

**Lifting the Fog:**  
**Understanding Sea Level Rise and Shoreline Change Planning Tools**  
August 18, 2014 || California Adaptation Forum || Sacramento, CA

**Workshop Proceedings Report**

**Workshop organizers**

Dani Boudreau, Tijuana River National Estuarine Research Reserve  
Kelley Higgason, Gulf of Farallones National Marine Sanctuary  
Rebecca Lunde, NOAA Office for Coastal Management<sup>1</sup>  
Sarah Newkirk, The Nature Conservancy in California  
Heidi Nutters, San Francisco Bay National Estuarine Research Reserve  
Marina Psaros, Coravai LLC  
John Rozum, TBG for NOAA Office for Coastal Management

**Support provided by**

NERRS Science Collaborative  
NOAA Office for Coastal Management  
The Nature Conservancy

**Report date**

November 21, 2014



<sup>1</sup> Formally known as the Coastal Services Center

# TABLE OF CONTENTS

INTRODUCTION .....	2
Background .....	2
Workshop Goals and Objectives .....	3
Opening and Framing .....	3
TOOLS CAFÉ .....	3
FACILITATED DISCUSSION .....	6
CLOSING .....	9
Next Steps for Lifting the Fog planning team .....	9
APPENDICES .....	11
Appendix A: Workshop Agenda .....	12
Appendix B: Tool and Project Summaries .....	11
Appendix C: Workshop Organizer and Speaker Contact Information .....	17
Appendix D: Workshop Attendee List .....	18
Appendix E: Simplified Sea Level Rise Model Comparison .....	20
Appendix F: Sea Level Rise Viewer, Coastal Resilience Tool, and Surging Seas Risk Finder Tool Comparison .....	21

## INTRODUCTION

### Background

The emergence of new sea level rise (SLR) planning guidance, tools, and models over the past several years has created a need for better communication strategies that connect these emerging products to their key target audience – primarily local and coastal decision-makers<sup>2</sup>. The Lifting the Fog project is providing practical resources and support for collaboration to both the end-users of SLR tools and models, as well as to the tool development community in the state of California through dialogue and outcomes from two statewide workshops.

The first workshop, hosted on May 22, 2014 (referred to here as the Tool Development Community workshop) utilized a facilitated process with invited participants from the tool and model development community to engage in dialogue, and begin to develop a shared communication framework to help end-users navigate the different planning tools and data available to them. The workshop provided a first of its kind, statewide forum for the tool development community to discuss projects, lessons-learned, and potential for collaboration. A number of communication deliverables were proposed at the [May 22<sup>nd</sup> workshop](#), and some are currently in development (see Next Steps section of this document for a list).

**The second workshop, hosted on August 18, 2014 as a pre-forum workshop of the California Adaptation Forum in Sacramento, CA, is outlined in the following proceedings report** (see Appendix A for agenda). This workshop focused on providing resources to coastal decision-makers to help them navigate the SLR tools and models available to support planning

---

<sup>2</sup> In this instance, coastal decision-makers can be defined as people working to manage resources or make decisions affecting resources along the coasts and estuaries of California, including local, state and federal entities, non-profit organizations, consultants and scientists.

and management efforts across the State. An interactive experience was provided for participants that included three primary parts: 1) an interactive tool café with stations for tool exploration with developers; 2) a panel session for direct interaction between model and tool developers with decision-makers and end-users; and 3) a discussion of communication strategies around SLR decision-support tools. Workshop participants were a diverse mix of practitioners attending the California Adaptation Forum, including federal, state and local agencies; consultants; non-profit organizations and academia.

### **Workshop Goals and Objectives**

- Tool development community and end-users meet and better understand each other's methods, needs, and objectives;
- End-users understand the landscape of planning tools and data available to them, and learn when and how to use SLR models and tools in specific planning processes or other contexts;
- Participants learn strategies for communicating about tools and interpreting results; and
- End-users provide feedback to the tool development community on communication product needs, as well as the future direction of models and tools.

### **Opening and Framing**

The workshop began with an overview of the agenda and goals for the afternoon. Attendees were then given an overview of the May 2014 Tool Development Community workshop, focusing on some of the key products available for communicating about SLR tool similarities and differences. These products included:

- [A detailed matrix comparing the six SLR decision-support tools currently available in California;](#)
- [A simplified matrix, based on the above, posted on the Climate Central website as part of their release of Surging Seas 2.0 in California in May 2014;](#)
- A sea level rise model comparison table (see Appendix E); and
- The Sea Level Rise Viewer, Coastal Resilience Tool, and Surging Seas Risk Finder tool comparison developed by NOAA Office for Coastal Management and the Nature Conservancy (see Appendix F)

Attendees were encouraged to consider what additional products would be useful to them in order to better understand and communicate about SLR tools to their colleagues, decision-makers and the general public.

## **TOOLS CAFÉ**

The Tools Cafe was organized to provide an interactive experience, allowing participants to engage directly with the tool development community. Participants were given the opportunity to rotate through cafe stations to receive a guided tour of the tools and ask questions. Tool development teams were able to demonstrate the application of their tools and/or online adaptation resources in different planning contexts.

As participants rotated through the tool stations, they were encouraged to think about the following questions:

- What challenges do you anticipate (or do you already have) in using these tools?
- How do YOU communicate about tools in your work? How can we - the tool development community - help you do that?

- In addition to the tools you see and hear about today, what other tool related resources (guidance, technical assistance, etc.), would make it easier to integrate tools into your adaptation planning?

The following tools and/or online adaptation resources were represented at the Tools Cafe:

#### Adapting to Rising Tides Portfolio

**Focus area:** San Francisco Bay

**Link:** [www.adaptingtorisingtides.org](http://www.adaptingtorisingtides.org)

**Description:** The San Francisco Bay Conservation and Development Commission (BCDC) is working in partnership with the NOAA Office for Coastal Management<sup>3</sup>, the Metropolitan Transportation Commission (MTC), the Association of Bay Area Governments and many other partners to increase the preparedness and resilience of Bay Area Communities to sea level rise and storm events while protecting critical ecosystems and community services. The objectives of Adapting to Rising Tides (ART) are threefold:

- Create “road tested” adaptation tools, processes and resources that benefit others in the region and beyond;
- Identify how adaptation planning can be scaled up and down across different geographies, sectors, services and asset categories; and
- Integrate society and equity, economy, environment, and governance into all steps of the adaptation planning process.

