The Cost of Climate Change in Vermont:

Part One – Spending Inventory

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SolaVida

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SolaVida
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Executive Summary

The purpose of state public spending is to protect and support the health and well-being of state residents. Along with medical and health organizations worldwide, the World Health Organization and the Center for Disease Control and Prevention have declared climate change to be a primary threat to human health in the 21st century. Despite these warnings, state governments have chosen to address climate change mitigation and adaptation in a disaggregated manner. As time goes on, that approach will become increasingly unwise, especially given data indicating that states are not making the progress required. Over time, we can expect to see states develop comprehensive, strategic plans for addressing climate change challenges. These plans will require difficult funding allocation decisions.

In this report, we describe a "spending inventory" framework for methodically examining how states allocate funding to address climate change challenges. This is the starting point for states to develop a comprehensive, strategic plan for addressing climate change impacts. We address two fundamental questions:

- What actions is state government currently taking to address climate change?
- Relative to other climate change challenges, which issues are addressed the most with publicly-funded programs? Which are addressed least?

In this context, climate change challenges encompass the following:

- Mitigating greenhouse gas emissions;
- Enhancing resilience to climate change risks;
- Addressing disproportionate risk to vulnerable communities.

The approach taken has been to break this "spending inventory" concept into two pieces, and then apply the idea to an examination of spending by Vermont state government. As reported here in Part One, we executed a qualitative analysis that creates a foundation for a deeper, more quantitative Part Two analysis. Part Two is envisioned to uncover the actual spending within the more than 110 Vermont state programs identified in the Part One work. When Part Two is completed, the resulting comprehensive view of existing spending related to climate change will provide highly valuable information to a wide array of stakeholders - including state government, policy makers, NGOs, and advocacy groups.

Currently, the majority of the state's programs address climate challenges pertaining to energy and transportation. Issues that have been more moderately addressed are in the arenas of food systems and land use. Water management and public health are the least addressed areas of work. There is also a clear lack of attention to addressing the vulnerability of specific industries, like tourism, that are, and will be, strongly impacted by climate change. Finally, we note that assessing the level of effort and funding needed to fully address climate change challenges is a very different question, and that topic is outside the intent of the fully envisioned spending inventory project.

About the Authors

About SolaVida

SolaVida is a non-profit organization whose mission is to draw new constituencies into the crucial push for a deeper and faster response to the challenges of global warming. Given the scope of this unprecedented challenge to our shared environment, we need far more action by far more people. SolaVida works with local and national groups, developing projects that speak to new communities – encouraging people to reduce their personal and professional carbon footprints and to become actively engaged in the push to create an innovative and effective state-level policy that will create a better way to power the world.

Jake Gehrung

Jake is a recent graduate from the University of New Hampshire where he studied Environmental Science, Environmental Economics, Spanish, and Business Administration. His passion in life and career is to shift society toward sustainability and peace. As an undergraduate researcher, he completed projects in New England, New Zealand, and Ecuador to broaden his perspective on environmental sustainability. As a UNH 2020 Sustainability Fellow, Jake worked with SolaVida on the work described here. He hopes to continue building experience in sustainability, making the strongest impact through corporate and political efforts.

Dan Quinlan

SolaVida was founded by Dan Quinlan. Dan's professional life has spanned work in both the nonprofit and for-profit worlds – managing clean energy consulting projects at the local and federal level, creating and launching start-up businesses, business management, and management of R&D projects and teams. In addition to leading SolaVida's projects, Dan provides consulting services on climate change and clean energy projects with a particular focus on the health impacts of climate change and the healthcare sector.

Acknowledgements

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We note that the findings and opinions expressed in this report are solely those of the authors, and are not attributable to the experts acknowledged above, the University of New Hampshire, or the Sustainability Fellowship program's funders or supporters.

Introduction

Climate Change and Health in Vermont

The central purpose of public spending in the United States is to protect and support the health and well-being of the nation's citizens. Joined by health organizations and millions of medical providers from across the planet, the World Health Organization has stated that climate change is the dominant threat to health and well-being in the 21st century.[1] As the earth's climate continues to change due to human activity, the impact of climate change on health has become a "clear and present danger" that Federal and State governments must act upon (Figure 1).

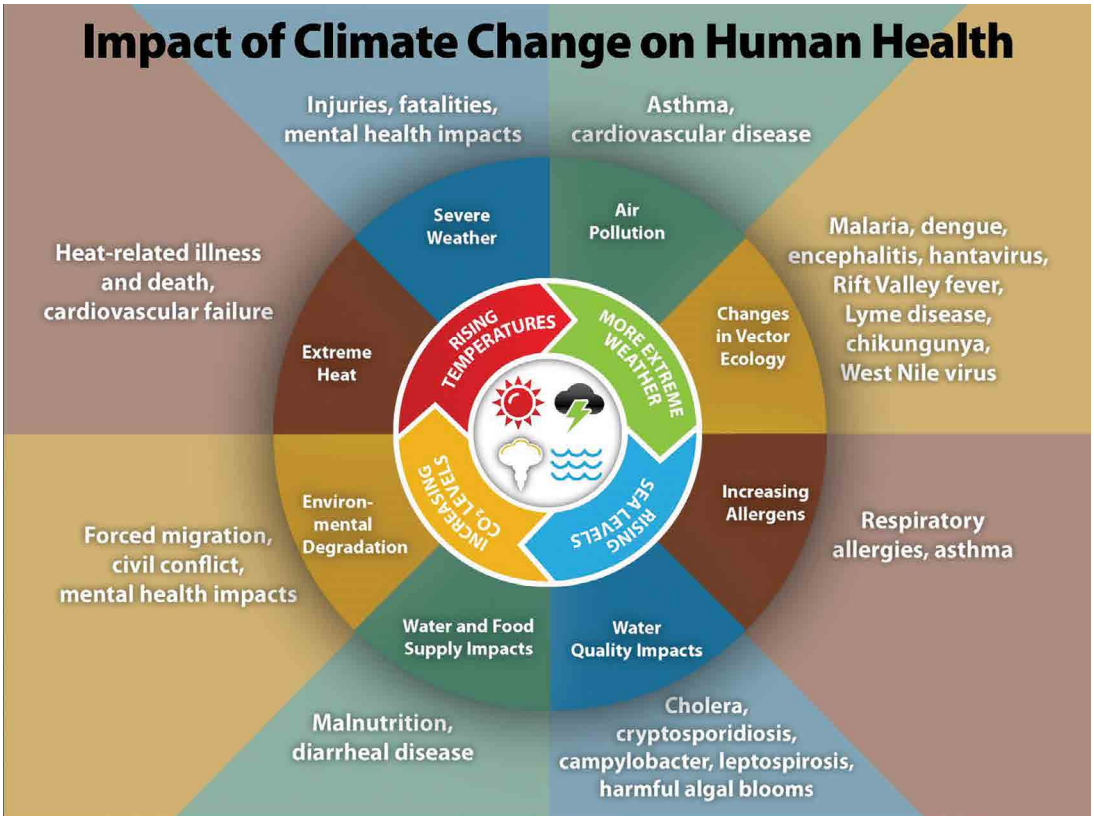


Figure 1 ***The Impact of Climate Change on Human Health*** [2]

In Vermont, climate change presents several challenges that fall within the framework of Figure 1. Fortunately, many Vermont organizations have been working to understand the potential severity and push state government toward taking action (Table 1). For this study, we organize the challenges into three broad categories: reducing greenhouse gas (GHG) emissions, addressing climate risks (e.g. storms and flooding, rising temperature), and attention to the disproportionate risk to vulnerable communities.

