Coastal Resilience Ventura

Climate Adaptation on an Urban Coast

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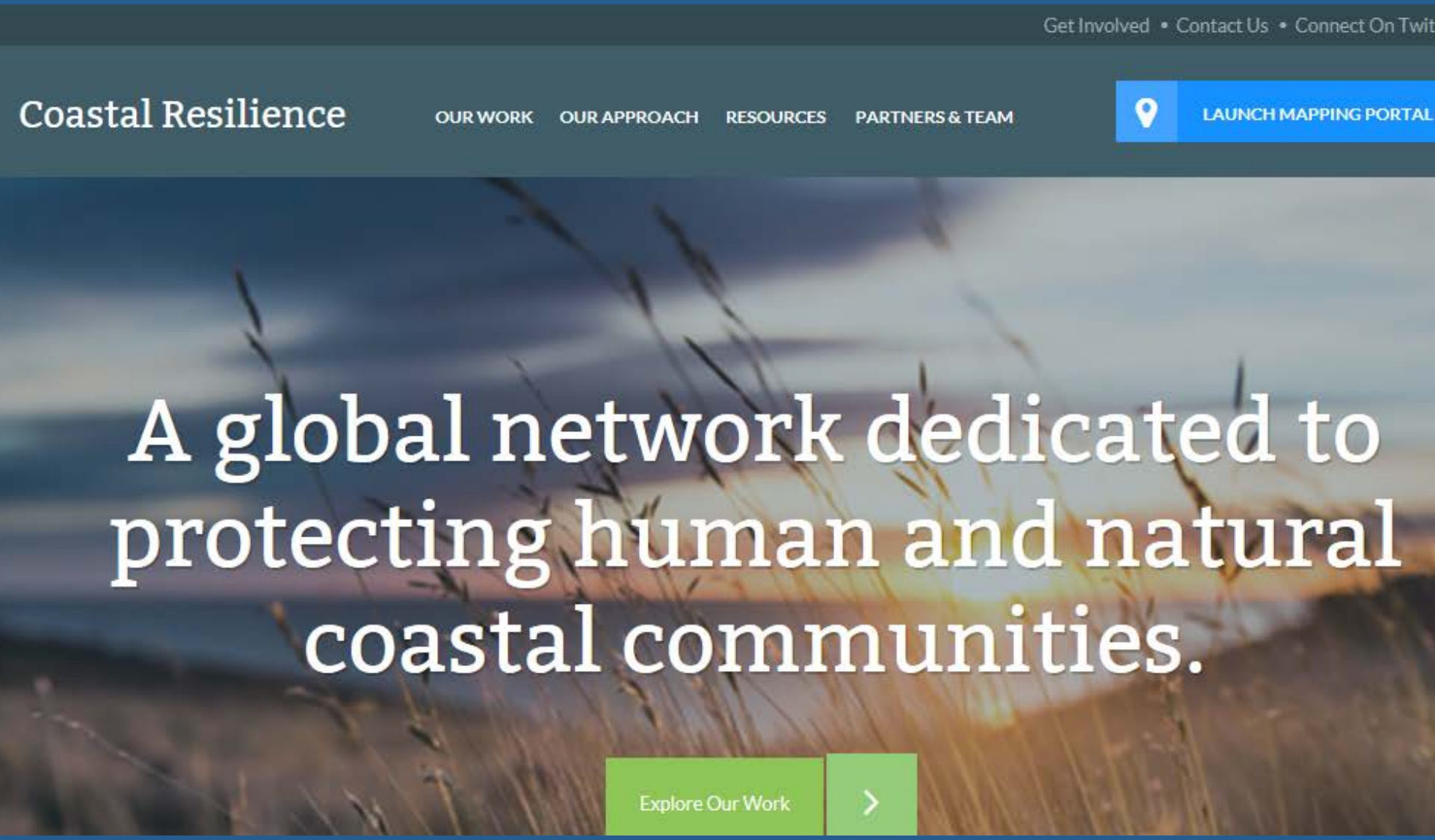
TNC – California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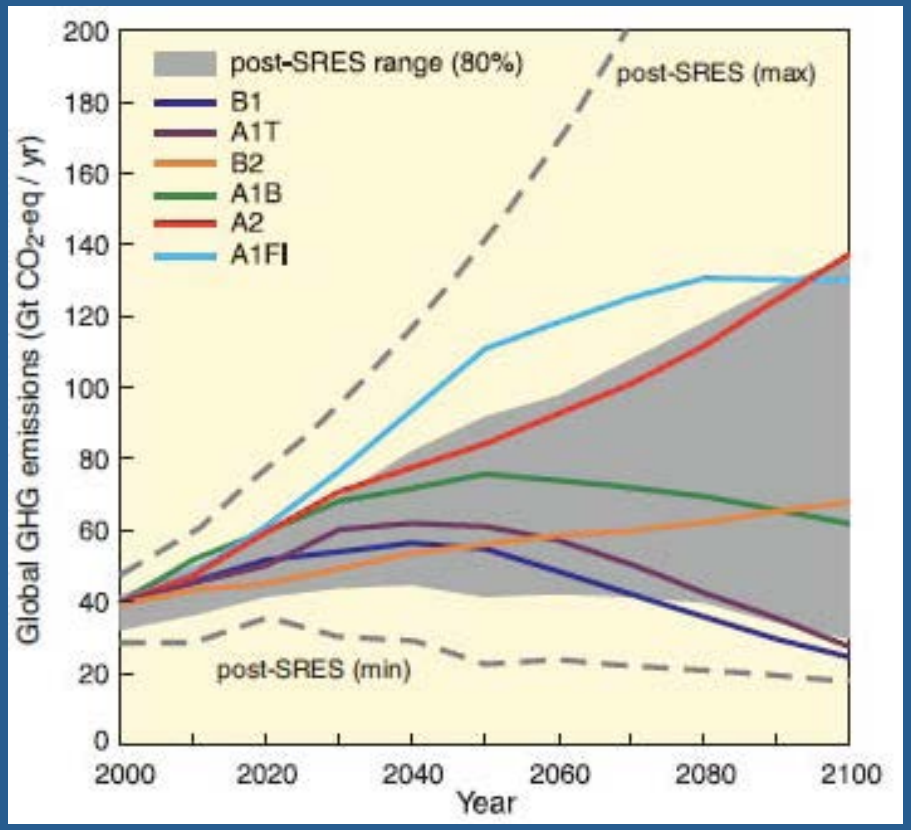
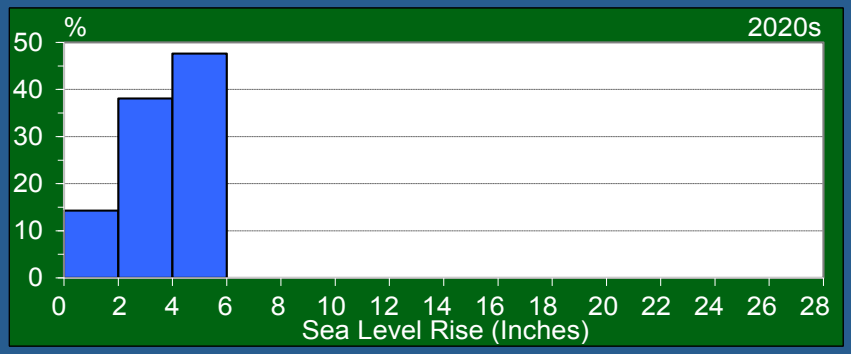
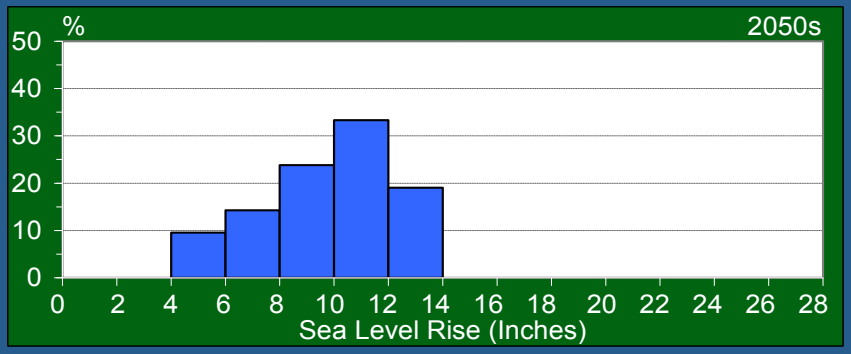
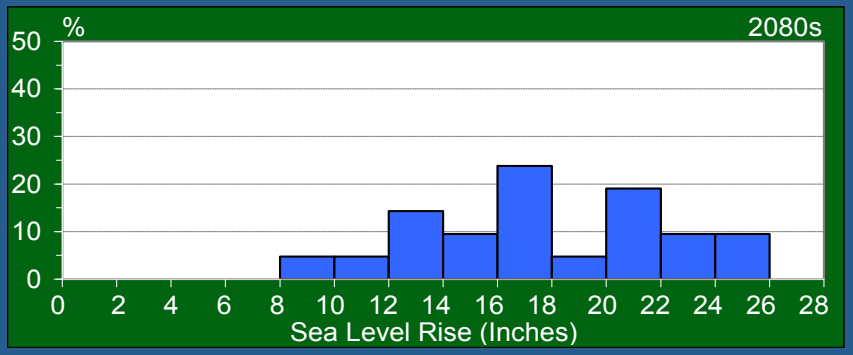








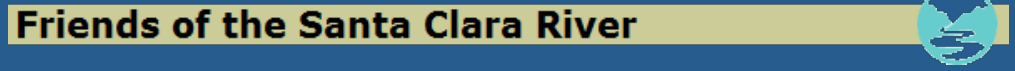
Case	Temperature change[a]		Sea level rise[b, c]
	Best estimate	Likely range	Model-based range
Year 2000[d]	0.6	0.3 - 0.9	Not available
B1	1.8	1.1 - 2.9	0.18 - 0.38
A1T	2.4	1.4 - 3.8	0.20 - 0.45
B2	2.4	1.4 - 3.8	0.20 - 0.43
A1B	2.8	1.7 - 4.4	0.21 - 0.48
A2	3.4	2.0 - 5.4	0.23 - 0.51
A1F1	4.0	2.4 - 6.4	0.26 - 0.59

Photo credit: Carey Batha for TNC

Coastal Resilience Ventura Aspects

- Stakeholder process
- Analysis of Local SLR Planning Tools
- Coastal Hazards
- Habitat Evolution
- Blue Carbon
- Green vs Grey Adaptation Tradeoffs

Partnerships



COASTAL RESILIENCE VENTURA CATALOGUE AND ANALYSIS OF LOCAL SEA-LEVEL RISE PLANNING TOOLS

February 8, 2013

Interviewed:

- City of Oxnard
- City of Ventura
- City of Port Hueneme
- County of Ventura
- Coastal Commission
- Naval Base Ventura County (NBVC)

Evaluated:

- Regional Plans (SCAG SCS, Ventura Alliance)
- General Plan and LCP Updates
- Specific Plans and Overlays
- Land Use Regulations
- Permitting and Compliance

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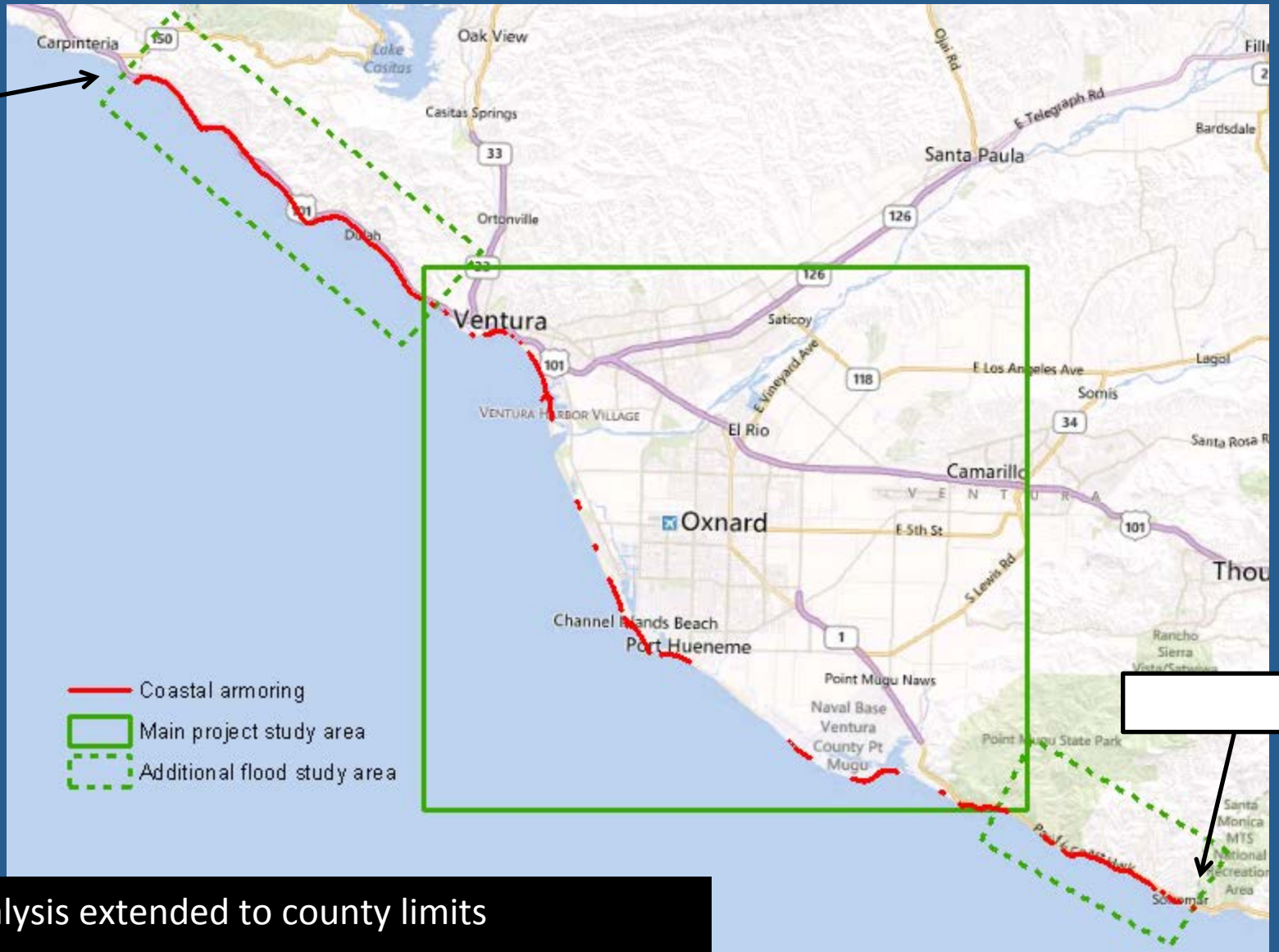
Study Area(s)



