

VERMONT'S ROADMAP TO RESILIENCE

Preparing for Natural Disasters and the
Effects of Climate Change in the
Green Mountain State



INSTITUTE FOR
Sustainable
Communities

what's possible



INSTITUTE FOR
Sustainable
Communities

Resilient Vermont

what's possible



The Project:

The Institute for Sustainable Communities, working closely with key stakeholders from state and local governments, businesses and nonprofits, is leading the Resilient Vermont Project to help make Vermont a model of community, economic, and environmental resilience.

The Challenge:

Vermonters recognize that our changing world and changing climate are bringing about new and unprecedented challenges. Vermont was hard hit by flooding in 2011, including unprecedented lake flooding in the spring and the catastrophic impacts of Tropical Storm Irene on August 28th. In the aftermath of these disasters, Vermont is now working to develop an integrated, long-term strategy for resilience – one that weaves together state, regional and local initiatives, and better equips the state to prepare for, respond to and bounce back from future climate impacts and the natural disasters that we know will come.

The Opportunity:

The Resilient Vermont project is a stakeholder-driven process to identify practical steps to reduce our vulnerabilities and minimize the risks to our citizens, our communities, our economy and our environment. The challenges ahead are great and will need to be met with strong leadership, partnership and commitment – core characteristics of a more resilient Vermont.

www.resilientvt.org

With generous support from:

High Meadows Fund
Jane's Trust
Gisela Gamper

The Lintilhac Foundation
The WaterWheel Foundation
ISC's Climate Innovation Fund



INSTITUTE FOR
Sustainable
Communities



...being resilient does not merely mean 'battening down the hatches'. It means considering both the risks and opportunities that may emerge in an uncertain future. ”



Since Tropical Storm Irene, our country has continued to experience more frequent and unusual weather, from catastrophic events like Hurricane Sandy and droughts in the West to more subtle changes in growing season and precipitation patterns. These changes are driving an increasing interest in the topic of resilience.

While the term resilience is used in many ways, it's important to remember that being resilient does not merely mean "battening down the hatches" or strengthening resistance to harm. It means considering both the risks and opportunities that may emerge in an uncertain future. Even as we work to prevent catastrophic impacts, we must always be aware of opportunities to benefit from the changing landscape. Our goal should be to help communities become stronger as well as better prepared.

The Resilient Vermont project has been a terrific opportunity for us to learn about resilience from our neighbors and friends in Vermont, where the concept of a sustainable community began for ISC. We are committed to helping our home state move forward towards resilience. Vermont can seize the opportunity to use our small size, strong social fabric, and deep-rooted commitment to citizen engagement to better prepare for the changes to come.

George Hamilton
President
Institute for Sustainable Communities

Acknowledgements

Our work on this project has benefited from the help of numerous organizations and individuals who have shared generously of their time, their knowledge, and their perspectives.

We would like to thank those who have funded this project, including The High Meadows Fund, Jane's Trust, The Lintilhac Foundation, The WaterWheel Foundation, Gisela Gamper, and ISC's Climate Innovation Fund. We appreciate the support provided by Sugarbush Resort, which has hosted our three stakeholder convenings. This project has been immeasurably enhanced by our partnership with the Vermont Natural Resources Council, our collaboration with the Vermont League of Cities and Towns, and the assistance of the Consensus Building Institute. We appreciate the insights and resources shared by Gavin Smith of the University of North Carolina Center for the Study of Natural Hazards and Disasters, who has been working with Governor Shumlin's Cabinet since 2011.

Many state agencies have provided staff time and resources to this project, including (but not limited to) the Agency of Administration, the Agency of Agriculture, the Agency of Transportation, the Agency of Commerce and Community Development, the Agency of Natural Resources, the Public Service Department and the Department of Emergency Management and Homeland Security. The active participation of many agency heads, commissioners, and deputy directors has given us excellent insights into the challenges and opportunities faced by state government. A number of Vermont's legislators have made time to meet with us and participate in Resilient Vermont events, and we are grateful for their time and experience.

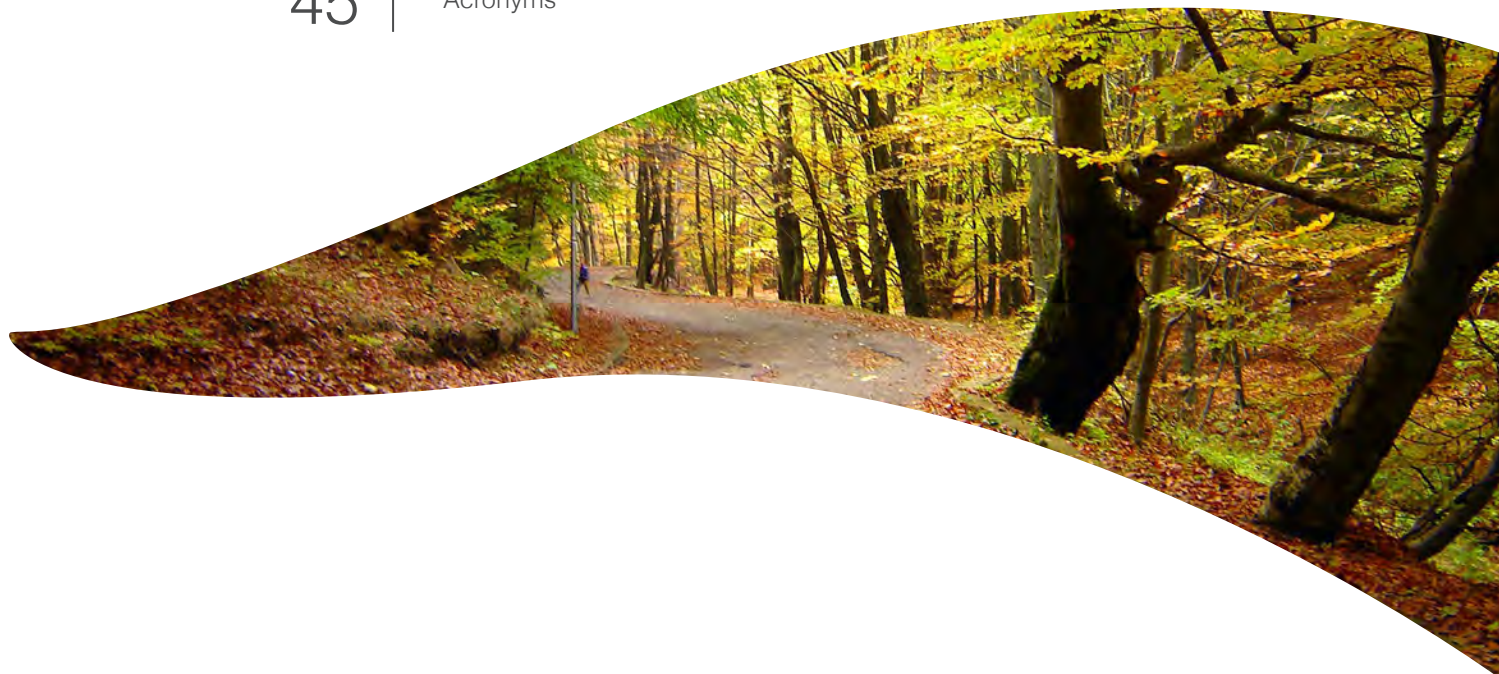
Regional and municipal officials have played a key role, sharing their experiences with Tropical Storm Irene as well as their knowledge of the daily challenges that face boards and commissions as they seek to make and implement good policy. Their insights have been invaluable. We have also benefited from the perspectives of environmental leaders and groups working to preserve Vermont's landscape and natural assets.

Many of Vermont's social service organizations, particularly those engaged in Irene recovery, have provided a wealth of information and perspective about the challenges faced by our most vulnerable Vermonters and the strength of our community fabric. We deeply appreciate their participation, knowing how very hard it can be to take time from meeting urgent needs to work on long-term planning activities.

Business leaders have informed and shaped this conversation as well. From the early and ongoing participation of major business leaders like Mary Powell of Green Mountain Power, Win Smith and Adam Greshin of Sugarbush, and Susan Zucker of Agri-Mark, to the critical insights provided by Vermont Businesses for Social Responsibility, the Vermont Business Roundtable, the Vermont and Lake Champlain Regional Chambers of Commerce, and a number of other economic development leaders. This has truly been a public-private process with many voices, and far stronger for that.

Table of Contents

3	Executive Summary
4	Introduction
10	Know Our Risks
17	Elevate & Integrate Emergency Management
24	Align Rules & Investments for Stronger Communities
35	Working Together & Learning Together
41	Recommendations
43	Next Steps for Implementation
45	Acronyms



Executive Summary

In 2012-2013, the Institute for Sustainable Communities (ISC) led the Resilient Vermont Project to develop priority recommendations for resilience to climate change. This project stemmed originally from the experience of Tropical Storm Irene and flooding in the spring of 2011, but these represent just one part of the profound changes we can expect with a changing climate. We need to be prepared for a range of scenarios.

The Resilient Vermont Project used stakeholder workshops, forums and interviews, review of reports and data on climate change, lessons learned from recent natural disasters, and the input of ISC staff to develop priority recommendations. We divide the recommendations into four categories:

Know Our Risks – Vermont needs to be well informed about risks posed by a changing climate and also needs to make information about those risks available in formats that can be utilized by communities and individuals as they plan for the future.

Elevate and Integrate Emergency Management – The work to plan, prepare for, respond to and recover from disasters should receive attention at all times, not only in the aftermath of a disaster, and shouldn't be isolated within one department, division or local organization.

Align Rules and Investments for Stronger Communities – We know our state's vulnerabilities and can predict increasing risks with climate change, but we have a system of incentives, rules, and frameworks for decision making that often favor inaction over proactive mitigation of climate-related hazards. We need to structure rules and direct our investments towards greater resilience.

Work Together and Learn Together – The challenges Vermont faces in establishing resilience are complex, they reach across sectors and across jurisdictions, and require collaboration and continuous learning. We need to build networks, programs, and engagement strategies to ensure that happens.

This report elaborates on these four areas with twenty-three specific recommendations.

The process of bringing stakeholders together to develop these recommendations has itself given us a head start on some of the findings. Many groups sprang up in the aftermath of Tropical Storm Irene to deal with resilience, in addition to organizations and individuals already taking on that challenge. The Resilient Vermont Project gave all of these players an opportunity to come together and share their ideas for future action while building a shared vision for what a resilient Vermont would look like. It improved communications from local to regional to state. It reaffirmed some things that already work and should serve as a base for future action. We recommend building on the momentum of statewide collaboration through establishing a Vermont Strong Network for resilience.

A resilient Vermont will be better prepared for, and able to more effectively manage and bounce back from natural disasters and climate-related shocks. However, the particular elements of this resilience will always be evolving, as new information or technology or circumstances shape Vermont's best available strategies. The recommendations in this report set up systems that allow us to do better today and continue to strengthen resilience into the future.

Introduction



This report is about building resilience to natural disasters and the changes we'll experience due to climate change.

The Resilient Vermont Project is a collaborative effort between the Institute for Sustainable Communities (ISC), the State of Vermont and several other partners to develop priority recommendations for next steps in resilience to climate change. It also cuts across all sectors and affects every Vermonter. Our findings suggest action in four areas:

Know Our Risks – Vermont needs to not only conduct the risk assessment to be well informed about risks posed by a changing climate, but also fully utilize the data we already have by making information easily accessible, in formats and tools that are useful to communities and individuals as they plan for the future.

Elevate and Integrate Emergency Management – The work to plan, prepare, respond to and recover from disasters is ongoing. It shouldn't receive attention only in the immediate aftermath of disaster and it shouldn't be isolated within one department, division or local organization. Vermont needs to elevate emergency management as critically important at all times, and integrate it throughout local, regional and statewide work.

Align Rules and Investments for Stronger Communities – We know that our state is vulnerable to climate change, and that our risks grow as the climate becomes more unstable. Yet, we also have inherited a system of incentives, rules, and frameworks for decision making that don't reflect this reality. We need to structure rules and direct our investments towards greater resilience and create disincentives for actions that increase vulnerability.

Work Together and Learn Together – The challenges Vermont faces in establishing resilience are complex, they reach across sectors and across jurisdictions, and require collaboration and continuous learning. It is easy for communications and collaboration to break down, even in a small state like Vermont, and we need to remain proactive in continuing to work, and learn, together.

The recommendations presented here reflect the voices of the over 400 Vermonters who participated in our process, our review of research into Vermont's climate future and on adapting to climate change generally, our review of lessons learned from past extreme weather impacts, and the expertise and perspective that ISC has acquired through our work in the U.S. and internationally. This report gives an overview of what we learned from these sources and distills that information into clear next steps. More background information is available from www.resilientvt.org.

Resilience in Vermont

The Resilient Vermont Project was initiated largely in response to weather events in 2011 – the unprecedented spring flooding and Tropical Storm Irene on August 28, 2011. As we wrote in our introduction to the draft recommendations presented at our final workshop, these experiences were “... shocking, inspirational and sobering. Shocking, because of the devastation to life and property and the broad scope of the damage, affecting every aspect of day-to-day life and work for tens of thousands of Vermonters; inspirational, demonstrating the depth and strength of Vermont’s human resources, community spirit, and willingness to work long and hard; and sobering, because we now have some sense of what lies ahead, and how prepared we are to meet the future.”

The other events of 2011 brought the threat of climate change into focus. However, there is increasing recognition that this is part of a larger trend. As much as we can learn from our experience, we also need to be looking forward and anticipating what lies ahead. The next major storm will not be another Irene. We need to build resilience in all areas of the state and need to recognize potential climate impacts beyond flooding. Vermont must strengthen its capacity to respond to and recover from a variety of potential challenges, including: wildfires, drought, severe winter storms, widespread power outages, and a rapid increase in fuel costs.