[1] www.who.int/news-room/spotlight/ten-threats-to-global-health-in-2019
[2] The Center for Disease Control and Prevention: https://www.cdc.gov/climateandhealth/default.htm

Table 1 *Vermont's Climate-Related Spending Activities*

CHALLENGES	ACTIVITIES DESCRIPTION	SOURCES*
Rising Temperature	Investigate the direct and indirect health impacts of rising temperature, while also funding programs that fully address this risk.	1, 2, 3, 6
Drought	Monitor drought stress and fund programs that improve water management; encourage reduced residential and agricultural water use.	3
Wildfire	Monitor the risk of wildfires and fund programs to reduce vulnerability to more frequent and unpredictable wildfires.	3, 6
Storms and Flooding	Address risks associated with extreme storms and flooding. Risks include the effects of both inundation and erosion, which result in infrastructure damage, land loss, and water contamination.	1, 2, 3, 6
Changing Seasons	Monitor the impact of shifting seasons (e.g., decreased snowpack), especially with respect to ecosystem health and economic viability of seasonal industries.	1, 2, 3
Pest Infestation	Monitor pests like the emerald ash borer, and fund programs to minimize the associated impacts.	3, 6, 7
Disease	Monitor disease propagation (e.g. Lyme disease), and fund programs to minimize the impact on health and well-being.	3, 6, 7
Community Vulnerability	Identify communities disproportionately affected by climate risks, and provide services to these communities with respect to both mitigation and resilience.	3, 4
GHG Mitigation	Assess sources of greenhouse gas emission and fund programs that directly mitigate emissions, or encourage state residents and businesses to do so.	1, 2, 3, 5

* Sources:
1 - State of Vermont. (2020). Climate Change in Vermont. https://climatechange.vermont.gov/
2 - Galford, Gillian L., Ann Hoogenboom, Sam Carlson, Sarah Ford, Julie Nash, Elizabeth Palchak, Sarah Pears, Kristin Underwood, and Daniel V. Baker, Eds, 2014: *Considering Vermont's Future in a Changing Climate: The First Vermont Climate Assessment*. Gund Institute for Ecological Economics, 219 pp.
3 - Vermont Emergency Management (VEM). (2018). Vermont State Hazard Mitigation Plan. https://vem.vermont.gov/sites/demhs/files/documents/2018%20Vermont%20State%20Hazard%20Mitigation%20Plan%20-%20Final%20Adopted_Interactive.pdf
4 - Personal Communication: Bindu Panikkar - Assistant Professor, Rubinstein School of Environment and Natural Resources, University of Vermont
5 - Energy Action Network (EAN). (2019). *Annual Progress Report for Vermont*. https://www.eanvt.org/2019-progress-report/
6 - Institute for Sustainable Communities. (2013). *Vermont's Roadmap to Resilience*. https://resilientvt.files.wordpress.com/2013/12/vermonts-roadmap-to-resilience-web.pdf
7 - Ulmer, J. (2020). Climate & Health. Vermont Department of Health. https://www.healthvermont.gov/environment/climate

Goals of the Study

Through the work of Vermont's Agency of Natural Resources, the Department of Public Service, and other organizations, Vermont residents are partially able to assess the state's progress in addressing climate change across multiple dimensions - including greenhouse gas emissions, changes in energy consumption, and resilience to severe weather events. That work provides insight into the outputs of the state's effort. This study focuses on understanding and quantifying a driving input of that work – programs and expenditures currently in place.

To date, the state has not comprehensively assessed its progress on addressing its obligation to expend funds to mitigate emissions and protect the public, and the state lacks a comprehensive strategy that acknowledges and addresses all major health and well-being risks over both the short and long term. In this report, we offer a qualitative assessment of the current status of Vermont programs addressing climate challenges. In Part Two of the Spending Inventory Project, we envision a more in-depth analysis, which would include gathering and analyzing budget and spending data for the programs and initiatives outlined in this initial report.

An inventory study would serve as a baseline as the state continues to move forward with the development of new and expanded programs, including actions related to the recently adopted Global Warming Solutions Act.[3] Considering the implications of Figure 1, the importance of understanding current state spending on climate change cannot be understated. When completed, this two-part spending inventory will answer two fundamental questions:

Question 1: What is the state of Vermont doing to address climate challenges?
This report includes a qualitative inventory of state-funded programs that address climate *resilience/adaptation* and *mitigation*, which we define as:

1. *Resilience/Adaptation Programs:* state-funded efforts with intended to protect the health and well-being of state residents from risks associated with climate change.
2. *Mitigation Programs:* state-funded efforts designed to reduce net greenhouse gas emissions associated with human activity in Vermont.

In Part One, we have endeavored to comprehensively identify all the areas where there is substantive state government activity addressing climate change. As such, we use activity as a proxy for spending. Programs included in this report provide a roadmap for the quantitative investigation and analysis to be completed in preparation for the second phase of work.

Question 2: Which climate change challenges are being strongly addressed? Which challenges are being moderately or weakly addressed?

[3] https://legislature.vermont.gov/Documents/2020/Docs/ACTS/ACT153/ACT153%20As%20Enacted.pdf

As one would expect, the climate challenges that Vermont is already addressing are not addressed equally, and the amount of spending varies enormously. Vermont needs to thoroughly examine all the primary impacts, including understanding the publicly-funded programs (state or federal) already in place. In answering this second question, this Part One study will provide the information needed to start the quantitative work of the Part Two study.

Research Limitations

Time Frame
This research was conducted as part of the University of New Hampshire Sustainability Fellowship program during a ten-week period in the summer of 2020. This assessment is an initial and rapid qualitative inventory, and, as such, the findings are preliminary. Given that Part Two of the study will include estimating actual expenditures, results from that work will be inherently more conclusive.

Expenditures Not Attributable to Climate Change
In some instances, programs and spending of interest are not solely attributable to the impacts of climate change. For example, bridge maintenance is a general infrastructure expense covered by pre-existing Vermont Agency of Transportation programs. While there are challenges in quantifying how the increased frequency and severity of storm events caused by climate change increases annual maintenance costs, that does not mean that a reasonable range of added cost cannot be estimated. These types of questions will be addressed in Part Two of the Spending Inventory Project.

Expert Availability
This research was conducted during the height of the COVID-19 crisis. The pandemic put significant pressure on many state and NGO employees, limiting their capacity to support this research through interviews and answering follow-up questions.

Part One - Spending Inventory Methodology

This study was completed using the following methodology:

1. *Climate Challenge Assessment* - We conducted background research on the impacts of climate change on human health in Vermont. We focused on reports published by the state and federally-funded organizations, as well as NGOs. Our assessment was further informed by subject matter experts. Climate challenges identified were used as the basis for identifying relevant programs, and assessing the degree to which they address climate threats to the health and well-being of the state's residents.

2. *Organization Research* - We reviewed online and other resources provided by all state agencies and partner organizations to identify efforts addressing climate risks identified in Stage 1. This aspect of the work was the basis for choosing the organizations discussed throughout this report. We also examined the work of additional organizations recommended during our interviews with subject matter experts.
3. *Program Research* - We conducted a thorough investigation of the selected organizations from Stage 2 above to identify specific programs that addressed climate challenges. We also determined the funding sources of these programs when that information was readily available.
4. *Confirmation Research* - We interviewed specialists in each spending area to verify programs identified in Stage 3, gain further information about funding sources, and identify spending areas we had not previously uncovered.
5. *Indicator Formation* - State-funded programs verified in Stage 4 were used as the basis for developing indicators, which were used to help verify and organize state spending.

Inventory of Spending

Inventory Categories

To offer a clear landscape of resilience and mitigation spending in the state, we grouped Vermont's programs into categories that logically and holistically address climate change driven threats to human health and well-being. The inventory begins with categories in which climate challenges are most thoroughly addressed relative to other categories, and ends with categories that are relatively unaddressed or neglected. Within each category, we have included a general description, followed by subcategories that encompass spending indicators developed within the project. These indicators are generalized descriptors used to organize over a hundred state and federal programs. We have also included some significant NGO efforts that we identified but could not confirm as publicly-funded. These are included to ensure the broad landscape of Vermont's climate-related programs are covered. Where possible, we provide our current view of the sources of funding from each indicator. "State" refers to programs primarily funded using state revenue including tax revenue and rate-payer dollars (i.e., utility bill fees), "Federal" refers to programs funded by the Federal government and "NGO" refers to NGO programs where the funding has not been determined. Refer to Appendix A for the supporting details underlying all the information provided.

