

TOOLS SELECTION

An introduction to geospatial tools for vulnerability assessment and climate adaptation planning

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NOAA CSC

20 km 30 km 40 km 50 km



What is a Tool?

- Documented guidance – how do I do this?
- Data portal – get the information I need
- An interaction device - civic engagement to get the feedback I need
- Model – represent this process
- Decision support system – integrate many data and models to represent a system

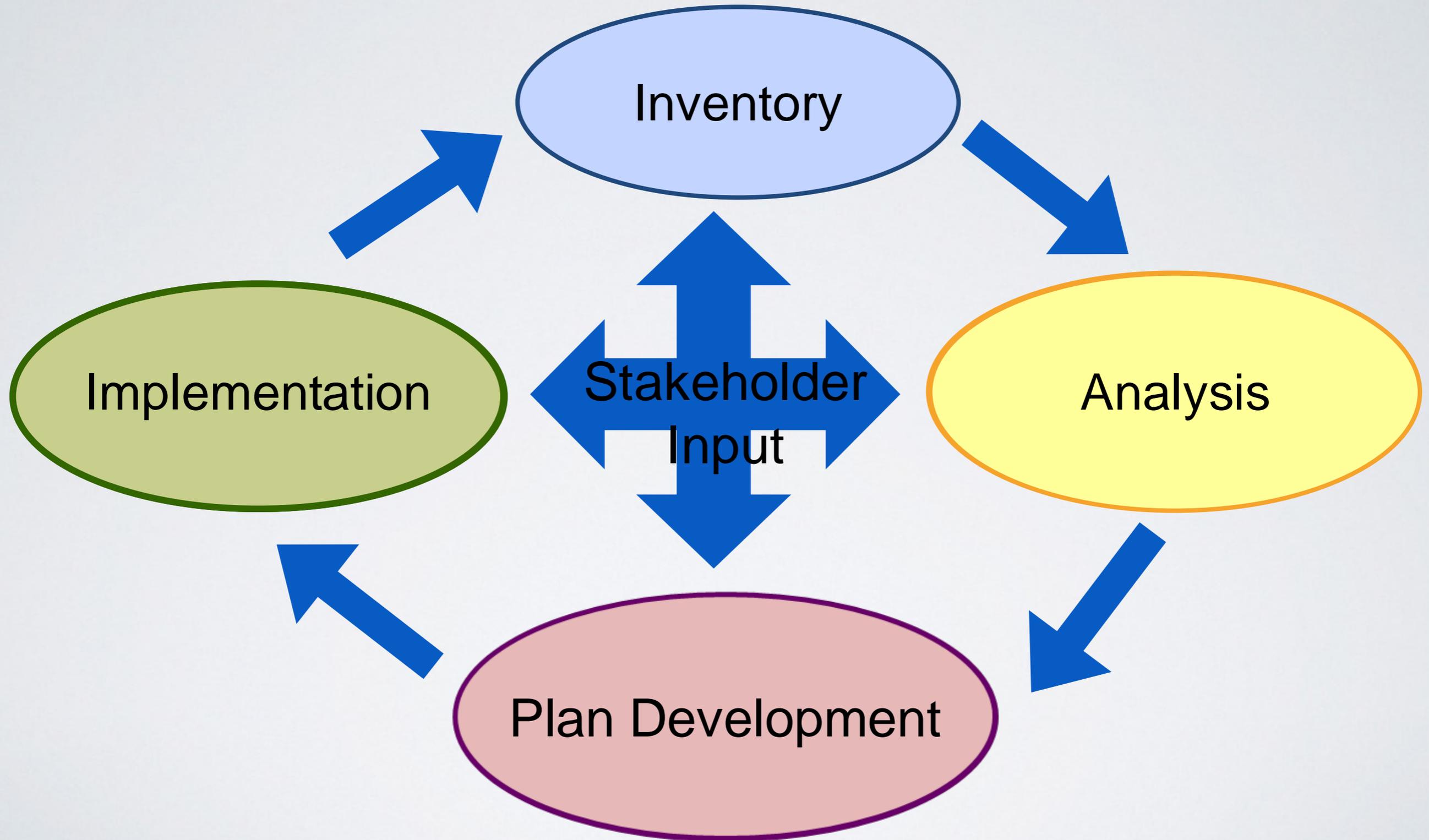


Roles for Tools

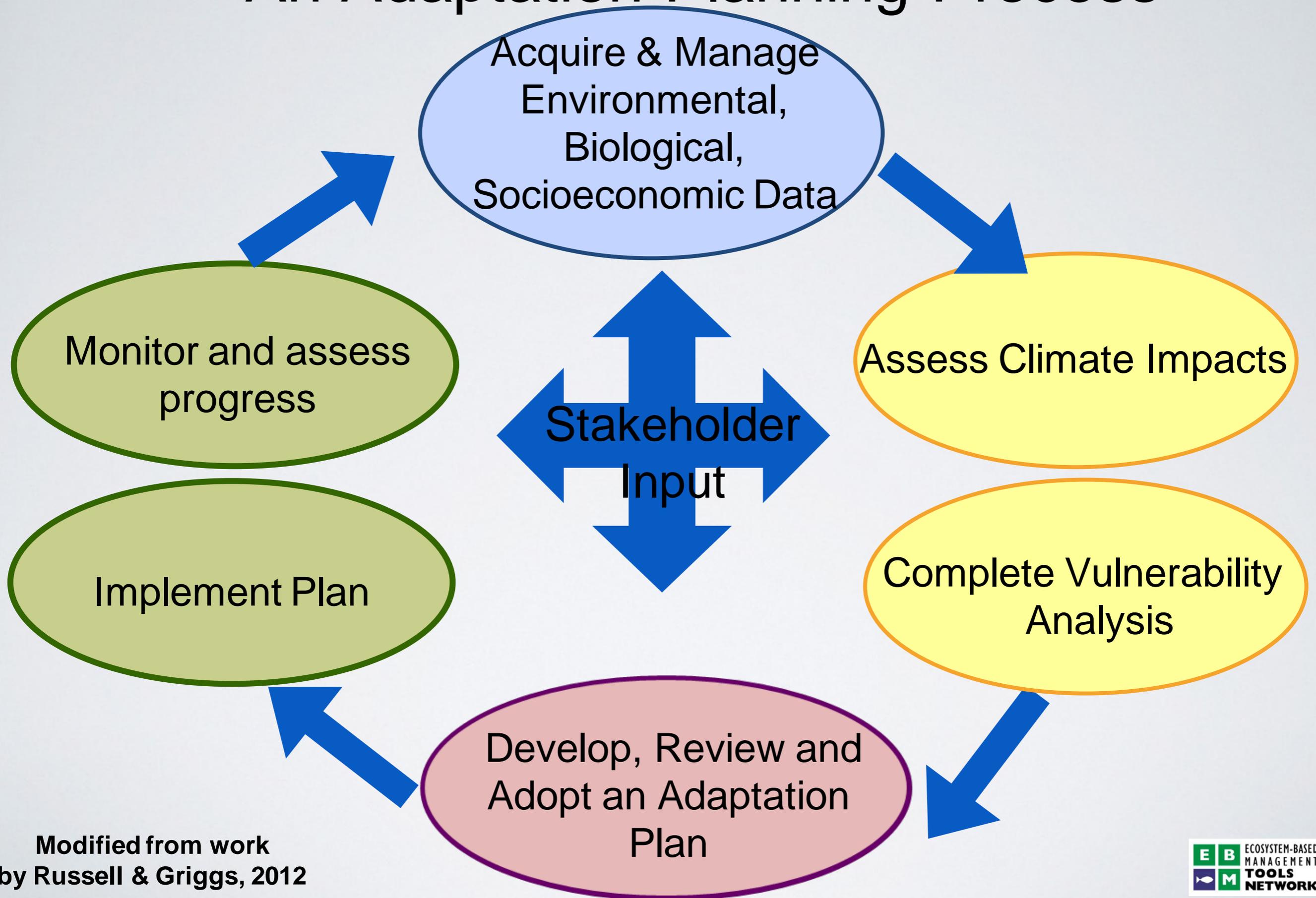
- The complexity of this work cannot be accomplished without them
- Gathering & managing information
- Conducting advanced spatial analyses and modeling
- Visualization
- Facilitating work across sectors and ecosystems
- Scenario “what if” testing



A Simplified Planning Process

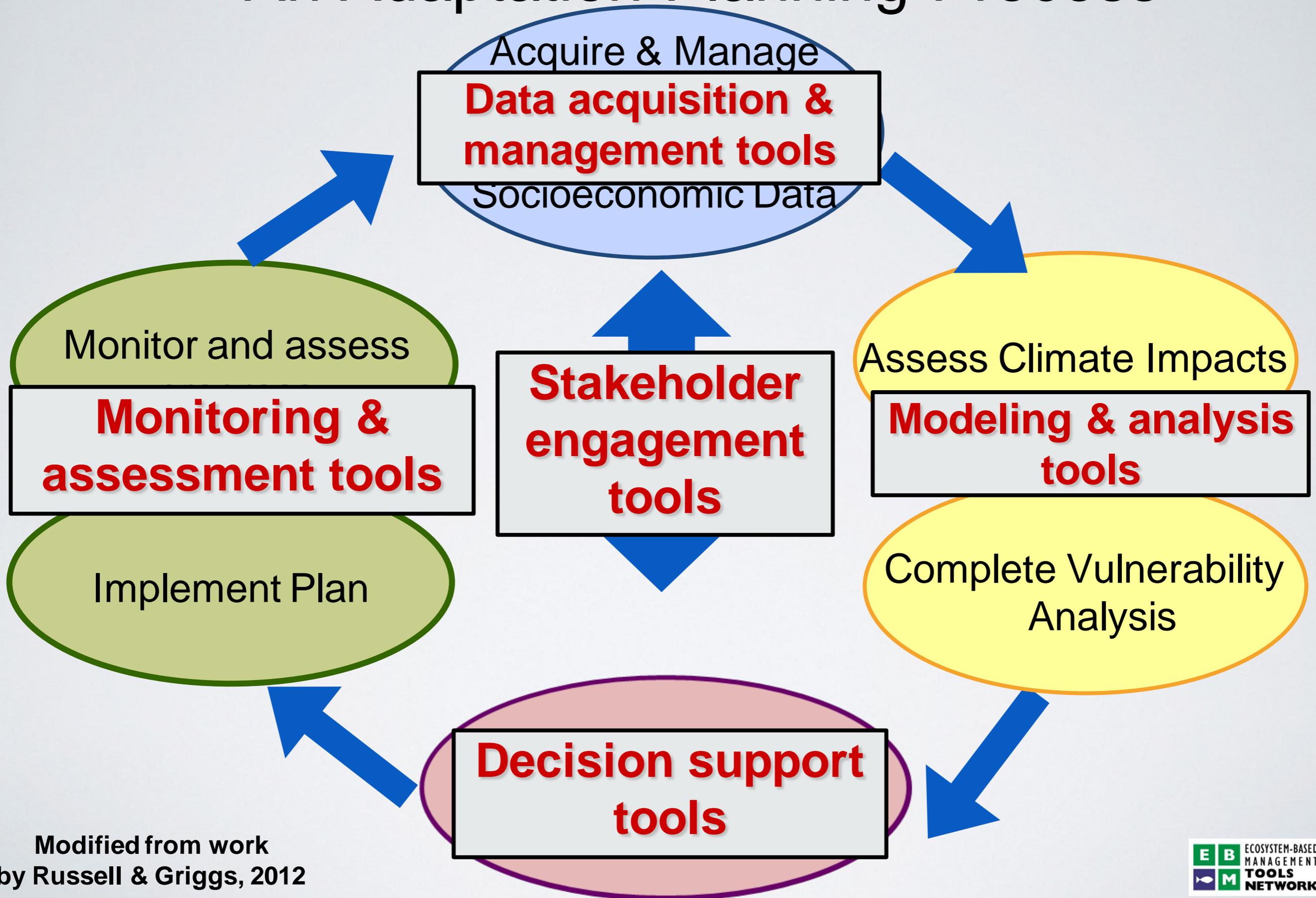


An Adaptation Planning Process



Modified from work
by Russell & Griggs, 2012

An Adaptation Planning Process



Modified from work
by Russell & Griggs, 2012

The Problem with Tools...

