

Climate Adaptation Resource Guide for Casco Bay Communities

December 2015

*“...Preparing for a climate-altered future will
put a premium on acting with intentionality
in carrying out adaptation.”*

[Climate-Smart Conservation](#),

National Wildlife Federation

Adaptation planning allows communities to anticipate climate risks and minimize vulnerabilities, potentially reducing long-term costs and socio-cultural disruptions while strengthening ecological and community resilience. The following resources and organizations can support Casco Bay watershed communities in their efforts to anticipate and plan for the far-reaching impacts of climate change.



University of Southern Maine

Portland, ME 04104-9300

www.cascobayestuary.org

207-780-4820

Toolkits and Viewers

Adaptation Toolkit for Public Officials

<http://www.maine.gov/dep/sustainability/climate/adaptation-toolkit/public-official.html>

Gulf of Maine Council Climate Network Community Toolkit

<http://www.gulfofmaine.org/2/climate-network-community-toolkit/>

New England Environmental Finance Center Climate Change Tools

http://efc.muskie.usm.maine.edu/pages/climate%20change_tools.html

Sustain Southern Maine Climate Change Resources

<http://sustainsouthernmaine.org/developing-our-action-plan-climate-change/>

Envisioning Change: Mapping Sea-level Rise in Casco Bay

<http://media.usm.maine.edu/~slc/>

Climate Solutions Mapping Project for Maine

<http://climatesolutionsme.org/>

NOAA's Digital Coast Sea-Level Rise Viewer

<http://coast.noaa.gov/digitalcoast/tools/slr>

Surging Seas Sea Level Viewer

<http://sealevel.climatecentral.org/>

Maine Geological Survey Sea-Level Rise/Storm Surge Viewer

http://www.maine.gov/dacf/mgs/hazards/slr_ss/index.shtml

Maine Beginning with Habitat Viewer

<http://webapps2.cgis-solutions.com/beginningwithhabitat/>

Maine Beginning with Habitat Toolbox

http://www.beginningwithhabitat.org/toolbox/about_toolbox.html

Maine Coastal Program--Coastal Erosion and Sea Level Rise Resources

<http://www.maine.gov/dacf/mcp/environment/coastal-erosion.htm>

Maine Coastal Program Resources for Local Climate Change Planning

<http://www.maine.gov/dacf/municipalplanning/technical/climate.shtml>

Maine Stream Habitat Viewer

<http://mapserver.maine.gov/streamviewer/streamdocHome.html>

Maine Sea Grant Coastal Community Resilience Tools

<http://www.seagrant.umaine.edu/extension/coastal-community-resilience>

EPA Water Utility Response On-the-Go (Mobile)

<http://watersgeo.epa.gov/responseotg/>

EPA's RAINE Database (Resilience and Adaptation in New England)

<http://www.epa.gov/raine/searching-raine-database>

Environment America's Extreme Weather Map

<http://environmentamerica.org/page/ame/hitting-close-home-global-warming-fueling-extreme-weather-across-us>

Organizations Working on Climate Adaptation within the Region

Casco Bay Estuary Partnership

The Partnership supports climate adaptation throughout the Casco Bay watershed through training programs, research, publications and other collaborative actions (featured in its [Casco Bay Plan 2016-2021](#)). It also helps support the ocean acidification monitoring station at Southern Maine Community College. Climate-related publications include:

- [Climate Trends in the Casco Bay Region](#) (2015)
- [Climate Change in the Casco Bay Watershed: Past, Present Future](#) (2009)
- [Geomorphology and the Effects of Sea Level Rise on Tidal Marshes in Casco Bay](#) (2012)
- [Sea Level Rise and Casco Bay's Wetlands: A Look at Potential Impacts](#) (a report with maps targeted to each of ten different municipalities around the Bay—in the [CBEP Publications Library](#))
- [State of the Bay 2015 Climate Change Indicator](#)
- [COAST in Action](#) (study of inundation in Portland's Bayside neighborhood)

Contact: Marti Blair, 207-780-4820, marti.blair@maine.edu

Casco Bay Regional Resiliency Assessment Program

This cooperative, non-regulatory program to assess the resilience of critical infrastructure, led by the Department of Homeland Security Office of Infrastructure Protection, involves gathering and analyzing data (*e.g.*, facility vulnerability assessments and modeling). Several projects are currently underway with a final RRAP report due out by December 2015:

