

Great Lakes State and Provincial Climate Change Mitigation and Adaptation: Progress, Challenges and Opportunities

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Abstract

At the state and provincial level, a number of existing measures address climate change mitigation. Less activity has taken place in the area of adaptation. In all cases, there are gaps in climate change policy among the Great Lakes states and provinces. Measures related to energy efficiency have received significant attention and are being implemented across multiple sectors. Agriculture, water quantity and water quality are recognized as significant issue areas, but respondent policy efforts are less well developed. Health and education are areas of importance, but policy efforts have been limited. Options for broader action and for identifying future trends are being explored and implemented at all levels, including local, state and federal programs, non-governmental initiatives, regional programs that include one or more Great Lakes state or province, and example programs outside the region. Potential next steps include better coordination within the region and a regional program that includes the Great Lakes as a whole.

Introduction

This paper examines the state of climate change policy among the Great Lakes states and provinces based on a July 2009 literature and internet review and subsequent interviews, conference calls and/or email exchanges in 2009 and 2010.^b The Great Lakes states and provinces have enacted a number of measures that either mitigate against or facilitate adaptation to climate change. However, many policies around the region do not cite climate change as a factor in the calculation of benefits. Although the policies may have a direct impact on climate change, they are often implemented based on energy efficiency, pollution concerns or economic factors.

Climate change policy is divided into two approaches – mitigation and adaptation. Measures classified as mitigation aim to prevent or reduce the degree of climate change. Measures classified as adaptation recognize the inevitable impacts of climate change and seek to prepare society for its effects.¹ Policies that offer climate change as rationale most often fall under mitigation.

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^b Interviews in 2009 were conducted with Alan Belenz, New York Office of Climate Change; Steven Chester, Michigan Department of Environmental Quality; Peter Ciborowski, Minnesota Pollution Control Agency; Doug Scott, Illinois Environmental Protection Agency; Joe Sherrick, Pennsylvania Department of Environmental Protection. Additional comments were provided in September 2009 through a conference call and written comments/email exchanges with Scott Deloney, Indiana Department of Environmental Management; Steve Chester, Michigan DEQ; Peter Ciborowski, Minnesota Pollution Control Agency; Steve Hammond, New York Department of Environmental Conservation; Jennifer McKay and Adam Redish, Ontario Ministry of the Environment; and Sara Walling, Wisconsin Department of Agriculture, Trade, and Consumer Protection. A final review by states and provinces was conducted in the summer of 2010 with comments received by Michael Beaulac, Michigan Department of Natural Resources and Environment; Peter Ciborowski, Minnesota Pollution Control Agency; Mark Lowery, New York Department of Environmental Conservation; Chris Popovich, Ontario Ministry of Natural Resources; Kim Hoover and Joe Sherrick, Pennsylvania Department of Environmental Protection; Marcel Gaucher, Québec Ministère du Développement durable, de l'Environnement et des Parcs; and Tim Asplund, Wisconsin Department of Natural Resources

Research suggests that the majority of current climate change policy among Great Lakes states and provinces centers on the reduction of greenhouse gas (GHG) emissions.² The most common emissions reduction measures include decreasing vehicle emissions, moving away from coal-powered electricity, and increasing consumer energy efficiency. These steps and others help reduce the level of GHGs emitted into the atmosphere. While some of these actions could be presented as adaptation steps, they are often justified as measures aimed at climate change mitigation.

The second major method of climate change mitigation currently being pursued in the region is the sequestration of GHGs through carbon sinks. Once carbon dioxide has been released into the air, forests and other vegetative cover (as well as oceanic organisms) will absorb the gas.³ Any mitigation step that promotes this process is a sink.⁴ Reforestation and land retirement are the primary methods of creating carbon sinks, although research is being conducted on large-scale underground carbon storage.

Many issues related to adaptation have been discussed, ranging from biodiversity decline to increased flood damage. The purpose of these discussions is to anticipate the types of changes that may be encountered and reduce vulnerability or increase resiliency to accommodate these changes. However, few policies or regulatory activities are expressly defined as adaptive measures.

