Tijuana River Valley Recovery Strategy (2012)
Tijuana Estuary Tidal Restoration Program (TETRP)

Goal 1. Increase tidal prism.

Goal 2. Restore former salt marsh, tidal channel, and mudflat to the maximum extent possible.

Goal 3. Increase area of undisturbed transition zone.

Goal 4. Restore barrier beach and dunes.

Goal 5. Increase habitat for endangered species.

Goal 6. Incorporate research and adaptive management.
Reduction in Tidal Prism: 55 – 85%

Historical Ecology Study (2017)

Consistently Open Mouth

<table>
<thead>
<tr>
<th>Habitat type</th>
<th>Area- USA (ha)</th>
<th>Net change</th>
<th>Percent change</th>
</tr>
</thead>
<tbody>
<tr>
<td>Dune</td>
<td>22</td>
<td>-3</td>
<td>-13%</td>
</tr>
<tr>
<td>Subtidal water + Mud flat / Sand flat</td>
<td>82</td>
<td>-41</td>
<td>-50%</td>
</tr>
<tr>
<td>Salt marsh</td>
<td>248</td>
<td>-105</td>
<td>-42%</td>
</tr>
<tr>
<td>Salt flat / Open water</td>
<td>17</td>
<td>3</td>
<td>19%</td>
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<tr>
<td>River channel</td>
<td>61</td>
<td>-51</td>
<td>-83%</td>
</tr>
<tr>
<td>River wash / Riparian scrub</td>
<td>730</td>
<td>-569</td>
<td>-78%</td>
</tr>
<tr>
<td>Alkali meadow complex / High marsh transition zone</td>
<td>761</td>
<td>-630</td>
<td>-83%</td>
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<tr>
<td>Grassland / Coastal sage scrub</td>
<td>976</td>
<td>-514</td>
<td>-53%</td>
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<tr>
<td>Pond</td>
<td>4</td>
<td>6</td>
<td>62%</td>
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<tr>
<td>Vernal pool</td>
<td>8</td>
<td>-8</td>
<td>-100%</td>
</tr>
<tr>
<td>Perennial freshwater wetland</td>
<td>4</td>
<td>7</td>
<td>188%</td>
</tr>
<tr>
<td>Riparian forest</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Concrete channel</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Agriculture</td>
<td>171</td>
<td></td>
<td>+INF</td>
</tr>
<tr>
<td>Developed / Disturbed</td>
<td>1,434</td>
<td></td>
<td>+INF</td>
</tr>
</tbody>
</table>

Distribution of salt marsh ca. 1850 and today.
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
Relating to Increased Extreme River Flow Events

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.

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

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.

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.tmarn.com/curnv/.
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 salinities
- Vegetation
- Invertebrates
- Fish
- Birds
High Dissolved Oxygen
High Nutrients

- Orthophosphate
- Ammonium
Exhibit includes four mural paintings and several watercolors.

Learn more: tmerr.org/visualizing-the-future

Art is how Audrey Carver interprets the world around her. When she was only two years old, the artist within blossomed, as she colored pieces of paper, the walls, the floor and even her feet—all potential masterpieces. Now, at 17, she attends the renowned Idyllwild Arts Academy. Through her paintings, she shares the beauty and drama of the natural world, and communicates the importance of respecting our environment to create a sustainable future.

Special thanks to the Climate Science Alliance – South Coast for helping to make this exhibit possible through their Artists in Residence Program. Learn more: climatesciencealliance.org
More extreme river flow events

Scenario A: Lake Tijuana

Decreased tidal prism

Scenario B: The Sea Around Us

Current Conditions

Increased tidal prism

Scenario C: Salt of the Earth

Fewer extreme river flow events

Scenario D: Marsh Madness

Figure 22. Results from the MEM sea level response model for the north arm marsh at Tijuana National Wildlife Refuge under the high (+166 cm by 2110) sea-level rise scenario with 100 mg/l mean annual suspended sediment concentration.
Scenarios

Identify key drivers and alternative ways the system can evolve

Expand and challenge our thinking, while being plausible and internally-consistent
There is uncertainty associated with both the marine and riverine drivers, as well as the interaction between the two.

Purple varnish clams

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

El Niño conditions pushed enough sand into the mouth of the Tijuana River south of Imperial Beach to close off the flow of the river to the ocean. With the weekend 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 leopard sharks, mollusks and other species that inhabit the area.