#### Cal-Adapt: Exploring California’s Climate

**Developers:** University of California Geospatial Innovation Facility; California Energy Commission

**Link:** [cal-adapt.org/sealevel/](http://cal-adapt.org/sealevel/)

**Description:** Cal-Adapt is a statewide portal of climate research, data and downscaled climate change scenarios produced by the State’s scientific and research community. Sponsored by the California Energy Commission and developed by UC Berkeley’s Geospatial Innovation Facility, the site highlights research into five specific climate impacts: temperature, precipitation, snow pack, wildfire risk and sea level rise. Currently, the site hosts a subset of the Pacific Institute 2009 SLR study. Cal-Adapt also links users to other resources developed by NOAA, Climate Central, BCDC, The Nature Conservancy, State Coastal Conservancy, and the Our Coast, Our Future effort.

#### Coastal Resilience Ventura

**Developers:** The Nature Conservancy; University of Southern Mississippi; The Natural Capital Project; NOAA Office for Coastal Management; and the Association of State Floodplain Managers

**Link:** <http://www.maps.coastalresilience.org/ventura>

**Description:** The Nature Conservancy’s Coastal Resilience tool ([maps.coastalresilience.org](http://maps.coastalresilience.org)) is a visualization and decision-support platform where ecological, social, and economic information can be viewed alongside sea level rise and storm surge scenarios to develop risk reduction and restoration solutions. The tool was first created in 2008 and used on the southern shores of Suffolk County, Long Island, in New York. The decision-support tool now covers different regions including: 10 U.S. States (Alabama, California, Connecticut, Florida, Louisiana, Mississippi, New Jersey, New York, Texas, Washington), 4 countries in Latin America (Mexico, Belize, Guatemala, Honduras) and 3 island nations in the Caribbean (Grenada, St. Vincent and the Grenadines, U.S Virgin Islands). There is also a U.S. National and global application.

---

<sup>3</sup> Formally known as the Coastal Services Center

Coastal Resilience 2.0 was released in October 2013 to better enable decision-makers to assess risk and identify nature-based solutions to reduce socio-economic vulnerability to coastal hazards.

#### Our Coast, Our Future

**Developers:** Point Blue Conservation Science; U.S. Geological Survey; Gulf of Farallones National Marine Sanctuary; Coravai, LCC

**Link:** [pointblue.org/ocof](http://pointblue.org/ocof)

**Description:** Our Coast, Our Future is a collaborative, user-driven project providing decision-support tools to help understand, visualize and anticipate the effects of sea level rise and storms on the North-central California coast, from Half Moon Bay to Bodega Head, and San Francisco Bay shorelines and baylands. The tool provides maps that use a 2-meter horizontal grid digital elevation model (DEM) and consider total water levels with static sea level rise of 0, 25, 50, 75, 100, 125, 150, 175, 200 and 500 centimeters. The inundation maps also consider the 1-year, 20-year and 100-year storm events and their corresponding wave hazards. The water level data was produced using the USGS's Coastal Storm Modeling System (CoSMoS).

#### Sea Level Rise and Coastal Flooding Viewer

**Developers:** NOAA Office for Coastal Management<sup>4</sup>

**Link:** [www.csc.noaa.gov/slr](http://www.csc.noaa.gov/slr)

**Description:** The Sea Level Rise and Coastal Flooding Impacts Viewer is a visualization tool for coastal communities showing the potential impacts from sea level rise and coastal flooding. The tool covers the contiguous United States coastline as well as Hawaii, the Pacific territories, Puerto Rico and the U.S. Virgin Islands (not yet available in Louisiana and Alaska). In California, the maps use a 5-meter horizontal grid digital elevation model (DEM) and consider static sea level rise on top of Mean Higher High Water (MHHW). The maps are created using a "modified" bathtub approach that includes a hydrologic connectivity assessment. This means that areas are only shown as inundated (in blue) if there is a feasible pathway for water to flow. Areas that are at or below the selected SLR elevation, but are disconnected, are shown in green.

#### Silicon Valley 2.0

**Project Focus:** Silicon Valley region

**Link:** [www.sccgov.org/sites/osp/SV2/Pages/SV2.aspx](http://www.sccgov.org/sites/osp/SV2/Pages/SV2.aspx)

**Description:** The Silicon Valley 2.0 Project is a regional effort, managed by the Santa Clara County Office of Sustainability and funded by the Strategic Growth Council, to minimize the anticipated impacts of climate change and reduce the generation of local greenhouse gas emissions. The project is using a risk management framework to:

- Evaluate the exposure of community assets (i.e., infrastructure, populations, and landscapes) to likely climate impacts;
- Examine the potential consequences to the economy, society, and environment of this exposure; and
- Develop preemptive adaptation strategies that improve community resiliency.

The project will prepare a strategic climate change adaptation plan that aims to facilitate and coordinate regional planning and implementation efforts in this area. The plan will identify assets within the region that are threatened by the anticipated climate change conditions and the magnitude of the potential economic, social, and environmental impacts that could result if no action is taken. Ultimately, the plan will identify the region's top priorities, and the near-term

---

<sup>4</sup> Formally known as the Coastal Services Center

actions needed to implement an effective regional scale adaptation response. The project will also develop a decision-support tool that will allow jurisdictions and other organizations to evaluate potential climate change impacts and strategies within their communities.

## FACILITATED DISCUSSION

Becky Smyth, NOAA Office for Coastal Management West Coast Director, led a discussion among workshop attendees and a panel of tool and/or coastal adaptation planning representatives including:

- Dani Boudreau, Tijuana River National Estuarine Research Reserve (CURRV)
- Kelley Higgason, Gulf of Farallones National Marine Sanctuary (OCOF)
- Wendy Goodfriend, Bay Conservation and Development Commission (ART)
- Demetra McBride, County of Santa Clara (Silicon Valley 2.0)
- Shruti Mukhtyar, U.C. Berkeley (Cal-Adapt)
- Sarah Newkirk, The Nature Conservancy in California (Coastal Resilience Ventura)
- John Rozum, TBG for NOAA Office for Coastal Management (NOAA SLR Viewer)
- Susan Wilhelm, California Energy Commission (Cal-Adapt)

The panel provided multiple examples of different on-the-ground planning processes, and how a wide-range of approaches have been developed to address a variety of local issues. Below are summarized highlights of the discussion.

### **Getting started using available resources and historical risk**

The Adapting to Rising Tides (ART) project, led by the Bay Conservation and Development Commission (BCDC) has learned that regionally available maps are an excellent first start to adaptation planning. BCDC staff felt that it's best to just start with whatever is available. Planners don't need to know everything, everywhere; they can progressively do the analysis to understand what's at risk. They could even initially get a group together using anecdotal information and local knowledge - without a map - to determine what is historically or currently at risk to coastal flooding, and then do the technical, map-based analysis afterward.

In addition, one of the key take away messages from the Tool Development Community workshop is that tools and models are in place to get you started with adaptation planning. Some tools are more sophisticated, or higher resolution, than others but that shouldn't stop people from using tools with less features. Understanding the limits of all the tools is important, but the chase for the perfect dataset shouldn't stop end-users.