- Flood analysis extended to county limits
- Erosion study area kept same (extensive armor)

Scenarios

Sea Level Rise:

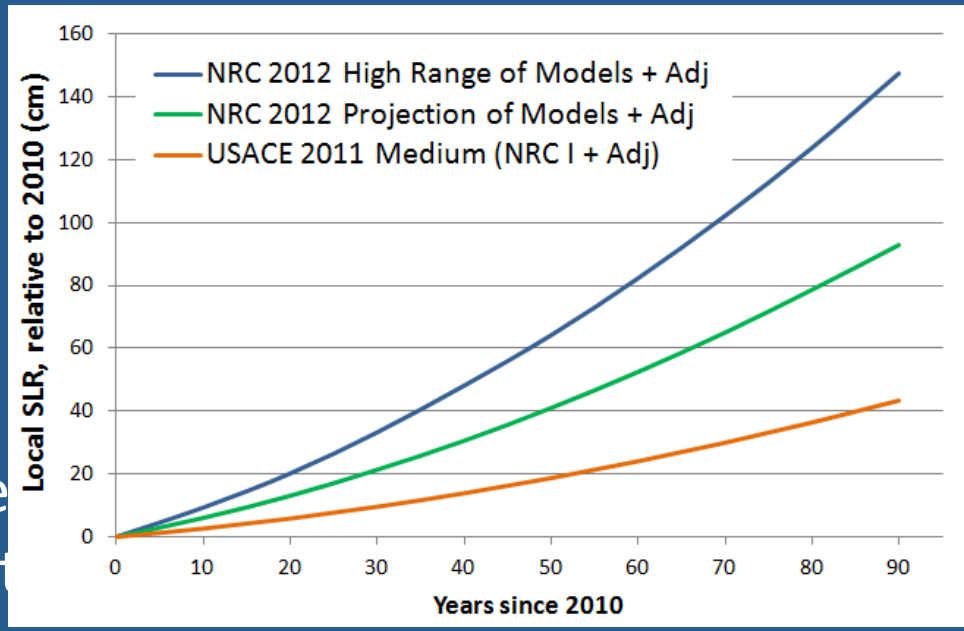
- Low: 0.44 meters by 2100
- Medium: 0.93 meters by 2100
- High: 1.47 meters by 2100

Wave Climate:

- No changes
- A doubling of El Nino frequencie
- A 500-year or an Arkstorm event doubling of El Nino frequencies

Fluvial Climate Scenarios:

- Existing conditions
- A2 Climate Scenario
- B1 Climate Scenario



Coastal Hazard Analysis

Assessed 4 contributing factors:

1. Erosion hazard zones

   Future erosion increases hydraulic connection and risk of flooding

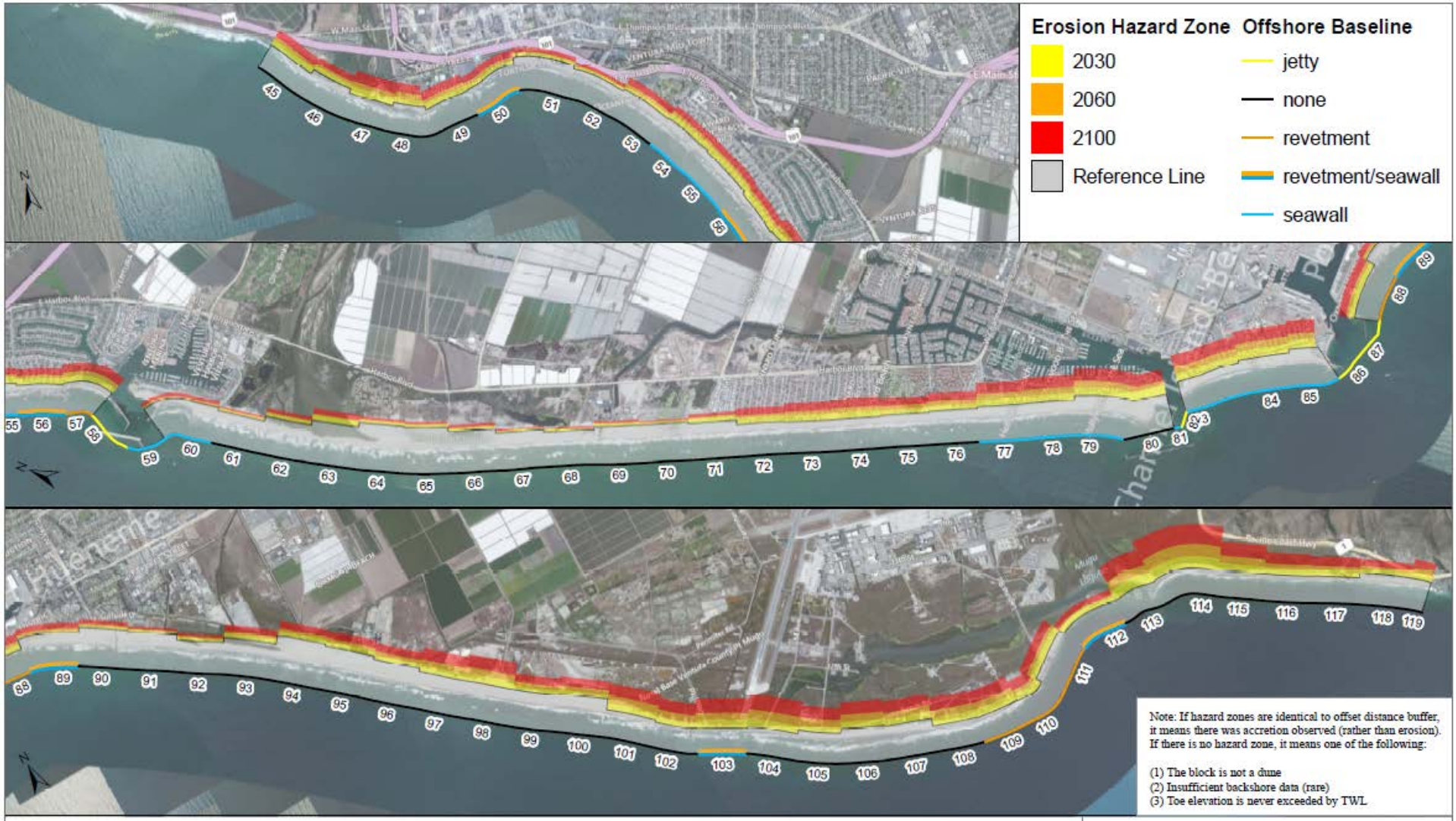
2. Coastal wave impact hazard zone - *momentum impact*
3. Tidal extent - *duration*
4. River floodplains

Ventura and Santa Clara River

Year	Low SLR + Existing Fluvial Flood	Medium SLR + B1 Climate Fluvial Flood	High SLR + A2 Climate Fluvial Flood
2030	X	X	X
2060	X	X	X
2100	X	X	X