- Contractors at the University of Mississippi are developing a storm surge model (for a storm making landfall just south of Portland), and helping supply Portland and South Portland with data on storm surge impacts to critical infrastructure. Planned completion for this task is early 2016.
- Argonne National Laboratory is developing Intensity Duration Frequency (IDF) curves for the Casco Bay region (useful for engineers and planners in designing

for heavy precipitation events) that incorporate model projections of future climate. They will be available on the [University of Maine Climate Change Institute](#) (CCI) site by the end of 2016.

- Argonne National Laboratory will complete a radar-based rainfall accumulation study that explores use of radar systems to provide data on high-spatial and temporal resolution historical precipitation events and that assists in IDF curve development. Expected completion is the end of 2015, with data posted on the CCI site (and potentially others).
- Argonne National Laboratory is assembling downscaled climate data for the region (temperature, rainfall, other basic parameters), which will be available from the CCI site. A *Community Planner's Guide* will be developed to help make those data accessible to non-technical users.

Contact: William DeLong, 207-432-5975, William.delong@hq.dhs.gov.

Cumberland County Emergency Management Agency

Cumberland County EMA is charged with developing and periodically updating the county's Hazard Mitigation Plan. This Plan is reviewed and approved by the Maine Emergency Management Agency and the Federal Emergency Management Agency (FEMA) before being formally adopted by towns. In the final stages of the Plan process, CCEMA staff members attend select board meetings in every community—providing an opportunity for discussion of climate adaptation planning. By signing the Plan, communities are eligible to have competitive projects funded at 75 percent through FEMA.

The 2010 Plan is being updated and will be finalized in 2017. CCEMA's planner, Margaret Cushing, is leading this process in cooperation with municipalities throughout the county. She is the primary CCEMA staff person dedicated to hazard mitigation: the other six employees focus on response to disasters.

Contact: Margaret Cushing, CCEMA Planner, 207-892-6785, cushing@cumberlandcounty.org

Cumberland County Soil and Water Conservation District

CCSWCD helps to coordinate the Interlocal Stormwater Group (ISWG), a regional partnership in which 14 municipalities share strategies for reducing stormwater pollution and complying with related Clean Water Act permits. ISWG communities work cooperatively to educate youth, municipal officials, developers and citizens about water quality and stormwater.

Contact: Jami Fitch, 207-892-4700, jfitch@cumberlandswcd.org

Friends of Casco Bay

Friends of Casco Bay's 2015 report, [A Changing Casco Bay](#), covers impacts of nitrogen pollution and coastal acidification, and includes actions that individuals can take to make a difference.

Contact: Mary Cerullo, [207-799-8574](tel:207-799-8574), mcerullo@cascobay.org

Greater Portland Council of Governments

Through its [Sustain Southern Maine](#) initiative, GPCOG completed a [regional sea-level rise vulnerability assessment](#) and shared climate change adaptation recommendations.

A [Casco Bay Environmental Planning Assessment](#) completed by GPCOG in 2012 summarizes planning activities and land-use regulations based on a survey of ten communities bordering Casco Bay. Sections of that plan most relevant to climate adaptation include shoreland zoning, stormwater management, impervious surface limits, LID techniques, drinking water protection and floodplain management.

The [Cumberland County Climate and Energy Plan](#), prepared by GPCOG and adopted by the Cumberland County Commissioners in 2012, outlines ways that municipalities and communities can reduce energy use and minimize greenhouse gas emissions.

GPCOG frequently assists communities around the region with adaptation planning, and is currently working with Chebeague Island to assess the vulnerability to sea-level rise of a current and potential wharf site. Summaries of three past coastal resiliency projects—in Cape Elizabeth, Freeport and South Portland, are available on the [environmental planning page](#) of the GPCOG website.

Contact: Rebecca Schaffner, 207-774-9891, rschaffner@gpcog.org

Gulf of Maine Research Institute

GMRI is exploring new technologies and business models to sustain the long-term health of the region's coastal economy in the face of significant fisheries changes. It recently received a \$6.5 million grant from NASA to create a new educational program to upgrade the technical infrastructure at its center for interactive learning, enabling classrooms in Maine and nationwide to investigate how climate change is affecting their local region and the rest of the world. The new programming will be offered by the 2018-2019 school year.

