

Climate Change, Forest Carbon & Carbon Markets



Forests are one natural solution to climate change because they remove carbon dioxide (CO₂) - a potent greenhouse gas (GHG) - from the atmosphere and store the carbon in trees, other plants and soil. Increasing the amount of carbon stored in forests and harvested wood products reduces atmospheric CO₂ from human-caused carbon emissions¹, mitigating the effects of climate change while sustaining the other critical ecological, social, and economic services that forests provide.

Trees sequester and store carbon

Through photosynthesis, living trees take CO₂ from the air and store it to grow and maintain their trunks, branches, leaves, and roots. Conversely, standing dead trees and dead downed wood and forest floor litter slowly emit carbon as they decay. Some of this released carbon is used by insects, fungi, trees, and other organisms for energy and growth. Trees that are burned in a forest fire or felled for use as firewood release carbon into the air, and also feed into the carbon cycle.



Figure concept from Forest Carbon working Group

Older forests store more carbon than younger forests, but they sequester it at a slower rate. This means that age diversity within a forest and across the landscape is the best way to maximize both carbon storage² and sequestration³. Plus diversity is a good strategy for climate resilience and forest health, too.

Forests of the Northeast store the equivalent of ~54 years of the region's current annual GHG emissions

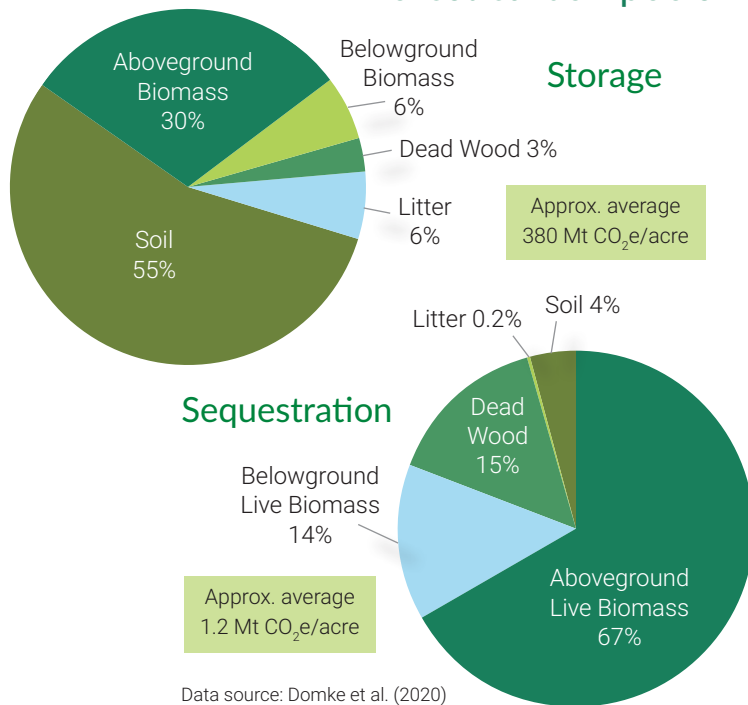
1. Carbon emissions - When carbon is released into the atmosphere. This occurs when fossil fuels or wood burns or decays.
2. Carbon storage - is the total amount of carbon contained in a forest both aboveground (mostly trees) and below ground (mostly soil) at a given time.
3. Carbon sequestration - is the process of removing carbon from the atmosphere through photosynthesis and storing it in another form that cannot immediately be released - wood. It is the rate of carbon uptake from the atmosphere.

Forest management and forest carbon

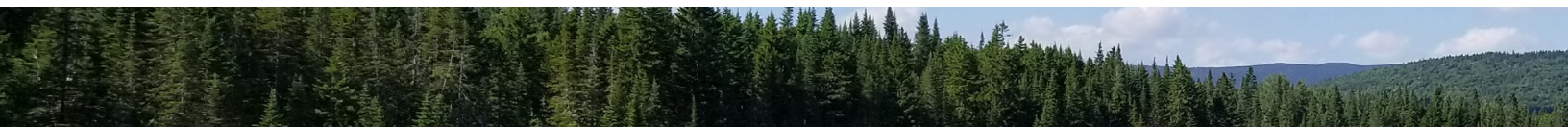
Harvesting trees can initially decrease the amount of carbon stored in the system, but it creates opportunities for greater carbon sequestration and long-term carbon storage. Harvesting trees removes carbon from the forest, but in the Northeast where natural regeneration is prevalent (and if natural regeneration is successful), other trees will quickly occupy the newly created space and sequester carbon as they grow, sometimes at an accelerated rate. Harvested wood that is used for long-lived products like furniture, flooring, and building materials, stores the carbon for the duration that it remains as wood. Plus, use of wood in construction instead of concrete, steel, or fossil fuels reduces global carbon emissions while supporting our local forest economy and helping to keep forests as forests. Wood that is landfilled releases its carbon at a very slow rate. This means that the amount of carbon stored in wood products in use and in landfills accumulates over time, and contributes to the overall importance of the forests in keeping CO₂ out of the atmosphere.

Landowners may wish to include maintaining or increasing forest carbon as a forest management goal, which can be combined with other goals like growing timber, improving forest health, and/or supporting wildlife. To achieve carbon goals, a landowner may require financial incentives. There are carbon offset markets, where carbon sequestered and stored by the forest are monetized and sold to another entity. There are also payments for practices, like in the Natural Resource Conservation Service's Environmental Quality Incentives Program (EQIP) program.

