San Diego Bay Terrain Model

Progress Report (February 1, 2011, April 30, 2011)

Richard M. Gersberg, Ph.D, Principal Investigator
San Diego State University Research Foundation

Purpose of the grant:

The main goal of this project is to define the potential impacts of sea level rise due to global climate change on the habitats of San Diego Bay's wetlands and eelgrass beds.

Objectives

Key concerns include sea level rise, coastal wetland alteration, possible eelgrass habitat loss, and San Diego's adaptation to sea level rise. The IPCC (Intergovernmental Panel on Climate Change) estimates that the global average sea level will rise between 0.6 and 2 feet (0.18 to 0.59 meters) in the next century and that by 2100, sea level rise could convert as much as 33 percent of the world's coastal wetlands to open water**.** However, more recent estimates by Vermeer and Rahmstorf (2009, published in the Proceedings of the National Academy of Sciences) who based their analysis on measurements of sea level and temperature taken over the past 130 years, identified a strong link between the rate of sea level rise and global temperature and project a sea level rise of 0.75 to 1.9 meters by 2100.

Specific objectives of the San Diego Bay Terrain Model project include:

1. Couple a high-resolution LiDAR digital elevation model of San Diego Bay's watersheds (recently developed from City of San Diego LiDAR data), with the high resolution bathymetry to be developed by Dr. Neal Driscoll at SIO, to generate a relatively seamless digital map of San Diego Bay's terrain.

2. Using the seamless high resolution terrain model of San Diego Bay generated above, delineate the specific effect of sea level rise on eelgrass and wetland and benthic habitats of San Diego Bay.

3. Using the SLAMM (Sea Level Affects Marshes) Model, delineate the effect of sea level rise on San Diego Bay's 's National Wildlife Refuge including the Sweetwater Marsh Unit and the South Bay Unit. This modeling will allow prediction of wetland inundation (and associated habitat change) under the range of plausible sea level rise scenarios.

Description of Work Completed

To date, we have been making steady progress towards the goals detailed above.

Sea-level rise will have a variety of effects on eelgrass habitat. Increased water depth will restrict the amount of light reaching seagrasses, and depending on the bathymetry of the Bay and topography of the surrounding landscape, change the geographic distribution of the eelgrass habitat. In addition, changes in tidal dynamics (e.g., water current speed, circulation flow patterns, tidal range) could have a range of impacts including reductions in light, an increase in water column turbidity, and alterations of the temperature regime. Based upon our current understanding of eelgrass distribution, it does seem likely that sea level rise will move the maximum depth of eelgrass growth and abundance closer to the current shoreline. The aim of the current effort is to use the seamless San Diego Bay Digital Elevation Model to better quantify this impact of sea level rise.

San Diego Bay Digital Terrain Model Mosaic

A seamless bathymetric/topographic digital elevation model (DEM) has been developed in this project for San Diego Bay (Figure 1) .The gridding and merging of the bathymetric and topographic data were accomplished using the data conversion, buffering, clipping, interpolation, mosaicking, and smoothing tools available in the ArcInfo GIS package. The resulting merged bathymetric/topographic model was output in the ArcInfo GRID format.

The San Diego Bay Digital Terrain Model Mosaic **S_Bay_DEM**, was created from three different sets of elevation data. All of the datasets were converted to NAD 83 UTM Zone 11N (meters) as the horizontal coordinate system and their vertical datum was converted to NAVD 88 (feet). The datasets are identified as follows:

times_mos_li1- this dataset was originally derived from the Corps Lidar data. It was mosaicked and then its horizontal coordinate system was converted from Geographic NAD83, GRS80 to NAD83 UTM (meters). Its vertical datum was already in NAVD88. The vertical units were converted from meters to feet. The cell size is 1 meter.

Minus_ascii1- this dataset was derived from ascii_to_sdba1. The ascii_to_sdba1 came from the Ports Natural Resources sdbay_bathy_2008_mllw_m&a_ascii.txt using the ASCII to raster tool. The horizontal coordinate system was defined as NAD83 UTM Zone 11N (meters). The vertical datum was MLLW (feet) and was converted to NAVD88 feet by subtracting 0.18 (feet). The cell size is 5 meters.

Asciit1_clip - this data set was originally derived from asciito_elev raster (the elevation data used in the SLAMM model). The horizontal coordinate system was already in NAD83 UTM Zone 11N (meters). The vertical datum was already in NAVD88 (feet). The cell size is 10 meters.

The datasets above were combined using the Mosaic tool into an elevation surface called **S_Bay_DEM**. Spatial reference information is as follows:

Horizontal Coordinate System - NAD83 UTM Zone 11 (meters)

Vertical Datum - NAVD88 (feet)

Cell Size - 1 meter

Significance of Results

The development of a San Diego Bay bathymetic/topographic model, has resulted in a prototype digital product that that can be employed for marine GIS and coastal zone management applications. It demonstrates how disparate spatial data can be utilized together if they are first transformed to a common reference coordinate system. Use of a merged seamless elevation model as a base data layer facilitates overlay and incorporation of other spatially referenced coastal and marine datasets. The base DEM can easily be converted to support mapping and other GIS applications, enhanced for data visualization, used for input to 2-D and 3-D environmental models, and employed in a predictive fashion to model the habitat (eelgrass and coastal wetlands) and infrastructure effects of sea level rise.

