on disseminating results in peer-reviewed journals—this applies to science organizations implementing monitoring programs in partnership with natural resource agencies[1,2].

This will require an incremental increase in funding for all monitoring and evaluation projects to support the cost of the publication and review process. Resource management agencies are increasingly being asked by Congress and others to produce solid scientific evidence of the efficacy of their conservation programs, as evidenced by strategic planning and reporting requirements under the Government Performance and Results Act. Publication of scientific results in peer-reviewed journals is still the most direct and time-honored way of demonstrating scientific credibility. Science organizations should seek to collaborate or, at minimum, invite comments from scientists at their partner institutions (whether public or private) in this process.

8. Expand programs and create partnerships that will facilitate data collection for use in prioritizing sites for future conservation, i.e., in guiding land and ocean *protection* efforts rather than management[1,2].

This is an arena in which the use of bird monitoring data at the landscape level has tremendous potential. In an era of dwindling biodiversity and increasing population pressure, such information is a high priority for many conservation organizations and agencies seeking to either rationalize their landholdings or to determine appropriate boundaries for no-take marine reserves.

9. Incorporate existing scientific measures of success already in wide use (i.e., bird monitoring metrics) into broader regional programs[1,2] within California, particularly by collaborating with the California Bay-Delta Authority and the California Legacy Project.

The Ecosystem Restoration Program of the California Bay-Delta Authority (formerly CALFED) is committed to implementing restoration actions in an adaptive management context. Both the Authority's restoration program and its science program embrace the tenets of science-based adaptive management, which relies on constant monitoring and evaluation of program elements. In particular, the Science program is seeking to establish performance "measures and metrics" that can be monitored to assess change over time. The Science program calls for scientific studies to "demonstrate, pilot test, and establish performance measure monitoring [6]."

The California Legacy Project seeks to develop an adaptive approach for identifying long-term priorities and targets for future investment in resource protection, habitat acquisition, and preservation. "Recognizing the importance of improving existing data, the Legacy Project is putting considerable effort into sparking or enhancing cooperative data efforts. The Legacy Project has [also] established an interagency natural resource monitoring team to coordinate and improve assessment and monitoring statewide [3]."

Chapter 3 References

1. Derived from a synthesis of case studies (see personal communications listed as sources in Chapter 2).

2. Sources for this material are primarily PRBO staff, particularly staff listed as personal communications in the case studies and the authors of the ACP Guide

3. California Legacy Project website: http://legacy.ca.gov/.

4. Jon Christensen. November 5, 2002. Fiscal Accountability Concerns Come to Conservation. The New York Times.

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6. Ecosystem Restoration Program. August 6, 2001. Draft Stage 1 Implementation Plan. CALFED Bay-Delta Program.

7. Margules C. R. and R. L. Pressey. 2000. Systematic Conservation Planning. Nature 405:243-253.

8. Memorandum of Understanding between the City of Los Angeles Department of Water & power, the County of Inyo, the California Department of Fish and Game, the California State Lands Commission, the Sierra Club, the Owens Valley Committee, and Carla Scheidlinger, June 13, 1997, Lower Owens River Project.

9. PRBO Conservation Science website: http: //www.prbo.org/tools

10. President's Executive Order Executive 13186, signed by the President January 17, 2001, mandating greater federal coordination to meet the requirements of the Migratory Bird Treaty Act.

11. Ralph, C. John; Geupel, Geoffrey R.; Pyle, Peter; Martin, Thomas E.; DeSante, David F. 1993. Handbook of field methods for monitoring landbirds. Gen. Tech. Rep. PSW-GTR-144.

Albany, CA: Pacific Southwest Research Station, Forest Service, U.S. Department of Agriculture; 41.

12. Salafsky, N., R. Margoluis, K. H. Redford, and J. G. Robinson. 2002. Improving the practice of conservation: a conceptual framework and research agenda for conservation science. Conservation Biology 16(6):1469-1479.

13. U.S. Fish and Wildlife Service. 2002. FY2003 Annual Performance Plan, FY 2001 Annual Performance Report. http://planning.fws.gov.

14. U.S. NABCI Committee. 2000. North American Bird Conservation Initiative, *Bringing It All Together.* U.S. Fish and Wildlife Service. Washington, DC, U.S.A.

