

## North-central California Coast and Ocean Climate-Smart Adaptation Project

Project Partners: *Bay Area Ecosystems Climate Change Consortium (BAECCC), California Landscape Conservation Cooperative (CA LCC), EcoAdapt, Farallones Marine Sanctuary Association (FMSA), Golden Gate National Recreation Area (GGNRA), Gulf of the Farallones National Marine Sanctuary (GFNMS), National Park Service Pacific West Region, Point Blue Conservation Science, and Point Reyes National Seashore*

### **Background:**

The North-central California coast and ocean is a globally significant, extraordinarily diverse, productive marine and coastal ecosystem that is home to abundant wildlife, valuable fisheries, two national marine sanctuaries and two national parks. It is a treasured resource of the San Francisco Bay Area's seven million residents that rely on this unique marine ecosystem for their livelihoods and recreation. It provides breeding and feeding grounds for at least 25 endangered or threatened species, including blue, fin, sperm, and humpback whales and one of the southernmost U.S. populations of threatened Steller sea lions. This area is especially important to approximately 350,000 wintering shorebirds, seabirds, and waterbirds, and many fish species including sturgeon, halibut, endangered Coho Salmon, and the commercially important Pacific Herring, that rely on creeks and extensive eelgrass beds to spawn. Significant coastal areas, including Tomales Bay, Bolinas Lagoon, and Esteros Americano and San Antonio, support a diversity of habitats, including eelgrass beds, intertidal sand and mud flats, and salt and freshwater marshes that provide numerous ecosystem services such as carbon sequestration, flood control and improved water quality (GFNMS 2008).

In 2009, the Gulf of the Farallones and Cordell Bank Sanctuary Advisory Councils recognized the importance of understanding climate change impacts to sanctuary resources, and called for the formation of a working group of local scientists from 16 agencies, organizations, and institutions to assess and downscale global climate change information into a regional climate change survey for north-central California coast and ocean ecosystems. The resulting [Climate Change Impacts Report](#) (Largier et al. 2010) documents recent observations and potential impacts, including: observed increase in surface ocean temperature offshore of the continental shelf; observed increase in extreme weather events (winds, waves, and storms); expected decrease in seawater pH due to uptake of carbon dioxide by the ocean; observed northward shift of key species (including Humboldt squid, volcano barnacle, gray whales, and bottlenose dolphins); possible shift in dominant phytoplankton (from diatom to dinoflagellate blooms); and the potential for effects of climate change to be compounded by parallel environmental changes associated with local human activities. This document serves as a robust, peer-reviewed, and scientifically sound foundation for climate adaptation planning. Recommendations from this report include the reduction of manageable stressors to enhance ecosystem resilience and the creation of policies and management strategies to minimize future impacts.

In response to the recommendations and final report, the GFNMS Climate-Smart Conservation Program, in partnership with FMSA, was begun as an effort to integrate adaptation planning, as well as monitoring, mitigation, and climate change education, into sanctuary management. To date, a Green Operations (mitigation) plan and an Ocean Climate Indicators Monitoring Inventory and Plan have been developed, and a Climate Communications Plan for

the sanctuary is planned. The next phase of the Climate-Smart Conservation Program is to implement the North-central California Coast and Ocean Climate Smart Adaptation Project.

## **Project Components:**

### **Phase 1 – Vulnerability Assessments and Ecosystem Services Valuation**

#### I. Identify scope of adaptation project

Project Coordinator, Sara Hutto, and Project PI, Kelley Higgason, spent several months reviewing literature specific to climate change adaptation planning processes, and brought together key GFNMS staff (including the research coordinator, resource protection coordinator and superintendent) in August 2013 to develop the geographic and temporal scope of the adaptation project, and to define the project goals.

#### II. Develop draft list of focal resources for the North-central California coast and ocean

Staff and project partners developed a draft list of focal resources (species, habitats, and ecosystem services) from internal planning documents (including the GFNMS Condition Report and Management Plan) and external research to be used in the selection of final focal resources during Stakeholder Workshop 1.



#### III. Convene Project Planning Committee

A planning committee of project partners, including Point Blue, EcoAdapt, NPS, CA LCC, BAECCC and GFNMS was convened in September 2013. The Committee has held two meetings thus far to advise workshop design and organization and to help develop workshop materials. The committee will continue an advisory role throughout the project, as well as help prepare information packets for the Vulnerability Assessment Workshop (including data from online tools such as Our Coast–Our Future and InVEST ecosystem services valuation), and review workshop outcomes.