We note that in some areas there is significant overlaps between categories, and some readers may disagree with where we have placed some activities. Yet, in keeping with the overarching goal of the study, a system of cataloging is necessary.

1. Energy

Since the start of the industrial revolution, fossil fuels have been used to meet growing energy demands in the United States. Today, Vermont's use of electricity and thermal energy accounts for 36% of its greenhouse gas emissions.[4] A primary focus of state-funded programs has been to mitigate climate change by reducing energy use, transitioning to renewable energy sources, and electrifying where possible. This massive transition requires that energy opportunities be made available to low-income communities. A second critical consideration is ensuring that both new and upgraded energy infrastructure is resilient to more powerful storms and heavier flooding events.

[4] Energy Action Network (EAN). (2019). Annual Progress Report for Vermont. https://www.eanvt.org/2019-progress-report/
Image: Flaticon.com

Electricity: Generation and Transmission

The generation, transmission, and (increasingly) storage of electricity are fundamental pieces of the puzzle. Renewable energy is a solution that saves money and emits far less greenhouse gases, and many states are significantly ramping up their support for renewable energy programs and investment.[5]

- **Renewable Energy Standard** - The state's Distribution Utilities (DUs) are using state funding in a drive to meet the Renewable Energy Standard, which requires an annual increase in the percentage of retail electric sales sourced from renewables, with emphasis on distribution of new renewable generation.

- **Smart Grid** - DUs are also integrating new information and communications technology that allows for sophisticated monitoring and control of energy consumption by energy companies and the customers they serve.

- **Residential Products and Incentives** - The DUs are providing products and incentives to homeowners that encourage the transition away from the fossil fuel energy based economy. For example, DUs are offering in-home battery products and incentives for renewable energy generation infrastructure that enables home based generation and storage. DUs also offer a credit on homeowner energy bills for providing stored energy during parts of the day when residential energy consumption is high.

Electricity: Efficiency

The most cost-effective solution in reducing GHG emissions associated with electricity is the deployment of well-designed energy efficiency programs. Energy efficiency technologies and smart building design drastically reduces demand from homes and businesses.

- **Products and Incentives** - Vermont offers products, incentives, and information services that make it easier for homeowners and business owners to carry out efficiency retrofits and install efficient systems. Through a combination of DU programs and Energy Efficiency Utility (EEU) programs, state residents have a wide array of opportunities to install efficient heating and cooling technology, as well as other types of equipment. Additionally, using online information resources and rebate offers, DUs and EEUs make the retrofitting process more cost-effective for homeowners and business owners.

- **Affordable Projects** - State government is conscious of economic barriers to completing energy efficiency projects and provides affordable options for retrofitting existing homes and purchasing new homes, including weatherization programs for low-income households.

[5] Energy Action Network (EAN). (2019). Annual Progress Report for Vermont. https://www.eanvt.org/2019-progress-report/
Image: Flaticon.com

- **Innovation** - The state recognizes the value of integrating new efficiency innovation into its publicly-funded programs. The EEUs monitor technological developments and introduce new ideas to customers through their programs. EEUs also develop synergies between electric efficiency and other energy efficiency programs to help ensure homeowners have opportunities to holistically maximize efficiency at minimum cost.

- **Public Buildings** - State government has direct control over the efficiency of public buildings and has taken explicit measures to ensure state buildings are designed and/or retrofitted to be more energy efficient. This effort is also being actively expanded to encompass more state-owned property.

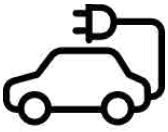
Energy Finance

To encourage investment by homeowners and businesses in projects that will reduce energy consumption in buildings, loan programs have been developed to help accelerate those investments. The resulting projects reduce monthly energy bills, while also helping to address the second-largest source of greenhouse gas emission in Vermont. By providing access to lower-cost capital, these programs help move this critical activity forward.

- **Residential Energy Financing** - State agencies have developed financing programs and mechanisms that support residential investment in efficiency projects. These programs facilitate a broad range of efficiency solutions, including weatherization. The EEUs are also researching energy inequity, as low-income and rural communities face greater barriers to accessing efficiency and renewable energy programs. Findings from that work are being integrated into product and service offerings.

- **Commercial Energy Financing** - State agencies have also developed energy finance programs, with a particular focus on solar energy projects in recent years.

2. Transportation



Fossil fuels used in the transportation sector are the dominant source of GHG emissions in Vermont, accounting for 45% of total emissions.[6] As well as being a core mitigation issue, transportation systems and infrastructure must be resilient to an array of climate risks, most notably flooding and extreme weather events. To best protect the health and well-being of state residents, these risks must be identified and incorporated into a particularly wide array of projects and organizational management.

[6] Energy Action Network (EAN). (2019). Annual Progress Report for Vermont. https://www.eanvt.org/2019-progress-report/
Image: Flaticon.com

Research, Planning, and Maintenance

To systematically ensure infrastructural resilience and mitigation in transportation, climate risks are being investigated, with resulting solutions being integrated into planning and maintenance programs.

- **Climate Adaptation Research** - The state actively directs funds toward research on climate-related challenges and opportunities in the context of transportation and related infrastructure.

- **Staff Training** – Vermont organizes opportunities for managers and staff in parts of the transportation sector to learn about extreme weather risks, including core topics related to the design, construction, and oversight of transportation and related infrastructure.

- **Extreme Weather Risk Assessment** - The state investigates and deploys developing technologies as part of efforts to understand infrastructure vulnerabilities to extreme weather events.

- **Risk-Informed Planning** - Vermont integrates acquired information on climate risks into structural planning, and creates public awareness of climate-related risks in the transportation arena.

Mitigation

Greenhouse gas emissions associated with transportation are lowered by reducing vehicle miles traveled (VMT) and transitioning to electric vehicles (EVs). A variety of public transit and EV charging infrastructure programs are underway in Vermont.[7]

- **Public Transit and Planning** - In recent years, the state has ramped up investments in the electrification of public transit and infrastructure. The combination of ambitious energy goals and new funding has allowed the state to convert much of the state-owned fleet to electric or hybrid models.

- **Parking and Charging** – By building new park-and-ride locations and modernizing existing sites, Vermont has been working to encourage ride sharing and the use of public transit. EV charging stations have been installed at park-and-ride locations and other state-owned property.

- **Financial Incentives** - The state recognizes the environmental and economic benefit of EV use and offers rebates that make purchase, lease and use of EVs more feasible. Rebate programs also extend to hybrid vehicles, electric bikes, and charging equipment.

[9] Energy Action Network (EAN). (2019). Annual Progress Report for Vermont. https://www.eanvt.org/2019-progress-report/
Image: Flaticon.com

Awareness - The state provides concise and informative resources about EV use and their benefits.

3. Food Systems

Climate change poses a largely ignored threat to food systems, from both a local and global supply chain perspective. For food coming from outside of Vermont, the risks are primarily transportation risks. (These are covered in the Transportation category). In this section, the focus is on the contribution of local food systems in meeting Vermont's food demand, and ensuring that local agricultural producers who export food are able to continue doing so. Protecting the agricultural sector requires that the state preserve the quality of farmland, while also supporting farmers and their operations in multiple dimensions. In addition, climate risks that pertain to food-insecure communities must be identified and addressed. The state also has an opportunity to further mitigate greenhouse gas emissions, given that 12% of Vermont's total GHG emissions come from agricultural operations.[8]

Farmland Quality

The continuity of local food production in Vermont is contingent on the preservation and protection of high-quality farmland. Climate risk assessment must be integrated into farmland management to ensure that Vermont's food system is not compromised as the number of extreme weather events rise.

Farmland Conservation - The state collaborates with designated organizations to ensure long-term conservation and protection of farmland necessary for continuous supply in the local food system.

NGO **Ecosystem Service Compensation** – There is a nascent effort to develop and adopt "ecosystem service payments", which compensate landowners for managing their land in a manner that maintains their inherent potential to mitigate climate change and ensure resilience. Agricultural ecosystem service payments are currently a significant focus of attention among research and advocacy organizations.

Operational Resilience and Mitigation

The latest research and strategies addressing climate risk must be incorporated into programs that provide technical and financial assistance to the farming community. Land management decisions are ultimately the most material to the sustainability and resilience of the agricultural sector.