Vermont does not exist in isolation. Our country has continued to experience more frequent and unusual weather, from catastrophic events like Hurricane Sandy and droughts in the West to more subtle changes in growing season and precipitation patterns. These challenges drain the resources available to any one state to address the impacts of climate change.

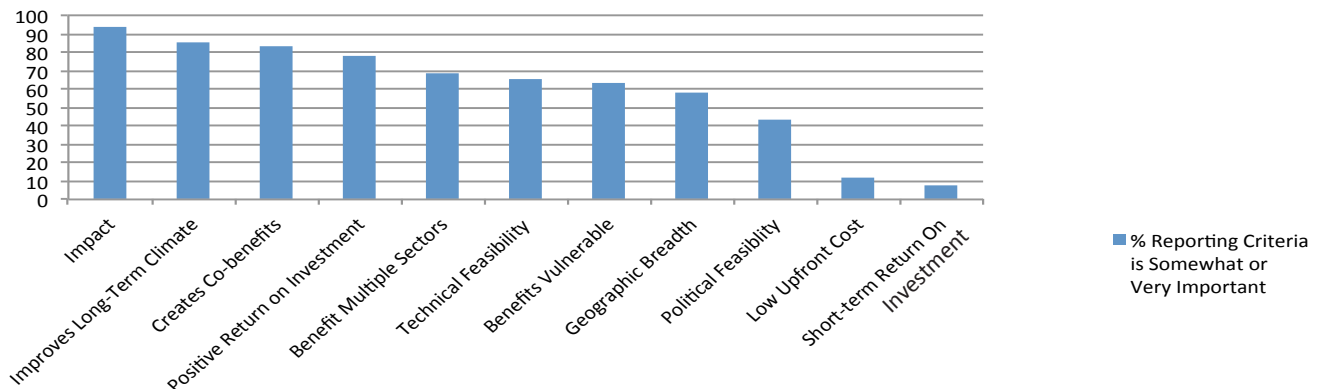
A Resilient Vermont:

A resilient Vermont is better prepared for and able to more effectively manage and bounce back from natural disasters and climate-related shocks, and the risks they pose to our economy, environment, and social well-being.

A resilient Vermont focuses on both proactively reducing our vulnerabilities and improving our response and recovery, to ensure that we are continually strengthening our resilience.

We must be resilient at every level – from individual residents, households, and businesses and neighborhoods, to the entire community and state. There is a shared sense of responsibility for resilience at every level and across the public, private, and nonprofit sectors.

ISC asked 60 stakeholders to tell us what criteria they would use to prioritize actions. The following shows how many people ranked these criteria as somewhat or very important.



This set of challenges means that we must be proactive in identifying and managing risks, reducing our vulnerabilities, and improving our response to climate change and natural disasters. **Because our climate is no longer in a business as usual scenario, we can't be either.** We must look at our strengths, such as community engagement and a history of progressive work on climate-related issues, and build from them. At the same time, we must acknowledge our weaknesses and begin to work on them, as well.

The overriding goal is to help communities become stronger, better prepared, better able to recover quickly from climate shocks and better able to maintain resilience over time.

To achieve our goal, our recommendations focus on system-wide changes in how we create resilience. We must become resilient at every level, from individual residents, households, and businesses, to the entire community and state. However, we need to put in place structures to support better planning, preparedness, risk assessment, and collaborative action at the community, regional, and state levels. This report does not offer advice for individual households or businesses. Guidance at this level would be an outcome of actions recommended in the report, but is not achieved directly by the report.

We also recognize that actions we take to decrease our greenhouse gas emissions and our dependence on fossil fuels not only reduce Vermont's contributions to climate disruption, but also make us stronger in the long run, poised to succeed in a low-carbon future. Our recommendations support that goal, but do not go into detail on our state's ongoing efforts to decrease fossil fuel dependence and greenhouse gas emissions. Much of this work is happening under the leadership of the Vermont Department of Public Service, the Climate Cabinet and the Vermont Energy Action Network. We strongly endorse the work happening in this area and are not putting forward additional recommendations with regard to greenhouse gas emissions.

Finally, we need to avoid thinking of resilience as a static solution. Our strategies will be modified as new information becomes available, experience informs better ways of doing things, and innovation introduces previously unconsidered possibilities for our climate change response. As ISC President George Hamilton says "...being resilient does not merely mean 'battering down the hatches'. It means considering both the risks and opportunities that may emerge in an uncertain future."¹ This report outlines ways to improve our ability to assess risks and identify, and act on, opportunities to build resilience at the local, regional, and state level.

“Tropical Storm Irene and the spring flooding that came before it were among the most powerful storms of this century, but we know they will not be the last. We must continue to improve our state's resilience to such extreme weather events – to strengthen our capacity as a state to prepare for, minimize the disruption of, and bounce back from future Irenes.”

– Peter Shumlin, Governor of Vermont



¹ *Taking Stock of Vermont's Resilience*, Prepared for the Resilient Vermont Solutions Summit, May 20-21, 2013

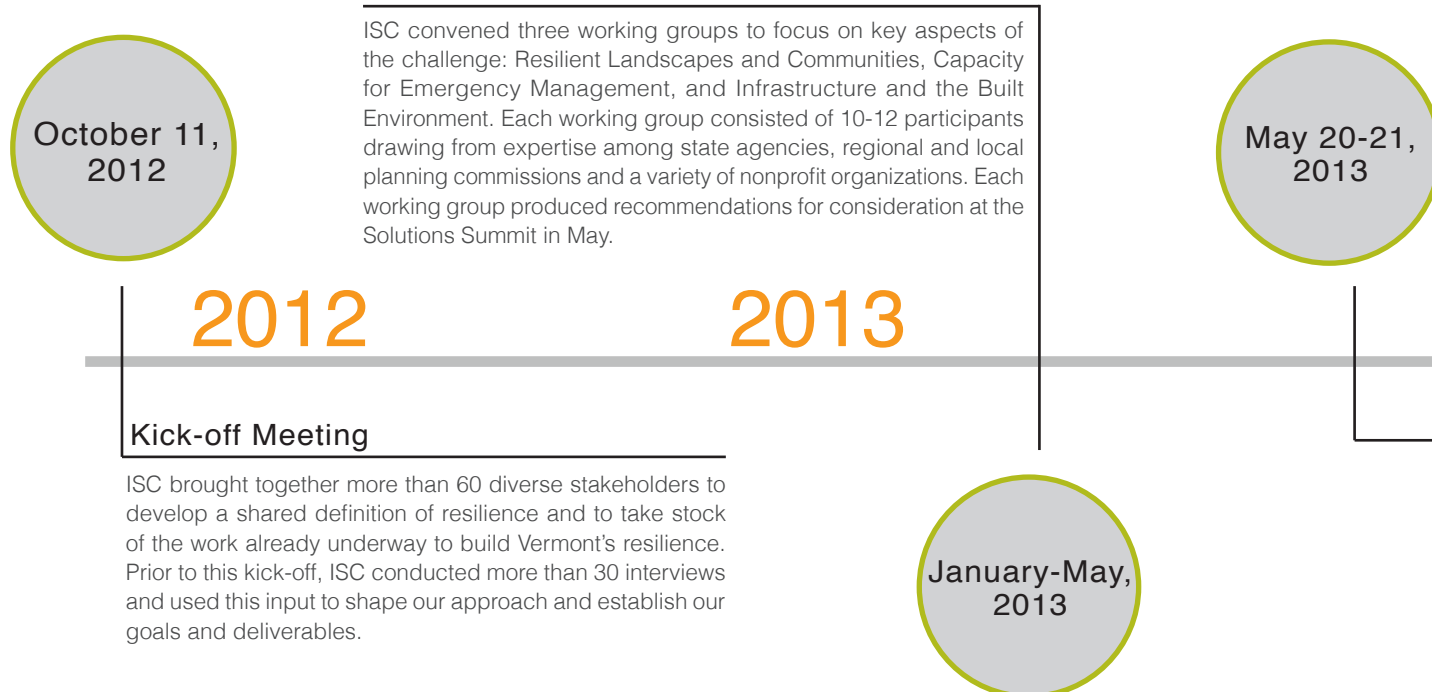
Creating the Roadmap

The recommendations in this report are the result of an 18-month process that started in the spring of 2012. The project engaged hundreds of people, including key leaders from state and local government, the business community, and the nonprofit sector, and built from the best available research and data. We combined insights from a broad cross section of expertise, and engaged individuals and organizations with experiences that ranged from small Vermont villages to national and international projects. At the heart of the project were a series of forums where participants came together for discussions to create a shared vision of resilience and a set of practical, prioritized steps to reduce our vulnerabilities and minimize the risks to our citizens, our communities, our economy and our environment. It was

an iterative process that combined framing information from existing reports, case studies, and background interviews, with public feedback and discussion as the recommendations took shape. This approach allowed us to build a well informed report and also had the lasting effect of bringing people together who can continue to share information and learn from each other.

This report provides a snapshot of the background information and deliberations from this process, while focusing on the final priorities and next steps for their implementation. To access more detailed documents from the discussions that informed our recommendations, please visit: www.resilientvt.org.

Working Groups





Local Focus Groups

Over the summer, six local focus group meetings were held in three regions across the state. A total of 50 people attended representing 31 municipalities and a variety of nonprofits and small businesses.

September 13,
2013

Solutions Summit

Our second workshop, "The Solutions Summit," brought together over 60 stakeholders to review, refine and prioritize recommendations brought forth by the three working groups. In preparation for the Summit, ISC prepared a stocktaking report, summarizing the key challenges and opportunities facing Vermont. The Summit provided an opportunity for participants to work on specific recommendations and begin to shape the action agenda.

July-August,
2013

Roadmap to Resilience Workshop

Approximately 60 stakeholders convened to review a draft set of priority recommendations, with feedback collected through October 2013.

Recommendations

Vermont has many of the key qualities that are essential to resilience: we have strong social networks, committed leaders, and a balance of self-reliance and community engagement that aptly reflects the “freedom and unity” of our state motto. Much of what we already do in our communities makes us more resilient. But there are actions we can take that will enhance our ability to address the risks we face. This report organizes recommendations into four suggested action areas:

Each of the following sections provide background information on the topic, a summary of our stakeholders’ overall vision for outcomes, and then specific, priority recommendations with an explanation of each. A list of all of the priority recommendations appears at the end of the document.



Know Our Risks

Vermont needs to not only conduct the research to be well informed about risks posed by a changing climate, but also fully utilize the data we already have by making information easily accessible, in formats and tools that are useful to communities and individuals as they plan for the future.



Elevate & Integrate Emergency Management

The work to plan, prepare, respond to and recover from disasters is ongoing, it shouldn't receive attention only in the immediate aftermath of disaster and it shouldn't be isolated within one department, division or local organization.

Vermont needs to elevate emergency management as critically important at all times, and integrate it throughout local, regional and statewide work.



Align Rules & Investments for Stronger Communities

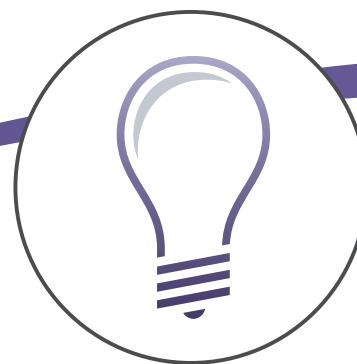
We know that our state is vulnerable to climate change, and that our risks grow as the climate becomes more unstable. Yet, we also have inherited a system of incentives, rules, and frameworks for decision making that don't reflect this reality. We need to structure rules and direct our investments towards greater resilience and create disincentives for actions that increase vulnerability.



Working Together & Learning Together

The challenges Vermont faces in establishing resilience are complex, they reach across sectors and across jurisdictions, and require collaboration and continuous learning. It is easy for communications and collaboration to break down, even in a small state like Vermont, and we need to remain proactive in continuing to work, and learn, together.

Know Our Risks



Vermonters increasingly recognize that climate change is not something we will experience only in the future. It is here now and its effects are measurable. We can see steady shifts, such as a 2°F increase in average temperature and 4°F increase in winter temperature since 1970². We can also see that the transition is not orderly. Severe weather events are becoming more intense and more frequent.³

We can predict generally what hazards we will encounter. For example, precipitation-related events such as flooding, severe thunderstorms, and tropical storms, as well as extreme temperatures, ice storms, wildfires, and infectious disease are public concerns. We know that climate change will weaken entire ecosystems as the climate that organisms have adapted to over time quickly changes. We can also imagine examples of impacts on specific groups, such as losses to the maple syrup and skiing industries, or the impact on elderly Vermonters who are particularly vulnerable to extreme temperatures and new disease vectors.

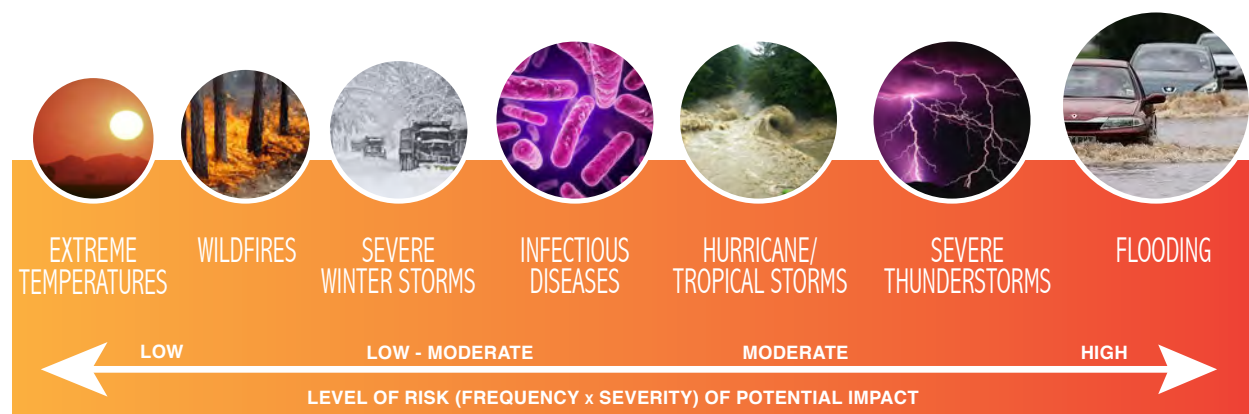
There is an increasing amount of information about the risk of climate change. Many organizations contributed reports that went into the development of this roadmap (see page 11). When we talk about knowing our risks, we do not just mean starting more research projects. Knowing our risks means a combination of getting more information where we lack it, putting the information we have into use, and establishing a system for updating our understanding as the climate continues to change and new data becomes available.