### **Providing regionally relevant data to manage risk**

One of the original intents of the Silicon Valley 2.0 project, led by Santa Clara County and funded by the Strategic Growth Council, was to provide regionally relevant data on the County level, with the long-term goal of expanding to other local geographies. Project managers are currently working with a neighboring county to initiate a similar effort. Additionally, project managers were focused on a risk management approach to adaptation planning, to inform near, mid, and long-term decisions by analyzing the cost of action and comparing it with the cost of inaction. The approach the project is taking includes two key products:

1. A tool that evaluates climate vulnerabilities and allows for geospatial mapping and forecasting across different scales and time horizons. They want to determine the value of different assets, focusing on: replacement value; change in operational value; revenue generated (e.g., toll road vs, regular road); cost of economic interruption.
2. A cross-jurisdictional implementation guide that includes both public and private sectors.

## **Embracing uncertainty**

Because the Climate Understanding & Resilience in the River Valley (CURRV) project led by the Tijuana River National Estuarine Research Reserve (TRNERR) works on the US-Mexico border, with 75% of the watershed in Mexico, there is a lot of uncertainty involved in planning for the future. Many historical and current border issues are hard to plan for, including trash, sewage, and sediment, and now with the added variable of climate change, the uncertainty is compounded. At first the planning team thought SLR maps would address most of their questions; however, after initial scoping it became clear that when dealing with high uncertainty, multiple risk factors, and multi-agency management frameworks, one model is not going to address every management concern. A lot of tools were available in the early scoping stage of the project, including the NOAA SLR Viewer, SLAMM, COSMOS 1.0, among others, to gain a full understanding of the state of the science. All of these provided different pieces of the puzzle, but none answered all of the questions. In order to embrace the inherent uncertainty of the region the planning team adopted a scenario planning approach<sup>5</sup> utilizing expert elicitation, with models being used as only one tool in a larger toolbox.

## **Stakeholder engagement on tool development**

A large portion of the discussion revolved around end-user engagement in tool development, so that the final product addresses the questions the stakeholders want answered. Panelists highlighted the following stakeholder engagement processes:

- There was robust stakeholder engagement involved in developing the TNC Coastal Resilience Tool. They went directly to the stakeholders, having learned from past experiences, “where they built it and they didn’t come”. They met repeatedly with stakeholders, and engaged a planning firm to help them do a local scale analysis. In the Ventura Project, they had the modeler at the table from the start, and made a large amount of progress as a result.
- The ART project came to a lot of the same conclusions as TNC at the same time. It is important that end-users are involved along the way and this was the approach they took also.
- Our Coast, Our Future also convened three scoping meetings to assess the need for coastal flood data, information and end-user technical capacities, as well as an outer coast focus group, and a San Francisco Bay advisory committee which met regularly over the course of the 3-year project.
- Silicon Valley 2.0 worked from the beginning with a technical advisory committee that included a number of local jurisdictions, asset managers, and non-profit organizations in order to collect input on the development of their tool.

## **End-user feedback for tool development teams**

The following requests for individual or collaborative communication projects were made:

- Include a narrated demonstration of how to use tools. For instance, a recorded video tutorial posted on a tool’s website homepage.
- Include the ability to overlay different flood scenarios, and compare the change in flood extent for each scenario. Marin County has a flood control project that had a little

---

<sup>5</sup> Developed four future planning scenarios for the Tijuana River Valley by looking at the changes in two primary variables: (1) increased or decreased tidal prism, and (2) increased or decreased extreme river events. In each future scenario the impacts associated with changes in these variables is assessed through expert elicitation for three categories: (1) Physical/ Geomorphological Characteristics; (2) Natural Habitats; and (3) Built Environment. Once complete, the four planning scenarios will inform the development of climate adaptation strategies, focusing on the usage of living shorelines. For more information visit: [www.trnerr.com/currv/](http://www.trnerr.com/currv/)

cartoon showing the way the water moved over time. It helps the public get a sense of what's really going on.

- If there were a way to describe each of the tools in a sound byte what would it be? Planners don't want to know the "under the hood" info. They need to know where to begin with a simplified, short sound-byte.
- Include case studies of how other communities have utilized tools. What data did they use? Did they use a consultant? Who pays for it and how much might it be? Who is available to provide technical assistance?
- Produce a video that highlights the differences between the tools, as well as information about when you should and should not be using tools.

### **Next steps for data and tools**

- It was suggested that a single point of contact be established to ask, "What's available for my area and what is the resolution?" We need to know what kind of information is available locally vs. regionally.
- Cal-Adapt is working to incorporate the Bay Area Coastal Storm Modeling System (CoSMoS) data into their tool. They are trying to align themselves with where the state is going.
- CoSMoS 3.0 is coming to Southern California, and being supplemented with work by Dave Revell and Ron Flick. This version will include shoreline change.
- There is a lot coming to Monterey Bay that will go on the Coastal Resilience website. TNC is also in the process of building out Coastal Resilience California to host anyone's modeling results.
- The Ocean Protection Council manages the coastal geoportal. There will be excellent topographic and bathymetric cloud point data sets available on Open Topography in the next 2 months.
- Point Blue also just released an update to the Future Marshes Tool for San Francisco Bay, which looks at future affects of marsh accretion and sedimentation, and sea level rise.

### **Moving forward from today**

Attendees provided the following recommendations on how to best enable end-users to move forward in utilizing SLR planning tools, and promote the use of tools as part of the planning process statewide:

#### Secure additional funding

- The State should dedicate funding to allow for continued collaboration.
- The State Coastal Conservancy is looking at regional approaches to utilizing data across a region. They have been running a series of grant rounds for communities to get started on that work.

#### Ensure social equity

- Most of the case studies are happening at well-mobilized jurisdictions and a lot of the lessons-learned are focused on adaptation. We need to mobilize this work with communities that have less capacity to do that work, and also focus on equity.
- An intern working with the Cal-Adapt team spent the summer talking to current and potential users of their tool about how it is being used and how it can be better. She tried to reach out to communities where adaptation hasn't begun and asked, "What is the minimum needed in order for you to initiate this?" She found lack of capacity, staff time, and resources to hire a consultant were the biggest barriers. She surveyed a range of



jurisdictions including: city municipal planners, public health, emergency planning, county staff, and consultants. (Report available upon request to Melissa Deas, [mdeas@mit.edu](mailto:mdeas@mit.edu))

#### Collaborate across jurisdictions and geographic boundaries

- The CURRV project is looking at transferring lessons-learned. They have been using their process to encourage bidirectional information transfer among stakeholders. Don't only think of what expertise stakeholders can offer the process but what resources the process can provide stakeholders to build regional capacity.
- There is a need to collaborate across geographies and bring more partners to the table, such as transportation agencies.

