

## Tools for Climate Change Adaptation Planning

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	ClimateWizard	Climate Sensitivity Database	Northeast Climate Data	HAZUS-MH (Hazards U.S. Multi-Hazard)	Sea Level Rise Affecting Marshes Model (SLAMM)
<b>Tool Type</b>			<b>Process</b>			<b>Tool Portals</b>		<b>Data portals</b>			
<b>Description</b>	An online database that guides users through ICLEI's 5 Milestones for Climate Adaptation planning framework. ADAPT walks you through the process of assessing your vulnerabilities, setting resiliency goals, and developing plans that integrate into existing hazard and comprehensive planning efforts.	CRISTAL enables local decision makers to assess the impact a project may have on the resources of a community, and modify projects to reduce vulnerability and enhance adaptive capacity by incorporating adaptation methods. This decision support tool is a user-friendly process for planners and managers to identify the links between the livelihoods of locals and climate. CRISTAL steps the user through a series of worksheets for each of the identification of impacts, through implementation and evaluation of strategies. It also includes example reports or case studies.	This toolkit provides guidance on how to prepare and map inundation estimate for your area. The toolkit was developed by the Digital Coast Partnership Group to help communities understand and address coastal inundation issues. Website components include: Understand basic information about coastal inundation; Identify your county's exposure and examine potential impacts; Map inundation to "see" potential impacts; Assess your community's risks, vulnerability, and resilience; Communicate risk strategies to initiate change; and, Discover how other communities are addressing this issue.	A three hour training designed to help communities characterize their exposure to current and future hazard and climate threats 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 elements of community vulnerability; and, Identify strategic "win-win" approaches for reducing risks and vulnerabilities while also addressing other community issues	A network of tool providers and practitioners that works to bring geospatial and other tools to planning processes. At the EBM Tools Network website, 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. Digital Coast is used to address timely coastal issues, including land use, coastal conservation, hazards, marine spatial planning, and climate change. One of the goals behind the creation of the Digital Coast was to unify groups that might not otherwise work together. This partnership network is building not only a website, but also a strong collaboration of coastal professionals intent on addressing coastal resource management needs.	With ClimateWizard you can: - view historic temperature and rainfall maps for anywhere in the world - view state-of-the-art future predictions of temperature and rainfall around the world - view and download climate change maps in a few easy steps  ClimateWizard enables technical and non-technical audiences alike to access leading climate change information and visualize the impacts anywhere on Earth. The first generation of this web-based program allows the user to choose a state or country and both assess how climate has changed over time and to project what future changes are predicted to occur in a given area. ClimateWizard represents the first time ever the full range of climate history and impacts for a landscape have been brought together in	Climate changes poses a daunting challenge to natural resource managers and in response the University of Washington has partnered with key collaborators to conduct a climate change sensitivity assessment. This assessment is designed to evaluate the sensitivity of the species and ecological systems of the Pacific Northwest to climate change. This digital database summarizes the inherent climate-change sensitivities for species and habitats of concern throughout the Pacific Northwest and will provide resource managers and decision makers with some of the most basic and most important information about how species and systems will likely respond to climate change.	This database provides projections of changes in temperature, precipitation, relative humidity, and snow cover for the U.S. Northeast that can be expected over the coming century under higher and lower emission scenarios as well as data on these variables for the period since 1961. The data compiled here was generated as part of the Northeast Climate Impacts Assessment, a collaborative research effort between the Union of Concerned Scientists and more than 50 independent scientists from across the Northeast region and beyond. Information can be displayed geographically or as a time series, and can be plotted for the entire region, an individual state, or major cities	FEMA's HAZUS-MH is a powerful risk assessment methodology for analyzing potential losses from floods, hurricane winds and earthquakes. Scientific and engineering knowledge is coupled with the latest geographic information systems (GIS) technology to produce estimates of hazard-related damage before, or after, a disaster occurs. Potential loss estimates analyzed include: physical damage, economic loss, and social impacts	SLAMM accounts for dominant processes in wetland conversion and shoreline modifications during long-term sea level rise (SLR). It provides more detail than static coastal topography alone, e.g. assessing the contribution of sea water inundation to the conversion of one habitat type to another based on elevation, habitat type, the presence of structures such as dikes, and other variables. SLAMM also accounts for relative SLR calculated as the sum of historic global sea level trends, site-specific coastal elevation changes due to subsidence and other factors, and accelerated global SLR due to global warming. It is useful for a range of landscape scales (<1 square kilometer to 100,000 square kilometers) at high resolution, and it enables managers to identify potential changes in both extent and composition of different wetland types. The latest version (Version 6) can capture feedback mechanisms between SLR and marsh accretion, but does not incorporate some other complex factors that affect regional marsh system response to SLR, such as localized geomorphology or hydrodynamics; nor does it address other impacts associated with climate change, including altered river flows, higher average temperatures, and more-intense hurricanes.