During heavy precipitation events the amount of precipitation has increased 74% between 1958 and 2010.⁴ As Mary Powell of Green Mountain Power has commented, “It feels like there’s no normal storm event anymore.”⁵ The utility actually ran through its entire \$6M storm repair budget for fiscal year 2013 in just 4 months.

“Before Irene we were very unaware of what the risks were, we were fairly complacent about what the risks were. **We need to start knowing what our risks are.**”

– Spencer Putnam
Weybridge Town Energy Committee

CLIMATE HAZARDS FACING VERMONT



² Betts, Allen. Climate Change in Vermont. Climate Change Adaptation White Paper Series. Vermont Agency of Natural Resources. 2011.
³ See for example: Betts, Allen 2011; Union of Concerned Scientists 2007; Johnson, Ian. Adapting Vermont's Transportation Infrastructure to the Future Impacts of Climate Change. VTrans Climate Change Adaptation White Paper. August 2012.
⁴ National Climate Assessment, Draft, 2013. <http://ncadac.globalchange.gov/>.
⁵ Quoted in the Burlington Free Press, Feb. 3, 2013 <http://www.burlingtonfreepress.com/article/20130203/GREEN/302030004/>.

Where Do We Want To Go?

To make good decisions, Vermonters will need accurate, up-to-date and accessible data and information about the climate risks we face.

In a system of strong information collection and dissemination:

We would have consistent and reliable data on vulnerabilities and risk, with coordination to ensure we identify and fill gaps in what we know. A regular schedule of reviewing and updating this information would ensure that it remains as accurate as possible as climate change causes conditions to change rapidly. This data would provide the projections needed to transition from planning based in historic trends that are no longer accurate, to making decisions based on climate projections.

We would approach data collection and research understanding how people on the ground will use the information generated.

The scope of research projects would include knowing in what format the end users need the information, how it would reach them, and whether analysis should include not only results but also tools for making decisions based on the results (for example interactive databases, case studies, templates for incorporating in planning documents, cost-benefit analysis tools).

We would learn to take action amidst uncertainty. While scientists continue to develop and refine climate models, what is clearly known is that the future is highly uncertain. Each model presents a range of scenarios dependent on factors such as global emissions, the interaction of different climate changes, and the rate at which these changes will occur. We need to take advantage of best available data, continue to check models and predictions against new data sets, and pursue strategies that will build our resilience to a range of potential impacts.

The Resilient Vermont Project drew information about climate impacts and risks from resources such as:

- **ANR Climate Change Vulnerability Assessment and Adaptation Strategy Report (2013):** Compiles the best available information on climate change impacts on forests, fisheries, wildlife, and water resources.
- **Research on Adaptation to Climate Change (RACC) Project:** This research program at the University of Vermont applies global climate models to our region and explores the link between climate change, land use and impacts on water quality in Lake Champlain.
- **Regional and National Organizations:** Such as the National Oceanic and Atmospheric Administration (NOAA), National Climate Assessment and Development Advisory Committee, Northeast Climate Impacts Assessment (NECIA), and the New England Climate Adaptation Project (MIT).

We also anticipate more information to become available soon from projects including:

- **Vermont Economic Resiliency Initiative (2015):** The Agency of Commerce and Community Development (ACCD), will produce a statewide map to identify areas where river instability, infrastructure vulnerabilities and other hazards intersect areas of critical economic activity.
- **Statewide Comprehensive Economic Development Strategy (CEDS) (2014):** ACCD is currently working to develop Vermont's first statewide CEDS. The strategy will include an analysis of economic clusters and will integrate climate impacts and resilience.
- **VT Department of Health Climate Change Adaptation Program:** Over the next four years, this program, funded by the Center for Disease Control, will identify the most pressing health threats posed by climate change and develop strategies for lessening their impacts.

How Do We Get There?

Our recommendations for ensuring availability, access and use of data to understand risk and guide decision making.



Develop and disseminate best available climate and risk information in user-friendly formats that can be incorporated into local, regional, and statewide plans and used to inform priorities and investments.

Recommendations throughout this report call on decision makers at local, regional, and state levels to use best available climate and risk information as they consider issues such as emergency preparedness, infrastructure investments, or public outreach campaigns. For this to happen, data and information must be disseminated in a thoughtful way, reaching the people who need it in a form that they can use.

We recommend that the Climate Cabinet take the lead in consolidating the data we have, identifying gaps and coordinating efforts across state agencies to fill these gaps. The Climate Cabinet has a standing data committee that can assist with this work.

The Climate Cabinet should play an important role in disseminating data among the state agencies and link with external partners to disseminate it more widely. The Climate Cabinet already has the charge of providing Vermonters with information on all matters related to climate change, including what can be expected in future years. Organizations with networks that can help in that work include Vermont League of Cities and Towns (VLCT), Vermont Energy and Climate Action Network (VECAN), the Association of Conservation Commissions, watershed organizations, and business associations.

Specific opportunities include convening partner organizations to:

- Create a data clearinghouse or “guide to best available climate information” for the state of Vermont.
- Work with Regional Planning Commissions (RPCs) to develop and disseminate templates for the inclusion of climate data in municipal plans.
- Develop a prioritization tool that gives weight to future conditions and risk, and helps focus mitigation efforts on those areas of highest risk.
- Partner with the UVM RACC Project to disseminate data from their climate models in a user-friendly format.
- Disseminate information to municipal officials, business leaders, public works departments and other target audiences.

Stakeholders also suggested ways partners could use new technology to create better prioritization tools. For example, the Department of Emergency Management and Homeland Security (DEMHS) and the RPCs could pilot new tools for communities to track data regarding infrastructure maintenance or damage caused by disasters, which is data required to be eligible for funding from FEMA. This work would include compiling current best practices in Vermont communities, piloting the use of smart phone apps, and supporting peer exchange forums on this topic between municipal public works departments.

Colorado Climate Preparedness Project

The Colorado Climate Preparedness Project provides an example of an online database being used to share information and disseminate best practices within a state. The project has developed a searchable online database of adaptation efforts in Colorado. Registered users can edit existing content and add new content, allowing organizations to share their work and learn from others.

For access to the online database, follow this link: www.coloadaptation-profile.org/.



Institute a sustained river corridor mapping program that provides information about flood and erosion risk to inform local, regional and state plans and the identification of hazard mitigation projects.

Vermont's Agency of Natural Resources (ANR) has completed 173 stream geomorphic assessments involving 165 communities and over 1,500 miles of river corridors throughout the state. These assessments detail river dynamics and present a picture of where instability and erosion hazards exist. In 2014, ANR will produce a statewide map of river corridors. In early 2014, ANR also plans to launch the "Focus on Floods" website to make this information more easily available. The site is being designed as a comprehensive tool for municipalities across Vermont to find all information related to flood hazard planning.

We recommend that ANR build from these efforts to support a sustained program that uses a broader public engagement process, ensures regular updating for the maps, and supports use of this information at municipal levels, with technical assistance to incorporate it into local planning.

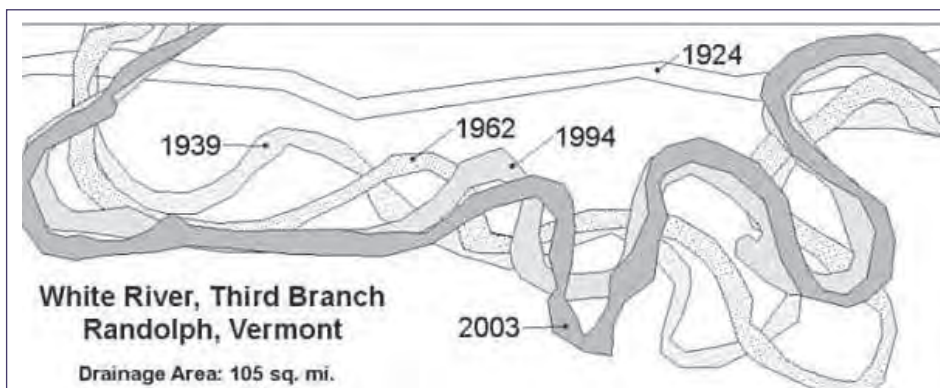
Specifically, the State of Vermont should:

- Broaden the engagement process associated with the development of river corridor maps and plans.
- Use the corridor planning process to foster a watershed scale dialogue about upstream-downstream coordination between jurisdictions.
- Use the maps to indicate high hazard areas, integrate consideration of uplands into the mapping, identify opportunities to reduce flood impacts, and provide guidance in prioritizing investment in flood mitigation.
- Provide background information with the maps that helps planners and the public understand what constitutes a hazard, how hazards were identified for their area, and how to assess the risk posed by that finding.
- Track use of the Focus on Floods website and gather visitor feedback on what could improve their ability to use the information found there.
- Work with RPCs to provide targeted technical assistance to pursue implementation projects based on these maps.
- Review whether savings could be achieved by co-locating this mapping program with the Vermont Agency of Transportation (VTrans) mapping office.

Watershed Scale:

Decisions made by one town affect the resilience of other towns within their watershed. For example, developing in a flood plain upstream may lead to increased flooding in downstream locations, while creating riparian buffers upstream may reduce flooding further down the river. Watersheds reach across municipal boundaries and recommendations throughout this report focus on planning and preparedness within regions to reflect this interconnection.

We anticipate that these recommendations would be implemented with assistance from RPCs.



As shown in this image, rivers are continuously changing and moving over time. ANR has developed mapping tools that allow us to understand the area that a river needs in order to meander over time ("the river corridor") and maintain a healthy ecosystem. Working with municipalities and regional planning commissions, this information can be integrated into planning and zoning to prohibit development in vulnerable areas and to help identify existing structures that are at risk.

Source: Vermont Agency of Natural Resources



Conduct a statewide transportation vulnerability assessment that produces a statewide data set and map that shows areas of highest relative vulnerability and is used to guide prioritization of investment.

The Vermont Agency of Transportation has taken steps towards understanding what resilience means for Vermont's transportation infrastructure. In 2012, VTrans collaborated with ANR to initiate a training program for agency personnel, municipal transportation staff, and others involved in transportation projects. The effort is focused on reducing the vulnerability of transportation infrastructure to flooding, and restoring flood-damaged infrastructure using strategies that increase long-term flood resilience. VTrans is also updating the hydraulics manual that provides guidance for bridge and culvert design and is drafting a Transportation Resiliency Plan. Their Vermont Online Bridge and Culvert Inventory Tool provides valuable information to local decision makers.

Our stakeholders spoke favorably of the work that has happened to date and called for going one step further with a statewide transportation vulnerability assessment. This assessment would both provide valuable information to local and state decision makers, and provide a model of analysis that could be scaled down for future assessments of municipal transportation infrastructure. As described in the following case study, Washington State Department of Transportation has conducted its own vulnerability assessment that can be a model for Vermont.

Washington State Transportation Vulnerability Assessment

In 2011, in anticipation of more frequent and intense rainfall events due to climate change, the Washington State Department of Transportation (WSDOT) conducted a statewide risk-based vulnerability assessment to identify and prioritize vulnerabilities in the state's transportation infrastructure system. The Federal Highway Administration (FHWA) provided a \$189,500 grant and WSDOT provided matching funds (the total cost was \$379,000).

Through fourteen statewide workshops, local participants helped to identify potential vulnerabilities for all modes of travel. Participants included local experts in geology, hydrology and transportation, including maintenance superintendents and field staff with first-hand knowledge of the impacts of past storm events. The University of Washington Climate Scientists and WSDOT provided climate change scenarios. The project resulted in a map that indicates the levels of vulnerability for routes of auto, air, rail and ferry travel.

WSDOT used this vulnerability assessment to implement a 'no regrets' asset management program. This program supports practices including seismic retrofits of bridges, improved fish passages, culvert replacements and drilled bridge shafts on new structures. Areas experiencing problems in response to climate impacts are on a watch list, including scour critical bridges and low-lying areas subject to sea-level rise flooding.

More information on WSDOT's Climate Impacts Vulnerability Assessment can be found online.



Incorporate vulnerable population data and analysis into municipal, regional, and state hazard mitigation plans with the help of social service providers so that the needs of Vermont's vulnerable populations are clearly identified and represented at all levels of hazard mitigation planning.

In the context of climate change “vulnerable populations” can mean a number of things. There are people who live in substandard housing located in flood-prone areas, people without access to transportation, people without personal savings, those with medical needs (such as a reliance on oxygen or prescription medications or in need of mental health counseling), people facing food insecurity that can quickly tip into hunger with a disruption to normal routines, people with physical disabilities, people who are New Americans who may face cultural and language barriers, there are the elderly and children.

Individuals and organizations across Vermont have rallied to help vulnerable populations during natural disasters; we also need to consider these groups during hazard planning and mitigation.