15. www.shiftingbaselines.org

Personal Communications

16. Leah Kirk, Project Coordinator, Inyo County Water Dept., 2-03 and 4-03

Conclusion

An Adaptive Conservation Strategy facilitates "learning by doing" and "learning by sharing information," both of which are science-based. Adaptive management at the site-specific level constitutes "learning by doing." The development of species, habitat, or ecosystem Adaptive Conservation Plans (ACPs) constitute "learning by sharing information." The goals of an Adaptive Conservation Plan tend to be general and overarching (for example "promote self-sustaining, functioning riparian ecosystems")—yet they can only be achieved through a multitude of individual on-the-ground projects that are monitored, assessed, and evaluated at the site-specific project level. An Adaptive Conservation Strategy constitutes a very large feedback loop between site-specific projects and many conservation practitioners with similar interests. Findings from individual projects inform ACPs, while recommendations contained in the ACPs inform management plans that guide the stewardship of natural areas.

Red-breasted Sapsucker Photo by Eric Preston.

The crucial components of a successful Adaptive Conservation Strategy (ACS) are collaboration, team work at the project level, keeping data current, information sharing, effective communication, flexibility (from all sides, including funders), and a results-oriented applied focus in monitoring, research, and management. The ACS has, to date, been based on the use of birds as indicators. Continuing research is needed to evaluate and refine our understanding of which bird species are the most accurate indicators of which elements of ecosystem integrity. It is fair to ask, however, whether the ACS process might also be applied in the field using other taxa as indicators (for example, bats or invertebrates). This is an area ripe for future investigation.

Natural resource management is an unpredictable process. For this very reason, conservation scientists have an unswerving belief in the power of objective scientific measurement to provide one of the best means for guiding conservation action. Yet managers are often overwhelmed by immediate problems: everything from controversies among conflicting user-groups to exotic species that threaten years of restoration investment to mysterious new plant and animal pathogens. It can be easy, at times, for managers to overlook the important role of science in achieving long-term conservation goals—whether through science partnerships or through participation in research themselves. For their part, conservation scientists must constantly make an effort to reach out to land and ocean managers to ensure that the results of monitoring and research efforts will be relevant and useful in addressing key resource management issues. Both conservation scientists and natural resource managers ultimately serve the same mission: facilitating and advancing successful, cost-effective conservation of our precious natural heritage. An Adaptive Conservation Strategy provides a win-win approach for achieving this mission.

Appendix 1. Adaptive Conservation Strategy Partners

Non-governmental Organizations

American Farmland Trust
American Bird Conservancy
Cache Creek Conservancy
California Association of Winegrape Growers
California Audubon
California Cattleman's Association
California Coastal Conservancy
California Farm Bureau Federation
California Native Grass Association
California Native Plant Society
California Oak Foundation
California Waterfowl Association
Center for Ecoliteracy
Central Valley Bird Club
David and Lucile Packard Foundation
Ducks Unlimited
Environmental Defense?
Friends Of Corte Madera Creek
Gateway to Lake Isabella Wetlands Project
Institute for Bird Populations
Island Conservation Ecology Group
Mountains Conservancy Trust
Mono Lake Committee
National Audubon Society
National Fish and Wildlife Foundation
Natural Resources Defense Council
North Bay Riparian Station
Sacramento River Discovery Center
Sacramento River Partners
San Francisco Bay Bird Observatory
Santa Cruz Bird Club
Santa Monica Mountains Conservancy
School Environmental Education Docents (SEED)
Scripps Research Institute
Sequoia Riverlands Trust
Solano Farmlands and Open Space Foundation
Southern Sierra Research Station
The Bay Institute Center For Ecoliteracy
The Nature Conservancy

Trust for Public Lands/
Wildlands Project
Wildlife Conservation Board
Wildlife Conservation Society
Youth Conservation Corps

Private Organizations

California North Coast Grape Growers Association
California Association of Winegrape Growers
California Prune Growers
Certified Rangeland Managers
California Rice Commission
Ecosystem Sciences
Hansen Biological Consulting
Hedgerow Farms
H.T. Harvey & Associates
Jones and Stokes Inc.
McBain and Trush Associates
Napa Valley Vintners Association
Prunuske Chatham Inc.
Registered Professional Foresters
Sea Ranch
Sonoma County Vintners Association
Sonoma Grape Growers
Wetland Concepts
Wine Institute

