



**INSTITUTE FOR AGRICULTURE AND TRADE POLICY**

# The State of the States on Climate Adaptation

Analysis of State Climate Adaptation Plans  
Related to Food and Agriculture

**By Zack Robbins**

Institute for Agriculture and Trade Policy

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## FOREWORD

As the impacts of climate change become increasingly apparent, society is becoming more serious about the need to significantly reduce greenhouse gas emissions and begin preparing for a changing climate. The needs are profound—practically every area of our economy and society will be impacted and we need comprehensive plans that address multiple areas of concern.

Among these sectors, agriculture and food production are arguably the most important areas for adaptation. As IATP has detailed in past reports, the impacts of climate change—more volatile weather, increased pest and disease issues, reduced overall precipitation—are expected to hit farming hard, all as we demand greater production to meet food, materials and energy needs. These challenges make it clear that our food and agricultural system and the people that work in these sectors need to be prepared for the changing climate. As a result, adequate preparation for climate change should be among the highest priorities of our governments.

At IATP, we wanted to see how and if our federal and state governments are undertaking this needed planning process to deal with the impacts of a changing climate from a food and agricultural perspective. The result is this first-of-its-kind analysis by Zack Robbins. His findings, as you will see, indicate that some work has been undertaken, but from our perspective, climate adaptation planning is currently well behind what is needed to meet the existing and expected challenges associated with climate change.

In the recommendations that follow this report, you'll see what IATP views as necessary considerations for state and other local governments in their climate adaptation planning to ensure more resilient and adaptive food and agriculture systems. IATP has worked for many years to identify and promote agricultural systems and food production approaches that both adapt to a changing climate and help to mitigate greenhouse emissions. Such systems and approaches do exist and are being developed, but need to be advanced and supported in a much more significant manner. Of critical importance to the success of shifting our food and agriculture systems is the direct involvement of farmers and rural leaders. As the people on the “front lines” of climate change, farmers and rural residents are already dealing with the impacts, and as a result, are likely the best source for viable strategies going forward. As future climate policies and adaptation strategies are being developed, it is incumbent on our policymakers and leadership to make sure that farmers, rural citizens and others that are most likely to be impacted are at the table.

Jim Kleinschmit, Director  
Climate and Energy Initiatives

## I. INTRODUCTION

Humans have been adapting agriculture to new climates and locations since cultivating the first crops nearly 10,000 years ago. As crops spread to new regions all over the world, farmers, out of necessity, had to learn how to grow these crops in new and sometimes challenging conditions. Due to the effects of climate change, farmers once again must learn how to adapt to growing crops in different, often drier or wetter climates than what they are accustomed. However, because of the rapid pace of these changes, many farmers, especially those with small and medium sized operations, face the increasingly difficult challenge of maintaining production and their livelihoods.

To date, 18 States have developed climate adaptation plans (CAPs) to proactively respond to the effects of climate change. The United States Environmental Protection Agency defines adaptation as “efforts [taken] by society or ecosystems to prepare for or adjust to future climate change. These adjustments can be protective (i.e., guarding against negative impacts of climate change), or opportunistic (i.e., taking advantage of any beneficial effects of climate change).”<sup>1</sup>

In order to increase or even sustain the current food supply, the agricultural sector must adopt adaptation strategies to change current farming practices.<sup>2</sup> Because of the high cost of adaptation—researching adaptation strategies, collecting climate data, disseminating the research to agricultural producers, and adjusting land management practices—public policy at the state and federal levels has a vital role in ensuring America’s farmers successfully adapt to climate changes.

We found that there was very little research available assessing how climate adaptation plans address agriculture and food production. This report is an attempt to help fill that void, by providing a preliminary analysis of how current CAPs are or could help agriculture adapt to climate change. We begin with an overview of climate change adaptation at the federal level because of the large role the federal government has through farm and land use policy in influencing farming and landscape decisions. Then the focus turns to an assessment of the 18 state CAPs that are currently published to identify common trends and identify areas of improvement. The report concludes by identifying the major challenges facing agricultural adaptation at the policy level and suggestions for overcoming these challenges.

## II. LEVELS OF POLICY

### A. The federal level

On October 5, 2009, President Barack Obama signed Executive Order 13514 requiring, among other measures, that all federal agencies create climate adaptation plans to improve the sustainability of the federal government.<sup>3</sup> In February 2013, federal government agencies finally released their internal CAPs as part of the annual Sustainability Plans mandated by the executive order.<sup>4</sup> These agency-specific climate adaptation plans send the message that adaptation planning is an important part of responding to climate change and should be incorporated into every policy area, including agriculture.

Besides developing an internal climate adaptation plan, the USDA is providing leadership in agricultural adaptation by developing a network of "Regional Hubs;" these hubs are designed to increase the capacity of the USDA to transfer information and technical knowledge at the local and regional levels. Specifically, the "USDA's Regional Hubs are intended to deliver science-based knowledge and practical information to farmers, ranchers and forest landowners within each region of the United States to support decision-making related to

climate change."<sup>5</sup> In order to achieve this goal, the Regional Hubs will rely on three mechanisms: technical support, assessments and regional forecasts, and outreach and education.<sup>6</sup> The Regional Hubs' technical support is supposed to include testing and supporting new management practices to give agricultural producers an array of tools to sustainably adapt to regional and local climate changes. The hubs are also expected to conduct periodic regional risk and vulnerability assessments and give agricultural producers access to regional climate data. Through these support services, the Hubs are hoping to help improve the decision making abilities of agricultural producers regarding the adoption of new land management practices and introduction of new varieties of crops and livestock. The hubs' final mechanism—outreach and education—will communicate the findings of the risk and vulnerability assessments to producers through extension services, while also informing the public on climate change risks to agricultural lands.