Stakeholders shared stories from Tropical Storm Irene of problems that stem from lack of this planning, such as mobile homes forgotten and evacuation shelters that were not handicap accessible. They were concerned about over reliance on informal community networks if the severity of disasters or their frequency increases, and if changes to levels of civic participation weaken these organic connections.

Vermont is fortunate to have a strong network of social service providers, including the Department of Health, Community Action Councils, housing organizations, fuel assistance, and weatherization providers, who can provide valuable insights during pre-disaster planning. Engaging these organizations in the emergency operations and hazard mitigation planning process will also strengthen relationships that are needed in the response and recovery phases. A more transparent planning process with broader across the board public participation ensures that all Vermonters are served by resilience work.

“ We need to keep in mind that those who are most vulnerable should be served by the work we do – not have their lives made more difficult. Often there are unintended circumstances. The bar should be set to ask – is it good for vulnerable populations? ”

– Alison Friedkin, Central VT
Community Land Trust





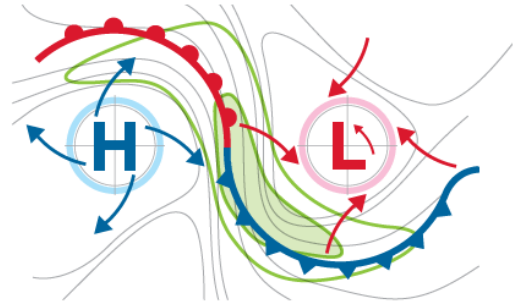
Take advantage of a strategic opportunity to forge a public-private partnership between IBM, electric utilities and the state to utilize a state-of-the-art weather model, in combination with state data, to improve the accuracy of storm predictions, enable early warnings, and efficiently mobilize emergency equipment and personnel.

Vermont has a unique opportunity to pursue a public-private partnership that will provide access to state-of-the-art weather modeling. The Deep Thunder computer model developed by IBM makes weather predictions with greater accuracy and localization than has been possible before. These predictions could allow Vermont to anticipate the potential impacts of storms and guide where and how response teams are mobilized (including from other states if needed), notify emergency and medical personnel, and deploy equipment in a way that will reduce damages and cost. Additionally, advanced notice and mobilization will allow private operators of critical infrastructure – such as the electric grid and telecommunications systems – to minimize down time.

Deep Thunder establishes an innovative research platform. It brings together data sets that correlate natural phenomena, such as precipitation, temperature, wind and solar activity, with information on electricity generation and usage, road and bridge infrastructure, and water quality. This type of integrated data analysis is key for future predictive work in an unstable climate. It also represents the type of public-private partnerships that will be key to building models and conducting research as we try to understand what is happening under climate change. This project presents a potential for entirely new ways to anticipate risks and act to mitigate them.

We recommend that the State of Vermont be proactive in building this partnership and designate a representative to continue developing the concept.

IBM's Deep Thunder Project



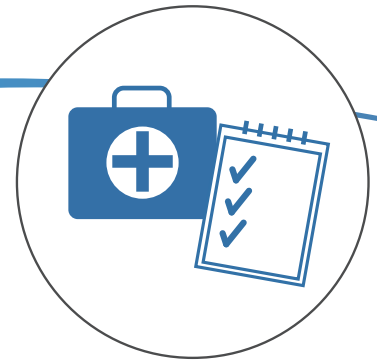
IBM's Deep Thunder computer model makes weather predictions with greater accuracy and localization than has been possible before.



“ It is not about weather but integrating forecasts into decision making to optimize business processes. Rather than monitor a storm, we can stage resources at the right place and time prior to the event to minimize the impact. **”**

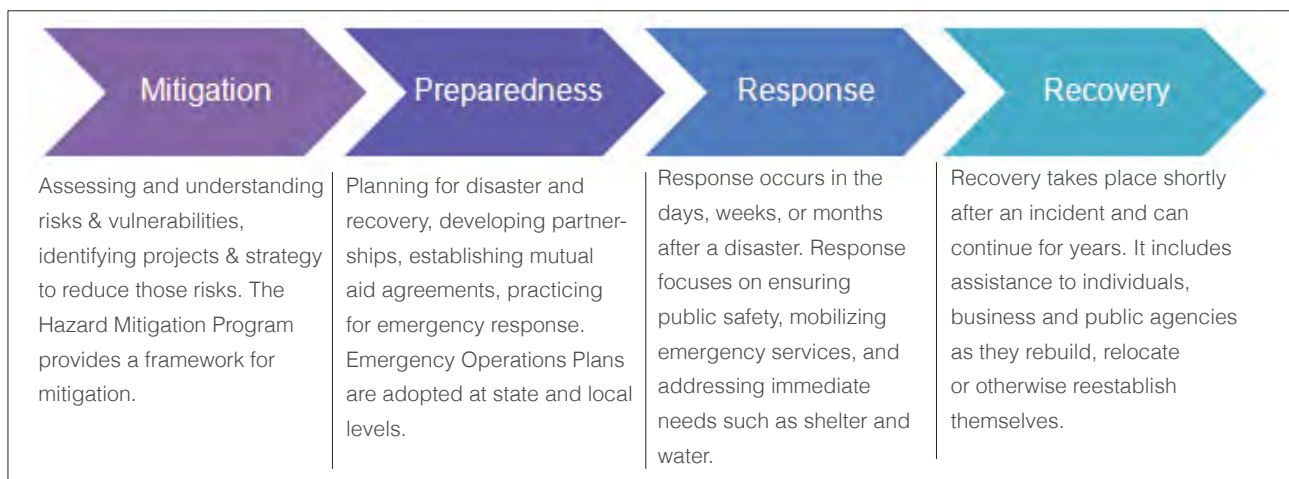
– Lloyd Treinish, Chief Scientist for the Deep Thunder Project

Elevate and Integrate Emergency Management



A strong emergency management system is foundational to bolstering Vermont's resilience to natural disasters and other disruptions. The work to plan, prepare, respond to, and recover from disasters is ongoing, it shouldn't receive attention only in the immediate aftermath of disaster, and it shouldn't be isolated within one department, division or local organization. Vermont needs to elevate emergency management as critically important at all times, and integrate it throughout local, regional and statewide work.

Emergency management, broadly defined, encompasses many of the key components of resilience: anticipating hazards, reducing risks, preparing for disasters, and effectively responding and recovering in a way that makes us less vulnerable in the future.



To prepare adequately for the next emergency, Vermonters should have a greater awareness of the components of emergency management and clarity on roles and responsibilities. It is important to understand the scope of emergency management, which covers phases beyond the immediate disaster response and recovery.

Vermonters need to recognize that the demands on our emergency management system will be growing. As discussed in the **Know Our Risks** section, extreme weather events are increasing, and we can see that increase play out in the growing number of FEMA disaster declarations in our state.

The effects of this trend are amplified by similar experiences in other states. As other states also face more disasters, the nationwide network of resources becomes more stretched. Those resources include both response teams who can help in recovery and funding from federal agencies. For example, Vermont received over \$185 million dollars from FEMA in the aftermath of Tropical Storm Irene, but FEMA describes greater resource constraints in the future as "seemingly unavoidable".⁶

We need to strengthen our emergency management systems today so that they can meet the demands that will be placed on them in upcoming years.

⁶ FEMA Crisis Response and Disaster Resilience 2030 Published January 2012.

Where Do We Want To Go?

A strong emergency management system is critical to be ready for the impacts of climate change and the future disasters we will experience. This system helps to reduce the loss of life and property, to deliver an expedient and well-coordinated response, and to ensure that each rebuilding effort leaves us stronger and more resilient.

Within a strong system:

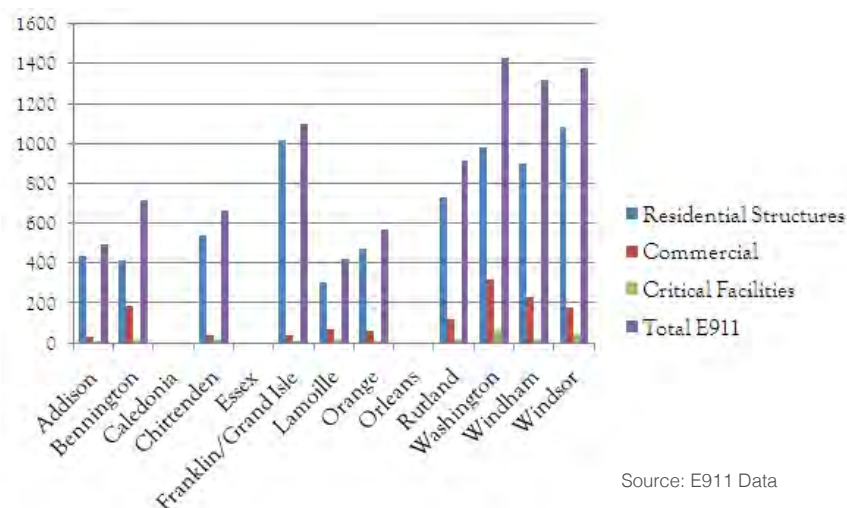
Vermont would be proactive in managing risk. Resiliency calls on Vermonters to become engaged in emergency management-related functions in ways that cut across previous roles and divisions, and require a much greater understanding of risk than ever before. Those already in leadership would set an example through visible projects and championship of resiliency as a guiding objective.

Vermont's emergency response plans and procedures would be customized to meet Vermont's needs. We cannot rely on federally set minimum thresholds or cookie cutter approaches. Vermont is unique in many ways, we are a small state with a dispersed population, we have a mountainous landscape that can leave communities isolated when power and telecommunications go out, we have no county government and don't have the strong network of faith-based organizations that play an integral role in emergency management elsewhere in the country. We need to base plans and procedures on the most up to date information, integrating on-the-ground input from communities with what we learned about vulnerabilities during recent disasters, and what we can anticipate as future risks based on best available climate change data.

Emergency management plans would be developed in coordination with plans for rivers, climate change, infrastructure, land use and capital budgets. Developing plans and procedures rooted in Vermont's particular needs requires everyone to become better informed about emergency management so that we may participate productively in the planning conversation, and for those managing the processes to clear avenues for that participation, and for people in a variety of fields to contribute. It also requires us to make use of existing information, particularly for plans to build from each other.

All phases of emergency management would be coordinated, from local to regional to state levels. We would match a local can-do spirit in response to challenges with the necessary resources, training, and connections to regional and state level support. Stakeholders spoke of gaps appearing in planning, communications and interoperability between different jurisdictions. We need to know that these are being addresses at a system-wide level. Gaps emerging today will only become more problematic as the severity and frequency of disasters increase.

Structures Located in Flood Hazard Area



Source: E911 Data

How Do We Get There?

Our recommendations for creating more robust, integrated systems in all aspects of emergency management.



The State of Vermont should become an innovator in instituting resilience in emergency management in ways that best serve the needs of Vermonters.

The field of emergency management is undergoing a significant change, shifting from a disaster-focused discipline into a forward-looking risk management function that cuts across all areas of government. To be effective in the face of multiple risks, emergency management must become better integrated into community development and governance. As Robert Schneider describes in his overview of the “new” emergency management: “The linkage of hazard mitigation... to the broader task of developing sustainable communities potentially places emergency management at the very heart of community planning.”⁷

As a small state with deep roots in citizen participation and planning, Vermont is uniquely positioned to develop new models for the integration of emergency management into sustainable community development. The priority recommendations throughout this report reflect that opportunity, with an emphasis on collaboration from local through to state levels, transparency in government processes, and broader participation in resiliency work.

Achieving this community-connected approach to emergency management will require restructuring at levels of government beyond the community. In particular, the following recommendations reflect the need for:

- Strengthened regional networks, particularly through a greater role for the Regional Planning Commissions.
- An elevated role for the Division of Emergency Management and Homeland Security so that it can coordinate across agencies.
- A resilience champion within state government who can keep everyone moving in the same direction and bring greater visibility to resilience work.

In addition, the **Working Together and Learning Together** section recommends specific networks that will give local citizens a clear option for participating in resilience planning.



⁷ A Strategic Overview of the “New” Emergency Management - Robert O. Schneider, Ph.D., Chair-Dept. Political Science and Public Administration, University of North Carolina at Pembroke MS Word 51KB.



Within state government, assign a champion responsible for resilience and risk management who is authorized to coordinate the work across state agencies to achieve a consistent approach, identify and advance state priorities, and ensure accountability.

Vermont needs a coordinated approach to advancing resilience across state government and all of its functions. To be successful, this coordinating function must be assigned to an entity that has adequate authority, credibility, and scope. This entity would be responsible for establishing state goals for resilience, coordinating projects and programs that cut across agencies, ensuring that data and information are shared, and providing accountability – that recommended actions are advanced. The person in this role would also serve as a form of ombudsman, improving transparency with regional and local emergency managers.

We recommend that the state identify a Chief Resiliency Officer. While we considered the Climate Cabinet and DEMHS as possible coordinating entities in this capacity, our recommendations already include substantive steps towards strengthening their core roles and our stakeholders felt that a designated Chief Resiliency Officer for resiliency coordination within the state would be most effective.

“ Right now there is no risk owner. Usually when you deal with risk you have an owner. This concept doesn’t usually get applied to the public sphere, but maybe it should. The risks of climate change to Vermont need an owner who can work on mitigation strategies and direct resources toward mitigation of risk. ”

– Stakeholder



Photo credit: Gordon Miller, www.gmphoto.zenfolio.com/



Elevate the position of the Division of Emergency Management and Homeland Security within state government to increase their authority and ability to effectively integrate preparedness and risk management into all state government functions.