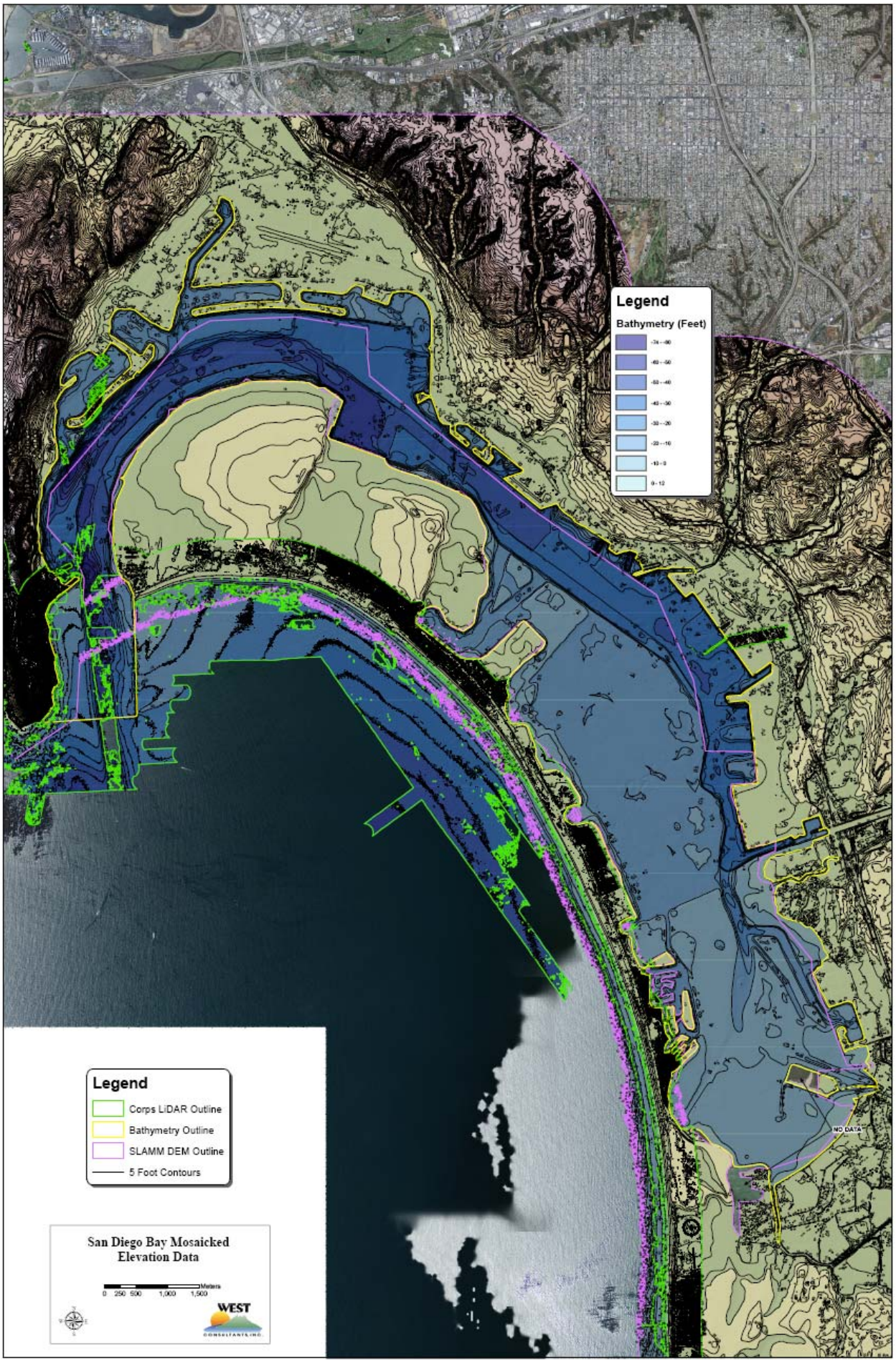
Legend
Bathymetry (Feet)
-74 - -60
-60 - -50
-50 - -40
-40 - -30
-30 - -20
-20 - -10
-10 - 0
0 - 12
NO DATA
Legend
Corps LiDAR Outline
Bathymetry Outline
SLAMM DEM Outline
5 Foot Contours
San Diego Bay Mosaicked
Elevation Data
0 250 500 1,000 1,500
Meters
WEST
CONSULTANTS, INC.

Figure 1. The Seamless San Diego Bay Digital Terrain Model Mosaic

Anticipated Work for the Next Reporting Period

1. Develop statistical frequency distributions of eelgrass abundance versus depth (and do field verification of this with Dr. Todd Anderson) to generate a predictive capability with which to model the effect of sea level rise on eelgrass habitat.