All of the Regional Hubs' planned services conform to the recommended role of the federal government in climate adaptation found in a 2013 review of the research conducted on climate adaptation in the United States.<sup>7</sup> Applying the

### California and Pennsylvania communication policies

Even though policies may be similar, the quality and effectiveness of each policy can vary greatly. For instance, even though nearly half of CAPs mention a policy designed to increase the coordination among researchers, extension services, and natural resource managers, some lack the level of detail necessary to achieve the policy's goal. In order to illustrate this point, look at the difference in detail between the language used in Pennsylvania's and California's Climate Adaptation Strategies (CAS) to achieve the goal of increased coordination and communication.

Pennsylvania's *Pennsylvania Climate Adaptation Planning Report: Risks and Practical Recommendations* recommends that the state "Expand technical assistance programs to help farmers make decisions about sustainable crops and production practices (e.g., Penn State Ag. Extension, USDA Natural Resources Conservation Service, county conservation districts, county extension agents)."<sup>22</sup> This recommendation broadly defines the adaptation strategies that need increased coordination generally as "sustainable crops and production practices." Because this policy is a recommendation for the State legislature, the broad wording could either give state agencies more flexibility to meet local adaptation needs or give the agencies and the producers they support more opportunities to avoid implementing the policy. Specific state programs are identified to implement the policy recommendations; but under the current wording they are not obligated to comply with the policy. Additionally, this policy omits any mention of how to fund the recommended expanded technical assistance (TA) programs and what priority state agencies and programs should give to the TA programs. Given limited and often shrinking state budgets, new climate adaptation policies must be prioritized for each state in order to optimize the benefit of the policies while minimizing the costs.

In contrast, the policy in California's 2009 Climate Adaptation Strategy includes much more detail:

Complement federal financial and technical assistance such as those offered by the NRCS [Natural Resource Conservation Service] for farmers under the co-leadership of the Department of Conservation (DOC) and the CDFA [California Department of Food and Agriculture] to collaboratively encourage improved farm management practices involving tillage, rotations, manure management, fallowing, use of cover crops, intercropping, multi-cropping, and fertilizer-use efficiency, which result in net environmental benefits including reduction of soil erosion, increased soil fertility, water-holding capacity, and reduced on and off-site contamination of water resources.<sup>23</sup>

This policy includes specific adaptation strategies that designated state agencies (i.e. the Department of Conservation and the California Department of Food and Agriculture) must encourage farmers to adopt. Unlike Pennsylvania's recommendation, California's policy limits the adaptation strategies that state agencies can help farmers adopt. The California policy also requires the DOC and CDFA to implement the policy, but provides them with the flexibility to adjust the scale of the TA collaboration to fit in with the larger priorities of the agencies.

findings of the review to agriculture, the federal government—including the USDA—should 1.) provide usable information for agricultural producers to adapt to climate change; 2.) support clearinghouses for sharing data, resources, and knowledge relating to agricultural adaptation; and 3.) create a flexible regulatory framework that can adjust to meet the needs of local climatic changes. The Regional Hubs network, if they implement all three mechanisms as planned, will satisfy the review’s recommended guidelines for the federal government in addressing climate adaptation.

## B. The state level

The climate adaptation plans that exist at the state level complement the Regional Hubs’ focus on local and regional strategies to adapt agriculture to a changing climate. Currently, 18 states have CAPs originating from four different sources (see Table 1 for an overview of state climate adaptation plans).<sup>8</sup> Eight (44 percent) of the adaptation plans come from executive orders that either assigned a committee to identify policy recommendations for a state climate adaptation plan or used the regulatory powers of the executive to mandate climate adaptation strategies (i.e., California).<sup>9</sup> Four plans (22 percent) originated from the State legislature, mostly in the form of non-binding recommendations; only Hawaii’s legislature has passed a set of statewide climate adaptation priority guidelines.<sup>10</sup> The other CAPs either come from a Governor’s committee (11 percent) or from state agencies (22 percent). Currently, only Hawaii and California mandate state agencies to adopt climate adaptation policies; in the remaining 16 states, CAPs only have the authority of recommendations.

Table 1: Overview of state Climate Adaptation Plans

State	Year	Source of CAP	CAP Title
Alaska	2010	Executive Order	Alaska’s Climate Change Strategy: Addressing Impacts in Alaska
California	2009	Executive Order	2009 California Climate Adaptation Strategy
Colorado	2010	State Agencies	Colorado Drought Mitigation and Response Plan
Connecticut	2011	Governor’s committee	Connecticut Climate Change Preparedness Plan: Adaptation Strategies for Agriculture, Infrastructure, Natural Resources and Public Health Climate Change Vulnerabilities
Florida	2008	Executive Order	Florida’s Energy and Climate Change Action Plan
Hawaii	2012	State Legislature	Climate Change Adaptation Priority Guidelines
Maine	2010	State Legislature	Maine Climate Change Adaptation Report