Emergency management should be integrated across all state agencies and functions, not isolated within one division. The Division of Emergency Management and Homeland Security (DEMHS) should have a stronger connection to the Secretary of Administration. The Agency of Administration, through its authority over interagency issues, has greater power to compel action within other state agencies. DEMHS needs this support for tasks such as:

- Helping state agencies prioritize completing their Emergency Operations Plans.
- Getting consistent staffing of the state Emergency Operation Center (EOC).
- Bringing agencies together to resolve inconsistencies in their policies and practices.
- Securing commitments to implement the goals of the state hazard mitigation plan.
- Developing emergency personnel plans and strategies to ensure there is adequate capacity and trained personnel on hand during emergencies.⁸

The Governor should further reinforce the importance of resilience work by hosting an annual preparedness meeting of the Cabinet and promoting publicly visible preparedness projects, such as reducing the vulnerability of state buildings and properties.

“ Based on Irene experience, one of the big problems in emergency management continues to be in communications vertically and horizontally. Money was spent by government to put radios in people’s hands but we haven’t worked enough statewide or regionally to create a system robust enough to reach people we need to reach. Hardware is one thing but getting the resources to do what we need to do is another issue. **”**

– Bill Burden, Strafford Emergency Management Director, LEPC 12 Chair

⁸ A similar recommendation with additional detail has been put forward by Gavin Smith in his report to the Agency of Commerce and Community Development. http://accd.vermont.gov/sites/accd/files/Documents/strongcommunities/cpr/VT-StateAgencyPolicyOptionsFINAL_web.pdf



Increase emergency management capacity at the local/municipal level to ensure that those who are responsible for emergency management functions before, during, and after disasters have the skills, training, and equipment they need.

Local governments in Vermont are charged with a great deal of responsibility in all phases of emergency management. Local focus groups confirm that this task can overwhelm the capacities of many Vermont communities, both small and large. Vermont municipalities, with few exceptions, report that they lack the expertise, resources, and staff to execute the responsibilities of emergency management effectively and efficiently. Support organizations that work with municipalities during disasters also voiced concern about local capacity. Vermont should continue to increase the opportunities for high-quality education and training available to local decision makers.

Within the framework of current local trainings, we have the opportunity to build in more components for resilience. Examples participants gave include:

- Increase promotion of Vermont's annual preparedness conference and make resilience a key theme in 2014.
- Build from the Local Emergency Planning Committee (LEPC) model already in place.
- Create a curriculum for training emergency management directors that's similar to the online webinar series created by UVM for agricultural emergency preparedness.
- Set up a peer-exchange system for those involved in emergency management to learn from each other (particularly for those who did not experience Irene to learn from those who did).
- Offer a retreat for newly appointed emergency management directors, similar to the Selectboard Retreat already offered through the Vermont League of Cities and Towns (VLCT).

Just as we found a need for more attention to how information on climate risks translates into action, we also found a need to reconsider how trainings translate into change. Examples of shifts in approach requested by stakeholders include: targeting particular audiences (e.g. basic overviews versus highly specialized workshops), trainings focused on real world examples, hands-on trainings and practices, and greater convenience and affordability.

“ The challenge is implementation...how do we implement plans when everyone is a volunteer? Getting a plan is an achievement, but actually doing hazard mitigation grants, unless the RPC will help apply, is a real challenge for the 220 communities that don't have professional staff. ”

– Mike Miller, City of Barre Director of Planning, Permitting and Inspection Services



Regionalize key emergency management functions to provide more efficient and effective support to communities, improve communications, and create strong regional coordination.

Vermont lacks a strong regional system for government. This missing layer weakens some components of our emergency management. We recommend developing stronger regional functions through Regional Planning Commissions and regional Emergency Operations Centers (EOCs).

The RPCs played a very active role in helping municipalities with disaster management post-Irene, and have established relationships with the municipalities that enable them to effectively integrate the work of emergency management into other municipal functions, such as land use planning. Currently each RPC receives support for approximately 0.5 FTE through FEMA's Emergency Management Planning Grant (EMPG) Program, which enables them to provide a basic level of assistance to prepare municipal hazard mitigation plans and provide some support to Local Emergency Planning Committees (LEPCs). We recommend strengthening their role in providing additional technical support and capacity to municipalities in planning, recovery and hazard mitigation, by funding at least 1 FTE at each RPC dedicated to emergency management.

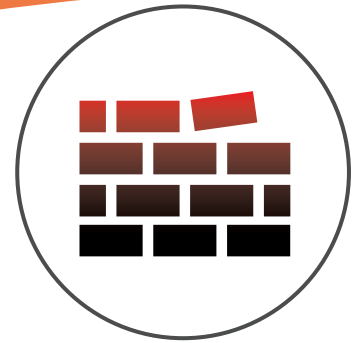
We also recommend regional Emergency Operations Centers. During emergencies, Vermont's response effort is coordinated through the State Emergency Operations Center (SEOC) located in the Waterbury State Office Complex. Vermont currently has the highest ratio of municipalities (247) coordinated through a single EOC in the country. Only two other states have a single State EOC, Rhode Island and New Hampshire. Regional EOC's would mirror the coverage of the existing public safety districts. They would be staffed with full-time personnel who are responsible for preparedness, response and recovery functions, and could be activated during state or regional emergencies utilizing the Incident Command Structure. Regional EOCs would be the main liaison between DEMHS and the municipalities. They would work in close collaboration with the Regional Planning Commissions. Ludwig Schumaker outlined a implementation strategy for this regionalization in his 2008 Naval postgraduate thesis *Emergency Management Span of Control: Optimizing Organizational Structures to Better Prepare Vermont for the Next Major or Catastrophic Disaster*. We recommend starting discussions with the model proposed by Schumaker.

“ The lesson of Hurricane Katrina for Vermont is not about hurricanes or levees. It is that major or catastrophic disasters occur, and the failure of continuity of government may follow from the absence of structures and processes that allow local and state emergency management bodies to have situational awareness, perform resource coordination functions, or to formulate actionable requests for assistance. ... Our challenge in this new century is a difficult one. Although we must have plans for the known, our challenge is really to prepare for the unknown and the uncertain. That may seem an impossible task, but it is not.⁹ ”

– Ludwig Schumaker, quoted in post-graduate thesis.

⁹ handle.dtic.mil/100.2/ADA493908

Align Rules & Investments for Stronger Communities



As Vermont develops a clearer understanding of climate change risks and how to respond to them, we need a regulatory structure and investment and incentive system to match. Every day we make investments that run counter to known risks, including ones where we have already experienced the consequences through the damage that followed the flooding of 2011. We continue to build in flood plains, to pave areas that provided storage of storm water, to build transportation infrastructure to outdated design standards, to incentivize the lowest cost construction projects over the most resilient, and to write plans as if past climate trends are a reliable predictor of future hazards.

Changing our response to climate change will take time and intention. The way we develop and manage land is influenced by decisions made by private, municipal, state and federal land owners. Our regulatory system is determined at local, state, and federal levels – each with different areas of control. We do not have infinite financial resources. Plus, we must seek out solutions that offer the best outcomes across multiple priorities, such as improving our ability to withstand major weather events, promoting economic vibrancy, maintaining communities' character, and supporting a high quality of life for Vermonters.

Since 2011, Vermont has made progress toward aligning rules and investment in support of more resilient communities. Specific examples include:

- Updates to the rules of Vermont's Emergency Relief and Assistance Fund (ERAF) to create additional incentives for municipalities that adopt higher standards for hazard mitigation.
- The revision of Vermont's bridge and culvert construction standards incorporating river science and creating consistency between VTTrans and ANR.
- New requirements for regional and municipal plans to include a flood resilience element which creates a stronger link between hazard mitigation plans and land use plans (as required by Act 16).

The **Know Our Risks** section contains recommendations that will provide us with good understanding of what challenges we'll face, but we then need to align programs, rules and investments to act on that information.

“ We need to make smarter investments and by that we mean not just building back to minimum standards but to standards that can help us withstand future events.”

– Jeb Spaulding, Secretary of
Administration



Where Do We Want To Go?

The recommendations in this section are intended to help align Vermont's rules and investment with desired outcomes for greater resilience.

In this system:

Resilience would be institutionalized as an investment priority. Decision makers would have the training to assess how to prioritize investments in the face of an unstable climate. These decision makers include civic leaders, infrastructure owners, and land owners. Just as we need tools and training to interpret what climate information means for local risks and opportunities, we need ways to understand its implications for investment.

Mitigating hazards before damage occurs would become a priority for rules, guidelines, and investments. Not only is this priority important for preventing loss of life and property, it also recognizes that the funding sources for rebuilding and recovery which brought over \$540 million in Federal resources to Vermont after Irene will become more scarce as disasters become more frequent.¹⁰ Our clearest prediction for the future is greater potential damage from weather events and fewer funds from outside the state to help with recovery.

We need to mitigate the potential damage whenever we can, starting now, without waiting until we face the financial challenges of rebuilding after future losses.

Incentive systems created by public funding sources would match best practices for resilience. We would not create incentives to wait until after damage has occurred to rebuild parts of our infrastructure. We would create positive incentives that reward people and communities for undertaking projects such as land management practices that promote resilience.

We would have a comprehensive approach to land use and development that minimizes floodprone development. A comprehensive approach would protect against creating new hazards along currently undeveloped river corridors and protect upland areas that capture and store rainwater. Existing development (such as downtown centers) that likely will not move receives protection from these measures. However, we also will need to tackle the difficult question of removing development from some areas, whether that means not rebuilding after the next major flooding event or removing structures now, before the next flood occurs.



¹⁰ Source: <http://www.vpr.net/apps/irene/index#mapping-link>.

How Do We Get There?

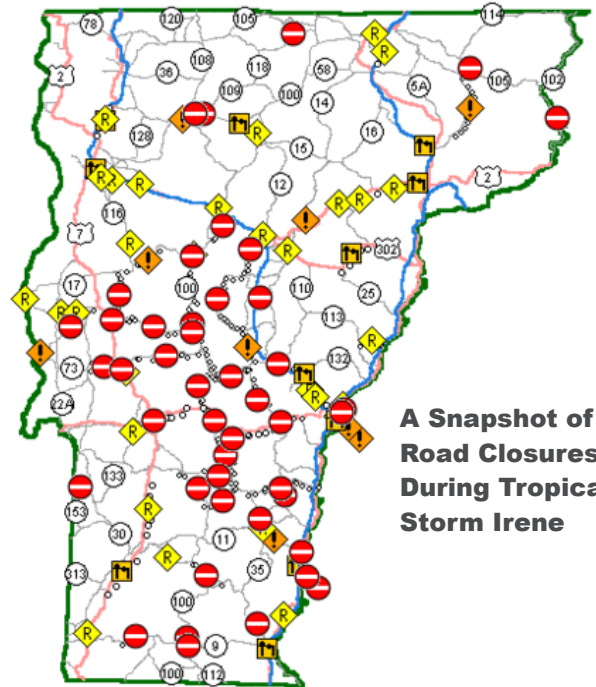
Our recommendations for ensuring that investments, rules, and regulations help us to effectively prepare and respond to climate disruption.



Provide guidance and incentives for proactive investment in transportation infrastructure.

The most expensive damages from extreme weather events have occurred to Vermont's transportation infrastructure. During Tropical Storm Irene, Vermont's state highway system alone sustained nearly \$200 million in damage, affecting more than 500 miles of roads and 200 bridges. More than 2,000 segments of municipal roads were damaged, along with over 280 bridges and almost 1,000 culverts. Damage to the rail system cost almost \$21.5 million.¹¹ At the same time, a 2013 report by VTrans documents a \$240 million annual shortfall in Vermont's transportation budget over the next 5 years – a gap that will only get worse if climate change puts additional stress on our present systems.

Reducing vulnerability before damages occur can change this equation. In 2005, the Multihazard Mitigation Council conducted a widely cited study, *Natural Hazard Mitigation Saves: An Independent Study to Assess the Future Savings from Mitigation Activities*, which documented how every \$1 spent on mitigation saves society an average of \$4. Reports since that time have reinforced that finding. For example, the state's *Irene Recovery Report: A Stronger Future (2012)* recommends VTrans modify its design, maintenance, and project prioritization processes to account for vulnerability to and impact on flooding, and that VTrans "... review all other programs, including town grant programs, to look for opportunities to prioritize projects and maintenance strategies that will reduce risk of future flood hazards in vulnerable areas."



At both the state and local level, there is strong interest in developing construction guidelines and climate adaptation best practices for Vermont's transportation infrastructure to withstand future extreme weather and the increased likelihood of flooding and erosion. Because we can no longer rely on historic trends, we need to need to utilize predictive models to inform our design standards. We recommend:

- Developing a set of construction guidelines or adaptation best practices that can be used by the Agency as well as by municipalities.

We also need to put those best practices into actual practice. We recommend:

- Providing a cost-benefit analysis tool that allows decision makers to understand the benefits of building more resilient infrastructure alongside costs of initiating new projects or making change to standards for planned projects.
- Altering the current system that pays more for rebuilding after transportation infrastructure is damaged. Municipalities should receive support for proactively creating resilient infrastructure, based on guidance from best practices and an assessment of risk developed through the previously recommended transportation vulnerability assessment. The state of Vermont should consider the overall resilience of our transportation system and start investing in improving that resilience immediately.

¹¹ Vermont Agency of Natural Resources, <http://www.anr.state.vt.us/anr/climatechange/irenebythenumbers.html>.



Prioritize investment in resilient water and wastewater infrastructure.

Water infrastructure, including drinking water, wastewater and stormwater systems, will be heavily impacted by increased precipitation and changes to Vermont's climate. In many Vermont communities, these systems are already suffering from deferred maintenance. We know our systems currently cannot withstand flooding. For example, thirty public water systems issued Boil Water Notices as a result of Irene, while seventeen municipal wastewater treatment facilities (WWTFs) reported compromised operations, with issues ranging from pump station overflows to incomplete processing of sewage including damages relating to mechanical, electrical, and debris accumulation problems.