A number of the measures identified among the Great Lakes states and provinces could also be presented as “no regrets” approaches. These can be mitigative or adaptive in nature, but also provide benefits unrelated to climate change that equal or exceed their costs. One example of a no-regrets mitigation measure is expanding public transportation. Vehicle emissions of carbon are reduced, which could have a long-term effect on climate change, but traffic congestion, general pollution and surface road infrastructure costs are also decreased in the present.

Mitigation and adaptation steps are not mutually exclusive. For example, water conservation reduces the need for water processing and distribution, burning fewer fossil fuels to deliver water and achieving a mitigation effect. At the same time, water conservation establishes patterns of behavior that prepare users for a future of reduced or less reliable water supplies. These changes in behavior can represent an adaptation measure taken in light of anticipated changes. In addition, water conservation is a no-regrets strategy that reduces water bills and, for areas already experiencing water shortages, may reduce the severity of existing water supply issues.

Methodology

Focus areas for this study were selected based on a review of current climate change literature. Categories of mitigation measures were developed in part using compilations of state measures distributed by the Pew Center on Global Climate Change⁵ and the United States Environmental Protection Agency.⁶ State and provincial climate action plans (CAPs) were frequently referenced to determine areas of importance across the region. Two Great Lakes-specific papers, *Preparing for a Changing Climate: The Potential Consequences of Climate Variability and Change in the Great Lakes Region*⁷ and *Preparing for Climate Change in the Great Lakes Region*⁸, identified many adaptation practices. Additional measures were incorporated following a review of material offered by state/provincial agencies such as the New York State Office of Climate Change.

Whether or not a policy is couched as a response to climate change is a matter of semantics and is often determined by a political or institutional mindset. For example, Indiana and New York both provide incentives to consumers to purchase more energy efficient appliances. However, Indiana’s policy is based mainly on electrical load impacts, while New York identifies energy efficiency as a necessary mitigation measure. Table 1 displays measures that are typically presented as a response to climate change.

Table 1: Climate Change Policy Areas

<i>Policy Area</i>	<i>Policies</i>
Agriculture	Energy use training; Methane capture
Industry	Greenhouse gas reporting; Regional cap and trade programs
Power & Energy	EERS ^e ; Biomass research; Coal and sequestration research; RPS ^d ; Smart-metering; Public benefits funds; Green power purchases; State lead-by-example initiatives
Transportation	State fleet regulations; Low carbon fuel standards; Hybrid incentives,
Adaptation	Municipal climate action plan facilitation; Climate change education & outreach; State office established

In the interest of transparency and cohesiveness, the climate change policies considered in this paper include ones of unknown value. For example, the net impact of biofuels remains uncertain, and there appears to be some disagreement on the net impacts of methane capture and recycling. Two measures, carbon sequestration and assisted migration, remain disputed due to questions of large-scale technical feasibility.

Evaluating education policies presents unique challenges. While most governments provide information on their websites or link to educational pages, a fundamental question remains regarding whether these efforts truly constitute an education policy. Some evidence of an active outreach and/or awareness program was necessary to qualify for mention here.

Policies were broken into various sectors in order to facilitate the analysis and presentation of information in this paper. Although an effort was made to ensure a comprehensive list of sectors, an exhaustive list of individual adaptation and mitigation measures would be difficult to compile given the numerous options available to address each problem.

Summary and Analysis of Great Lakes State and Provincial Climate Change Policy

COMMON MEASURES: Strong patterns emerge when comparing state and provincial policy enactments. Most climate change policy is housed within a variety of pre-existing programs such as agriculture, energy efficiency, and water and air quality, and contains strong no-regrets undertones (Table 2).

Table 2: Common Mitigation and Adaptation Policies

Mitigation measures that have been adopted by at least 5 of the 10 Great Lakes Commission Member States and Provinces	
<i>Policy Area</i>	<i>Steps</i>
Ag & Forestry	Reforestation/afforestation financial assistance; Conservation and land management promotion; Education/outreach and technical assistance for energy efficiency; Methane capture
Commercial	Building efficiency codes; Heating/cooling efficiency incentives; Lighting efficiency incentives; Renewable energy installation incentives

^e Energy Efficiency and Resource Standards – a market-based mechanism to encourage more efficient generation, transmission, and use of electricity and natural gas.

^d Renewable Portfolio Standard – an obligation to derive a certain percentage of energy from specified energy sources.