Table 1: Overview of state Climate Adaptation Plans

State	Year	Source of CAP	CAP Title
Maryland	2011	Executive Order	Comprehensive Strategy for Reducing Maryland’s Vulnerability to Climate Change - Phase II: Building Societal, Economic, and Ecological Resilience
Massachusetts	2011	State Legislature	Massachusetts Climate Change Adaptation Report
Minnesota	2010	State Agencies	Adapting to Climate Change in Minnesota: Preliminary Report of the Interagency Climate Adaptation Team
New Hampshire	2009	Executive Order	The New Hampshire Climate Action Plan: A Plan for New Hampshire’s Energy, Environmental and Economic Development Future.
New York	2010	Executive Order	New York State Climate Action Council Interim Report
Oregon	2011	Governor’s committee	Report of the Legislature: Oregon Global Warming Commission
Pennsylvania	2011	State Legislature	Pennsylvania Climate Adaptation Planning Report: Risks and Practical Recommendations
Utah	2007	State Agencies	Drought in Utah: Learning from the Past - Preparing for the Future
Vermont	2010	State Agencies	The Potential Impacts of Climate Change on Agriculture in Vermont
Washington	2012	Executive Order	Preparing for a Changing Climate: Washington State’s Integrated Climate Response Strategy
Wisconsin	2011	Executive Order	Wisconsin’s Changing Climate: Impacts and Adaptation

## 1. Research methodology

Since state CAPs are relatively new and little research has been done on how climate adaptation plans address agriculture, this report provides a preliminary analysis of the content and direction of CAPs. The quantitative dimension of the analysis identified all policies in the CAPs that deal with adapting agriculture and livestock production to a changing climate.<sup>11</sup> Then, similar policies were sorted into 11 groups and 35 sub-groups to identify common trends in CAPs across states. Lastly, the most and least common policies are identified and analyzed to assess both the areas of agreement and range of diversity quality of the policies. Three of the most cited policies are highlighted in the text boxes.

## 2. Policy sub-group trends

Overall, this report identified 92 policies mentioned in the 18 CAPs. Because of the wide range of policy areas found in the CAPs, the policies were first categorized into 11 policy groups. Then, to achieve a more detailed analysis, policies were further organized into sub-groups; the most common policy sub-groups are shown in Table 1. The most frequent policies, found in 78 percent of CAPs, are those supporting land management practices (e.g., low-till cultivation, inter-cropping, using cover crops, adjusting planting dates, and altering crops to meet changing climatic conditions). By including policies that support researching new crop varieties with the land management practices sub-group, the percentage of CAPs that mention at least one of these policies increases to 92 percent—all states but Alaska. The high frequency of land management policies is expected because altering land management practices is a direct and crucial method for adapting agricultural production to climate change.

Information sharing policies focused on improving the exchange of climate change data and new adaptation practices between researchers and agricultural producers are found in half of the CAPs. The prevalence of policies focused on improving information sharing and communication reflects both the “newness” of the climate challenge and the need to remedy the information bottleneck that currently hinders agriculture’s adaptation to climate change.<sup>12</sup> Given the increased frequency and severity of drought predicted for much of the United States, many states (44 percent) also include water use efficiency and conservation policies in their CAPs. And despite the strong focus and interest by many researchers and communities on developing local food systems and infrastructure, is in part based on the mounting challenges associated with global food supply chains, policies supporting local food systems appear only in 33 percent of states’ CAPs.

The results of the sub-group frequency ranking also indicate the importance many CAPs place on preserving agricultural land (50 percent) and adopting a more holistic approach to land use planning (39 percent). These land use planning policies include measures to promote sustainable development, incorporating watershed planning in land use decisions, and providing land use planning resources to local governments. Policies preserving agricultural land are imperative because of the economic pressures urban sprawl places on fertile land and farmers near urban centers; without some sort of protection for these peri-urban farms, developing more robust local food systems will prove much more challenging.

Due to the more volatile weather patterns farmers face from climate change, one-third of state CAPs include policies to improve real-time and long-range weather forecasting

## New York Crop Adaptation Policy

New York’s chapter on “Adapting to Climate Change” in the New York State Climate Action Council’s 2010 Interim Report provides a detailed and flexible policy for introducing crop varieties able to thrive in New York’s changing climate:

Support the introduction of existing varieties and the development of new varieties that can take full advantage of the beneficial effects of climate change... Implementation should include the following: Development of varieties that are optimized for increasing levels of atmospheric CO<sub>2</sub>; Introduction of new crop varieties from other regions into New York State; Development of crops with increased tolerance to climate stresses. These stresses include summer heat stress; and drought, frost/freeze and extreme precipitation events. These traits can be developed using conventional breeding, molecular-assisted breeding and genetic engineering.<sup>24</sup>

In addition to developing new crop varieties adapted to New York’s local environment, this policy also suggests the more cost-effective strategy of introducing existing crops that will thrive in New York’s new climate. Furthermore, this policy identifies the specific climate stresses new crops must adapt to, as well as a wide variety of crop development methods to build resistance to these stresses (some of which, like genetic engineering, are themselves controversial). The New York Interim Report is also one of the few CAPs to include a cost assessment of the policy (“Low to moderate when compared to the cost of now action”) and identify possible funding sources through private-public partnerships with seed companies.

capabilities. Improving the accuracy of weather forecasts available to farmers will reduce the weather-related risk they face by allowing farmers to plant crops best suited to the season’s predicted growing conditions. Additionally, one third of CAPs also refer to measures to increase crop diversity. Increased crop diversity further mitigates risk due to weather and climate by increasing the resiliency of a farmer’s crops; if a farmer plants multiple varieties of the same crop that thrive in different growing conditions, at least one of those varieties is likely to be suitable for harvest at the end of the growing season.<sup>13</sup>