<b>Tool Type</b>	Process	Process	Process/Visualization	Process	NA	NA	Climate data access, visualization, analysis	On-line database and index	Climate data access, visualization	GIS/Socio-economic Model	GIS/Geophysical model
<b>Complexity</b>	Low	Low	Medium to High	Low	Low	Low	Low	Low-Medium	Low	High	Medium-High
<b>Developer</b>	ICLEI Sustainable Communities	International Institute for Sustainable Dev (IISD), World Conservation Union (IUCN), SEI-US	NOAA CSC	NOAA CSC	EBM Tools Network	NOAA Central Services Center	C. Zganjar (TNC); E. Girvetz (then U. Washington, now TNC), and G. Raber (U. Southern Mississippi)	Univ. Washington / TNC	Hayhoe, Wake, Anderson, Liang, Maurer, Zhu, Bradbury, DeGaetano, Stoner and Wuebbles.	FEMA	Warren Pinnacle Consulting, Inc.
<b>Price</b>	Requires membership with ICLEI	Free	Free	Free	Free	Free	Free	Free	Free	Free	Free
<b>Additional Software Needed</b>	NA	NA	ArcGIS, VDatum, other geospatial models	NA	NA	NA	None	None	None	GIS	GIS
<b>Link</b>	<a href="http://www.iclei.usa.org/">http://www.iclei.usa.org/</a>	<a href="http://www.cristaltool.org">http://www.cristaltool.org</a>	<a href="http://www.csc.noaa.gov/digitalcoast/">http://www.csc.noaa.gov/digitalcoast/</a>	<a href="http://www.csc.noaa.gov/digitalcoast/training/">http://www.csc.noaa.gov/digitalcoast/training/</a>	<a href="http://www.ebmtoolsdata.org">http://www.ebmtoolsdata.org</a>	<a href="http://www.csc.noaa.gov/digitalcoast/index.htm">http://www.csc.noaa.gov/digitalcoast/index.htm</a>	<a href="http://www.climatewizard.org/">http://www.climatewizard.org/</a>	<a href="http://courses.washington.edu/ccdb/drupal/">http://courses.washington.edu/ccdb/drupal/</a>	<a href="http://www.northeastclimatedata.org">http://www.northeastclimatedata.org</a>	<a href="http://www.fema.gov/plan/prevent">http://www.fema.gov/plan/prevent</a>	<a href="http://warrenpinnacle.com/prof/SLAMM/">http://warrenpinnacle.com/prof/SLAMM/</a>

**POSSIBLE ADDITIONAL CHARACTERISTICS**

<b>Key input/data needs</b>											
<b>Training needed</b>											
<b>Scope</b>											
<b>Key output</b>											
<b>Appropriate use</b>											
<b>Examples</b>											
<b>Alternatives to consider</b>											
<b>Strengths</b>											
<b>Weaknesses</b>											
<b>Computer requirements</b>											



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Sea Level Rise Affecting Marshes Model (SLAMM-Viewer)	Land Use Portfolio Model (LUPM)	CommunityViz	NatureServe Vista	Maxent	SimCLIM	NEAFWA Regional Vulnerability Modeling	CanVis	Google Mashups	Hazard Assessment Template
<b>Analytical</b>						<b>Visualization</b>			
SLAMM-View is a web-mapping application that portrays pairs of simulation results from the Sea Level Affects Marshes Model (SLAMM) with other contextual layers such as state and county boundaries, roads, and National Wetland Inventory data via web mapping services. SLAMM-View utilizes a combination of server and client software (Java and Java-script) based on Image Matters' userSmarts® technology to provide functionality for interactive layer display selectivity and ordering, and adjustable transparency. Panning and zooming tools allow the user to focus on their particular locality of interest. One unique aspect of this web-mapping tool, vital to comparing the selected pair of simulation results, is that the dual maps are geographically-linked: zooming or panning in one map causes an identical action in the other map.	A tool for modeling, mapping, and communicating risk. It is designed to help public agencies and communities understand and reduce their vulnerability to, and risk of, natural hazards. The LUPM is adapted from financial-portfolio theory, a method for evaluating alternative, regional-scale investment possibilities on the basis of their estimated distributions of risk and return. Data inputs include the probability of the hazard event, the planning time horizon, the assets at risk (e.g. tax parcels), the spatial probabilities of damage, the dollar value and/or vulnerability of each asset, and the cost and effectiveness of the risk-reduction measures being considered. LUPM calculates estimates for the total cost, number of locations mitigated, return on investment, expected loss, and community wealth retained. Finally, the user can display maps showing the results of each mitigation policy, and compare and rank the policies according to their own priorities.	