#### Work with the private sector

- More private sector engagement is needed. BCDC has taken on this issue, and has invited them to engage, but it has been challenging to get them to. One of the approaches they are now going to attempt is to go to organizations that represent the private sector rather than to the private sector directly (i.e., a representative from all the refineries within a certain geography). Planning has never been one size fits all.

## CLOSING

Final comments for the session were given by Michael McCormick of the Governor's Office of Planning and Research (OPR). He outlined that OPR is focused on three primary avenues to support moving adaptation planning forward in California:

- Visioning, including looking into possible planning options.
- Legal requirements, including requirements associated with CEQA, general plan updates (guidelines update underway at the moment) and other avenues.
- Incentive-based, such as seed funding to allow people to do deep planning.

Mr. McCormick also highlighted the success of the California Adaptation Forum as an indicator of how people within the state are moving on this issue. Attendance at the Forum far exceeded expectations, with over 800 attendees. He ended by emphasizing the importance of building a community of practitioners who are well-versed on the utilization of tools and models in planning. Opportunities such as the Forum and Lifting the Fog are helping to do just that.

#### **Next Steps for Lifting the Fog planning team**

Moving forward, the Lifting the Fog planning team is exploring avenues for continued collaboration. Listed below are a number of follow up products that interested parties can expect to see from this group.

- [Executive Summary](#) for the Lifting the Fog collaboration, outlining overall findings from the project and potential future collaborations.
- [Website](#), housed under The Nature Conservancy's Coastal Resilience Network, that includes compiled resources such as:
  - Project reports including, proceedings reports from the May 2014 Tool Development Community and August 2014 Coastal Decision-Maker workshops (i.e., this report), and the Executive Summary
  - Finalized Tools Matrix
  - Contact and technical assistance information for highlighted sea level rise models, tools, and projects

- Case studies highlighting adaptation planning efforts that integrate sea level rise and shoreline change tools and models in California

# Appendices

## Appendix A: Workshop Agenda

### Lifting the Fog: Understanding Sea Level Rise and Shoreline Change Planning Tools

A Pre-Forum Event

August 18, 2014 2:00 – 5:00PM

#### AGENDA

2:00 **Introduction to session**

2:10 **Overview of SLR Tools in California**

2:30 **Tool Café**

Tools represented

- Our Coast Our Future
- NOAA's Sea Level Rise and Coastal Flooding Viewer
- Coastal Resilience Ventura
- Cal-Adapt
- Silicon Valley 2.0
- Adapting to Rising Tides Portfolio

3:55 **Facilitated discussion in Three Parts**

- Challenges in using tools and data in adaptation planning
- Communicating the availability of tools and data
- Moving forward: new projects, tools, guidance

4:55 **Closing Thoughts**

Support provided by: NOAA Office for Ocean Management  
NERRS Science Collaborative  
The Nature Conservancy



## Appendix B: Tool and Project Summaries

### Tools Represented

#### 1. Sea Level Rise and Coastal Flooding Impacts Viewer (SLR Viewer)

- a. **Organizer/Sponsor:** National Oceanic and Atmospheric Administration (NOAA) Coastal Services Center
- b. **Link:** [www.csc.noaa.gov/slr](http://www.csc.noaa.gov/slr)
- c. The Sea Level Rise and Coastal Flooding Impacts Viewer is a visualization tool for coastal communities showing the potential impacts from sea level rise and coastal flooding. The tool covers the contiguous United States coastline as well as Hawaii, the Pacific territories, Puerto Rico and the U.S. Virgin Islands (not yet available in Louisiana and Alaska). In California, the maps use a 5-meter horizontal grid digital elevation model (DEM) and consider static sea level rise on top of mean higher high water (MHHW). The maps are created using a “modified” bathtub approach that includes a hydrologic connectivity assessment. This means that areas are only shown as inundated (in blue) if there is a feasible pathway for water to flow. Areas that at or below the selected SLR elevation, but are disconnected, are shown in green.
- d. The purpose of the SLR Viewer is to provide coastal managers and scientists with a preliminary look at sea level rise and coastal flooding impacts. The viewer is a screening-level, planning tool that uses nationally consistent data sets and analyses. Data and maps provided can be used at several scales to help gauge trends and prioritize actions for different scenarios. It can be used to get a quick look at where the future shoreline would be if SLR were to rise today.

#### 2. Cal-Adapt: Exploring California’s Climate

- a. **Organizer/Sponsor:** University of California Geospatial Innovation Facility; California Energy Commission
- b. **Link:** [cal-adapt.org/sealevel/](http://cal-adapt.org/sealevel/)
- c. Cal-Adapt is a statewide portal of climate research, data and downscaled climate change scenarios produced by the State’s scientific and research community. Sponsored by the California Energy Commission and developed by UC Berkeley’s Geospatial Innovation Facility, the site highlights research into five specific climate impacts: temperature, precipitation, snow pack, wildfire risk and sea level rise. Currently, the site hosts a subset of the Pacific Institute 2009 SLR study (#3 above). Cal-Adapt also links users to other resources developed by NOAA, Climate Central, the SF Bay Conservation and Development Commission, the Nature Conservancy, State Coastal Conservancy, and the Our Coast, Our Future effort..
- d. Cal-Adapt’s purpose is to provide tools, maps and data of the current climate research to California decision makers, managers, planners, businesses and the public.

#### 3. Coastal Resilience Ventura

- a. **Organizer/Sponsor:** The Nature Conservancy
- b. **Link:** <http://www.maps.coastalresilience.org/ventura>
- c. The Nature Conservancy’s Coastal Resilience tool ([maps.coastalresilience.org](http://maps.coastalresilience.org)) is a visualization and decision support platform where ecological, social, and economic information can be viewed alongside sea level rise and storm surge

scenarios to develop risk reduction and restoration solutions. The tool was first created in 2008 and used on the southern shores of Suffolk County, Long Island, in New York. The decision support tool now covers different regions including: 10 U.S. States (Alabama, California, Connecticut, Florida, Louisiana, Mississippi, New Jersey, New York, Texas, Washington), 4 countries in Latin America (Mexico, Belize, Guatemala, Honduras) and 3 island nations in the Caribbean (Grenada, St. Vincent and the Grenadines, U.S Virgin Islands). There is also a U.S. National and global application. Coastal Resilience 2.0 was released in October 2013 to better enable decision-makers to assess risk and identify nature-based solutions to reduce socio-economic vulnerability to coastal hazards. The core partners involved in the development of Coastal Resilience include The Nature Conservancy, University of Southern Mississippi, The Natural Capital Project, NOAA Coastal Services Center, and the Association of State Floodplain Managers.

- d. Coastal Resilience in Ventura, California, is positioned to support local governments and institutions that are either responding to disasters or preparing and planning for current and future climate conditions. The purpose of the tool is to inform county hazard mitigation planning. Its intended uses are to (1) raise awareness of coastal hazards issues; (2) examine local flood risk; and (3) identify potential adaptation solutions.