Forest carbon pools



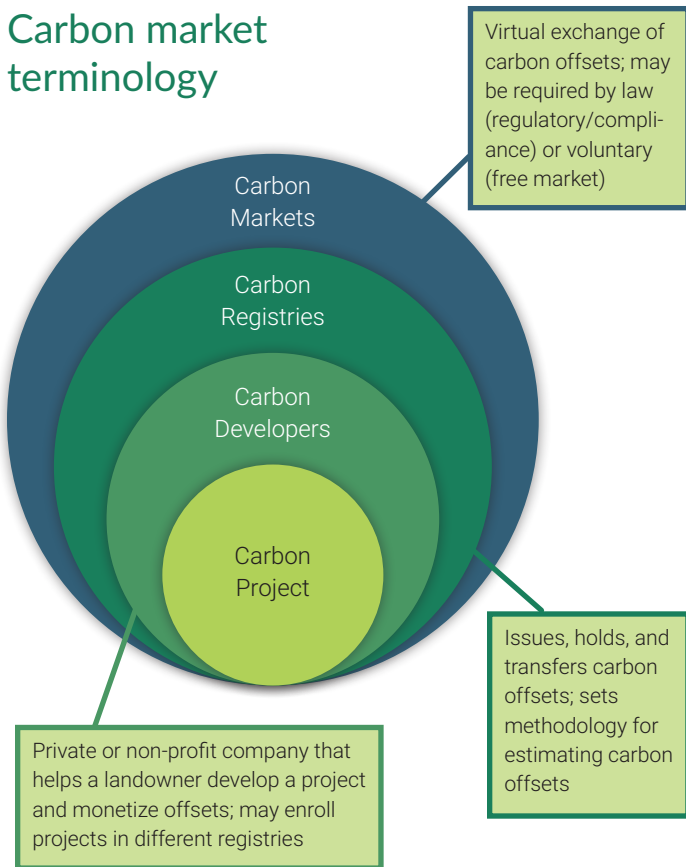
Data source: Domke et al. (2020)



Forest carbon markets

Forest carbon markets allow for businesses, municipalities, and other organizations to purchase carbon credits to offset their CO₂ and other GHG emissions. A forest carbon credit is created when landowners undertake specific projects to increase their forests' ability to absorb CO₂ and store carbon. The projects are then verified and monetized in the marketplace for forest carbon. Reducing emissions of CO₂ and other GHG's can be difficult and expensive, so forest carbon offset markets provide these entities with an alternative to reduce their impacts on climate change. In this way, the increased CO₂ intake by forests is used to offset CO₂ emissions by another entity. Ideally, both emission reduction and offset purchase should occur.

Carbon market terminology



Carbon offset programs for small landowners

Forest carbon market opportunities for landowners that own smaller acreages are becoming available and several entities offer programs for smaller landowners.

For an up-to-date list of carbon market programs and their requirements please go to:

www.northeastforestcarbon.org/forest-carbon-financial-markets

How can landowners participate in a forest carbon market?

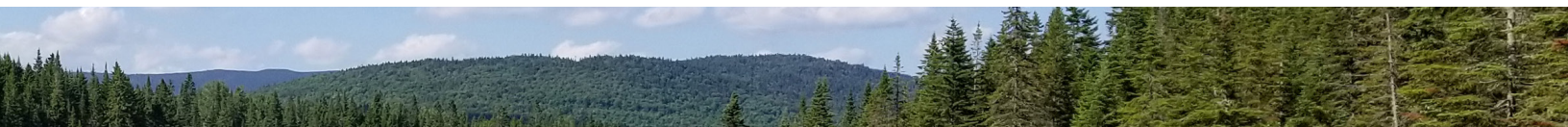
Landowners can sell their carbon credits directly through a forest carbon market, but undertaking a carbon offset project is expensive, so many landowners participate through forest carbon programs where third-party companies assist with the up-front and ongoing costs of the project in exchange for a share of the revenues. Lengthy contracts are involved in these forest carbon projects for most programs.

Three main types of carbon offset projects can be used to participate in carbon markets:

- 1 Avoided conversion:** protecting the forest from future development to keep the carbon in the forest's trees and soils. These projects usually include the establishment of a conservation easement or the transfer of private land to public ownership. In order to qualify, easements cannot be too restrictive on the timber and its management.
- 2 Afforestation, reforestation, or revegetation:** growing new trees to remove CO₂ from the air and store carbon. For these projects, trees are planted and/or conditions are created that will encourage the growth of trees in an area previously absent of trees.
- 3 Improved forest management:** using practices that increase the amount of CO₂ removed from the air and carbon stored in an existing forest. Strategies to do this might include setting aside a reserve area, harvesting less frequently to grow larger trees, thinning to allow remaining trees more room to grow, and/or increasing the diversity of species and age classes (i.e., forest structure). This is the most common forest carbon offset type.

To be considered a valid carbon offset project:

- The amount of CO₂ absorbed by a forest, and/or the amount of carbon it stores, must be higher than it would have been had the project never taken place;
- There cannot be a loss of forest carbon in another area (e.g., a landowner reduces the number of trees cut in one forest, but more trees are cut elsewhere to compensate (called leakage);
- It must have a long-term time commitment to ensure the additional CO₂ absorption isn't short-lived; and
- It must be periodically checked to verify that the impact of the project continues to meet the carbon credits awarded.



Securing Northeast Forest Carbon Program (SNFCP) is a cooperative program of the State Foresters from Connecticut, Maine, Massachusetts, New Hampshire, New York, Rhode Island, and Vermont funded through a USDA Forest Service grant. The goal of SNFCP is to educate forest landowners, foresters, and managers in the 7-state region about the importance of forest carbon, how it can be included as a management goal, and ways that carbon management can be financed.

To reach the forest carbon expert at your state agency in New England & New York:

Connecticut - Andrea Urbano, Service Forester, CT Dept. of Energy and Environmental Protection - Andrea.Urbano@ct.gov

Maine - Donald Mansius, Director of Forest Policy and Management Division, Maine Forest Service - Donald.J.Mansius@maine.gov

Massachusetts - Sean Mahoney, MA DCR Markets and Utilization Forestry Program Director - DCR.Forestry@mass.gov

New Hampshire - Matt Kelly, Forestry Field Specialist, UNH Cooperative Extension - Matt.Kelly@unh.edu

New York - Bryan Ellis, Forest Climate Section Leader, NY DEC, Division of Lands and Forests - bryan.ellis@dec.ny.gov

Rhode Island - Nancy Stairs, Coop. Forestry Program Supervisor, RI Div. of Forest Environment - nancy.stairs@dem.ri.gov

Vermont - Alexandra Kosiba, Climate Forester, VT Dept. of Forests, Parks and Recreation - Alexandra.Kosiba@vermont.gov



For more information go to www.northeastforestcarbon.org or scan the code to take you there.