Complicated and Confusing

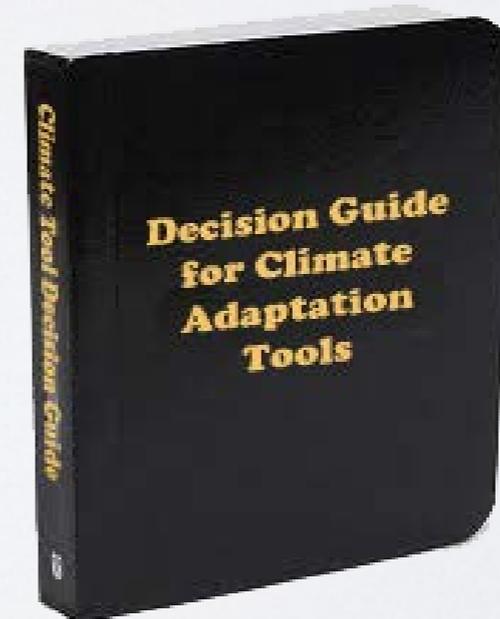


Require considerable capacity

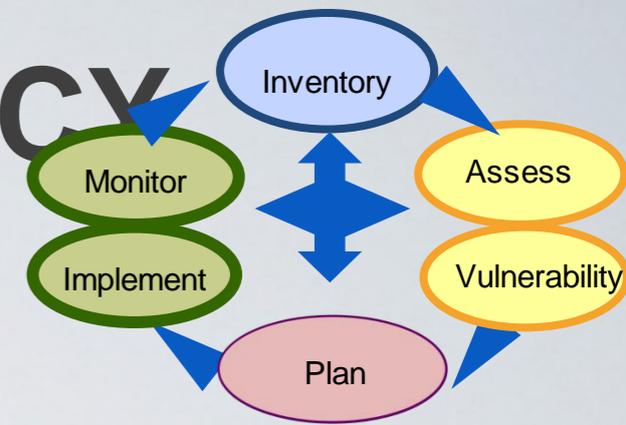
Tend to drive a top down, “Predict-and-Plan” process

WAYS TO THINK ABOUT TOOLS

- Type
- Function
- How it assists planning process
- Sectors addressed

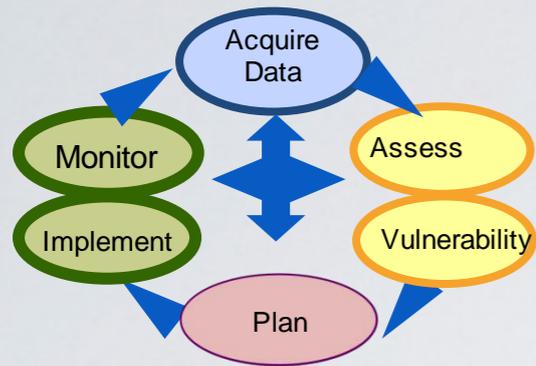


HOW TOOLS AFFECT THE POLICY CYCLE

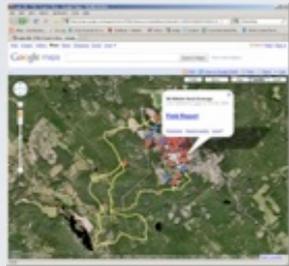


	Stakeholder Engagement	Scoping	Assess			Plan	Implement	Monitor
			Impact	Vulnerability	Risk			
CanVis	↔		↔					
SLR Viewer*	↔		↔					
Our Coast, Our Future*	↔		↔					
SimCLIM*		↔						
SLAMM			↔					
CommunityViz	↔							
NatureServe Vista*	↔							
HAZUS			↔					
SoVI		↔						
CCVI			↔					
InVEST*	↔							

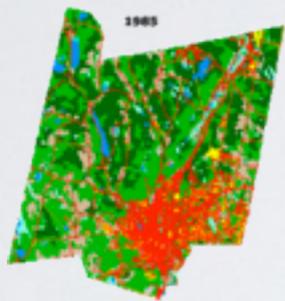
TYPES OF TOOLS



- Process

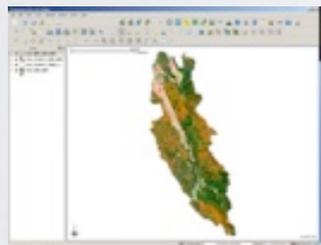


- Visualization



- Web-based

Considered for Guide



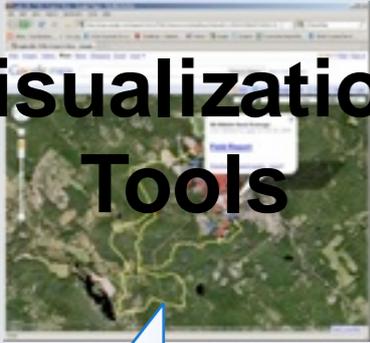
- Desktop GIS



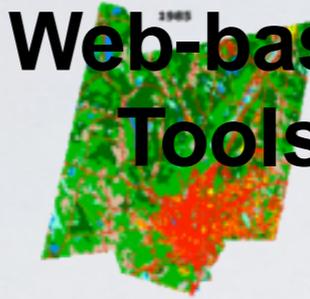
- Toolkits

Factors to Consider:

Visualization Tools



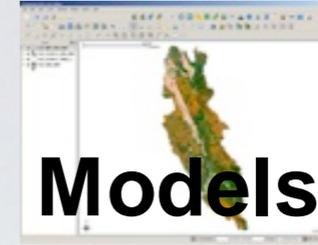
Web-based Tools



GIS-based DSTs



Models



Toolkits



FUNCTIONALITY

LEARNING CURVE

COST

SKILLS NEEDED

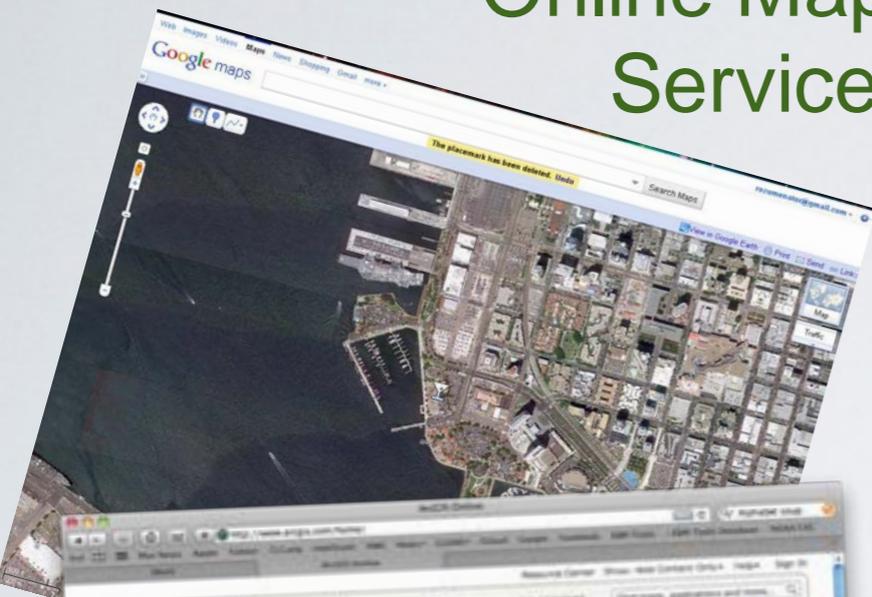
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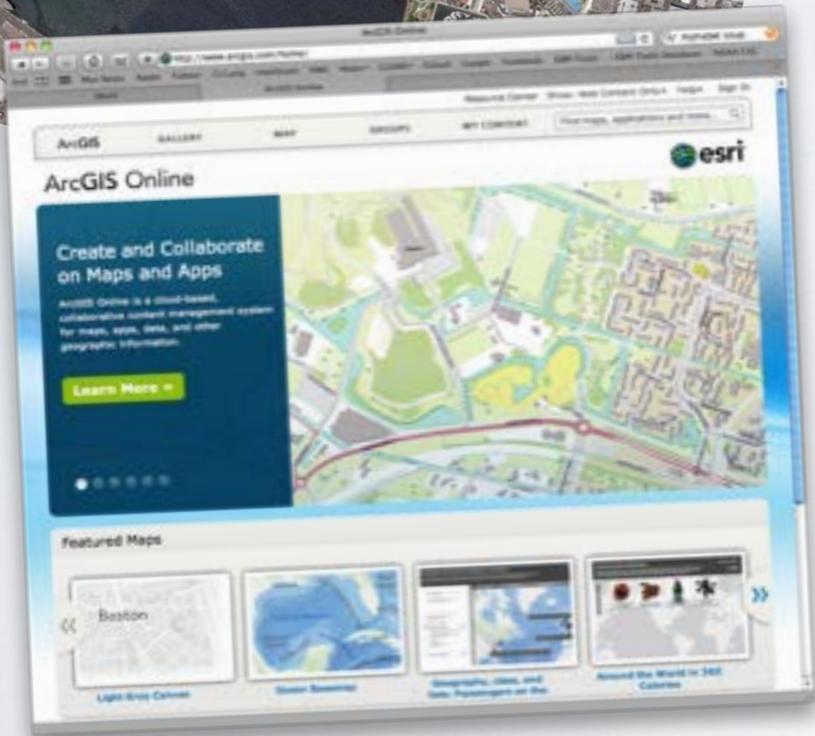


Starting Simple: Online Mapping and “Mashups”

