

PEOPLE AND NATURE

ADAPTING TO A CHANGING CLIMATE

Charting Maine's Course

A Summary of
the Report Presented by The Maine Department of Environmental Protection to
The Joint Standing Committee on Natural Resources of the 124th Maine Legislature

FEBRUARY 2010

Participating Organizations

* indicates
Coordinating Committee

American Council of Engineering Companies*
Associated Builders and Contractors
Associated General Contractors of Maine
Bangor Hydro-electric Company
Casco Bay Estuary Partners
Chewonki Foundation*
City of Biddeford*
City of Portland*
City of Lewiston
Coastal Enterprises, Inc.
FPL Energy / Nextera*
Friends of Casco Bay
Grondin Construction
Hannaford*
Maine Aquaculture Association
Maine Association of Conservation Commissions
Maine Association of Conservation Districts
Maine Association of Insurance Companies*
Maine Association of Planners*
Maine Audubon Society*
Maine Better Transportation Association*
Maine Center for Public Health
Maine Council of Churches*
Maine Chamber of Commerce*
Maine Coast Heritage Trust
Maine Forest Products Council*
Maine Innkeepers Association*
Maine Medical Association
Maine Motor Transport Association
Maine Municipal Association*

Maine Organic Farmers and Gardeners Association*
Maine Potato Board
Maine Public Health Association
Maine Professional Guides Association
Maine Real Estate and Development Association*
Maine Rural Partners
Maine Tourism Association*
Maine Wastewater Control Association
Maine Water Utilities Association
Maine Wild Blueberry Association
Manomet Center for Conservation Sciences*
Natural Resources Council of Maine*
Passamaquoddy Tribe (Sipayik)
Physicians for Social Responsibility*
Portland Chamber of Commerce*
Small Woodlot Owners Association of Maine*
Southern Maine Regional Planning Commission
SkiMaine Association*
The Maine Realtors Association
The Nature Conservancy*
Town of Edgecomb
Town of Montville
University of Maine*
U.S. Green Building Council, Maine Chapter
Town of York
Wells National Estuary Reserve
White Brothers Contracting

State and Federal Agencies

Bureau of General Services
Bureau of Insurance
Department of Agriculture
Department of Conservation
Department of Economic and Community Development
Department of Environmental Protection
Department of Inland Fisheries and Wildlife
Department of Marine Resources
Department of Transportation
Land for Maine's Future
Maine Center for Disease Control
Maine Drinking Water Program
Maine Forest Service
Maine Emergency Management Agency
Maine Geological Survey
Public Utilities Commission
State Planning Office
United States Environmental Protection Agency



Maine Faces Certain Change

In 2009, the Maine Legislature directed the Department of Environmental Protection to evaluate what options the State and its citizens have as we adapt to the impacts of climate change. Legislators recognized that climate change is already occurring, and while Maine has made significant progress in reducing greenhouse gas emissions and should continue those efforts, we face unavoidable changes in our climate in any case.

The Department was charged with bringing together a broad cross section of Maine people representing such diverse interests as business, trade, agriculture, forestry, health, transportation, and conservation, as well as state and municipal government. More than 70 groups participated in coordinating and working committees.

The effort built upon the 2009 University of Maine report, *Maine's Climate Future: An Initial Assessment*¹ which offers an informative and up-to-date summary of climate change effects right here in Maine. The report demonstrates that Earth's climate is in the midst of significant change and argues that Maine must respond to climate changes that are already occurring. It assures us that there are actions worth taking because they will benefit Maine regardless of the specific path of climate change.

In February 2010, the Department presented the Legislature with a report that details the findings, strategies and recommendations of these many interests: *People and Nature Adapting to a Changing Climate: Charting Maine's Course*.²

This report alerts our agencies, businesses, communities and our neighbors to the imminent impacts of climate change, and suggests that early planning and adaptive actions are likely to be cost effective.

The Report includes numerous strategies and over 60 recommendations. This document is a summary of that report. It illustrates the key themes that recurred across the many topics and sectors considered, whether coastal ecosystems, public health, invasive species, transportation systems or agriculture.

OUR WELFARE depends so directly on the natural environment; efforts to protect Maine's communities and people must go hand-in-hand with strategies to minimize impacts to natural habitats.

