Climate Change Management

Walter Leal Filho
Jesse M. Keenan *Editors*

Climate Change Adaptation in North America

Fostering Resilience and the Regional Capacity to Adapt

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Preface

North America and the Caribbean are affected by extreme weather and climate change at a variety of scales and within the context of an even greater diversity of geographies, ecologies and institutions. Whereas droughts affect the western part of the USA and Canada, the eastern portion of the continent is particularly prone to flooding and sea-level rise. Even in the Caribbean, where tropical cyclones have been the primary risk factor for generations, a persistent drought is leading to severe ecological stresses that are driving unprecedented transformations in economy and society.

According to the Fifth Assessment Report (AR5) produced by the Intergovernmental Panel on Climate Change (IPCC), recent climate variations and individual extreme events demonstrate both impacts of climate-related stresses and the vulnerabilities of exposed systems. Many climate stresses that carry risk—particularly related to severe heat, heavy precipitation and declining snowpack—will increase in frequency and/or severity in North America in the coming decades. AR5 also states that current and future climate-related drivers of risk for small islands during the twenty-first century, such as those in the Caribbean region, will include sea-level rise (SLR), tropical and extratropical cyclones, increasing air and sea surface temperatures, and changing rainfall patterns. In addition, these patterns are likely to persist in some of the most advanced urban environments in the world, including Miami, Washington, D.C., New York and Boston.

Among other things, AR5 states that adaptation to climate change generates greater benefits when delivered in conjunction with other development activities, such as disaster risk reduction and community-based approaches to development. Whether it is a sparsely populated Caribbean island or a major continental urban region, adaptation processes are increasingly be recognized as critical steps where conventional modes of consumption, production and risk mitigation are unsustainable. The above state of affairs illustrates the need for a better understanding of how climate change affects North America and for the identification of processes, methods and tools that may help countries and communities to develop an adaptive capacity. There is also a critical need to showcase successful examples of how to

manage the social, economic and political complexities posed by climate change, so that lessons can be learned and best practices may be disseminated.

This book serves the purpose of showcasing experiences from research, field projects and best practice in climate change adaptation in North America that may be useful or implemented in other countries and regions. A further aim of this book is to document and disseminate the wealth of experiences available today. Part I describes experiences on climate adaptation management in rural and urban areas, including elements related to community deliberations and the influences of policy and governance. Part II focuses on climate change and the built environment, also emphasizing aspects of planning. Part III includes a set of papers with an emphasis on adaptation, resilience and multi-hazard mitigation. Part IV puts an emphasis on information, communication, education and training on climate change. Part V entails elements related to climate change, planning and health, as well as two examples from other regions. A final chapter offers a cross-disciplinary perspective on the factors shaping North American adaptation research.

We thank the authors for their willingness to share their knowledge, know-how and experiences, as well as the many peer reviewers, which have helped us to ensure the quality of the manuscripts.

Hamburg, Germany — Walter Leal Filho
Cambridge, MA, USA — Jesse M. Keenan
Spring 2017

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About the Editors

Professor Walter Leal (BSc, PhD, DSc, DPhil, DL, DLitt, DEd) is a Senior Professor and Head of the Research and Transfer Centre "Applications of Life Sciences" at the Hamburg University of Applied Sciences in Germany and at Manchester Metropolitan University. He has in excess of 250 publications to his credit, among which ground-breaking books such as "Handbook of Climate Change Management" and others. He teaches on information, education, communication on climate change at various European universities. He has over 20 years of research experience and has a particular interest on the connections between climate and human behavior.

Professor Jesse M. Keenan (A.B., M.Sc., Ph.D., J.D., LL.M., A.M., ASCE) is a member of the faculty of the Graduate School of Design at Harvard University where he teaches courses and conducts research in resilience and adaptation science. Keenan has served as Vice-Chair of the U.S. Community Resilience Panel for Building and Infrastructure Systems under two White House administrations and as Editor of the Built Environment at climate.gov. Keenan has conducted climate adaptation research with various cities around the globe including Amsterdam, Boston, Miami, New York City (NYC), Rotterdam, Sao Paulo, Rio de Janeiro, Stockholm and Tokyo. Keenan's many publications include, "Blue Dunes: Climate Change By Design."

Chapter 1
Climate Change Adaptation in North America: A Short Review of Priorities

Walter Leal Filho

Abstract This short papers offers an overview of some of the priorities to foster climate change adaptation in North America. It is meant to outline some areas where the impacts of climate change can be better addressed, and in the context of which adaptation strategies may be implemented.

Keywords Climate change · Priorities · North America · Adaptation

Introduction

There are a few regions in the world as prepared to cope with climate change as North America. Apart from Mexico, which is still regarded as a developing country and as such as certain limitations in respect of financial resources and access to technologies, both the United States and Canada are well resourced, and hence better able to adapt, than many other countries round the world. Mearns et al. (2009) produced a regional climate change assessment program for North America.

The latest report produced by the Intergovernmental Panel on Climate Change (IPCC) contains a chapter on North America which outlines the particularities of the region, as well as outlines aspects related to its vulnerability (Romero-Lankao et al. 2014).