Table 2: Common Mitigation and Adaptation Policies (continued)

Industrial	Voluntary GHG reporting; Regional cap and trade membership; Renewable energy installation incentives
Power & Energy	No nuclear ban; Biomass initiatives; EERS; Cleaner coal research; RPS; Renewable utility financial initiatives; Statewide net-metering; Public benefit funds; State purchaser of green power; State building and/or appliance efficiency requirements; Official energy strategy
Residential	Appliance efficiency incentives; Additional weatherization funding; Incentives for renewable installation
Transportation	State fleet biofuel and fuel efficiency standards; Anti-idling actions Hybrid incentives; E-85 fueling stations funding
Cross-Cutting	Smart growth; Financial promotion of recycling; Climate advisory boards; State climate change offices; Recommendation of mitigation steps; Climate Registry membership and promotion
Adaptation measures that have been adopted by at least 5 of the 10 Great Lakes Commission Member States and Provinces	
<i>Policy Area</i>	<i>Steps</i>
Education	Energy conservation; Pandemic; Climate change
Health	Urban forestry; Pandemic response plan
Planning	Smart growth; Sewage system improvement assistance; Municipal runoff requirements; Feedlot runoff requirements; Industrial stormwater runoff requirements; Pollution prevention assistance
Waterways	Floodplain management resources; CDFs; TMDL limits
Conservation	Water diversion prohibition; Energy efficiency incentives; Conservation tillage promotion; Conservation districts; Electronics recycling
Cross-Cutting	Invasive species monitoring; Regional cooperation; Public education; Wildlife action plan; Forest monitoring; Forest Strategic Management Plan; Water quality monitoring; Air quality monitoring, Habitat restoration

A variety of promising management practices and policies are observed in the Great Lakes region within individual governments. Illinois is a member of the Chicago Climate Exchange, the world's first multinational, multi-sector GHG cap-and-trade market.⁹ The state began mandating the capture and sequestration of emissions from new coal-fired plants in 2009.¹⁰ Minnesota and Wisconsin are members of Powering the Plains, devoted to supplying the Great Plains entirely with locally produced clean energy by 2050.¹¹ Michigan's Executive Directive No. 2009-4 implements mitigation recommendations from the state's Climate Action Plan (CAP) and calls for analysis on the need for a state adaptation plan.¹² The Michigan Department of Community Health, in partnership with the Department of Natural Resources and Environment (DNRE), is developing a state strategic plan to address public health impacts from climate change, due to be completed in September 2010.¹³ Minnesota's Department of Health is developing a similar plan.¹⁴ Every Great Lake state is a member of a Carbon Sequestration Regional Partnership sponsored by the Department of Energy.¹⁵

Ontario released a comprehensive Climate Change Action Plan¹⁶ in August 2007 that includes large investments in public transit, the phasing out of coal-fired generation by 2014, the promotion of renewable energy, the protection of green space, and the fostering of green investment and jobs in the province. Ontario's 2009 *Green Energy Act* implemented North America's most comprehensive feed-in tariff, designed to spark the development of renewable energy projects. The Ontario Expert Panel on Climate Change Adaptation, convened in 2007,

released a report¹⁷ in 2009 that makes specific recommendations as to how the province can prepare and plan for climate change impacts; the development of an adaptation strategy and action plan is a key recommendation in this report. The provincially-funded Ontario Centre for Climate Impacts and Adaptation Resources works with Ontario communities to undertake risk-based assessments and capacity building to improve the resiliency of communities to climate change impacts. The passage of Bill 185, *The Environmental Protection Amendment Act (Greenhouse Gas Emissions Trading), 2009*, on December 15, 2009 advanced Ontario's work with other jurisdictions to implement a cap and trade program that supports provincial greenhouse gas reduction goals and that can be integrated with other emissions trading systems. Québec formally introduced a carbon levy in 2007 to fund its 26-point, \$1.5 billion CAP (2006-2012).¹⁸ Most of the funding is directed towards mitigation actions, in particular through public transport development, energy efficiency and energy recovery from biomass. The measures included in the CAP (2006-2012) are complementary to those of Québec's Energy Strategy¹⁹ (2006-2015) aimed at improving energy efficiency, reducing consumption of petroleum and accelerating the development hydroelectric and wind energy projects. In the current CAP, some \$93 million is dedicated to adaptation measures and the Government is currently preparing an adaptation strategy due in 2011. Québec has announced a reduction target of 20 percent below 1990 levels by 2020 and is currently working on a new CAP (2012-2020).