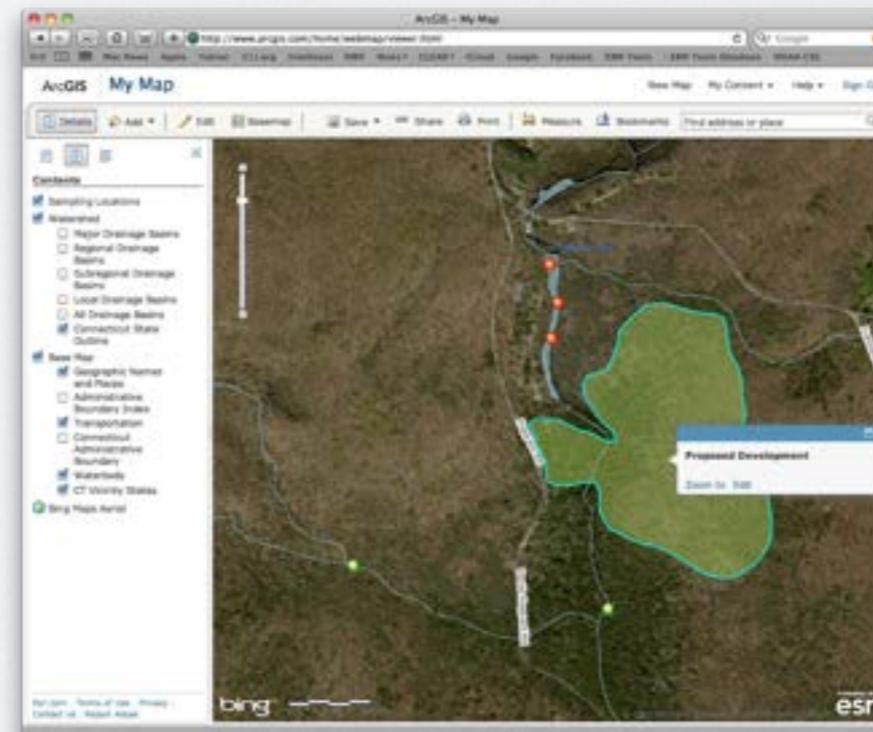
Online Mapping Services



Your Data

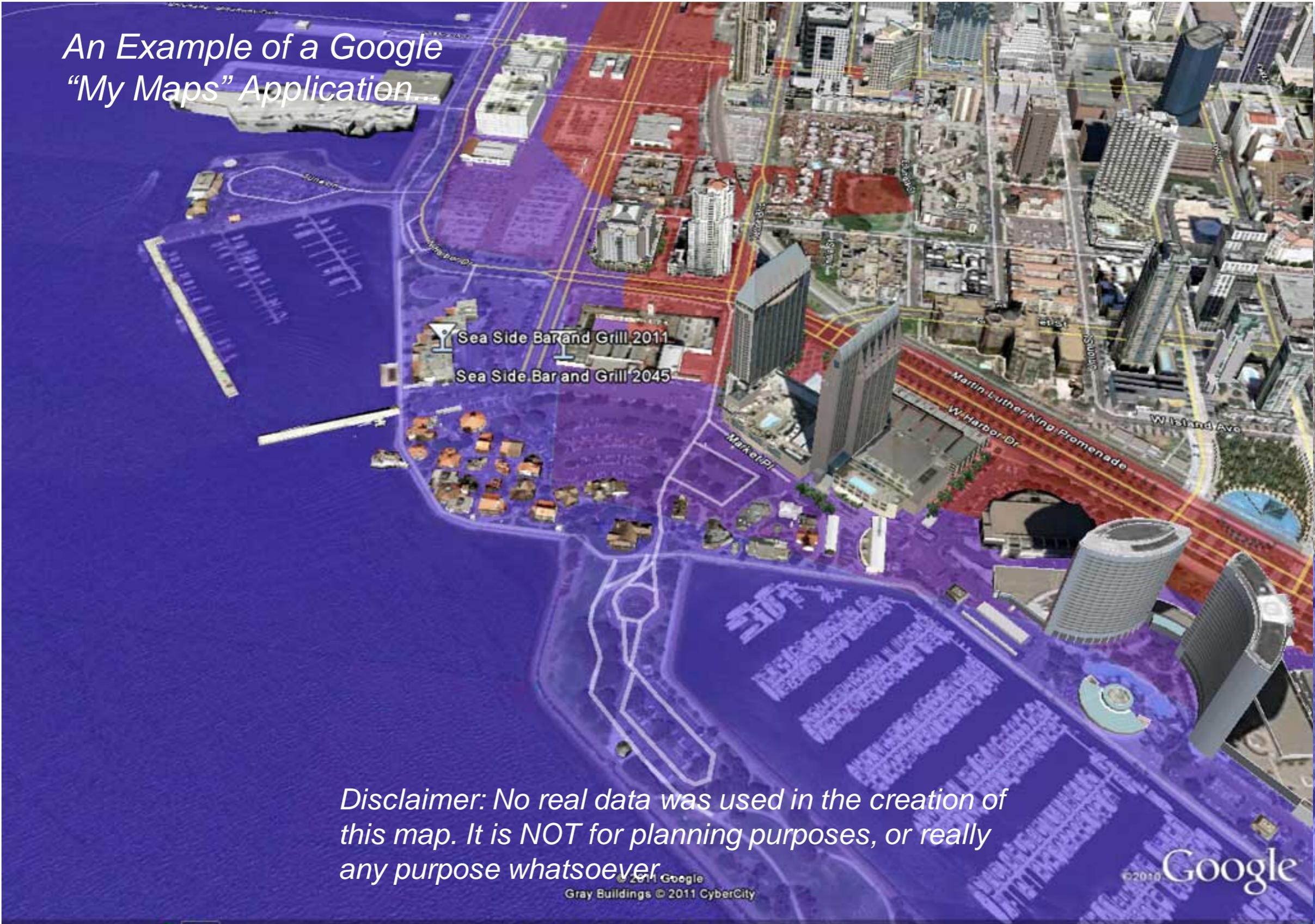


New “Mashup” Map



Starting Simple: Online Mapping and “Mashups”

*An Example of a Google
“My Maps” Application*



Disclaimer: No real data was used in the creation of this map. It is NOT for planning purposes, or really any purpose whatsoever.

Simulation Tools: CanViz



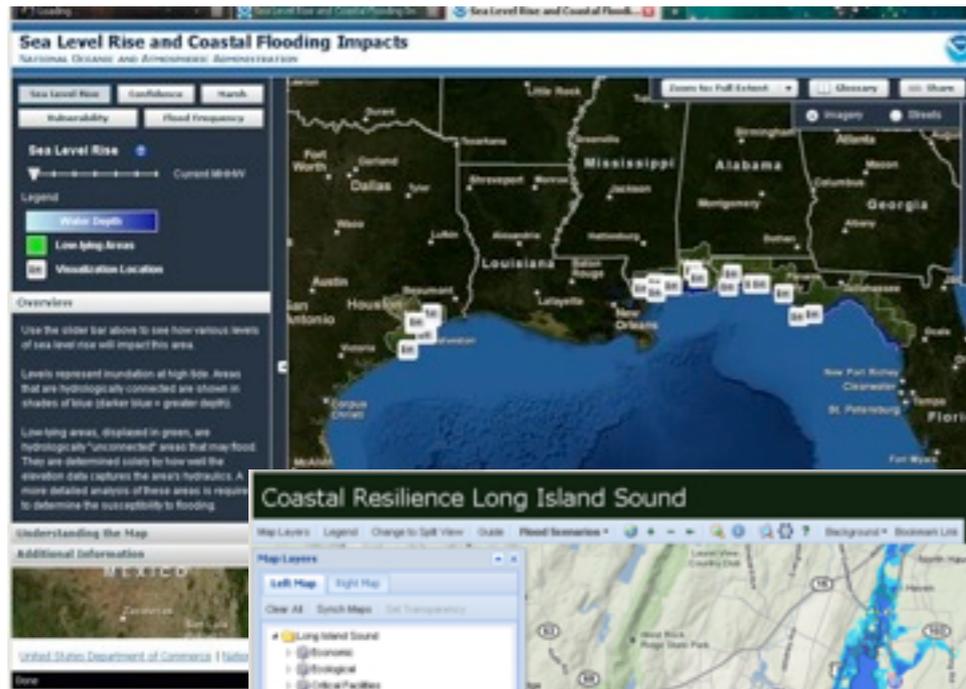
- Easy-to-use photo simulation software
- Use local photos, with provided tools and “objects”
- Best of all: ITS FREE!!!
- Online Training available

www.csc.noaa.gov/digitalcoast



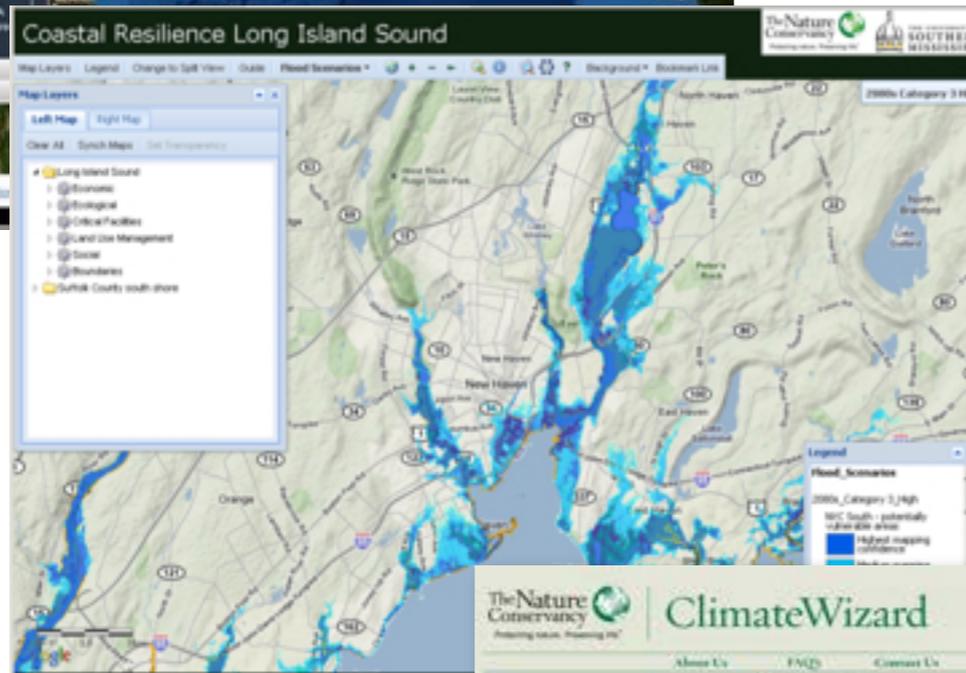
NOAA Coastal Services Center
LINKING PEOPLE, INFORMATION, AND TECHNOLOGY

Web-based Tools



SLR and Coastal Flooding Impact Viewer
(NOAA CSC)

Geographic Focus: National



Coastal Resilience

(The Nature Conservancy & Partners)

Geographic Focus: Regional/Local
(LIS, GOM, Florida Keys, Ventura area in CA)



Climate Wizard

(The Nature Conservancy)

Geographic Focus: National/Global

Sea Level Rise and Coastal Flooding Impacts Viewer

The screenshot shows a web browser window with the address bar displaying <http://www.csc.noaa.gov/digitalcoast/tools/slrviewer/index.html>. The page header includes the "DIGITAL COAST" logo and the text "NOAA Coastal Services Center". Navigation links include "Home", "About", "Data", "Tools", "Training", "Approaches", and "In Action". A search bar is located in the top right corner.