Business and Operational Consulting Services - The state, in collaboration with other organizations, has invested in programs that help farmers plan for climate risk and manage their land based on attention to resilience strategies. State government also has fostered

[8] Energy Action Network (EAN). (2019). Annual Progress Report for Vermont. https://www.eanvt.org/2019-progress-report/
Image: Flaticon.com

programs that give farm owners affordable opportunities to install renewable energy and conduct efficiency retrofits.

NGO **Waste Reduction** - Non-government organizations within the state have helped significantly reduce food waste – assisting food insecure populations while also preventing landfilled food waste and maximizing supply from agricultural operations.

Operational Project Financing - The state, in collaboration with other organizations, offers a variety of project financing options for agricultural efforts to mitigate climate change and become more resilient to its risks.

4. Land Use and Ecosystems

There are opportunities to both mitigate emissions and create resilience to climate change in the context of land use and ecosystem protection. Extreme weather, floods, and rising temperature threaten the well-being of Vermont's ecosystems and impact land use. Also, landfill waste accounts for 1.5% of total GHG emissions, while Vermont's ecosystems could be better managed to capture the emissions.[9]

<u>Monitoring</u>

With the onset of climate change risks, Vermont's land, water, and habitats are being transformed. As the state and stakeholders know from many years of experience, responsible long-term environmental management decisions will require rigorous expansion of climate risk monitoring in this context.

Forests - The state recognizes that healthy forests exhibit many important qualities that support environmental and human well-being, and has invested additional funds in monitoring forest land in the face of climate risks.

Watersheds - State government recognizes the importance of protecting freshwater sources and has invested in a variety of monitoring programs that examine watershed-scale freshwater quality.

Species - The state invests in tracking populations of both invasive and native species. This effort has been given additional attention as climate change transforms Vermont's habitats, creating opportunities for new pests and challenges for preexisting essential species.

[9] Energy Action Network (EAN). (2019). Annual Progress Report for Vermont. https://www.eanvt.org/2019-progress-report/
Image: Flaticon.com

Landowner Support

The State offers programs that facilitate responsible practices that mitigate GHG emission and ensure resilience to further environmental damages from climate change.

- **Land Management Consulting Services** – State government, in collaboration with other organizations, has invested in programs that guide and support landowners' resilience and mitigation strategies.

- **Funding & Easements** - The state collaborates with the Federal government on providing financial assistance and easement support to a variety of landowners. The goal is to facilitate best land-use practices that are beneficial to Vermont communities broadly.

Public Land Conservation

Public land management presents opportunities for the state to directly ensure climate mitigation and resilience strategies are integrated into land use.

- **General Conservation** - The state recognizes the long-term resilience and mitigation potential of conserving its forests and broader environmental quality. Through several programs, state government works to conserve and protect a variety of public lands.

- **Land Resilience** - The state has taken additional measures to enhance land resilience to extreme climate risks. Through collaborative efforts, state government has established programs to reduce the impacts of storms and floods on Vermont land.

5. Water Management

Climate change will continue to radically disturb the equilibrium of global water systems. In Vermont, unpredictable flooding and drought are major concerns, demanding a focus on risk resilience. This includes the disproportionate risk of flood damage experienced by vulnerable communities. In this spending category, major spending efforts are focused on the role of utilities, flood control, and water treatment in addressing these climate risks.

Utilities

The onset of climate risks has only made it more difficult to ensure sufficient quality and quantity of water supply. To state the obvious, this vital resource must be protected for generations to come, with continuous and equitable access to all residents.

Publicly Administered Projects - The state funds and manages efforts to improve water quality and water supply sources for all stakeholders.

Infrastructure & Flood Control

As flood events grow stronger and occur more frequently, communities must protect themselves by developing flood resilient infrastructure. Through collaborative efforts between agencies, state government has been applying a systems-thinking approach to construct long-term solutions throughout watersheds.

Publicly Administered Projects – The state manages federally-funded infrastructure projects to ensure resilience to heightened flood risk throughout Vermont.

Municipal Project Finance and Funding - Vermont manages funds allocated by the federal government that support municipal flood control efforts. Additional low-interest finance options are made available through the state's designated financial institution.

Information, Tools, and Training - The State works closely with public and private stakeholders to develop high-quality information resources for a variety of purposes from general awareness to specialized training.

Water Treatment

Recent changes in storm patterns have created major problems with water treatment given the increasing number of heavy rain events. This challenge requires investment in the improvement of current systems and the construction of new systems.

Publicly Administered Projects - The state funds and manages state based efforts to improve water quality and management systems.

Municipal Project Financing - The state has made low-interest project financing available through its designated financial institution.

6. Public Health and Communities

While virtually all climate challenges are, in one way or another, serious threats to public health, some climate risks have direct impacts on human health that must be addressed. Like other climate risks, disease concerns and extreme heat

Image: Flaticon.com

are more likely to strongly impact vulnerable communities. This disproportionate risk must be assessed and addressed with research-informed strategies.

Monitoring & Forecasting

Climate risks directly impacting human health (e.g. heat stress and pollution levels) must be carefully monitored so solutions can be put in place to protect the health and well-being of communities throughout Vermont.

Universal Impact – The Department of Health conducts federally-funded research on the ways in which climate change poses direct threats to public health. This fundamental assessment of universal public health risks is used for the development of information resources and outreach programs.

Vulnerable Community Impact - The state is in the early stages of investigating and understanding how some communities are disproportionately affected by climate risks due to their socioeconomic status or social identity. As is being recognized more broadly across the United States, there is growing recognition in Vermont that income levels and race correlate with the degree to which communities have the resources to be resilient to climate risks.

Education

With information on the potential for different climate risks to harm public health, it is critical to have programs that offer concrete solutions to health issues and adequate information resources.

Information Resources - The state has a variety of programs that focus on giving residents access to the information to be safe and resilient in the face of climate-related health risks.

7. Economic Vitality

The well-being of residents depends on a robust and vibrant state economy. As news from across the world demonstrates daily, the disruptive force of climate change on economic activity is enormous and unprecedented. While Vermont is addressing some infrastructure issues and other challenges that will affect all businesses, there is little indication of state spending designed to assist specific sectors as they attempt to assess climate challenges and adapt to them.

Image: Flaticon.com

Implications and Next Steps

Key Findings

As Vermont and other states go through their annual budget setting processes, the impacts of climate change will increasingly become a central priority. The daily news cycle demonstrates that the health and well-being of a vast and growing number of Americans is already being impacted. Similarly, the breadth of the work of many national and local health organizations vividly demonstrates the capacity of climate risks to undermine public health. Work underway in Vermont state government demonstrates a recognition that climate change poses threats. Yet, the results of this preliminary study indicate that the severity of those threats is far from fully recognized.

Question 1: What is the state of Vermont doing to address climate challenges?
There are more than 110 state-based climate mitigation and resilience programs are currently funded and operating. The funding ecosystem is complex, including state taxes, rate-payer funds, bond issuance, Federal funds and foundation funding.