Even though the cause of handling the impacts of climate change equally involves action in the mitigation and adaptation fronts-both are equally important-and despite the fact that many economic, social and political aspects are associated with them (Leal Filho 2011), this short overview focuses on adaptation, being consistent with the engagement of the author in international climate change adaptation initiatives. For purposes of this chapter, climate change adaptation is perceived as processes of designing, updating and implementing strategies to take

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Table 1.1 Preparedness of North American countries to implement climate change adaptation

Item	Availability	Impacts
Technologies	High	Greater availability of tools and methods to adapt
Financing	High	Possibilities to fund large initiatives and projects
Know-how	High	Wide knowledge of techniques and methods in support of adaptive action
Documentation	High	A wide range of data, documents and materials available, which may guide adaptation initiatives
Governance	High	Real commitment from decision-makers on what needs to be done
Public awareness	Medium	A wide-but not full-public awareness on the impacts of climate change

into account and cope with the impacts of climate change, to ensure the best action required to address them is taken.

Table 1.1 outlines the reasons why North America is well suited to engage in climate change adaptation initiatives. Even though its capacity is high in most areas, some deficiencies are seen in respect of public awareness, which shows the need for concerted efforts in this field.

Consistent with this overall high degree of preparedness, both in the United States and in Canada, there is a variety of regional initiatives focusing on climate change adaptation. The U.S. Department of Agriculture via the U.S. Forest Service, for instance, produced a national roadmap for responding to climate change (USDA 2010), which describes a variety of areas where action is needed. In addition, the Wildlife Conservation Society (WSC) has undertaken the Adaptation for Conservation Targets (ACT) framework, which has been designed to "motivate collaborative, scientifically defensible climate change planning for specific landscapes or seascapes by a multidisciplinary group of scientists and practitioners". The framework entails elements of conceptual modeling, scenario-based planning, and adaptive management, with a focus on addressing climate change matters.

In addition, the Conservation Biology Institute has coordinated the "AdaptWest" scheme, a spatial database and synthesis of methods for conservation planning aimed at enhancing resilience and adaptation potential of natural systems under climate change.

A further example of a regional initiative is the Nature Conservacy's **climate adaptation case studies**. This, as the name implies, is aimed at explaining how including future climate change considerations in our project planning strengthens and advances our overall conservation investments.

In Canada, the Government is helping Canadians adapt to the challenges posed by climate change, by emphasizing the need to make adjustments in decisions, activities, and thinking because of observed or expected changes in climate, in order to reduce harm or take advantage of new opportunities (Government of Canada 2016).

Adaptation actions can be in anticipation of, or in response to the impacts of a changing climate. Examples of adaptation measures include the development of

more stringent building standards for areas where heavier snowfall is expected, or limiting development in coastal areas where sea level is projected to rise. Black et al. (2010) produced a risk-based guide for local governments in British Columbia, which was well accepted by a number of municipalities in that Province, as well as elsewhere in the country, whereas Richardson (2010) published a guidebook for Canadian municipalities. The usefulness of information and technical materials approaching risks and disasters management is well proven (Leal Filho 2013) and their availability does offer valuable support to local agencies.

Still in Canada, Bizikova et al. (2008) produced a document titled "Canadian communities' guidebook for adaptation to climate change. Including an approach to generate mitigation co-benefits in the context of sustainable development", which outlines a variety of action that can be taken, in order to foster climate change adaptation in the country. Richardson (2010) on the other hand, produced a handbook which shows some useful insights into how Canadian municipalities may adapt to climate change.

A Matter of Prioritising

There is little doubt in relation to the fact that adaptation is vital to attempts made by North American countries to cope with climate change. The noticeable shifts in average conditions (e.g. temperature, precipitations and sea level rise), accompanied by changes in climate variability and the frequency of extreme weather and climate events indicate the pressing need for solid and well defined adaptation efforts. In an important document outlining a framework for responding to climate change (USDA 2008), the USDA and US Department of Forestry describe some key areas where action is necessary.

So, in moving forward and in order to ensure duly emphasis is given to the most essential features of the climate change adaptation process, this paper defends the view that four main priority areas should be considered.

Priority 1—Reducing vulnerability and risks, by investing on changes and/or improvements in infra-structure. This may, for instance, include more sea walls in coastal areas, or better flood control instruments in cities. Such enablers foster risk reduction and help to protect exposed systems.

Priority 2—Increasing resilience by acting in the interface between physically defined hazards and their impacts on specific sectors. For instance, the negative consequences of draughts may be reduced, by modernizing water systems—especially water supply routes-, especially in rural areas.

Priority 3—Raising Awareness and improving information, education and communication on climate change. In order to yield long-term benefits, there is a perceived need to foster a better learning from past events and disasters on the one hand, and to engage the population more actively in coping with future events. Indeed, raising capacity among the population is regarded as vital to raising their capability to handle climate change (UN/ISDR 2004).

