MEASURING CONSERVATION DELIVERY EFFECTIVENESS IN AN EVOLVING LANDSCAPE

Phase I: Executive Summary

Developed by the San Francisco Bay Joint Venture Science Subcommittee
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Acknowledgements

Executive Summary

Plan Purpose

The San Francisco Bay Joint Venture (SFBJV) Monitoring and Evaluation Plan (M&E Plan) offers a 20-year region-wide monitoring and research framework to measure the effectiveness of SFBJV partner conservation delivery actions. The implementation of the M&E Plan will benefit and provide information and guidance to the regional SFBJV community, conservation and science partners, regulatory agencies, decision makers and funding institutions.

The M&E Plan will direct the systematic evaluation of the response of conservation targets, such as habitats and species, to SFBJV conservation delivery actions in the context of landscape scale environmental change. The resulting monitoring and research data will provide information upon which to base management, conservation planning, and policy decisions. The resulting data will increase understanding of the effectiveness of SFBJV partner conservation delivery in benefitting wetland habitats and associated target wildlife populations at various scales.

By addressing all North American bird conservation initiatives, the M&E Plan presents a first step in attempting to link project, regional, and continental scale assessments. The M&E Plan can serve as the initial force for the integration of efforts among Joint Ventures and partners, and highlights the importance of aligning metrics and methods to increase comparability and scalability across projects, regions and flyways. By linking conservation accomplishments to wetland ecosystem services provided to San Francisco Bay area communities, the M&E Plan can also provide evidence of the extended economic benefits of SFBJV conservation delivery.

Planning Process

The M&E Plan framework is being developed in a multi-stakeholder process in three planning phases. This Phase I document presents recommendations for implementing a suite of priority monitoring and research objectives for key conservation targets and stressors. Their completion will outline the net change in the extent and condition of wetland habitats and associated wildlife throughout the SFBJV region and highlight the associated SFBJV contribution. This will offer critical insight into habitat and wildlife responses to conservation actions and environmental change at a variety of spatial scales.

Over 70 scientists, resource managers, conservationists and regulators from more than 40 organizations, businesses and agencies have participated in this first phase of the SFBJV M&E planning process. Participants have compiled relevant information and prioritized objectives for focus themes presented in seven independent Plan modules (sections II to VIII in the document):

> *Habitat Quantity*
> 1) Net Landscape Change
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> *Habitat Function - Target Organism Status & Trends*
> 2) Waterfowl
> 3) Shorebirds and Waterbirds
> 4) Riparian Landbirds
> 5) Special Status Species
>
> *Environmental Challenge*[*]
> 6) Invasive Species
> 7) Climate Change

M&E Plan Content

Each individual M&E Plan section module features priority monitoring and research objectives, summarized in Tables E1 and E2. Main themes of these priorities include net habitat quantity and connectivity, target population abundance and distribution estimates, vulnerability to invasive and

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[*] Please note that *contaminant bioaccumulation* and *human disturbance* threats are addressed as part of relevant target organism focus sections.

nuisance species, human disturbance, and climate change impacts, as well as regional integration and centralization of data via shared online databases or meta-databases. Each module further provides supporting information on recommended metrics, protocols, key partners, existing programs, and data repositories.

At this time, Phase I does not offer specific monitoring and research schedules, in depth protocols, data management specifics, and other concrete details. Instead, it establishes an initial framework that will provide guidance to SFBJV partners in the assessment of habitat extent, and the status and trends of target species as indicators of habitat condition, impacts of major environmental threats, and the effects of SFBJV conservation, enhancement, or restoration implementation actions at the project, regional and flyway scales.