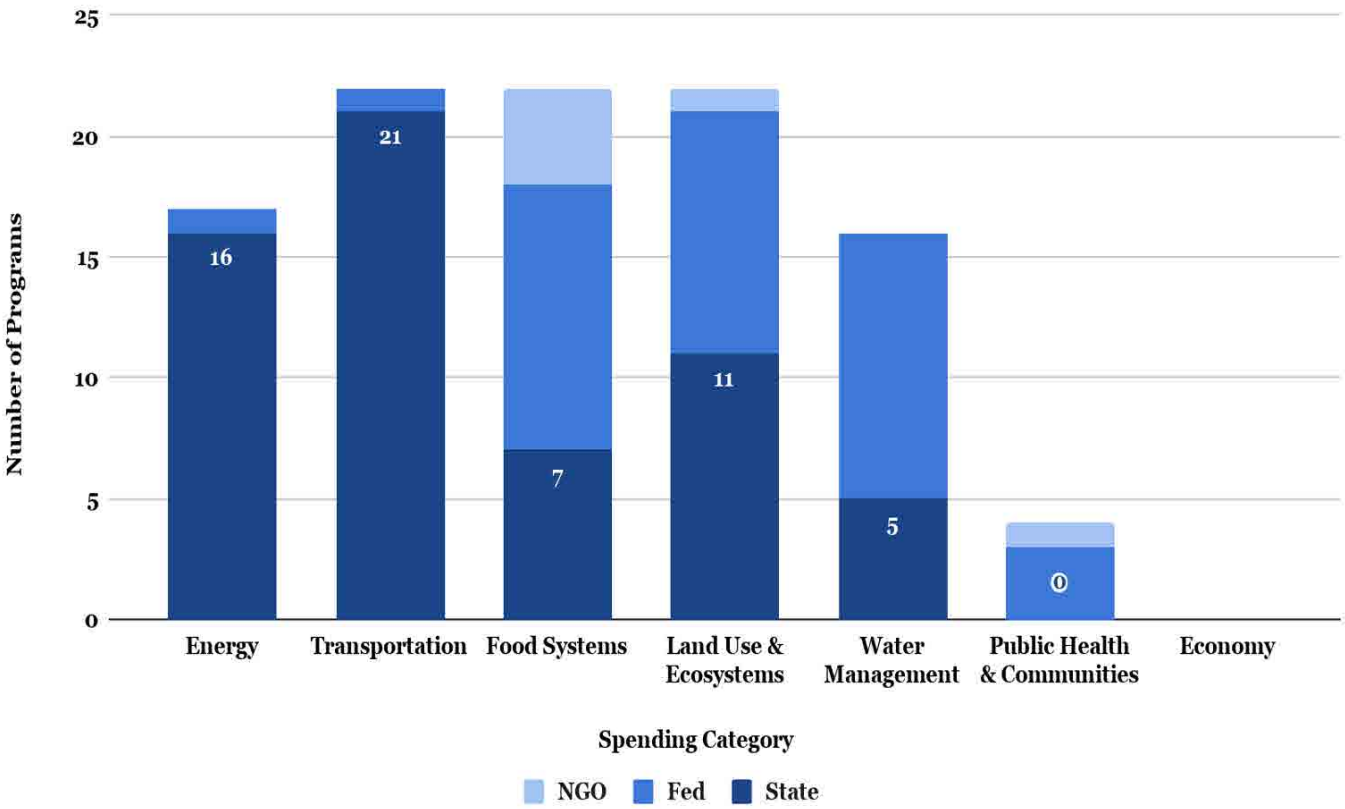


Figure 2 *Number of programs funded by the State compared to significant Federal and NGO programs across spending categories*

Question 2: Relative to other climate challenges, which challenges are addressed the most with publicly-funded programs? Which are addressed least?

While the state has done an admirable job developing funding support from multiple sources, the net total funding does not adequately address the challenges, including climate-driven risks that are being neglected.

Table 2: *Qualitative Overview of Spending Activities*

Category							
Rising Temperature							
Drought							
Wildfire							
Storms and Flooding							
Changing Seasons							
Pest Infestation							
GHG Mitigation							
Community Vulnerability							
OVERALL							

Relative degree to which climate challenges are addressed by spending:

Variety of Solutions	Moderate Solutions	Few Solutions	Neglected	N/A

Variety of Solutions

Energy: Vermont is a leader in funding programs that promote energy efficiency and clean energy, and by extension, mitigating greenhouse gas emissions with respect to electricity. It has also created well-designed programs available to low-income communities, although some programs are severely underfunded (e.g., weatherization). It is unclear whether the state is adequately addressing the need to protect the existing energy infrastructure given the threats posed.

Transportation: Vermont has made progress toward a transition to clean energy in the transportation sector. The State has also implemented a variety of risk assessment initiatives around transportation related infrastructure resilience, including significant attention to vulnerability analysis.

Images: Flaticon.com

Moderate Solutions

Food Systems: Vermont has several programs addressing climate risks to the food system, including attention to extreme weather and pests. The state also has many programs that help the agricultural sector reduce greenhouse gas emissions. However, it should be noted that there is little effort to support vulnerable communities. Many of the programs in place are a mix of Federal and NGO efforts.

Land Use and Ecosystems: Vermont most strongly invests in efforts to address extreme weather and greenhouse gas emissions. To a lesser degree, the state has programs in place that address the impact of drought, wildfire, and invasive species on land. However, there is inadequate attention to changing seasonal patterns on Vermont's economy and ecosystems. It should also be noted that the majority of programs found in this spending category were federally-funded.

Few Solutions

Water Management: While Vermont has several programs addressing storm and flood risk within the context of water management, it seems there is little or no investigation of the extent to which extended droughts are likely and what the impacts would be. There are also clear disproportionate risks to vulnerable communities that are not being addressed.

Public Health and Communities: Based on federal funding, the Vermont Department of Health has been able to conduct important research on climate challenges. As a result Vermont exceeds many other states in providing information to the public. However, the state lacks concrete solutions to address direct health risks, especially with regard to vulnerable communities.

Neglected

Economic Vitality: Climate challenges faced by vulnerable industries in Vermont have been largely overlooked. It is imperative that the state fund programs that assess challenges in this category, and present solutions for Vermont's businesses.

Image: Flaticon.com

Future Research

As noted previously, this report is the first stage of a more extensive study analyzing Vermont state government spending on climate change. Part Two of the work will include three major new components: (a) an examination of state agency budgets, (b) a disaggregation of mixed public spending efforts, and (c) a breakdown of the total current state expenditures associated with climate change.

The Part Two study will also integrate a discussion of new topics, including the following items:

- *Municipal Spending* - We were able to gather some information on programs primarily funded by municipalities, but were unable to dive deeply into confirming and assessing this key area of spending. As such, this aspect of public spending has not been assessed.
- *Leading State Research* - Within the context of each category, understanding Vermont's performance relative to other states would likely reveal programs and initiatives that the State should undertake.
- *Future Measures Analysis* - Throughout the Part One work, a wide variety of ideas for new policies and initiatives for addressing pressing climate change challenges in Vermont were noted by subject matter experts. Part Two work should include discussion of these opportunities.

The result of the full study will present the following opportunities:

1. Facilitate cost-benefit analysis of future climate policies by enabling stakeholders to compare the relative cost and level of activity of a proposed program to other publicly funded climate-related programs.
2. Provide an essential input for the estimating the cost of meeting Vermont's climate goals by analyzing the costs of progress so far.
3. Highlight quantitative differences between spending efforts that address different climate challenges (e.g. investments in *Energy* programs compared to investments in *Food System* programs).
4. Identify areas that are clearly underfunded, or neglected entirely, resulting in the development of plans and the allocation of funding addressing these issues.

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Appendix

Programs by Indicator

- ENERGY
  - Electricity: Generation and Transmission
    - **Renewable Energy Standard**
      - Renewable Energy Retail Sales (Green Mountain Power, or GMP, as representative of other DUs) - complies with Renewable Energy Standard (RES) as follows:
        - Tier I - An increasing percentage of retail electric sales that need to be sourced from renewables (percentage starts at 55% in 2017, the first year the RES is in effect, and increases by 4% every three years, eventually reaching 75% in 2032)
        - Tier II - An increasing percentage of retail electric sales that need to be sourced from new distributed renewable generation (required to procure 1% of their annual retail sales from Tier II-eligible facilities starting in 2017, increasing by three-fifths of a percent each year until reaching 10% in 2032)
        - Tier III - Additional increasing percentage of retail electric sales that need to be sourced from new distributed renewable generation or alternatively the DUs can acquire fossil-fuel savings through energy transformation projects (additional 2% of their annual retail sales in 2017, increasing by two-thirds of a percent each year until reaching 12% in 2032)
    - **Smart Grid**
      - Smart Grid (Public Utility Commission, or PUC, and Vermont Electric Power Company, or VELCO) - advanced, efficient transmission and monitoring system encompassing eEnergy Vermont program and Advanced Meter Infrastructure Plans--funded by American Recovery and Reinvestment Act (ARRA) and Smart Grid Investment Grants (SGIGs)
    - **Residential Products and Incentives**
      - Renewable Energy Products (GMP as representative of other DUs) - provides batteries, “powerwalls” and “energy bundles” that facilitate renewable energy use in homes
      - Peak Demand Credits (GMP as representative of other DUs) - offers credit on energy bills for collecting energy from a homeowner’s connected energy storage device