#### 4. Our Coast, Our Future

- a. **Organizer/Sponsor:** Point Blue Conservation Science; U.S. Geological Survey; Gulf of Farallones National Marine Sanctuary; Coravai LLC
- b. **Link:** [pointblue.org/ocof](http://pointblue.org/ocof)
- c. Our Coast, Our Future is a collaborative, user-driven project providing decision support tools to help understand, visualize and anticipate the effects of sea level rise and storms on the North-central California coast, from Half Moon Bay to Bodega Head, and San Francisco Bay shorelines and baylands. The tool provides maps that use a 2-meter horizontal grid resolution DEM and consider total water levels with static sea level rise of 0, 25, 50, 75, 100, 125, 150, 175, 200 and 500 centimeters. The inundation maps also consider the 1 year, 20 year and 100 year storm events and their corresponding wave hazards. The water level data was produced using the USGS's Coastal Storm Modeling System (CoSMoS).
- d. Our Coast, Our Future strives to improve municipal, county, state, and federal government capacity to plan for and respond to rising sea level and storm hazards within the San Francisco Bay Area. The user-defined, state-of-the-science decision support tools provide coastal resource and land use managers and planners locally relevant, online maps and tools to help understand, visualize and anticipate vulnerabilities to sea level rise and storms for most shoreline and baylands ecosystems, communities, and jurisdictions throughout the Bay Area.

#### Adaptation Projects Represented

##### 1. Adapting to Rising Tides Program (ART)

- a. **Focus Area:** San Francisco Bay
- b. **Link:** [www.adaptingtorisingtides.org](http://www.adaptingtorisingtides.org)
- c. **Description:** The San Francisco Bay Conservation and Development Commission (BCDC) is working in partnership with the NOAA Coastal Services Center (CSC), the Metropolitan Transportation Commission (MTC), the

Association of Bay Area Governments and many other partners to increase the preparedness and resilience of Bay Area Communities to sea level rise and storm events while protecting critical ecosystem and community services. The objectives of Adapting to Rising Tides (ART) are threefold:

- Create “road tested” adaptation tools, processes and resources that benefits others in the region and beyond
- Identify how adaptation planning can be scaled up and down across different geographies, sectors, services and asset categories
- Integrate society and equity, economy, environment, and governance into all steps of the adaptation planning process

The ART pilot project area focused on a portion of the Alameda County shoreline from Emeryville to Union City which covers 66 square miles and includes six cities, one unincorporated community, and numerous special districts. In close collaboration with a working group comprised of local, county, regional, state and federal partners, ART identified and characterized assets in twelve categories, conducted a vulnerability and risk assessment, and developed adaptation responses to address key planning issues. The ART Project has transitioned into an ART Program that will continue to develop and road test adaptation planning tools and resources to assist the region build climate resilience.

## 2. Climate Understanding & Resilience in the River Valley (CURRV)

- a. **Focus Area:** Tijuana River Valley
- b. **Link:** [trnerr.org/currv](http://trnerr.org/currv)
- c. **Description:** The Tijuana River Valley (TRV) contains one of the largest contiguous coastal wetland systems in Southern California, while experiencing intense pressure from development along the international border between the U.S. and Mexico. In order to maintain and improve the long-term viability of the TRV’s resources, the Tijuana River National Estuarine Research Reserve (TRNERR) is collaboratively leading a climate adaptation project, *Climate Understanding & Resilience in the River Valley* (CURRV), through which future planning scenarios are developed, outlining local vulnerabilities to sea level rise and riverine flooding as a result of climate change. The scenarios will inform the development of climate adaptation strategies for the public agencies that own and manage both the natural habitats and built environment of the TRV.

## 3. Silicon Valley 2.0

- a. **Project Area:** Silicon Valley region
- b. **Link:** [www.sccgov.org/sites/osp/SV2/Pages/SV2.aspx](http://www.sccgov.org/sites/osp/SV2/Pages/SV2.aspx)
- c. **Description:** The Silicon Valley 2.0 Project is a regional effort, managed by the Santa Clara County Office of Sustainability and funded by the Strategic Growth Council, to minimize the anticipated impacts of climate change and reduce the generation of local greenhouse gas emissions.

The project will use a risk management framework to:

- evaluate the exposure of community assets (i.e., infrastructure, populations, and landscapes) to likely climate impacts,
- examine the potential consequences to the economy, society, and environment of this exposure, and
- develop preemptive adaptation strategies that improve community resiliency.

The project will prepare a strategic climate change adaptation plan that aims to facilitate and coordinate regional planning and implementation efforts in this area. The plan will identify assets within the region that are threatened by the anticipated climate change conditions and the magnitude of the potential economic, social, and environmental impacts that could result if no action is taken. Ultimately, the plan will identify the region's top priorities, and the near-term actions needed to implement an effective regional scale adaptation response. The project will also develop a decision-support tool that will allow jurisdictions and other organizations to evaluate potential climate change impacts and strategies within their communities.

#### Other Sea Level Rise Models, Tools, or Projects (not represented)

##### **1. CoSMoS 3.0 Southern California**

- a. **Project Focus:** Southern California
- b. **Description:** In development, due in 2015  
An updated Southern California project is targeted for completion in 2015. Funding provided from the California Coastal Conservancy with additional support from local jurisdictions will stimulate this multi-agency collaboration featuring top coastal and climate scientists from Scripps Institution of Oceanography, Oregon State University, the private sector, and USGS. Model enhancements for Southern California will include:
  - i. Long-term coastal evolution modeled, including sandy beaches and cliffs
  - ii. Downscaled winds from Global Climate Models (GCMs) for locally generated seas and surge
  - iii. Discharge from rivers for event response and long-term sediment supply
  - iv. An improved baseline-elevation Digital Elevation Model (DEM) developed by the California Coastal Conservancy and the National Oceanic and Atmospheric Administration (NOAA) that incorporates the most recent bathymetric and topographic surveys available

##### **2. Surging Seas**

- a. **Organizer/Sponsor:** Climate Central
- b. **Link:** [sealevel.climatecentral.org](http://sealevel.climatecentral.org)
- c. Surging Seas Risk Finder is a multi-part public web tool that provides local sea level rise and flood risk projections, interactive maps, and exposure tabulations from zip codes and up. Projections integrate extreme flood statistics with dozens of sea level rise models and scenarios to choose from. Maps are based on the same 5-meter horizontal grid digital elevation model (DEM) used by NOAA's SLR Viewer and consider static sea level rise up to 10 feet above mean higher high water (MHHW). Maps illustrate which areas are or are not hydrologically connected to the ocean at each one-foot increment, and have layers for population, social vulnerability, property value, point features and more. Exposure assessments tabulate over 100 demographic, economic, infrastructure and environmental variables for every zip code and municipality, as well as planning, legislative and other districts. Additional features include heat maps showing wide-area exposure comparisons, and extensive data downloads.
- d. Surging Seas is designed to provide decision makers, planners, coastal managers, emergency managers, federal and state agencies, journalists and the general public with tailored local information to inform their understanding of and response to the risks of sea level rise and coastal flooding. The viewer is a

screening-level, planning tool that uses data drawn mainly from federal sources, including NOAA, USGS, FEMA, DOT, DOE, DOI, EPA, FCC and the Census.