The main content area features a "Tools" section with the title "Sea Level Rise and Coastal Flooding Impacts Viewer" and the "NOAA Coastal Services Center" logo. Below this, there are three navigation buttons: "Overview" (highlighted), "Support", and "Get It Now".

Overview
Being able to visualize potential impacts from sea level rise is a powerful teaching and planning tool, and the Sea Level Rise Viewer brings this capability to coastal communities. A slider bar is used to show how various levels of sea level rise will impact coastal communities. The initial project areas include Mississippi, Alabama, and parts of Texas and Florida, with additional coastal counties to be added in the near future. Visuals and the accompanying data and information cover sea level rise inundation, uncertainty, flood frequency, marsh impacts, and socioeconomics.

Launch Now 

Sea Level Rise and Coastal Flooding Impacts Viewer
Screenshot of the viewer interface showing a map of a coastal area with a legend on the left. The legend includes "Sea Level Rise" (with a slider bar), "Marsh Migration", and "Flood Frequency". The map shows a coastal region with various colored overlays representing different impact scenarios.

Features

- Displays** potential future sea levels
- Provides** simulations of sea level rise at local landmarks
- Communicates** the spatial uncertainty of mapped sea levels
- Models** potential marsh migration due to sea level rise
- Overlays** social and economic data onto potential sea level rise
- Examines** how tidal flooding will become more frequent with sea level rise

The browser status bar at the bottom shows "Trusted sites" and a zoom level of "100%".

www.csc.noaa.gov/slr

Sea Level Rise and Coastal Flooding Impacts

NATIONAL OCEANIC AND ATMOSPHERIC ADMINISTRATION

Sea Level Rise Confidence Marsh Vulnerability Flood Frequency

Sea Level Rise ?

Current MHHW

Legend

- Water Depth
- Low-lying Areas
- Area Not Mapped
- Visualization Location

View Levees

Overview

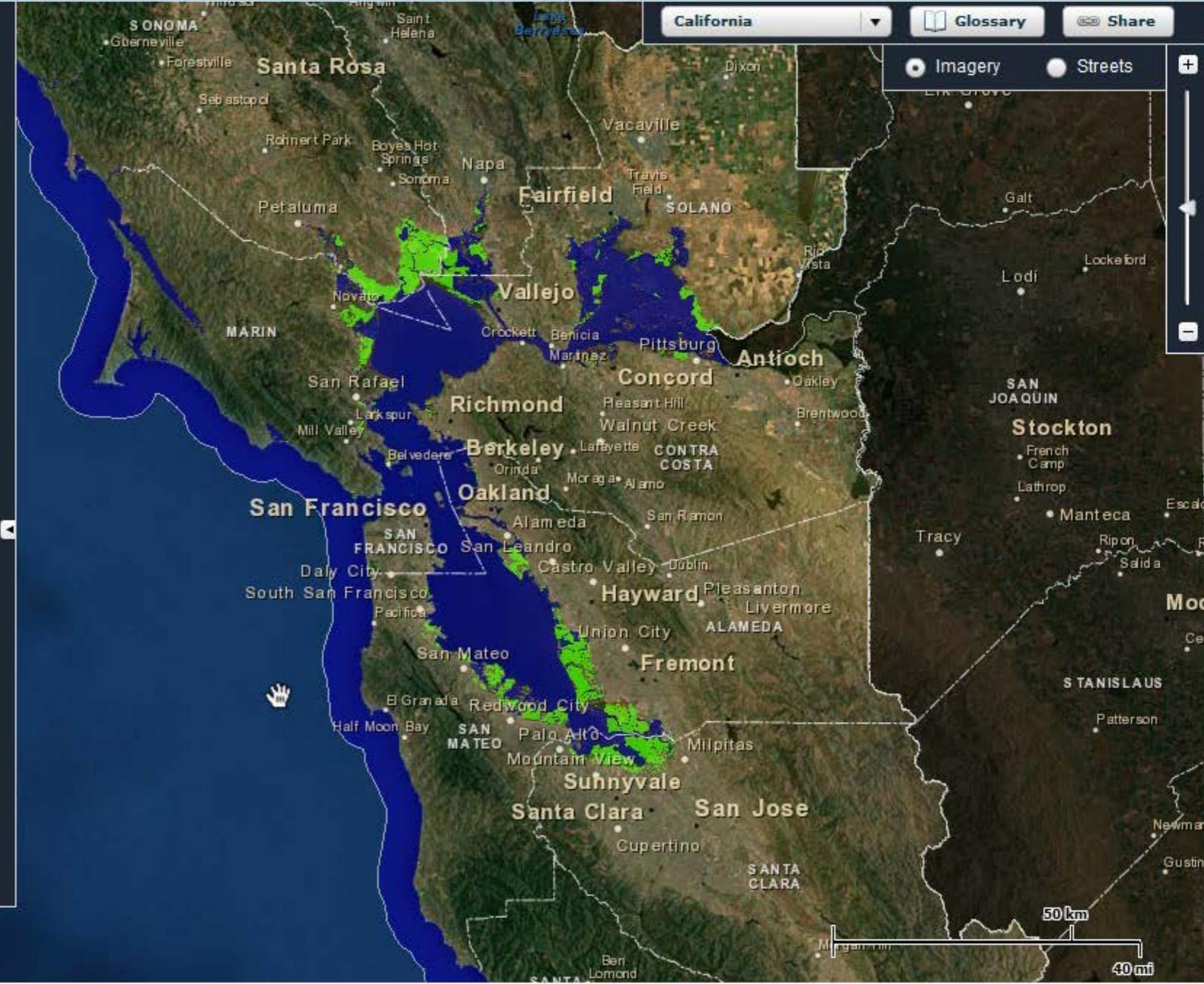
Use the slider bar above to see how various levels of sea level rise will impact this area.

Levels represent inundation at high tide. Areas that are hydrologically connected are shown in shades of blue (darker blue = greater depth).

Low-lying areas, displayed in green, are hydrologically "unconnected" areas that may flood. They are determined solely by how well the elevation data captures the area's hydraulics. A more detailed analysis of these areas is required to determine the susceptibility to flooding.

Understanding the Map

Additional Information



Sea Level Rise and Coastal Flooding Impacts

NATIONAL OCEANIC AND ATMOSPHERIC ADMINISTRATION

Sea Level Rise Confidence Marsh
Vulnerability Flood Frequency

Sea Level Rise ?
▼ | | | | | | | | | | Current MHHW

Legend

- Water Depth
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View Levees

Overview

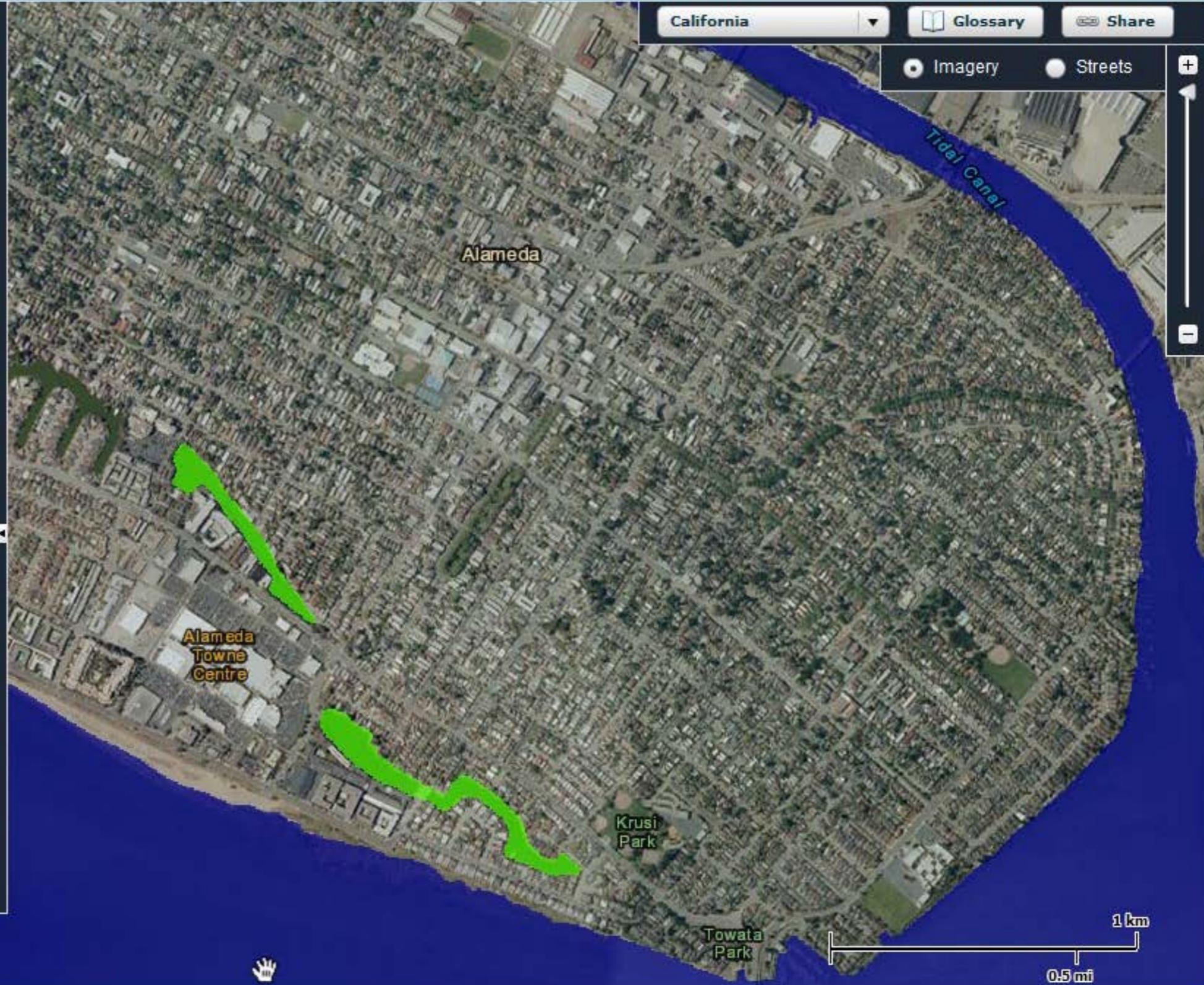
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Understanding the Map