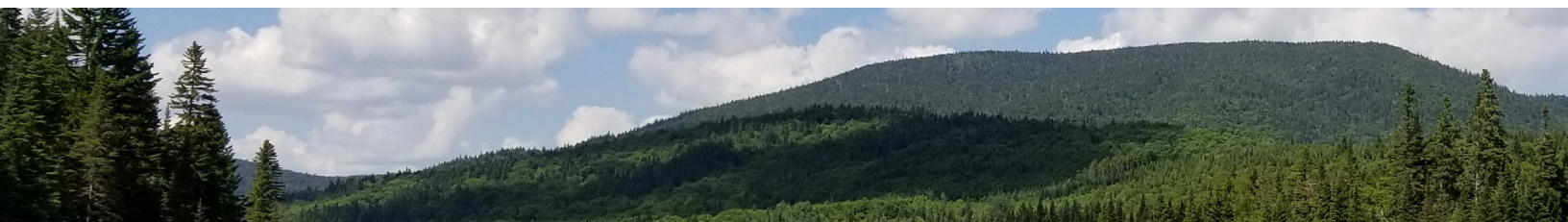
North East State Foresters Association

PO Box 2911
Concord, NH 03302-2911

603-588-3272
nefa@inrslc.com
www.nefainfo.org

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ADAPTED FROM publications produced by the VT Dept. of Forests, Parks & Recreation and NY Dept. of Environmental Conservation





MAINE FOREST SERVICE

PUBLICATIONS Available at - www.maineforestservice.gov



Fact Sheets

Forest Policy and Management Information Sheets

- [Weeding and Thinning Young Forest Stands](#)
- [Pruning Your Forest Trees](#)
- [Developing a Forest Management Plan](#)
- [Boundary Line Information](#)
- [Timber Harvesting in Shoreland Zones](#)
- [Wood Harvests: Worker's Compensation and Landowner Liability](#)
- [Invasive Plants in Maine Forests](#)
- [Fundamental Best Management Practices For Water Quality Protection During Forest Harvests](#)
- [What is Silviculture? An Introduction for Woodland Owners](#)
- [Some Things to Consider When Buying Forestland](#)
- [Wildlife Habitat and Forest Management](#)
- [Vernal Pools - Important Wildlife Habitat](#)
- [Forest Management and Vernal Pools](#)
- [Proper Sizing of Land Management Road Stream Crossings](#)
- [The Maine Tree Growth Tax Law](#)
- [Tree Growth Tax Law Plan Review - A Guide for Municipal Assessors](#)
- [The Maine Forest](#)
- [Maine's Celebrated White Pine: History, Identification, and Management](#)
- [Managing White Pine Stands In Maine: A Landowner's Guide](#)
- [Regenerating White Pine Stands In Maine: A Landowner's Guide](#)
- [Principal Disease and Insect Pests of White Pine in Maine](#)
- [Statewide Standards for Timber Harvesting and Related Activities in Shoreland Areas \(DEP Towns\)](#)
- [Wetland Crossings](#)
- [Making Maple Syrup for Fun and Profit](#)
- [Emerald Ash Borer Information for Maine Landowners](#)
- [Emerald Ash Borer Guidance for Maine Forest Managers](#)

Reference Publications

[Maine Register of Big Trees](#)

[Forest Trees of Maine - Centennial Edition](#)

Field guide to common trees in Maine

[Best Management Practices for Forestry:](#)

Protecting Maine's Water Quality

[The Woods In Your Backyard](#)

[What Will My Woods Look Like?](#)

Before and After Timber Harvesting

[The Forestry Rules of Maine - 2017](#)

A Practical Guide for Foresters, Loggers and Woodlot Owners

Annual Publications

[Forest & Shade Tree Insect & Disease Conditions of Maine](#)

[Silvicultural Activities Reports](#)

[Stumpage Price Reports](#)

[Wood Processor Reports](#)

Email Newsletter

[Monthly Insect and Disease Condition Report](#)

[Trees on Maine Street Bulletin](#)

[Woods Wise Wire](#)

Reports

[Active Firewood Processors - 2020](#)

[Coming Spruce Budworm Outbreak: Initial Risk Assessment and Preparation & Response Recommendations for Maine's Forestry Community](#)

[The Forests of Maine: 2018](#)

[J.W. Sewall Company Report on Hardwood Resource in the State of Maine, 2012](#)

[J.W. Sewall Company Report on Spruce-fir Resource in the State of Maine](#)

For additional information call: 207-287-2791 or email: forestinfo@maine.gov

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Maine Forest Service – Forest Policy & Management Division

Field Team - Foresters

Shane Duigan, District Forester

356 Shaker Road
 Gray, ME 04039
 Phone: (207) 592-1251
 E-mail: shane.p.duigan@maine.gov

Oliver Markewicz, District Forester

2281 Alfred Road
 Lyman, ME 04002
 Phone: (207) 441-3712
 E-mail: Oliver.C.Markewicz@maine.gov

Mike Richard, District Forester

131 Bethel Road
 West Paris, ME 04289
 Phone: (207) 441-3276
 E-mail: Michael.B.Richard@maine.gov

Julie Davenport, District Forester

564 Skowhegan Road; PO Box 416
 Norridgewock, ME 04957
 Phone: 207 592-2238
 E-mail: julie.davenport@maine.gov

Jim Ferrante

P.O. Box 1107
 Greenville, ME 04441
 Phone: (207) 441-4308
 E-mail: jim.ferrante@maine.gov

Kenny Ferguson, District Forester

P.O. Box 415
 Old Town, ME 04468
 Phone: (207) 215-9092
 E-mail: kenneth.e.ferguson@maine.gov

Lauren Ouellette, District Forester

Forestry Road
 Island Falls, ME 04747
 Phone: (207) 441-3817
 E-mail: lauren.ouellette@maine.gov