### 3. FEMA San Francisco Pilot/Proof of Concept

- a. **Focus Area:** County and City of San Francisco
- b. **Description:** FEMA is undertaking a sea level rise pilot study to develop a non-regulatory product that accounts for future sea level rise conditions. The pilot study focuses on a 13-mile segment of open Pacific shoreline west of the Golden Gate. The methods and tools developed for the FEMA California Coastal Analysis and Mapping Project (CCAMP) will be used to analyze future coastal flood risks that take into account sea level rise and sea level rise-driven changes to wave hazards and storm-induced erosion.

### 4. The Impacts of Sea Level Rise on California's Coast

- a. **Organizer/Sponsor:** Pacific Institute; California Energy Commission
- b. **Link:** [pacinst.org/publication/the-impacts-of-sea-level-rise-on-the-california-coast-sea-level-rise-maps/](http://pacinst.org/publication/the-impacts-of-sea-level-rise-on-the-california-coast-sea-level-rise-maps/)
- c. As one of the first California-wide sea level rise studies, these maps provide access to sea-level rise scenarios generated by the Pacific Institute and the U.S. Geological Survey as part of the CA Energy Commission's Public Interest Energy Research Program (PIER). Originally published in 2009, the tool shows the threat of inundation due to flooding over three depths based on a 100-year flood scenario starting at MHHW. The site offers interactive maps showing coastal and erosion hazard zones and downloadable, static maps (as PDFs) depicting a variety of hazards from coastal flooding to thematic maps of potential impacts from sea level rise. The maps are based on a patchwork of DEM's that have a range of horizontal grid resolutions (from 2-10 meters).
- d. The purpose of these maps and data are to inform California decision makers, planners and businesses. It is for planning level work only and not to be used for site level work.



## Appendix C: Workshop Organizer and Speaker Contact Information

<b>Lifting the Fog California Adaptation Forum</b> Organizer/Speaker Contact Information August 18, 2014			
Name	Title	Organization	Email
Becky Smythe	West Coast Director	NOAA Office for Coastal Management	rebecca.smyth@noaa.gov
Dani Boudreau	Coastal Training Program Associate	Tijuana River National Estuarine Research Reserve	dboudreau@trnerr.org
Demetra McBride	Director, Climate Action & Sustainability	Santa Clara County	demetra.mcbride@ceo.sccgov.org
Heidi Nutters	Coastal Training Program Coordinator	San Francisco Bay National Estuarine Research Reserve	heidin@sfsu.edu
John Rozum	Coastal Land Use Specialist	NOAA CSC	john.rozum@noaa.gov
Kelley Higgason	Ocean Climate Initiative and Our Coast—Our Future Coordinator	Gulf of the Farallones National Marine Sanctuary	kelley.higgason@noaa.gov
Kelly Leo	Coastal Program Manager	The Nature Conservancy	kleo@tnc.org
Kristen Goodrich	Coastal Training Program Coordinator	Tijuana River National Estuarine Research Reserve	kgoodrich@trnerr.org
Marina Psaros	Principal	Coravai	marina@coravai.com
Michael Fitzgibbon	Chief Tech Officer	Point Blue Conservation Science	mfitzgibbon@pointblue.org
Sarah Newkirk	Coastal Project Director	The Nature Conservancy	snewkirk@tnc.org
Shruti Mukhtyar	Web Application Developer	Geospatial Innovation Facility, UC Berkeley	mukhtyar@berkeley.edu
Susan Wilhelm	Associate Engineer	California Energy Commission	susan.wilhelm@energy.ca.gov
Wendy Goodfriend	Senior Planner	SF Bay Conservation and Development Commission	wendyg@bcdca.gov

## Appendix D: Workshop Attendee List

California Adaptation Forum: Lifting the Fog 18-Aug-14 Attendee List		
FirstName	LastName	Company
Grant	Ballard	Point Blue Conservation Science
Carey	Batha	California Coastal Commission
Julie	Benabente	City of San Jose
Sara	Billing	City of Emeryville
Louis	Blumberg	The Nature Conservancy
Danielle	Boudreau	Tijuana River National Estuarine Research Reserve
Brian	Brennan	Beach Erosion Authority for Clean Oceans and Nourishment
Steven	Cliff	California Dept of Transportation
Rachel	Couch	California State Coastal Conservancy
Kelsey	Ducklow	California Coastal Commission
Michael	Fitzgibbon	Point Blue Conservation Science
Matt	Gleason	Southern California Association of Governments
Wendy	Goodfriend	Bay Conservation and Development Commission
Phyllis	Grifman	USC Sea Grant
Juliette	Hayes	Federal Emergency Management Agency, Region 9
Kelley	Higgason	Gulf of the Farallones National Marine Sanctuary
Andrea	Jones	Audubon California
Robert	Kamansky	Santa Ana Watershed Project Authority
Robert	Kay	Adaptive Futures
Kelly	Keen	California State Lands Commission
Polaris	Kinison Brown	EMC Planning Group
Erica	Kudyba	San Mateo County
Aldaron	Laird	Trinity Associates
Kelly	Leo	The Nature Conservancy
Dolores	Leonard	National Estuarine Research Reserve System Science Collaborative
Alexandra	Leumer	The Nature Conservancy
Jack	Liebster	County of Marin
Matthew	Maddox	Rincon Consultants, Inc.
Suzanne	Marr	US Environmental Protection Agency, Region 9
Mary	Matella	California Coastal Commission
Demetra	McBride	Santa Clara County
Moira	Mcenespy	California State Coastal Conservancy
Michael	McCormack	Council on Environmental Quality
Aaron	McGregor	California Ocean Science Trust
Steven	Messner	Enterprise Futures Network
Michael	Migliori	NOAA Office of Ocean and Coastal Resource
Shruti	Mukhtyar	UC Berkeley
Sarah	Newkirk	The Nature Conservancy
Alyssa	Newton Mann	USC Sea Grant
Heidi	Nutters	San Francisco Bay National Estuarine Research Reserve
Joe	Otts	Portland State University
Hilary	Papendick	California Coastal Commission
Jeff	Rayos	County of Alameda
David	Revell	Revell Coastal
Pam	Rittelmeyer	UC Santa Cruz