Additional Information



Sea Level Rise and Coastal Flooding Impacts

NATIONAL OCEANIC AND ATMOSPHERIC ADMINISTRATION

Sea Level Rise Confidence Marsh
Vulnerability Flood Frequency

Sea Level Rise ?
1 ft SLR

Legend

- Water Depth
- Low-lying Areas
- Area Not Mapped
- Visualization Location

View Levees

Overview

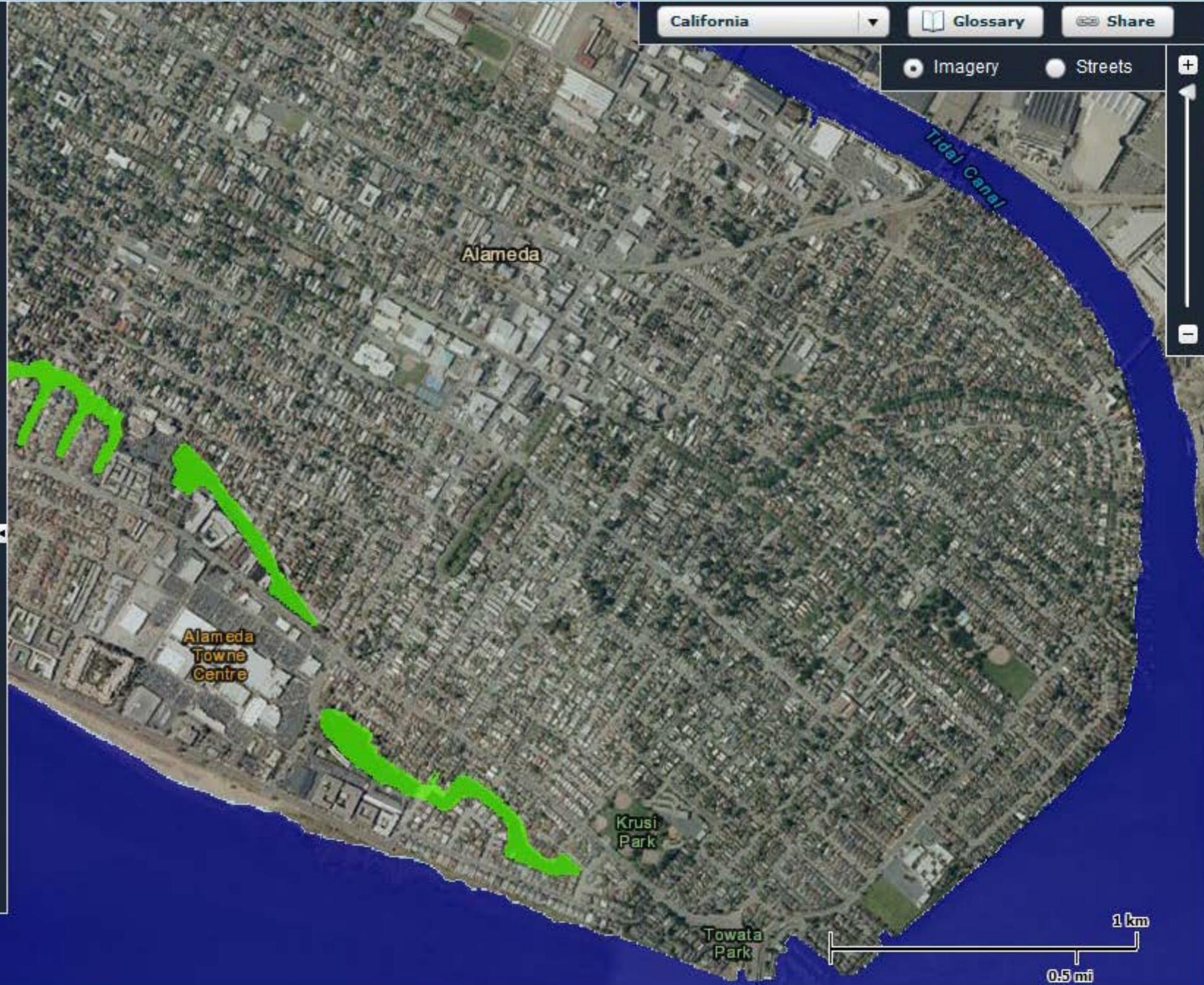
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Understanding the Map

Additional Information



Sea Level Rise and Coastal Flooding Impacts

NATIONAL OCEANIC AND ATMOSPHERIC ADMINISTRATION



Sea Level Rise Confidence Marsh

Vulnerability Flood Frequency

Sea Level Rise ?

6 ft SLR

Legend

- Water Depth
- Low-lying Areas
- Area Not Mapped
- Visualization Location

View Levees

Overview

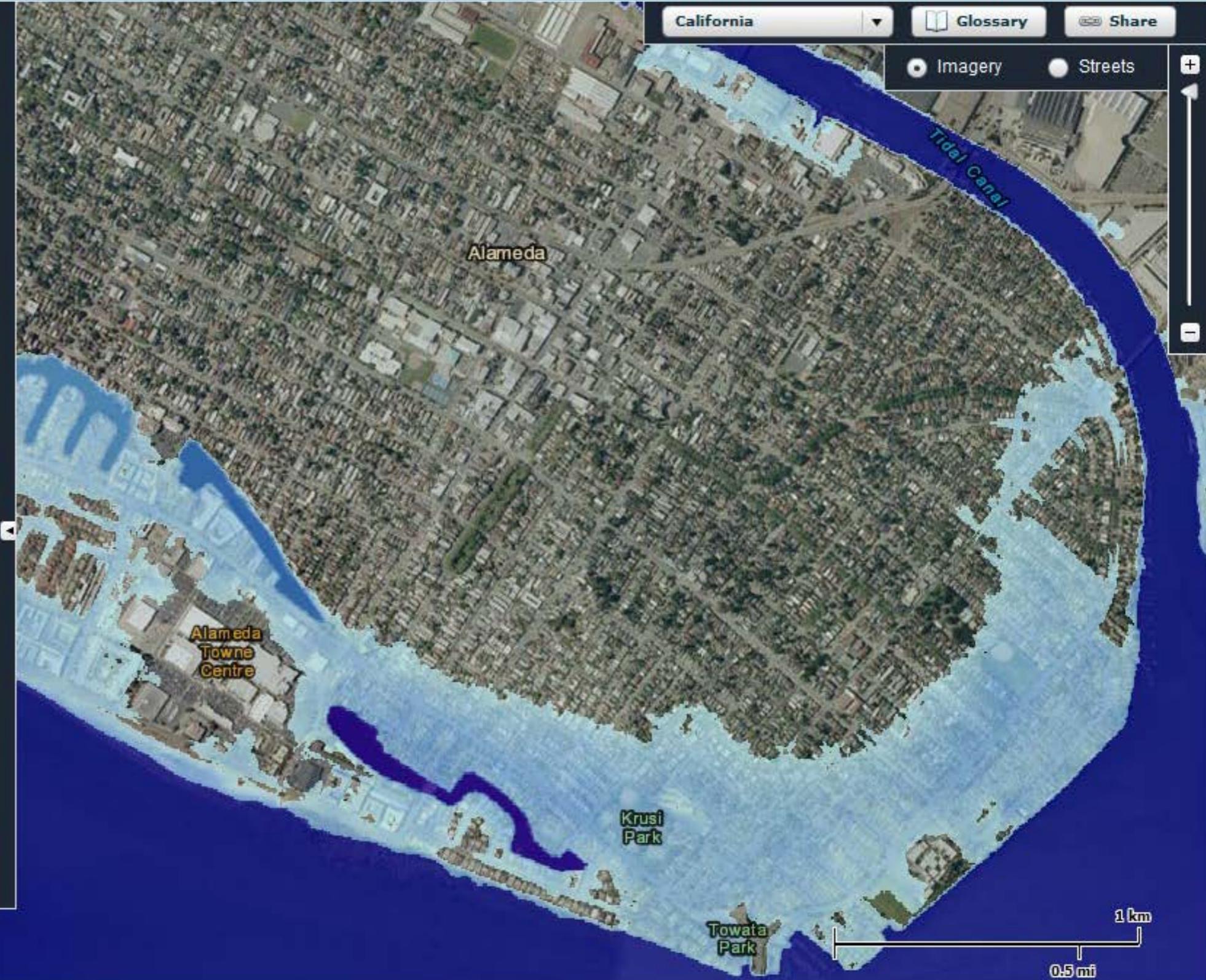
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Understanding the Map

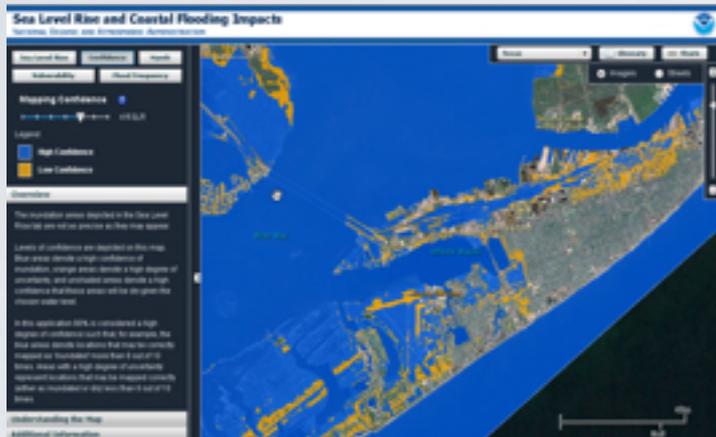
Additional Information



Five Components of the NOAA SLR Viewer



Impacts of Sea Level Rise: Visualize impacts for mean higher high water (MHHW) 6-foot SLR scenarios overlaid on aerial imagery, street map, and terrain map. Photos of SLR on individual structures illustrate site-specific impacts.



Communicate Mapping Confidence: Visualize the mapping confidence of inundation area based on uncertainty of elevation data and MHHW tidal surface.



Visualize Marsh Impacts: Visualize the impacts of SLR scenarios on marshes using Coastal Change Analysis Program (C-CAP) data.



Coastal Flood Frequency: Communicate that today's flood is tomorrow's high tide. Use three years of observed water level data at NOAA's National Water Level Observation Network (NWLON) stations to show increased frequency of everyday flooding.

Pros & Cons of Web-Based Tools

Pros

- ✓ Easy to start: its all been done for you
- ✓ Usually easy to use: good interfaces and limited options

Cons

- ✓ Often limited to pre-run packaged analyses
- ✓ Usually limited to its data, can't integrate local data
- ✓ Often can't readily save and download data and your results for further work



So you want to do more yourself?