1. <http://climatechange.umaine.edu/about/reports/climate-future>
2. <http://www.maine.gov/dep/oc/adapt>

CLOCKWISE, STARTING AT LEFT: BRIDGET BESAW; BRUCE KIDMAN; ISTOCKPHOTO.COM/GMINICHOLAS

It is evident that the prudent path is preparation for a range of possibilities. We must take actions that will protect Maine citizens, their property, institutions and natural resources under a variety of likely scenarios.

Doing What Comes Naturally

We make decisions to invest in adaptive action all the time. We do it in our family life, our work life, and at all levels of government. Maine farmers, forest managers and fishermen will tell you that adapting to changing conditions is nothing new. We look ahead, weigh the evidence at hand, consider costs and benefits and make the best decisions we can. This is what climate change adaptation is about as well; we already have the conceptual tools to do the job.

By and large, we also have the institutions in place to address climate change adaptation. What *People and Nature Adapting to a Changing Climate* emphasizes is the need for greater coordination between existing entities, for sharing planning efforts and research so that emerging data, models and approaches are available broadly.

Who should be included in this network? A useful starting point can be found in the impressive list of 73 entities that volunteered to work on *People and Nature*. But this is a starting point only. This report alerts our agencies, businesses, communities and our neighbors to the imminent impacts of climate change, and suggests that early planning and adaptive actions are likely to be cost effective.



Themes

Representatives of more than seventy stakeholder groups met repeatedly over the course of the last year to evaluate what options the State and its citizens have as we adapt to the impacts of climate change. A number of themes emerged:

1. Climate change affects everyone
2. Some of our communities and neighbors are at more risk
3. There are actions worth taking now
4. We depend on natural systems
5. Not all change is bad
6. We need to work together and at the right scales
7. We must maintain momentum

A Thumbnail Sketch of Climate Change

Weather is variable and we adjust our expectations and activities accordingly.

When we talk about climate, we are referring to broad weather patterns and long term averages. Over a thirty-year period, for example, what is the average amount of precipitation, the range of air or sea temperatures? Is sea level rising more quickly; are lakes freezing later? These are all measurable phenomena, and they are all changing. The release of the University of Maine's *Maine's Climate Future* report last year gave us the most reliable window to date on how Maine's climate has been changing.

Following are some of the changes we can expect based on those trends:

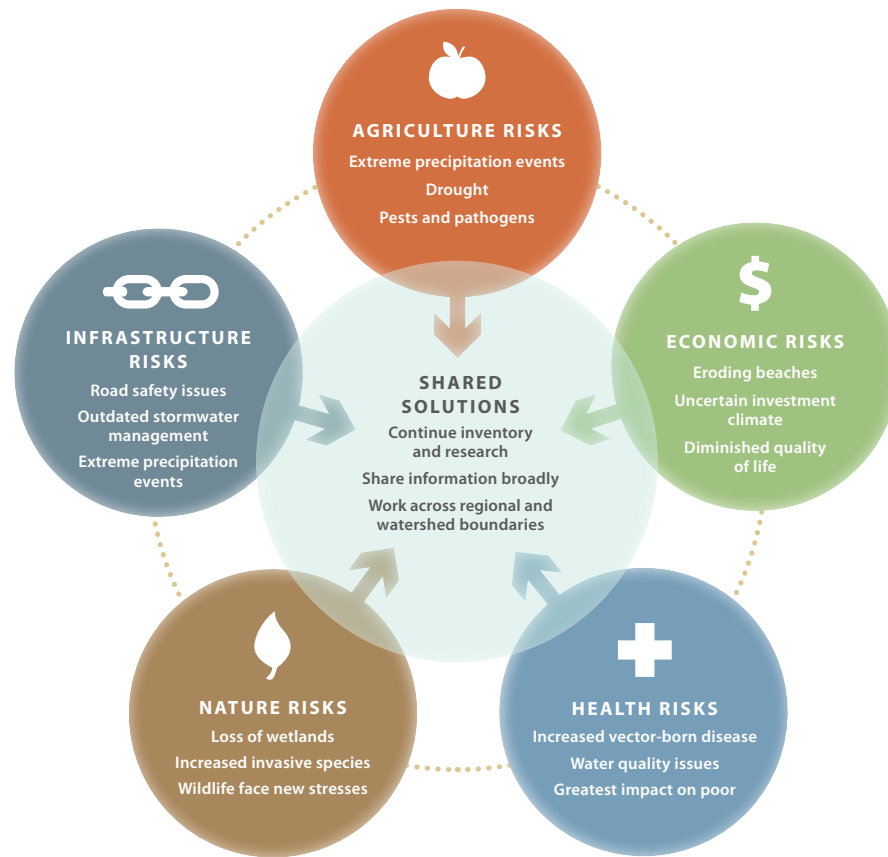
- Sea level will rise at an accelerated rate, threatening coastal infrastructure from roads and rails to waterfronts and wastewater plants, as well as beaches and wetlands that are at the foundation of many coastal economies;
- The temperature of sea water will rise, and its chemical composition will continue to change, creating challenges for sea life and for people who make a living from the sea;
- Winter precipitation will increase and come more often as rain, presenting implications for tourism, agriculture and storm water control;
- Storms will be more frequent and more intense, damaging crops, threatening property, saturating soils and producing septic system failures and contamination—all placing new pressure on emergency response;
- Even as overall temperature and precipitation amounts trend upward, the year to year and season to season weather will be more variable, presenting the prospect of floods one season and droughts another;
- As average winter temperatures moderate, pests and pathogens that our colder temperatures have kept out will expand their range in Maine, presenting new public health issues and new intruders into agricultural fields and forests; and
- Freshwater flows in rivers and streams will change, altering conditions for aquatic life and water supplies for our businesses and communities.