Much of Vermont's water infrastructure is managed by municipal boards and volunteer commissions. These organizations need support to assess the vulnerabilities of their infrastructure and anticipate future impacts. Specific recommended actions include:

- Provide training in asset management (see recommendation below).
- Create a set of case studies demonstrating how infrastructure improvements can be financed and can achieve positive return on investment.
- Prioritize infrastructure projects that increase system resilience when providing state grants or revolving loan funds.



¹² See <http://theiam.org/what-asset-management> for a definition.



Invest in training and technical assistance programs to promote cost-effective action and preparedness and reduce future disruptions to state and municipal infrastructure systems.

Owners and managers of publicly owned infrastructure need training on how to increase the systems' resilience and minimize future disruptions and catastrophic failures. Vermont's infrastructure systems, including our transportation, water, energy and telecommunications systems, are the backbone of our communities and our economy. However, these systems are going to be under increasing stress due to Vermont's changing weather patterns.

We recommend targeted assistance in evaluating best practices for resilient infrastructure, performing cost-benefit analysis, and planning how to make successful investments in long-term risk reduction. Specific needs include:

- **Asset Management:** Asset Management is an approach to operating, managing and planning physical infrastructure in a way that is sustainable and recognizes life cycle costs.¹² Vermont Rural Water has already begun offering training in asset management to water system owners and operators. This effort should be scaled up with a goal of having every selectboard/city council, as well as water/fire district boards, familiar with the concept.
- **Climate Data:** Decisions about these systems are often based on past experiences and projections that do not factor in projected climate impacts. Infrastructure managers need access to best available climate projections and how to incorporate them into investment decisions (see previous recommendations in **Know Our Risks**).
- **Case Examples:** Develop case examples that show how climate data was utilized to inform decisions and result in a different approach that produced a positive return on investment and increased.
- **Rate Setting:** In many Vermont communities with public water systems, rates have not changed significantly in decades. This is a reality in communities across the country and a variety of new rate structures are being developed to ensure that systems generate enough revenue to keep up with operations, maintenance and environmental requirements.
- **Transportation Construction Practices:** Training and technical assistance in support of the transportation adaptation guidelines (see previous recommendation).

Of Note:

- In Vermont, more than 2,884 miles of class 1 & 2 roads and 8,531 miles of class 3 roads that fall under the jurisdiction of local governments.
- There are 17 electrical utility service providers that own and maintain the electric grid lines.
- Vermont has 1,443 public water systems. Most Vermonters are served by community water systems, and – unique in the US – a large percentage (40%) are served by small community water systems serving less than 3,300 people.



Engage private landowners as key partners to implement land management practices that reduce hazards and support healthy ecosystems.

Building resilience will require a change in our land management practices. We know a range of best practices for land management that landowners can undertake such as: installation of riparian and shoreline buffers; preservation and restoration of floodplains, shoreline habitat, wetlands, and forested areas; improvements to infiltration of rainwater; and attention to new pests and invasive species introduced through climate change. We also know these practices will protect not only the landowners' own holdings, but also the larger watershed, particularly those who live downstream.

However, we face many challenges in implementing best practices across all land parcels. Private landowners don't always know best practices for resilience – landowners with small parcel sizes may not even be aware that their land management matters. Some resilient practices are low- or no-cost, others require investments that a particular owner may not be ready to make. Investments become particularly challenging when the benefits of resilient practices aren't economic and don't accrue to the landowners who engaged in the practice, but instead to the larger community and overall resilience in Vermont. We cannot solve each of these challenges immediately, but some groups are already working on this issue and there are currently opportunities to do more to engage private landowners in developing resilience.

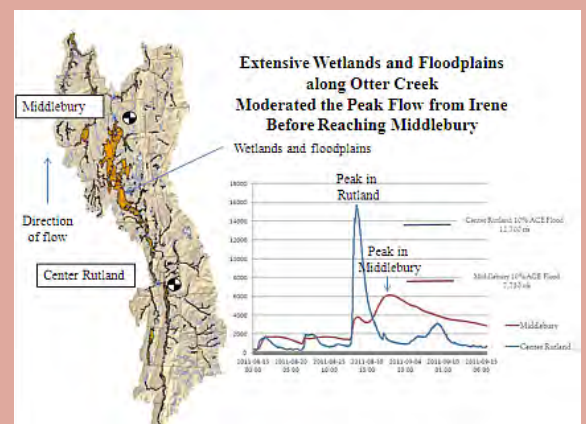
Some opportunities to engage private landowners right away are:

- Develop a Floodplain Management Best Practices Manual that clearly articulates the costs and benefits of different approaches to floodplain management.
- Utilize the Focus on Floods website (currently under development by ANR) as a portal to all available information and resources.
- Develop workshops to share results of river science pilot programs ANR has undertaken with landowners across the state.
- Provide case studies and recognize Vermonters who act as “good neighbors” adopting practices that make their communities safer.
- Invite individuals to participate as representatives of landowners in the collaborative networks described in **Working Together and Learning Together**, in addition to broad public participation in resilience work.

Otter Creek Floodplain Reduces Vulnerability in Middlebury, Vermont

In Vermont, the Otter Creek serves as an example of the important role that our natural systems play to help protect our built environment from flood impacts. The Otter Creek runs from the Green Mountains to Lake Champlain, connecting Rutland and Middlebury. During Tropical Storm Irene, the Otter Creek River caused significant flooding in the Town of Rutland. However, 30 miles downstream, Middlebury stayed dry. This difference is attributed to the floodplains and wetlands that have been protected in the watershed. These areas were able to store so much water that measurements of the amount of water flowing through the river were actually lower in Middlebury as compared to Rutland. In fact, the wetlands along the Otter Creek surrounding Middlebury stored so much water that on August 29, water flow was measured at 13,500 cfs (cubic feet per second) in Rutland but at the same time, the river was only at 3,700 cfs in Middlebury. This example shows firsthand how wetlands can act as a natural defense against floods and how we might be better served to understand and protect the ecosystem services provided to us by protecting our floodplains.

Watch a video recounting the story in detail here: www.action.clf.org/site/PageNavigator/hurricane_irene_anniversary.html.





Leverage existing investment in conservation and stormwater management to maximize resilience benefits.

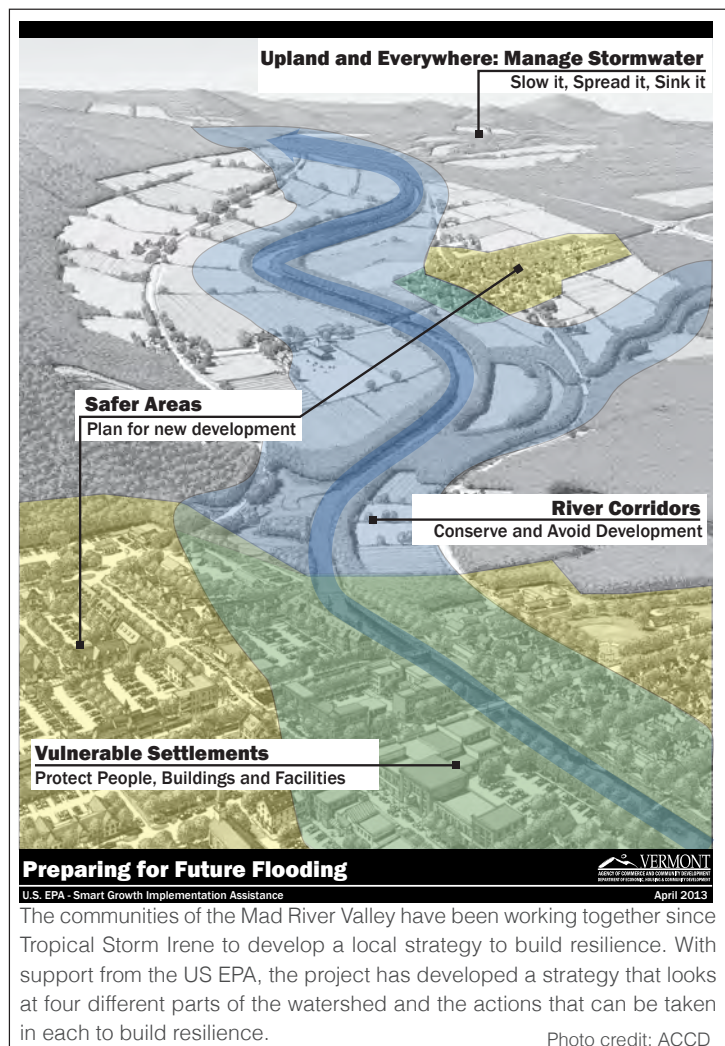
Vermont currently invests in conservation of farm and forest land, river corridor restoration and stormwater management through federal agencies, the State of Vermont (through state agencies as well as the current use program), municipalities, and nonprofit organizations (including land trusts). These investments maintain Vermont's rural working landscape, support economic development, support local food production, and protect the water quality in rivers, streams and lakes. Although resilience may not be the first goal of some of these programs, it is often the end result. Because undeveloped lands absorb precipitation instead of channeling it directly into urban stormwater systems that can become overloaded, these investments reduce the burden on infrastructure during storm events. Because the flood waters can wash over undeveloped lands without being rerouted by structures, and because root systems of vegetation on the land help hold soil in place, these investments have the benefit of mitigating flooding downstream. Because soil filters pollutants out of storm water, these investments also help with water quality during recovery from heavy precipitation events.

We can do more to maximize the resilience co-benefits of lands kept in conservation, forestry, and agriculture through:

- Ensuring that organizations making conservation and working lands investments are aware of the potential resilience benefits, including flood water retention and storage, groundwater recharge, stream channel protection or restoration, and wetland protection/ restoration.
- Ensuring those receiving funds have access to information and technical assistance for best practices in managing for resilience (see also previous recommendation on engaging private landowners).
- Using statewide risk data and river corridor maps to identify priority areas for conservation.
- Working with organizations to incorporate resilience into their selection processes.

Each of these investments has the potential to provide co-benefits in regard to climate adaptation and flood resilience.

Undeveloped areas such as agricultural lands provide resilience benefits. These benefits can be increased by maintaining riparian buffer zones and removing hazards like round bales of hay from floodways where they can wash downstream.¹³



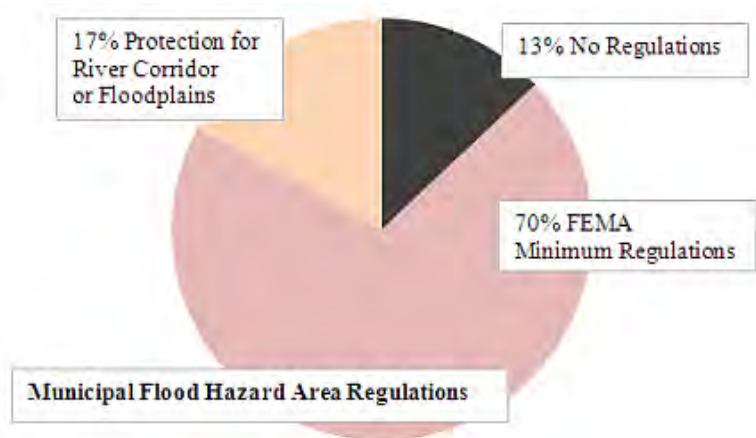
¹³ Vermont State Agency Policy Options, report written by Gavin Smith of the Coastal Hazards Center. http://accd.vermont.gov/sites/accd/files/Documents/strongcommunities/cpr/VT-StateAgencyPolicyOptionsFINAL_web.pdf.



Create a regulatory framework/approach to land use that does not create any new or additional vulnerabilities along Vermont's waterways ("No Adverse Impact" approach).

Currently, floodplain regulations in Vermont are adopted and enforced by municipalities. Decisions made in one community have implications for downstream communities, for whom flood damage may increase due to development further up the waterway. In discussion and polling, community members voiced great concern over the development allowed by their neighbors upstream, but that concern has not led to land use rules that combine the need of those upstream and those downstream. Today, 70% of Vermont municipalities have adopted the FEMA minimum floodplain protections (which do not protect against erosion hazards), 17% have adopted additional protections within river corridors, and 13% have no floodplain regulations at all.

An alternative to the regulation today is an emerging approach known as "no adverse impact" that is based on the principle that one property owner should not adversely impact the flood risk of other properties or communities. In polling during our final summit to review recommendations, 76% of participants felt a no adverse impact rule would significantly increase our resilience. On the other hand, focus groups, which contained many of the same stakeholders, were consistently hesitant about new regulations and about the sort of state- or region-wide regulations (as opposed to local regulations) implied by creating these upstream / downstream linkages. This priority recommendation reflects our conclusion that aggressive rules are needed and that they can be implemented in a way that is respectful of local concerns while also taking a bigger picture view of protecting against major risks to Vermont communities.



Municipal Flood Hazard Area Regulations

Vermont's Agency of Natural Resources should work closely with the RPCs and municipalities to implement a No Adverse Impact approach to development in river corridors. Specifically, this would include:

- ANR, in partnership with the RPCS, should produce a set of model flood hazard bylaws that can be implemented by municipalities. The models would include a minimum standard as well as options for additional protections.
- ANR should seek funding to support a flood resiliency position within each RPC. This staffperson would be responsible for working closely with the municipalities in their region to support efforts to incorporate river corridor mapping into town plans and policies, to adopt flood hazard bylaws, and would provide education, training, and technical assistance within their region. RPCs would be responsible for reviewing town plans and zoning regulations as they relate to floodplain protection, reviewing the quality of local administration of these regulations, suggesting improvements, and reporting on performance metrics to VANR.
- ANR should continue to develop incentives for municipalities to adopt flood hazard bylaws; one example would be to award additional points on state grant applications.
- ANR should monitor and publicly report performance metrics to determine the progress being made toward reducing our flood vulnerabilities.



