Coupled Research & Management at the Tijuana Estuary

Jeff Crooks
Tijuana River National Estuarine Research Reserve
National Estuarine Research Reserve System
National Oceanic & Atmospheric Administration

- Federal – State Partnerships, established by the Coastal Zone Management Act
- Provide protection of resources for research
- Enhance awareness and understanding of estuaries, and provide opportunities for education and interpretation
- Protect areas that contribute to the typological and biogeographical balance of the system
Estuarine Wetlands

They represent the one place on earth where the three major habitat types – land, sea, and freshwater – come together
Science-Based Ecosystem Management - Sources of Information

information resolution timescale

coarse-grained to fine-grained

perspective and context

millenia centuries decades years days minutes

paleontology, geology
archaeology

historical ecology

long-term monitoring

experiments
Ecosystem Monitoring: Assessing “Vital Signs” and Fostering Adaptive Management

PERL and TRNERR

- Water parameters - Temperature, Salinity, Dissolved Oxygen, Turbidity, pH, depth
- Nutrients / Chlorophyll a
- Topography
- Soil
- Vegetation
- Invertebrates
- Fish
- Birds

South San Diego Bay
Tijuana River Estuary
Los Peñasquitos Lagoon
Average Yearly Temperature
Difference from the Long-Term Average

Oneonta Slough Datalogger Station
Spring 2016
Mouth Closure
Mouth Closure - 2016

**TJ river mouth reopened after flooding, shark deaths**

The flood conditions pushed enough sand into the mouth of the Tijuana River mouth at Imperial Beach to close off the flow of the river to the ocean. With the continued rains water from the closed-off estuary was backing up into Imperial Beach streets, forcing an emergency opening of the river mouth with heavy equipment Monday afternoon. After the water receded it became apparent that the oxygen-depleted waters had been fatal to many, if not all, of the fish species in the area.
New sand poses possible threat to Tijuana River

Officials at Tijuana River reserve prepare for worst in wake of replenishment project in Imperial Beach

By Katherine P. Harvey | 11:35 a.m. Feb. 6, 2013

Ecological ‘Heart Attack’ Feared if IB Sand Closes the Tijuana River

Experts at the Tijuana River National Estuarine Research Reserve are concerned sand from a recent replenishment project could impact flow of the Tijuana River and threaten life supported by Southern California’s largest coastal wetland.

Imperial Beach, CA

By KHARI JOHNSON (Patch Staff) - ☀ February 1, 2013 7:58 am ET
Wave Heights at Point Loma Buoy

Recent El Niño
Long-Term Average

Difference Between Observed and Predicted Tides at Scripps Pier

Sea Level Rise

Meltzer 2016
Southern California Mean Sea Level Trends (MSL) and El Niño

Measured Sea Level Rise At Scripps Pier

Sea Level Rise Projections
Southern California Mean Sea Level Trends (MSL) and El Niño

Measured Sea Level Rise At Scripps Pier

Year

Sea Level Rise Projections

Meters
High Dissolved Oxygen
High Dissolved Oxygen

Graph showing dissolved oxygen levels from January to March 2017.
High Dissolved Oxygen / Phytoplankton Bloom
Very High Nutrient Loading

mg/l

2017

Dec | Jan | Feb | Mar | Apr | May

Tijuana San Diego Los Pen
Tijuana San Diego Los Pen
Tijuana San Diego Los Pen
Tijuana San Diego Los Pen
Tijuana San Diego Los Pen
Tijuana San Diego Los Pen
Tijuana San Diego Los Pen

Orthophosphate
Ammonium
TETRP (Tijuana Estuary Tidal Restoration Project)
Tijuana River NERR
Long-Term Monitoring

• Serves as an early warning system
• Help steer management
• Track short-term variability, long-term change
• Provide background data for projects
• Stimulate new research ideas
Tijuana River Flow
WATER AT SAN YSIDRO POLLUTED

Schools Close and People Warned as Sewage Affluent Contaminates Wells

SAN YSIDRO, Sept. 16.—Schools were closed temporarily, public drinking fountains were sealed and housewives warned to boil all drinking water today by County Health officials after it was learned that the water supply of this community was contaminated by Tijuana sewage affluent.
Climate Understanding & Resilience in the River Valley

Conduct Vulnerability Assessment

Develop Climate Adaptation Strategy

Focus on:
- Sea Level Rise / Effects on Tidal Prism
- Riverine Flooding
Scenario A: Lake Tijuana

A river mouth that remains mostly closed limits the exchange of water between the river and the sea, and tends to form a large lake in the lower valley. With nowhere to go, water and sediment entering from upstream collects and can cause severe flooding in the upper valley. Extreme events temporarily open the mouth and flush the collected water. Sea level rise impacts are limited as sedimentation helps the land rise quicker than the sea. However, beachfront areas are still affected, and when sea level rise is coupled with riverine flooding the results can be extremely destructive.

Changes to the Physical Environment

River-Ocean Connection & Water Residence Time
The river mouth is mostly closed, trapping water in the system for long periods of time. The mouth is opened periodically during storm events that create extreme river flows and flush the system.

Flooding, Inundation, & Sediment Dynamics
Severe riverine flooding impacts the entire valley as extreme river flow events increase freshwater inputs and water ponds behind the closed river mouth. There is potential for dramatic restructuring of the valley as new river channels are created during storms and other channels filled in due to sedimentation.

Surface- & Ground-Water Salinity
There is an increased freshwater influence with variable conditions experienced during periods of mouth closure.

Example Management Challenges

Transportation
Access in the valley is frequently impaired by excess sediment and flooding, obstructing emergency evacuation routes, roads, bridges, and trails. This may lead to a need for more resources for emergency rescue operations.

Sediment Management
Large amount of sediment transport during extreme river flow events possibly overwhelming current sediment management Best Management Practices.

Changes to the Natural Environment

Beaches, Sand Dunes, & Salt Flats
Slight Increase.

Open Tidal Channels & Mudflats
Limited saltwater influence and rising elevations due to sediment aggradation result in large decreases in habitat.

Salt Marsh
Limited saltwater influence and an increase in freshwater inputs result in large decreases in habitat area.

Fresh and Brackish Marsh
As freshwater collects behind the closed mouth, fresh and brackish marsh areas increase in size.

Upland
Sediment aggradation outpaces sea level rise causing a large increase of upland areas in the lower valley.

Riparian
Increased freshwater inputs from extreme river events in the upper valley result in large increases in riparian areas.

Wetland-Upland Transition
Increased freshwater inputs cause a large decrease in these habitats as they transition into fresh and brackish marsh.

Scenarios are not predictions but are alternative representations of how the future may unfold in response to potential climate and environmental changes. For more details visit: http://www.tmnen.com/cmrn/