Importance of M&E Plan to SFBJV Conservation Partnerships

At a May 2011 M&E Plan vetting workshop, 45 SFBJV partners outlined the benefits they foresee the M&E Plan implementation will provide:

- Increased coordination that helps create efficiencies by working together;
- Bridging the gap between management and science: Making information & data transferrable and translatable between scientists and land managers;
- Building a foundation for linking existing databases via a central regional data (or meta-data) repository, and developing data collection standards, devising the best strategy on how to most effectively collaborate on data management;
- Developing clear regional wetland conservation goals, targets, and indicators with an outcome-based assessment framework that ties into existing regional planning structures;
- Focusing limited resources to answer the key conservation/restoration questions that are linked to local or regional conservation goals;
- Creating better integration across species or functional groups;
- Improved and standardized protocols for monitoring;
- Growing access to funding for monitoring;
- Increasing communication and collaboration with regulatory agencies;
- Integration with larger landscape conservation efforts, such as the California Landscape Conservation Cooperative.

Plan Benefits
As the result of a multi-stakeholder collaboration, the M&E Plan will aid increased local, regional, and national coordination, facilitate cooperation, and create efficiencies by identifying lead partners on priority objectives and programs. It will facilitate the completion of outlined monitoring objectives and scientific investigations aimed to inform conservation and management actions. It will allow for better

cross-disciplinary integration of applied science, and help focus data collection methods and create standardized datasets for easier comparison across scales, and straightforward transfer among managers and practitioners. It will facilitate steps to incorporate, or connect relevant data repositories, linking relevant datasets for analysis at the regional and national scales.

Outcomes of the M&E Plan will inform the design of regional decision support systems, and so further heighten communication and collaboration among scientists, resource managers and regulators. By creating a more streamlined and coordinated approach for assessment of multi-scale conservation status that informs local, regional, and national decision-makers, it will create better opportunities to procure funding support for the outlined monitoring activities and research. This will benefit all partners involved.

Next Steps
Phase I 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, utilizing the Conservation Measures Partnership's Open Standards for Conservation methodology[1] and Structured Decision Making (SDM). These approaches will help participants continue to refine and integrate the overall Plan objectives as our knowledgebase evolves. Planning Phase III will then incorporate the resulting refined conservation goals and target performance objectives into an upcoming revision of the 2001 SFBJV Implementation Plan. We therefore consider this M&E Plan a "living document" that will change over time with continually developed and focused content.

Future M&E Plan Phases Will Address:

- Securing opportunities for funding & implementation of prioritized Phase I objectives;
- Developing outcome-based objectives relevant to target habitat and organism conservation strategies;
- Setting performance criteria that are currently not yet defined for most target organisms;
- Evaluating the effect of habitat conservation delivery on target species population status;
- Using appropriate metrics (i.e. vital rates) to scale up to flyway and continental estimates;
- Establishing a better integration with other monitoring and evaluation frameworks.
- Expand the scope of the M&E Plan to include a more detailed consideration of habitat transition zones, subtidal habitats, and ecosystem services.

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[1] http://www.conservationmeasures.org/

