The San Francisco Bay Joint Venture Monitoring & Evaluation Plan

MEASURING CONSERVATION DELIVERY EFFECTIVENESS IN AN EVOLVING LANDSCAPE

Phase I - Section V: Riparian Landbirds

Developed by the San Francisco Bay Joint Venture Science Subcommittee

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V. Status & Trends - Riparian Landbirds

The San Francisco Bay Joint Venture (SFBJV) region contains riparian habitat essential for nesting, migrating, and wintering landbirds, and endangered salmonid species[1]. Riparian ecosystems are naturally resilient, provide curvilinear habitat connectivity, link aquatic and terrestrial ecosystems, and create thermal refugia for wildlife. For birds, riparian ecosystems are recognized as one of the most important habitat types in the West (RHJV 2004).

The total amount of riparian habitat within the SFBJV region has been severely diminished, and the condition of what remains is represented along a spectrum of highly compromised to relatively intact (Biodiversity Action Plan for Sonoma County 2010; Bay Area Open Space Council 2008; California's Wildlife Action Plan 2007). The impacts of climate change are projected to provide additional challenges for riparian-associated birds and other wildlife (Ackerly et al. in press).

In recent decades, stream and riparian restoration have increased dramatically in response to the loss and degradation of riparian habitat, the listing of imperiled salmonids, and water quality concerns in the region. In keeping with landscape connectivity, biodiversity, and specific landbird focused conservation goals, long-term monitoring data can help to:

- Assess conservation delivery effectiveness,
- Contribute to prioritizing stream and riparian systems for conservation actions, and
- Forecast and verify model projections on abundance and distribution shifts due to climate change and other threats and their impacts.

A limited number of site-specific riparian monitoring efforts currently exist in the SFBJV region (e.g. Gardali et al. 2010) but these are insufficient to evaluate past and ongoing SFBJV restoration and enhancement efforts and to guide future conservation and management. Hence, a clear strategy is needed to track regional population trends and evaluate their response to changing riparian habitat and environmental conditions.

In the context of the SFBJV's Implementation Plan goals (2001), this M&E Plan section will outline the initial components of a long-term creek and riparian-associated landbird monitoring and evaluation framework that ultimately addresses: 1) habitat extent and condition, 2) stability or sustainability of riparian systems and communities, 3) the health or fate of individual species, and 4) the effectiveness of our conservation delivery and management, in the context of existing SFBJV habitat acreage goals (SFBJV 2001), and the general conservation and management goals stated below. The aim of the M&E framework is to integrate as much as possible with existing projects, programs, and protocols, and engage and inform SFBJV partners in their continued work to manage, restore and enhance creek and riparian wetlands in the region in response to habitat loss and other threats (Figure 5.1).

[1] Salmonid species are addressed in the special status species section of this plan.

General Riparian Habitat Conservation and Management Goals:

- Maximize riparian habitat extent[1]
- Maximize conditions that contribute to riparian landbird abundance and species richness, riparian bird breeding success, and winter season riparian bird survival;
- Maximize riparian biodiversity;
- Minimize negative impacts from human disturbance;
- Minimize occurrence of invasive or nuisance species;
- Maximize adaptation/resilience to projected climate change impacts.

At this time, this Plan section is not designed to present a detailed monitoring program with schedules and protocols, data management specifics, and other concrete details. Instead it is to establish an overall framework that will provide general guidance to SFBJV partners in the assessment of habitat extent, and the status and trends of riparian landbird species as indicators of habitat condition, and the effects of SFBJV conservation, enhancement, or restoration implementation actions at the project, regional and Flyway scales. It also aims to develop a process to accomplish the integration with existing national and international networks such as Partners in Flight at Pacific Flyway and continental scales. More details will be developed throughout phase II of the M&E planning process.

This Riparian Land Bird Section Currently Provides:

- A set of prioritized monitoring and evaluation objectives addressing general questions of habitat quantity, SFBJV contribution, population abundance and species richness trends of riparian landbirds at the project and regional scales within the SFBJV region.

- A suite of prioritized and general recommendations for further research needs, monitoring and evaluation metrics, protocols, and data repositories for integration with existing monitoring and evaluation programs, as relevant to various target landbird species.

- Information on key partners and existing monitoring programs to integrate with or compare to.