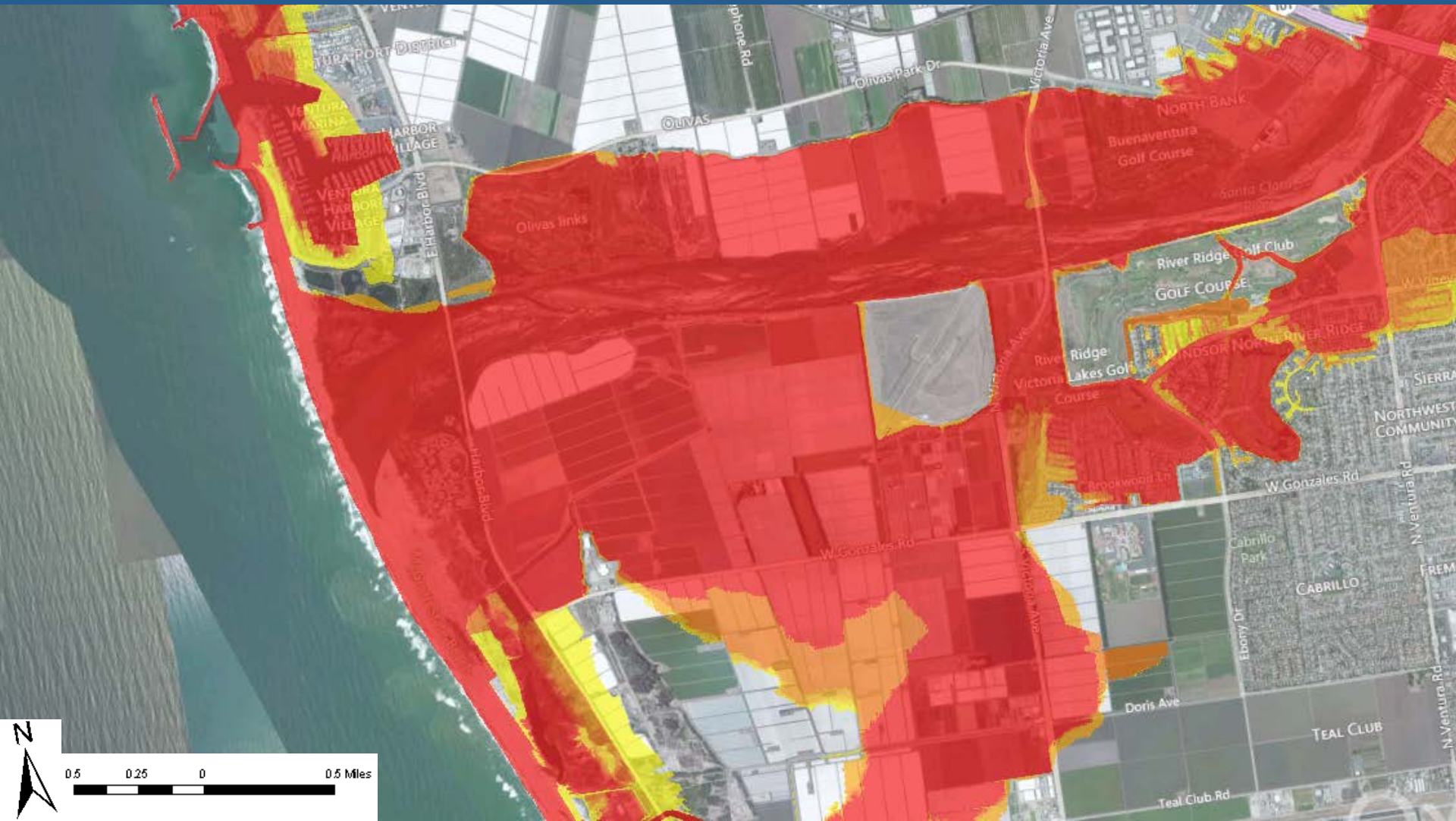
Coastal Erosion Hazard Zones

High SLR, Arkstorm & Double El Niño Frequency

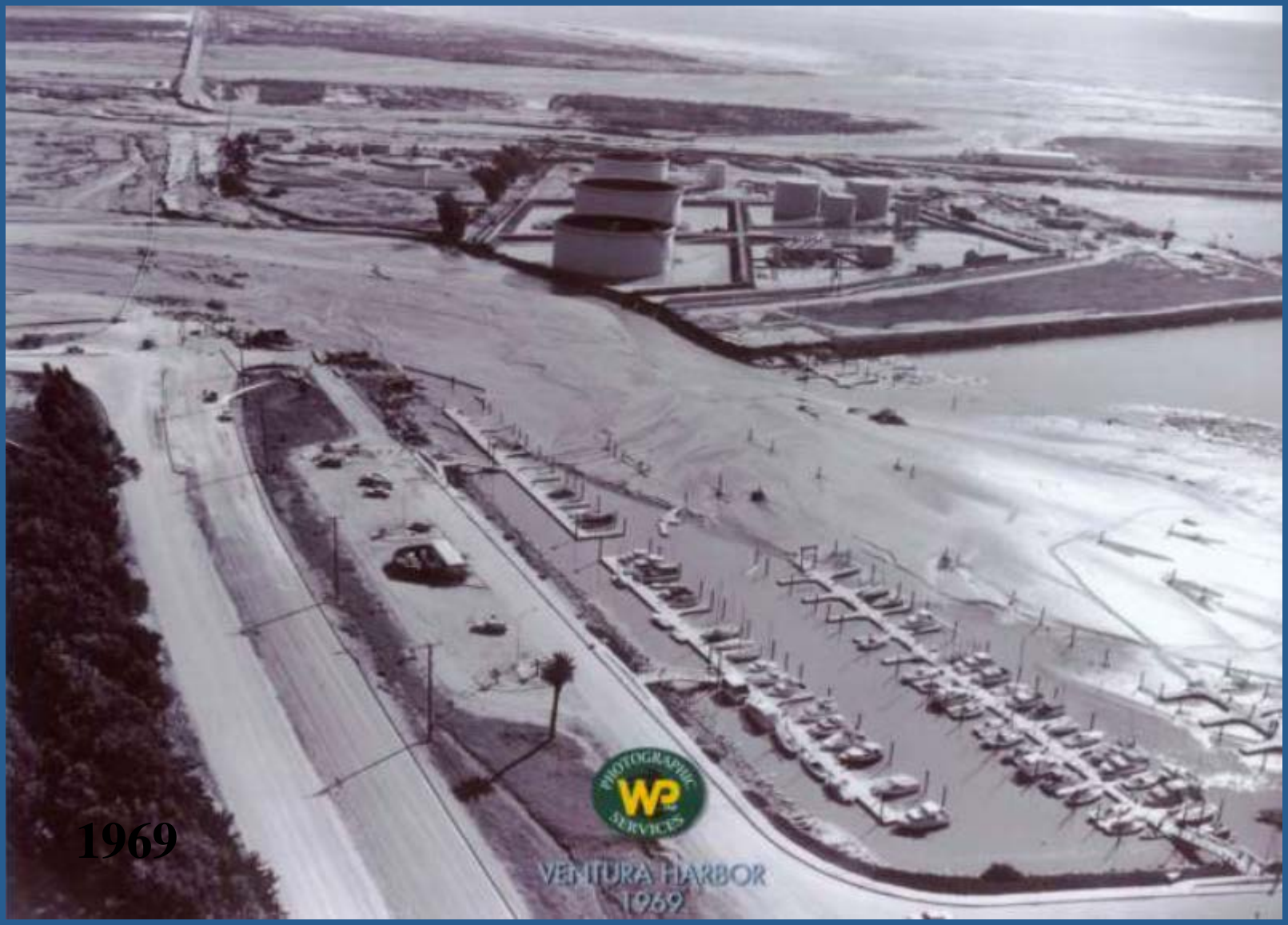


Santa Clara River – Relative Risk

Spatial aggregation

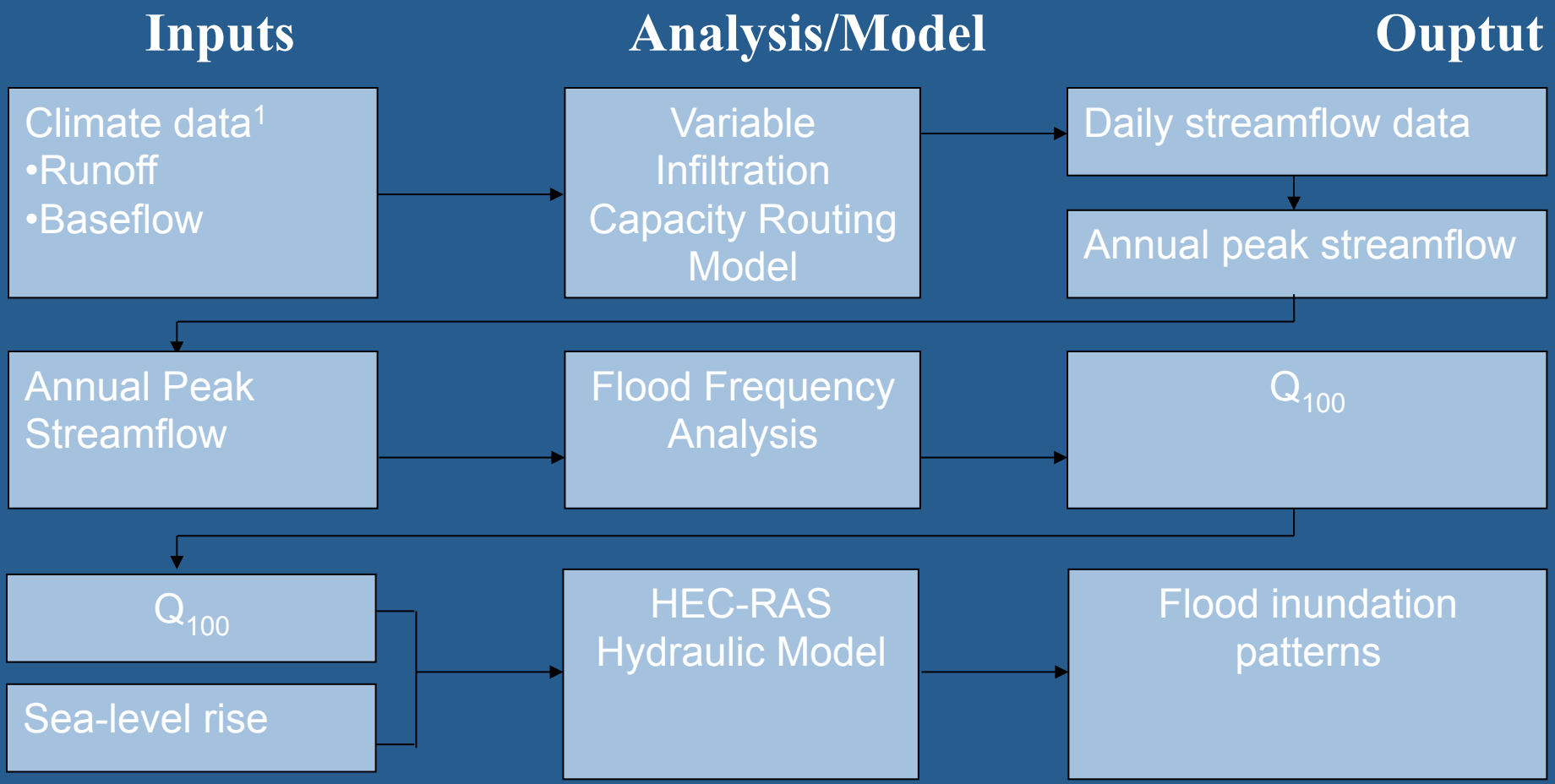


Fluvial Flooding



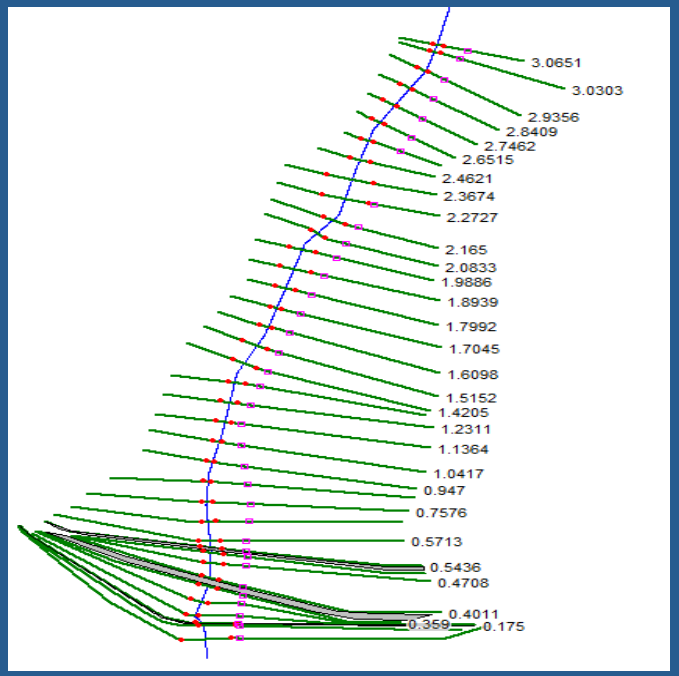
Fluvial Analysis

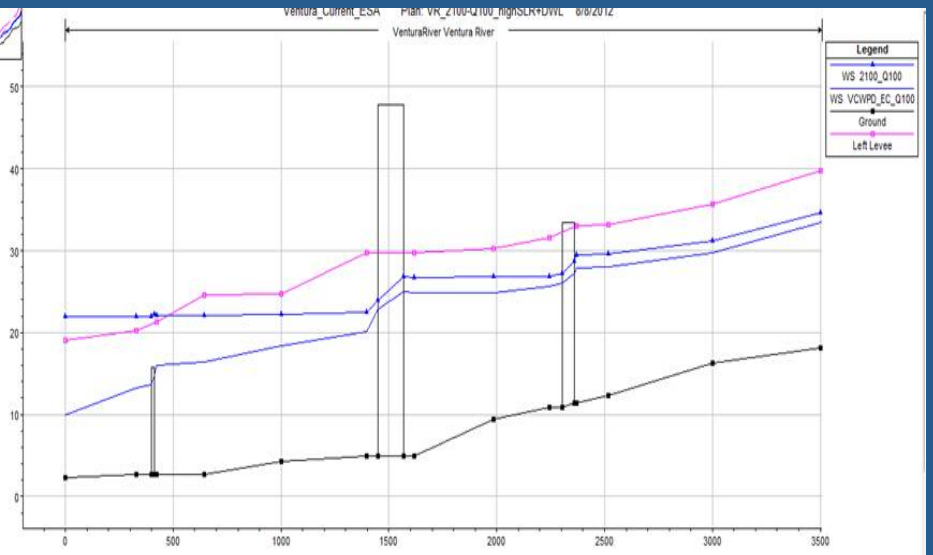
Hec -RAS models:
- **Ventura River**
- **Santa Clara River**



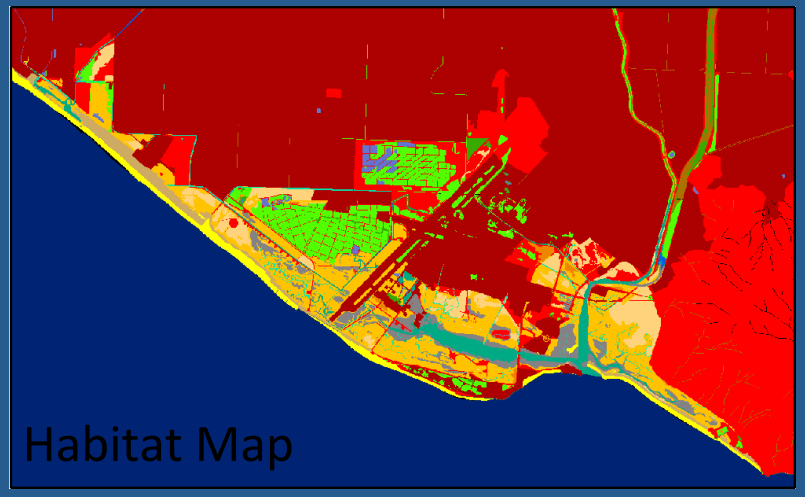
[1]Data produced by California Climate Change Center

Ventura River Modeling and Mapping





Habitat Evolution - SLAMM?



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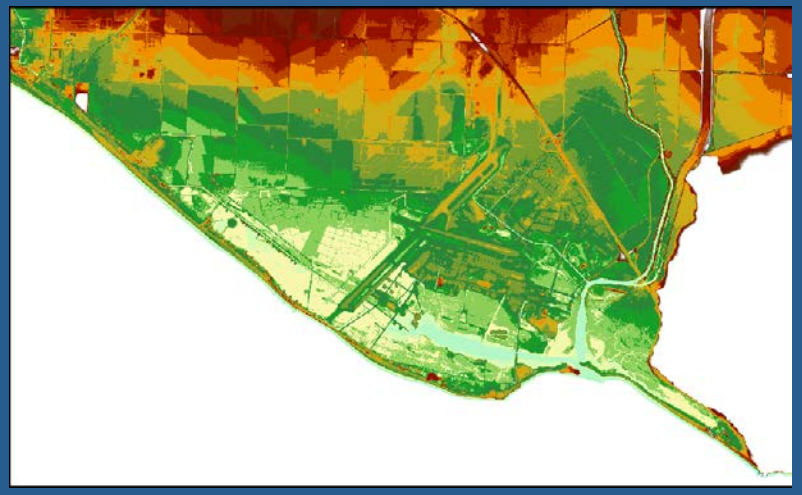

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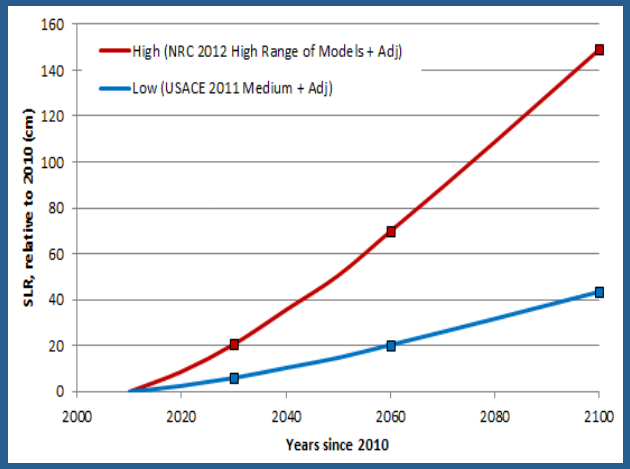