New York participates in the Regional Greenhouse Gas Initiative (RGGI), the U.S.'s only mandatory cap-and-trade program. In August 2009, New York Governor David Paterson issued an executive order setting the goal of reducing state emissions by 80 percent of their 1990 levels by 2050. This executive order also created the State Climate Action Council and charged it with developing a CAP, of which a draft is expected to be released for public comment on November 2, 2010²⁰. New York's CAP will outline steps to achieve the mitigation goal and will contain an adaptation plan. Its Sea Level Rise Task Force (report due January 1, 2011) focuses solely on measures for the state's coastal regions to respond to rising ocean levels.²¹

In June 2009, Pennsylvania released a Climate Impact Report documenting the anticipated affects of climate change within the state.²² Pennsylvania is currently participating with stakeholders to develop an adaptation strategy report in 2011. Although not a requirement of the 2007 Pennsylvania Climate Change Act²³, this initiative has broad support and the report will be incorporated into the next Action Plan.²⁴

GAPS: Tendencies toward policy gaps begin to appear as state regulation or acceptance of climate change mitigation and/or adaptation becomes a stronger component of a given policy's rationale. Policies seeking to physically cap emissions, provide education, and prepare for a changing composition of natural resources receive less attention (Table 3).

Table 3: Unique and Less Common Mitigation and Adaptation Policies

Less common mitigation steps (adopted by fewer than 5 of the 10 Great Lakes Commission Member States and Provinces)	
<i>Policy Area</i>	<i>Steps</i>
Commercial	Appliance efficiency standards
Power & Energy	Smart metering; Mandatory green purchase options
Residential	Appliance efficiency standards; Building code standards
Transportation	Statewide emissions testing; Fuel efficiency education; Low carbon fuel standards
Cross-Cutting	Municipal CAP facilitation

Table 3: Unique and Less Common Mitigation and Adaption Policies, continued

Adaptation measures adopted by fewer than 5 of the 10 Great Lakes Commission Member States and Provinces	
<i>Policy Area</i>	<i>Steps</i>
Education	Municipal CAP facilitation; Heat wave awareness
Health	Heat wave response plan; Cooling centers
Waterways	Dam removal program
Conservation	Irrigation use reporting; Non-agricultural efficiency incentives; Recycling requirements; Bottle deposits
Cross-Cutting	Native species viability studies

Some policies receiving less attention at the state or provincial level are being addressed at the federal or municipal levels. Both the Canadian and U.S. federal governments have established regulations regarding appliance efficiency, building codes, air quality standards, and pollution runoff, to name a few. Some policies are universally enforced, such as emissions testing for vehicles in heavily congested areas. Others, such as building efficiency codes, are not always implemented in individual states. In addition, some municipalities have implemented zoning laws restricting pollution or other degradation of local areas. Chicago, New York, and several other cities have developed CAPs, some of which incorporate adaptation planning.

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Climate change policies not covered by states and provinces are also addressed by third parties. This is particularly true in the area of education. National organizations conduct education and awareness campaigns in every region. A number of cities have signed on to the Sierra Club's *Cool Cities* initiative, an agreement to achieve emissions seven percent below 1990 levels by 2012 that has enrolled over 400 municipalities.²⁵ Some states also rely on utilities to promote energy efficiency. Additionally, a number of environmental organizations across the Great Lakes basin are engaged in environmental renewal projects (e.g., dam removal, habitat restoration) which support climate change adaptation.