GIS-based Decision Support Tools

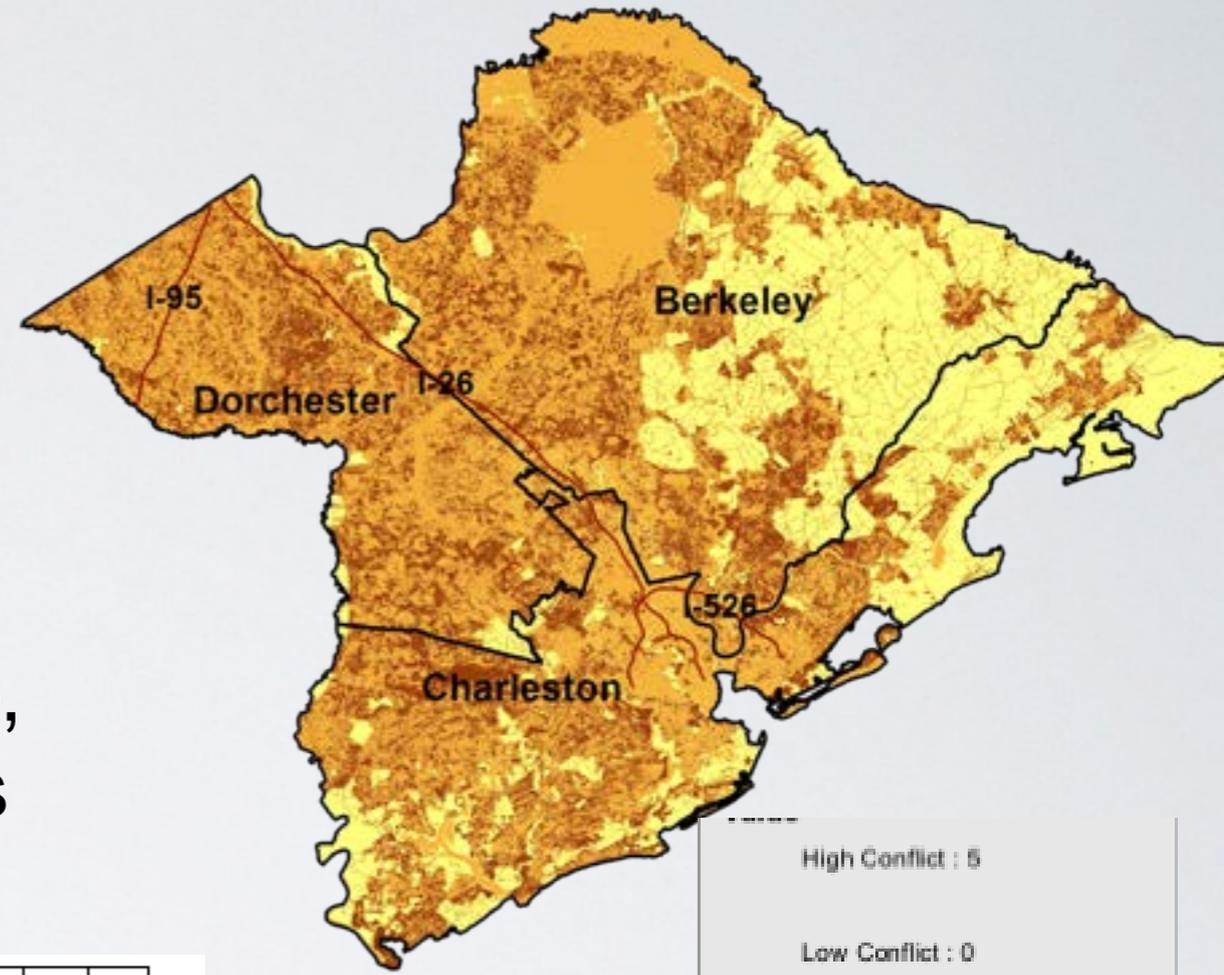
communityviz[®]



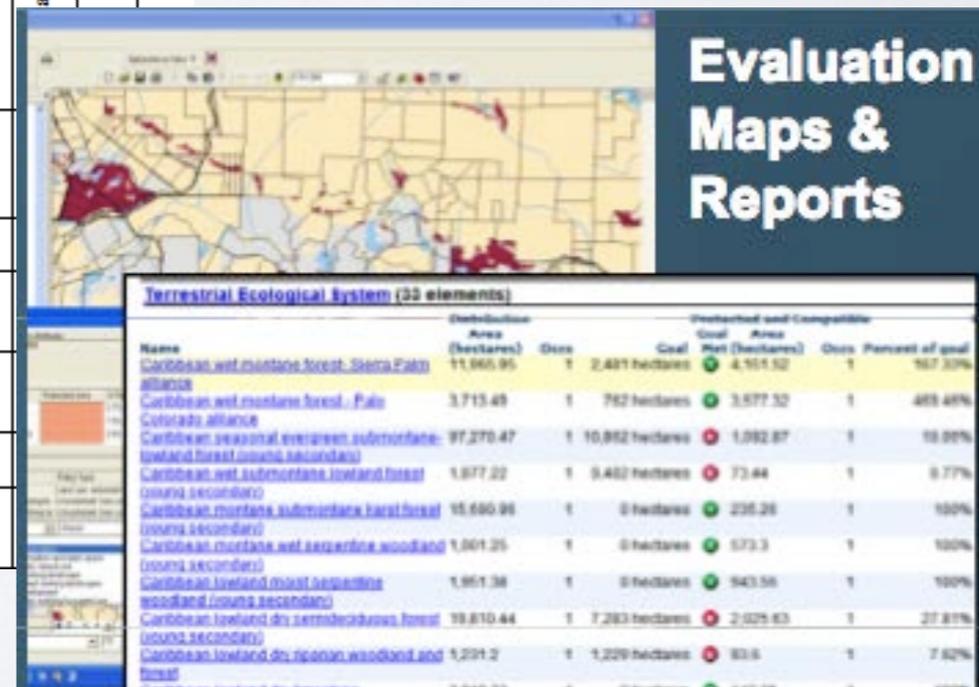
A planning tool that allows communities to develop and compare alternate scenarios.



- Map natural system, including habitat types, incidence of species, current land use
- Identify conservation goals and targets for success
- Assess Current Conditions, Future Use, Mitigation Scenario against these goals



Conservation Element	Urban/Suburban	Rural Residential (with minimal)	Rural Residential (with minimal)	Agriculture	Timber Forest	Recreational Parks	Natural Areas (park)	Conservation Management	Habitat Restoration	Mines	Active Landfills	Local Roads (paved)	Local Roads (dirt)	State/Inter-state Roads	Transmission Corridors	Flooding (50-100 yr)	Storm Surge	Wind	Sea Level Rise
Nonriverine Swamp and Wet Hardwood Forest	3	3	3	3	3	3	2	1	1	3	3	3	3	3	3	1	2	1	3
Floodplain Forest	3	3	3	3	3	3	2	1	1	3	3	3	3	3	3	1	2	1	3
Salt and Brackish Marsh	3	3	3	3	3	3	2	1	1	3	3	3	3	3	2	1	2	2	2
Fresh - Oligohaline Tidal Marsh	3	3	3	3	3	3	2	1	1	3	3	3	3	3	2	1	2	2	2
Tidal Wooded Swamp	3	3	3	3	3	3	2	1	1	3	3	3	3	3	3	1	2	2	3
Dry and Mesic Oak and Mixed Forest	3	2	3	3	3	3	2	1	1	3	3	3	2	3	3	2	3	2	3



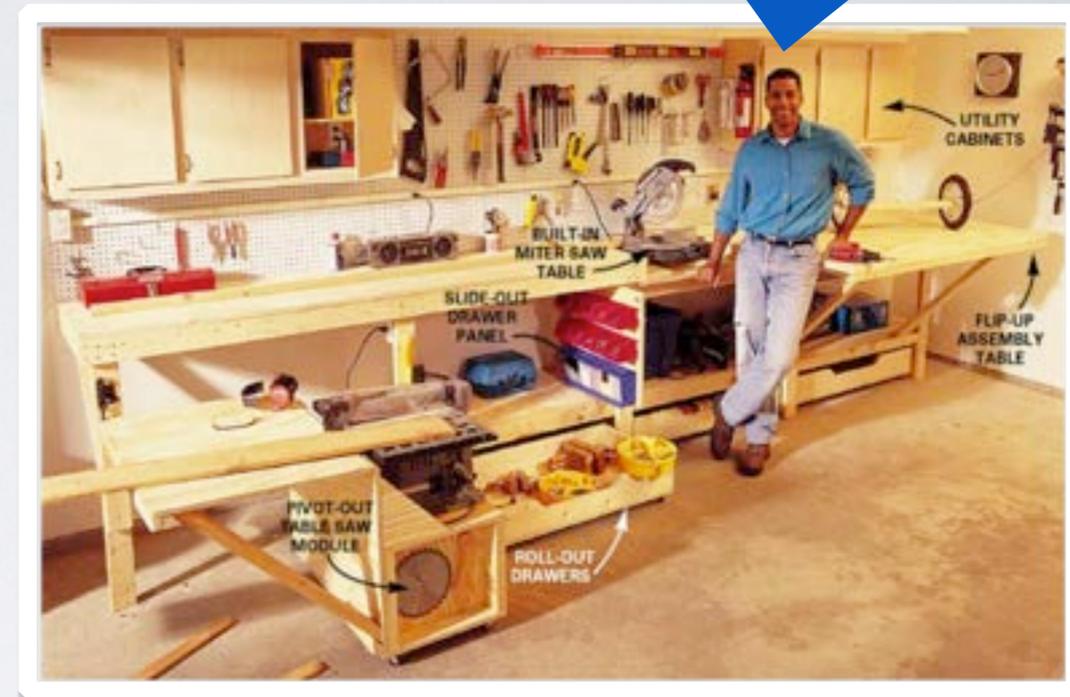
Evaluation Maps & Reports

Terrestrial Ecological System (33 elements)						
Name	Distribution Area (hectares)	Dist	Goal Met (hectares)	Dist	Percent of goal	
Caribbean wet montane forest, Sierra Zapin alliance	11,965.95	1	2,421 hectares	4,511.52	1	167.33%
Caribbean wet montane forest, Palo Colorado alliance	3,713.48	1	762 hectares	3,577.32	1	468.48%
Caribbean seasonal evergreen subtropical forest (young secondary)	97,270.47	1	10,852 hectares	1,082.87	1	18.00%
Caribbean wet subtropical lowland forest (young secondary)	1,877.22	1	3,482 hectares	73.44	1	8.77%
Caribbean montane subtropical forest (young secondary)	15,690.96	1	0 hectares	236.26	1	100%
Caribbean montane wet aspen woodland (young secondary)	1,001.25	1	0 hectares	573.3	1	100%
Caribbean lowland moist evergreen woodland (young secondary)	1,951.38	1	0 hectares	543.56	1	100%
Caribbean lowland dry semideciduous forest (young secondary)	19,810.44	1	7,283 hectares	2,029.63	1	27.81%
Caribbean lowland dry riparian woodland and forest	1,291.2	1	1,229 hectares	83.6	1	7.62%

For the Serious DIY: Toolkits

- Planning projects have diverse needs and issues
- Generally not a single, one-size-fits-all tool available
- Still, there are many tools that can address parts of your needs, SO....

I built my toolkit in just one weekend!