Table E1: Overview of Prioritized M&E Objectives

	Priority M&E Objective 1:	Priority M&E Objective 2:	Priority M&E Objective 3:
Net Landscape Change	*Net Change in Habitat Quantity.* Throughout the SFBJV region, evaluate the net change in the area of wetland habitat types at regular time intervals. Also assess habitat change in the context of specific target species or functional group use.	*SFBJV Contribution to Habitat Gain and Connectivity.* At regular intervals, a) evaluate the relative acreage contribution of SFBJV projects to the extent of suitable habitat types; and b) determine the level of landscape scale connectivity between habitat types and assess nearest neighbor relationships of habitats situated in proximity to each other across the region.	*Habitat Condition.* At regular intervals, assess regional wetland habitat type condition relevant to supporting target organism needs, utilizing protocols that allow maximum comparability with other regional efforts
Waterfowl	*Habitat Quantity & SFBJV Contribution.* Every five years, evaluate the net change in the extent and distribution of diving and dabbling duck habitats throughout the SFBJV region, and evaluate the regional contribution and effect of SFBJV projects and habitat restoration/enhancement to suitable habitat use by diving and dabbling ducks, respectively.	*Waterfowl Distribution and Abundance.* Every three years, map and evaluate the winter habitat utilization, species composition, distribution and abundance status and trends of diving and dabbling ducks by habitat type throughout the SFBJV region. To do so, continue to support and expand existing, and implement new abundance surveys of wintering waterfowl as appropriate.	*Human Disturbance; Project & Regional Scale.* Annually (for first five years, then every three or five years) evaluate the levels of anthropogenic disturbance in spatially representative high value areas for diving and dabbling ducks where public access occurs; evaluate impacts to roosting and foraging from disturbance and frequency by watercraft, trail use, noise, etc.
Shorebirds and Waterbirds	*Habitat Quantity & SFBJV Contribution.* Every five years, evaluate the net change in the extent and distribution of shorebird and waterbird habitat types throughout the SFBJV region, and determine the relative contribution of SFBJV activities.	*Species Composition & Wintering Population Trend Estimates.* For the next 10-20 years, support, continue, integrate and expand as appropriate, ongoing (project-scale, e.g., pond surveys at species or guild level), and recently implemented Pacific Flyway Shorebird Survey (PFSS; regional & flyway scale) annual abundance surveys of wintering shorebirds.	*Population Trends – Breeding Birds; Regional-Scale.* Continue and/or establish a 10-20 year breeding shorebird and waterbird monitoring program in the SFBJV region to assess the number and success of breeding birds per year.
Riparian Landbirds	*Habitat Quantity & 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.	*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.	*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.
Special Status Species	*Regional Status Database with Report Template & Decision Support Capability.* Over the next 5-10 years, develop and maintain a regional open access focal special status species monitoring data repository with online reporting templates for easy use as regional decision support tools. To be utilized by existing special status species status monitoring programs.	*Habitat Quantity & SFBJV Contribution.* Every five years, determine how much focal special status species habitat is available by evaluating the net change in area of species-specific habitat types throughout SFBJV region, and determine the relative contribution of SFBJV activities.	*Presence/Absence/Distribution Inventory.* Annually (or as appropriate) over the next 10 years, assess project-specific and regional special focal status species population size, presence/absence and distribution trends. Utilize open access database for data repository, analysis, and decision support.
Invasive Species	*Pre- and Post-Implementation Monitoring of Target Invasives; project scale.* Implement pre- and regular post-implementation surveys of SFBJV project and neighboring sites, for the EDRR of target invasive or nuisance species from lists determined by a coordinated SFBJV region partnership effort.	*Success Monitoring to Evaluate Control Efficacy.* Monitor the efficacy of existing control methods in an adaptive management framework at the project scale. Determination of which treatments are effective, and at what costs or impacts, will help managers choose the most effective and methods to target any given invasive or nuisance species.	*Long-term Monitoring of Extant Target Invasives & Nuisance Species* Implement regular surveys of SFBJV project and reference sites to assess the distribution, abundance and spread of established populations of recognized target invasive or nuisance species and, delineate "clean areas." Prioritize management actions to keep "clean" areas free of invasives. This should be integrated with existing monitoring frameworks as much as possible. Regularly evaluate and prioritize species for control/eradication treatment.
Climate Change	*Identify Climate-Sensitive Indicators and Define and Standardize Key Monitoring Metrics.* Develop wetland type specific conceptual models that articulate the key processes climate change will affect and help define hypotheses to monitor and evaluate impacts. Utilize existing indicator suites, or identify novel climate-sensitive indicators and define relevant key abiotic and biotic metrics to assess climate-related changes affecting regional ecosystems. Define and standardize related key metrics to measure long-term condition trends and impacts in real-time, and to utilize as empirical inputs to obtain well calibrated model outputs.	*Collect Empirical Data for Wetland Ecosystem Vulnerability Analyses.* Monitor environmental drivers and their impact on climate-sensitive indicator species and SFBJV target organisms for use in vulnerability analyses. Evaluate vulnerability via exposure and sensitivity assessments and consider adaptive capacity of indicators. Every five years, monitor and evaluate projected changes in habitat suitability due to climate change impacts for indicator species and/or SFBJV target organisms.	*Monitor Sea Level Rise, Salinity, and Sediment Dynamics and Spatial Extent of Habitat Types.* a) Monitor sea level rise and related salinity change magnitude, timing and variability, and sediment dynamics at key areas throughout SFB, and in SFBJV region coastal estuaries. This should include estimation of suspended sediment concentrations and bedload transport rates at mouths of tributaries, and accretion or erosion rates of geomorphic surfaces, and determination of the rate of organic and sediment accretion in natural and restored marshes compared to the rate of sea level rise. b) Every five years, in conjunction with net landscape change analysis, evaluate the net change (gains & losses) in spatial extent of SFBJV region wetland types, with a goal to track long-term changes due to climate change induced drivers. Use data to model future geomorphological changes that may be a result of climate change drivers.