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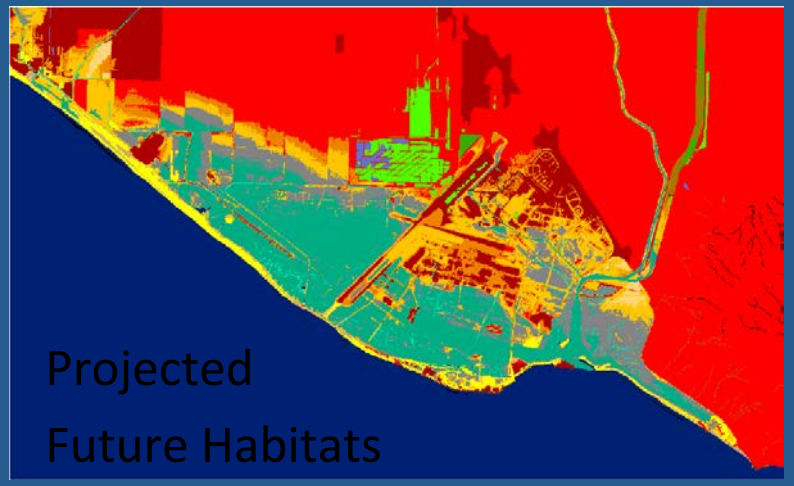
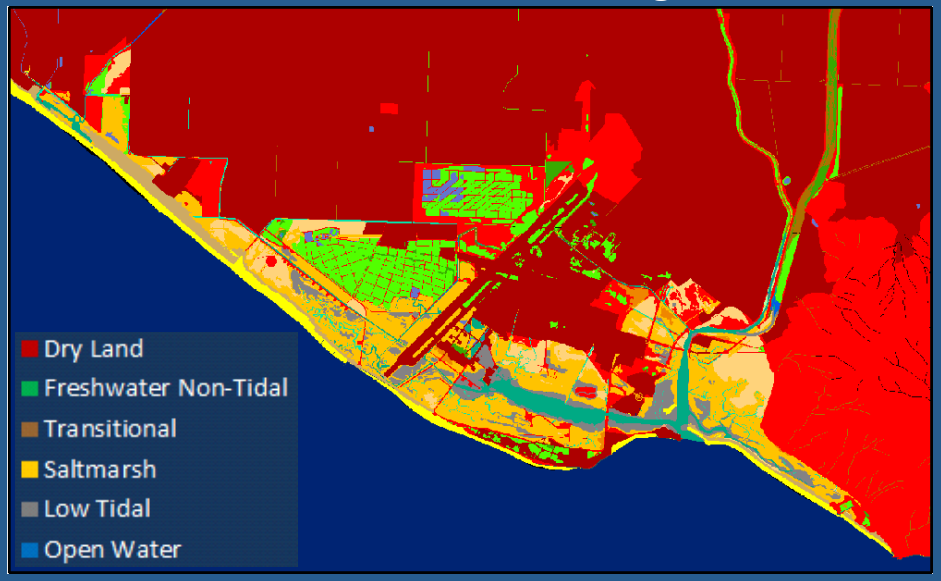


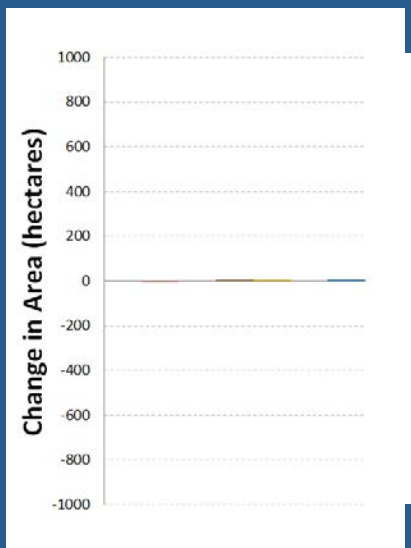
Protect Developed Dry Land (including agriculture)
vs. Allow marshes to transgress