Priority 4—Preventing maladaptation by reflecting very carefully on the types and nature of any investments on adaptation. Apart from the fact that adaptation programmes which are not well reflected and considered upon are very costly, they often cause more harm than any good. Projects should be weighted not only in respect of cost-benefits under the specific circumstances at a given time when they are started, but also in terms of their long-term sustainability.

Whereas government will still play a central role in handling the impacts of climate change and in spearheading adaptation, it is vital that the communities are duly engaged.

This list of priorities is not meant to be comprehensive, nor it is meant to be hierarchical, i.e. the listed measures all bear equal relevance. But it does serve the purpose of illustrating some key areas where immediate action is needed.

Climate change is a problem which global in nature, but quite local as far as its impacts are concerned. Therefore, operationally, even though most of the climate change adaptation initiatives are coordinated by the central or regional government level, it is essential that municipalities are involved. This is so because they are uniquely placed to realise the implementation of adaptation plans, especially in respect of land use planning, management of their areas and territories (especially in coastal areas) and in terms of information, awareness raising and communication.

Conclusions

The North American region is well prepared to cope with the many challenges climate change poses to it, even though there is a constant need to monitor expected or possible impacts to human beings, to the physical environment and to private and public property and infra-structure. One lesson which can be useful to other regions in the world, is the need to anticipate the effects of climate change and taking preventive actions, before major impacts occur. In this particular field, the North American region offers many useful lessons and examples, whose replication in other parts of the world could be quite useful. This may entail setting up and implementing effective strategies to monitor, manage and reduce climate risks and increase a given community's overall resilience.

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Part I
Climate Adaptation Management in Rural and Urban Areas

Chapter 2
Community Deliberation to Build Local Capacity for Climate Change Adaptation: The Rural Climate Dialogues Program

C. Daniel Myers, Tara Ritter and Andrew Rockway

Abstract Apathy and skepticism about climate change make mobilizing collective action for adaptation difficult in rural areas of the US. This paper evaluates the potential for deliberative public engagement to overcome these obstacles through a case study of the Rural Climate Dialogues (RCD) program. A Rural Climate Dialogue (RCD) convenes a demographically and politically representative group of residents for three days of deliberation about the local impacts of climate change and about how their community can adapt. Following the Citizens Jury model, participants spend three days hearing expert testimony, deliberating together to identify elements of their community that are threatened by climate change, and devising recommendations for individual and community actions that can enhance their community's climate resilience. Drawing on case studies of RCDs in three Minnesota communities, this evaluation finds that participating in an RCD reduces skepticism about climate change and increases beliefs that the local community can and should take action. Further, these dialogues spur collective action by setting clear, public goals and building support for direct involvement from community leaders and public officials. This success suggests that deliberative public engagement can be a useful tool for adaptation planning in rural communities and other areas where apathy and skepticism are significant barriers.

Keywords Climate change adaptation · Deliberation · Public engagement · Citizens Jury · Rural climate adaptation

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Introduction

Rural areas in the United States face unique challenges in adapting to climate change. The economies of rural areas, which "have limited economic diversity and relatively high dependence on climate-sensitive sectors" (IPCC 2014, p. 1471), are particularly threatened by changes in temperature and rainfall patterns (Hales et al. 2014). Rural residents are also more likely to be dependent on carbon-intensive forms of transportation. Despite this vulnerability, a range of factors make adaptation planning difficult in rural areas. Public opinion in rural areas tends to be highly skeptical about climate change (Howe et al. 2015), and rural residents see little place for themselves in media discourses about climate change, which often treat climate change as a global issue whose primary impacts will be on urban and coastal areas (Moser 2014). Additionally, rural areas tend to have lower government capacity (McGuire et al. 1994; Hall 2008) and receive less attention from private philanthropy (Newstead and Wu 2009).

This constellation of factors create a conundrum—rural areas face some of the greatest adaptation challenges, but also the greatest barriers to mobilizing collective action to address these challenges. The Rural Climate Dialogue (RCD) program was developed by the Institute for Agriculture and Trade Policy and the Jefferson Center to provide a way for rural areas to mobilize action on climate change adaptation through a process of deliberative public engagement. In contrast with many forms of public engagement, which seek to educate or inform the public, deliberative public engagement combines education with the active involvement of citizens in decision-making. While deliberative processes include education by technical experts, the centerpiece of this form of engagement is discussion among lay-citizens about the challenges facing their community and ultimately the production of citizen-driven recommendations or findings. The Rural Climate Dialogues process builds on one model of deliberative public engagement, the Citizens Jury (Crosby and Nethercutt 2005), in which a small group of demographically and ideologically representative community members deliberate intensively for an extended period of time to produce recommendations for their community. By directly involving citizens in the adaptation planning process, the RCD program aims to overcome the apathy, skepticism, and lack of capacity that make adaptation planning difficult in rural areas.

This paper describes and evaluates the RCD model using case studies of three RCDs conducted in the rural Minnesota communities of Morris (June 2014), Itasca County (May 2015), and Winona County (March 2016). These communities were selected to reflect the economic and cultural diversity of rural Minnesota. This evaluation finds that the RCD program has contributed to local adaptive capacity by producing a series of recommendations for individual and community action that has served as a focal point for local adaptation planning, by changing attitudes about climate change and the need for action on climate change adaptation among

participants, and by helping to build networks among local groups for future action. However, the nature and degree of these contributions depends on contextual factors about the communities.