Analysis of climate change mitigation and adaptation policies across Great Lakes jurisdictions points to four adaptation issues that are receiving only limited policy-level attention: 1) the development of migration corridors for species as they transition to more northern regions; 2) tourism adaptation; 3) agricultural adaptation; and 4) adverse health impacts. Some research has taken place in these areas and these issues are beginning to receive attention, but assumptions to date are that adjustments will largely occur via natural market forces. Migration corridors, which have been repeatedly highlighted and will probably require policy intervention, are mentioned in recommendations made in some state and provincial strategy documents. The only enacted legislation regarding migration corridors at the state or provincial level is Chapter 613 of the Laws of New York, 2007²⁶, which established the New York State Sea Level Rise Task Force, directs the Task Force to make recommendations to "protect and connect ... habitats to allow ... species to migrate as temperature changes." At the federal level, Section 481 of the proposed American Clean Energy and Security Act requires the establishment of a National Wildlife Habitat and Corridors Information Program to coordinate corridor planning and development.²⁷ Canada has not enacted corridor legislation at the federal level.

Regional and Federal Climate Change Policy Trends

There are several policy initiatives under way at the regional and federal levels that could heavily impact how the Great Lakes states and provinces view and implement climate change policy in the future. The most significant are cap and trade programs. In the Northeast, the RGGI is already holding carbon bidding. New York is the only participating member from the Great Lakes, although Ontario, Pennsylvania, and Québec all hold observer status. On the western side of the Great Lakes, the Midwestern Greenhouse Gas Reduction Accord (MGGGA) is developing the framework for a cap and trade system that would begin on Jan. 1, 2012. The agreement will also encourage energy efficiency programs and the use of biofuels. The MGGGA was signed by four Great Lakes states – Illinois, Michigan, Minnesota and Wisconsin – with Indiana, Ohio, and Ontario holding observer status. The MGGGA Advisory Committee released their final recommendations²⁸ and model rule²⁹ in the spring of 2010, and participating governors are currently reviewing the recommendations in order to advise the next steps at the regional and federal levels. Further west, the Western Climate Initiative (WCI) is also working toward a cap and trade system that would begin in 2012. Ontario and Québec are full partners under the WCI and are working to develop the WCI cap and trade program.³⁰

Energy resources that produce fewer or no GHG emissions³¹ will continue to be promoted, along with additional energy efficiency mechanisms such as new fuel standards.³² A more robust Clean Water Restoration Act would regulate development and pollution of waterways.³³ At the regional level, the Great Lakes Restoration Initiative (GLRI) includes funding for a suite of projects that should provide adaptive infrastructure.³⁴ One such GLRI-funded project includes statistical and dynamical downscaling of variables and regional and global climate models for application to Michigan to assess changes in mean climate and weather extremes, including lake-effect snow and the hydrology budget of the Great Lakes Basin for the mid- and late 21st century. Included in this study are large-scale atmospheric circulation patterns and Great Lakes water levels.³⁵

The Great Lakes-St. Lawrence River Basin Water Resources Compact and the Great Lakes-St. Lawrence River Basin Sustainable Water Resources Agreement provide an early adaptation step with their emphasis on proper water management. This includes a water diversion prohibition, promotion of water conservation, water use reporting, and accounting for the impacts of water consumption on natural resources.^{36,37} In 2009 the International Joint Commission's Upper Great Lakes Study Board expanded the scope of its work to include an evaluation of the potential impacts on upper Great Lakes water levels due to possible climate change scenarios and develop potential adaptive measures to address those impacts. The results of this study, expected in late 2011, could have important implications for climate change adaptation policy in the Great Lakes region. These efforts reflect an awareness of the need to prepare for lower water levels and potential water quality degradation anticipated as a result of climate change. Also, the 2007 Canada-Ontario Agreement Respecting the Great Lakes Basin Ecosystem includes a commitment to understand the impacts of climate change on the Great Lakes ecosystem composition, structure, and function.³⁸

The American Clean Energy and Security Act, which passed the U.S. House of Representatives in June 2009, included provisions to support increased renewable energy usage, higher efficiency standards, and a cap and trade program. It also introduced several adaptation measures, including state assistance to develop and implement adaptation plans.³⁹ However, Senate negotiations on a climate change bill halted in the summer of 2010 defeating the prospect of U.S. climate change legislation passing out of the 111th Congress.^{40 41} A new Climate Services Agency has been proposed within the U.S. Department of Commerce's National Oceanic and Atmospheric Administration (NOAA) to integrate the agency's climate research arm with its more consumer-oriented services.⁴² The U.S. Environmental Protection Agency also has a Climate Change program⁴³ as do several other U.S. federal agencies. Additionally, the U.S. Interagency Climate Change Adaptation Task Force established by President Obama will release its final report in October, 2010 with recommendations for U.S. adaptation to climate change both domestically and internationally.⁴⁴