#### IV. Conduct 2 stakeholder workshops: 1) Focal Resources, 2) Vulnerability Assessments.

Following the successful model developed by EcoAdapt for the Sierra Nevada Adaptation Project, Focal Resources Workshop attendees will finalize the draft list of North-central California coast and ocean focal resources using a set of evaluation criteria (deliverable 1), and identify information needs for the vulnerability assessments. Vulnerability Assessment

Workshop attendees will develop management goals and objectives for the final focal resources, assess vulnerability to climate change impacts using supporting data and information prepared by the Workshop Planning Committee (deliverable 2) and use the [Yale Mapping Framework](#) to identify appropriate spatial analysis to achieve the project goals. The Yale Framework enables resource managers to choose appropriate modeling strategies depending on the adaptation objectives and level of ecological analysis, and effectively helps to direct all future adaptation actions.

## **Phase 2 – Climate-Smart Working Group and Adaptation Implementation**

### **V: Convene Climate-Smart Adaptation Working Group**

Based on expertise and jurisdictional boundaries, a sub-set of representatives from local, state, and federal agencies, non-profit organizations, and academic institutions that participated in the stakeholder workshops will be invited to serve on a Climate-Smart Adaptation Working Group that will meet 3-4 times over the course of 1 year. The working group will: 1) define distinct climate scenarios for the study region and 2) develop prioritized adaptation recommendations.

### **VI. Climate-Smart Adaptation Working Group define climate scenarios**

Staff and Point Blue Conservation Science will summarize vulnerability assessment results and compile climate projections and anticipated impacts for a climate change profile of the study region. The purpose of the climate profile is to “develop a shared understanding of where the greatest uncertainty lies” (Moore et al. 2013) and to bring all working group members up to speed on what is known and what is unknown regarding projected climate impacts in the study region. Working group members will then define distinct scenarios (deliverable 3) for the study region based on the most uncertain climatic and non-climatic drivers of change (based on the climate change profile) and the most important (greatest impact) climatic and non-climate drivers of change (based on vulnerability assessments). Scenario planning is used to overcome climate uncertainty by focusing on important and uncertain climate impacts to develop adaptation actions for multiple, plausible climate futures (Moore et al. 2013).

### **VII. Climate-Smart Adaptation Working Group develop adaptation actions**

Staff and Point Blue will summarize the developed climate scenarios and create discussion templates modeled after the “Futures of Wild Marin” workshop (Moore et al. 2013), to aid the working group in brainstorming adaptation actions. Based on National Wildlife Federation and Point Blue Climate-Smart Conservation Principles, and using the developed scenarios as a framework, working group members will: 1) define criteria for prioritization of adaptation actions (e.g. feasibility, cost-effectiveness, climate-smart, collaborative); 2) brainstorm potential management actions for each climate scenario (in an iterative process, which may result in further revision of scenarios); 3) evaluate and prioritize brainstormed actions using defined criteria; and 4) identify specific actions that are currently occurring or may be implemented immediately as pilot adaptation responses. The working group chair and project coordinator will present the final recommended actions (deliverable 4) to the GFNMS Sanctuary Advisory Council and request approval. These recommendations will be forwarded to the sanctuary superintendent as well as other coastal resource management agencies in the region for consideration in their current or future adaptation planning efforts such as GGNRA, PRNS, California State Parks, and Counties of San Mateo, San Francisco, Marin and Sonoma.

### VIII. Develop Adaptation Implementation Plan

Based on the approved adaptation actions staff, in consultation with the GFNMS superintendent and project partners, will develop an Adaptation Implementation Plan (deliverable 5) including a summary of approved adaptation actions, implementation prioritization and schedule, and participating partners.

### IX. Design pilot Green Resilient Shorelines Adaptation Projects

Staff, in consultation with the GFNMS superintendent and project partners, will design 2-4 pilot Green Resilient Shorelines (GRS) adaptation projects as a subset of the recommended adaptation actions for the study area, including: implementation and construction time line, project costs, monitoring plan, and outreach plan (deliverable 6). GRS projects will help achieve the strategic goal of the Bay Area Ecosystems Climate Change Consortium, which has identified GRS as the current focus of an effort to promote a regional approach and alliance to wetlands restoration. Examples of potential GRS projects include: restoring the hydrologic function and floodplain in Bolinas Lagoon by road and levee removal to allow upland migration of the lagoon; building causeways over key coastal drainages to allow upland migration and address flooding in the lagoon; working with farmers to restore the upland floodplain and allow deposition of sediment in fields instead of in the lagoon; and seagrass restoration and expansion in Tomales Bay to provide increased habitat and carbon sequestration.

### **References:**

Largier, J.L., B.S. Cheng, and K.D. Higgason, editors. 2010. *Climate Change Impacts: Gulf of the Farallones and Cordell Bank National Marine Sanctuaries*. Report of a Joint Working Group of the Gulf of the Farallones and Cordell Bank National Marine Sanctuaries Advisory Councils. 121pp.

Moore, S.S., N.E. Seavy, and M. Gerhart. 2013. Scenario planning for climate change adaptation: A guidance for resource managers. Point Blue Conservation Science and California Coastal Conservancy.

NOAA Gulf of the Farallones National Marine Sanctuary Final Management Plan. 2008. Volume II of IV. 451 pp.