- Electricity: Efficiency
  - **Products and Incentives**
    - Distribution Utility Products (GMP as representative of other DUs) - offers efficient HVAC products like heat pump water heaters, the eWater Program (smart thermostats), and cold climate heat pumps
    - Energy Efficiency Utility Rebates (Efficiency Vermont, or EVT, as representative of other EEUs) - offers a variety of commercial and residential rebates for products for HVAC (e.g. furnaces), insulation (e.g. doors, windows), efficient lighting, and appliances
  - **Affordable Projects**
    - Weatherization Assistance Program (Department for Children and Families) - this is a retrofitting program that allows low-income residents to complete a variety of energy efficiency projects
    - Vermod (High Meadows Fund; Vermont Housing and Conservation Board; EVT) - this initiative brings professionals together to design and construct "zero energy modular homes" that are affordable while accomplishing rigorous health, energy efficiency, and structural goals
  - **Innovation**
    - Emerging Technology Pilots (EVT) - identifies and tests new energy efficiency technology for deployment and new rebate programs
    - Weatherization Agency Collaboration (EVT) - integrating electricity efficiency strategies into thermal efficiency designs
  - **Public Buildings**
    - State Energy Management Program (EEUs) - Authorized by Act 58 of 2015, the Vermont Department of Buildings and General Services is funding energy efficiency projects for State buildings and facilities, which is being expanded to municipal, university, school, and hospital communities
- Finance
  - **Residential Energy Financing**
    - Financing for Homeowners program (EVT) - includes: the Home Energy Loan for weatherization and heating improvements; the NeighborWorks of Western Vermont Energy Loan for energy efficiency improvements, as well as health and safety improvements (spans across HVAC categories)
    - Residential Loan (VGS) - VGS partners with Green Mountain Credit Union to offer favorable interest loans for upgrading to a new high-efficiency heating system
  - **Commercial Energy Financing**
    - Financing for Businesses program (EVT) - includes: Business Energy Loan for general energy efficiency projects for businesses; Institutional Financing Options

        - Business Loan (VGS) - VGS partners with Green Mountain Credit Union to offer favorable interest loans for upgrading to a new high-efficiency heating system
        - Commercial Energy Loan Program (Vermont Economic Development Authority) - finances energy generation and efficiency projects for Vermont businesses

- TRANSPORTATION
    - Research, Planning, & Maintenance
        - **Climate Adaptation Research**
            - Basin Resilience to Extreme Events project (Vermont EPSCoR and University of Vermont, or UVM) - research project to assess resilience in the Lake Champlain Basin
            - Methods and Tools for Transportation Resilience Planning (American Association of State Highway and Transportation Officials or AASHTO) - research project dedicated specifically to identifying and assessing areas of the Vermont transportation system that are vulnerable to erosion, flooding, and deposition.
        - **Staff Training**
            - Flood Resiliency Training (VTrans) - educates "key audiences" on flood risk, infrastructural impact, and management
            - Emergency Management Training (VTrans and ANR) - specific training that prepares staff to support other agencies and face higher levels of risk
        - **Extreme Weather Risk Assessment**
            - Flood Modeling Program (Agency of Transportation, or VTrans, and Agency of Natural Resources, or ANR) - using LiDAR to assess flood risk and erosion
            - Vermont Transportation Resilience Planning Tool or "TRPT" (VTrans) - a web-based application that offers a real-time assessment of transportation infrastructure vulnerability
        - **Risk-Informed Planning**
            - Vermont State Hazard Mitigation Plan (Vermont Emergency Management, or VEM) - a comprehensive assessment of risks posed by climate change on Vermont State infrastructure and specific projects designated to addressing these risks
            - Transportation Resiliency Plans (VTrans) - watershed assessment of flood risk in transportation infrastructure, resilience strategy development, and spending prioritization
            - Resilient Vermont Project (VTrans and the Institute for Sustainable Communities) - compiling an inventory of resilience-related building in the State and prioritizing spending

- Mitigation
  - **Public Transit and Planning**
    - Transformation of the State Vehicle Fleet - by July 2021, no less than 75% of state-owned vehicles (Department of Buildings and General Services) must be hybrid of plug-in electric vehicles
    - Volkswagen Electric Vehicle Supply Equipment (EVSE) Grant Program - the state has allocated its share of the recent nationwide VW settlement into vehicle electrification, which has included the acquisition of two electric transit buses and two electric school buses as part of a pilot project
    - Low or No Emission Vehicle Deployment Competitive Grants or "Low-No Grants" Program (VTrans) - grant money solicited from fed for low or no emission public trans options, which have been used to purchase two electric transit buses and two cutaway buses in Vermont
    - Traffic light systems (VTrans) - converted traffic signals and flashing beacons to LED and are partially solar-powered at all locations
    - Vermont renewable energy goals (VTrans) - incorporates the State's renewable energy goals into planning by emphasizing compact, mixed-use development and the State analyzes GHGs from proposed projects requiring assessment under the National Environmental Policy Act or "NEPA"
  - **EV Parking and Charging**
    - Volkswagen Electric Vehicle Supply Equipment (EVSE) Grant Program - the state has allocated its share of the recent nationwide VW settlement into vehicle electrification, which has included EV charging stations call "highway corridors"
    - Go Vermont "Park and Ride" Program (VTrans) - public parking locations (30 total state-managed and 62 municipal-managed) that facilitate reduced car travel and are equipped with LED lighting and Level 1 electric charging
    - Solar-powered parking garages (VTrans) - has installed photovoltaic systems or "PVs" at ten garages and has entered into third-party agreements to install more
    - Distribution Utility Charging Stations (Green Mountain Power as representative of other distribution utilities) - constructs public and workplace EV charging stations
    - Electric Vehicle Charging Station Loan Program (funded by State Infrastructure Bank; managed by Vermont Economic Development Authority, Vermont Agency of Transportation and the Federal Highway Administration) - loan for building charging stations that is available to businesses and municipalities
  - **Financial Incentives**
    - Plug-in electric vehicle incentive program (VTrans and Distribution Utilities)

- incentives for VT home-owners to purchase or lease EVs
        - Distribution Utility (DU) Programs - offers: product discounts for level 3 chargers and EVs; rebates for electric lawn mowers, EVs, and ebikes; offers an in-home car charger for those who buy EVs
        - High-fuel-efficiency vehicle incentive and emissions repair program (VTrans) - incentivizes and facilitates home-owners to transition fossil-fuel vehicles toward fuel efficient vehicles like hybrids
        - Efficiency Organization Programs - Burlington Electric Department (BED) partners with Efficiency Vermont (EVT) for the provision of incentives for energy efficient products and appliances, as well as providing incentives directly for some products (e.g. rebates for EVs, and electric bikes)
    - **Awareness**
        - Drive Electric Vermont or DEV (VTrans and VEIC) - funded by Low or No Emission Vehicle Deployment competitive grant program and increases awareness of electric vehicles, encourages investment in charging infrastructure, and coordinates with other New England and Mid-Atlantic states to plan for greater regional infrastructure buildout

- WATER MANAGEMENT
    - <u>Utilities</u>
        - **Publicly Administered Projects**
            - Clean Water State Revolving Fund (Vermont Municipal Bond Bank or VMBB) - offers low-interest financing for wastewater treatment, stormwater control, and sensitive water protection projects
            - Drinking Water State Revolving Fund (Vermont Municipal Bond Bank or VMBB) - offers low-interest financing for private entities and municipalities to make improvements that protect public health and ensure compliance with the Safe Drinking Water Act.
    - <u>Infrastructural Flood Control</u>
        - **Publicly Administered Projects**
            - Vermont Downtown Action Team or "V-DAT" (managed by Vermont Department of Housing and Community Development; funded by Federal Disaster Recovery) - a team of diverse capabilities, including marketing, urban design, and planning, that developed and executed community-specific economic recovery plans for the communities most heavily impacted by recent storm events
            - Public Utility Commission or "PUC" Section 248 Proceedings (Agency of Natural Resources or "ANR" and PUC) - ANR works with PUC on new projects to ensure Vermont's natural resources and environmental quality are protected, which has an increasing valuable collaboration as climate risks

become more prevalent

- Watershed Protection and Flood Prevention Program (United States Department of Agriculture, Natural Resources Conservation Service) - collaborative effort between the State and Federal governments that offers financial and technical assistance to all stakeholders for the following purposes: Erosion and sediment control; Watershed protection; Flood prevention. Enables restoration and protection of up to 250,000 acres of watershed area.