John	Rozum	National Oceanic and Atmospheric Administration
Elisabeth	Russell	Association of Monterey Bay Area Governments
Kirsten	Schwind	Bay Localize
Aleka	Seville	Four Twenty Seven
Gwen	Shaughnessy	National Oceanic and Atmospheric Administration
Missy	Stults	University of Michigan
Geiska	Velasquez	City of Morro Bay
Kathleen	Van Velsor	California Department of Conservation
Susan	Wilhelm	California Energy Commission
Susan	Wright	County of San Mateo

## Appendix E: Simplified Sea Level Rise Model Comparison

Tool/ Model	Key Features	Appropriate for:
<b>NOAA SLR Viewer</b>	<ul style="list-style-type: none"> <li>• Linear superposition</li> <li>• Modified bathtub</li> <li>• Focus on future high tide, given the current configuration of the shoreline</li> </ul>	<ul style="list-style-type: none"> <li>• DoD BRAC closure</li> <li>• Screening / Scoping: Highlight where planners need to know more</li> <li>• Can be used for local/ jurisdictional planning</li> </ul>
<b>USGS CoSMOS</b>	<ul style="list-style-type: none"> <li>• Dynamic/hydrodynamic</li> <li>• Includes extreme events</li> <li>• Forcing mechanisms</li> </ul>	<ul style="list-style-type: none"> <li>• Climate impact assessment</li> <li>• Good for local/jurisdictional planning</li> </ul>
<b>ESA/PWA</b>	<ul style="list-style-type: none"> <li>• Shoreline response</li> <li>• Extreme events</li> <li>• Capable of working directly with communities</li> </ul>	<ul style="list-style-type: none"> <li>• Climate impact assessment</li> <li>• Good for local/ jurisdictional planning</li> </ul>
<b>FEMA SLR pilot</b>	<ul style="list-style-type: none"> <li>• Regulatory base data</li> <li>• Shoreline response and extreme events</li> <li>• 50-year hindcast</li> </ul>	<ul style="list-style-type: none"> <li>• Will support national mapping</li> </ul>

# Sea Level Rise Viewer and Coastal Resilience Tool

---

## Use These Tools to Assess Sea Level Rise Impacts

*The National Oceanic and Atmospheric Administration (NOAA) Coastal Services Center and The Nature Conservancy, working singularly and in partnership, help communities become more resilient. Each organization has developed a tool to assess sea level rise impacts, and this fact sheet shows how the tools are both distinct and complementary. Both organizations are Digital Coast partners. To see more resilience-related products, visit the Digital Coast at [www.csc.noaa.gov/digitalcoast](http://www.csc.noaa.gov/digitalcoast).*

### **Sea Level Rise Viewer** – [www.csc.noaa.gov/digitalcoast/tools/slrviewer](http://www.csc.noaa.gov/digitalcoast/tools/slrviewer)

This NOAA tool provides a first look at a community's potential exposure to inundation from coastal flooding and sea level rise and provides nationally consistent data for download or consumption via map services. Most of the data sets visible in the viewer are available for use in other applications. The digital elevation models (DEMs) that form the base maps are conditioned specifically for mapping inundation and have been used in selected coastal resilience efforts and for storm surge modeling and mapping by the National Hurricane Center. These DEMs are available for download. NOAA's primary objectives for this tool are to provide a consistent, national viewer and open access to the data that local communities need to address their needs.

### **Coastal Resilience Tool** – <http://coastalresilience.org/tools>

Built by the Nature Conservancy, this tool is where ecological, social, and economic information can be viewed alongside sea level rise and storm surge scenarios in specific geographies. In addition, specific geographies have plug-in tools that address specific coastal issues and help users visualize potential nature-based adaptation solutions. As such, this tool is less about data availability and download, and more about providing social, economic, and ecological assessments for decision makers. The tool incorporates map services from the Sea Level Rise Viewer, as well as other external services on coastal hazards. These detailed analysis results help communities identify nature-based solutions for reducing vulnerabilities and disaster risk. Currently most fully implemented for the Gulf of Mexico, the tool will feature ten different geographies from around the world in a new platform set to launch in August 2013.

### **Surging Seas Risk Finder** – <http://sealevel.climatecentral.org>

Climate Central built this public web tool to help communities, planners, and leaders better understand sea level rise and coastal flood risks. The multi-part tool provides local sea level rise and flood risk projections, searchable interactive maps, "fast look" community reports, data downloads, and exposure tabulations by zip codes, municipalities, counties, and more. Exposure assessments cover over 100 demographic, economic, infrastructure and environmental variables using data drawn mainly from federal sources, including NOAA, USGS, FEMA, DOT, DOE, DOI, EPA, FCC and the Census. Maps are based primarily on elevation data supplied by NOAA and used in NOAA's Sea Level Rise Viewer. Currently the tool is available for FL, NJ, NY, the West Coast and New England, and will be released for the remaining US coastal states including HI and AK in 2014.