Its scientists are tracking temperature changes within the Gulf of Maine and their impact on marine species. A [recent article in Science magazine](#) highlight the Gulf's warming and its impact on cod populations. Other projects related to adaptation at GMRI include an [aquatic survey to monitor the Casco Bay ecosystem](#), sampling fish and plankton near the Presumpscot River estuary over a ten-year period; and [Gulf of Maine Lobster Forecasting](#)

Contact: Elijah Miller, 207-228-1667, emiller@gmri.org

Island Institute

Island Institute currently has three projects that relate to climate adaptation in Casco Bay. A new pilot project is testing ocean acidification remediation at Paul Dobbins' Ocean Approved kelp farm off Chebeague Island. Island Institute scientist

Susie Arnold and Nichole Price from Bigelow Laboratory are deploying sensors for pH, CO₂, dissolved oxygen, temperature and salinity in and around the kelp farm to determine if kelp has the capacity to locally remediate ocean acidification (and whether it is beneficial to collocate kelp and shellfish).

Island Institute is partner in a Coastal Community Grant Program project (supported by the Maine Coastal Program) in which Greater Portland Council of Governments is helping Chebeague Island conduct a sea-level rise vulnerability assessment.

The Institute is also working with island communities on economic diversification in light of fisheries changes. It is offering a six-month [Aquaculture Cohort](#) program in 2016 introducing island residents to shellfish and seaweed aquaculture (with about half of the registrants currently coming from Casco Bay). Participants in this Institute project may also elect to participate in a Maine Sea Grant “[Aquaculture in Shared Waters](#)” training program.

Contacts: Susie Arnold, Marine Scientist and Nick Battista, Marine Programs Director,
207-594-9209, sarnold@islandinstitute.org and nbattista@islandinstitute.org

Maine Coastal Program

The Maine Coastal Program (MCP), housed at the Maine Department of Agriculture, Conservation and Forestry provides funds to regional councils and communities around Casco Bay through two competitive grants program. Municipalities in Maine can [apply each year](#) to help fund municipal and regional projects in Maine’s coastal zone through the Coastal Community Grant Program and Shore and Harbor Planning Grant Program.

With support from MCP, South Portland updated its comprehensive plan language; Cape Elizabeth completed a stormwater study of its town center and revised its shoreland zoning ordinance; and Yarmouth, Freeport and Brunswick received introductory presentations on sea-level rise. Chebeague is currently undertaking a vulnerability assessment of its ferry landing at the Stone Pier, and a review of its comprehensive plan (in conjunction with GPCOG).

The MCP has a webpage of resources on [planning for climate variability](#) and one on [coastal erosion and sea level rise](#). It is currently compiling case studies based on past projects funded through its [Coastal Community Grant Program](#)—which will be posted on its website by June 2016).

Contact: Elizabeth Hertz, 207-287-8061, Elizabeth.hertz@maine.gov

Maine Geological Survey

Maine Geological Survey (MGS), in conjunction with the Maine Coastal Program (MCP) and Regional Planning Organizations, has worked with roughly half of the

municipalities bordering Casco Bay (specifically Cape Elizabeth, South Portland, Portland, Freeport, Harpswell and Phippsburg) to complete sea-level rise vulnerability assessments using a scenarios-based approach. Additional assessments of mainland communities bordering Casco Bay are included in the [Sustain Southern Maine Sea Level Rise Vulnerability Assessment](#). Phippsburg worked with MGS and MCP on a study of marsh migration and road impacts that involved extensive public outreach.