The Canadian federal government published its official Climate Change Plan for Canada in 2002.⁴⁵ In 2007 the Canadian government provided \$1.5 billion in funds for a Trust Fund for Clean Air and Climate Change.⁴⁶ The funds are provided to provinces to address their individual CAPs. The Regional Adaptation Collaboratives Climate Change Program is a cost-shared Canadian federal-provincial program to help Canadians reduce the risks and maximize the opportunities posed by climate change. In 2007, the Canadian federal government announced an investment of \$86 million (CAN) over four years devoted to five adaptation measures through its Climate Change Impacts and Adaptation Division:

- Research to improve climate change scenarios;
- Risk management tools for adaptation and to support the development and implementation of regional adaptation programs;
- Program to assist Northerners in assessing key vulnerabilities and opportunities for adaptation, climate change and health adaptation in northern and Inuit communities;
- Assessment of anticipated health vulnerabilities and impacts in Northern provinces; and
- Pilot Climate and Infectious Disease Alert and Response System.⁴⁷

Climate Change Policies in States and Provinces outside the Great Lakes

Areas outside the Great Lakes region can provide guidance for future efforts, and were examined to identify unique approaches that may be regionally applicable. The Pacific Northwest and New England states have displayed advanced policies in the United States, although California has been the most proactive in reducing carbon emissions,⁴⁸ leads the continent in fuel efficiency standards, and has developed a low carbon fuel standard to decrease the carbon intensity of transportation fuels. In 2009, eleven northeast and mid-atlantic states, including New York and Pennsylvania, signed a Memorandum of Understanding to develop a regional low carbon fuel standard modeled after California's.⁴⁹ Some other innovative and beneficial initiatives which may provide context for future policy decisions include the following:

- Maryland maintains a coastal adaptation website, which provides management tools and facilitates collaboration.⁵⁰
- StormSmart Coasts Network is an effort to provide multi-state coastal adaptation information via information sharing. Six states are currently connected with four more slated to join.⁵¹
- Washington, D.C., has implemented vehicle feebates⁵², while Portland, Ore., has instituted them for new buildings.⁵³
- Kansas has denied air permits for coal-fired energy plants by citing CO₂'s climate change and health impacts.⁵⁴
- California and Vermont have instituted feed-in tariffs^e.⁵⁵
- Nine states outside the Great Lakes region have adopted adaptation plans.⁵⁶
- Connecticut directs a portion of its revenues from RGGI into an adaptation fund, while New Jersey and Delaware have agreed to do so once they begin trading.⁵⁷
- Massachusetts directs a portion of its revenues from RGGI into its Green Communities program, which provides funding and technical support to the state's cities and towns.⁵⁸
- Boulder, Colorado and California's Bay Area Air Quality Management District, which covers nine counties in the San Francisco Bay Area, both have passed carbon taxes.^{59,60}

^e Feed-in tariffs mandate utilities purchase renewable energy produced by consumers at a premium price.

- Montgomery County, Maryland passed the nation's first countywide carbon tax in May, 2010.
- British Columbia has also adopted a carbon tax.⁶¹
- British Columbia is establishing an assisted migration program.⁶²
- Alberta has progressively capped industrial emissions since 2007.⁶³
- Saskatchewan's Climate Change Education funding equaled approximately \$2 million, the Green Technology Commercialization Fund approximately \$1 million and the Energy Conservation Initiative \$2.8 million from the federal government in 2007.⁶⁴
- Conserve Nova Scotia will be given a \$10.2 million budget to help educate the public on reducing their energy use. Programs will focus on residential, commercial, industrial, and transportation sectors.⁶⁵
- The Conference of New England Governors and Eastern Canadian Premiers has published a regional CAP and instituted other regional initiatives to promote energy efficiency and renewables.⁶⁶

Institutional Approaches for Addressing Climate Change

As previously stated, most climate change policies are designed to address a separate issue such as water or air pollution. Therefore, their origins are developed piecemeal from legislative and departmental activity. This is particularly true of adaptation measures, making it difficult to identify a preferred process (task forces, regular departmental meetings, etc.) for developing climate change policy. Only within the past five years have other venues for policymaking been observed. Approaches range from the adoption of task force recommendations to replicating another state's policies. It will be important to watch for future policies specifically addressing climate change, and the methods used to develop them.