Randy Lagasse, District Forester

45 Radar Road
 Ashland, ME 04732
 Phone: (207) 557-1086
 E-mail: randy.lagasse@maine.gov

Allyssa Gregory

536 Waldoboro Road
 Jefferson, ME 04348
 Phone: (207) 441-2895
 E-mail: Allyssa.gregory@maine.gov

Michael Jensen, District Forester

P.O. Box 130
 Jonesboro, ME 04468
 Phone: (207) 441-4924
 E-mail: Michael.P.Jensen@maine.gov

Augusta Staff

Donald Mansius, Division Director

(207) 287-2791
donald.j.mansius@maine.gov

Jack Hernandez, Landowner Outreach Forester

(207) 287-8430
john.d.hernandez@maine.gov

Greg Lord, Senior Planner

(207) 287-4950
gregory.r.lord@maine.gov

Tom Gilbert, Water Resources Specialist

(207) 287-1073
thomas.gilbert@maine.gov

Greg Miller, GIS Coordinator

(207) 287-8121
greg.t.miller@maine.gov

Jan Ames Santerre, Community Forestry/Project Canopy Coordinator

(207) 287-4987
jan.santerre@maine.gov

Jereme Frank, Biometrician

(207) 441-0833
Jereme.M.Frank@maine.gov

**Adam Cates
 Regional Enforcement Coordinator - South**

(207) 441-4139

**Dan Jacobs
 Regional Enforcement Coordinator - North**

(207) 441-4128

**Terri Coolong
 Regional Enforcement Coordinator – Central**

(207) 215-0679

Morten Moesswilde

Field Team Leader
 Phone: (207) 592-2239

Maine Forest Service Technical Assistance, Grants and Financial Incentive Programs

[Project Canopy](#)

(Urban and Community forestry for local governments, schools, and non-profits)

[WoodsWISE](#)

(Private woodland ownerships)

[FireWISE](#)

(associations, neighborhoods, and communities)

[Invasive Plants](#)

(local governments, NGO's, private woodland owners)

Other Divisions of the Maine Forest Service

[Forest Health and Monitoring Division](#)

(Forest and tree insects & diseases, forest inventory)
 207-287-2431

[Forest Protection Division](#)

(Forest Rangers - Wildfire control, natural resource law enforcement)

For additional information call: 207-287-2791 or email: forestinfo@maine.gov

(6/16/2022)

Communities Leading on Climate June 17, 2022 - Technical Assistance Resources

Contact: [Judy East](#), Bureau Director 207-592-1724

The Bureau of Resource Information and Land Use Planning (BRILUP) in the Department of Agriculture Conservation and Forestry provides data, research, technical assistance (TA), and planning services to every corner of the state. Its six programs serve communities from the southern beaches and Maine's 3,500-mile coast to the far reaches of the north woods, all facing the challenges of a changing climate, a rising ocean, unprecedented development pressure, and a goal to secure the climate adaptation and mitigation recommendations for all of Maine.



Below are contact emails to each of the six programs and selected climate-related technical assistance resources for communities. Note that there are many more resources available on each web page provided.

1. [Maine Land Use Planning Commission \(LUPC\)](#) – [Stacie Beyer](#), Acting Executive Director

[Reports and Publications](#) – multiple brochures and fact sheets including “About Your LUPC Permit”, “Buying and Selling Property”, “Culvert Sizing”, “Clearing Standards”, “Accessory Structures” etc.

[Plans, Maps, and Data](#) – digital parcel viewer, Comprehensive Land Use Plan and [Application Forms](#) – all in PDF format, some digital filing, electronic payment

2. [Municipal Planning Assistance Program \(MPAP\)](#) – Director (job posting soon)

[Technical Assistance](#) – from Agriculture to Wind; model ordinances, publications (much is pre-2010)

[Municipal Climate Adaptation Guidance Series](#) – guidance on transportation, StreamSmart crossings, wastewater, drinking water, site plans, subdivision, shoreland zoning; Maine Flood Resilience Checklist

[Coastal Community Grant Case Studies](#) – descriptions of the projects’ approach and results, identify next steps and needs, share lessons learned and applicability for other municipalities.

3. [Maine Floodplain Management Program \(MFMP\)](#) – [Sue Baker](#), Program Coordinator

[Floodplain Mapping Resources](#) - prepare maps that help identify whether there is a mapped flood hazard and [Flood Resilience Checklist](#), a self-assessment tool for municipalities.

[Floodplain Ordinances & Permit Forms](#) - provides custom model ordinances and ordinance reviews to determine community compliance with the NFIP.

[Maine Floodplain Management Handbook](#) – Comprehensive guide to flooding and community response.

[Flood Information For](#) – provides workshops, presentations, and one-on-one assistance to homeowners, businesses, local officials, lenders, insurance agents, and contractors

4. [Maine Geological Survey \(MGS\)](#) - [Stephen Dickson](#), State Geologist

Map viewers: users zoom in on the maps to your area of interest. Note that the extent of the data is not always statewide. Each include data disclaimers, video tutorials, FAQs and allow for data download.

[Sea Level and Storm Surge Viewer](#) - approximates the potential inland extent of inundation from several scenarios (1.2, 1.6, 3.9, 6.1, 8.8 and 10.9 feet) of sea level rise or storm surge along the Maine coastline on top of the Highest Astronomical Tide

[Beach Mapping Program Shoreline Changes](#) - surveyed shoreline positions for most of the larger beach systems along the southern to mid-coast Maine coastline in York, Cumberland, and Sagadahoc counties

[Coastal Bluffs and Landslides](#) - line data describing the shoreline type and relative stability of bluffs along a section of the Maine coast

[Coastal Structure and Dune Crest Inventory and Overtopping Potential](#) - maps the extent of coastal engineering structures (e.g., seawalls, bulkheads, jetties, etc.) and coastal sand dune crests along the coastlines of communities in Cumberland and York Counties, from South Portland through Kittery

[Highest Astronomical Tide Line](#) – the approximate extent of the inland limits of the predicted Highest Astronomical Tide along the Maine coastline

[Potential Tidal Marsh Migration Map](#) - four datasets identify non-tidal lands within existing tidal estuaries that could be inundated and facilitate the development of new areas of tidal marsh if sea level rises by 1, 2, 3.3 or 6 feet above current highest annual tide (HAT)

[Living Shorelines Decision Support Tool](#) - generalized information regarding the potential suitability of living shoreline approaches for sections of shoreline along the Maine coast.