None of these changes will occur in isolation. Interactions among them can be very complex. An increase in global air temperature over time causes expansion of sea-water, a component of sea-level rise. A shift in the timing of rain and snow events may combine with greater amounts of precipitation, resulting in greater runoff in Maine's watersheds. But less snow and more rain in winter could also leave less snowpack come spring, and smaller flows for hydropower production.

It is evident that the prudent path is preparation for a range of possibilities. We must take actions that will protect Maine citizens, their property, institutions and natural resources under a variety of likely scenarios.

NOT ALL OUR CITIZENS and not all of our infrastructure will bear the brunt of climate change as well as these granite shores.





Some Things Are Evident

Common themes emerged across the boundaries of four working groups that addressed Maine’s Natural Environment; Coastal Environment; Built Environment; and Human and Social Environment. *People and Nature* presents these within the structure of Strategies and Recommendations, and the reader is referred to that full report for a detailed account. This synthesis addresses seven broad areas to illustrate the interrelations, interdependencies and continuities.

1. Climate change affects everyone

Perhaps the most fundamental observation is that the impacts of climate change will have broad economic, biological and social implications across all sectors of Maine life.

Consider the built environment, that which we construct to provide us with shelter, places in which to work, and common services such as transportation, safe drinking water, wastewater treatment and energy. These are critical to our society; where we have the greatest financial investment; and as we learned during the ice storm of 1998, life is immune to weather impacts.

Consider as well that all of the likely changes to Maine’s climate will affect recreation and tourism, major contributors to the state’s economy.

Consider also the coastal zone which is home to the majority of the state’s population and the destination of so many of Maine’s visitors each year. Property owners and government at all levels will be faced with difficult choices, including the possibility that it may be most cost-effective in the long term to move or abandon infrastructure at risk of severe damage due to sea-level rise and severe weather threat. Consider the instability of roadways under more intense storm events, and the intrusion of saltwater into drinking water systems and the carrying capacity of stormwater and wastewater infrastructure during extremely heavy and prolonged rains.

Stakeholders representing Maine business interests such as property insurance, real estate, tourism, and forest products

A SIGNIFICANT NUMBER of recommendations aim to provide resources to citizens and local entities to develop their own responses to climate change.

It makes sense to focus on taking action on a “no regrets” basis—for example, improving stormwater and wastewater infrastructure to protect water quality in any eventuality.

have been significantly involved in developing *People and Nature*. It will be essential that these and many other business and industrial entities continue to develop their own capacity to address both opportunities and challenges.