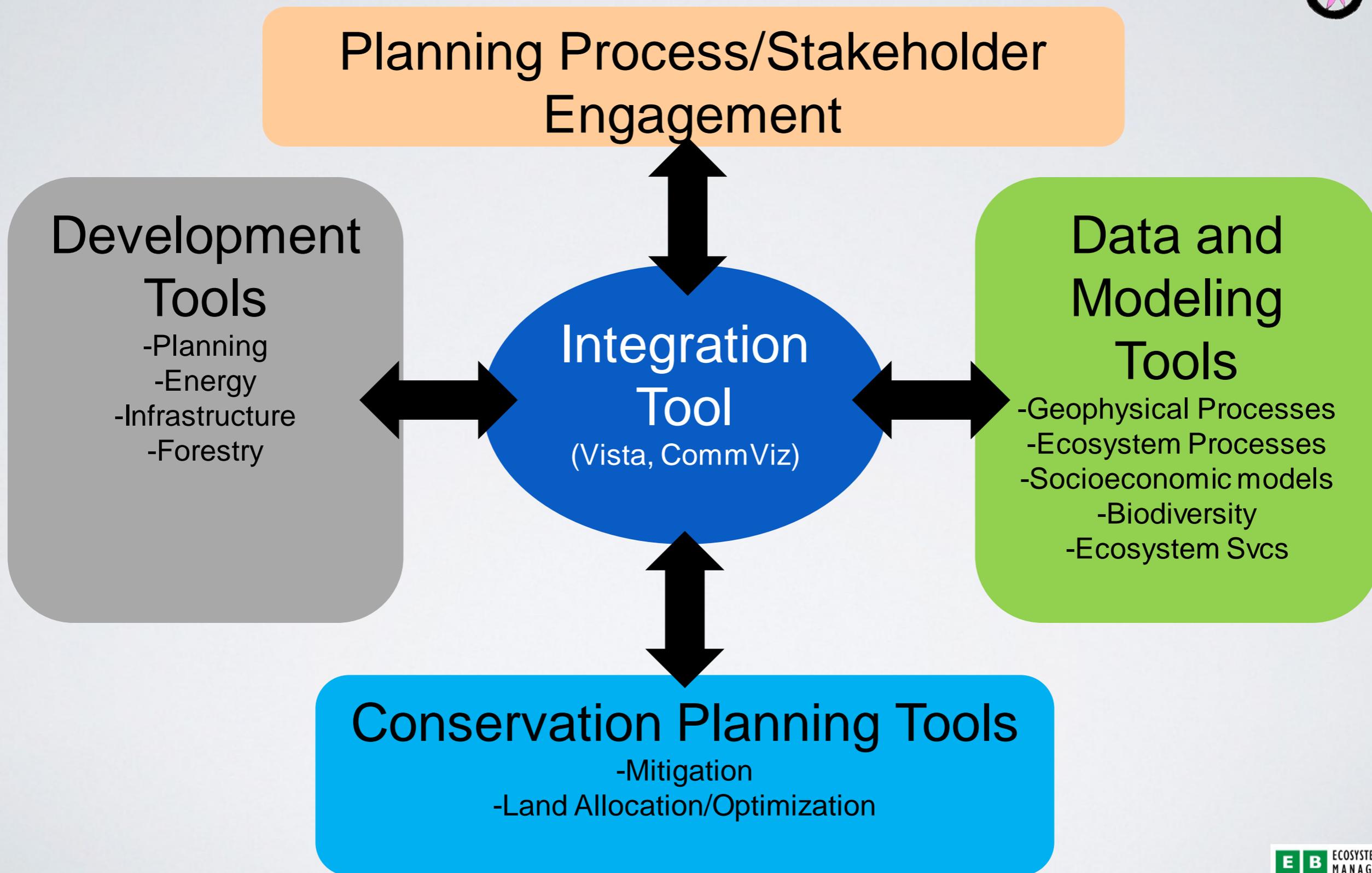


Linking groups of tools through an interactive process gives the flexibility to address an almost unlimited number of issues, with existing tools.





Toolkit Structure



Steps in Assembling a Toolkit

- Produce an information workflow that supports your project objectives & decision product needs
- Search & select tools that can produce the needed products from available data
- Filter selection for tools that meet your resource/capacity
- Try to pick tools that are able/proven to work together if possible



Integrated Planning for Resilient Communities

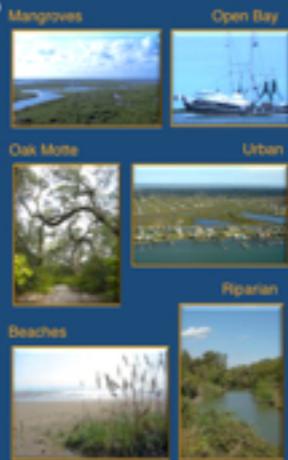
Berkeley-Charleston-Dorchester, SC

Function:

Supports integrated hazard- and ecosystem-based land use planning

Mission-Aransas NERR Case Study

A resource-based "rural but growing" region seeking an EBM approach to planning linking land use and estuary health



Integrated Land-Sea Toolkit

Mission-Aransas NERR, TX

Function:

DST to assess the effects of urbanization on water quality and biodiversity

Contexts

Pilot project: Eastern Shore of Virginia NWR



Refuge Vulnerability Assessment & Alternatives Toolkit

VA, NV, CA

Function:

Cumulative effects assessment for wildlife refuges and evaluate management scenarios

RVAA Pilots Toolkit

Vulnerability Assessment Tools

Expert Assessment Tools
Climate Change Vulnerability Index
Structured Decision Making
Climate Expert Workshops

Data & Modeling Tools

Geophysical Process Tools
N-SPECT, Climate Predictions Models

Ecological Process Tools
Habitat Priority Planner,
CircuitScape, VDDT

Biodiversity Tools
Mapping and Distribution Modeling
Tools – e.g., See5, MaxEnt, SLAMM