Table 2: Policy Sub-Group Frequency Ranking for 18 State Climate Adaptation Plans

Policy Sub-Group	# of State Adaptation Plans Including Policy Group	% of State Adaptation Plans Including Policy Group
1. Land Management Practices	14	78%
2. Crop Adaptation	13	72%
3. Information Sharing	9	50%

Table 2: Policy Sub-Group Frequency Ranking for 18 State Climate Adaptation Plans

Policy Sub-Group	# of State Adaptation Plans Including Policy Group	% of State Adaptation Plans Including Policy Group
3. Agricultural Land Preservation	9	50%
5. Technical Assistance	8	44%
5. Water Use Efficiency	8	44%
5. Water Conservation	8	44%
5. Pest Control Practices	8	44%
9. Land Use Planning	7	39%
9. Climate Change Data	7	39%
11. Local Food Demand	6	33%
11. Crop Diversity	6	33%
11. Weather Forecasting	6	33%

### 3. Policy trends

Analyzing climate adaptation plans at the sub-group level creates a general picture of the type of adaptation measures states are considering; however, in order to assess the quality of the CAPs, this report also examines individual policies. Because the exact wording of policies varies, similar policies are grouped together under a synthesized version of each of the 92 policies identified. Table 3 shows the most common policies found in the 19 CAPs.

The top two policies both address the communication and decision making gaps that currently exist between researchers studying climate change and the agricultural producers whose crops and livestock are actually affected by climate change.<sup>14</sup> Without a coordinated communication network between researchers and farmers, all other adaptation strategies will prove less effective, the agricultural policies will either be disconnected from scientific advances in adaptation strategies or the constraints limiting the action farmers can take.

Many CAPs also promote improved irrigation efficiency and water storage projects because of the increased prevalence and severity of droughts across much of the U.S. Additionally, the increasing temperatures caused by climate change have expanded the range of damaging pests, diseases, and weeds, which have spurred many states (39 percent) to include policies aimed at improving pest management adaptation strategies. As this is especially an issue of concern as pests move into new areas where there has been little or no experience dealing with them, a quarter of states recommend improving pest identification and monitoring systems to better prepare for the new pests.

Surprisingly, only 37 percent of CAPs mention supporting programs to promote local food, despite the rising popularity of farmers markets and local food.<sup>15</sup> The lack of policies supporting local food may stem from a perceived disconnect between local food and climate adaptation—some policy-makers may not consider promoting local food production and consumption as a mechanism to adapt to climate change. The CAPs that do recognize the connection, such as the *Massachusetts Climate Change Adaptation Report*, realize that “shortening the distance from production to consumption minimizes potential supply disruption due to storm events [that will become more severe due to climate change].”<sup>16</sup> Similarly, only five state CAPs mention developing local alternative energy sources, such as biofuels, as an adaptation strategy; many more states only mention supporting biofuels as a strategy to mitigate climate change by reducing the demand for fossil fuels.

In order to protect existing farmland from being developed, 26 percent of CAPs include language to reduce the rate of conversion of agricultural land and open green space to developed uses. Since small and medium sized farms are both the most vulnerable to climate change and conversion to non-agricultural uses, policies that support agricultural land preservation also support small and medium sized farms.

Table 3: Frequency Ranking for Most Common Policies in 18 State Climate Adaptation Plans

Policy Group	Policy	# of State Adaptation Plans Including Policy	% of State Adaptation Plans Including Policy
Communication	Increase coordination among researchers, extension services, and natural resource managers to achieve greater efficiency and effectiveness in monitoring, research and development of adaptation strategies	9	50%
Communication	Expand technical assistance programs to help farmers make decisions about sustainable crops and production practices	8	44%
Water	Promote irrigation efficiency	8	44%

Table 3: Frequency Ranking for Most Common Policies in 18 State Climate Adaptation Plans

Policy Group	Policy	# of State Adaptation Plans Including Policy	% of State Adaptation Plans Including Policy
Land Management	Adopt conservation tillage/no-till land management practices	7	39%
Land Management	Develop crops with increased tolerance to climate stresses such as high temperatures, saline soils, drought, insect pests, and disease (using methods such as conventional breeding, molecular-assisted breeding, and genetic engineering)	7	39%
Pest, Disease, and Weeds	Support pest management adaptation	7	39%
Local Food	Support programs to promote local food and products (e.g. farmer's markets, CSA)	6	33%
Land Management	Protect and restore native vegetation, habitats and riparian areas along agricultural lands and water ways	6	33%
Land Management	Identify crops better able to accommodate shifting climate conditions	5	28%
Land Use	Reduce rate of conversion of agricultural land and open green space to developed uses	5	28%
Water	Facilitate water storage projects at all scales	5	28%
Energy	Develop local alternative energy sources, encouraging local renewable energy production on agricultural lands (e.g. biofuels)	5	28%

Table 3: Frequency Ranking for Most Common Policies in 18 State Climate Adaptation Plans

Policy Group	Policy	# of State Adaptation Plans Including Policy	% of State Adaptation Plans Including Policy
Pest, Disease, and Weeds	Improve pest identification and monitoring	5	28%

The climate action plans also have 34 unique policies; Table 4 shows 10 of these policies. Some of these policies are innovative, such as the idea to transform invasive plant species into biofuel or animal feed in the *Pennsylvania Climate Adaptation Planning Report: Risks and Practical Recommendations*. Washington's recommendation to "[e]xpand and improve the effectiveness of the state's water right transfer program by seeking statutory changes that provide flexibility and incentives to current water right holders interested in transferring their water to other users" is another innovative strategy to "reduce the impacts of severe droughts and extreme weather events on irrigated agriculture."<sup>17</sup>