The Importance of Rural Engagement

While public engagement is important to all climate adaptation efforts, it plays a particularly important role in rural areas. Rural communities are particularly susceptible to climate change impacts on many levels. Rural communities are more likely than urban or suburban communities to have natural resource-based economies. These industries, including agriculture, forestry, and fishing, will become less predictable in the face of more frequent extreme weather events, temperature changes, droughts, floods, wildfires, and increases in weeds, diseases and other pests. As a result, rural economies based on these industries will become less stable as climate change intensifies (Hales et al. 2014).

This increased instability occurs amidst existing economic insecurity. In 2014, the rural poverty rate was just over 18%, compared to the national average of 15% (USDA Economic Research Service 2016). Rural households have lower incomes and older housing stock on average as compared to urban households (Cutter et al. 2003). This means that most rural residents spend a larger percentage of their income on energy costs and often use more energy to heat and cool energy-inefficient spaces. Rural residents will be disproportionately impacted by energy costs as heating and cooling needs change in the face of more extreme temperatures.

Though the stakes are high in rural America, support for climate action among rural residents is lower than in the general population. Environmental concern in general, and climate change concern specifically, has been found to be higher among urban than rural residents (Safford et al. 2012; Howe et al. 2015). The polarization of climate change attitudes along cultural lines can make discussing climate change difficult in these environments, as the science of climate change is overwhelmed by questions of identity and group membership (Kahan 2012, 2015). Rural engagement on climate change must confront this skepticism by providing a space where citizens can discuss the local impacts of climate change without triggering identity threat. The perspectives that arise from these conversations can form the basis for local adaptation planning and help guide state and national policy to ensure that rural voices are included in policy solutions.

This is particularly important because many of the interventions needed to address climate change will come from rural communities. According to the 2010 Census, rural America encompasses nearly 75% of the land area and 19% of the population in the United States. The rural landscape—forests, farms, and rangelands—has exceptional potential to capture carbon and generate wind, solar and other renewable energy, with the people and ingenuity to oversee the transition to a

low carbon economy. Although rural America will be disproportionately impacted by climate change, it has much to gain by undertaking climate change adaptation and mitigation efforts.

Deliberative Public Engagement

One tool to address this engagement challenge is deliberative public engagement. Advocates of deliberative public engagement argue that it is a way to both improve policy and democratize the policy-making process.[1] In contrast to forms of public engagement that focus on a one-way process of educating the public, deliberative public engagement aims to engage members of the public in a two-way conversation about important public issues. Citizens are not seen just as an audience to educate, but instead as experts in their own right whose values and situated knowledge are important inputs into the policy process. Deliberative public engagement aims to create situations where citizens can learn from experts, from each other, and come to collective decisions through (generally face-to-face) discussion.

Often, deliberative engagement takes the form of mini-publics, in which "citizens representing different viewpoints are gathered together to deliberate on a particular issue in small groups" (Grönland et al. 2014). While mini-publics take a variety of forms, all contain some form of the following three elements: *education* about the issue under discussion, *deliberation* in which citizens discuss the issue in a structured fashion, and *recommendations* agreed to by the forum's participants, which are sometimes actual policy decisions but more frequently a report or series of findings that are treated as inputs into a broader policy process. Mini-publics usually involve face-to-face interaction within an intensive, but time-bound period (e.g. a few hours or days). Proponents of mini-publics argue that education and deliberation with a diverse group of fellow citizens produces "refined" public opinion, and thus adds democratic legitimacy to policy-making processes (Fishkin 2009). This is particularly true on highly polarized issues where citizens are unlikely to talk with others who hold different views in the normal course of political life, or on technically complex issues where even highly informed citizens cannot be expected to hold well-reasoned opinions (Warren and Gastil 2015).

Climate change adaptation—an issue that is complex, poorly understood in the mass public, and politically divisive (Moser 2014)—would thus seem to be an ideal candidate for deliberative public engagement.[2] Indeed, a number of existing studies report efforts to include deliberative public engagement as part of adaptation

[1]See, for example, Fishkin (2009) and Myers and Mendelberg (2013) in political science, Gastil and Black (2007) in communications, Forester (1999) in planning, and De Vries et al. (2011) in health policy.

[2]For a related argument see Brulle (2010).

planning processes (e.g. Few et al. 2007; Milligan et al. 2009; Heberle et al. 2014; Phadke et al. 2015). Notably, these examples all deal with adaptation in urban or coastal areas. Nevertheless, they contain important lessons for deliberative engagement about climate adaptation in general. Since climate change is an issue where a small number of citizens are highly engaged, recruitment for deliberative fora must be conducted carefully in order to include a range of participants, not merely the usual activists (Few et al. 2007). The complexity of climate change adaptation means that fora must be carefully designed to allow for meaningful discussion of technical issues among non-experts (Milligan et al. 2009; Sheppard et al. 2011). Engagement neither begins nor ends with the deliberative forum itself; instead the process of organizing and conducting the forum should be seen as an opportunity to build trust and social capital around the issue to drive future action (Heberle et al. 2014; Phadke et al. 2015). Perhaps most importantly, deliberative engagement must put real power over the forum's outcomes in the hands of citizen deliberators (Few et al. 2007). Processes that are structured to produce a predetermined conclusion produce backlash against adaptation planning efforts; organizers need to support citizens' recommendations even if these decisions "get it wrong" from the perspective of technical or government elites.