**Ecosystem
Services InVEST**

Conservation & Mitigation Tools

**Land Allocation/
Optimization Tools**
Marxan, Zonation, C-Plan

Mitigation Planning
Vista Site Explorer, Mitigation Query
Tool

Info Exchange Tools

**Data Portals &
Exploration**
Landscape, DataBasin, Atlas, etc.

“Development” Planning Tools

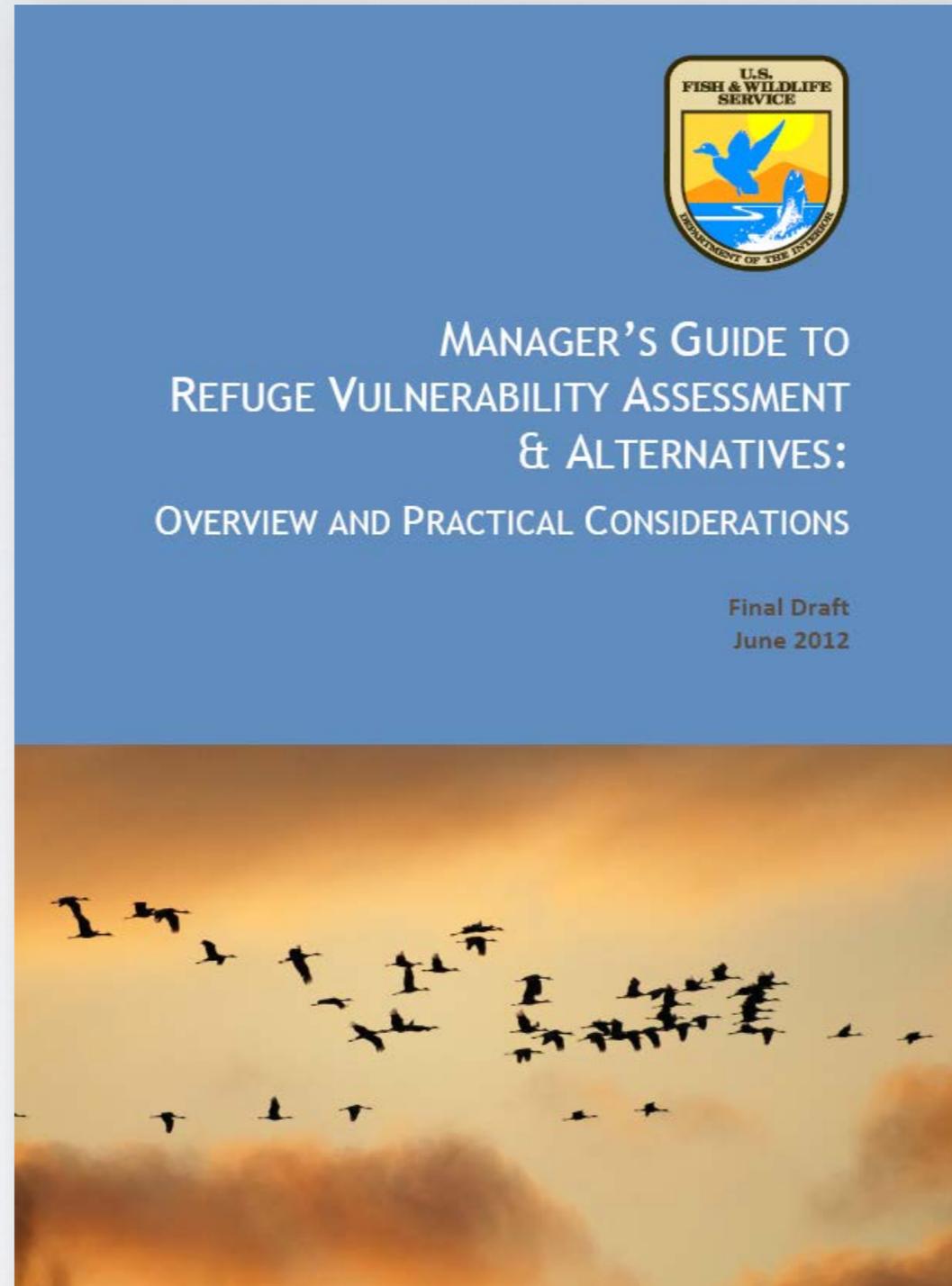
Land Use Planning Tools
CommunityViz

**Energy and
Infrastructure Planning
Tools** QuantM

Forestry Tools

**Framework
Integration Tool
NatureServe
Vista**

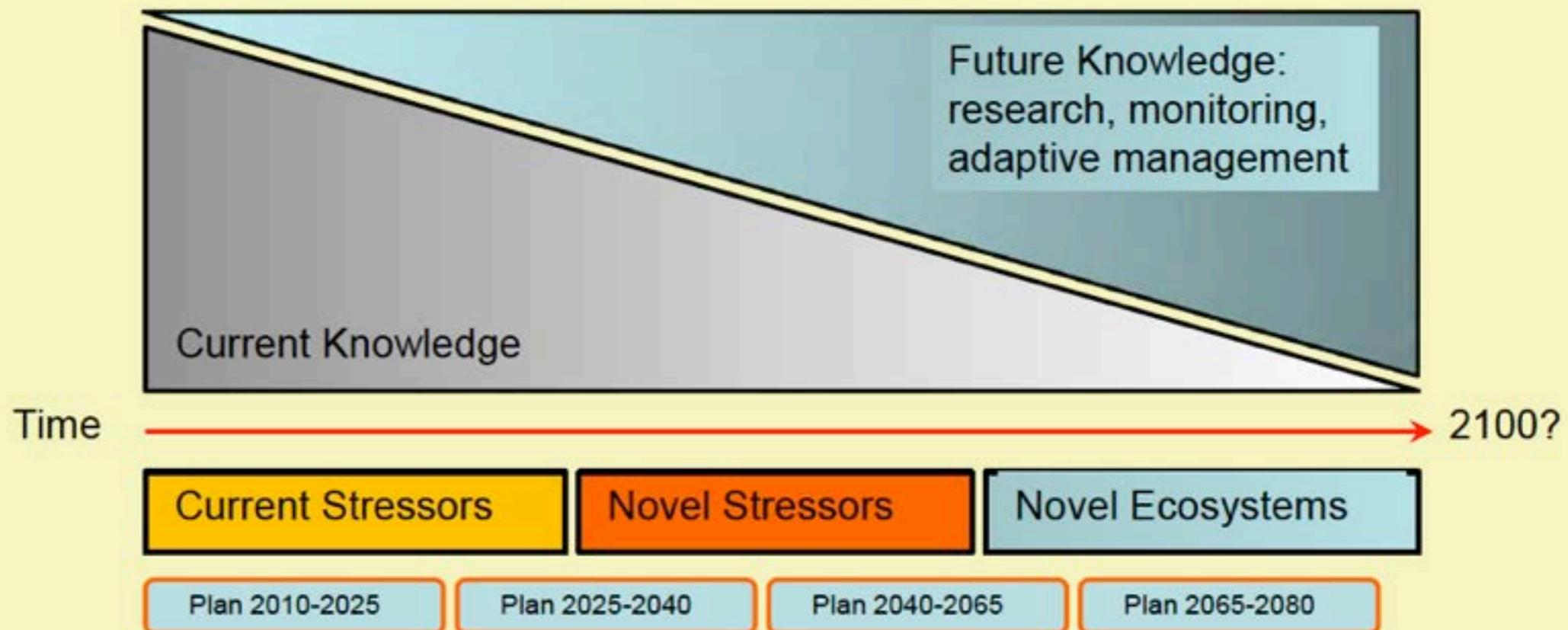
RVAA Guidance



The Challenge

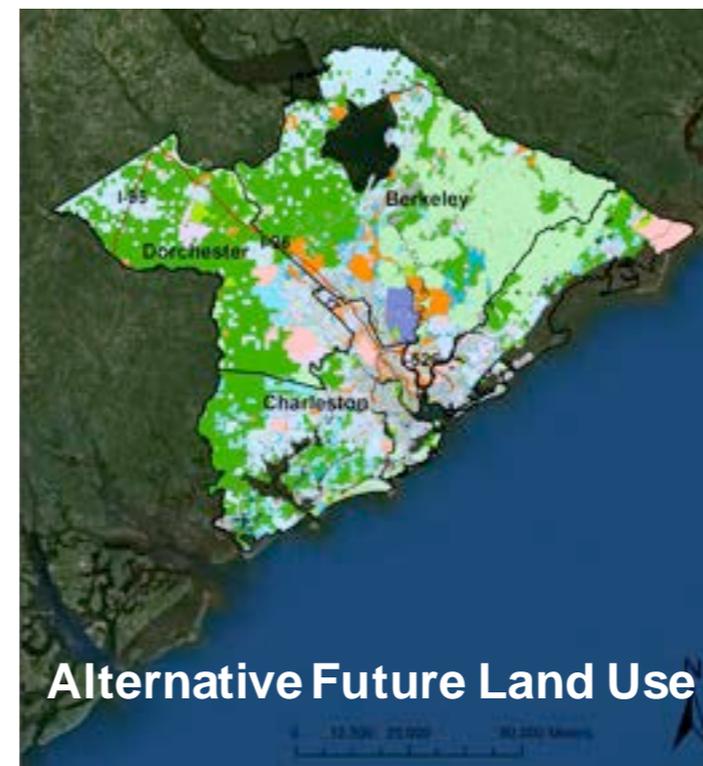
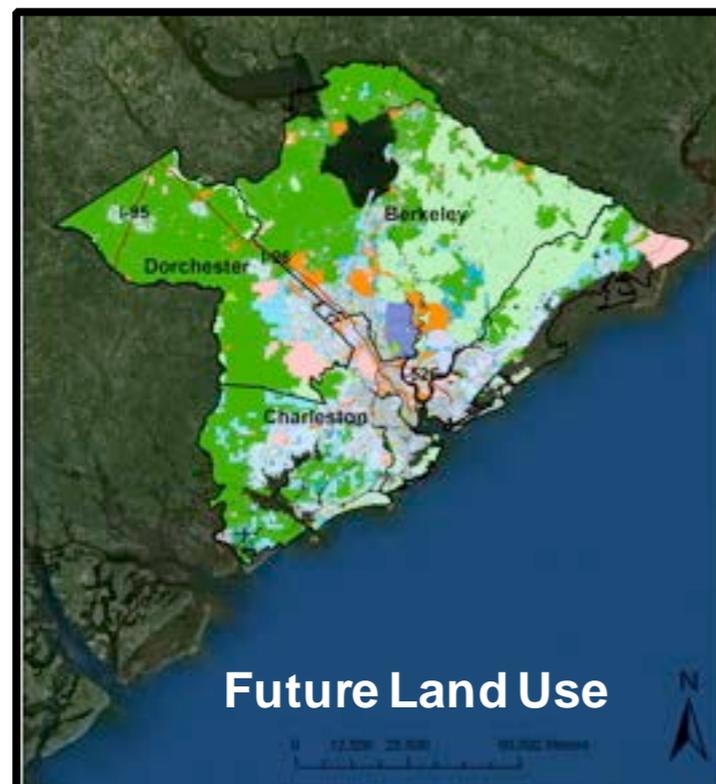
Planning time horizons do not coincide with predicted climate impacts

Interaction of climate effects knowledge, uncertainty, and timing of action



Scenario Planning

- Looks at a range of possible futures
- Help communities identify “thresholds” of change in the face of uncertainty
- Effective method for community engagement and consensus building



Scenario Planning Example

*CommunityViz and CHARM
(Community Health and Resources Model)*

The diagram at the top left illustrates the hardware setup: an IR light pen is directed at a screen, which is connected to a computer via an image output line. The screen is labeled 'Screen' and the computer 'Computer'. The photograph on the right shows a group of people gathered around a large-format digital map, with one person pointing at the screen. The screenshot of the CHARM software interface shows a map with various colored zones. A 'Scenario 360 - Dynamic Update' dialog box is open, indicating 'Updating Painted Resid...' and 'Scenario 360 - Dynamic Update'. A 'Style Palette' is visible on the right, listing various land use categories such as 'SF Rural (0.2 DU/Acre)', 'SF Low (1 DU/Acre)', 'SF Med (4 DU/Acre - 0.1 FAR)', 'SF Hi (8 DU/Acre - 0.1 FAR)', 'Townhomes (20 DU/Acre - 0.2 FAR)', 'Town Center (30 DU/Acre - 1 FAR)', 'City Center (50 DU/Acre - 2 FAR)', 'Urban Core (80 DU/Acre - 3 FAR)', 'Commercial Park (0.15 FAR)', 'Industrial Park (0.35 FAR)', 'Park', 'No Change', 'Townhomes RD (20 DU/Acre - 0.2 FAR)', 'Town Center RD (30 DU/Acre - 1 FAR)', 'City Center RD (50 DU/Acre - 2 FAR)', and 'Urban Core RD (80 DU/Acre - 3 FAR)'. Two bar charts are also visible: 'Total Painted Employees' showing 52,233 employees and 'Total Painted Population' showing 167,306 people.

Things to consider...

- Know what kind of analyses you need to guide you in the planning process.
- Make sure the tool is integrated into your planning process.
- Know the tools limitations.
- Understand data and technical needs of the tools.
 - Assess staff capacity to run and maintain.
 - Do you need an external service provider?
- Ask lots of questions first. Seek out advice from those with experience using tool.
- Maintain a healthy skepticism.



Tool Resources



ebmtools.org

<http://www.csc.noaa.gov/digitalcoast/>



Tools for Climate Change Adaptation Planning (California)

Tool Name	Adaptation Database for Planning Tool (ADAPT)	CRISTAL (Community-based Risk Screening Tool - Adaptation and Livelihoods)	NOAA CSC Coastal Inundation Toolkit	NOAA CSC Roadmap	Ecosystem-Based Management Tools Network	Digital Coast
Tool Type	Process	Process	Process/Visualization	Process	Tool Portal	Data and Tool Portal
Description	An online database that guides users through ICLEI's 5 Mitigation for Climate Adaptation planning framework. ADAPT walks you through the process of assessing your vulnerability, setting resilience goals, and developing plans that integrate into existing board and comprehensive planning efforts.	CRISTAL enables local decision makers to assess the impact a project may have on the resilience of a community, and modify projects to reduce vulnerability and enhance resilience capacity by incorporating adaptation methods. CRISTAL steps the user through a series of worksheets for each of these elements from the identification of impacts, through implementation and evaluation of strategies.	This toolkit provides guidance on how to prepare and map inundation estimates for your area. Toolkit components include: Understand basic information about coastal inundation; Identify your county, exposure and combine potential impacts; Map inundation to "sea" potential impacts; Assess your community's risks, vulnerability, and resilience; Communicate risk strategies to include change; and; Discover how other communities are addressing climate change.	A three hour training designed to help communities characterize their exposure to current and future hazard and climate threat, and assess how existing planning and policy efforts may integrate this information to address community issues. After completing this course, participants will be able to: Identify key issues and impacts associated with current and future coastal hazard risks; Identify major obstacles of community vulnerability and; Identify strategic "win-win" approaches for reducing risks and vulnerability while also addressing other community goals.	A Network of tool providers and practitioners that works to bring geospatial and other tools to planning processes. As the EBM Tools Network evolves, you can find an online database of tools, training resources, webinars, and links to case studies.	Digital Coast is a data and tool portal provided by NOAA Coastal Services Center. The Digital Coast also provides the tools, training, and information needed to turn these data into the information most needed by coastal resource management professionals. All tools and data provided on Digital Coast is freely available.
Skill Level	Low	Low	Medium to High	Low	Low	Low
Developers	ICLEI Sustainable Communities	International Institute for Sustainable Dev (IISD), World Conservation Union (IUCN), SERIS	NOAA Coastal Services Center	NOAA Coastal Services Center	EBM Tools Network	NOAA Coastal Services Center
Price	Requires membership with ICLEI	Free	Free	Free	Free	Free
Additional Software Needed	NA	NA	ArcGIS, VDatum, other geospatial models	NA	NA	NA
Link	http://www.adapt.org/	http://www.cristal.org/	http://www.csc.noaa.gov/ebmtools/inundation/	http://www.csc.noaa.gov/ebmtools/roadmap/	http://www.ebmtools.org/	http://www.csc.noaa.gov/digitalcoast/
Adaptation Process						
Assess Vulnerability	*	*	*	*	*	*
Assess Risk	*	*	*	*	*	*
Develop Plan	*	*	*	*	*	*
Implement Plan	*	*	*	*	*	*
Monitoring	*	*	*	*	*	*
Engage Stakeholders	*	*	*	*	*	*

The original version of this sheet was created by the Ecosystem-Based Management Tools Network and the San Francisco Bay National Estuarine Research Reserve. More information and links to tools can also be found on the related EBM Tools page: <http://ebmtoolsdatabase.org/resource/climate-change/vulnerability-assessment-and-adaptation-tools>

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Climate Tools Matrix

Climate Tools Decision Guide (Coming in 2013)