- **Municipal Project Finance and Funding**
  - Emergency Relief and Assistance Fund or "ERAF" (Vermont Emergency Management, or VEM) - the Federal government funds 75% of disaster relief after "federally-declared disasters," while the State contributes between 7.5% and 17.5% and municipalities contribute the remainder. Municipalities are required to contribute more if they have not taken specific precautions established by the Federal government.
  - Clean Water State Revolving Fund (Vermont Municipal Bond Bank or VMBB) - offers low-interest financing for wastewater treatment, storm water control, and sensitive water protection projects
  - Drinking Water State Revolving Fund (Vermont Municipal Bond Bank or VMBB) - offers low-interest financing for private entities and municipalities to make improvements that protect public health and ensure compliance with the Safe Drinking Water Act.
- **Information, Tools, and Training**
  - Flood Ready Vermont (Agency of Commerce and Community Development) - offers a variety of resources to Vermonters with region-specific information on flood challenges and potential solutions. Resources include the River Corridors webpage, the Update Your Plans webpage, the Use Natural Flood Protection webpage and the Improve Infrastructure webpage.
  - Vermont Flood Ready Atlas (Agency of Commerce and Community Development) - online-map tool that allows Vermonters to identify locations, services, and structures at risk of flood damage. The tool also allows Vermonters to see where there is natural flood protection in the form of forests, wetlands, floodplains and river corridors.
  - Smart Growth Implementation Assistance, Community Resilience: Planning for Flood Recovery and Long-Term Resilience in Vermont (Funded by the Environmental Protection Agency and the Federal Emergency Management Agency; Managed by Agency of Commerce and Community Development) - the program presents general flood resilience strategies, as well as in the context of disaster recovery, land use policy, and State policy
  - Vermont Economic Resiliency Initiative or "VERI" (Agency of Commerce and

Community Development) - project that offers guidelines and long-term strategy for cities, towns, and states to "reduce and better manage their flood risks."
        - Flood Training: *Making Room for Rivers* - a professional training that introduces concepts of River Corridor and floodplain management, provides case studies of communities that are proactively exemplifying these efforts, dives into more technical risk management and provides outreach tools to help participants understand the value of protecting River Corridors and floodplains.
- Water Treatment
    - **Publicly Administered Projects**
        - Watershed Protection and Flood Prevention Program (United States Department of Agriculture, Natural Resources Conservation Service) - collaborative effort between the State and Federal governments that offers financial and technical assistance to all stakeholders for the following purposes: Water quality Improvements; Rural, municipal and industrial water supply; Water management. Enables restoration and protection of up to 250,000 acres of watershed area.
    - **Municipal Project Financing**
        - Clean Water State Revolving Fund (Vermont Municipal Bond Bank or VMBB) - offers low-interest financing for wastewater treatment, storm water control, and sensitive water protection projects
        - Drinking Water State Revolving Fund (Vermont Municipal Bond Bank or VMBB) - offers low-interest financing for private entities and municipalities to make improvements that protect public health and ensure compliance with the Safe Drinking Water Act.

- LAND USE & ECOSYSTEMS
    - Monitoring
        - **Forests**
            - Forest Health Monitoring Program (Agency of Natural Resources, or ANR) - ongoing project that collects data on a variety of tree characteristics for many species in Vermont
        - **Watersheds**
            - Stream Geomorphic Assessment Program (Agency of Natural Resources, or ANR) - an effort to monitor energy flow throughout Vermont watersheds and dynamic processes affected by natural and human-induced variables. This assessment has become critical with increased storms and flooding to ensure effective and resilient land management projects.
            - Rivers & Stream Monitoring Programs (ANR) - a variety of projects and

programs that assess fluvial water quality, with most attention given to Lake Champlain Basin
    - Lake Monitoring Programs (ANR) - a variety of projects and programs that assess lake water quality, with most attention given to Lake Champlain
    - Wetland Monitoring Programs (ANR) - a variety of "special studies" managed by the Watershed Management Division, which has given special attention to climate risk assessment
  - **Species**
    - Wildlife Diversity Program (ANR) - encompasses the Vermont Natural Heritage Inventory program and broader efforts that centered on assessing the array of species found in Vermont
    - Vermont Invasives Program (ANR) - collects and catalogs Vermont's invasives species like the Emerald Ash Borer, which is extremely harmful to forest health and has flourished with ongoing climate change
- Landowner Support
  - **Land Management Advising**
    - Vermont Farm and Forest Viability Program (Vermont Housing and Conservation Board) - supports forest land management and is driven to enhance economic viability of enterprises overseeing these lands
    - Forest Carbon Program (Vermont Land Trust) - a comprehensive effort to inform all "forestowners" how to best manage their land to ensure carbon sequestration, a critical process wherein forests absorb carbon dioxide, a GHG
    - Universal Recycling Bill programs (ANR) - the bill prohibits food waste from landfills and requires composting or other food waste diversions, so the Agency of Natural Resources has some state-funded programs to assist with this waste diversion
    - Vermont Environmental Stewardship Program or "VESP" (Agency of Agriculture, Food, & Markets) - a pilot program to directly support landowners, primarily farmers, limit water pollution and maintain freshwater quality.
    - River Corridor and Floodplain Protection Program (Agency of Natural Resources) - Vermont agency officials offer direct support to landowners, municipalities, and other parties by giving advice on protecting natural land and preventing flood damage.
    - River Management Program (Agency of Natural Resources) - Vermont agency officials offer technical and regulatory assistance during construction or excavation in rivers and streams.
    - Conservation Technical Assistance (United States Department of Agriculture, Natural Resources Conservation Service) - gives landowners access to technology needed to maximize and maintain natural mitigation and

resilience potential of Vermont land. Major uses of the program include (from website): "Reduce soil loss from erosion; Solve soil, water quality, water conservation, air quality, and agricultural waste management problems; Reduce potential damage caused by excess water and sedimentation or drought; Enhance the quality of fish and wildlife habitat Improve the long term sustainability of all lands, including cropland, forestland, grazing lands, coastal lands, and developed and/or developing lands; Assist others in facilitating changes in land use as needed for natural resource protection and sustainability"

- Regional Conservation Partnership Program (United States Department of Agriculture, Natural Resources Conservation Service) - facilitates collaborative efforts to complete innovative conservation projects

- **Funding & Easements**
  - Healthy Forests Reserve Program (United States Department of Agriculture, Natural Resources Conservation Service) - enables landowners to maintain and improve the resilience and mitigation potential of forestland resources through easements and financial assistance.
  - Agricultural Conservation Easement Program: Wetland Reserve Easements (United States Department of Agriculture, Natural Resources Conservation Service) - provides financial assistance directly to landowners that allows them to maintain and improve the quality of wetlands through reserve easements.
  - Ecosystem Restoration Grants (Agency of Natural Resources) - offers funding to landowners for projects that prevent water pollution and promote long-term resilience to the effects of erosion and runoff.
  - River Corridor Easements (Agency of Natural Resources) - incentivizes landowners to limit activity near stream channels and enable the channel to achieve a natural path with least erosion potential