Focus Team Process & Participants

In a series of in-person meetings and phone conferences, the riparian landbird focus team established focus-specific M&E and research objectives, relevant metrics, protocols, and data repositories, key partners, and existing programs for potential integration. All M&E Plan focus teams convened on May 26, 2011 for a daylong professionally facilitated workshop to vet and identify the top priorities of the identified monitoring, evaluation and research objectives. Focus team participants included:

Name	Affiliation
Demers, Jill	San Francisco Bay Bird Observatory
Doster, Rob	US Fish & Wildlife Service – Migratory Bird Program
Gardali, Tom	PRBO Conservation Science
Geupel, Geoffrey*	PRBO Conservation Science
Guldman, Sandy*	Friends of Corte Madera Creek Watershed
Huning, Beth	San Francisco Bay Joint Venture
Lorenzato, Stefan*	Riparian Habitat Joint Venture - DWR
Scoggin, Sandra	San Francisco Bay Joint Venture
Sloop, Christina	*Team Coordinator*, San Francisco Bay Joint Venture
Stevens, Phil*	Urban Creeks Council

*Participated in the prioritization of objectives at May 2011 workshop.

Focal Habitat & Species

The general focal habitat type is riparian. Habitat type extent will be mapped and periodically updated as outlined in Habitat Quantity- Net Landscape Change, section II. of this Plan. Further riparian classification by seral stage (early and late temporal stages in forest succession) is desirable. Additional classification should consider urban versus rural riparian areas, as these are likely to have somewhat different bird species communities, different environmental stressors, and hence different trajectories. Utilizing a riparian model (as part of the Bay Area Aquatic Resource Inventory, SFEI 2010) as the basis for characterizing habitat extent would allow fine-tuning of model parameters (e.g. tree height or sediment or rock inputs).

Riparian-associated focal species, and other landbird species (passerines and near-passerines) in the Bay Area are target organisms and habitat functional indicators. Focal species provide specific comparisons in time and place while other avian riparian species provide information on species richness or diversity, and indicate change patterns outside the focal species descriptions of habitat quality. Therefore, all species observed during monitoring activities should be recorded in order to have the most complete picture of the riparian landbird communities and to increase the knowledge of the distribution, abundance, and temporal variation of those species.

Performance Targets

The SFBJV Implementation Plan does not currently provide population targets for riparian-associated landbirds. Lack of population or performance targets is a

challenge to developing a Monitoring and Evaluation framework, and developing population targets for riparian-associated landbirds is a high priority.

Monitoring and Evaluation Objectives

Populations of landbirds that use riparian areas in the SFBJV region during the breeding season will be used to approximate overall condition of riparian areas and the well being of riparian bird species. Focusing on the breeding season overlooks critical periods within the annual cycle that have the potential to limit populations, or drive changes in population size. Additional seasons focusing on common songbirds should be added via citizen science volunteer engagement (e.g., eBird), and expanded further in the future, if financial resources are available.

Without identified population targets for riparian-associated landbirds in the SFBJV region, the following objectives outline a monitoring program that addresses the SFBJV's need to evaluate conservation actions within an adaptive management and evaluation framework.

Priority M&E Objectives and Associated Metrics, Protocols & Considerations

Summarized below are the highest priority M&E objectives the riparian landbird focus group identified based on several criteria:

1) Ease of implementation
2) Long-term importance;
3) A natural "early" step;
4) Usefulness for managing or modeling;
5) Ability to help manage JV "effectiveness"; and
6) Cost-effectiveness.

These criteria were assigned scores from 1-5 (lowest to highest value) by each participant. Final scores were averaged across participants and the top three priority objectives are listed here:

- **Priority M&E Objective 1[2]:** *Habitat Quantity and SFBJV Contribution.* Every five years, evaluate the net change in the extent (acreage) and distribution of riparian habitat types throughout the JV region, and determine the relative contribution of SFBJV activities.
    - *Metric:* Change in area of stream and riparian habitat extent
        - *Protocol:* Net Landscape Change analysis *(*GIS*,* bathymetry, Bay Area Aquatic Resource Inventory (BAARI) Riparian Habitat Model (SFEI, 2010))[3], and integrate with the upcoming State Wetland and Riparian Area Monitoring Program (WRAMP) protocols as much as possible)
        - *Consideration:* Riparian Habitat SFBJV serves as clearing house for riparian mapping protocol

[2] This objective links directly with prioritized objectives in the net landscape change section module.
[3] See Net Landscape Change section of this plan for more details.