To address these challenges, the Rural Climate Dialogues were designed based on the Citizens Jury model of deliberation (Crosby and Nethercutt 2005). A Citizens Jury provides citizens the opportunity to study an issue intensively over a number of days, deliberate together with a diverse group of their peers, and develop solutions to challenging public issues. The recommendations of a Citizens Jury provide insight for policymakers and the broader public into the informed opinions and priorities of a community. Citizens Juries have been used for a range of purposes including evaluating political candidates, proposing reforms for state electoral processes, assessing health care reform proposals, and evaluating ballot initiatives (Crosby and Nethercutt 2005; Knobloch et al. 2013; Munno and Nabatchi 2014).

A Citizens Jury consists of a randomly selected and stratified group of participants that, as nearly as possible, resembles the demographic and attitudinal makeup of their community. This includes political identification and attitudes towards the issue under discussion; for deliberation about climate change this means recruiting a group that includes Democrats, Republicans, and Independents as well as those who believe in anthropogenic climate change and those who deny or are skeptics of it. The ideal jury is large enough to reflect the demographic and cognitive diversity of the community, but not so large jurors are unable to engage in productive deliberation with one another; most are in the range of 15–24 jurors. To limit barriers to participation and ensure that jurors reflect a community's varying levels of engagement on the issue, jurors are paid a stipend and receive reimbursement for travel and childcare costs. This recruitment strategy ensures the Citizens Jury serves as a microcosm of community perspectives, a key element in the forum's claim to democratic legitimacy.

Citizens Juries usually deliberate in a concentrated, intensive fashion, generally meeting eight hours a day for several days. A jury begins with introductory

exercises intended to help jurors get comfortable with each other and with the process of deliberation. During the first several days jurors alternate hearing testimony from a diverse set of experts on the issue with deliberating in small groups about the testimony. Experts are typically instructed to provide only background information on an issue or topic to inform the jury's deliberation without unduly biasing that deliberation. After an expert testifies, jurors deliberate among themselves with the goal of identifying those elements of the information provided that are most relevant to the question facing their community, as well any lingering questions or doubts about the information provided. Once expert testimony concludes, participants draw on the information presented as well as their collective knowledge to develop recommendations that address the issue.

The Citizens Jury process of public deliberation allows non-expert community members to influence policy and community action. The structure of expert testimony and the educative nature of the deliberation allow jurors to make informed recommendations on behalf of their community. The diversity of participants also lends broader legitimacy to the recommendations. Since many rural municipalities lack the technical and financial resources to adequately explore the local impacts of climate change and develop an adaptation plan in response, the work of empowered citizens can extend local governmental capacity and help diffuse tension associated with top-down approaches to addressing climate change.

The Rural Climate Dialogues Process

The Rural Climate Dialogues aim to galvanize leadership in rural communities by connecting diverse citizens and community groups and create a space for rural citizens to directly influence climate policy at the state and national levels by identifying key challenges facing their communities. To achieve these aims, staff pursue three distinct phases in the Rural Climate Dialogues process: networking and relationship building to form community coalitions, Citizens Jury-style public deliberation to produce climate resilience recommendations, and sustained community organizing to support implementation of actions and projects identified through deliberation.

The first phase of the RCD process aims to build community support for action on climate change and extreme weather. Staff meet with a diverse cross-section of local leaders from government, education (K-12 and higher education), business, and community organizations to discuss the most pressing issues in the community and to identify connections between their work and the challenges prompted by climate change. Staff form an ad hoc advisory committee of interested leaders who help select the issues most important for the Citizens Jury in their community to consider, identify speakers to address those issues, and begin forming an ongoing coalition of leaders and organizations committed to advancing the work of the

Citizens Jury. This phase of the process can vary in length, but usually takes three to eight months.

The next phase, engaging the public in deliberative dialogue, serves as the creative focal point of the Rural Climate Dialogues process. The Citizens Jury model, described above, engages eighteen people from the community to study, discuss, and outline courses of action to address the local impacts of extreme weather and climate change.

To recruit a diverse group of participants, five thousand randomly selected individuals from the community are sent invitations to participate in the dialogue. Interested individuals apply by answering a questionnaire, also available online and over the phone, to assess demographic and attitudinal characteristics. Direct mail recruitment is supplemented with online advertising through Craigslist and Facebook, media releases, and word of mouth. Applicant data is anonymized and aggregated in a potential pool of participants. Eighteen jurors and three alternates are selected from this pool to reflect the demographics of the community/county, including political affiliation and attitude toward climate change. Individuals unable to participate are replaced with an applicant closely matching their demographic and attitudinal profile.