Table E2: Overview of Prioritized Research Objectives

	Priority Research Need 1:	Priority Research Need 2:	Priority Research Need 3:
Net Landscape Change	*Regional Historic Datasets.* Develop or acquire appropriate geo-referenced datasets of wetland extent prior to 2010, not covered by the Bay Area Aquatic Resource Inventory, National Wetland Inventory (NWI, USFWS [1972-2007]), National Hydrography Dataset (NHD, USGS [varies]), EcoAtlas Modern (SFEI [1997]), and EcoAtlas Historical (SFEI [c. 1850]).	*SFBJV Database Enhancements.* Expand SFBJV project database for landscape change metrics and GIS capabilities, and integrate with BAARI in order to allow net change reporting in database interface.	*Habitat Hot Spots & Connectivity; Regional Scale.* Determine and map habitat type extent and outline hotspots for target organism use. Evaluate the level of connectivity between habitat types considering adjacent, linked, similar, identical habitat types across the region.
Waterfowl	*Habitat Use.* Radio-tag individuals of target species to investigate relative use of specific habitat types over time throughout the SFBJV region.	*Flyway Scale Dynamics.* – Impacts from Outside SFBJV Region. Within the context of annual life cycle modeling, assess the impacts of breeding, survival, and migration dynamics occurring outside the SFBJV region to SFB wintering population abundance and health. This may be investigated cooperatively with the National Science Support Team to the North American Waterfowl Management Plan.	*Diving Duck Carrying Capacity; Regional Scale.* Continue, expand and improve current modeling work of SFB diving duck species carrying capacity to incorporate other areas and prey sources in the estuary to improve habitat carrying capacity estimates. This work should also be expanded from main target species to other diving ducks throughout the SFB area as well as for target dabbling ducks.
Shorebirds	*Regional Hot Spots and Threats Assessment.* a) Determine shorebird hotspot characteristics (i.e. abiotic factors) and locations and the level of connectivity between habitat types (utilized for foraging, roosting, and nesting & chick rearing) situated in proximity to each other across the region. b) Identify major threats to shorebirds at identified hot spots by evaluating impact of highways, power lines, development, other human disturbance, and predator distribution and abundance on adult, nest and brood survival.	*Regional Restoration Impact on Wetland Birds.* Synthesize existing knowledge on wetland restoration efforts in the SFBJV region and evaluate how shorebird populations have been affected.	*Landscape Change Impacts - Shorebird Vulnerability and Habitat Suitability.* a) Implement landscape-scale models that incorporate habitat type and landscape covariates to predict avian response to changes in land use, climate change, and restoration and habitat evolution scenarios. b) Model predicted changes in habitat suitability given scenarios of projected changes in land use, climate change, and restoration and habitat evolution. Utilize information gained to protect, restore, and enhance areas that will remain or likely become important bird areas in the future.
Waterbirds	*Climate Change – Sea Level Rise (SLR) Impacts on Target Species and Ecotones. a)* Evaluate and model the changes in predation risk, habitat & food resource availability/accessibility, water level and tidal dynamics, and other projected impacts to waterbirds from sea level rise. b) Evaluate the effects of marsh ecotone restoration projects on birds that require high-tide refugia (e.g., rails).	*Causes of Target Species Population Decline & SFBJV Impact on Recruitment.* a) Conduct a meta-analysis to determine what the potential causes of regionally declining waterbird populations are, and design coordinated studies to address the most likely threats. b) Evaluate the effects of land uses changes due to SFBJV restoration and enhancement projects on waterbird nesting success and chick survival in the region.	*Regional Protocol Standardization and Alignment with National Protocols.* Evaluate and standardize local waterbird survey protocols currently used by various groups in the SFBJV region, and align procedures as much as possible with those outlined in available national or continental protocols.