The ad hoc nature of climate change policies impacts departmental responsibility within agencies ranging from agriculture to transportation. Carbon-specific legislation typically falls under the jurisdictions of a state or provincial Pollution, Energy and/or Commerce Department or Ministry, while most adaptation measures fall under the auspices of an Environmental or Natural Resources Department or Ministry. While the establishment of separate agencies or secretariats responsible for climate change policy coordination and education may become increasingly common, implementation authority will probably remain within agencies according to specialization.

Some metrics have been established to gauge climate change progress. Energy Efficiency Resource Standards and Renewable Portfolio Standards provide targets for energy consumption reductions and renewable energy growth. Most states have also developed energy strategies which direct their efforts by establishing timelines for energy targets. These ambitions are dampened by a recent analysis asserting that most states are on pace to fall short of their targets.⁶⁷ The Minnesota Pollution Control Agency reports biennially to the Minnesota state legislature on progress toward the state meeting its 2015 and 2025 GHG reduction goals. The reports contain a series of metrics of progress (e.g. lb GHG per light duty vehicle-mile traveled, etc.).⁶⁸ Ontario and Québec have adopted CAPs to guide near-term activities, listing a multitude of actions for implementation by 2014 and 2012, respectively. Parliamentary updates are provided in Ontario by the Ministry of Environment and in Québec by the Ministry of Sustainable Development, Environment and Parks. Pennsylvania submitted its Climate Change Action Plan in December 2009, requiring triennial updates thereafter.

A key component of targeted climate change legislation to date has been a system of regional approaches. The Conference of New England Governors and Eastern Canadian Premiers published a regional CAP in 2001.⁶⁹ Since then, the three strongest emissions reduction initiatives in North America have emerged from the three regional coalitions noted earlier: RGGI, MGGA and WCI. Regional efforts to boost clean energy sources such as the Midwestern Governors Association's Energy Security and Climate Stewardship Platform for the Midwest⁷⁰ and the WCI and RGGI are playing critical roles in the development of climate change policy at the

state and provincial level. Binational collaboration under the Great Lakes-St. Lawrence River Basin Water Resources Compact also demonstrates the effectiveness and necessity of regional approaches to issues of adaptation.

While several Great Lakes states are addressing climate change through existing programs and policies as described above, others are establishing new institutional structure to support their climate change activities. New York and Pennsylvania have established offices of climate change to develop policies and facilitate collaboration among state agencies, while Ontario established a Climate Change Secretariat in 2008 to fulfill a similar role. Québec created its Bureau of Climate Change (Bureau des changements climatiques) in 2002; the Bureau now coordinates the implementation of the CAP and develops new policies and regulation. Other Great Lakes states and provinces have installed similar institutions. In 2009, the state of Minnesota established an interagency team, with representation from principal resource management and emergency response agencies, focused on climate change adaptation policies. Additionally, the Wisconsin Initiative on Climate Change Impacts (WICCI)⁷¹, a partnership between the WDNR, the University of Wisconsin–Madison, and other state agencies, is working to assess and anticipate climate change impacts on Wisconsin's natural resources, ecosystems, regions and industries (including agriculture, tourism and other human activities) and to develop and recommend adaptation strategies that can be implemented by businesses, farmers, public health officials, municipalities, wildlife managers and other stakeholders. Michigan's Department of Natural Resources and Environment is charged with coordinating implementation of the state's CAP. It also has a formal cooperative agreement with Wisconsin's DNR to utilize the WICCI governance model to help jointly prioritize needs and develop appropriate climate change strategies. The Ouranos Consortium, created in 2001 through an initiative of the Québec government, advances research in regional climatology and adaptation. Climate simulations and scenarios conducted by Ouranos are used in impact and adaptation studies in public health, forest and water management, energy, agriculture, infrastructures, biodiversity and maritime and northern environments.