University Organizations

California State University-Chico
Cornell University - Department of Ecology and Evolutionary Biology
Integrated Hardwood Range Management Program, University of California (UC)

Hastings Natural History Reservation, UC Berkeley
International Center for the Environment, UC Davis
San Francisco State University, Center for Tropical Research
UC Cooperative Extension (UC-Berkeley, UC-Davis).
UC Davis
UC White Mountain Research Station – Eastern Sierra Institute for Collaborative Education

City Governments

City of Chico
City of Los Angeles Department of Water and Power
City of Santa Cruz

County Organizations

Bonnelli Park
William Heise Park
East Bay Regional Parks
Environmental Education Council of Marin
Marin County Resource Conservation District
Marin County Storm water Pollution Prevention Program (MCSTOPP)
Marin Municipal Water District
Mono County
Napa County Planning Board
Santa Cruz County Parks
Solano County Farmlands and Open Space Foundation
Sonoma County Agricultural Preservation and Open Space District
Topanga Conservation District

State of California Organizations

Ano Nuevo State Park
Bolsa Chica Ecological Preserve
California Department of Fish and Game
California Department of Forestry and Fire Protection
California Department of Water Resources
California Department of State Parks and Reserves
California State Water Resources Control Board
Caswell State Park
Chino Hills State Park
Crystal Cove State Park
Daley Ranch
Grasslands Water District
Gray Lodge Wildlife Area
Grizzly Island Wildlife Area
Los Banos Wildlife Area
McGinty Mountain
Mendota Wildlife Area
Mono Lake Tufa State Reserve
Woodson Bridge State Ecological Reserve
Resource Conservation Districts
State Lands Commission
State Park System in California
Upper Butte Basin Wildlife Area
Wildlife Conservation Board
Yolo Bypass Wildlife Area

Other State Organizations

Oregon Department of Fish and Wildlife
Washington Department of Fish and Wildlife

Federal Organizations

Alcatraz Island
Boardman Naval Weapons Testing Facility
Bureau of Land Management
Bureau of Reclamation
California Coastal National Monument
Camp Pendleton
Channel Islands National Marine Sanctuary (NMS)
Channel Islands National Park
Cordell Banks NMS
Department of Defense

Don Edwards San Francisco Bay NWR
Farallones National Wildlife Refuge
Golden Gate National Recreation Area
Gulf of the Farallones NMS
Kern National Wildlife Refuge (NWR)
Marine Corps Mountain Warfare Training Center
Monterey Bay NMS
Point Reyes National Seashore
National Park Service
Natural Resource Conservation Service
Naval Air Station, Alameda (closed)
NOAA Fisheries (formerly National Marine Fisheries Service)
NOAA National Marine Sanctuaries
Partners for Wildlife Program
Point Mugu (Navy)
Redwoods National Park
Sacramento NWR Complex
Salinas River NWR
San Clemente Island
San Francisco Bay NWR Complex
San Luis NWR Complex
Seal Beach NWR
Stone Lakes NWR
Sweetwater NWR
USDA Forest Service
US Fish and Wildlife Service
US Geological Survey
US Navy
US Shorebird Conservation Plan
Vandenberg Air Force Base

Museums

California Academy of Science
LA County Natural History Museum
Museum of Vertebrate Zoology, UC Berkeley
San Diego Natural History Museum
San Bernardino County Natural History Museum

International Organizations

Canada Department of Fisheries and Oceans
Canadian Wildlife Service
CISESE (Mexico)
North American Waterbird Conservation Plan
North American Waterfowl Management Plan
Partners In Flight

Consortia

Bay-Delta Science Consortium
California Cooperative Oceanic Fisheries Investigations (CalCOFI)
California Oak Mortality Task Force
Central Valley Habitat Joint Venture
Cosumnes River Project
Intermountain West Joint Venture
Pacific Coast Joint Venture
Riparian Habitat Joint Venture
San Francisco Bay Joint Venture
Sonoran Joint Venture
South Bay Salt Pond Restoration Project (San Francisco Bay)
U.S. Shorebird Conservation Plan
Western Hemisphere Shorebird Reserve Network

Appendix 2. List of Adaptive Conservation Plans Applicable to California

The following plans were developed to guide habitat conservation, under the auspices of three of the four continental bird conservation plans (as of May 2003).