It is an ArcGIS extension that adds interactive analysis tools and a decision-making framework to the ArcGIS platform. Scenario 360 helps you view, analyze and understand land-use alternatives and impacts. A GIS-based decision-support tool, shows you the implications of different plans and choices. It supports scenario planning, sketch planning, 3-D visualization, suitability analysis, impact assessment, growth modeling and other popular techniques. Its many layers of functionality make it useful for a wide range of skill levels and applications.	NatureServe Vista 2.5 is a decision support system for conducting conservation planning and integrating conservation with other assessment and planning activities such as land use, transportation, energy, natural resource, and ecosystem-based management. NatureServe Vista enables users to evaluate, create, implement, and monitor land use and resource management scenarios that operate within the existing economic, social, and political context to achieve conservation goals. The tool operates on an ArcGIS platform. The latest version (v2.5) integrates interoperability with N-SPECT and other hydrologic models to support integrated land-water assessment and planning.	Maxent is a program that produces models of species geographic distributions based on presence-only data. It was designed specifically for modeling distributions when users have access to historical and/or current species localities, but do not have data on sites where the species is known to be absent. Latitude/longitude information on where species have been found and environmental data potentially correlating with species' distributions are the required input. When climate-related factors are believed to drive the current distribution of a species, these variables can be used to generate a model of the current climate envelope, and then the software can project that preference onto models of future climates. Such projections may provide information on future range shifts the species will	SimCLIM is a software system that integrates models and data for purposes of assessing the impacts of, and adaptations to, climate variability and change, including extreme events.	This modeling process will provide us with estimates of how the vulnerabilities of important fish and wildlife habitats vary geographically across the northeastern states an important regional context within which to make conservation planning decisions. The vulnerability model has now been developed and is currently being applied to a sample of 22 habitat types.	CanVis is a visualization program used to simulate potential impacts from coastal development or sea level rise. The software is used by municipalities to brainstorm new ideas and policies, undertake project planning, and make presentations. Incorporates docks, buildings, rising waters, and other objects into user photographs to see potential scenarios. Allows users to quickly brainstorm "what if" scenarios with this easy-to-use tool.	Utilize Google Earth and Google Maps to create unique interactive maps for your websites. Method for anyone to effectively convey geographic data and information over the web. Useful for stakeholder engagement.	This Internet tool helps to construct websites that identify potential hazards for specific locations. Website users identify the location by address, owner name, or by clicking in the map. The tool queries the hazards data to determine the hazards zone(s) for the location. Typical users include planning and permitting departments, residents applying for building permits, hazard mitigation officials, and natural resource planners. The tool's functionality can be set up for any location that has the required data and resources. Geographic information system (GIS) staff members with Internet mapping experience are needed to acquire, set up, and customize the tool.