The three-day Citizens Jury convenes for eight hours per day over a Thursday, Friday, and Saturday. Over the course of three days, participants are asked to set priorities in three categories: challenges pertinent to climate change that pose a threat to the long-term well-being of the community, opportunities to strengthen the community in the face of climate change, and action steps to address challenges and realize opportunities. This framework helps participants and the community set clear, actionable priorities without being overwhelmed by the scale of the climate change problem. Figure 2.1 shows the schedule for the Winona RCD; while the list of expert speakers was slightly different for each jury, the overall schedule was similar.

At the start of the jury, participants familiarize themselves with discussion guidelines and the dynamic of group deliberation by engaging in a simulation exercise focused on a public challenge a fictional community faces. The challenge encourages participants to think through risk mitigation in the face of uncertainty while practicing discussion skills. In small groups, participants assess information and develop a course of action for the fictional community. Each small group shares their course of action and describes their process for arriving at the recommendation. Participants are also asked to share their feelings about the process of deliberation. Importantly, the public challenge used in this exercise is not related to climate change. This gives jurors a chance to learn how to work as a group in a low-stakes environment where the political divisions that might become salient in a discussion about climate change are not relevant.

During the remainder of the first day and most of the second day the event alternates between expert presentations related to local climate change and extreme weather and small group deliberation about the information presented by these experts. To frame the overall discussion, the first presentation focuses on local weather and climate trends, describing the magnitude and effects of change in the

WINONA COUNTY CLIMATE DIALOGUE

Thursday, March 3rd – Introduction, Issue Expert Testimony, Deliberation

8:00am-12:00pm: Introductions, practicing the deliberative dialogue process

12:00pm-12:50pm: Lunch for participants

1:00pm-2:50pm: WEATHER TRENDS (*Mark Seeley, University of Minnesota climatologist and meteorologist*), idea and question generation, Q&A, debrief

2:50pm-3:35pm: ENERGY (*Lynn Hinkle, MN Solar Energy Industry Association & Chris Meyer, SE Clean Energy Resource Team Coordinator*), idea and question generation, Q&A

3:50pm-5:00pm: Speaker debrief & wrap up work

Friday, March 4th – Issue Expert Testimony, Deliberation

8:30am-8:50am: Morning introductions

8:50am-11am: WATER (*Josh Eash, Regional Hydrologist with Upper Mississippi River Fish and Wildlife Refuge & Jennifer Biederman, Professor of Biology at Winona State University*), idea and question generation, Q&A, debrief

11:00am-12:15pm: INSURANCE (*Mark Kulda, Insurance Federation of Minnesota*), idea and question generation, Q&A, debrief

12:15pm-1:15pm: Lunch for participants

1:15pm-2:30pm: PUBLIC HEALTH (*Bruce Snyder, University of Minnesota*), idea and question generation, Q&A, debrief

2:30pm-3:45pm: AGRICULTURE *Jake Overgaard, University of Minnesota Extension - Winona County Agriculture Production Systems Specialist*), idea and question generation, Q&A, debrief

3:45pm-4:40pm: Making connections between presentations

4:40pm-5:00pm: Wrap up work

Saturday, March 5th – Final Recommendations for Neighbors

8:30am-9:00am: Morning introductions

9:00am-9:50am: Drafting

10:05am-11:00am: Choosing top challenges

11:00am-12:00pm: Choosing top opportunities

12:00pm-12:45pm: Lunch for participants

12:45pm-3:10pm: Identifying: What should our neighbors know?

3:10pm-5:00pm: Identifying: What should be done?

5:00pm: Adjourn

Fig. 2.1 Winona County climate dialogue schedule

historical record. Participants deliberate about which information from the presentation is most important to share with neighbors in understanding climate change, prioritizing five to ten key "facts" to include in their final report. The next presentations, five in total, focus on specific topics relevant to the community and the impacts of climate change and extreme weather on each. Topics vary by

community, but can include agriculture, public health, local infrastructure, water resources, energy systems, insurance, wildlife and habitat, tourism, and recreation. As shown in Fig. 2.1, local experts, such as professors at local universities or agents of the local agricultural extension office, are used whenever possible. Each topic presentation is followed by small group deliberation to discuss challenges, opportunities, and action steps and evaluate the trade-offs in pursuing one course of action over another.

The third and final day involves extensive deliberation in small and large groups to produce a final report for their community. The day begins with an assessment of the top challenges and opportunities posed by climate change, and continues in the afternoon with discussion of the actions that are most critical to address these as well as the information that is most important to transmit to other residents of the community. From the list created over the first two days, participants consider trade-offs involved in each challenge, opportunity, and action before voting to identify priorities for the community. These priority lists form the bulk of the information participants share with their neighbors. Participants are also asked to assess whether actions are best taken by individuals or by the community collectively. Finally, participants draft a brief statement for their neighbors outlining their experience in the dialogue process, the reasons for selecting certain challenges/opportunities/actions over others, and the importance of acting to address extreme weather and climate change.[3] Importantly, the Rural Climate Dialogues process does not necessarily aim to build a unified consensus around how the community should adapt to climate change; instead, the final recommendations reflect a range of options for actions that reflect the community's diversity. The difference in values and opinions add strength to the overall recommendations, providing varied foci for diverse actors and "stakeholders" to coalesce behind when thinking about and working toward local adaptation efforts.