[Resources for Planners and Developers](#) - focused set of map and resources links on water supply geologic hazards, and property characteristics including [Aquifer maps](#) displaying aquifers statewide.

[Plug and play – range of MGS mapping products](#) - an amalgamation of a range of MGS products that allows users to add other layers available on AGOL to the viewer using the upper right tab.

5. [Maine Natural Areas Program \(MNAP\)](#) – Molly Docherty, Director

[Pre-acquisition Review](#) - pre-acquisition review service for conservation projects under consideration for conservation, have landowner engagement, and are scoping/drafting funding proposals or land donations.

[Site Review](#) - environmental site review services for information on rare and exemplary botanical features.

[Forest Management Plan Review](#) – review of Forest Management Plans (typically submitted by licensed foresters on behalf of their clients) to determine presence of rare, threatened, or endangered species or sensitive habitats.

Map Links and GIS Resources – [Conservation Lands](#), [Coastal Resiliency Mapping including Tidal Marsh Migration](#), [Coastal Undeveloped Habitat Blocks after 1M SLR](#), [Ecological Reserves](#),

[Information Requests](#) - Data is available (much in GIS format) for rare and exemplary botanical features, large undeveloped blocks of land, and riparian areas.

6. [Land for Maine’s Future \(LMF\)](#) – Sarah Demers, Director

[Types of Funding](#) and [Applying for funds](#) – description of how funds are used and how to apply.

[Funded projects](#) – map viewer of funded projects by funding category.

Keep in mind that BRILUP resources are statewide in nature. BRILUP staff can and do provide presentations on any of these resources to municipalities, regional groups, legislators, and their contractors. If your Community Action Project needs very specific data and analysis of sea-level rise, for instance in one embayment, one municipality, one stretch of beach or dune system, or one working waterfront, you may require the services of a paid consultant funded by a grant or municipal funds. The consulting community in Maine is extensive and very good. They are accustomed to using the data provided by BRILUP and downscaling it to local circumstances. MPAP staff can provide assistance in the issuance of a Request For Proposals/Qualifications (RFP/RFQ) to address your specific needs. Good luck!

Maine Department of Marine Resources - The CoastWise Approach

[CoastWise](#)- a comprehensive set of best practices based on the latest science and methods to design and build safe, cost-effective tidal crossings that maximize climate resilience potential. This site includes a list of technical providers to help communities. The CoastWise Manual is due for release October 2022 and workshops throughout Maine’s Coast will follow.



[Maine Tidal Restriction Atlas](#) – map viewer that complements CoastWise efforts by providing the most current assessment of roads and other structures in the tidal environment that present risks to community adaptation and tidal wetland health.



The CoastWise Approach for Tidal Road Crossings

The Challenge

Safe, dependable roads are crucial for supporting Maine’s economy, access to critical services, and a way of life valued by citizens and visitors alike. Maintaining roads is a challenge for most communities in Maine, especially in coastal areas experiencing rapid change due to accelerated sea level rise. Where roads cross tidal wetlands at over 800 locations in Maine, the challenges are considerably magnified.

Tidal wetlands buffer the impacts of coastal storms and flooding, restrict the movement of land-derived pollutants to nearshore areas, support fish and wildlife, and provide opportunities for commercial harvesting and recreation. Some tidal wetlands, like salt marshes, store carbon that would otherwise contribute to sea level rise and other climate shifts. These benefits are possible only if tidal wetlands are healthy and resilient to sea level rise. That requires unimpaired tidal flow, but about 90% of Maine’s tidal road crossings are tidal restrictions. These crossings endanger Maine’s tidal wetlands, but are also more apt to experience flooding, higher maintenance costs, and interrupted access to critical services.

The CoastWise Response

The challenges of creating climate resilient roads that serve communities best require us to more fully address the unique complexities, uncertainties, risks, and benefits associated with tidal environments. In response, Maine Coastal Program and over 30 organizations developed the CoastWise Approach for tidal crossing design. CoastWise provides a voluntary set of best practices, decision-making tools, and sequence for designing safe, cost-effective, ecologically supportive, and climate-resilient tidal crossings.

CoastWise Principles

Tidal wetlands are dynamic systems influenced by a wider range of interacting social and environmental factors than most non-tidal streams. They require a design approach that adequately addresses complexity and risk, now and in the future. Principles of the CoastWise Approach include:

- ◆ **Know your Tidal Crossings:** Use the Maine Coastal Program’s Tidal Restriction Atlas or other available tools to learn which crossings are tidal or likely to become tidal in the coming decades.
- ◆ **Ask for Advice:** CoastWise Technical Partners can help with project planning, connecting with the right resources, and providing other support to navigate the tidal crossing design process.
- ◆ **Engage Qualified Engineers:** Crossings that effectively manage risk and provide the greatest resilience benefits require engineers skilled in tidal hydrodynamic modeling.

- ◆ **Encourage Local Participation:** Crossing design involves value judgements having lasting impact. A transparent, participatory design process encourages outcomes that serve communities best.
- ◆ **Start with Sea Level Rise:** Objective, risk-based selection of a sea level rise scenario early in the project process provides the necessary foundation for all subsequent work.
- ◆ **Identify Low-lying Features of Concern:** Understanding the vulnerability of flooding to severely damaged wetlands, the built environment, and resource uses is essential for managing risk.
- ◆ **Establish Clear Objectives:** Early development of clear, measurable crossing performance objectives streamlines the design process and avoids costly design revisions.
- ◆ **Size Crossings for Resilience:** Keeping pace with sea level rise requires tidal wetlands to experience the full ebb and flow of the highest tides throughout the life of the crossing.