Geophysical Model, Visualization	Modeling/Analysis Tool, GIS-based	GIS-based DST	GIS-based DST, ArcView Extension	GIS/Geophysical model	Data collection(GIS), modeling/analysis, DST	Habitat vulnerability modeling framework and tool	Scenario Visualization	Online Mapping Visualization	Online Mapping Visualization
Medium-High		Medium	Medium-High	Medium-High	High	Low-medium	Low	Low-Medium	High
Image Matters LLC/USGS	USGS-Western Geographic Science Center	Orton Foundation, Placeways LLC	NatureServe	GIS	CLIMsystems, Ltd.	none	NOAA CSC	Google	NOAA CSC
Free	Free	\$350-850 dependent on Package	Free	Phillips, Dudik & Schapire, supported by AT&T Labs; Princeton U.; the Center for Biodiversity & Conservation, AMNH	sliding scale: \$300/yr student	Manomet Center for Conservation Sciences/NEAFWA	Free	Free	Free
GIS	GIS	GIS	GIS	Free	GIS	Free	None	None	GIS
<a href="http://www.slamview.org">http://www.slamview.org</a>	<a href="http://geography.wr.usgs.gov/science/lupm.html">http://geography.wr.usgs.gov/science/lupm.html</a>	<a href="http://placeways.com/communityviz/">http://placeways.com/communityviz/</a>	<a href="http://www.natureserve.org/prodServices/vista/overview.jsp">http://www.natureserve.org/prodServices/vista/overview.jsp</a>	<a href="http://www.cs.princeton.edu/~schapire/maxent/">http://www.cs.princeton.edu/~schapire/maxent/</a>	<a href="http://climsystems.com/simclim/">http://climsystems.com/simclim/</a>	None, yet	<a href="http://www.csc.noaa.gov/digitalcoast/tools/canvis/">http://www.csc.noaa.gov/digitalcoast/tools/canvis/</a>	<a href="http://www.google.com/earth/">http://www.google.com/earth/</a>	<a href="http://www.csc.noaa.gov/digitalcoast/tools/ha/">http://www.csc.noaa.gov/digitalcoast/tools/ha/</a>




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NOAA Coastal County Snapshots	Spatial Trends in Coastal Socioeconomics (STICS)	SoVi (Social Vulnerability Index)	Climate Adaptation Knowledge Exchange (CAKE)	WeAdapt	System for Assessing Vulnerability of Species (SAVS) to Climate Change	Framework for categorizing the relative vulnerability of threatened & endangered species to climate change	Climate Change Vulnerability Index
<b>Socioeconomic</b>		<b>Multituse</b>					<b>Species Indices</b>
The Coastal County Snapshots tool provides local officials with a quick look at a county's demographics, infrastructure, and environment within the flood zone. These are snapshots in time and were made with the best available national data. Use the map or pull-down menus to select the county of interest and see county-specific data. The data characterize a county's demographics, infrastructure, and environment within the flood zone. Download a full county report to get more information on what steps a community can take to plan for hazards.	The Spatial Trends in Coastal Socioeconomics (STICS) website includes information for all 50 states and provides a set of Web-based data analysis and display tools to facilitate data retrieval, mapping, analysis, assessments, and comparative studies. The website also features query tools that enable users to retrieve data by individual or multiple counties or watersheds (based on the definitions of these categories found in the NOAA Coastal Assessment Framework). The primary objective of this website is to increase awareness and provide socioeconomic information to the coastal stewardship community in a timely fashion. Coastal professionals can use income and employment data found on the website to gain insights into the socioeconomic trends in the nation's rapidly developing coastal regions. This product can also help coastal managers make more informed decisions regarding program priorities and delivery of services.	SoVi is a comparative metric that facilitates the examination of the differences in social vulnerability among counties. It graphically illustrates the geographic variation in social vulnerability. It shows where there is uneven capacity for preparedness and response and where resources might be used most effectively to reduce the pre-existing vulnerability. The index synthesizes 32 socioeconomic variables, which the research literature suggests contribute to reduction in a community's ability to prepare for, respond to, and recover from hazards. The data were culled from national data sources, primarily those from the United States Census Bureau.	