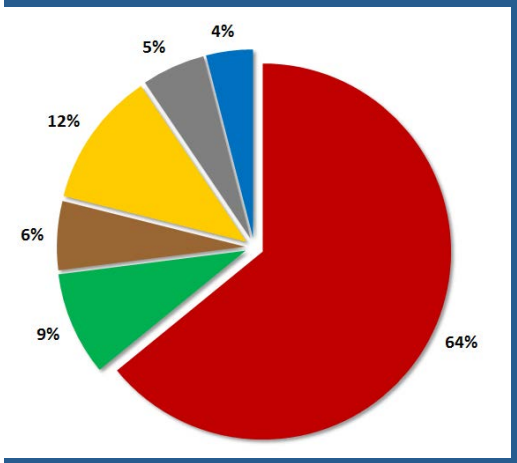
SLAMM

Example Scenario: 2010

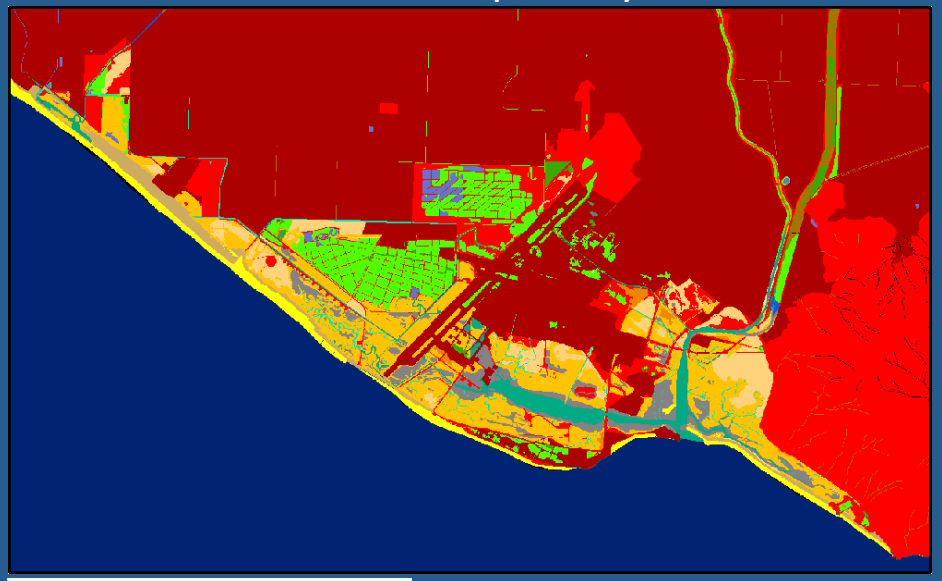
Allow wetlands to transgress

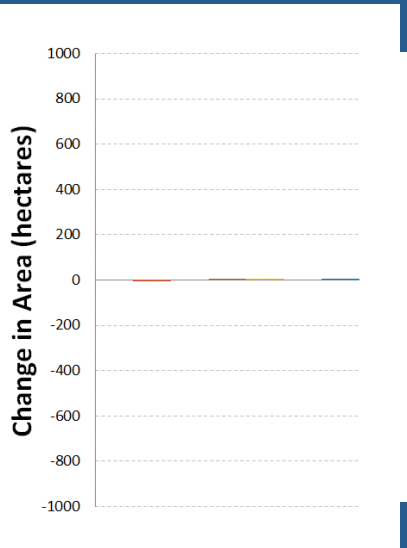


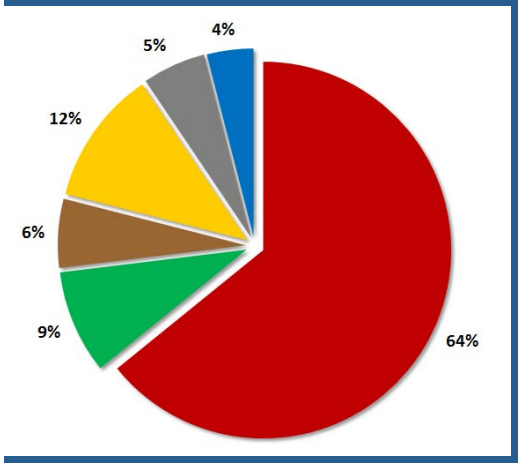




Protect developed dry land



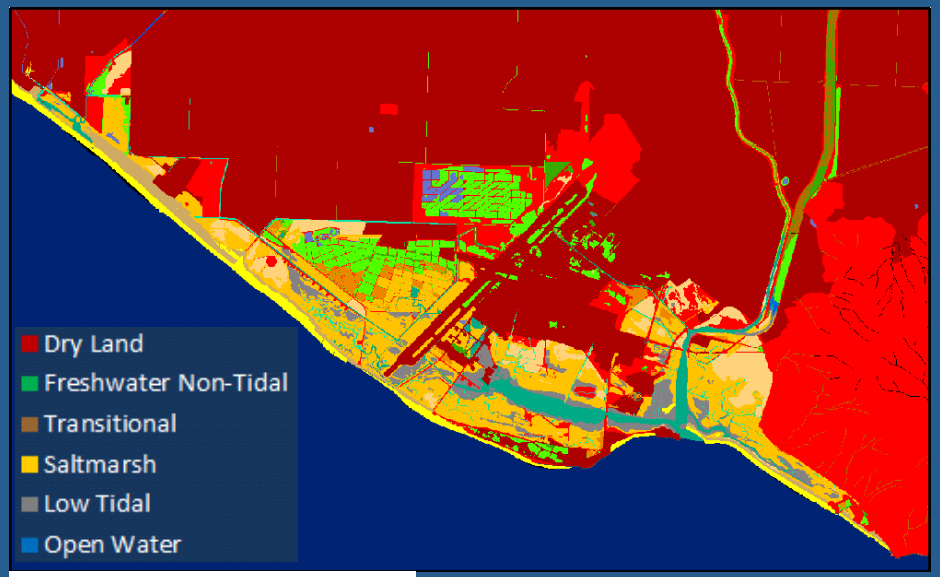


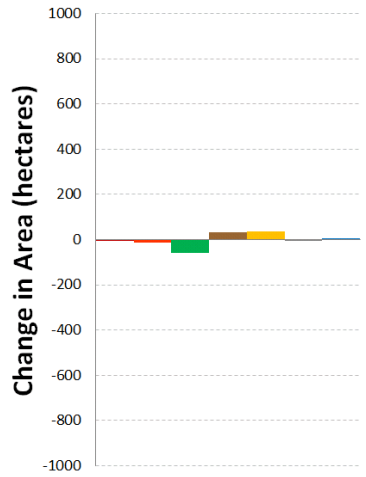


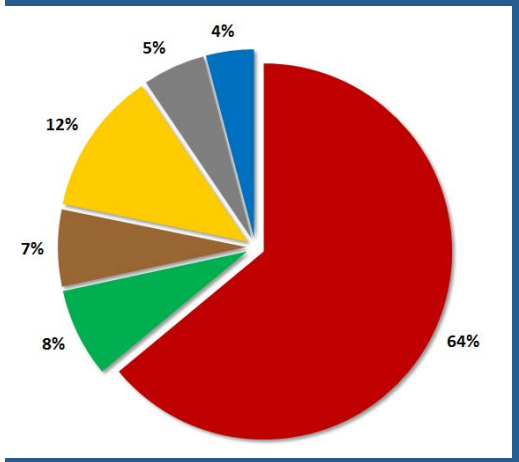
SLAMM

Example Scenario: 2030

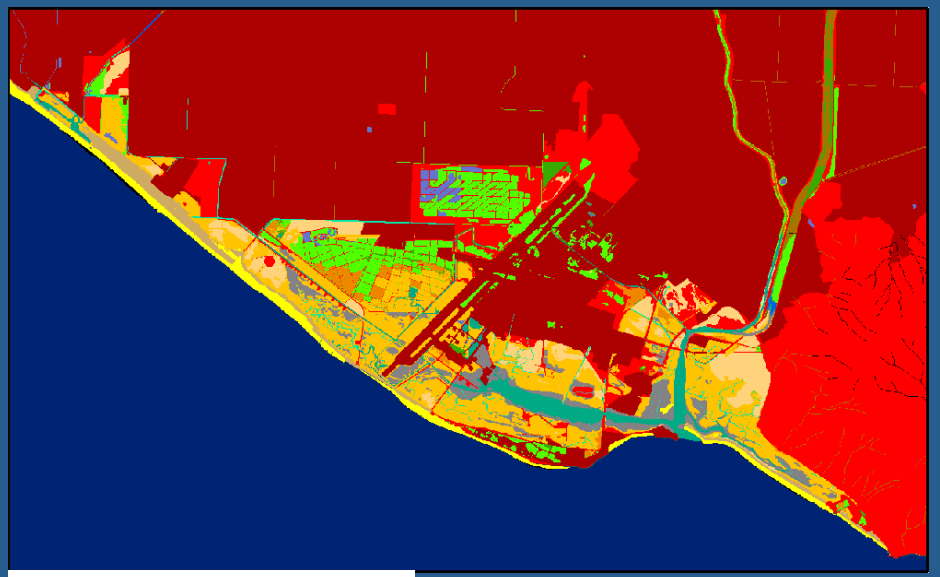
Allow wetlands to transgress

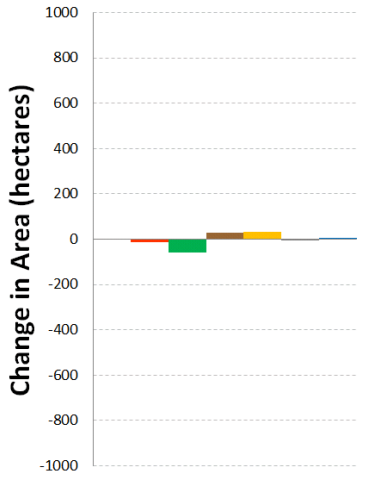


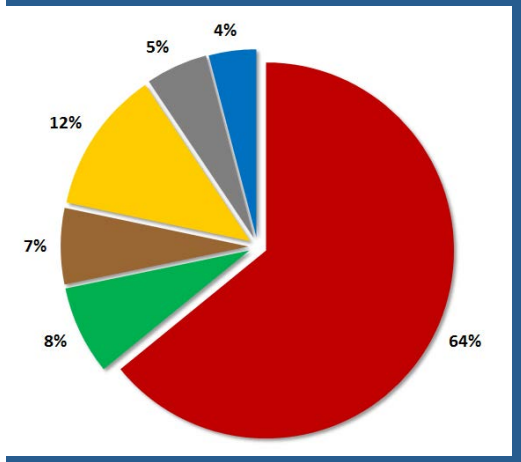




Protect developed dry land



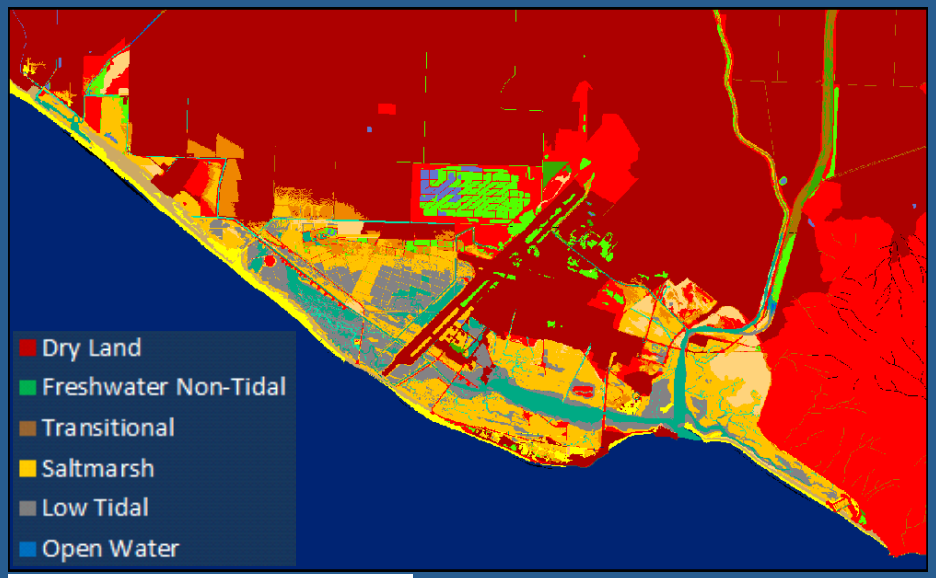


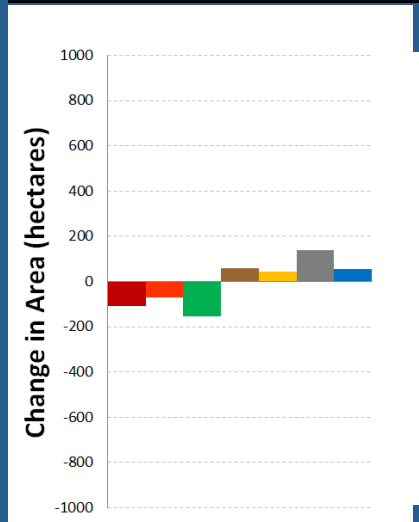


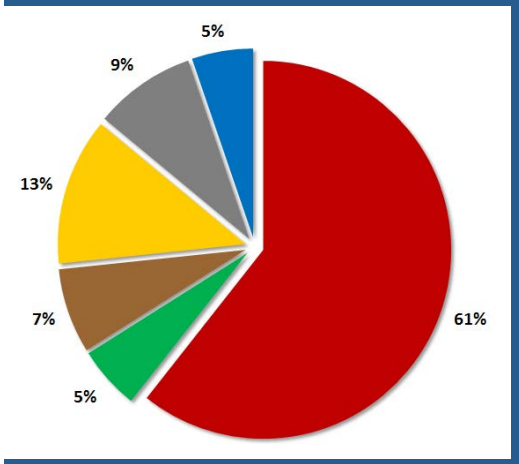
SLAMM

Example Scenario: 2060

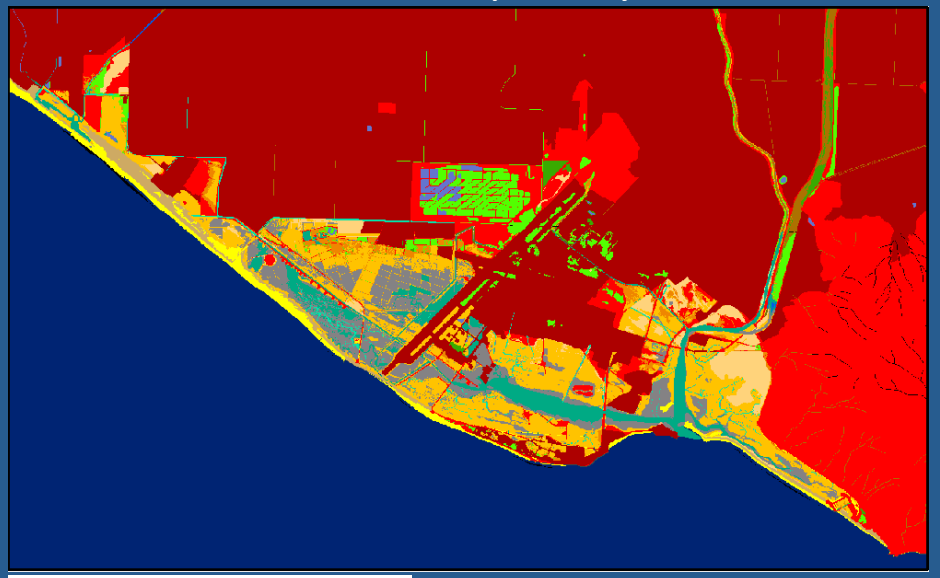
Allow wetlands to transgress

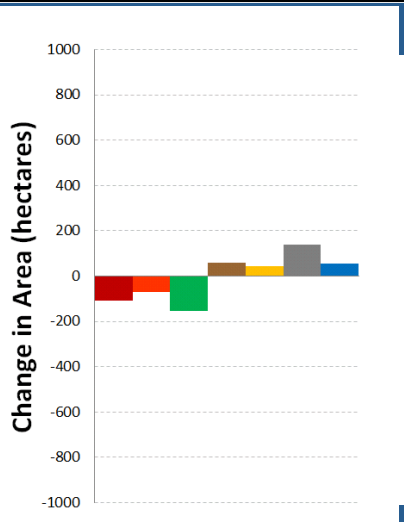


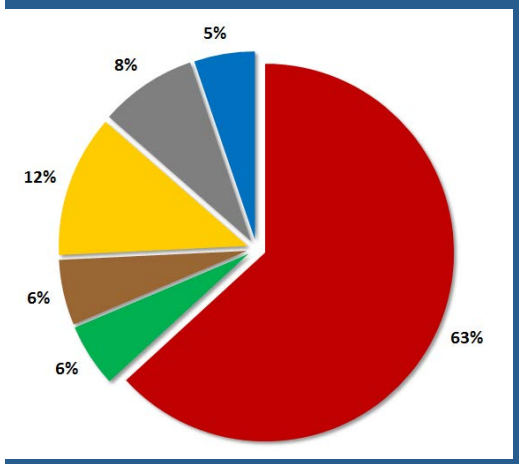