Learn More

For information about the CoastWise Program, please contact Slade Moore (below). For advice on individual crossing projects, contact any of the listed providers according to their service areas.

Statewide

Slade Moore
CoastWise Project Manager
Habitat Restoration Coordinator
Maine Coastal Program
Maine Department of Marine Resources
smoore@bioconserve.net
207-837-3805

Statewide

Bill Bennett
Fish and Wildlife Biologist
Gulf of Maine Coastal Program
U.S. Fish and Wildlife Service
william_bennett@fws.gov
207-781-8364 x15

Southern Maine

Jacob Aman
Project Manager
Wells National Estuarine Research Reserve
jaman@wellsnerr.org
207-646-1555 x112

Casco Bay

Matt Craig
Habitat Program Manager
Casco Bay Estuary Partnership
matthew.craig@maine.edu
207-228-8359

Downeast

Jeremy Gabrielson
Senior Conservation Planner
Maine Coast Heritage Trust
jgabrielson@mcht.org
207-607-4587

Organizations Contributing to Development of the CoastWise Approach



Regional Collaboration for Climate Resilience in Coastal Maine



BACKGROUND

The New England Environmental Finance Center, Casco Bay Estuary Partnership, and Resilience Works partnered with the coastal towns of Harpswell, Phippsburg, and West Bath (together the 'coastal cohort') to help the three towns prepare for the effects of climate change and secure initial funding for shared coastal resilience priorities. As leaders of small, peninsular communities reliant on natural resource economies and home to aging populations, town administrators and staff sought to better understand climate impacts like sea level rise, storm surge, flooding, and erosion and identify associated adaptation strategies and funding sources.

*Coastal Flooding Inundates Wallace Shore Road in Harpswell, Maine
Photo: Harpswell Conservation Commission*



APPROACH

The New England EFC and CBEP piloted a three-part workshop series with the coastal cohort to identify community assets (physical, ecological, social), understand local climate-related hazards, vulnerabilities, and risks affecting those assets, and brainstorm and prioritize actions that build community resilience.

Workshops included opportunities to hear directly from community members representing local conservation commissions, land trusts, and the shellfishing industry, as well as guest speakers on technical, scientific, planning, and funding-related topics and approaches. In parallel to the workshops, each town worked through a step-by-step vulnerability and risk assessment tool adapted from the U.S. Climate Resilience

HIGHLIGHTS

SERVICE PROVIDERS

New England Environmental Finance Center (EFC)

Casco Bay Estuary Partnership (CBEP)

Resilience Works, LLC

COMMUNITIES

Towns of Harpswell, Phippsburg & West Bath, Maine

SIZE/SCALE

Populations <5,000

KEYWORDS

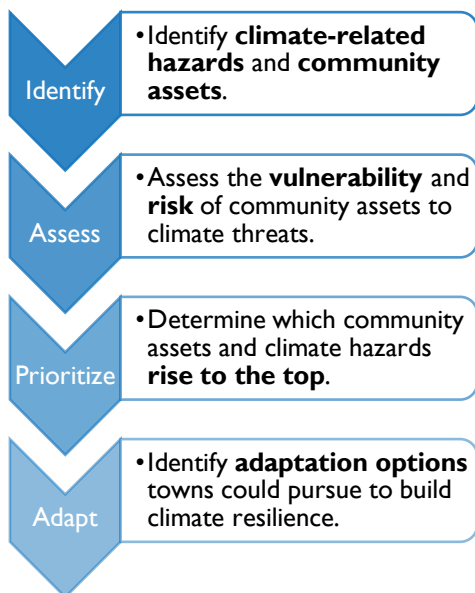
Coastal Resilience, Climate Adaptation, Vulnerability & Risk Assessment, Sea Level Rise

CONTACTS

Chloe Shields
Deputy Director, New England EFC
chloe.f.shields@maine.edu

Victoria Boundy
Community Engagement Coordinator, CBEP
victoria.boundy@maine.edu

Toolkit to produce a prioritized list of vulnerable community assets, which informed subsequent town-specific and cohort-wide adaptation strategies and project ideas.



Sabino Landing in West Bath, Maine

Photo: GEI Consultants Drone Team

KEY FINDINGS

Participating in this facilitated process formed new relationships and established a foundation for regional collaboration, which led the three towns to craft a joint proposal for funding to advance shared priorities. The coastal cohort successfully secured funds from the Maine Governor's Office of Policy Innovation and the Future for engineering services to assess three town landings/wharfs and their vulnerability to current and projected sea level rise, storm surge, and King tide events to inform a maintenance and upgrade plan for improved resilience. Selected town landings included Garrison Cove in Harpswell, Acre Lot Wharf in Phippsburg, and Sabino Landing in West Bath. Preliminary designs and cost estimates resulting from these analyses will position the towns to jointly seek additional state or federal funding for implementation.



Garrison Cove Town Landing in Harpswell, Maine

Photo: Bill Muldon

ADDITIONAL RESOURCES

[U.S. Climate Resilience Toolkit's Steps to Resilience](#)

[Harpswell, West Bath, Phippsburg to investigate climate's impact on future of town landings](#) in *The Times Record*

[Climate project to examine flood risk at Garrison Cove](#) in the *Harpswell Anchor*

Climate Center at the Gulf of Maine Research Institute

At the Gulf of Maine Research Institute, our mission is to pursue collaborative solutions to global ocean challenges. Without a doubt, climate change is the foremost global ocean challenge of our time.

As climate-related needs of our stakeholders have increased, so too has the prominence of climate work across GMRI program areas. In 2020, we launched our Climate Center to connect and accelerate our work in this space, hiring Dr. Dave Reidmiller to lead the effort.

Climate Center Capabilities

Our Climate Center employs a user-centered 'Science-Engagement-Solutions' framework to deliver climate services to coastal and marine stakeholders. Enumerated below are capabilities GMRI can offer (or is planning to build out) to support community-led climate action.