MGS has several upcoming projects of relevance to Casco Bay communities:

1. A NOAA Project of Special Merit, titled Building Resiliency along Maine's Bluff Coast, will focus on Casco Bay bluff erosion hazards--helping municipalities learn new ways of managing bluffs and reexamine their commitment to setbacks. This project will be done in conjunction with Cumberland County Soil and Water Conservation District.
2. Through a 2-year NOAA Coastal Management Fellowship project, MGS and MCP plan to engage municipalities with a resiliency self-assessment, in addition to using existing incentives to participate or increase their scores in the National Flood Insurance Program Community Rating System. Currently only Cape Elizabeth (Class 9) and Portland (Class 8) are participating in this incentive based program (which provides a 5 percent discount for each class-level increase) based on policies such as shoreland zoning with open space provisions; meeting or exceeding state freeboard standards; building code standards; comprehensive plans and MS4 stormwater measures.
3. MGS has created statewide GIS layers that can viewed online (<http://www.maine.gov/dacf/mgs/hazards/coastal/index.shtml>) showing existing highest annual tide; scenarios of sea-level rise or storm surge with layers for 1-foot, 2-foot, 1 meter and 6-feet; and a hurricane inundation layer for Category 1 and 2 storm events.

Contact: Peter Slovinsky, 207-287-2801, peter.a.slovinsky@maine.gov

Maine Sea Grant

In addition to its [Coastal Community Resilience website](#), Maine Sea Grant has several resources to help municipalities and landowners with climate preparedness.

- Maine Property Owner's Guide to Managing Flooding, Erosion and Other Coastal Hazards website: <http://www.seagrants.umaine.edu/coastal-hazards-guide>
- "Building a Resilient Coast" Tours (most recently in cooperation with the Wells Reserve): <http://www.wellsreserve.org/visit/calendar/999-tour-building-a-resilient-coast>
- "Recognizing Resilient Properties" trainings for real estate professionals

Contact: Kristen Grant, 207-646-1555 (ext. 115), knggrant@maine.edu

Maine Audubon

In conjunction with Manomet Center for Conservation Sciences and others, Maine Audubon has completed two studies of climate change and biodiversity, available online at <http://maineaudubon.org/publications-resources/>. Maine Audubon helped found the [Stream Smart Program](#), which provides ongoing trainings for public works directors, contractors, planners, engineers, landowners and conservation volunteers and professionals on how to build and upgrade road-stream crossings in ways that sustain wildlife habitat, improve public safety (especially as more extreme precipitation events occur), and minimize risk of washouts and storm damage.

Contact: Sally Stockwell, 207-781-2330, sstockwell@maineaudubon.org

Manomet Center for Conservation Sciences

Manomet has prepared climate adaptation plans for two sites in the Casco Bay watershed (Maquoit Bay and in the Sebago Lake watershed) and has published a list of funding resources for climate adaptation work. More information and publications are available at <https://www.manomet.org/program/climate-services/climate-change-adaptation>.

Contact: Eric Walberg, 207-721-9040, ewalberg@manomet.org

Maine Coast Heritage Trust

MCHT's booklet, [Conservation Options: A Guide for Maine Landowners](#), offers an array of strategies for open space protection. It also has a flyer on the [Public Benefits of Conserved Lands](#).

Contact: Warren Whitney, 207-729-7366, wwhitney@mcht.org

Maine Department of Environmental Protection Water Bond Funds

The Maine Department of Environmental Protection has begun disbursing funds from a \$10 million Water Bond that voters approved in November 2014. More than \$5 million is dedicated to funding vital public improvement projects including stream crossing or culvert upgrades, and \$400,000 is set aside for state wetland restoration. Projects are intended to reduce the risk of culvert failure; incorporate provisions for climate change, flood protection and resiliency; remove barriers to fish passage; and restore wetlands that provide wildlife habitat. [RFP information](#) is on the Maine DEP website.

Contact: Bill LaFlamme, 207-215-9237, william.n.laflamme@maine.gov

Maine Department of Inland Fisheries and Wildlife (MDIFW)

In 2015, MDIFW collaborated with more than 100 conservation partners to revise Maine's [Wildlife Action Plan](#), several sections of which relate to climate change adaptation. Table 3-3 on page 13 of Element 3 lists links to PDFs containing Species of Greatest Conservation Need and habitat information for four different sub-categories of climate change. The [Conservation Actions chapter](#) has additional climate-related recommendations.

Contact: Amanda Shearin, Ph.D., 207-287-5260, amanda.f.shearin@maine.gov

Natural Resources Council of Maine

NRCM hosts climate-related forums, encourages [business engagement](#) (see <http://www.nrcm.org/projects-hot-issues/clean-air-clean-energy/federal-climate-and-energy-issues/become-a-maine-businesses-for-climate-action/>) and has a list indicating what percentage of Maine towns will be affected by different increments of sea-level rise (<http://www.nrcm.org/projects-hot-issues/clean-air-clean-energy/global-warming-air-pollution/effects-of-sea-level-rise-on-maine/top-20-maine-towns-affected-by-sea-level-rise/>).