Table 4: Selection of Least Frequent State Climate Adaptation Plan Policies\*

Policy Group	Policy	State
Communication	Improve understanding of federal climate change regulations and legislation	MN
Energy	Make invasive species valuable as a biofuel or animal feed	PA
Local Food	Reuse urban buildings for agriculture and promote vertical agriculture (e.g. green roofs)	CT
Livestock	Increase installation of energy-efficient cooling systems in livestock facilities	NY
Research	Consider native Hawaiian traditional knowledge and practices in planning for the impacts of climate change	HI
Research	Update soil classification maps for changes due to climate change	CA
Research	Create a vision for the future of the State's agriculture with all stakeholders in the agricultural community (i.e. build upon strengths, seize opportunities, address risks, and focus on sustainability)	CT
Water	Increase flexibility of state water right transfers	WA



## The Connecticut Climate Change Preparedness Plan

The *Connecticut Climate Change Preparedness Plan* has one of the most comprehensive local food policy recommendations of the 18 CAPs. This recommendation goes beyond the general language of supporting local food found in CAPs—such as Vermont’s recommendation to support “small-scale farms that supply food to their local areas”<sup>25</sup>—to provide a comprehensive strategy to support all the elements of a viable, local agriculture market. The plan suggests that:

Connecticut should adopt policies that encourage a viable, local agriculture market by supporting the infrastructure and programs needed to grow, process, store, market and sell local agricultural products.... Specifically, Connecticut should adopt supportive policies, including funding and grant opportunities, repeal counterproductive land ordinances, and allow for property tax reductions to accelerate farmland protection and expansion of agriculture operations. The State should create incentives for the transition and adoption of new adaptation practices and technologies, and support the development of in-state agricultural processing and packaging facilities, such as produce canning plants, dairy processing cooperatives, and animal slaughter facilities. The State also should set an example of buying local by supporting local food choices in State-owned and operated office buildings, schools, hospitals and other institutions.<sup>26</sup>

Connecticut is one of two state CAPs that include policies to support both the supply and demand of local food production, both of which are crucial to support a vibrant local food system. Connecticut also determined that this policy is of “high urgency,” with “relatively low to medium resource needs.”

Table 4: Selection of Least Frequent State Climate Adaptation Plan Policies\*

Policy Group	Policy	State
Water	Incentivize water pricing systems that reward water conservation	CA
*34 policies are found in only one state’s CAP; of those 34, ten are presented in the table.		

## III. OVERCOMING ADAPTATION CHALLENGES

Although state climate adaptation plans are moving in a promising direction, they still face four primary challenges.<sup>18</sup> While these challenges apply to CAPs in general, the problems are being addressed in the elements relating to agriculture adaptation. However, this positive outlook depends on the implementation of the recommendations of the CAPs into policy.

The first challenge facing agriculture’s adaptation to climate change is the decision making gap that often exists between researchers, policy makers, and agricultural producers. With 72 percent of CAPs including at least one policy to improve the communication of climate change data and adaptation practices, most plans are moving in the right direction to address this challenge by giving farmers and ranchers the tools and information they need to make informed decisions about how to adapt to climate change.

Second, many CAPs lack the financial resources needed to implement all of their recommendations and/or policies. 37 percent of CAPs mention some form of financial planning (e.g., identifying partnerships with companies and non-profits, specifying government agencies and/or programs responsible for implementing the policy, etc.), but only 21 percent prioritize their policies to maximize the use of limited resources. Relating to these financial constraints, most states—except for California, which has already begun implementing its CAP—have not yet achieved the level of detail needed in order to implement their CAPs.

Third, government institutions generally lack the flexibility necessary for adjusting adaptation policies to meet local needs and conditions. Many CAPs (50 percent) recommend reviewing state tax codes, land use laws, and/or water rights laws in order to create a more flexible institutional system. Most notably, one policy in Maine’s CAP recommends improving federal fund flexibility to meet Maine’s local priorities, a recommendation found in no other CAPs.<sup>19</sup>

Fourth, CAPs often suffer from a lack of leadership—a problem which appears to have largely bypassed agricultural adaptation because of the similar vision found across all CAPs. Different states have different focuses to meet local priorities, but no CAP contradicts any other CAP.

## IV. CONCLUSION

This preliminary assessment of state climate adaptation plans is just the beginning of the research needed to ensure that public policy aids agricultural producers in adapting to a changing climate. Even though this report is one of the first to examine how U.S. state climate adaptation plans address agriculture, several conclusions can be drawn:

### ■ A LARGE VARIANCE IN THE DETAIL OF CAPS EXISTS.

Only a few states have very detailed plans that are either in the process of implementation (i.e., California) or detailed enough that the recommendations could easily be implemented into policy (e.g., Massachusetts). Conversely, several states (i.e., New Hampshire and Alaska) have very broad recommendations that have not yet been tailored to fit their specific agricultural needs and changing climate conditions.<sup>20</sup> These general recommendations state defined goals of *what* adaptation looks like for the agricultural industry, but provide no guidance on *how* to achieve these adaptation goals. In order for future adaptation plans to be effective, they must increase the level of detail of *who* will implement the policy, *how* they will implement it, and *how* the policy will be funded.<sup>21</sup>

### ■ THE AGRICULTURAL POLICIES IN CAPS LARGELY LACK PRIORITIZATION.

Given limited state resources, policies need to be prioritized. This should be based on their cost, adaptation benefits, local climatic conditions, and multifunctionality. This last point is particularly important, as the urgency of the climate crisis and the multiple roles that agriculture plays requires that climate adaptation not be done in isolation. Instead, practices that provide both adaptive and mitigative benefits (such as increasing soil carbon) and ones that contribute to other needs (clean water, biodiversity, etc.) need to receive the highest prioritization.