SCIENCE

- Fisheries Ecology
- Resource Economics
- Learning Sciences
- Sea Level Rise
- Greenhouse Gas Emissions
- Coastal Ecology / Geomorphology
- Physical Oceanography
- Biological Oceanography
- Decision Science

ENGAGEMENT

- Fishermen
- Farmers
- Fisheries Managers
- Students
- K-12 teachers
- Informal Educators
- Municipal Leaders
- Elected Officials
- Marine Businesses

SOLUTIONS

- Ocean Data Products
- Sustainable Seafood
- Aquaculture
- Climate Finance
- Climate Risk
- Ocean Climate Policy
- Adaptation Engineering / Coastal Planning
- Climate Tech / Ventures

Example services that we can offer include:

SCIENCE

- Compile existing climate vulnerability information
- Deliver localized projections of flood risk under various thresholds
- Gather data & produce accessible maps and graphics to inform decisions
- Conduct municipal climate risk assessment

ENGAGEMENT

- Convene stakeholders to identify values
- Lead community science efforts to raise awareness of municipal climate hazards (e.g., through collection of local flood data)
- Deliver customized climate education and literacy-building programming
- Facilitate community climate planning and prioritization processes

SOLUTIONS

- Design customized response options
- Draft municipal climate action plan (with list of prioritized projects)
- Support the navigation of financing options to enable action



For more information, visit gmri.org/climate or contact:

Dave Reidmiller, Ph.D.
Director, Climate Center
dreidmiller@gmri.org

Community Resilience Training

Building Community Capacity for Climate Planning

Designed to support coastal communities in planning for sea level rise, Community Resilience Training—a project of GMRI's Climate Center—is a three-part curriculum that facilitates experiences for communities to develop the knowledge, skills, and relationships that support community-based climate planning.

PART I - COMMUNITY CAPACITY BUILDING EVENT: Introduction to Sea Level Rise

PART II - COMMUNITY RESILIENCE TRAINING:

1. Planning Forward

is an active learning, small-group activity that brings forward community values and identity to guide and empower participants to confront the difficult reality of our changing climate and consider possible futures through new perspectives.

Small group, hands-on learning experience

2. Resource Workshop

brings together neighboring communities for a workshop that connects participants with relevant tools, resources, processes, and professionals through interactive presentations.

Regional workshop with interactive presentations

3. Resilience Planning

works with communities to implement a planning framework where communities determine and prioritize next steps that best reflect and respond to their climate planning needs.

Community-driven planning

PART III - COMMUNITY ENGAGEMENT EVENT: Community Climate Planning Next Steps

Community engagement events prior to and following the training build community awareness about climate impacts, particularly sea level rise, and support community-determined next steps. A community of practice provides ongoing support for participants; sharing resources, case studies, events and funding opportunities.

These trainings are co-led by the Gulf of Maine Research Institute and the Island Institute. For more information, contact Gayle Bowness, Municipal Climate Action Program Manager, at gayle@gmri.org.

Community Resilience Training is led by:



In partnership with:



With funding from:



Additional advisory support provided by the Towns of Vinalhaven and St. George, Maine Sea Grant, Wells National Estuary Research Reserve, Maine Department of Environmental Protection, Maine Geological Survey, Governor's Office of Policy Innovation and the Future, and NOAA's Office of Coastal Management.

Serving Coastal Resilience Needs in Maine

Maine Sea Grant, University of Maine Cooperative Extension, and our coastal partners are helping communities to prepare for climate change. Our work enables community-centered climate dialogue. We assist municipalities in evaluating risks and prioritizing investments. Our team provides expertise in project design, implementation, and decision-making processes that promote economic and social justice through community development.

Weathering the Storm: Community Preparedness

Extension staff work with municipalities and community groups to build adaptive capacity, providing resources and support that are especially critical for rural, under-resourced and under-served communities.



Activities:

- ▶ Co-leading the Maine Climate Change Adaptation Providers' Network since 2010
- ▶ Developing the Estimating the Local Marine Economy training program
- ▶ Developing a Municipal Climate Resilience Implementation and Planning Guide
- ▶ Managing the Southern Maine Beach Profile Monitoring Program since 1999
- ▶ Supporting the Collaboration to Build Social Resilience in Southern Midcoast Maine
- ▶ Providing technical assistance and support directly to coastal municipalities



Research for Innovation Through Change

Our research investments support collaborations with community and industry stakeholders that address a range of challenges, including climate-related impacts on coastal ecosystems and commercially harvested species, ocean acidification, sea level rise, and severe coastal storms.

Research investments:

- ▶ Sea Grant American Lobster Initiative research and extension investments
- ▶ Northeast Sea Grant Consortium ocean renewable energy research collaboration
- ▶ Forecasting for coastal storm erosion impacts
- ▶ Evaluating ecosystem services and climate vulnerabilities of salt marsh ecosystems
- ▶ Adaptation in marine fisheries and fisheries management in a changing ecosystem
- ▶ Composition and transport of Forever Chemicals in Maine estuaries



Meeting the Mark: Assisting State Policy Implementation and Agency Targets

Maine Sea Grant staff serve on municipal, regional, and statewide working groups tasked with addressing the priorities of the 2020-2024 Maine Climate Action Plan, and community and regional initiatives to address coastal and working waterfront infrastructure vulnerability.

Activities:

- ▶ Serving on the FEMA Marine Infrastructure Solutions-Based Team
- ▶ Supporting the Community Resilience Partnership Program
- ▶ Evaluating a statewide approach for ocean and coastal acidification monitoring
- ▶ Developing research funding criteria to address Maine Climate Action Plan targets



Teamwork

Building community resilience requires community organizing and diverse expertise. Explore these webpages to connect your community with a network of experts and the resources needed to prepare for climate change.



Collaboration to Build Social Resilience in Southern Midcoast Maine

Learn how emergency management, conservation, social service, and municipal sectors joined forces to better prepare, respond, and recover from storms while better serving residents whose circumstances make them more vulnerable to storm impacts.

Visit or scan: bit.ly/3QnA53C



Southern Maine Beach Profile Monitoring

Learn how community members, property owners, and students volunteer to monitor changes on Maine's sandy beaches. Volunteer teams collect monthly beach profile data that is analyzed by the Maine Geological Survey and used by regulators, resource managers, and scientists to inform beach management and planning.