Protect developed dry land



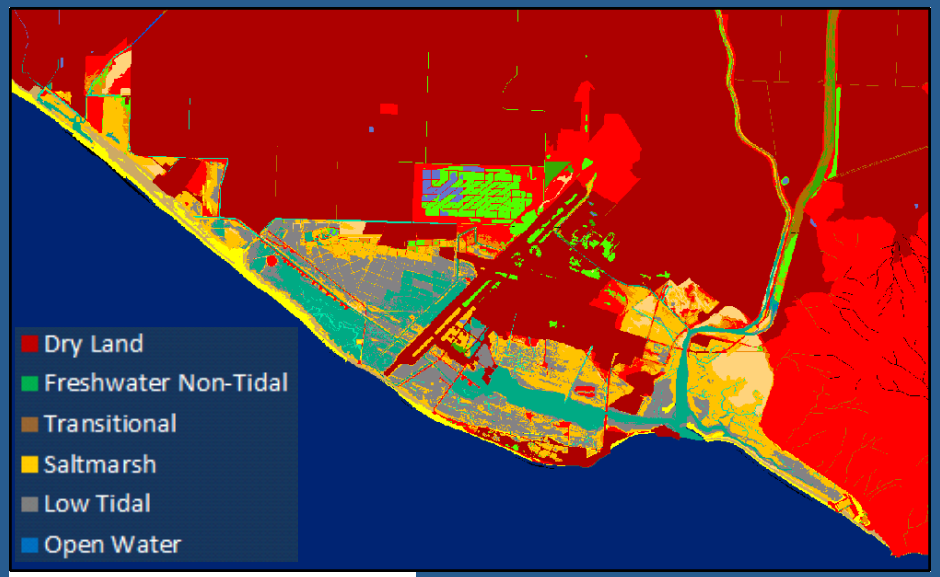


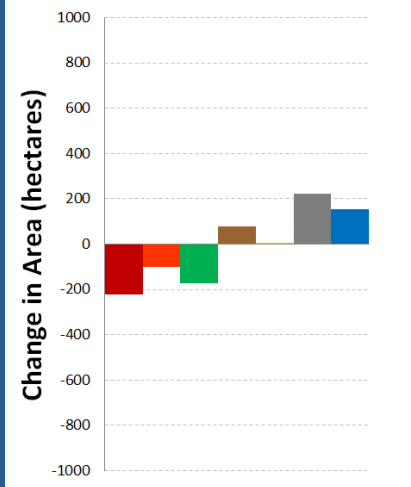


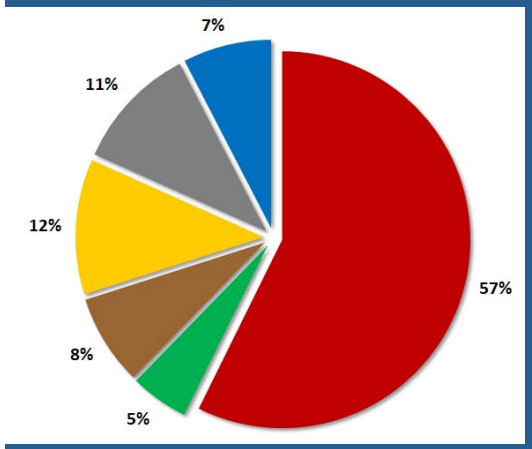
SLAMM

Example Scenario: 2070

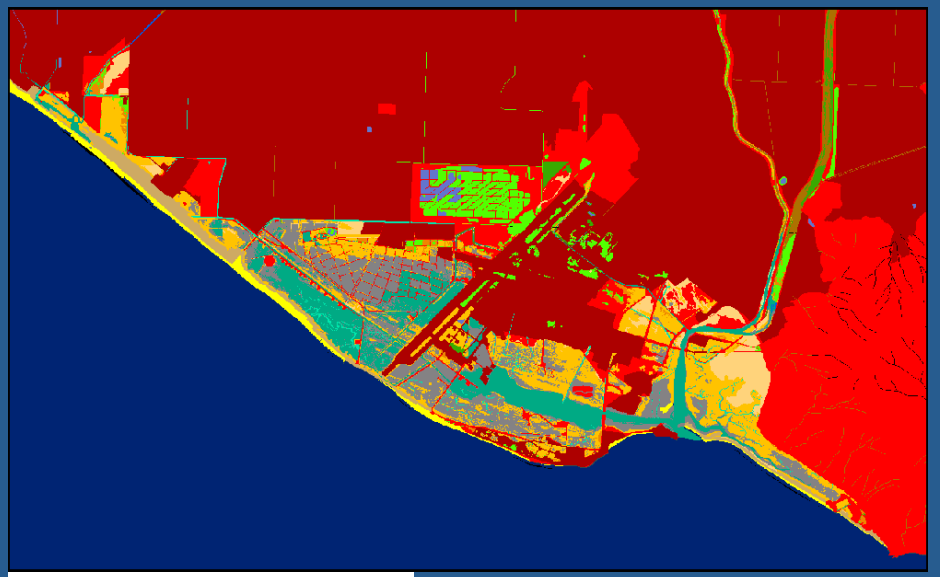
Allow wetlands to transgress

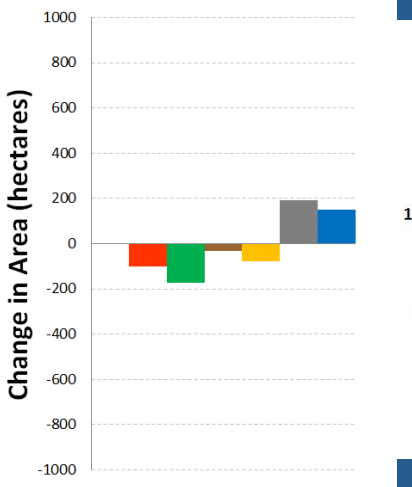


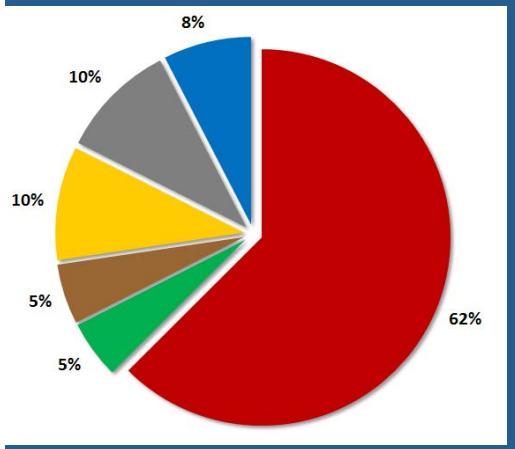




Protect developed dry land

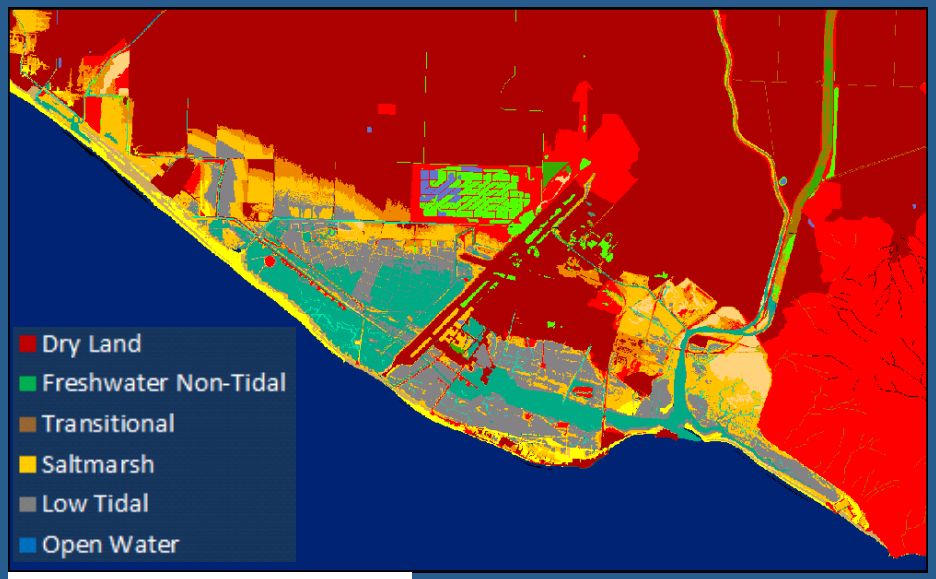


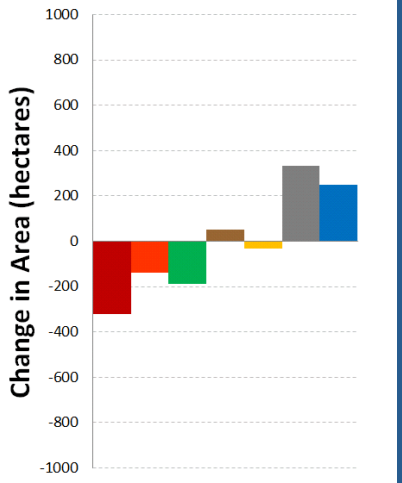


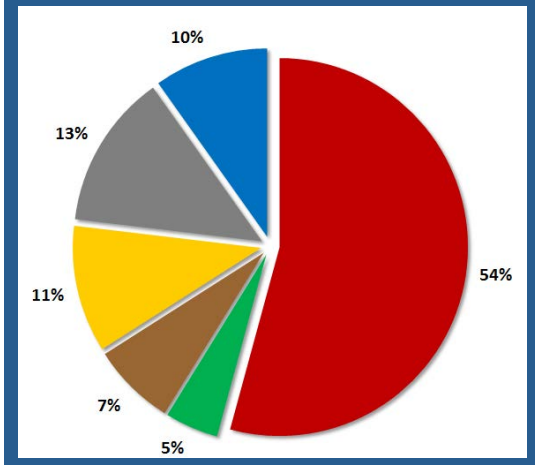


Example Scenario: 2080

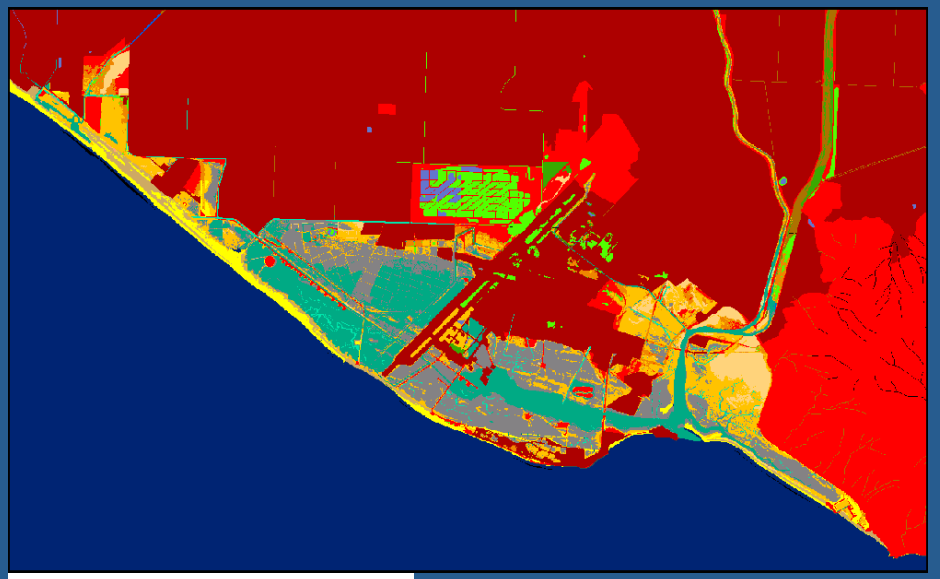
Allow wetlands to transgress

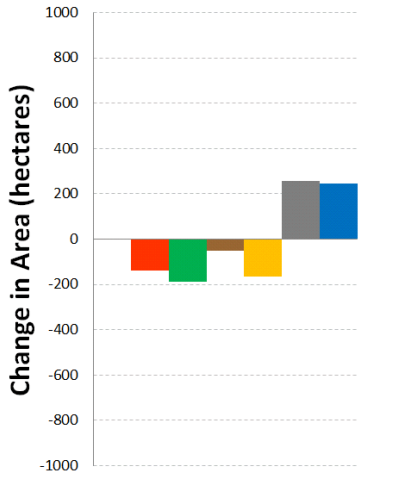


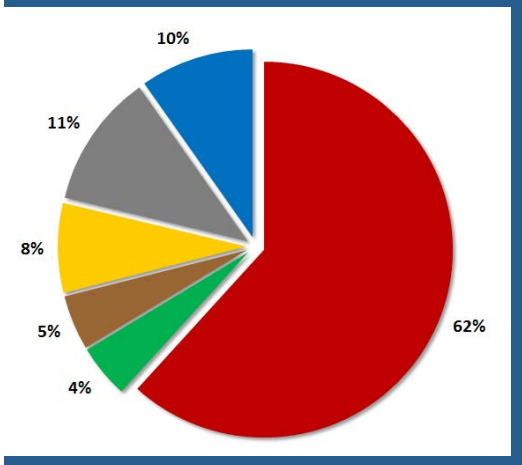




Protect developed dry land



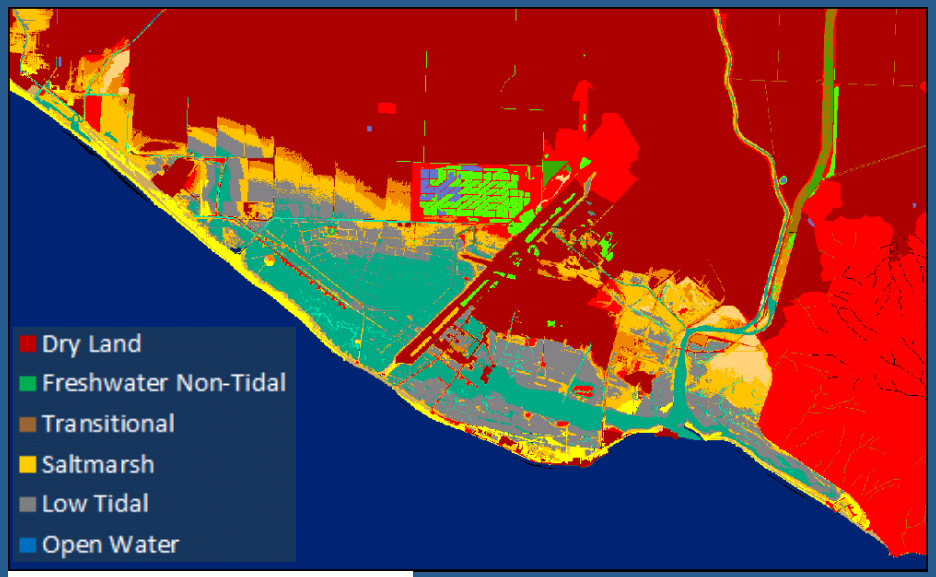


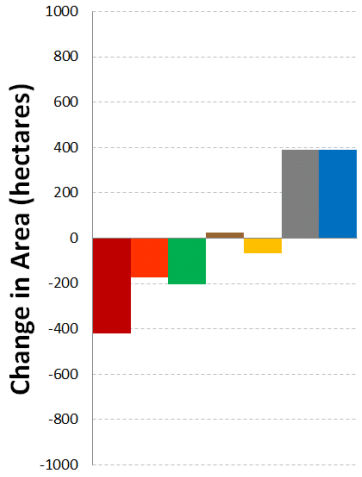


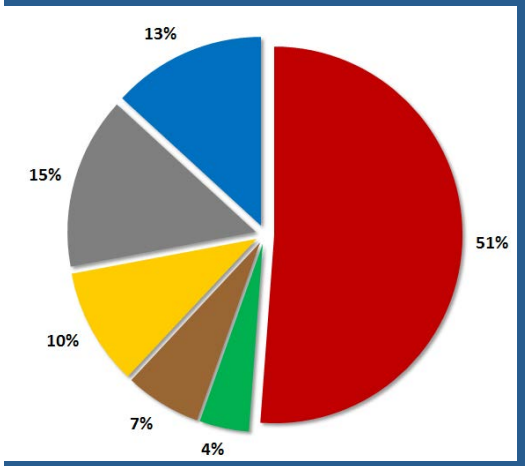
SLAMM

Example Scenario: 2090

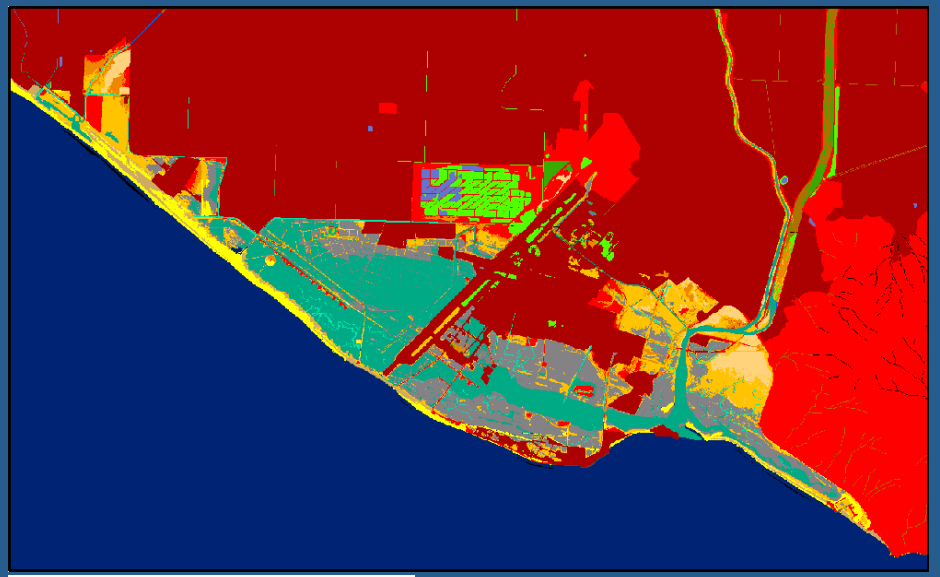
Allow wetlands to transgress