### ■ RURAL DEVELOPMENT IS NOTABLY ABSENT FROM NEARLY ALL CAPS.

The plans that do mention rural development only do so indirectly through policies aimed at local agricultural development and agricultural land preservation.

The threats of climate change to agriculture are real and are beginning to affect many states. The climate adaptation plans currently published are promising and moving in the right direction. Unfortunately, since most of the CAPs are just recommendations, they remain unimplemented ideas. In order for the promising trend of CAPs to continue, more states must begin to formally adopt policies that support farmers and ranchers in adapting to changes in their local climates.

## Works Cited

- Bierbaum, Rosina (2013). "A comprehensive review of climate adaptation in the United States: more than before, but less than needed." *Mitigation and adaptation strategies for global change*. 18 (3), p. 361 – 406. <http://link.springer.com.proxyau.wrlc.org/content/pdf/10.1007%2F11027-012-9423-1.pdf>
- Executive Order 13514, "Federal Leadership in Environmental, Energy, and Economic Performance." October 5, 2009. Available at [http://www.whitehouse.gov/assets/documents/2009fedleader\\_eo\\_rel.pdf](http://www.whitehouse.gov/assets/documents/2009fedleader_eo_rel.pdf).
- "Obama Administration Releases Federal Agency Strategic Sustainability Performance Plans." February 7, 2013. Available at [http://www.whitehouse.gov/administration/eop/ceq/Press\\_Releases/February\\_07\\_2013](http://www.whitehouse.gov/administration/eop/ceq/Press_Releases/February_07_2013).
- USDA, "USDA Regional Hubs for Risk Adaptation and Mitigation to Climate Change." July 2013. Available at [http://www.usda.gov/oce/climate\\_change/USDA%20Regional%20Hubs\\_070213%20Presentation.pdf](http://www.usda.gov/oce/climate_change/USDA%20Regional%20Hubs_070213%20Presentation.pdf).
- USDA, "Fact Sheet: USDA Regional Hubs for Risk Adaptation and Mitigation to Climate Change." Available at [http://www.usda.gov/oce/climate\\_change/USDA%20Regional%20Hubs%20Fact%20Sheet%2005052013.pdf](http://www.usda.gov/oce/climate_change/USDA%20Regional%20Hubs%20Fact%20Sheet%2005052013.pdf). (Accessed 22 September 2013).
- Center for Climate and Energy Solutions (2013), "State and Local Climate Adaptation," available at <http://www.c2es.org/us-states-regions/policy-maps/adaptation>.
- State of Washington Department of Ecology (April 2012). *Preparing for a Changing Climate: Washington State's Integrated Climate Response Strategy*. Available at <https://fortress.wa.gov/ecy/publications/publications/1201004.pdf>
- Oregon Department of Energy (February 2011). *Report of the Legislature: Oregon Global Warming Commission*. Available at <http://www.keeporegoncool.org/sites/default/files/ogwc-standard-documents/2011Report.pdf>.
- Minnesota Pollution Control Agency (August 2010). *Adapting to Climate Change in Minnesota: Preliminary Report of the Interagency Climate Adaptation Team*. Available at <http://www.pca.state.mn.us/index.php/view-document.html?gid=15414>.
- Pennsylvania Department of Environmental Protection (2011). *Pennsylvania Climate Adaptation Planning Report: Risks and Practical Recommendations*. Available at <http://www.elibrary.dep.state.pa.us/dsweb/Get/Document-92911/27000-REG-DEP4303%20%20Pennsylvania%20Climate%20Adaptation%20Planning%20Report.pdf>.
- New Hampshire Department of Environmental Services (March 2009). *The New Hampshire Climate Action Plan: A Plan for New Hampshire's Energy, Environmental and Economic Development Future*. Available at [http://des.nh.gov/organization/divisions/air/tsb/tps/climate/action\\_plan/documents/nhcap\\_final.pdf](http://des.nh.gov/organization/divisions/air/tsb/tps/climate/action_plan/documents/nhcap_final.pdf).
- Maine Department of Environmental Protection (February 2010). *Maine Climate Change Adaptation Report*. Available at [http://cci.siteturbine.com/uploaded\\_files/climatechange.umaine.edu/files/Maine\\_CC\\_Adapt\\_Full\\_Report\\_2010.pdf](http://cci.siteturbine.com/uploaded_files/climatechange.umaine.edu/files/Maine_CC_Adapt_Full_Report_2010.pdf).
- Adaptation Advisory Group (January 2010). *Alaska's Climate Change Strategy: Addressing Impacts in Alaska*. Available at [http://www.climatechange.alaska.gov/aag/docs/aag\\_all\\_rpt\\_27jan10.pdf](http://www.climatechange.alaska.gov/aag/docs/aag_all_rpt_27jan10.pdf).
- Governor's Steering Committee on Climate Change Adaptation Subcommittee (2011). *Connecticut Climate Change Preparedness Plan: Adaptation Strategies for Agriculture, Infrastructure, Natural Resources and Public Health Climate Change Vulnerabilities*. Available at [http://www.ct.gov/deep/lib/deep/climatechange/connecticut\\_climate\\_preparedness\\_plan\\_2011.pdf](http://www.ct.gov/deep/lib/deep/climatechange/connecticut_climate_preparedness_plan_2011.pdf).
- Executive Office of Energy and Environmental Affairs and the Adaptation Advisory Committee (September 2011). *Massachusetts Climate Change Adaptation Report*. Available at <http://www.mass.gov/eea/docs/eea/energy/ccaa/eea-climate-adaptation-report.pdf>.
- Governor's Action Team on Energy and Climate Change (October 2008). *Florida's Energy and Climate Change Action Plan*. Available at <http://www.climatestrategies.us/library/library/view/65>.
- Colorado Water Conservation Board and Department of Natural Resources (September 2010). *Colorado Drought Mitigation and Response Plan*. Available at <http://cwcb.state.co.us/water-management/drought/Documents/StateDroughtMitPlan2010/2010DroughtHazardMitigationPlan.pdf>.
- California Natural Resources Agency (2009). *2009 California Climate Adaptation Strategy*. Available at [http://resources.ca.gov/climate\\_adaptation/docs/State-wide\\_Adaptation\\_Strategy.pdf](http://resources.ca.gov/climate_adaptation/docs/State-wide_Adaptation_Strategy.pdf).
- Utah Division of Water Resources (April 2007). *Drought in Utah: Learning from the Past - Preparing for the Future*. Available at <http://www.water.utah.gov/DroughtReport/binder2A.pdf>.
- Iowa Smart Planning Task Force (November 2010). *Iowa Smart Planning Task Force Report*. Available at [http://publications.iowa.gov/10062/1/2010-11-15\\_Smart\\_Planning\\_Task\\_Force\\_Report.pdf](http://publications.iowa.gov/10062/1/2010-11-15_Smart_Planning_Task_Force_Report.pdf).