The effect of climate change on Maine’s economy demands additional study. Already, the New England Environmental Finance Center at the Muskie School, University of Southern Maine, is undertaking significant work in this area, focusing initially on climate effects on the economy of Maine’s southwestern coast. As this and similar research proceeds, it makes sense to consider taking action on a “no regrets” basis: for example, improving stormwater and wastewater infrastructure to protect water quality in any eventuality.

2. Some of our communities and neighbors are more at risk

Maine communities and people will be unequally affected by climate change—often because some already face otherwise unrelated challenges. Among these vulnerable populations are elders, children, indigenous people, the disabled and handicapped, refugees, migrants and low income groups. As we plan, special attention must be given to their particular vulnerabilities and needs.

The elderly and very young, for example, are likely to experience more intense health impacts because of compromised immune and disease-resistance systems. Many of these groups have less access to information and resources that would otherwise allow them to be proactive in preparing for climate-related epidemics, natural disasters, weather events and associated health risks. There is an imperative to integrate their needs into the wider overall scheme of planning and response.

Maine’s residential housing stock is among the oldest in the country and that makes it among the most vulnerable. The Maine State Housing Authority, in collaboration with the Maine Green Building Council, the Maine Chapter of the American Council of Engineering Companies, Maine’s local public housing authorities, Federal and state agencies and other stakeholders should be asked to develop tools to assess the climate vulnerability of older (> 30 years) public and multi-family housing and make recommendations for renovation standards.

3. There are actions worth taking now

While everyone acknowledges that Maine’s response to climate change will need to incorporate new information from research and monitoring, we have enough data to begin to act right now. There are actions worth taking because they will benefit Maine citizens regardless of the specific path of climate change.

One of the first discoveries of the statewide planning process was the variety of ways Maine people and institutions are already planning and responding to climate change, as these examples illustrate:

- Three coastal municipalities in southern Maine are working together to assess the impacts sea level rise, storm surges and more frequent precipitation will have on their citizens, infrastructure and natural resources. They are exploring ways proactive planning and mutual assistance could limit risk, damage, redundancy and costs.
- In December, the Casco Bay Estuary Project released *Climate Change in the Casco Bay Maine Watershed: Past, Present and Future*. Running well over forty pages, the report’s distinguished authors describe how the climate of the watershed is likely to be affected in the years ahead.
- In recent years, Maine’s Department of Transportation has included considerations of climate in its long-range planning processes, and recently completed a study, *Climate Change and Transportation in Maine*. As the authors point out, “many of these projected impacts already occur with noticeable frequency... many of the issues associated with climate change are expected to be more intense versions of the same problems MaineDOT already deals with effectively... [yet] the long lifecycles of most transportation infrastructure demand early preparation to protect significant taxpayer investments into a reasonably foreseeable future.” Significantly, the Department’s thoughtful and proactive approach places Maine in a better position to access federal funding.
- The State’s Beginning with Habitat program, in partnership with Manomet Center for Conservation Sciences, is undertaking a climate change vulnerability assessment for Maine’s Species of Greatest Conservation Need and threatened and

Since our welfare depends so directly on the natural environment, efforts to protect Maine's communities and people must go hand-in-hand with strategies that minimize impacts to natural habitats and ecosystem.

endangered plant species to inform Maine's State Wildlife Action Plan.

- Efforts are underway to improve emergency planning and response, fundamental responsibilities of government at all levels. Response to severe weather events causing flooding or power outages, for example, is standard for local municipalities and emergency services, utilities, and for state and Federal agencies. The report recommends continuing to improve cooperative efforts at all levels.

4. We depend on natural systems

Since our welfare depends so directly on the natural environment, efforts to protect Maine's communities and people must go hand-in-hand with strategies that minimize impacts to natural habitats and ecosystems. Healthy ecosystems provide clean water, energy, carbon storage and flood protection and are the basis for our forest products and ocean fisheries economies. Loss of any of these would be devastating to our citizens.

Yet missteps in protecting our infrastructure could be equally devastating to ecosystems already vulnerable to climate impacts. Both state and local planners need a standardized set of criteria for assessing the vulnerabilities of built infrastructure and natural resources within their jurisdictions.