Partners in Flight

Coastal Shrub and Chaparral Bird Conservation Plan
Coniferous Forest Bird Conservation Plan
Desert Bird Conservation Plan (in process)
Grassland Bird Conservation Plan
Oak Woodland Bird Conservation Plan
Riparian Bird Conservation Plan
Sagebrush Bird Conservation Plan (in process)
Sierra Nevada Bird Conservation Plan

U.S. Shorebird Conservation Plan

Southern Pacific Shorebird Conservation Plan

North American Waterbird Conservation Plan

California Current Marine Bird Adaptive Conservation Plan (in process)

(PRBO has also participated in the development of the *Conservation Strategy for Landbirds in the Columbia Plateau of Eastern Oregon and Washington.)*

NOTE: All plans are available for download as PDF files at www.prbo.org, link "conservation planning."

Appendix 3. How to Create an Adaptive Conservation Plan

An Adaptive Conservation Strategy (Fig. 1) can be conceptualized as a giant feedback loop between two separate iterative cycles: (1) the site-specific adaptive management cycle, where monitoring data are collected and adaptive conservation plan recommendations are implemented, and (2) the plan cycle, which develops Adaptive Conservation Plans (ACPs) that cover a region containing many site-specific projects and their associated data (as distinguished from site-specific management plans).

While adaptive management is a decades-old concept, the Adaptive Conservation Plan has been developed and refined over the past dozen years or more. This Appendix addresses the detailed steps that have been successfully used to collaboratively develop ACPs based on results from adaptively managed conservation projects. (Note: see chapter 1 for references cited here.)

The steps in developing an Adaptive Conservation Plan are:

a. **Synthesize findings** from multiple adaptively managed projects.
b. **Develop a written/on-line Adaptive Conservation Plan** focused on the ecosystem or habitat of interest. The plan incorporates findings from step a, as well as peer-reviewed literature, gray literature, and expert opinion. Conservation plans advance recommendations to guide resource management and policy.
c. **Disseminate and incorporate plan recommendations** into resource management and/or policy by partnering with or conducting outreach to appropriate audiences and sites.
d. **Iteratively reassess and revise** both site-specific resource management plans/practices and Adaptive Conservation Plans.

The philosophy underlying the Adaptive Conservation Planning process is that in the realm of natural resource management, where action is almost always necessary with imperfect knowledge, it makes sense to maximize and make use of what we do know and build from there. Therefore, the Adaptive Conservation Planning process begins by assessing the "state-of-the-science" knowledge concerning birds and their habitats. Planning is also a successful process for partnering between scientists and land or ocean managers–both governmental and private—to develop conservation goals, monitor actions in support of those goals, and evaluate progress in meeting them.

Step a: Synthesize findings from multiple adaptively managed projects.

The ACP process begins with an exercise designed to collect, synthesize, and articulate the current state of scientific knowledge concerning the conservation of a given species, habitat type, or ecosystem. By definition, this process includes the participation of as many as possible of the key management agencies and researchers with expertise and experience in the topic of interest.

- Recruit key experts to participate in development of relevant information on a species, habitat, conservation issue, or threat. Through their experience and knowledge of the gray literature, experts capture much of the knowledge from projects that have been adaptively managed (that is, they have access to the data collected at the project level.) Analyze and interpret data to inform project management and share in the ACP.

  For example, Bird Conservation Plans developed by California Partners in Flight use a suite of focal species created by identifying focal habitats , and then selecting those species associated with important habitat elements or ecosystem attributes, as well as those species with special conservation needs. Thus, a suite of species was chosen whose requirements define different spatial attributes, habitat characteristics, and management regimes representative of a healthy system. This process resulted in a diverse list of focal species for each habitat that includes both common and uncommon or rare species.