Dunnington, Gwen (April 2010). "The Potential Impacts of Climate Change on Agriculture in Vermont," *Climate Change Adaptation White Paper Series*. Available at <http://www.anr.state.vt.us/anr/climatechange/Pubs/VTCCAdaptAgriculture.pdf>.

New York State Climate Action Council (November 2010). "Adapting to Climate Change," *Interim Report*. Available at [http://www.dec.ny.gov/docs/administration\\_pdf/irchap11.pdf](http://www.dec.ny.gov/docs/administration_pdf/irchap11.pdf).

Maryland Commission on Climate Change Adaptation and Response and Scientific and Technical Working Groups (January 2011). *Comprehensive Strategy for Reducing Maryland's Vulnerability to Climate Change - Phase II: Building Societal, Economic, and Ecological Resilience*, ed. Katharine Boicourt and Zoe P. Johnson. Available at [http://dnr.maryland.gov/climatechange/climatechange\\_phase2\\_adaptation\\_strategy.pdf](http://dnr.maryland.gov/climatechange/climatechange_phase2_adaptation_strategy.pdf).

Climate Change Adaptation Priority Guidelines, HI-SB2745, 26th State Legislature (2012).

*Wisconsin's Changing Climate: Impacts and Adaptation* (2011). Wisconsin Initiative on Climate Change Impacts. Nelson Institute for Environmental Studies, University of Wisconsin-Madison and the Wisconsin Department of Natural Resources, Madison, Wisconsin.

Martinez, Steve, et al. *Local Food Systems: Concepts, Impacts, and Issues*, ERR 97, U.S. Department of Agriculture, Economic Research Service, May 2010.

## Endnotes

1. Environmental Protection Agency, (2013), "Adaptation Overview," available at <http://www.epa.gov/climatechange/impacts-adaptation/adapt-overview.html>.

2. Executive Office of Energy and Environmental Affairs and the Adaptation Advisory Committee, (Sept. 2011), "Massachusetts Climate Change Adaptation Report," available at <http://www.mass.gov/eea/docs/eea/energy/cca/eea-climate-adaptation-report.pdf>.

3. Obama, Barack (October 5, 2009). Executive Order 13514 – Federal Leadership in Environmental, Energy, and Economic Performance. Office of the Press Secretary, available at [http://www.whitehouse.gov/assets/documents/2009fedleader\\_eo\\_rel.pdf](http://www.whitehouse.gov/assets/documents/2009fedleader_eo_rel.pdf).

4. "Obama Administration Releases Federal Agency Strategic Sustainability Performance Plans," Press Release, Executive Office of the President, February 7, 2013, [http://www.whitehouse.gov/administration/eop/ceq/Press\\_Releases/February\\_07\\_2013](http://www.whitehouse.gov/administration/eop/ceq/Press_Releases/February_07_2013); "Federal Leadership in Environmental, Energy, and Economic Performance," Executive Order, October 5, 2009, [http://www.whitehouse.gov/assets/documents/2009fedleader\\_eo\\_rel.pdf](http://www.whitehouse.gov/assets/documents/2009fedleader_eo_rel.pdf).

5. USDA, "Fact Sheet: USDA Regional Hubs for Risk Adaptation and Mitigation to Climate Change." Available at [http://www.usda.gov/oce/climate\\_change/USDA%20Regional%20Hubs%20Fact%20Sheet%2005052013.pdf](http://www.usda.gov/oce/climate_change/USDA%20Regional%20Hubs%20Fact%20Sheet%2005052013.pdf). (Accessed 22 September 2013).