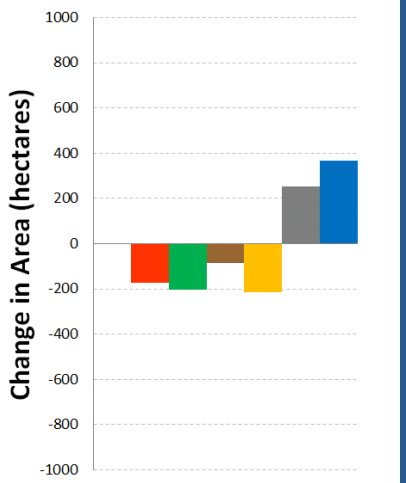


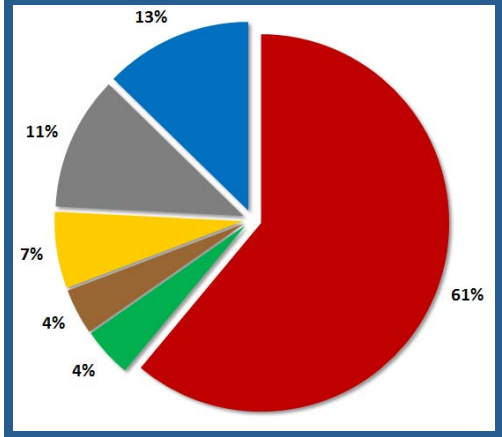




Protect developed dry land



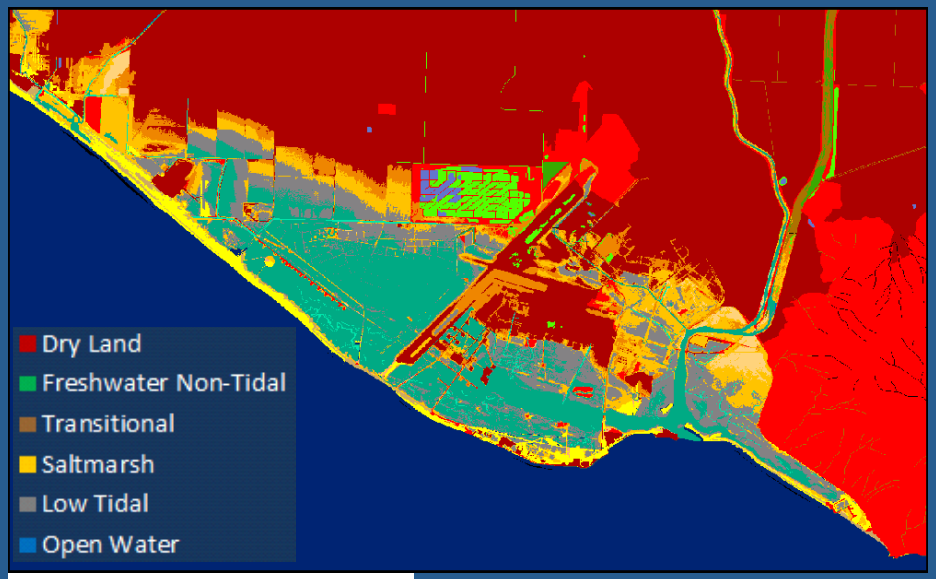


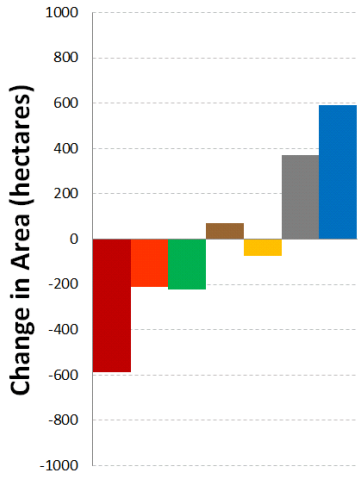


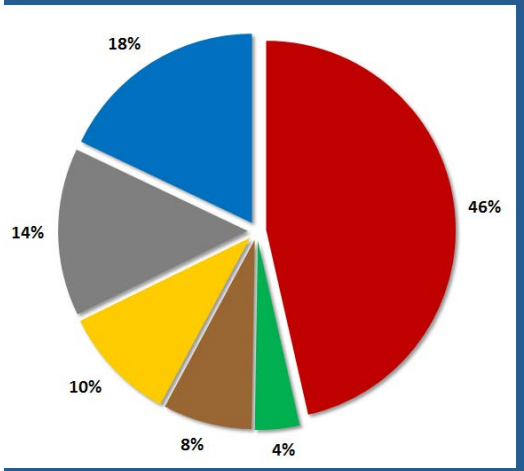
SLAMM

Example Scenario: 2100

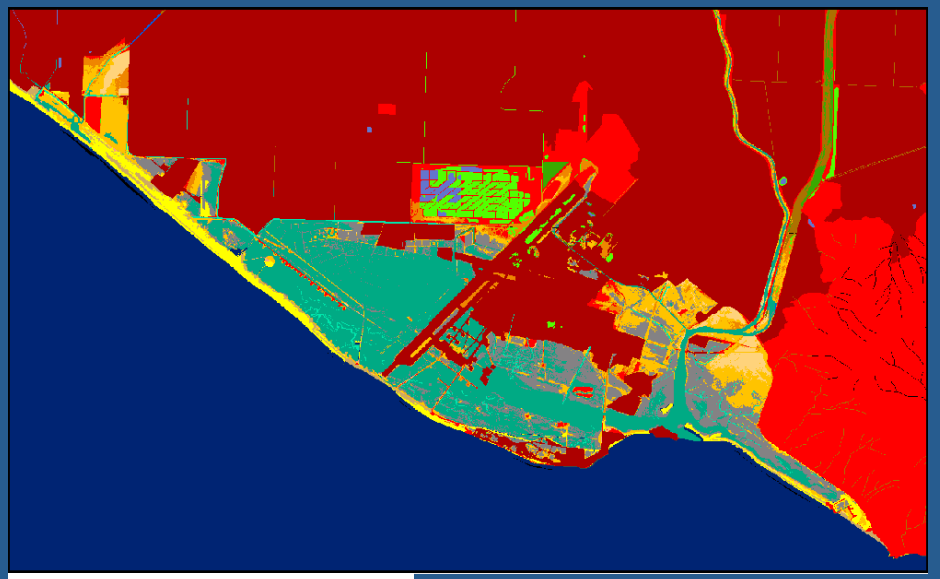
Allow wetlands to transgress

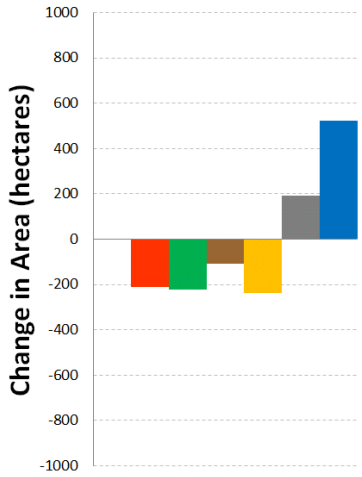


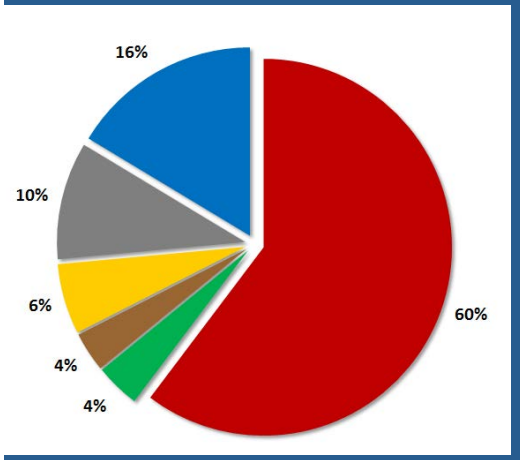




Protect developed dry land



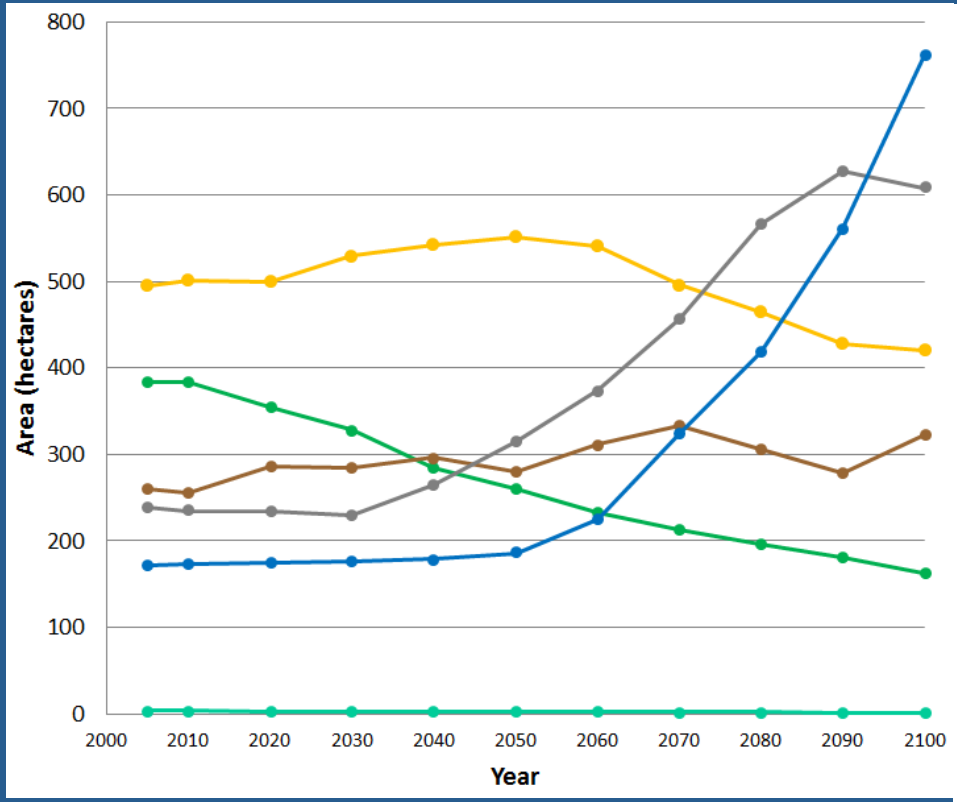




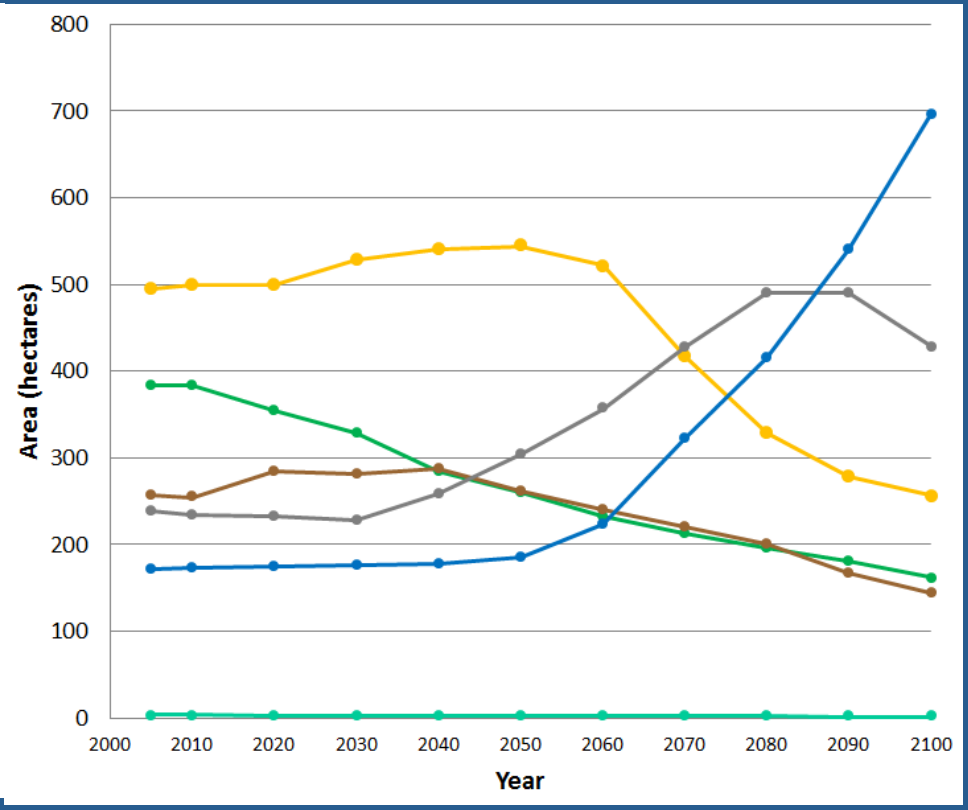
SLAMM

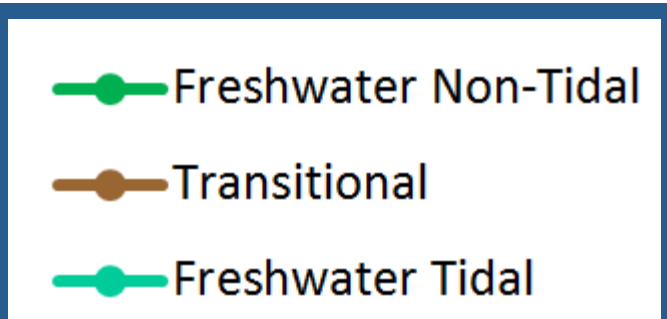
Habitat Area over Time

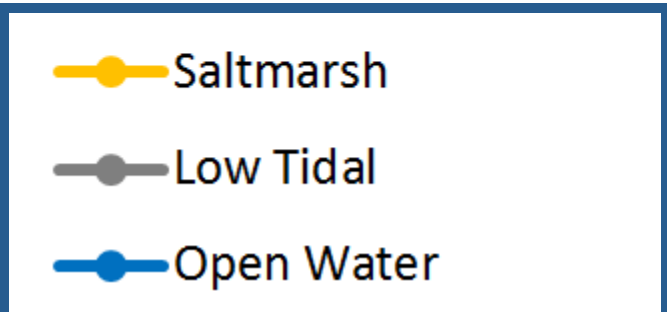
Allow wetlands to transgress



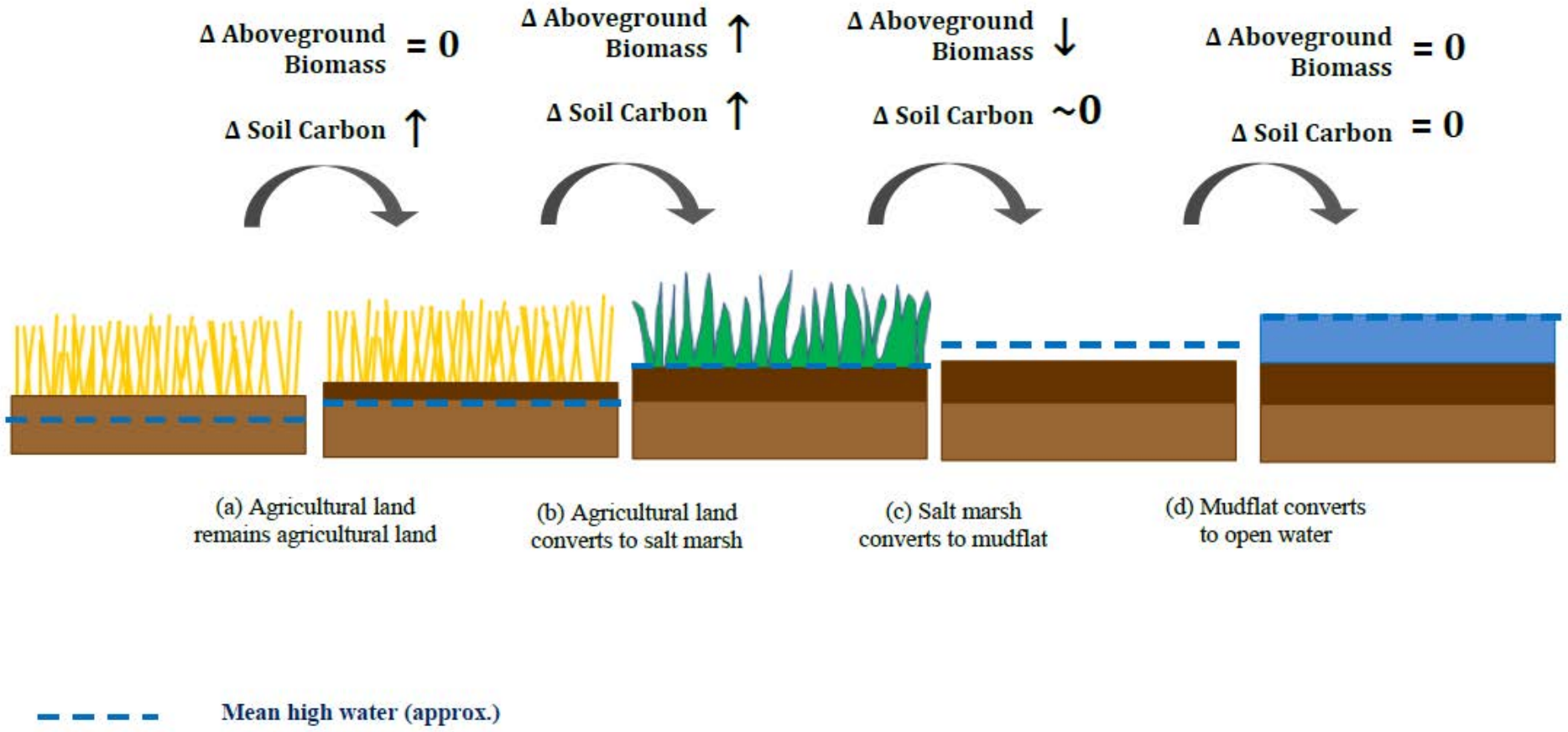
Protect developed dry land







Coastal Ecosystems: Long-Term Carbon Sequestration and Storage



Note: This is an example and does not show all possible habitat conversions.

