Incorporating Climate-Smart Adaptive Strategies into Wetlands Recovery in Coastal Southern California
Project Status Summary – December 18, 2015
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Project Overview

The goal of this project is to develop and demonstrate a method for managers to assess climate-change associated vulnerabilities at specific wetland locations by using the most appropriate tools to develop restoration and management priorities. This will be done by defining major coastal archetypes based on wetland setting, form, and composition. Existing models and tools will be coupled with specific archetypes in consideration of major anthropogenic constraints to help inform the decision making process. We will focus on the tools and models related to changes in hydrology related to climate change, such as sea-level rise, fluvial inputs, and associated impacts on sediment movement and other factors, as these are the most influential drivers affecting coastal wetlands. With an understanding of the vulnerabilities of wetland ecosystems, we will then develop climate-smart adaptation strategies and a decision-support tool to guide restoration project prioritization and design.

Status of Major Work Elements

The project consists of four major work elements. The status of each element is summarized below:

Update Functional Landscape Units

The goal of this task is to develop a matrix of contemporary archetypes for coastal wetlands. The contemporary archetypes will be used to help organize coastal wetlands into groups/categories that may respond differently to sea level rise. The archetype analysis is complete.

Previous wetland mapping was used to define 106 discrete wetlands along the southern California coast. We compiled a series of 58 variables related to physical conditions/drivers for each wetland. These variables generally fell into one of five categories:

- Catchment properties (proxy for inputs of water and sediment)
- Wetland dimensions, such as size, slope, ratio of dimensions, etc.
- Proportion of subtidal vs intertidal area
- Inlet dimensions and condition
- Wetland volume/capacity

We identified a five-cluster solution that maximized separation and minimized misclassification between clusters. Nine predictor variables explained the majority of the variability between clusters:

- wetland area
- area/depth (erosion area)
- slope from mouth to head
- integrated slope (STD of pixel slope)
- mouth elevation relative to MSL
- mean mouth width

- total area inundated at spill height
- percent wetland >2m at low tide
- total percent subtidal

We identified 5 archetypes based on the results of the cluster analysis (Table 1). These archetypes will be used to guide subsequent steps in the project

Table 1: Final archetypes and associated habitats

Archetype	general description	associated habitats
1	small creek systems; minimal subtidal habitat area; generally higher gradient	intertidal (Cowardin), Riparian marsh and meadow (CalVeg)
2	Intermittently closing river mouth estuaries	intertidal (Cowardin), Riparian marsh and meadow (CalVeg)
3	open basin, extensive subtidal habitat, fringing intertidal;	intertidal emergent, pickleweed and/or cordgrass habitats (CalVeg)
4	large, depositional river valleys, fringing marsh; high dynamic ratio	intertidal emergent, pickleweed and/or cordgrass habitats (CalVeg), moderate subtidal area (Cowardin)
5	open water harbors, bays, lagoons; large area, wide & low-lying mouth	dominated by subtidal habitat

Compile and Evaluate Relevant Assessment Tools

The goal of this task is to summarize existing tools and efforts focused on modeling or evaluating the effects of sea level rise on coastal wetlands in southern California. The attributes, strengths and weaknesses of each model will be identified relative to their applicability to the identified archetypes. The tool evaluation is in-progress.

Our approach to this task is to build on past work done by Then Nature Conservancy and NOAA. Previous model and assessment tool summaries have been prepared for southern California. We are updating these by providing additional information on how marsh evolution is handled (or not) by the tools, an element that is largely absent from existing modeling summaries. The revised model summary will be support development of adaptation strategies and decision support tools in subsequent project tasks.

Assess Relative Vulnerabilities and Effects of Sea Level Rise

The goal of this task is assess the relative vulnerability to sea level rise of coastal wetland archetypes based on the modelling tools identified. Site specific modeling is beyond the scope of this project. Instead, we will develop and test hypothesis about how various archetypes will evolve in response to sea level rise and produce conceptual forecasts of future conditions. The results will allow managers to develop general relationships between potential management/restoration options and expected changes for different systems along the coast. The vulnerability assessment is in-progress.

Relative vulnerability will be assessed using a conceptual model that relates physical drivers to biological responses, mitigated by the surroundings of the adjacent landscape (Figure 1).

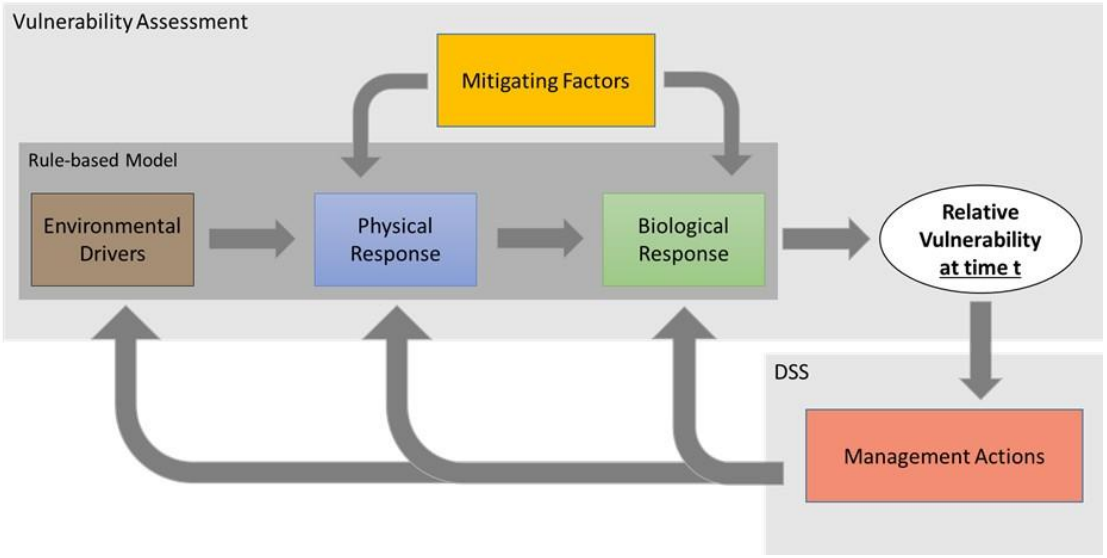

Figure 1: Conceptual model for vulnerability assessment

We are in the process of compiling existing data sets that on environmental drivers that will be used to develop a series of decision rules that will produce relative vulnerability rankings for individual wetlands. These rankings will based on expected trajectories of response for each of the 5 identified archetypes.

Develop Decision Support Tool for Adaptation Strategies

The goal of this task is to develop a decision support tool that will help managers match available restoration and management practices to various archetypes in terms of their potential effectiveness at accommodating potential sea level rise effects. We are currently conceptualized the decision support tools.

The project team partnered with ESRI to hold a design sprint in July 2015. During the design sprint we discussed the intended audiences and outcomes of the decision support systems and brainstormed potential structures and functionality of the ultimate system (Figure 2). We are currently refining these concepts so that we can begin developing the actual tools. The tool will be aimed at providing ways for managers to better understand what models and information are available for specific wetlands, access results of the vulnerability evaluation, and screen potential adaptation strategies.

Figure 2: Decision support design sprint and sample storyboard for potential tool development