The report encourages the Maine Geological Survey to evaluate the adequacy of setback requirements for beaches and bluffs, and to review the adequacy of existing policies and best management practices (for example promoting so-called "soil solutions" that minimize armoring of eroding beaches and bluffs). The State Planning Office and the Department of Environmental Protection—in collaboration with municipalities and landowners—should jointly review current state-level limitations and prohibitions on development in coastal areas, and recommend policies and incentives so that public funds would not underwrite expansion or rebuilding in hazard areas without appropriate evaluation and engineering.

Wetlands of all types act as buffers and sponges for the overflow of water from an increasingly impervious human environment.

They also protect our communities from flood damage. As sea level rise and severe storms drive beaches, dunes, marshes and

wetlands inland, these protective resources may be unable to migrate to new locations, putting at risk vital habitat for a wide range of marine and terrestrial species.

A working group of state natural resource agencies and stakeholders should continue efforts to identify undeveloped low-lying coastal areas for wetland migration, and undeveloped uplands that protect these systems. Work is already underway at the Maine Natural Areas Program and Maine Geological Survey to identify landscapes to which tidal wetlands are likely to migrate. A collaborative of state agencies should report to the Legislature on strategies to prioritize and fund removal of existing tidal restrictions where this would maintain natural systems and reduce damage to coastal infrastructure.

Among ongoing efforts is a Maine Forest Service project with assistance from the United States Fish and Wildlife Service, the Maine Department of Inland Fisheries and Wildlife and the Nature Conservancy to inventory roadstream crossings in the Penobscot River Watershed. Other work is taking place in the Ossipee, Presumpscot, Royal, Sheepscot, Narraguagus, and Machias Rivers watersheds.

Beginning with Habitat steering committee which includes the State Planning Office, and the Departments of Transportation, Conservation and Inland Fisheries and Wildlife should collaborate with municipalities, landowners and the interagency stream connectivity work group to identify and distribute priorities and data important for maintaining linkages between key habitat blocks. Municipalities and others can use this information to help maintain or restore these resources. At the same time, land conservation through new funding for the Land for Maine's Future program could assist in the long-term protection of undeveloped low-lying coast line and other vulnerable but essential resources.

5. Not all change is bad

Some of the same climate trends that present challenges also bring potential benefits to such sectors as agriculture, forestry, tourism and investment. Warmer summer weather may drive more tourists to our ocean beaches, inland lakes and mountains. And as regional warming increases, some suggest that Maine could become a last refuge for winter sports and recreation.



WHATEVER THE CHALLENGES a changing climate presents to Maine in the coming years, it will be important to see them from a variety of perspectives. We will need to ask how our responses impact our natural ecosystems, our built infrastructure and all of our neighbors.

Forested lands cover approximately 90% of Maine and the forest products industry has been central to the Maine economy for generations. Since growing forests remove carbon dioxide from the atmosphere and sequester the carbon, their role is vital. There will be a growing emphasis in coming decades on forest practices that increase carbon storage while at the same time producing sustainable and renewable wood products and energy—all this in addition to providing wildlife habitat and maintaining freshwater resources.

And while we anticipate a long term loss of some commercially valuable tree species like spruce, others may fill the niche. The University of Maine should partner with industry, updating growth and yield models for current and projected forest species, and identifying forest practices likely to protect forest productivity and decrease vulnerability to climate change-related stresses. Assessing the position of the Maine forest products industry in the global marketplace is also important. All this calls for renewed efforts to keep Maine’s forests intact, the goal of such present endeavors as the Great Maine Woods Initiative and Keeping Maine’s Forests.

In agriculture, longer growing seasons should translate into more produce to market, more local produce available to consumers, and greater food security for our citizens. There will likely be the opportunity to introduce new crops as well. But we need to prepare for these opportunities. For example, Maine farmers depend on Federal conservation funds. There is an interest in re-targeting these programs to be more responsive to Maine-specific needs. In order to address climate change adaptation challenges, Maine may need to negotiate greater flexibility in the allocation of Federal funds and in how Federal rules are applied.