Mean sea level shown for reference only. Time between transitions is not specified and depends on land elevations, rate of sea level rise, and accretion rate.

figure 4

Ventura County Climate Change Vulnerability Assessment

Conceptual Model of Accounting Framework

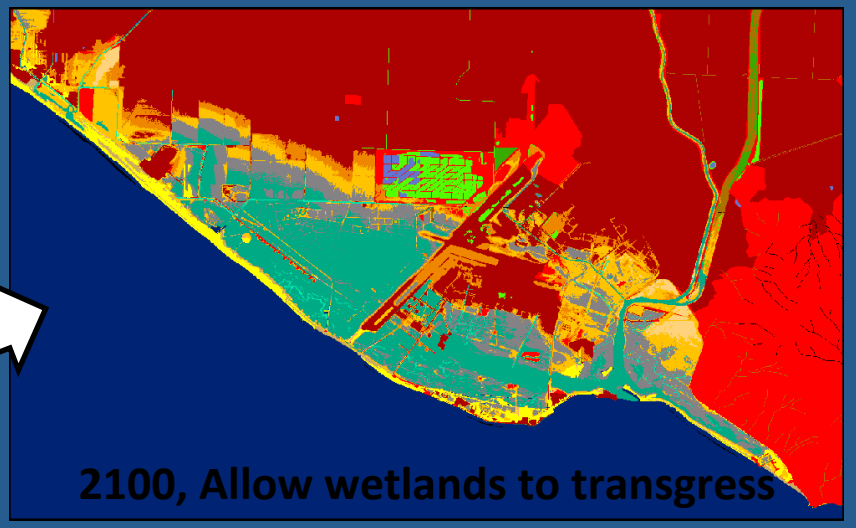
ESA PWA Ref# D211452.04

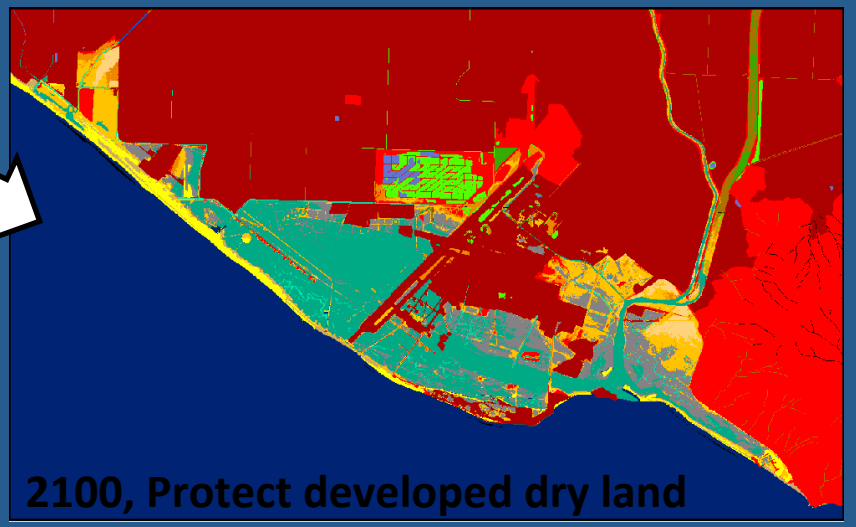
ESA PWA

Approach in Mugu Lagoon

Current habitat areas
x (sequestration rate – emissions rate)
= Total sequestration

Future Scenarios. For example…

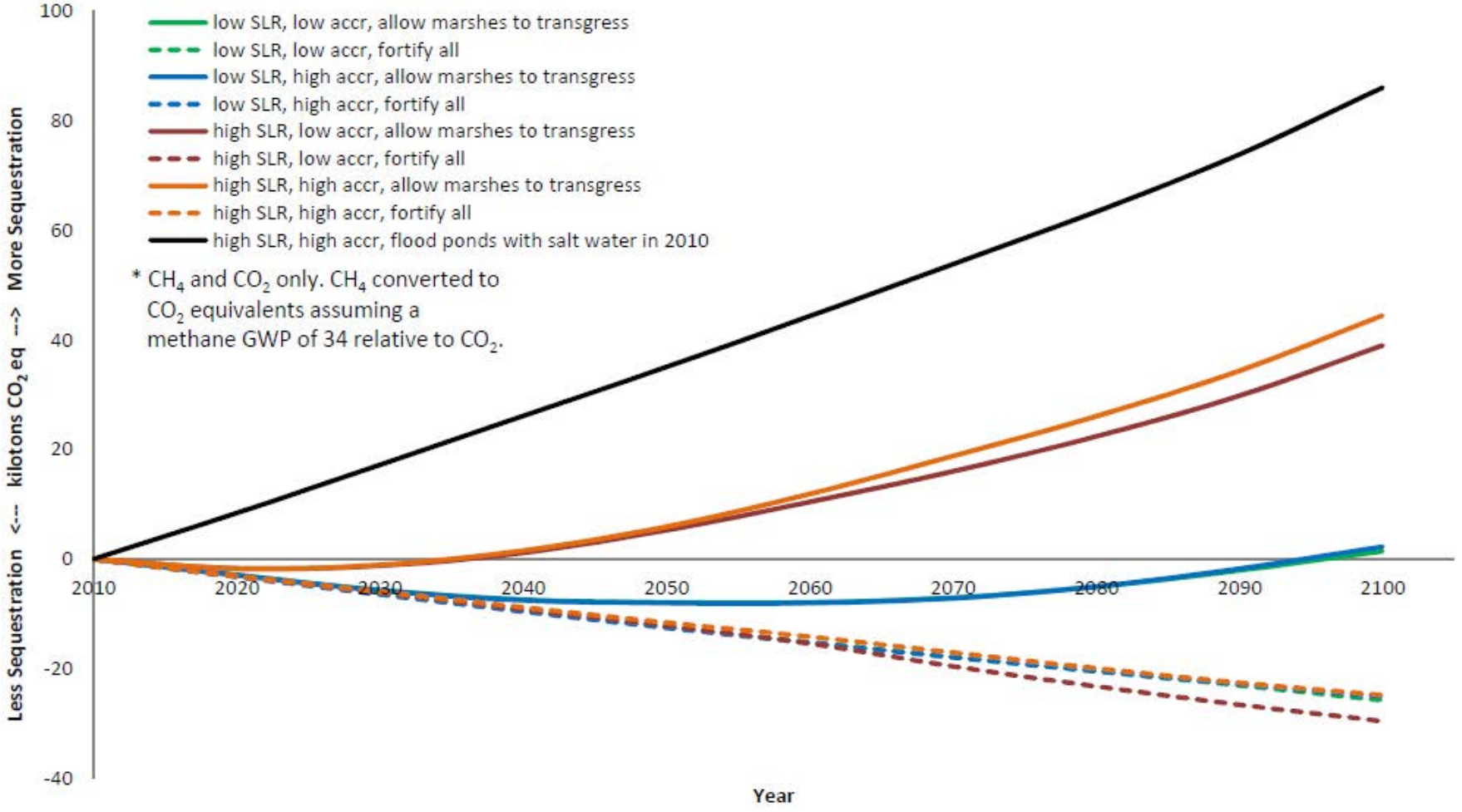




Approach in Mugu Lagoon

- Estimate emissions with historic land use change
  - Assessment of created accommodation space
  - Estimate of soil carbon density.
  - Estimate of CH_4 emissions across salinity gradient, if possible
- Explore whether emissions are likely to be ongoing
  - Soils maps
- Estimate emissions and reductions for future scenarios
  - Time series assessment of land use change (from model)
  - Estimate of emissions and change through time.

Total Greenhouse Gas Sequestration*



Normally, GHG accounting results are presented in tonnes or megatons. In this case, the size of the Mugu Lagoon and Ormond Beach study area lends itself to kilotons, a less typical unit of analysis.

figure **12b**
Ventura County Climate Change Vulnerability Assessment

Total GHG Sequestration (Methane 100-yr GWP of 34)

ESA PWA Ref# D211452.00

ESA PWA

Emission/Sequestration Data

- IPCC 2006 Guidelines for GHGs – Vol 4
- IPCC 2013 Wetlands Supplement

  Guidance for accounting for wetland conversion and restoration in coastal, freshwater, and constructed wetlands
- CalEEMod 2013 – GHG accounting software for projects
- Elgin 2012, Soil organic matter in SoCal marshes
- Formeller et al 2008, Carbon accounting for Cal Poly Pomona campus
- San Francisco Bay marsh carbon sequestration studies

- Others? *In particular, methane emissions from duck ponds*

Land Use/Land Cover Data

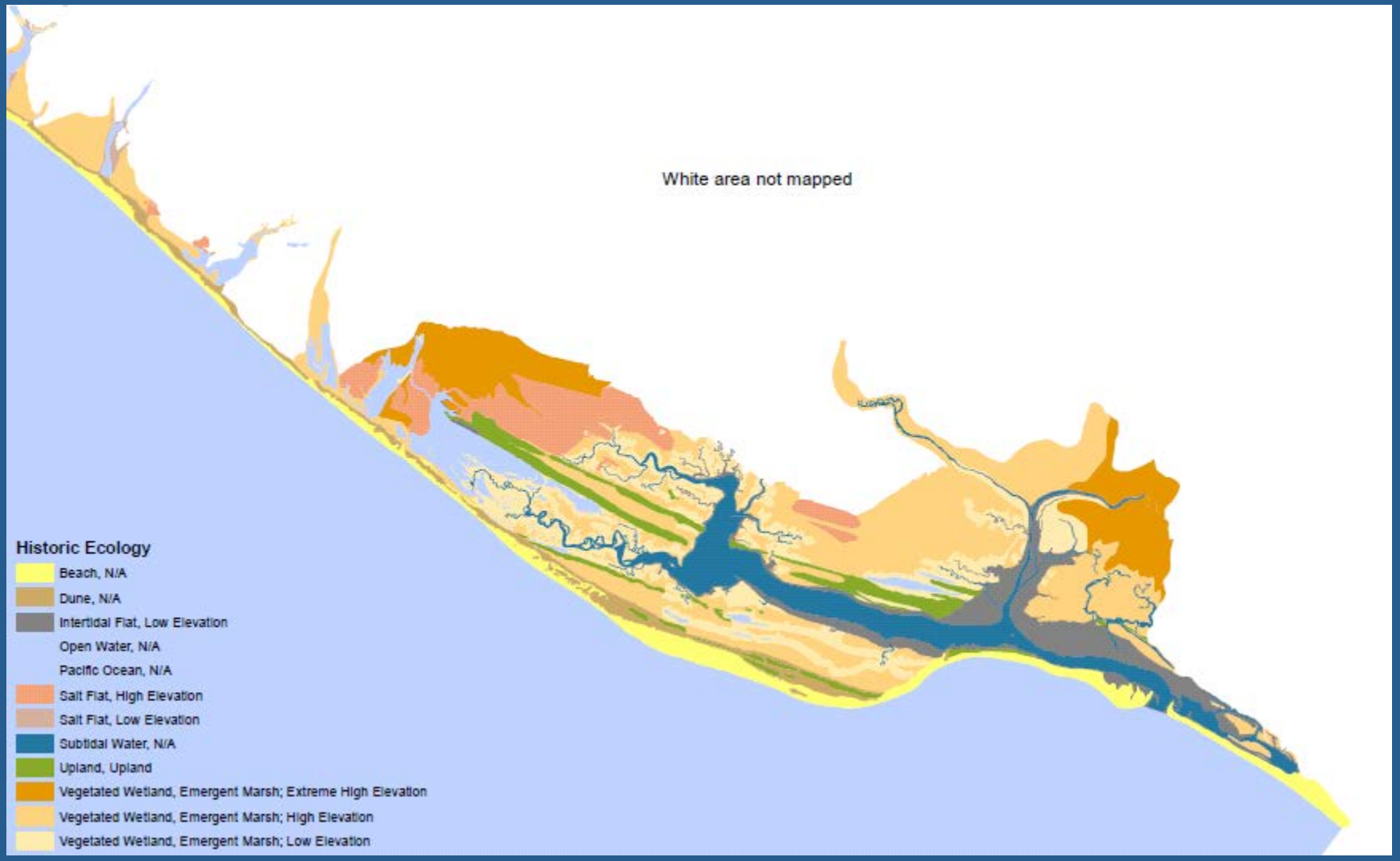
Soil Map (SSURGO 2008)

Land Use/Land Cover Data

Crop Map (Ventura County Ag Commission 2013)

Land Use/Land Cover Data

Historic Wetland Map (USGS Digital T-Sheets)



Green vs Gray

- Focus group interviews of potential adaptation strategies
- Evaluate changes to physical extent of hazards
- Economic analysis (initial effort)
  - Risk reduction
  - Cost estimate of construction
  - Impacts to Agriculture
  - Recreation
  - Ecosystem Services

Table 30 – Summary of All Benefits - NBA			
TOTAL	**2030**	**2060**	**2100**
Mean High Water	$7,806	$255,517	$81,17[illegible]
Storm	$2,690,360	$18,314,525	$104,[illegible]
Wave	$1,631,100,669	$2,119,28[illegible]	$[illegible],197,047
Erosion	$352,635,184	$6[illegible],3[illegible],50	$650,244,754
Total NBA	**$1,986,426,[illegible]**	**$2[illegible]747,959,211**	**$3,562,581,861**

Table 31 – Summary of All Benefits - EBA			
TOTAL	**2030**	**2060**	**2100**
Mean High Water	$9,702	$203,139	$99,910,177
Storm	$15,025,983	$68,732,214	$312,797,682
Wave	$1,714,421,453	$2,217,111,389	$3,005,868,254
Erosion	$431,162,955	$735,754,201	$780,745,704
Total EBA	**$2,160,610,391**	**$3,021,597,803**	**$4,099,411,639**

Risk Reduction Only!

Decision-Support
www.maps.coastalresilience.org

RESILIENCE MAPPING

The coastal resilience approach and mapping are informing restoration, adaptation and conservation decisions around the world.