- **Priority M&E Objective 2:** *Population Abundance Trends at Multiple Scales.* Annually (for first three years, then every three or five years depending on power analysis of initial three years of data, determine population size and density for focal and other important local breeding landbird species at the local and regional scales. Be able to detect declines or increases of 25% in short and medium term time frames at the regional scale and perhaps sub-regional scale, utilizing the following *metrics*:
    - Breeding season density or relative abundance of selected riparian focal species
    - Wintering season frequency of occurrence/relative abundance of selected riparian focal species
        - *Consideration:* Build upon existing projects and promote use of eBird by Audubon and other birders.
    - Frequency of data collection
        - *Consideration:* Surveys should be conducted at least 3 times during the breeding season and a minimum of 1 time during the non-breeding season or depending on specific questions assessed
        - *Consideration:* Track the fate of focal species outside the Bay Area as much as possible.

- **Priority M&E Objective 3:** *Species Richness at Project Scale.* Annually (for first five years, then every three or five years), evaluate declines or increases in species richness for focal riparian species at the Project scale. Assuming the site is a restoration site, surveys should begin pre-restoration or if not possible the year after planting and continue for a minimum of two, and ideally three consecutive years. Frequency after initial three years of monitoring will depend on the level of funding and project objectives. At best, a reference site or sites should be surveyed on the same schedule for comparison. The following *metrics* should be used:
    - Breeding season species richness
    - Wintering season species richness
        - *Consideration:* Utilize eBird to move beyond breeding season and develop target species richness estimates for riparian creeks.
    - Habitat/vegetation data
    - Frequency of data collection
        - *Considerations:* Surveys should be conducted at least 3 times during the breeding season and a minimum of 1 time during the non-breeding season or depending on specific questions assessed

- **Priority M&E Objective 4:** *Climate Change.*[4] Contribute monitoring data to data repositories which may be linked with other programs and the SF Bay JV project data base to enable larger-scale assessment of local changes across a broader climatic gradient and habitat project impacts.

[4] This objective links directly with prioritized objectives outlined in the climate change section module.

Recommended Metrics

Monitoring metrics should ideally be derived from established population targets, such as those set by Partners in Flight for priority species in the 2004 North American plan (Rich et al. 2005). Because there are currently no population targets for riparian-associated birds in the SFBJV region, broad metrics are recommended here, yet focal species assessments can also be used as a general indicator of habitat condition. Ultimately, the metrics used should lead to refining the monitoring program in a way that clarifies: 1) habitat condition, 2) stability or sustainability of riparian systems and communities, 3) the health or fate of individual species, and 4) the effectiveness of SFBJV conservation delivery and management. The measurements proposed below head us in this direction, but by themselves will not provide enough information to draw precise conclusions, highlighting the need for further research and monitoring program development.

The recommended metrics and associated objectives are as follows, and should be maintained as options, even after population targets are established:

- Habitat quantity – acreage by seral stage, if possible (Objective 1)
- Density – for as many species as possible derived from analysis that includes detection probabilities (Objective 2)
- Relative Abundance – for when an estimate of density cannot be obtained (Objective 2)
- Total number of species (species richness) (Objective 3)

We acknowledge that information on density, abundance, and community composition may be misleading indicators of habitat quality (Van Horne 1983, but see Bock and Jones 2004). However, other metrics such as fecundity and survival require substantial resources to monitor at small and large scales. Hence, they are not core recommendations for this plan. Further, no targets exist for demographic parameters at any scale. Should a project have sufficient funds, we recommend monitoring some measure of reproductive success and / or adult survival – see Information Needs/Research Priorities below.

Recommended Protocols

Protocols for estimating landbird density, abundance, and composition are well developed and typically only differ in small details. Similarly, analyses of these types of data are well developed.

Recommendations are made by geographic scale:

- Project – The Point Count method is recommended at the project scale. Several types of point count protocols exist, but survey methods that allow for estimation of detection probabilities are required. The Area Search or spot mapping for high-density species (e.g. Song Sparrow) method should be used for small sites (e.g., when fewer than 5 survey points can be accommodated).
- Sub-region – Recommendation is the same as at the regional level.

- Region – The Point Count protocol is recommended. Several types of Point Count protocols exist, but survey methods that allow for estimation of detection probabilities are required.
- Flyway/Continental – Recommending protocols for the Pacific Flyway and Continental scales is beyond the scope of this plan. However, our data on population sizes can contribute to any assessment toward evaluating the national targets (as defined by Rich et al. 2004). Further, we recommend contributing all data to the California Avian Data Center, which in turn provides data to larger scales (including global) via the Avian Knowledge Network. Finally, we support the continuation and addition of Breeding Bird Surveys Routes in the JV region.