Summary

Most climate change policies are actually measures supporting business growth, agriculture, and natural resource protection, and are more aptly termed 'policies with climate change implications.' Climate change mitigation and adaptation are merely positive externalities in these instances. For example, state and provincial policies provide incentives to industrial and commercial businesses to install energy efficient and renewable technologies; farmers are provided incentives to practice better land management; and the biofuel industry receives significant subsidies to support production.

It is also notable that education does not receive broad attention at the state/provincial level. Although public awareness related to climate change is conducted throughout the region, it is often carried out by federal, local or non-profit entities. Climate change regulations are more commonly mandated by the federal government. Finally, state and provincial governments are adopting many 'lead-by-example' policies, such as building codes and vehicle fleet efficiency standards applied to their own operations.

Several Great Lakes jurisdictions have implemented climate change measures in almost every sectoral area of climate change policy. Some have also created specific institutional mechanisms to coordinate and administer climate change policy. Illinois, Michigan and Pennsylvania have all developed CAPs, but their activity relies on existing programs and funding for implementation. Ohio and Indiana have not developed a CAP against which to measure progress, although, as noted earlier, they have adopted a number of policies with climate change implications. Clearly there are opportunities for the Great Lakes states and provinces to learn from each other, build on successes, and implement climate change policies and programs in a more collaborative way.

Opportunities for Regional Action

Current policy gaps are exacerbated by uncertainty surrounding future changes and challenges. Therefore, climate model outputs must be made more consistent to demonstrate a sounder science basis and support decisionmaking.⁷² The GLRI-funded project to downscale models in Michigan is an example of how this can be done on a state level. Once this is achieved, the models can be incorporated into responses related to ecosystems, health, infrastructure, and other effects. These predictions will feed a four-step approach to future adaptation efforts: establishing areas of need, determining appropriate courses of action, evaluating effectiveness, and determining how future responses should incorporate changing variables. This is the heart of adaptive management: a process of acting and reacting to achieve the best outcome in an uncertain environment.

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Although forums for coordination on mitigation measures, such as the Great Lakes Wind Collaborative, exist on the regional level, the greatest potential for multistate cooperation lies within adaptation opportunities. While economic and regulatory policies are sensitive to governmental jurisdictions, the dynamic nature of ecosystems is not. Other adaptation solutions that can be addressed on a regional basis include the following:

- Promoting those activities which enhance both mitigation and adaptation efforts;
- Demonstrating the present effects of climate change as a means of gaining public and political support while changing the behavior of people and institutions;
- Promoting no-regrets strategies to appeal to those motivated by the potential for positive change;
- Identifying strategic locales for specific attention (e.g., tributaries, watersheds);
- Better coordinating regional cap and trade programs;
- Enhancing state and agency coordination to address the multi-sector impacts of policies;
- Increasing integration and reporting through
 - Panels to establish proper climate adaptation measures;
 - Toolboxes to facilitate sharing of best management practices and other information; and
 - Enhanced adaptive management, facilitated by long-term monitoring of effects of natural and policy forces;
- Reducing the duplication of work via
 - Development of standards for what constitutes an adaptation measure, and reconciling current and proposed policies which enhance long-term resiliency; and
 - Increased information sharing among federal, state, and local governments.

¹ (June, 2009) <http://www.epa.gov/climatechange/effects/adaptation.html>

² Balstad, Roberta, Lenhardt, Christopher (2005). *Why is Mitigation Important?* Columbia University. <http://ccir.ciesin.columbia.edu/nyc/pdf/q4a.pdf>

³ (October, 2006) <http://www.epa.gov/sequestration/>

⁴ <http://www.fern.org/pages/climate/carbon.html>

⁵ <http://www.pewclimate.org/states-regions>

⁶ <http://www.epa.gov/climatechange/wywd/stateandlocalgov/state.html>

⁷ Bisanz, Jeanne M., and Sousounis, Peter J. 2000. *Preparing for Climate Change*. Ann Arbor, MI: Great Lakes Regional Assessment Team

⁸ Dinse, K., Read, J., and Scavia, D. 2009. *Preparing for Climate Change in the Great Lakes Region*. Ann Arbor, MI: Michigan Sea Grant.

- 9 <http://www.chicagoclimatex.com/content.jsf?id=64>
- 10 http://www.coal.org/news/article.asp?ARTICLE_ID=165&
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