Visit or scan: bit.ly/3QfzCRb



Maine Climate Change Adaptation Providers Network

Find Maine's best climate resilience tools, guidance, and a network of experts that assist communities in preparing for climate change and building resilience. The Maine Climate Change Adaptation Providers (CCAP) Network is a network of adaptation professionals from more than 50 organizations working together to build community resilience in Maine.



Visit or scan: bit.ly/39yiDc2



Taking Action

Resilience building is a continual cycle of steps from high-level visioning of community needs to assessing, planning, and implementing projects. Progress is often non-linear and communities can take action at points all along the cycle.

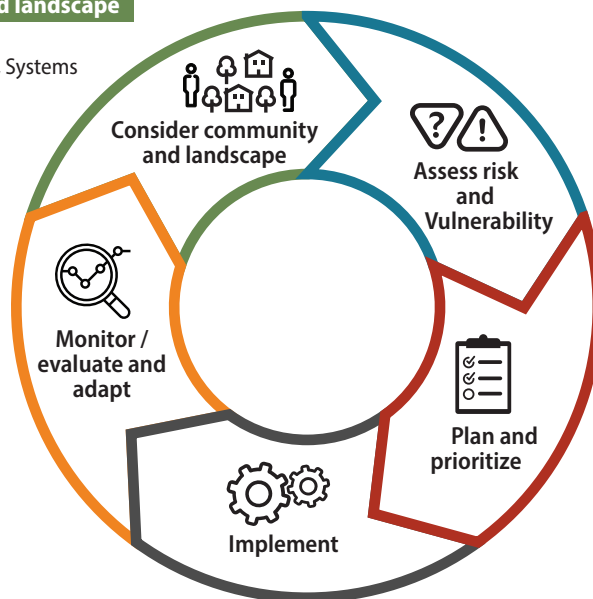
Consider community and landscape

Focus on:

- Characterization, Location, Systems
- Timeframes
- Partnerships and Teams
- Diverse, Interdisciplinary, Inclusive

Monitor / Evaluate and Adapt

- Resilience Indicators
- Criteria
- Metrics and Evaluation



Implement

Consider

- Chronic/Acute Hazards
- Long/Short-Term Actions
- Hazard Mitigation Linked With Adaptation

Assess risk and vulnerability

Compile and understand:

- Data, Tools, Models, Knowledge
- Exposure and Sensitivity, Adaptive Capacity and Potential Impacts
- Past, Present, Future, Geographical, Economic, Human/Social, Critical Infrastructure, Built and Natural Environment

Plan and prioritize:

- Prioritize Vulnerabilities
- Identify, Evaluate, and Prioritize Strategies
- Factors: Scales/Scalable, Risk-Based Planning, Robust, Redundant, Resourceful, Feasible, Compatible, Cost-Effective, Equitable, Objective



Southern Maine Planning and Development Commission (**SMPDC**) is one of Maine's regional planning organizations and delivers planning and economic development expertise to its 39 member municipalities. SMPDC's **Regional Sustainability and Resilience Program** provides *technical assistance* and *planning services* to southern Maine municipalities to enhance sustainability, climate preparedness, and community resilience. SMPDC supports *municipal planning* and *climate change action* through activities such as comprehensive plan development, municipal greenhouse gas inventories, hazard vulnerability assessments, climate adaptation planning, and educational workshops.

SMPDC has developed resources and guidance documents that communities can use to better understand climate change issues and impacts, integrate climate considerations into municipal planning, and take action on climate resilience. While many of the resources listed below were designed for southern Maine, they are broadly *applicable for communities across Maine*.

Climate Newsletter

SMPDC's Regional Sustainability and Resilience Program offers a bi-monthly newsletter highlighting key climate happenings, program updates, trainings, and funding opportunities.

Sign up at:

<https://smpdc.org/rsrp>

Model Ordinances

- **Municipal Guidance for Coastal Resilience: Model Ordinance Language for Maine Municipalities**
 - Technical guidance, specific yet customizable ordinance language, and a menu of land use provisions and resilience measures that municipalities can incorporate into existing ordinances or combine for a standalone ordinance to enhance resilience to coastal hazards.
<https://tinyurl.com/5d6968te>
- **Road Design Standards**
 - Standards for road design and construction of new streets in rural communities that promote health and safety, provide a safe and convenient environment for both pedestrian and vehicular traffic, and minimize long-term street maintenance and repair costs by incorporating more climate resilient designs.
<https://tinyurl.com/2fyz7nm2>
- **Stormwater Management: Erosion and Sediment Control**
 - Model ordinance and accompanying regional checklist and standards document for Sediment and Erosion Control Plans for development sites to ensure sound stormwater management, minimize soil pollution, and protect regional water quality.
<https://tinyurl.com/527z8mja>
- **Stormwater Management: Low Impact Development (LID) (coming soon)**
 - Standards for LID measures to protect water quality, reduce adverse impacts of development on the natural environment, and promote climate resilience measures.

Other Resources

- **Municipal Electric Vehicle (EV) Readiness Toolkit**
 - Technical guidance for encouraging EV adoption, fleet transitions, and infrastructure development. Includes a zoning and ordinance guide and a model ordinance for EV infrastructure.
<https://www.maineleancommunities.org/municipal-ev-toolkit>
- **Greenhouse Gas (GHG) Inventory Protocol**
 - Step-by-step guide for conducting a community-wide GHG inventory.
<https://smpdc.org/ghginventory>
- **Webinar Recordings**
 - SMPDC has a variety of climate-related online seminar recordings posted on its website. Topics include climate change action, groundwater rise caused by sea level rise, and hazard mitigation funding programs.
<https://smpdc.org/rsrp>

For more information, visit
smpdc.org or contact

Abbie Sherwin

Senior Planner & Coastal
Resilience Coordinator

asherwin@smpdc.org

or

Karina Graeter

Sustainability Coordinator

kgraeter@smpdc.org

(207) 571-7065