General information on point count and area search surveys including example data forms can be found at the California Avian Data Center: http://data.prbo.org/cadc2/index.php?page=songbird-tools.

Research and Information Needs

Priority Research & Information Needs

Summarized below are the highest priority research needs the riparian landbird focus group identified at the 26 May 2011 workshop based on these criteria: 1) ease of implementation 2) long-term importance; 3) a natural "early" step; 4) usefulness for managing or modeling; 5) ability to help manage JV "effectiveness"; and 6) cost-effectiveness. These criteria were assigned scores from 1-5 (lowest to highest value) by each participant. Final scores were averaged across participants and the top three priority objectives are listed here:

Priority Research Need 1: *Assess Focal Species, Population and Riparian Acreage Targets*. Identify a suite of focal species and develop population targets for focal riparian breeding landbirds specific to the riparian habitats in the SFBJV region (see Chase and Geupel 2005), including species groups that occur in early- and late-seral stages by vegetation type and in urban and rural areas.

- *Consideration:* In concert with the development of population targets revise riparian acreage targets as well. Develop a system for monitoring the gain *and* loss of riparian acreage as outlined in the Net Landscape Change section of this plan. Confer with the RHJV to maintain consistency and transferability.

Priority Research Need 2: *Determine Targets and Monitoring Scheme for Vital Rates*. Develop a monitoring program that considers vital rates (reproductive success and annual survival). Vital rates provide a more direct measure of habitat quality and population dynamics than density alone. To verify that conservation actions are leading to healthy and resilient populations of focal species, survival and/or reproductive success should be measured and targets developed.

Priority Research Need 3: *Evaluate Human Disturbance Impacts.* Determine the impacts of anthropogenic disturbance to riparian landbirds. In particular, evaluate impacts from human

associated feral species, and the potential for restoration projects as an "attractive nuisance" providing corridors for predators and feral species, and "luring" wildlife into potential sink habitats.

Additional Research & Information Needs

Here we provide more recommendations for further research and information needs, as relevant to various target landbird species, to support the long-term effectiveness of SFBJV habitat conservation delivery.

HABITAT AVAILABILITY

- Forecast Change[5] – Evaluate future environmental change with a focus on climate change and development. In particular, model future impacts to riparian vegetation associated with flood management, water availability, sea level rise, and ecological restoration.
- Connectivity – Prioritize riparian areas that are providing important connectivity and/or have the potential to if restored. Riparian areas are the ultimate connectors and their protection and restoration will have benefits beyond landbirds.

TARGET SPECIES STATUS & TRENDS

- Focal Species Distribution/Habitat Suitability Maps - Develop regional predictive maps of current and future distribution/suitability for as many species as possible to inform conservation planning.
- Restoration Impact – Synthesize existing knowledge on riparian restoration efforts in the Bay and how bird populations have been affected.

ENVIRONMENTAL CHALLENGES

- Climate Change Indicators[5] – Conduct a vulnerability analysis to determine which riparian focal species are most vulnerable to the effects of climate change and recommend and/or ensure that those species are sufficiently monitored.[6]
- Population Pressures - Summarize population status and pressures for key focal species used to make habitat evaluations.

[5] This objective links directly with research objectives outlined in the climate change section module.
[6] Need to do this for all avian or special status taxa (not just riparian-associated landbirds) – see other M&E Plan sections.

Data Management

Collective standardized data sharing protocols should be developed for the SFBJV region and linked to existing relevant national databases. A useful way of collective data storing is to create a common metadata website that provides relevant information on the data, shows the spatial extent of the data on a map, data format and ease of transfer, and includes disclaimers about data availability and allowed uses. This approach lets data owners decide whether to post entire datasets, or to just provide their metadata information and allow others to request a full dataset directly from the source, specifying intended use. An existing portal for this proposed online forum is in development via the San Francisco Bay Conservation Commons. This metadata approach still allows datasets to reside in different databases, and after standard data conventions are developed and followed, will enable easy transfer. Development of clear protocols on the rights and responsibilities of data sharing will only help this process of collaboration.

Status monitoring data should be contributed or linked via metadata portals to online repositories, such as the California Avian Data Center (CADC; Ballard et al. 2008), which already supports the recommended protocols. Data can easily be made available via CADC and simple trend analysis tools are already in place.

