CALFED Progress Report
California Sea Grant College Program

ConfirmationNumber 20100301142350

ProjectYear_2A 1st **ProjectNo_2C** R/SF-28

Printed: 3/1/2010 2:26:20 PM **TypeQuestionnaire_2B** Interim Questionnaire

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Project Information

ProjectNo_2C R/SF-28 **StartDate_3a** 9/1/2007 **EndDate_3b** 8/31/2010
ProjectTitle_4 Tidal wetland vegetation response to climate change in the San Francisco Bay: predictive modeling for species distributions in a changing environment

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Additional Research Mentors and Community Mentors

Additional Research Mentors_8

Additional Community Mentors_9

Dr. Drew Talley, University of San Diego

Project Objectives: Please type your responses, and answer the questions in a style appropriate for laymen.

ProjectObjectives_10

Objective 1. Through intensive vegetation sampling tied in with elevation surveys and measures of inundation depth and duration, I plan to determine the lower elevation limits of dominant plant species across all habitat types and document patterns in inundation regime and salinity ranges within monospecific and assemblages of dominant species.

Objective 2. Through field transplant experiments, I will examine how dominant species from freshwater, brackish, and salt marshes respond to increases in salinity and inundation when transplanted to marshes with higher salinity and into low marsh regions both within its current site and sites with higher salinity.

Objective 3. Through a greenhouse experiment, I will measure the performance of individual dominant species and one common invasive species from salt, brackish, and freshwater marshes under a variety of salinity and inundation regimes. Inundation regimes will be based on current and predicted water levels under climate change scenarios. Data collected will provide parameters for species and habitat distribution models.

Objective 4. Using existing spatially explicit species distribution models, I will model the potential niche of each of the target species, conditioned by salinity, inundation, elevation, and land use parameters derived in Objectives 1 through 3 for current Bay-Delta conditions and predicted climate change scenarios.

Summary of progress in meeting each of these goals and objectives

ProgressSummary_11

Objective 1. Vegetation and elevation surveys began in September 2007 and will be completed during the summer of 2010. Water level monitoring stations have been installed at all six field sites in the summer of 2008; however, not all sites have complete data sets due to vandalism and equipment malfunction.

Objective 2. A preliminary transplant experiment was initiated in March 2008. The experiment was not successful due to a variety of reasons. A new methodology will be employed in March 2010 based on insight from the preliminary experiment and advice from PhD dissertation committee members.

Objective 3. The greenhouse experiment will be initiated in April 2010, and modified to incorporate soil seed bank response to changes in salinity and inundation.

Objective 4. Spatial data are currently being collected. Spatial modeling will begin in Fall 2010 when the 2010 field season is complete.

PROJECT MODIFICATIONS: Please explain any substantial modifications in research plans, including new directions pursued. Describe major problems encountered, especially problems with experimental protocols and how they were resolved. Describe any ancillary research topics developed.

Modifications_12

The proposed transplant experiment was determined to not be the most effective way at measuring the effects of increased salinity and inundation on tidal wetland plants species in the field based on a preliminary experiment that was initiated in Spring 2008. A modification to the experiment will be implemented in Spring 2010, which will incorporate the methodology of Dr. James Morris called the 'marsh organ'. Plants collected from a freshwater site will be planted into large, long PVC pipes that are positioned at three fixed heights in a wooden structure. One height will represent the current average elevation of the species and two lower heights will simulate effects of increased inundation. Multiple structures will be made and placed into channels within both the native tidal marsh site and two sites with higher salinity levels. The height of the structure will be adjusted in each channel to obtain the appropriate elevations. Only two dominant plant species will be examined in order to guarantee appropriate sample sizes and statistical power. This methodology will allow me to examine effects in increased inundation and salinity on plant growth under field conditions while reducing the potential for plant death due to transplantation effects alone.
There will also be modification made to the greenhouse experiment to make the project applicable to a broader audience. SEE ADDITIONS SECTION FOR MORE TEXT.