  Partners participate in developing focal species accounts, derived from both scientific and gray literature, which differ from other species accounts (such as *The Birds of North America* series) in that they focus on species-specific conservation priorities[10]. When employing focal species accounts, include detailed information on species' ecological requirements. Also emphasize key conservation concerns (such as declining populations); identification of stresses and related threats (such as habitat fragmentation contributing to increased predation or parasitism, resulting in low nest success); and management, monitoring, research, policy, and education priorities. For a description of the use of focal species in Conservation Planning, see Chase and Geupel (in press)[5].
- Collaborate and include a wide range of participants. In addition to thoroughness, inclusiveness also facilitates "buy-in" to the plan and engenders support for ongoing action to implement and test recommendations. Peer review of the process also occurs when participants review one another's work products.
- Fundraise for the costs of plan participation in order to foster participation from a wide range of collaborators. (This practice has allowed PRBO to contract with various partners in the development of species accounts and the plan itself.)
- Seek to submit the completed plan for peer review. For example, a review of the Riparian Bird Conservation Plan was published in Western Birds in 2001, which validated the value of the plan in tightening the link between science and "on-the-ground" management, and which called for greater transparency in showing assumptions upon which management recommendations are based to aid in generating hypotheses for testing through adaptive management[10].

Step b: Develop a Written/On-line Adaptive Conservation Plan

This step results in a written product: the Adaptive Conservation Plan (abbreviated ACP; some plans are called bird conservation plans or BCPs). The plan includes both analysis and synthesis of information developed for focal species and other issues in Step 1. A key facet of Adaptive Conservation Planning, however, is that the plan is available online and is updated regularly, incorporating the latest data, new findings and, at times, new analyses. Thus ACPs are dynamic "living" documents, reflecting the reality of the systems they seek to conserve.

- Subsequent to completion of the species accounts and other background information, hold a meeting of all participants in the ACP process to synthesize information, incorporate expert opinion, and conduct peer review.
- Develop a set of shared conservation priorities or goals. These priorities may include specific objectives for bird species, populations, or habitats as well as an emphasis on recommended land or ocean management practices to address identified stresses and threats.
- Identify assumptions and gaps in current understanding. Assumptions serve as hypotheses that can then be tested through implementation "on-the-ground" (at the project level). In this way, ACPs provide decision-makers and conservation initiatives with biological assumptions (models) in a timely manner, and these can be tested with ongoing monitoring [9].
- Designate a lead author whose job it is to further synthesize the data and information compiled in steps 1 and 2.
- Develop conservation recommendations for land or ocean managers that are designed to improve habitat conditions for wildlife, with an emphasis on current and novel information.

Step c. Disseminate and Incorporate Plan Recommendations

This step is crucial to the ACP's function as a means of "sharing learning." ACPs contain a wide variety of useful, often hands-on management, monitoring, and research recommendations that will benefit not only birds but also many other wildlife species. Despite the fact that these plans are available online, it takes time and a certain overcoming of inertia to ensure their adoption and widespread use by resource management agencies. ACP conservation recommendations can also improve the delivery of conservation through funding programs, both private and public (see Chapter 1, "Programmatic/Policy Applications of ACPs").

- Ensure adequate funding for both ACP plan printing and creation of CDs. Share these with key individuals and organizations. Above all, ensure access to the plan online!
- At the project level, the intent is that land or ocean managers seek to implement conservation and management recommendations from applicable ACPs.
- Collaborate with appropriate participants in the ACP development process to craft an outreach strategy appropriate to each resource management agency. For example, a key goal should be to incorporate ACP recommendations into resource management plans—as they are created or updated—at the local, state and federal levels. This may most effectively be accomplished through personal presentations and question & answer sessions. Presentations should seek to highlight information in the ACPs of most relevance to the agency/staff in question.
- Summarize, synthesize, and communicate scientific assessments and conservation recommendations to management agencies, conservation funders, local policy makers, local resource conservation advocates, and the public. This can be accomplished through a variety of means: sharing the ACP itself, media coverage, list-serves, etc.

- Work to improve conservation funding programs by ensuring that appropriate ACP recommendations are incorporated into program funding criteria.
- Work to improve conservation policies and laws by sharing appropriate ACP recommendations with lawmakers and their staff.
- Consider the goal of strengthening the citizen constituency for conservation and management of critical wildlife habitats by communicating conservation science priorities to the public.