Existing Monitoring Programs

There are currently no riparian landbird-specific SFBJV-wide monitoring programs in place. There are, however, some long-term and/or large-scale programs that should inform a riparian-associated landbird-monitoring program either by cross-validation, lessons learned, and or added value. These include:

- The Breeding Bird Survey – The Breeding Bird Survey (BBS) is an international program run by the USGS; it has been in operation in the Bay Area since 1968. There are only 9-10 survey routes in the nine counties, and they are all along roads and not habitat specific (habitat information is lacking). This program provides information on population trends for individual species during the breeding season.
- Christmas Bird Count – The Christmas Bird Count (CBC) is an international program run by Audubon; it has been in operation, at fluctuating levels of effort, in the Bay Area since 1915. There are a total of 18 CBC survey circles in the nine counties, but these are not habitat specific. This program can provide information on population trends for individual species during the winter period.
- Coyote Creek Field Station – The San Francisco Bay Bird Observatory operates constant-effort mist-net program. Operating since 1982, data standardized since 1987. Single site (33 acre) located on Reach 2 of the Coyote Creek in Santa Clara County. The site underwent riparian restoration in 1987 and 1993.
- Palomarin Field Station – PRBO operates mist-net program in operation since 1965 (data standardized since 1979) at a single site in Marin County. Palomarin has provided several trend assessments (Johnson and Geupel 1996, Chase et al. 1997, Gardali et al. 2000, Ballard et al. 2003).

- eBird – Not truly a monitoring program, the Cornell Lab of Ornithology citizen science program offers birders a means to upload their observations into the eBird database. Some quality control exists in the process and over time, with enough contributions, it may be possible to evaluate trends in occupancy and distribution of individual species and communities.
- Point Reyes National Seashore and Golden Gate National Recreation Area (NPS) – This PRBO and NPS survey was designed specifically for riparian-associated birds in these two national parks in Marin County. The survey uses two methods, point counts and mist-netting, to monitor changes in abundance for as many species as possible as well as to estimate reproductive success and survival (Gardali et al. 2010).

Key Partners

- PRBO Conservation Science – Can provide expertise on survey design at any scale, data collection, and data management, and analysis and interpretation.
- San Francisco Bay Bird Observatory – Can provide expertise on survey design at any scale, data collection, and data management and analysis.
- California Avian Data Center – Can provide data management tools, analyses, and access to several independent data streams.
- National Park Service – Recently developed a detailed riparian monitoring scheme as part of their Inventory and Monitoring program
- Bay Area Audubon Chapters - Data collection.
- USGS – Research and publications.

Next Steps - A Phased Approach

In this first planning phase, each M&E Plan focus section features priority objectives and references supporting information determined by the SFBJV science sub-committee. This information will be utilized in planning phase II to secure implementation funding for the outlined priority objectives, and as a basis for further Plan development to continue to refine and integrate the overall Plan objectives as our knowledgebase evolves. Phase III will evaluate and incorporate additional conservation goals and target performance objectives into an upcoming revision of the SFBJV Implementation Plan (originally released in 2001). We therefore consider the M&E Plan a "living document" that will change over time with continually refined and focused content. For more details on the planning phases, please refer to the Introduction & Overview section of this plan under *Planning Phases – A "Living Document."*

Future Challenges For Riparian Landbird Related Monitoring And Research Include:

- Linking effects of conservation delivery actions to target organism status.
- Determining appropriate management strategies and desired outcomes relevant to target habitats.
- Refining monitoring objectives with focus on measuring conservation or management action impact or progress against specified outcomes.
- Developing suitable performance targets and management thresholds.
- Identifying and implementing appropriate metrics (e.g., vital rates) that are relevant to the SFBJV and larger landscape scales (e.g., flyways).
- Maximizing integration with other regional and national landbird conservation initiatives.

References

Ackerly, David D., Rebecca A. Ryals, Will K. Cornwell, Scott R. Loarie, Sam Veloz, Kelley D. Higgason, Whendee Silver, Todd E. Dawson. Potential impacts of climate change on biodiversity and ecosystem services in the San Francisco Bay Area. Public Interest in Energy Research (PIER) 2011 report on Climate Change, California Energy Commission. *In press*

Ballard, G., G. R. Geupel, N. Nur, and T. Gardali. 2003. Long term declines and decadal patterns in population trends of songbirds in Western North America, 1979 – 1999. The Condor 105:737-755.

