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Final Project Progress Report**

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Evaluating the Functional Recovery of Restored Coastal Wetland in Southern
California

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Project Hypotheses

Within the Huntington Beach Wetlands (HBW), we hypothesized that Brookhurst and Magnolia Marshes (marsh areas isolated from tidal influence for approximately 100 years) would have significantly different physical characteristics (salinity, temperature, moisture, sediment parameters), more terrestrial plant, algal, invertebrate and microbial communities and altered food web structure from neighboring Talbert Marsh (a marsh area whose tidal connect was restored 20 years ago). In addition, we hypothesized that once Brookhurst Marsh was restored (Summer 2009), these differences would decrease and with time, resemble those of Talbert Marsh. This restoration of structure and function will occur on differing time scales; we predicted that physical parameters would quickly become similar while algal, invertebrate and microbial communities would begin to change on a month - year time scale. Changes to the plant community and the food web structure are anticipated to occur on a year - decadal time scale (beyond the funding cycle for this project).

Project Goals and Objectives

The overall goal of our study was to evaluate the success of a large-scale restoration of the Huntington Beach Wetlands (HBW) in Huntington Beach, CA. Our study characterized the structure and function of three wetland landscapes in the wetland complex (salt marsh high and mid zones and seagrass beds) before a major restoration project began in Brookhurst Marsh. Within each landscape we detailed the physical parameters of sediment communities, quantified benthic plant, algal, microbial, and faunal diversity, with special note of invasive species, and characterized the trophic pathways that link the primary producers and consumers.

Briefly describe project methodology

We established transects in each of the three marshes, running east-west from the marsh edge near Pacific Coast Highway (PCH) to the levee and then into the channel across the seagrass beds. To accommodate the differences in marsh area and to ensure we had adequate replication within the marsh, we established twelve transects in Brookhurst Marsh and five each in Talbert and Magnolia Marshes. Along each transect, we targeted each distinct habitats that occurred: (1) brackish marsh near PCH in Brookhurst, (2) pickleweed in the middle marsh in

all three marshes, (3) unvegetated salt pannes in all three marshes, (4) cordgrass habitat in the low marsh of Talbert, and (5) seagrass beds in the channel. Permanent sampling plots were placed in a stratified random manner every 5 m along the transect within habitats, for an approximate total of 400 plots (5 per habitat; 20 per transect). In each plot, we collected physical measurement and plant cover and species data, and in a subsample of plots (3 plots per habitat per transect), we collected sediment samples (for grain size and organic matter), algal, microbial, and invertebrate samples (for community characterization), and stable isotope samples (for food web analysis).

Describe progress and accomplishments toward meeting goals and objectives

Immediately after the start date of the grant (October 2008), we sampled all three marshes as discussed above. All collected samples were processed from November 2008 - August 2009. The following year (October 2009), we again sampled as discussed above. Algal, isotope and invertebrate samples have been processed. We are still processing stable isotope and microbial genetics samples. We are also working on a statistical analysis of these data.

Project modifications

The only modification that occurred in the proposal layout was a date change for restoration completion of Brookhurst Marsh from March 2009 to July 2009. Due to this change our evaluation in Fall 2009 is a 3 month evaluation, not a 6-month evaluation. In addition to the proposed work, we have added one major component (microbial characterization) to this project and developed two ancillary research topics (fish community and diet analysis, planting regime evaluation). The microbial samples were an addition to our project with expertise from a collaborator here at CSULB (J. Dillon). We collected pre- and post-restoration microbial samples to analyze bacterial 16sRNA and assemble partial phylogenetic trees. From these data, we can compare bacterial community composition pre- and post-restoration as well as among the marshes.

Ancillary research topics:

Fish community and diet analysis: Based on our work with this grant at HBW, we (Whitcraft, Allen and C, Lowe - also CSULB) received a grant from NOAA Montrose Settlements Restoration Program to analyze fish community structure among the marshes and to do active and passive tracking of fish locations. In addition, we are conducting gut content and caging experiments to determine the role that food availability and foraging plays in habitat selection in these newly restored wetland habitats.

Planting regime evaluation: In conjunction with a management need of HBWC, we are evaluating the efficacy of manual planting on high marsh berms as a method to quickly restore plant cover and to create nesting habitat for Belding's savannah sparrows.