Develop model flood resiliency bylaws for compact communities located in river corridors.

Vermont's village centers and downtowns are unique historic, cultural and economic assets. Many of these communities are located along rivers and lakes and are therefore prone to flooding and erosion damage. Vermont needs different regulations for these existing compact communities, as compared with less developed portions of the watershed. To date, the model floodplain bylaws that have been created have not addressed the unique challenges of Vermont's villages and downtowns.

Community leaders have requested a set of model bylaws focused on compact communities that illustrate a range of options they can choose from to increase the protection of their communities. These model bylaws should take into account the diversity of local conditions and constraints faced by Vermont's communities, including size of community, geography, financial and capacity base, and ease of enforcement. Model bylaws should show ways to prevent development that will further encroach into the river corridor, incentivize reducing the footprint of existing development in the corridor, and include standards for retrofitting structures to withstand flooding.

The Vermont Agency of Natural Resources, Agency of Commerce and Community Development, Vermont League of Cities and Towns, and Regional Planning Commissions have the expertise to develop these models, and we recommend that they lead the project.





Establish a dedicated fund to support the purchase of hazard-prone properties that are at high risk but are not eligible for funding through FEMA or other programs.

Vermont has a large number of homes and structures located in hazardous areas. We should help people move to safer locations by choice, rather than after disaster displaces them. We should be able to support communities in transforming high risk areas into open lands that can fulfill a variety of hazard mitigation, environmental, water quality and flood management functions. The FEMA hazard mitigation buyout program, while an important source of funding to purchase damaged properties in high-risk locations, does not meet statewide needs to relocate structures located in high-risk areas. FEMA buyouts are only available after a disaster, and many vulnerable properties don't qualify for this pool of funds.

We should find cost-effective solutions that take us out of a cycle of rebuilding and repairing structures after disaster strikes and let us invest instead in land management that minimizes flood damage and gives citizens options to reduce risk to their property and themselves.

Structuring and capitalizing a hazard prone property fund will be challenging, and to do so requires dedicated partners thinking creatively. We recommend a combination of state officials, housing organizations, the Vermont Housing and Conservation Board, and philanthropic organizations begin this process with a goal of having a proposal for how it would be implemented by the end of 2014.

“ People hate to see restrictions but it's foolish to allow development that's going to cost us fiscally and possibly result in the loss of life. If we let people build and we say we are going to help them when there is a problem, are we then going to invest public money if there is a loss? ”

– Stakeholder



Designate pilot adaptation areas and direct investments into those areas.

Vermonters are anxious to implement adaptation and resilience improvements. While work needs to continue in communities across the state, we have seen in other places that complex ideas like “resilience” can be made concrete by selecting pilot communities to implement a suite of adaptation practices. These pilots can test potential approaches, demonstrate what is possible, provide valuable data (including return on investment), and an educational opportunity for decision makers and the public.

A similar concept is currently being used in Rutland to demonstrate the potential for a Vermont community to become “zero-energy” through an intensive energy efficiency retrofit program and the installation of renewable energy.

Other regions outside of Vermont, such as Broward County, Florida, have implemented adaptation pilot areas. In the instance of Vermont’s resilience work, these pilot areas would feature investments in river corridor protection and restoration, storm-water management, drinking and wastewater infrastructure, building retrofits for flood resilience, and community education and engagement.

Adaptation Action Areas in Broward County, Florida

The Florida 2011 Community Planning Act created the option for Florida’s county government to designate priority Adaptation Action Areas, which would receive prioritized funding for infrastructure and adaptation efforts.

In 2013, Broward County became the first region in the state to adopt the concept in its regional plan. Located in southeast Florida with 23 miles of coastline, Broward County is highly vulnerable to sea level rise. The region includes 31 municipalities and a total population of over 1.8 million people. Over the next four years, the County will be working with local municipalities to designate the areas that are most vulnerable to sea level rise as Adaptation Action Areas. These areas will benefit from advanced planning and funding for infrastructure investment.

More information available online at:
<http://www.icleiusa.org/blog/archive/2013/03/25/broward-county-incorporate-climate-change-into-plans-targets-adaptation-action-areas>.



Working Together & Learning Together



During the response and recovery phase of Tropical Storm Irene, many new collaborative efforts were born and proved invaluable to those who were involved. Within state government, the Irene Recovery Coordination Team supported a coordinated approach to recovery and resilience that spanned state agencies, including ACCD, VTrans, DEMHS, ANR, Agency of Human Services, Agency of Agriculture, as well as other agencies and organizations, including the RPCs. Within particular regions, we are seeing new partnerships emerge to address common challenges. For example, the communities of the Mad River Valley are working together on a long-term flood resilience project with support from the US EPA. The Resilient Vermont Project is itself an example of a collaborative network as we brought together diverse stakeholders to learn from each other and work with each other to develop recommendations.

Implementing strategies for resilience means we will need to work across jurisdictional boundaries and across levels of government and bring new partners to the table. Vermont must foster stronger collaboration and alignment to leverage resources and maximize results. We saw this theme throughout our recommendation areas. **Know Our Risks** calls on those producing information about climate change impacts to coordinate with those expected to act on that information so that the final product meets the end users' needs. It also calls on us to be continually learning about new information. **Elevate and Integrate Emergency Management** supports better collaboration between local, regional, and state levels as well as across departments. **Align Rules and Investments** calls on us to work together to ensure that our programs, policies, investments and incentive systems all work towards common resilience goals.

Our earlier sections connected collaboration to work on particular recommendations, this section addresses the formation of collaborative networks for ongoing resilience.

“ . . . individuals, families, neighborhoods, communities, and the private sector will likely play an increasingly active role in meeting emergency management needs. The public's ability and desire to self-organize will grow, as the role of the individual, access to information, and technology all evolve.”

– FEMA 2030 REPORT - FEMA Crisis Response and Disaster Resilience 2030. Strategic Foresight Initiative, January 2012.

Where Do We Want To Go?



Even while stakeholders acknowledge the importance of collaborative effort for resilience, it's easy to lose sight of that priority in day-to-day work. Collaboration requires someone to invite partners to the table, and set common goals and outcomes. Because many issues won't find easy accord among the different stakeholders, collaboration requires additional effort to keep everyone moving in the same, positive direction. Vermont stakeholders have described a layered approach to resilience, based on networks and collective action, to build capacity for understanding and managing climate impacts at all levels, from the household, family and enterprise to the community, region and state. This approach requires intentional effort to build opportunities for collaboration.

Effective opportunities for collaboration would balance the exploratory information sharing that leads to creative insights with a need to act efficiently on immediate challenges. Participants from many backgrounds would be actively invited in to share their ideas and have the background information they need to participate. The collaborative group would match the time commitments and level of formality appropriately with the tasks at hand. It would also check its work against outside information, such as climate data, demographics of the communities, and best practices developed elsewhere.

Pulling together diverse networks will rely on a public that is engaged in risk and resilience issues. Some of that engagement will come from making more information available. However, it also means a shift in thinking about the relevance of that information. We need clear pathways from learning about important issues in resilience to taking personal action to increase resilience.

Collaborative networks allow everyone to contribute from their expertise, while also providing enough framing information to make that expertise relevant.

Another component of these participatory networks is how we learn together, in addition to how we work together. The **Know Our Risks** section discussed how data and information are presented. We need to complement that work on delivering information with work on learning processes that bring together many different strands of data and information. Everyone has their own areas of deep expertise – whether that's in emergency response systems, knowing a particular parcel of land, knowing the people in a community, or something completely different.

As organizations receive new information from the networks to which they belong, they need to be able to adjust their practices. Part of learning will be the ability to make changes as circumstances change in an unstable climate, and being able to learn from trial and error. Setting one standard way of doing things will not work over time.

Finally, **successful collaboration will require leadership** in fostering individual networks and pulling together the efforts of smaller collaborations into a greater whole for resilience at a statewide level.

How Do We Get There?

Our recommendations for fostering stronger collaboration and alignment across organizations, sectors and jurisdictions to leverage resources and maximize results.



Create the Vermont Strong Network – a cross-sector collaboration that includes nonprofit, public and private organizations involved in resilience work to align efforts, share best practices, and leverage resources to advance resilience efforts statewide.

We have myriad organizations working to promote resilience throughout Vermont. Currently many of these efforts are not connected to one another, there is duplication of effort and missed opportunities to share lessons learned across different parts of the state. A Vermont Strong Network would link the organizations and individuals for greater collective impact.

A Vermont Strong Network would:

- Build from the common vision and shared agenda that has been put forth in this document;
- Develop a shared system for tracking progress over time- including an annual progress report;
- Facilitate communications across partners by creating communication platforms that might include a website, listserv, and annual gathering of network members;
- Serve as the coordinating entity that advances the common agenda by guiding the overall strategy, supporting activities that align partners, establishing the shared tracking system, building public will, advancing policy, and mobilizing funding.¹⁴

We recommend building from the current momentum for collaborative action on resilience and fathering a group of core partners to advance the concept of a Vermont Strong Network. The partners would further define the functions of the network, identify the necessary resources (both funding and people power), and identify an institutional home for such a network.



¹⁴ To learn more about the roles of backbone organizations, see http://www.ssireview.org/blog/entry/understanding_the_value_of_backbone_organizations_in_collective_impact_2.



Use regional networks to support watershed-scale planning and enable municipalities to collaborate across jurisdictions to set priorities and make cost-effective investments that reduce hazards for downstream communities and development.

Reducing the impact of future flooding will require Vermont communities to work across their municipal boundaries and consider solutions at a watershed scale. In recent years, ANR has encouraged efforts to plan across municipal lines – currently the state helps to develop watershed plans for each of the state’s 17 major basins. ANR also produces corridor maps and plans, which often span multiple jurisdictions. Watershed collaboration offers an opportunity for communities to pool their collective resources to make investments in projects such as land conservation, floodplain restoration, stormwater management, and the removal/replacement of undersized bridges and culverts that can help to increase the safety and reduce loss in downstream communities. However, municipalities often do not cooperate at the watershed level to identify and implement projects and conservation practices that will provide region-wide benefits.

We recommend that RPCs play a key role in helping municipalities link to the larger region for watershed management. The new flood resilience component added to regional plans through Act 16 will provide a chance for RPCs to ensure that municipalities are addressing potential hazards across the watershed. RPCs can provide local planning support by helping communities understand how their decisions about development, river management and land conservation affect the communities downstream from them. We also recommend that they support collaboration between towns for project implementation.

We recommend that ANR work with municipalities to increase the public and local government engagement in the river corridor planning process. This process can be one mechanism for towns to come together across the watershed and can both support the RPC’s work on regional planning and be supported by that RPC work as they bring towns to the table for discussion of watershed issues.

We recommend that Vermont municipalities build from these two region-based planning processes (regional plans with flood resilience component and river corridor planning) to become more engaged overall in planning efforts that are going on in communities within their watersheds.





Support local resilience networks that bring together planning boards, conservation commissions, emergency managers, social service providers and other leaders to develop a shared vision for resilience within a community.

Within Vermont municipalities, there are a variety of groups working on community resilience. These groups include selectboards, planning commissions, conservation commissions, emergency management directors, emergency management committees, housing organizations, food shelves, energy committees and others. It is important to align these organizations' efforts so that they can share information, resources, and creative ideas.

Community-Resilience.org has proposed a pilot program that would follow intensive community-based planning for hazard mitigations, with informal ways for participants to continue checking in after the planning has ended. If this model proves able to build useful social capital and enhance long-term resilience, it may suggest a way to create local resilience networks without large time commitments that tax the capacity of local citizens who are already heavily involved in their community. We recommend piloting this concept.

“ I don't know where our emergency shelter is, don't know how to get in touch with people, don't know who the emergency coordinator is... doubt if anybody else does except maybe the selectboard. ”

– Fran Putnam, Weybridge Town
Energy Committee





Invest in education and outreach to increase public literacy regarding river science and floodplain management practices.

We recommend more proactive education campaigns that engage the general public in learning about key resilience topics and considering how they can contribute to greater resilience themselves. One area for piloting a new model of outreach and education is in river science and floodplain management practices.

Climate change and the increasing intensity and frequency of precipitation is expected to significantly impact Vermont's waterways. In particular, our rivers, streams, lakes and ponds will be experiencing more frequent flooding and associated erosion and water quality degradation. Over the past decade, ANR has dramatically increased our understanding of watersheds and how Vermont's unique topography and geology affect the behavior of rivers and streams. Working with landowners across the state, as well as other state and federal agencies, ANR has supported dozens of pilot projects to identify land management practices that can help reduce the impacts of flooding, including floodplain protection and restoration, low-impact streambank stabilization, and improved stormwater management to reduce the amount of water reaching the river during a storm. We recommend that ANR draw on this past work to launch specific public education and outreach efforts that include:

- Partnering with a range of local organizations to deliver workshops, as a way to both ensure consistent messaging about ANR's findings and invite new conversations about how these findings might be used at a local level.
- Creating a computer simulation program or game that enables Vermonters to see how upstream mitigation projects can reduce downstream vulnerabilities.
- Engaging more private landowners (see earlier recommendation for details).
- Working with RPC's to develop model flood resilience bylaws that can be used by municipalities (see earlier recommendation for details).
- Sharing resources and educational materials, including summaries of best practices, via a new flood resilience website that ANR will launch in 2014.
- Developing performance metrics for outreach and education programs to monitor their success, their budgets, and the possibility for replication and scaling them up.