Ballard, G., M. Herzog, M. Fitzgibbon, D. Moody, D. Jongsomjit, D. Stralberg. 2008. The California Avian Data Center. [web application]. Petaluma, California. www.prbo.org/cadc. (Accessed: 24 March 2011).

Bay Area Open Space Council. 2008. San Francisco Bay Area Upland Habitat Goals - Preserving Biological Diversity for Future Generations. Methodology and Vegetation Representation Analysis. August 2008.

Biodiversity Action Plan for Sonoma County. 2010. Priority Actions to Preserve Biodiversity in Sonoma County. http://www.sonomalandtrust.org/pdf/Biodiversity_Action_Plan_2010_reduced.pdf

Bock, C. E., and Z. F. Jones. 2004. Avian habitat evaluation: should counting birds count? Frontiers in ecology and the environment 8:403-410.

California's Wildlife Action Plan. 2007. California Wildlife: Conservation Challenges. http://www.dfg.ca.gov/wildlife/WAP/docs/report/full-report.pdf

Chase, M. K., N. Nur, and G. R. Geupel. 1997. Survival, productivity, and abundance in a Wilson's Warbler population. The Auk 114:354-366.

Chase, M K. and G. R. Geupel**.** 2005. The use of avian focal species for conservation planning in California. p 130-142 *In* Proceedings of the Third International Partners in Flight conference, C.J. Ralph and T.D. Rich eds. USDA Forest Service Gen. Tech. Report PSW-GTR-191

Gardali, T., G. Ballard, N. Nur, and G. R. Geupel. 2000. Demography of a declining population of Warbling Vireos in coastal California. The Condor 102:601-609.

Gardali, T., D. Humple, M. Herzog, M. Koenen, D. Press, W. Merkle, and S. Allen. 2010. Riparian Landbird monitoring protocol for Golden Gate National Recreation Area and Point Reyes National Seashore: version 4.4. Natural Resource Report NPS/SFAN/NRR—2010/207.

Johnson, M.D., and G.R. Geupel. 1996. The importance of productivity to the dynamics of a Swainson's Thrush population. The Condor 98:133-141.

RHJV (Riparian Habitat Joint Venture). 2004. Version 2.0. The riparian bird conservation plan: a strategy for reversing the decline of riparian associated birds in California. California Partners in Flight. http://www.prbo.org/calpif/pdfs/riparian.v-2.pdf.

Rich, T. D., C. J. Beardmore, H. Berlanga, P. J. Blancher, M. S. W. Bradstreet, G. S. Butcher, D. W. Demarest, E. H. Dunn, W. C. Hunter, E. E. Iñigo-Elias, J. A. Kennedy, A. M. Martell, A. O. Panjabi, D. N. Pashley, K. V. Rosenberg, C. M. Rustay, J. S. Wendt, T. C. Will. 2004. Partners in Flight North American Landbird Conservation Plan. Cornell Lab of Ornithology. Ithaca, NY. Partners in Flight website. http://www.partnersinflight.org/cont_plan/ (VERSION: March 2005).

SFBJV Implementation Strategy. 2001. Restoring The Estuary. A Strategic Plan for the Restoration of Wetlands and Wildlife in the San Francisco Bay. Implementation Strategy for the San Francisco Bay Joint Venture.

SFEI 2011. BAARI Standards And Methodology For Stream Network, Wetland And Riparian Mapping manual, Wetland Regional Monitoring Program (WRMP), available at: http://www.wrmp.org/docs/SFEIMAPPINGSTANDARDS_01062011_v3.pdf; accessed May 17, 2011.

Van Horne, B. 1983. Density as a misleading indicator of habitat quality. Journal of Wildlife Management 47:893-901.

The San Francisco Bay Joint Venture is a partnership of public agencies, environmental organizations, the business community, local governments, and landowners working cooperatively to protect, restore, increase, and enhance wetlands and riparian habitat in the San Francisco Bay Watersheds. We bring an ecosystem and collaborative approach to developing and promoting wetland and riparian habitat conservation throughout the Bay Area.

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Nonprofit and Private Organizations

Bay Area Audubon Council
Bay Area Open Space Council
Bay Planning Coalition
Citizens Committee to Complete the Refuge
Ducks Unlimited
National Audubon Society
Pacific Gas & Electric Company
PRBO Conservation Science
Save the Bay
Sierra Club
The Bay Institute

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