While drafting this statement marks the end of the Citizens Jury, it serves as the beginning of the next stage of engagement. Following public deliberation, participants and community leaders identified through pre-Citizens Jury relationship building are empowered to work on the action steps together. With assistance from project staff, community leaders, jury participants, and other community members seek and share resources to implement community action recommendations. High School students develop community-based service learning opportunities to act on the priorities they identified. Through peer-to-peer networking, community members share climate change information with their neighbors and friends, using the Citizens Jury report as a starting point for deeper conversation and movement

[3]Though the community jury is the main public deliberative activity of the Rural Climate Dialogues process, high school students are also engaged in deliberation to advance the perspectives of young people in the community. In an abbreviated deliberative process over the course of many class periods, students hear from experts and develop their own priorities for addressing climate change. Depending on the timing of student deliberation, their priorities are either presented to the community jury or incorporated into the community report.

towards community action. Post-jury organizing work in each of the three Minnesota communities are discussed in detail in the following sections.

Results of the Process

To evaluate the success of the RCD process this section looks at three different kinds of outcomes. The first is the impact of the deliberative process on individual participants, in terms of changes in individual attitudes as well as participants' satisfaction with the deliberative process. This is examined by testing for change in participants' responses to pre- and post-jury surveys. The second outcome is the substantive content of the jurors' conversations and recommendations, evaluated through a thematic analysis of the final recommendations produced by the juries that draws together themes common to the three juries while also noting differences across them. The final outcome is post-jury organizing, evaluated based on the extent to which deliberative engagement served to spur future community action, and the factors that might contribute or detract from deliberative success.

Quality of Deliberation and Impact of Process on Participants

To evaluate jurors' perceptions of the quality of the process, as well as the effect of the jury on participants' attitudes, all jurors completed a pre-deliberation survey at the start of the first day as well as a post-deliberation survey at the end of the final day. This section reports mean responses to questions about deliberative quality on the post-deliberation surveys, and test of attitude change using paired one-sided *t*-tests comparing pre-deliberation responses to post-deliberation responses.

As is commonly found in studies of deliberative public engagement (see Myers and Mendelberg 2013, p. 709), most deliberators reported being highly satisfied with the citizen jury process. The post-deliberation survey measured perceived deliberative quality using a five-item index drawn from Esterling et al. (2015), where each item asked participants to agree or disagree with a statement about the event, where agreement indicates a positive evaluation of the event. On a 5-point scale where 5 indicates strong agreement the average score on the index was 4.52, showing that deliberators were highly satisfied with the quality of discussion at the event. Focusing on specific aspects of the process, jurors were highly satisfied with the information presented, with a mean response of 4.3 on a 5-point scale from "very unsatisfied" to "very satisfied," and with the work of the discussion moderators, with a mean response of 4.3 on a 5-point scale from "very ineffective" to "very effective" on a three-item scale. Jurors reported high levels of agreement with their groups' recommendations (mean response of 4.2 on a 5-point strongly agree-strongly disagree scale), and also agreement with the statement "I can live with the recommendations produced at this meeting, including any that I disagree

Table 2.1 Effect of Citizens Jury on support for action

Who?	Can take action		Should take action	
	Pre-deliberation	Post-deliberation	Pre-deliberation	Post-deliberation
Myself	**3.3**	**4.2**	**3.6**	**4.3**
Community	**3.9**	**4.4**	**3.9**	**4.4**
Local government	**3.8**	**4.3**	4	4.2
State government	**3.9**	**4.4**	**4.0**	**4.4**

Bolded numbers indicate a statistically significant difference between pre- and post-deliberation measures (1-sided *t*-test, $p = 0.05$)

with" (mean response of 4.4). Asked how much they agreed or disagreed with the statement "I would participate in an event like this again" all but one participant agreed or strongly agreed, with 44% agreeing and 53% strongly agreeing.

Participating in the event significantly increased participants' expectations that climate change would have an impact on their communities. Both pre- and post-deliberation surveys asked how likely it was that their community would see an increase in the number of extreme weather events and major shifts in climate patterns in the coming years a 5-point scale from "very likely" to "very unlikely." The mean response to the question about extreme weather increased from 3.9 to 4.4, while the mean response to the question about climate patterns increased from 3.8 to 4.3; both changes are statistically significant ($p < 0.001$).

Stronger beliefs that climate change would have an effect on their communities was accompanied by increased support for action at the individual, community, and state level. Participants were asked whether they agreed or disagreed with the statements about whether four different entities can take action to address changes in climate as well as whether these entities should take action. Responses were on a five-point scale from "strongly disagree" to "strongly agree." Table 2.1 shows the result. Belief that action is possible as well as support for action increased for all four entities, with the strongest effect at the individual and community level.