Recommendations



Know Our Risks

1. Develop and disseminate best available climate and risk information in user-friendly formats that can be incorporated into local, regional, and statewide plans and used to inform priorities and investments.
2. Institute a sustained river corridor mapping program that provides information about flood and erosion risk to inform local, regional and state plans and the identification of hazard mitigation projects.
3. Conduct a statewide transportation vulnerability assessment that produces a statewide data set and map that shows areas of highest relative vulnerability and is used to guide prioritization of investment.
4. Incorporate vulnerable population data and analysis into municipal, regional, and state hazard mitigation plans with the help of social service providers so that the needs of Vermont's vulnerable populations are clearly identified and represented at all levels of hazard mitigation planning.
5. Take advantage of a strategic opportunity to forge a public-private partnership between IBM, electric utilities and the state to utilize a state-of-the art weather model, in combination with state data, to improve the accuracy of storm predictions, enable early warnings, and efficiently mobilize emergency equipment and personnel.



Elevate & Integrate Emergency Management

6. The State of Vermont should become an innovator in instituting resilience in emergency management in ways that best serve the needs of Vermonters.
7. Within state government, assign a champion responsible for resilience and risk management who is authorized to coordinate the work across state agencies to achieve a consistent approach, identify and advance state priorities, and ensure accountability.
8. Elevate the position of the Division of Emergency Management and Homeland Security within state government to increase their authority and ability to effectively integrate preparedness and risk management into all state government functions.
9. Increase emergency management capacity at the local/municipal level to ensure that those who are responsible for emergency management functions before, during, and after disasters have the skills, training, and equipment they need.
10. Regionalize key emergency management functions to provide more efficient and effective support to communities, improve communications, and create strong regional coordination.



Align Rules & Investments for Stronger Communities

11. Provide guidance and incentives for proactive investment in transportation infrastructure.
12. Prioritize investment in resilient water and wastewater infrastructure.
13. Invest in training and technical assistance programs to promote cost-effective action and preparedness and reduce future disruptions to state and municipal infrastructure systems.
14. Engage private landowners as key partners to implement land management practices that reduce hazards and support healthy ecosystems.
15. Leverage existing investment in conservation and stormwater management to maximize resilience benefits.
16. Create a regulatory framework/approach to land use that does not create any new or additional vulnerabilities along Vermont's waterways ("No Adverse Impact" approach).
17. Develop model flood resiliency bylaws for compact communities located in river corridors.
18. Establish a dedicated fund to support the purchase of hazard-prone properties that are at high risk but are not eligible for funding through FEMA or other programs.
19. Designate pilot adaptation areas and direct investments into those areas.



Working Together & Learning Together

20. Create the Vermont Strong Network – a cross-sector collaboration that includes nonprofit, public and private organizations involved in resilience work to align efforts, share best practices, and leverage resources to advance resilience efforts statewide.
21. Use regional networks to support watershed-scale planning and enable municipalities to collaborate across jurisdictions to set priorities and make cost-effective investments that reduce hazards for downstream communities and development.
22. Support local resilience networks that bring together planning boards, conservation commissions, emergency managers, social service providers and other leaders to develop a shared vision for resilience within a community.
23. Invest in education and outreach to increase public literacy regarding river science and floodplain management practices.

Next Steps for Implementation

The recommendations in this Roadmap point to next steps of varying complexities, costs, and stages of development. Some are projects ready to go right now, others will take more groundwork to be ready for full implementation. As Vermont acts on these priority recommendations, we should:

- Continue coordinating across groups to be efficient in how we deploy resources, to create effective partnerships across silos, and to learn from each other.
- Build off of current momentum. Many of our recommendations use changes already underway as a starting point; we should support that progression and guard against losing track of what's happening right now while we investigate new opportunities. Our stakeholder process also built interest in particular recommendations from organizations in a position to champion different components of the plan. We should act on that potential leadership.
- Have a long-term view. Our stakeholders were clear: climate change is a big challenge and our approach must take the long view. Some of our recommendations won't happen overnight, but the steps towards realizing them can start right now.
- Ensure accountability through establishing performance metrics and making progress reports publicly available.

Establish a Statewide Vermont Strong Network

We recommend establishing the Vermont Strong Network to keep forward momentum and coordinate the statewide resilience efforts. This Network will build from the commitment of stakeholders in the Resilient Vermont Project. It will keep resilience in the public eye even when there is not a current disaster in our state to command that attention.

The Vermont Strong Network does not replace the need for changes within state government to support on-going resilience work, particularly assigning a state champion for resilience. The Vermont Strong Network is a mechanism that can pull together community level networks and emerging regional networks. It can shepherd projects without a clear home in either state government or a single organization. Also, state officials will need the grassroots organizing possible through the Vermont Strong Network to effectively engage with the myriad groups of every size, in every corner of the state, involved in resilience.

In its early stages, we recommend that the Network focus on the following key areas:

- Ensuring that everyone has the same understanding of climate data and projections, which includes working with the Climate Cabinet as they gather best available information and disseminating that information.
- Building local capacity for emergency management and infrastructure management. Within the network will be a variety of organizations that provide training and technical assistance who can share best practices and identify training gaps. There also will be individuals who can share best practices on a peer-to-peer basis. This networking will be particularly useful in connecting those who worked on Irene response and recovery within those who did not.
- Identifying priority funding needs and identifying opportunities for Vermont to tap into more funding for resilience.
- Reporting on statewide progress towards greater resilience.

Support Recommendations Ready for implementation in 2014

As noted in the above, the recommendations in the Roadmap capture existing forward momentum. Some of these recommendations build from projects, skills and resources available from existing programs. We have worked with stakeholders to identify recommendations that are in development for implementation in 2014, and we support



that continued work. These recommendations include:

- *Developing and Disseminating Best Available Climate Risk and Vulnerability Information in User-Friendly Formats.* This recommendation appears in the Vermont Strong Network, but is also part of the existing mandate for the Governor's Climate Cabinet.
- *Increasing Emergency Management Capacity at the Local / Municipal Level and Investing in Training and Technical Assistance Programs for State and Municipal Infrastructure Systems Owners and Managers.* These recommendations appear in the overall recommendation for the Vermont Strong Network and also include actions being undertaken by other entities. DEMHS and the RPCs have committed to work on this area in 2014.
- *Instituting a Sustained River Corridor Mapping Program.* Many of the recommendations about reducing flood vulnerabilities rely on information from the mapping program started at ANR. The agency is working on providing the necessary staff to fully implement this program.
- Improving Hazard Mitigation plans, including incorporating best available climate data, increasing consistency with municipal and regional land use plans and incorporating vulnerable population data and analysis into municipal, regional, and state hazard mitigation plans. Multiple individual towns have started this planning work. The RPCs will also work in the coming year to improve municipal and regional hazard mitigation plans.
- Conducting state-wide analysis to develop methods and tools for transportation resilience planning. There is work underway to analyze vulnerabilities and risks to the system and to prioritize investment strategies.
- The State of Vermont and utilities are moving forward on the opportunity to work with IBM in a public-private partnership to create a state of the art, localized weather prediction program that can result in highly accurate, localized early warnings for storm impacts.

The recommendations in this report also name partners when the actions clearly fall within their authority, but are not in current plans for 2014. The Institute for Sustainable Communities will be following up with those partners, and discussing next steps towards implementation. Other recommendations don't have a home in a single existing organization or small group of organizations, and the Vermont Strong Network can work with other entities concerned with resilience to find homes for those. Some of the recommendations require time to lay the groundwork for implementation, and we've identified those in their descriptions, for example, developing No Adverse Impact policies for floodplains, engaging private landowners, and establishing a dedicated fund for hazard-prone properties. However, we believe that all recommendations can be implemented in the near future.

These Recommendations Will Evolve

Our definition of resilience begins with the ability to adapt. Similarly, we know that the recommendations in this report will evolve over time, as some are implemented, others are added, and new opportunities for collaboration arise. We should review and adjust our approaches over time as conditions change. We should be accountable not only for implementing the recommendations in this report, but also for checking back regularly to confirm that we are on the right path. This evolution requires continuous awareness of resilience as a statewide priority. Too often following a disaster, there is a short-term focus on reducing hazards and building resilience, but this focus wanes over time as seemingly more pressing issues come to the fore. We know that Vermont will continue to experience more frequent and destructive disasters as climate disruption continues. We owe it to all those who suffered in Irene and to the future Vermonters who will experience disasters, to take action and be accountable to the lessons we've learned.

List of Acronyms

ACCD – Agency of Commerce and Community Development

ANR – Vermont Agency of Natural Resources

CEDS – Comprehensive Economic Development Strategy

DEMHS – Department of Emergency Management and Homeland Security

EMPG – Emergency Management Planning Grant

EOC – Emergency Operations Center

ERAF – Vermont’s Emergency Relief and Assistance Fund

FEMA – Federal Emergency Management Agency

ISC – Institute for Sustainable Communities

LEPCs – Local Emergency Planning Committees

NECIA – Northeast Climate Impacts Assessment

NFIP – National Flood Insurance Program

NOAA – National Oceanic and Atmospheric Association

RACC – Research on Adaptation to Climate Change

RPCs – Regional Planning Commissions

SEOC – State Emergency Operations Center

US EPA – United States Environmental Protection Agency

UVM – University of Vermont

VECAN – Vermont Energy & Climate Action Network

VHFA – Vermont Housing and Finance Agency

VLCT – Vermont League of Cities and Towns

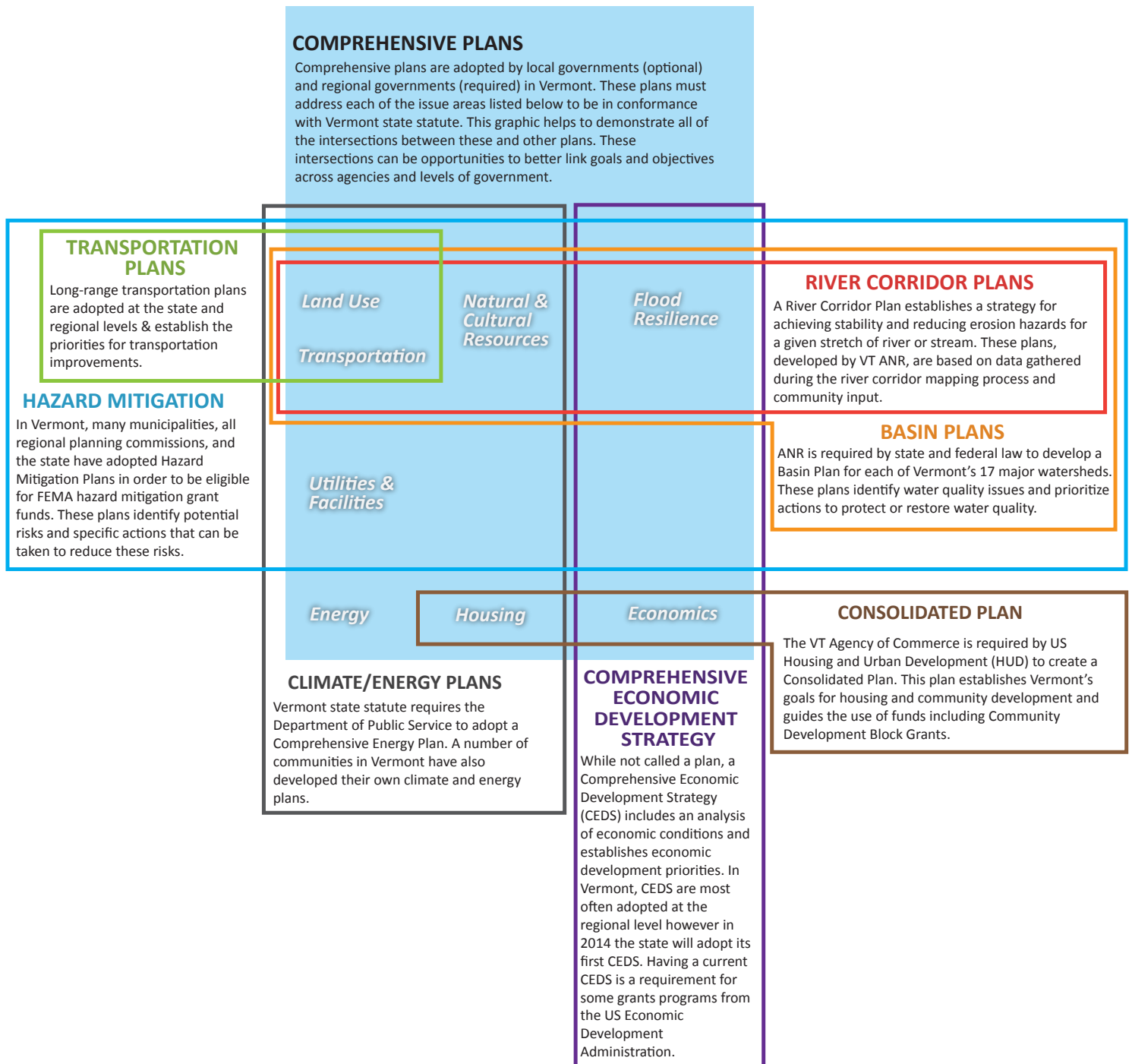
VNRC – Vermont Natural Resources Council

VTrans – Vermont Agency of Transportation

WWTF – Wastewater Treatment Facilities

Planning in Vermont

At local, regional & state levels, Vermont has numerous planning processes in place. Resilient Vermont stakeholders have been in strong agreement that we don't need more plans but that we need to better link the plans we have to create more consistency and alignment. This graphic shows the topical areas where Vermont's current plans overlap. While many plans touch on all the issues, we show where the core areas of focus overlap.





INSTITUTE FOR
Sustainable
Communities

HEADQUARTERS
535 Stone Cutters Way
Montpelier, VT 05602

T 802-229-2900
F 802-229-2919



www.facebook.com/SustainableComm



www.twitter.com/SustainableComm



www.iscvt.org



www.resilientvt.org



www.sustainablecommunitiesleadershipacademy.org