Step d: Iteratively reassess and revise ACPs and site-specific management plans

Step d constitutes the feedback loop in the ACP process. As such, its purpose is to incorporate new or updated information and data into existing ACPs. Such data may take the form of expanded geographic coverage, greater understanding of a particular species or stress, or information concerning bird response to specific plan recommendations that have been implemented in the field. This step ensures that the ACP will remain a living document. The long-term emphasis is on revising conservation recommendations to ensure their efficacy and applicability.

- Track and incorporate new data available as a result of wildlife monitoring at the project level.
- Pool data in a central location to facilitate analysis.
- Analyze data (on bird species occurrence, reproduction, diversity, abundance, and survival) contributed from many sources.
- Revise plan recommendations and assumptions, as needed, based on results.
- Add focal species as necessary. For plans developed using a subset of focal bird species to define overall ecological requirements, the focal species list should (1) be directly linked to the defined conservation objectives and (2) include species that make good indicators for monitoring the results of management action.

Appendix 4 References

Please consult the references cited for Chapter 1.

Appendix 4. Case Study Interview Questions

PRBO Conservation Science:
"Developing and Implementing
an Adaptive Conservation Strategy"

Case Study Questions for Partners

1. Please provide your full name, title, address and telephone number, and a few salient facts about your position within your current agency and PRBO (for example, what is your role; how long have you been in this position; how did you begin working with PRBO?).

2. Could you tell me in your own words why you initially were interested in working with PRBO and what you believe have been the benefits to conservation?

3. Have any management changes occurred or management plans been developed as a direct or indirect result of PRBO monitoring data and management recommendations? Why or why not?

4. Would you be willing to provide a quote or two about your agency's relationship with PRBO and the value of that relationship to conservation?

5. In your mind, what are some of the incentives/advantages to other organizations (government and non-governmental) to work with PRBO? What are some of the disincentives/disadvantages?

6. If PRBO wanted to create incentives to encourage agency feedback concerning how bird data and management recommendations are used or incorporated into official resource management planning or policy documents, what would you recommend?

7. If you could choose one area in which PRBO or your agency's relationship with PRBO could improve, what would it be?

8. Anything else to add?

Appendix 5. Glossary of Terms and Acronyms

ACP – Adaptive Conservation Plan, a species, habitat, or ecosystem conservation plan, which pools data from many projects to develop conservation recommendations for practitioners at both the project and program levels. One of the two elements of an Adaptive Conservation Strategy (sometimes titled "Bird Conservation Plan.")

ACS – Adaptive Conservation Strategy; a conservation approach that consists of Adaptive Management at the site-specific level and, in addition, Adaptive Conservation Plans that provide a systematic means of synthesizing data, sharing learning, and influencing policy

adaptive management – a decades-old method of natural resource management that integrates design, management, and monitoring to systematically test assumptions in order to adapt and learn.

agency – a government organization or department at the local , state, or federal level with jurisdiction over natural resources (such as the USDA Forest Service or the California Department of Fish and Game).

BLM – U.S. Bureau of Land Management

CalPIF – California Partners In Flight

conservation management – any natural resource management undertaken for the purpose of conserving biodiversity, wildlife, landscapes, natural processes, ecosystems, or habitats. Conservation management is thus distinguished from, but often intertwined with, other types of natural resource management, such as commodity production or recreation management.

conservation scientist – a scientist trained to conduct monitoring or research of relevance to practitioners.

focal species – a group of species selected to represent the range of ecological ? within an ecosystem.

FWS – U.S. Fish and Wildlife Service

manager – one who manages natural resource projects or programs for conservation purposes; steward.

NABCI – North American Bird Conservation Initiative

NRCS – Natural Resources Conservation Service

partner – any organization or individual working as part of a team with one or more others in pursuit of common conservation objectives; partners usually bring some level of their own project support to an endeavor.

PIF – Partners In Flight

PRBO – PRBO Conservation Science (originally established as Point Reyes Bird Observatory)

practitioner – manager; conservation scientist.

science organization – an organization whose mission is to use the scientific method to produce data and recommendations that will further natural resource conservation

team – a set of individuals with complementary expertise, often from various organizations, working collaboratively and interdependently toward specific conservation goals.

USFS – USDA Forest Service