6. Ibid.

7. Bierbaum, Rosina (2013). "A comprehensive review of climate adaptation in the United States: more than before, but less than needed." *Mitigation and adaptation strategies for global change*. 18 (3), p. 361 – 406. <http://link.springer.com.proxyau.wrlc.org/content/pdf/10.1007%2Fs11027-012-9423-1.pdf>

8. The Center for Climate and Energy Solutions identifies fifteen completed CAPs: Center for Climate and Energy Solutions (2013), "State and Local Climate Adaptation," available at <http://www.c2es.org/us-states-regions/policy-maps/adaptation>. This report also includes documents from four other states that either focus on adapting to climate change in general (Minnesota and Hawaii) or developing new drought adaptation plans in response to climate change (Colorado and Utah). Washington, D.C.'s 2012 Sustainable DC Act is not included in this analysis because it neither mentions climate change nor adaptation.

9. Ibid.

10. Climate Change Adaptation Priority Guidelines, HI-Act 286, 26th Legislature. (2012), available at [http://www.capitol.hawaii.gov/session2012/bills/GM1403\\_PDF](http://www.capitol.hawaii.gov/session2012/bills/GM1403_PDF)

11. Policies relating to agricultural policies to mitigate climate change are not included, since the report focuses on adaptation policies. Because of this focus, many biofuel policies are not included in the policy analysis because biofuels are largely framed as a substitute for fossil fuels that can reduce greenhouse gas (GHG) emissions, and not as a solution to adapt agriculture production to changing climatic conditions. "Policies" in the general sense refer to both policy recommendations and binding policies; when discussing individual policies, the distinction is made between the two types of policies.

12. Bierbaum 2013.

13. Lin, Brenda (2011), *Resilience in Agriculture through Crop Diversification: Adaptive Management for Environmental Change*, available at <http://bioscience.oxfordjournals.org/content/61/3/183.full.pdf+html>.

14. Ibid.

15. Martinez, Steve, et al. *Local Food Systems: Concepts, Impacts, and Issues*, ERR 97, U.S. Department of Agriculture, Economic Research Service, May 2010.

16. Executive Office of Energy and Environmental Affairs and the Adaptation Advisory Committee, (Sept. 2011), "Massachusetts Climate Change Adaptation Report," available at <http://www.mass.gov/eea/docs/eea/energy/cca/eea-climate-adaptation-report.pdf>.

17. Department of Ecology, (April 2012), *Preparing for a Changing Climate: Washington State's Integrated Climate Response Strategy*, available at <https://fortress.wa.gov/ecy/publications/publications/1201004.pdf>.

18. Bierbaum 2013.

19. Maine Department of Environmental Protection, (Feb 2010), "Maine Climate Change Adaptation Report," available at [http://cci.siteturbine.com/uploaded\\_files/climatechange.umaine.edu/files/Maine\\_CC\\_Adapt\\_Full\\_Report\\_2010.pdf](http://cci.siteturbine.com/uploaded_files/climatechange.umaine.edu/files/Maine_CC_Adapt_Full_Report_2010.pdf).

20. For instance, New Hampshire's plan only lists seven strategies (e.g. "maintain local agricultural lands") that require evaluating to sustain the state's agricultural and forest industries. New Hampshire Climate Change Policy Task Force, (March 2009), *The New Hampshire Climate Action Plan: A Plan for New Hampshire's Energy, Environmental and Economic Development Future*, available at [http://des.nh.gov/organization/divisions/air/tsb/tps/climate/action\\_plan/documents/nhcap\\_final.pdf](http://des.nh.gov/organization/divisions/air/tsb/tps/climate/action_plan/documents/nhcap_final.pdf).

21. Broad recommendations could also give state agencies and programs more flexibility to meet local adaptation needs policies.

22. Pennsylvania Department of Environmental Protection, (2011), *Pennsylvania Climate Adaptation Planning Report: Risks and Practical Recommendations*, available at <http://www.elibrary.dep.state.pa.us/dsweb/Get/Document-92911/27000-RE-DEP4303%20Pennsylvania%20Climate%20Adaptation%20Planning%20Report.pdf>.

23. California Natural Resource Agency, (2009), "2009 California Climate Adaptation Strategy," available at [http://resources.ca.gov/climate\\_adaptation/docs/Statewide\\_Adaptation\\_Strategy.pdf](http://resources.ca.gov/climate_adaptation/docs/Statewide_Adaptation_Strategy.pdf).

24. New York State Climate Action Council, (Nov. 2010). Interim Report, "Adapting to Climate Change," available at [http://www.dec.ny.gov/docs/administration\\_pdf/irchap11.pdf](http://www.dec.ny.gov/docs/administration_pdf/irchap11.pdf).

25. Dunnington, Gwen, (April 2010), "The Potential Impacts of Climate Change on Agriculture in Vermont," available at <http://www.anr.state.vt.us/anr/climatechange/Pubs/VTCCAdaptAgriculture.pdf>.

26. Governor's Steering Committee on Climate Change Adaptation Subcommittee, 2011, *Connecticut Climate Change Preparedness Plan: Adaptation Strategies for Agriculture, Infrastructure, Natural Resources and Public Health Climate Change Vulnerabilities*, available at [http://www.ct.gov/deep/lib/deep/climatechange/connecticut\\_climate\\_preparedness\\_plan\\_2011.pdf](http://www.ct.gov/deep/lib/deep/climatechange/connecticut_climate_preparedness_plan_2011.pdf).