Riparian Landbirds	*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, including species groups that occur in early- and late-seral stages by vegetation type and in urban and rural areas.	*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.	*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.
Special Status Species	*Projected Habitat Loss and Conversion Trends.* Evaluate special status species-specific scenarios of expected future wetland-type loss or conversion due to sea level rise, development, restoration and other likely land use changes. • Model impacts of continued habitat loss and conversion on special status species; • Model impacts of habitat conversions for specific benefit to special status species on other species.	*Climate Change – Regional Impacts.* Evaluate the projected impacts to special status species persistence from climate change. Assess and monitor effects of sea level rise & other projected impacts on relevant special status species (e.g., endangered tidal marsh species).	*Invasive or Nuisance Species Impact; Regional Scale.* Determine the effects of invasive or nuisance species (i.e. invasive Spartina, California Gull, red fox, raccoons, feral cats, etc.) on relevant special status species.
Invasive Species	*Occurrence Lists & Range Maps of Extant Invasive or Nuisance Species.* Develop & maintain up-to-date habitat-specific lists and distribution maps of target invasive species already extant at SFBJV project wetland types or in adjacent areas.	*Impacts on Natives & Ecosystem Processes.* Investigate how specific invasive species affect native fauna and flora and the key ecosystem services we want wetlands to provide at SFBJV projects sites and throughout the region.	*Occurrence Lists of Expected Invasive and Nuisance Species.* Develop and maintain habitat-specific or geographically focused lists of target invasive or nuisance species expected to colonize at project and regional scales.
Climate Change	*Impacts of Climate Drivers on the Evolution of Restored Wetland Habitats.* a) Assess the potential impacts of various projected climate change scenarios on restoration-related habitat evolution, (e.g., in the context of long-term trajectories of restored tidal marsh and riparian habitats, and the consequences of expected vegetation change for wildlife; or projected vegetation migration patterns in habitat transition zones, and within-zone shifts in plant communities due to salinity changes. b) Determine how accurately regional sediment (inorganic component) and marsh accretion (organic component) models predict net accretion & erosion rates in individual marshes in the SFBJV region. As needed, design improvements in sediment data collection and/or analysis. Determine the sediment budget for different sections of SFB and relevant coastal estuaries. Conduct long-term status and trend monitoring of sediment dynamics.	*Vulnerability Assessments of Target Organisms and Indicators.* Perform vulnerability assessments to assess impacts of climate drivers on population processes, sustainability, and connectivity of target or indicator species: determine which species are most vulnerable to the effects of climate change, and ensure that those species are sufficiently monitored. Incorporate demographic impacts (e.g., reproductive or nest success, overwinter survival). Do this for all target groups in the SFBJV region (waterfowl, shorebirds & waterbirds, riparian land birds, special status species, other key indicator species).	*Importance of Ocean-Estuary Linkages to Tidal Wetland Resilience;* Assess the dependence of tidal wetland resiliency on estuary-ocean linkages beyond SLR effects on marsh flooding and sediment dynamics: *Larval Exchange, Freshwater Runoff & Tidal Range, Influx of Upwelled & Acidified Water Impacts*

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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