## Quick Reference for Using These Complementary Tools

Coastal Resilience Decision Support Tool	Sea Level Rise and Coastal Flooding Impacts Viewer	Surging Seas Risk Finder
<a href="http://www.coastalresilience.org">www.coastalresilience.org</a>	<a href="http://www.csc.noaa.gov/digitalcoast/tools/srviewer">www.csc.noaa.gov/digitalcoast/tools/srviewer</a>	<a href="http://sealevel.climatecentral.org">sealevel.climatecentral.org</a>
<b>Purpose</b>		
<ul style="list-style-type: none"> <li>To compile and deliver Web-based planning tools that incorporate nature-based solutions for disaster risk reduction and climate adaptation</li> </ul>	<ul style="list-style-type: none"> <li>To provide a visual screening tool and nationally consistent data to help communities visualize and plan for exposure to sea level rise and more frequent tidal flooding</li> </ul>	<ul style="list-style-type: none"> <li>To provide a multi-part web tool to help communities, planners, and leaders better understand sea level rise and coastal flood risks to diverse populations and assets over time.</li> </ul>
<b>Geographic Coverage</b>		
<ul style="list-style-type: none"> <li>Local and regional tool available for the following domestic and international locations:</li> </ul>	<ul style="list-style-type: none"> <li>National tool that is complete for the following regions:</li> </ul>	<ul style="list-style-type: none"> <li>National tool that is complete for the following regions:</li> </ul>
<ul style="list-style-type: none"> <li>Gulf of Mexico and multiple bays (in TX, MS, LA, AL, FL, FL Keys)</li> </ul>	<ul style="list-style-type: none"> <li>Gulf of Mexico (TX, MS, AL, FL)</li> </ul>	<ul style="list-style-type: none"> <li>Gulf of Mexico: FL to date (TX, MS, AL to be released by end of summer 2014)</li> </ul>
<ul style="list-style-type: none"> <li>West Coast (Puget Sound, WA, Ventura County, CA)</li> </ul>	<ul style="list-style-type: none"> <li>West Coast (CA, OR, WA)</li> </ul>	<ul style="list-style-type: none"> <li>West Coast: CA, OR, WA</li> </ul>
<ul style="list-style-type: none"> <li>East Coast (NY, CT, NJ)</li> </ul>	<ul style="list-style-type: none"> <li>East Coast ((All states)</li> </ul>	<ul style="list-style-type: none"> <li>East Coast: FL, NJ, NY, New England States (GA, SC, NC, VA, DE, MD, PA to be released by end of summer 2014)</li> </ul>
<ul style="list-style-type: none"> <li>Caribbean (USVI, Grenada, St. Vincent and the Grenadines)</li> </ul>	<ul style="list-style-type: none"> <li>Pacific (HI, CNMI, Guam, American Samoa)</li> </ul>	<ul style="list-style-type: none"> <li>Pacific (HI to be released by end of summer 2014)</li> </ul>
<ul style="list-style-type: none"> <li>Central America (Mesoamerican Reef)</li> </ul>	<ul style="list-style-type: none"> <li>Caribbean (PR, USVI)</li> </ul>	
<ul style="list-style-type: none"> <li>A global application in development with country scale information will be completed in 2014.</li> </ul>	<ul style="list-style-type: none"> <li>Alaska and Louisiana timeline TBD due to data availability and quality issues.</li> </ul>	<ul style="list-style-type: none"> <li>Alaska and Louisiana timeline TBD due to data availability and quality issues</li> </ul>
<b>Key Distinctions</b>		
<ul style="list-style-type: none"> <li>Takes a deep dive at selected geographies with a focus on determining nature-based adaptation solutions</li> </ul>	<ul style="list-style-type: none"> <li>Takes a screening-level look across coastal areas of contiguous US, and selected islands</li> </ul>	<ul style="list-style-type: none"> <li>Takes a screening-level look across coastal areas of contiguous US, HI, and AK</li> </ul>

<ul style="list-style-type: none"> <li>• Uses different data sets and analysis for different locations</li> </ul>	<ul style="list-style-type: none"> <li>• Uses consistent methods and data for all locations</li> </ul>	<ul style="list-style-type: none"> <li>• Uses consistent methods and data for essentially all locations (filling gaps with best available elevation data)</li> </ul>
<ul style="list-style-type: none"> <li>• Sea level rise scenarios are based on various emission scenarios and specific time increments, as well as one-foot or one-meter increments above mean high water irrespective of time</li> </ul>	<ul style="list-style-type: none"> <li>• Sea level visualizations are provided at one-foot increments (0-6 feet) above mean higher high water irrespective of time.</li> </ul>	<ul style="list-style-type: none"> <li>• Maps are based primarily on elevation data supplied by NOAA and used in NOAA’s SLR Viewer. Maps display static water levels up to 10 feet above the local high tide (MHHW).</li> </ul>
<ul style="list-style-type: none"> <li>• Includes storm surge scenarios derived from regional Sea, Lake, and Overland Surges from Hurricanes (SLOSH) or MIKE21 model outputs for some geographies</li> </ul>	<ul style="list-style-type: none"> <li>• Includes flood frequency information based on local National Weather Service field office thresholds for shallow coastal flood warnings</li> </ul>	<ul style="list-style-type: none"> <li>• Local projections combine sea level rise and storm surge to give integrated risk estimates by decade</li> </ul>
<ul style="list-style-type: none"> <li>• Chronic shallow coastal flooding information not included</li> </ul>	<ul style="list-style-type: none"> <li>• Storm surge data not included</li> </ul>	<ul style="list-style-type: none"> <li>• No physical modeling of storm surge or waves on top of sea level rise, nor coastal erosion nor other coastal processes</li> </ul>
<ul style="list-style-type: none"> <li>• Socio-economic exposure map based on Social Vulnerability Index (SOVI) data and potential structural damage estimates from Federal Emergency Management Agency HAZUS model runs</li> </ul>	<ul style="list-style-type: none"> <li>• Socio-economic exposure map based on Social Vulnerability Index (SOVI) data and block group level economic data from US Census and Bureau of Labor Statistics</li> </ul>	<ul style="list-style-type: none"> <li>• Analyses cover 100 demographic, economic, infrastructure, and environmental variables, and conducted by zips, cities, counties, states, as well as planning and legislative districts. Socio-economic exposure map based on Social Vulnerability Index (SOVI) data, plus population density, race/ethnicity, per capita income, and property value layers.</li> </ul>
<ul style="list-style-type: none"> <li>• Marsh and mangrove migration analyses at specific sites based on SLAMM runs or other GIS methods</li> </ul>	<ul style="list-style-type: none"> <li>• Marsh migration analysis available for all geographies based on NOAA coastal land cover data and migration rules modified from the Sea Level Affecting Marshes Model (SLAMM)</li> </ul>	<ul style="list-style-type: none"> <li>• Displays levee data from the Midterm Levee Inventory (FEMA/USACE), the best available national levees dataset. Does not provide analysis on marsh or mangrove migration.</li> </ul>
<ul style="list-style-type: none"> <li>• Develops custom plug-ins for specific geographies (e.g., natural coastal defense using InVEST model, risk reduction explorers, oyster habitat restoration dashboard)</li> </ul>	<ul style="list-style-type: none"> <li>• Displays simulations of sea level rise at local landmarks</li> </ul>	<ul style="list-style-type: none"> <li>• User can select among various global sea level rise models and scenarios (NOAA, USACE, IPCC, etc.) when viewing integrated sea level rise and storm surge risk estimates by decade</li> </ul>
<ul style="list-style-type: none"> <li>• Displays assessment of natural ability of marsh, mangrove, and oyster and coral reefs to protect human communities</li> </ul>	<ul style="list-style-type: none"> <li>• Associated data provided for download or as mapping services for use by communities as a foundation for further local assessment</li> </ul>	<ul style="list-style-type: none"> <li>• provides custom community “fast look” reports, plus extensive data downloads (excel format) for sea level and flood risk projections, and for any data variable chosen (e.g. road miles), intersected by the administrative area chosen (e.g. city council district)</li> </ul>

DRAFT by Climate Central 6/23/2014

NOAA Coastal Services Center  
[www.csc.noaa.gov](http://www.csc.noaa.gov)

The Nature Conservancy  
[www.nature.org](http://www.nature.org)

NOAA Digital Coast  
[www.csc.noaa.gov/digitalcoast](http://www.csc.noaa.gov/digitalcoast)

NOAA and The Nature Conservancy are Digital Coast partners. To access additional data, tools, and training, visit the Digital Coast at [www.csc.noaa.gov/digitalcoast](http://www.csc.noaa.gov/digitalcoast).

DRAFT