Contact: Dylan Voorhees, 207-430-0112, dvoorhees@nrcm.org

New England Environmental Finance Center (NE/EFC)

US EPA funding will allow to the NE/EFC to continue serving EPA's Region 1 (northern New England states) from 2015-2021. The NE/EFC currently has two regional initiatives relevant to Casco Bay communities: one that that involves planning for climate adaptation and one focused on integrated stormwater planning and training.

The NE/EFC has developed guidelines and tools that small New England communities can use to start or continue a climate adaptation plan. All the resources will be posted on the [NE/EFC website](#), and an outreach program will be launched to disseminate the information and begin working with communities.

Incorporating a training package from the University of Maryland, NE/EFC is currently working with communities around Narragansett Bay in Rhode Island on stakeholder consensus and stormwater management training, and plans to expand the training program to other New England communities.

Contact: Martha Sheils, 207-228-1864, Martha.sheils@maine.edu

NOAA Coastal Services Center

In addition to its sea level-rise viewer, NOAA's Digital Coast site offers many other adaptation resources, including [on-site trainings and webinars](#).

Contact: Rebecca Newhall, 978-281-9237, Rebecca.newhall@noaa.gov

NOAA National Centers for Environmental Information, Eastern Region Office

The [Regional Climate Services Office](#) provides various resources to assist planning and decision-making, including a [quarterly Climate Impacts and Outlook bulletin](#) for the Gulf of Maine region and monthly webinars related to regional weather and climate.

Contact: Ellen Mecray, 508-824-5116, ext. 263, ellen.l.mecray@noaa.gov

The Nature Conservancy Maine Chapter

TNC's Maine Chapter has habitat restoration projects underway in both inland and nearshore portions of the Casco Bay watershed, as well as a marine program

(exploring a potential permit banking strategy for ground fisheries and working to increase more volunteer monitoring of diadromous fish runs along the coast).

It has two habitat restoration specialists who work statewide, who work helping communities to increase the size of culverts to enhance fish passage, improve stream function, maintain habitat diversity and better withstand large storms. Its staff is also working on projects to increase nearshore resilience through eelgrass planting, saltmarsh restoration and oyster cultivation. Ongoing monitoring of these experimental sites will help provide guidance for more far-reaching efforts. TNC also participates in the Stream Smart Program, helping to change the state's culture of road-building and maintenance, and in the statewide Stream Connectivity Work Group.

TNC also works on policy measures to advance climate adaptation such as carbon credits and sustainable energy.

Contact: Jeremy Bell, 207-607-4820, jbelle@tnc.org

University of Maine Climate Change Institute

The University of Maine [Climate Change Institute](#) conducts research and graduate education focused on variability of Earth's climate, ecosystems, and other environmental systems, and on the interaction between humans and the natural environment. The Institute has numerous resources to help understand climate trends and impacts, and is the home of Maine State Climatologist Dr. Sean Birkel (sbirke61@maine.edu). The Institute houses information sources such as [Maine's Climate Future 2015 Update](#) and tools such as the [Climate Reanalyzer](#). The Institute is developing a Climate Futures initiative to further bridge science and tools to provide decision-support frameworks for planning and management in a changing climate.

Contact: Betty Lee, 207-581-3406, bliqcs@maine.edu

USFWS Gulf of Maine Coastal Program Habitat Resilience

The U.S Fish and Wildlife Service (USFWS) Gulf of Maine Coastal Program has completed a resilience literature review that looks at the intersection of ecological and social resilience in adaptive management. The report identifies important ecological and social factors that foster greater resiliency, including overlapping governance and strong organizational relationships, diversity and ecological variability, and understanding of ecosystem functions.

The Gulf of Maine Coastal Program contributes to building more resilient landscapes and communities through its habitat protection and restoration programs (*e.g.*, providing technical assistance to replace culverts with structures that restore passage for aquatic species and protect municipal infrastructure).