6. We need to work together and at the right scales

Maine’s adaptation planning efforts must include the participation of individuals, business and industry, public interest groups, land owners and government at all levels. Broad-based approaches that cross local political boundaries, watershed lines, state and regional divisions will often emerge as the appropriate scale for planning, resource allocation and implementation. One of the best examples is the application of technology.

Developing public policy and making decisions to allocate resources to address the likely impacts of climate change requires confidence in the scientific and technical data informing the process. Local authorities and citizens, no less than state and federal agencies, need access to accurate information. For example, planners at every level have decried the lack of high resolution topographic mapping data for Maine's coast. Without it, we lack the essential capacity to assess our vulnerability to impacts such as salt water incursion into groundwater tables (and thereby into private and public drinking water sources) and the actual risks to roads and buildings.

The technology in question is called Light Detection and Ranging, or LiDAR, and it is used to create digital elevation models essential for accurate high tide and 100-year flood-plain maps (some of which are half a century out of date). Combined with updated storm frequency data and other information, LiDAR would benefit public agencies like MaineDOT (and thus the traveling public) and local planners. To date however, progress has been stymied as each entity independently contemplated the high cost of acquiring the technology.

Working together and working at scale has provided a breakthrough as interests across five New England states combined efforts to jointly seek federal funding for LiDAR. Private and public organizations have offered matching funds, and the prospects are now promising.

A significant number of recommendations in *People and Nature* aim to provide resources to citizens and local entities to develop their own responses to climate change. One recommendation calls for the State Planning Office to distribute technical assistance materials to support local adaptation plans, and to encourage towns that share common river, beach or bay systems to develop regionally consistent zoning and coordinated emergency response plans. In fact all state agencies are encouraged to work with affected entities to develop and disseminate information that will build awareness and offer tools to plan for climate impacts.

Much of what we know already about the effects of climate change comes from data gathered over extended periods of time. Adaptation planning at the state and local level needs information that is specific to our geographical location. Repeatedly, participants identified the need for more inventory and monitoring.



Much of what we know already about the effects of climate change comes from data gathered over extended periods of time. Adaptation planning at the state and local level needs information that is specific to our geographical location.

There are calls to assess and catalogue pier, harbor and waterway infrastructure likely to need elevation or improvement and to encourage interactions among Federal, state, and local emergency services providers that would enhance regional and statewide response and recovery capacity. Stakeholders encouraged a number of ongoing initiatives from adoption of a statewide mutual aid agreement to standardized response training, interoperable communication systems and regional emergency shelter systems.

These collaborative approaches are both timely and strategic: Federal legislation will, over time, generate revenue that states may use for mitigation, adaptation, habitat restoration and related

MAINE PEOPLE and institutions are up to the challenge. Together, we can seek resources for monitoring, research and information sharing.

needs. In order to take advantage of such funding opportunities, Maine will need to have in place a comprehensive adaptation plan that is substantially more detailed than the current Report, and will need to demonstrate a coordinated capacity to administer and utilize such funds.

In this regard, Maine's Federal and state lawmakers should advocate for appropriations that provide Maine with resources to support critical monitoring, research, information exchange, and adaptation planning specifically applicable to Maine.

7. We must maintain momentum

While there are many encouraging examples of how Maine citizens and institutions have already stepped forward in identifying, measuring, monitoring and planning for the impacts of climate change, the momentum must continue. The broad stakeholder process established in response to the Maine Legislature's direction has brought together—for the first time—many of those taking the lead and many looking for guidance.

This Summary barely scratches the surface of the thought captured in *People and Nature Adapting to a Changing Climate*, the work done to date—or the work that lies ahead. But it should be sufficient to show that Maine people and institutions are up to the challenge. As is so often the case, we become more creative and productive by working together.

The collaboration spawned, insight shared and initiatives strengthened by this process have been impressive. Stakeholders give great credit to the Maine Department of Environmental Protection, to Commissioner David Liell for his leadership, Gary Westerman for his facilitation skills and to Malcolm Burson for marshalling tremendously diverse perspectives and information into a coherent whole. But without such a coordinating entity, this momentum and coordination are likely to falter. The very obvious benefits of information and resource sharing could be squandered.

So *People and Nature Adapting to a Changing Climate* is also a call for ongoing coordination, and participants look to the Legislature for its affirmation of the work done to date, and direction to continue.