Themes and Recommendations from Jury Deliberation

To summarize the substance of jurors' recommendations for adaptation in their communities team members conducted a thematic analysis of the final recommendation documents produced by the three juries. Two team members independently reviewed the final recommendations produced by all three juries, noting commonalities as well as differences across these documents. They then collaborated to produce a final list of themes that both observed in all three communities, and that might thus shed light on the adaptation priorities in rural communities more generally.

Jurors in all three initial Climate Dialogues shared common assessments of the major challenges and opportunities presented by climate change.[4] In each community, participants highlighted the critical importance of their local and regional natural resources base as drivers of economic activity and local quality of life. Recommendations focused on managing land-intensive activities (like agriculture and forestry) by introducing diversity into those systems to both add resilience in the event of extreme weather "shocks" and to provide data to evaluate the success of these changes as the overall climate continues to change. In Morris, jurors were concerned with the susceptibility of monoculture farming to climate change and highlighted the opportunity to "sustain and strengthen [our] agricultural economy" by introducing "diversity in farming" that develops new businesses and supports the interests of younger generations of farmers. In Itasca County, jurors recommended the community "manage forests so that they're more adaptable in the face of changing conditions" by evaluating native species and non-native species in areas with climate conditions similar to those projected in Itasca, by thinning dense pine forests, and by replacing ash trees susceptible to pests. Winona County jurors proposed "adopting agricultural best management practices," like "planting perennials and forages," introducing buffer strips, and planting "pollinator habitat, native plants, and prairie grasses" to improve water quality and reduce soil and nutrient loss while "maintaining production and profitability" for farmers.

Jurors also emphasized local water resources as a "canary in the coal mine" of unsustainable practices that threaten drinking water supplies, industrial and agricultural water use, habitat degradation, and more. For each community, water quality and quantity serve as highly visible markers of progress toward or regression away from sustainable activity. Winona County jurors noted "high intensity precipitation events may lead to short-term increases in water temperature, higher magnitude flooding, erosion, runoff of sediments and pollution, and degraded stream habitat for coldwater fish and other aquatic invertebrates." Jurors in Itasca County prioritized the impact of extreme events on "the life of capital assets" and "operational disruptions for public infrastructure." All three communities recommended actions related to green stormwater infrastructure, including "ecosystem restoration" (Winona County); "reduc[ing] imperviousness and allow[ing] water to infiltrate into the ground, … adapt[ing] stormwater infrastructure to hold higher volumes, and … maintain[ing] riparian buffers and forest cover, using natural features that slow or retain water" (Itasca County); and "us[ing] water channeling and drainage … and, where possible, captur[ing] water for other uses" (Morris) that closely reflected local ecological and economic features.

Finally, jurors shared the assessment that others in the community, including elected officials and other policymakers, lack adequate understanding of the threat presented by climate change. Their recommendations focused on the need for community education efforts to expand climate change awareness. They also

[4]For the full list of findings and recommendations from each jury, see http://www.ruralclimatenetwork.org/content/rural-climate-dialogues.

promoted the need for broader decision making authority, including through better public participation processes, to allow for more voices and perspectives to shape policy and community action. Morris jurors cited "the lack of education on these issues overall, particularly among public officials who are responsible for advocating change to the general public, undermines the ability to make changes." They recommended "building and reinforcing community relationships through discussion," "involving social and local media and others in promoting sustainable and energy-efficient practices and habits", "implement[ing] discussion of climate change into K-12 education," and "hold[ing] town meetings where government officials, agricultural producers, utility providers, human services, and the public can generate and discuss new ideas so voters and consumers can make more informed decisions." Jurors in Itasca County noted that "information is power," "information [needs to be] accessible," and "decision-makers at all levels—including individuals, government, and businesses—need to be informed and engaged concerning how changes in climate affect our natural resources and economy." Jurors in Winona County recommended supporting "local organizations [that] can provide community members with resources to help successfully implement [action] ideas," as well as research and outreach efforts specific to each priority topic area.

Post-jury Organizing

Despite much common discussion around issues of land use, water resources, and public education, the organizing efforts that developed from the jury recommendations led in unique directions for each community. Organizing is an ongoing process and the long-term effects of this organizing should continue for several years to come. This section reports the initial outcomes of post-jury organizing in Morris and Itasca County which were held roughly two years and one year, respectively, prior to this writing. Organizing after the Winona jury, held just a month prior to this writing, shows promise but is at a very early stage.

In Morris, jury recommendations helped shift the thinking of a skeptical City Manager, who took to heart the jury's encouragement to strengthen community resilience around climate threats. In particular, the City of Morris is exploring new methods of managing stormwater and generating local renewable energy as an economic driver. Toward the latter point, the City Council signed a climate protection technical assistance agreement with the City of Saerbeck, Germany to outline opportunities for Morris to develop and sell renewable energy generated locally. The agreement was hailed as "unprecedented" and "unlikely to happen without the Dialogue" by community members and other public officials. The City of Morris is also installing energy efficiency improvements within public buildings and on public streets. Other community members are helping to expand awareness of climate change in the community by pursuing meetings with neighbors, hosting