Contact: Jed Wright, 207-781-8364 (ext.12), jed_wright@fws.gov

Wells Reserve Coastal Training Program

The [CTP at Wells National Estuarine Research Reserve](#) offers science-based trainings to local and regional decision-makers on topics such as land use, climate change (sea-level rise) and green infrastructure.

Contact: Dr. Christine Feurt, 207-646-1555 ext .111, cfeurt@wellsnerr.org

Model Municipal Projects and Products

Cape Elizabeth rewrote its shoreland zoning ordinance to add 3 vertical feet over the Highest Astronomical Tide in its development review.

(http://www.capeelizabeth.com/government/rules_regs/ordinances/zoning/zoning.pdf)

With funding support from the Maine Coastal Program, It has also created a new stormwater plan for its town center that could serve as a model for other communities. It will be available by the end of 2015: contact Town Planner Maureen O'Meara at Maureen.omeara@capeelizabeth.org.

South Portland has completed a detailed vulnerability assessment with assistance from GPCOG, made significant strides with mitigation measures, and put language on sea-level rise into its comprehensive plan

(http://www.southportland.org/files/4113/7279/7365/Final_Plan_Adopted_10-15-12_without_Appendices.pdf)

Georgetown (which lies just outside the Casco Bay watershed boundary) received support from the Maine Coastal Program to complete a Climate Change Adaptation Report that could serve as a model for other communities. Providing a thorough overview of threats and detailed localized responses, it includes recommendations at both municipal and individual levels. It is online at

<http://gtownconservation.com/wp-content/uploads/2015/08/Georgetown-Adaptation-Report-ALL-chapters-FINAL-8.75x11.25-v10forPDFonlineV2.pdf>.

Harpswell provides all new town residents with *A Resident's Conservation Guide to Casco Bay*, a short handbook that offers guidance on Bay-sensitive landscaping, pest management, boating practices and household actions. The guide (online at http://www.harpswell.maine.gov/vertical/Sites/%7B3F690C92-5208-4D62-BAFB-2559293F6CAE%7D/uploads/A_Residents_Conservation_Guide_to_Casco_Bay_Rev_1.3_120613_-_on-line.pdf). Harpswell also developed an Open Space Plan that helps guide development to appropriate areas while fostering preservation of twelve "focus areas" that are critical to water resources, wildlife and commercial fish species. The Plan is online at

http://www.harpswell.maine.gov/index.asp?SEC=33C20AD8-07E9-4F5C-9AE7-A26DC9701C19&Type=B_BASIC.

Appendix A: Key Characteristics of Climate-Smart Conservation

Link actions to climate impacts

Conservation strategies and actions are designed specifically to address the impact of climate change in concert with existing threats; actions are supported by an explicit scientific rationale.

Embrace forward-looking goals

Conservation goals focus on future, rather than past, climatic and ecological conditions; strategies take a long view (decades to centuries) but account for near-term conservation challenges and needed transition strategies.

Consider broader landscape context

On-the-ground actions are designed in the context of broader geographic scales to account for likely shifts in species distributions, to sustain ecological processes, and to promote collaboration.

Adopt strategies robust to uncertainty

Strategies and actions ideally provide benefit across a range of possible future conditions to account for uncertainties in future climatic conditions, and in ecological and human responses to climate shifts.

Employ agile and informed management

Conservation planning and resource management is capable of continuous learning and dynamic adjustment to accommodate uncertainty, take advantage of new knowledge, and cope with rapid shifts in climatic, ecological, and socioeconomic conditions.

Minimize carbon footprint

Strategies and projects minimize energy use and greenhouse gas emissions, and sustain the natural ability of ecosystems to cycle, sequester, and store carbon.

Account for climate influence on project success

Considers how foreseeable climate impacts may compromise project success; generally avoids investing in efforts likely to be undermined by climate-related changes unless part of an intentional strategy.

Safeguard people and nature

Strategies and actions enhance the capacity of ecosystems to protect human communities from climate change impacts in ways that also sustain and benefit fish, wildlife, and plants.

Avoid maladaptation

Actions taken to address climate change impacts on human communities or natural systems do not exacerbate other climate-related vulnerabilities or undermine conservation goals and broader ecosystem sustainability.

(from the National Wildlife Federation's [Climate-Smart Conservation](#), 2014)

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