Project outcomes

We have extensive data on the parameters discussed above. In addition to developing GIS map layers that will be shared with HBWC, we will share all of our data (in a summarized format) with HBWC in order to help with adaptive management. We also have agreed to help construct exhibits at the HBWC nature center that explains our project and the restoration implications. We (PI's and associated students) will be participating in a planned speaker series also to be held at HBWC. Finally, we anticipate that several publications will result once analyses are completed.

Impacts of project

Loss of coastal wetlands and their associated services during the past century has been extensive; in California, less than 10% of historical coastal wetlands remain intact. Before they were drained and filled to accommodate urban growth, the Santa Ana River coastal wetlands (of which HBW is a portion) covered some 2,950 acres. Today, only about 300 acres remain, and much of this is highly degraded and isolated from tidal action. To offset such habitat loss, wetland managers and conservation groups have increasingly turned to restoration and mitigation as potential solutions. In southern California, nearly every embayment has one or more wetland restoration programs in progress or planned. Postrestoration monitoring and assessments for these projects typically focus on structural attributes of the restored habitats; however, recent research emphasizes the importance of evaluations including ecosystem function. Thus, in-depth function-based assessments of restoration in California wetlands (like this project) are essential to understanding how to manage these important and threatened systems as well as to advancing the fields of restoration and wetland ecology.

Benefits, commercialization and application of project results

We have worked extensively with the landowner (Huntington Beach Wetlands Conservancy - HBWC) to share data, provide advice, and apply the results of our study to their ongoing restoration plan (including restoration of Magnolia Marsh in Spring 2010).

Gordon Smith, HBWC chairman, (714) 307-9775, gws575@mac.com

Economic benefits generated by discovery

None

Issue-based forecast capabilities

None

Tools, technologies and information services developed

We have gathered extensive data (including plant cover data and benthic habitat characterization) that will be used to generate GIS map layers for use in planning and management. These will be shared with HBWC.

Publications

Theses, dissertations

Title: EVALUATING RESTORATION PLANTING REGIMES IN A NEWLY RESTORED SOUTHERN CALIFORNIA SALT MARSH

Authors: Emily Blair (CSULB graduate student), Christine Whitcraft, Bengt Allen
Schools: CSU Long Beach

Media coverage

Name of publication/radio station, etc: Inside CSULB blog
(<http://csulb.edu/misc/inside/core/?p=7259>)

City: Long Beach

State: CA

Date of publication/broadcast: September 19, 2009

Headline or topic: CSULB Marine Biologists Helping Restore Wetlands Along PCH

Name of publication/radio station, etc: This Week at the Beach
(<http://cf.papubs.csulb.edu/news-events/story.cfm?hackid=1219>)
City: Long Beach
State: CA
Date of publication/broadcast: August 31, 2009
Headline or topic: Marine Biologists at Cal State Long Beach Helping Restore Huntington Beach Wetlands

Name of publication/radio station, etc: Everything Long Beach.com
City: Long Beach
State: CA
Date of publication/broadcast: September 11, 2009
Headline or topic: Marine biologists at Cal State Long Beach help Huntington Beach Wetlands Conservancy restore coastal marshes

Please list any workshops/presentations given

From the Bench. 2009.
Authors: Whitcraft, C., C. Sayre, R. Wigginton (CSULB students)
Title: "Wetland science and management: invasion and restoration"
Audience: students and faculty from CSULB (approx. 20).
Content: informal presentation of preliminary data

Invited speakers. Montrose Settlements Restoration Program Research Symposium. 2009.

Authors: B. Allen, Whitcraft, C., and C. Lowe.
Title: "Huntington Beach Wetlands Restoration Project"
Audience: MSRP scientists and managers (approx. 50).
Content: preliminary data from restoration work and future work with fish tracking and diet studies

Cooperating organizations

Federal organizations

National Oceanic and Atmospheric Administration (NOAA)
Montrose Settlements Restoration Program (MSRP) - collaboration with fish community evaluation and diet studies in HBW

Academic Institutions

CSULB start-up funds (Whitcraft, Allen) were used to supplement the SG funding.

International implications

No international colleagues involved. Globally, wetland restoration is being used as a strategy to combat wetland loss and degradation. Thus the results of our study have international (as well as national and regional) implications and applications.

Keywords

salt marsh, wetland, functional recovery, structural metrics, trophic structure, restoration

Notes

This rapid response funding allowed us to leverage a multi-million dollar restoration project in a timely manner. We have developed numerous ancillary projects that will contribute crucial data to the landowner.