BENEFITS AND APPLICATIONS: Suggest the relevance of these new findings to management. Describe any accomplishment, that is significant effects your project has had on resource management or user group behavior. CALFED is looking for "management cue" (see http://science.calwater.ca.gov/pdf/soemgmtcues.pdf).

BenefitsApplic_13

The results from this proposed research will be many. First, a greater understanding of edaphic factors driving current species distributions will be produced. I will document species distributions along salinity, elevation, and inundation gradients, which will aid in restoration planning for resource managers and policy makers. Second, comprehensive data on species responses to altered salinity and inundation regimes will be produced, which will provide critical parametization of climate change models for the Bay-Delta and other Pacific coast watersheds. Additionally, understanding how species respond to changes in their physical environment is critical for predicting changes in species assemblages. Third, I will collaborate with my faculty and community mentors to generate scientifically valid models of dominant plant species occurrence and predicted habitat changes throughout the Bay-Delta under various climate change scenarios. The model outputs will benefit multiple agencies. Fourth, I will actively promote and disseminate the findings of this research to policy makers, resource managers, academics, and the general public in order to raise awareness of how predicted climate change will affect local tidal marsh communities. As an example of outreach, I will create a

webGIS of the data produced and of the model outputs.

PUBLICATIONS: List any publications, presentations, or posters that have resulted from this funded research. Give as many details as possible, including status of paper (e.g., in review; in press), journal name, conference location and date of presentation. Please note (as outlined in the conditions of the award) that each fellow is required to submit an abstract for an oral or poster presentation at each State of the Estuary conference and CALFED Science Conference during the duration of the fellowship.

Publications_14

No publications have resulted from the research thus far. I am in the process of writing a review paper discussing the importance of incorporating a landscape perspective when studying wetlands, which will be the basis for the introduction to my dissertation research. It will be submitted to the journal Wetlands in April 2010.
I attended the State of the Estuary conference in 2009 and presented a poster, but the research was not from my dissertation project. Due to the stop-work order and subsequent lack of funding during the 2009 field season, I did not have any data from my dissertation research to present. I will present the results from my 2010 field season at the CALFED Science Conference in 2010.

COOPERATING ORGANIZATIONS: List those agencies and/or persons who provided financial, technical or other assistance to your project since inception. Describe the nature of their collaboration.

CoopOrganiz_15

I have received logistical support for field work from faculty and staff at San Francisco State University and University of San Francisco. Staff at PRBO Science have assisted me with planning and initiating the spatial modeling aspect of my project. The Northern California Botanists society awarded me a small research grant in 2008 that support a small field work campaign in 2009 to maintain the water level stations installed at my field sites. Drs. Wayne Sousa, Whendee Silver, John Callaway, and Katharine Suding have assisted me in designing legitimate experimental designs and have aided me in planning for my 2010 field work season.

AWARDS: List any special awards or honors that you, or mentor or members of the research team, have received during the duration of this project.

Awards_16

No awards or honors have been received since the inception of this project.

KEYWORDS: List keywords that will be useful in indexing your project.

Keywords_17

San Francisco Bay Estuary, climate change, tidal wetland vegetation, inundation regime, species distribution modeling

PATENTS: List any patents associated with your project.

Patents_18

There are no patents associated with this project.

Additions: Additional information can be added here. Please begin the text with the number of the question you are adding to.

Additions_19

CONTINUED FROM PROJECT MODIFICATIONS: The details of the experiment are being determined currently and likely will incorporate effects of increased salinity and inundation on soil seed banks in addition to mature plants. The number of species examined will be reduced in order to obtain sufficient replication and statistical power and will focus on species that are located at tidal wetland sites where the largest shifts in inundation and salinity regime are predicted to occur (ie, brackish and freshwater sites). The experiment will begin in April 2010.

One of my community mentors, Dr. Drew Talley, has left his position as research coordinator at the San Francisco Bay NERR. I will ask the current research coordinator, Dr. Matt Ferner, to assist in the community mentor duties, as Dr. Talley is no longer in a position to do so.