Includes georeferenced case studies, directory, tools, and resource library. Can search by text, map, or both.	weADAPT.org is an online 'open space' on climate adaptation issues (including the synergies between adaptation and mitigation) which allows practitioners, researchers and policy makers to access credible, high quality information and to share experiences and lessons learnt with the weADAPT community. It is designed to facilitate learning, exchange, collaboration and knowledge integration to build a professional community of practice on adaptation issues while developing policy-relevant tools and guidance for adaptation planning and decision-making.  The new release of weADAPT.org includes innovative new tools for "knowledge integration", our Adaptation Layer - a Google Earth interface to show 'who is doing what, where' and to create 'adaptation stories', a new climate adaptation Knowledge Base, customized user and organisation profiles and adaptation decision support tools such as the prototype Adaptation Decision Explorer (ADX).	The System for Assessing Vulnerability of Species (SAVS) quantifies the relative impact of expected climate change effects for terrestrial vertebrate species. The SAVS uses 22 criteria related to expected response or vulnerability of species in a questionnaire to provide a framework for assessing vulnerability to climate change. The online questionnaire is completed using information gathered from published materials, personal knowledge, or expert consultation.	This tool is actually a method without associated software. The method involves an evaluative framework composed of four modules. Module 1 categorizes baseline vulnerability to extinction or major population reduction. Module 2 scores the likely vulnerability of a species to future climate change, including the species' potential physiological, behavioral, demographic, and ecological response to climate change. Module 3 combines the results of Modules 1 and 2 into a matrix to produce an overall score of the species' vulnerability to climate change. Module 4 is a qualitative determination of uncertainty of overall vulnerability based on evaluations of uncertainty done in each of the first 3 modules.	The Climate Change Vulnerability Index uses a scoring system that integrates a species' predicted exposure to climate change within an assessment area and three sets of factors associated with climate change sensitivity, each supported by published studies: 1) indirect exposure to climate change, 2) species-specific factors (including dispersal ability, temperature and precipitation sensitivity, physical habitat specificity, interspecific interactions, and genetic factors), and 3) documented response to climate change. Assessing species with this Index facilitates grouping taxa by their relative risk to climate change, and by sensitivity factors, which we expect will help users to identify adaptation options that could benefit multiple species.
Online Visualization and data interpretation	Online Visualization and data interpretation	Data Visualization			Species Assessment	Species Assessment	Species Assessment
Low	Low	Low	Low	Low	Low	Low	Low
NOAA CSC	NOAA CSC	University of South Carolina	EcoAdapt/Island Press	EcoAdapt/Island Press	NA	NA	MS Excel; GIS helpful
Free	Free	Free	Free	Free	US Forest Service	EPA	NatureServe
None	None	None	None	None	Free	Free	Free
<a href="http://csc-s-maps-g.csc.noaa.gov/County">http://csc-s-maps-g.csc.noaa.gov/County</a>	<a href="http://marineconomics.noaa.gov/socioeconomics/">http://marineconomics.noaa.gov/socioeconomics/</a>	<a href="http://webra.cas.sc.edu/hvri/products/sovi/">http://webra.cas.sc.edu/hvri/products/sovi/</a>	<a href="http://www.cakex.org">www.cakex.org</a>	<a href="http://www.weadapt.org/">http://www.weadapt.org/</a>	<a href="http://fs.fed.us/rm/grassland-shrubland-casert/products/species-vulnerability">www.fs.fed.us/rm/grassland-shrubland-casert/products/species-vulnerability</a>	<a href="http://cfpub.epa.gov/ncea/cfm/recordisplay.cfm?id=203743">http://cfpub.epa.gov/ncea/cfm/recordisplay.cfm?id=203743</a>	<a href="http://www.natureserve.org/climatechange">www.natureserve.org/climatechange</a>