- <u>Public Land Conservation</u>
  - **General Conservation**
    - Natural Areas Conservation Investment (Vermont Housing and Conservation Board) - direct investment in land conservation to protect environmental quality, resources, and benefits exhibited by natural areas
    - Forestland Conservation Investment (Vermont Housing and Conservation Board) - direct investment in land conservation to protect environmental quality, resources, and benefits exhibited by forestland
    - Outdoor Recreation Land Conservation Investment (Vermont Housing and Conservation Board) - direct investment in protecting public access to natural areas for recreation purposes and conserving the land for future use
  - **Land Resilience**

        - Act 250 Program (Vermont Natural Resources Board)- (from website) "provides a public, quasi-judicial process for reviewing and managing the environmental, social and fiscal consequences of major subdivisions and developments in Vermont. It assures that larger developments compliment Vermont's unique landscape, economy and community needs." Most recently, Act 250 has been instrumental to addressing climate risks in land management.
        - Emergency Watershed Protection Program (United States Department of Agriculture, Natural Resources Conservation Service) - helps communities become resilient to growing climate risks (e.g. floods, fires, windstorms) via technical and financial assistance
        - Watershed Protection and Flood Prevention Program (United States Department of Agriculture, Natural Resources Conservation Service) - collaborative effort between the State and Federal governments that offers financial and technical assistance to all stakeholders for the following purposes: Erosion and sediment control; Watershed protection; Flood prevention; Water quality Improvements; Water management; Fish and wildlife habitat enhancement. Enables restoration and protection of up to 250,000 acres of watershed area.

- FOOD SYSTEMS
    - <u>Farmland Quality</u>
        - **Ecosystem Service Compensation**
            - Soil Ecosystem Service Payment (Vermont Land Trust or VLT) - If soils are managed properly, farm owners can maximize GHG sequestration and flood control and receive ecosystem service payments from the State (under development at the moment, no concrete programs yet).
        - **Farmland Conservation**
            - Farmland Conservation Program (VHCB and Agency of Agriculture, Food & Markets) - invests in conservation easements matched by United States Department of Agriculture, Natural Resources Conservation Service programs.
    - <u>Operational Resilience and Mitigation</u>
        - **Business and Operational Advising**
            - Farm and Forest Viability Program (Vermont Housing & Conservation Board, or VHCB, and Vermont Land Trust) - supports farmland management by providing expert consulting and is driven to enhance economic viability of enterprises overseeing these lands
            - Working Lands Enterprise Initiative (Agency of Agriculture, Food & Markets Programs) - Partially funded by the State and supports innovative food

systems solutions

- Business Operations Assistance (Agency of Agriculture, Food & Markets Programs) - The agency helps connect farmers to local grocery stores and gives other business support
- Vermont Agriculture and Food System Plan: 2020 (Vermont Farm to Plate) - provides information resources that help Vermonters, particularly member organizations, integrate strategies for addressing climate risks
- Livestock and Grazing Programs (Vermont Grass Farmers Association or VGFA) - VGFA facilitates the annual Vermont Grazing & Livestock Conference and informs Vermont's Grazing Lands Partnership with the mission to "create healthier soils, cleaner water and financially and personally sustainable farms."
- Research Informed Programs (University of Vermont or UVM) - UVM researchers are dedicated to finding solutions to Vermont's food system challenges and have worked closely with all advising groups to ensure the best outcomes for Vermonters and the environment.
- Landscape Conservation Initiatives (United States Department of Agriculture, Natural Resources Conservation Service) - provides technical assistance that facilitates voluntary conservation programs that improve environmental quality in addition to agricultural productivity
- Agricultural Management Assistance (United States Department of Agriculture, Natural Resources Conservation Service) - helps farmers reduce financial risk through a variety of strategies including diversification, marketing, and natural resource conservation.
- Conservation Stewardship Program (United States Department of Agriculture, Natural Resources Conservation Service) - offers operation-specific technical advice to support individual environmental conservation and agricultural productivity goals, especially as they pertain to resilience and mitigation.
- Environmental Quality Incentives Program (United States Department of Agriculture, Natural Resources Conservation Service) - provides technical support to farmers to address natural resource challenges and maximize environmental qualities by improving water and air quality, holistically conserving water, promoting soil health, reducing soil erosion and sedimentation, maintaining and expanding wildlife habitat, and becoming resilient to unpredictable weather.
- Conservation of Private Grazing Land (United States Department of Agriculture, Natural Resources Conservation Service) - provides technical and education assistance to private grazing operations that promote (from website): "better grazing land management; protecting soil from erosive wind and water; using more energy-efficient ways to produce food and

fiber; conserving water; providing habitat for wildlife; sustaining forage and grazing plants; using plants to sequester greenhouse gases and increase soil organic matter; and using grazing lands as a source of biomass energy and raw materials for industrial products."

- **Waste Reduction**
  - Gleaning Programs (Vermont Foodbank) - 600 volunteers harvest about 465,000 pounds of vegetables from Vermont farmland to prevent waste and distribute them to various sites throughout the state dealing with food insecurity
- **Operational Project Financing**
  - Vermont Agricultural Credit Corporation Programs (Vermont Economic Development Authority) - offers the "Farm Ownership Loan" and the "Farm Operating Loan", which enable farmers to acquire land and pay necessary operating expenses, respectively. The VACC also offers an "Agricultural Energy Loan" that helps finance renewable energy and energy efficiency projects.
  - Landscape Conservation Initiatives (United States Department of Agriculture, Natural Resources Conservation Service) - provides financial assistance that facilitates voluntary conservation programs that improve environmental quality in addition to agricultural productivity
  - Conservation Innovation Grants (United States Department of Agriculture, Natural Resources Conservation Service) - funding for state specific innovative projects in agriculture, many of which address climate resilience and mitigation concerns
  - Conservation Stewardship Program (United States Department of Agriculture, Natural Resources Conservation Service) - offers operation-specific financial assistance to support individual environmental conservation and agricultural productivity goals, especially as they pertain to resilience and mitigation.
  - Environmental Quality Incentives Program (United States Department of Agriculture, Natural Resources Conservation Service) - provides financial support to farmers to address natural resource challenges and maximize environmental qualities by improving water and air quality, holistically conserving water, promoting soil health, reducing soil erosion and sedimentation, maintaining and expanding wildlife habitat, and becoming resilient to unpredictable weather.
  - Agricultural Conservation Easement Program: Wetland Reserve Easements (United States Department of Agriculture, Natural Resources Conservation Service) - provides financial assistance directly to farm owners who are eligible for purchasing Agricultural Land Easements. The easements protect the agricultural use, in addition to mitigation and resilience potential of

the land. In the case of working farms, the program helps farmers and ranchers keep their land in agriculture. The program extends to a variety of agricultural operations and landowners (e.g. includes both government and non-government entities).
        - Energy Efficiency Utility Rebates (Efficiency Vermont, or EVT, as representative of other EEUs) - offers a variety of commercial rebates for agricultural equipment
        - Financing for Agricultural Operations Program (Efficiency Vermont or EVT) - facilitates general energy efficiency projects with low-interest loans
        - Rural Energy for America Program or "REAP" (United States Department of Agriculture) - offers low-interest financing options to farmers and small rural businesses that enable renewable energy and energy efficiency projects.

- PUBLIC HEALTH & COMMUNITIES
    - <u>Monitoring & Forecasting</u>
        - **Universal Impact**
            - Building Resilience Against Climate Effects, or "BRACE" (Centers for Disease Control and Prevention (CDC); Vermont Department of Health) - BRACE is a federally-funded five-step program that Vermont's health officials have used to establish a strategy for addressing climate risks directly impacting the health and wellbeing of Vermonters. The steps are as follows (from website): Anticipate Climate Impacts and Assessing Vulnerabilities; Project the Disease Burden; Assess Public Health Interventions; Develop and Implement a Climate and Health Adaptation Plan; Evaluate Impact and Improve Quality of Activities
        - **Vulnerable Community Impact**
            - University of Vermont Rubenstein School of Environment and Natural Resources - Dr. Bindu Panikkar is leading social science research efforts to understand how minority communities, particularly in rural areas, are disproportionately affected by ongoing climate risks in a variety of contexts, including energy, food security, and housing.
            - Heat Vulnerability Index (Department of Health) - this resource provides an overview of how different areas throughout Vermont are more vulnerable to heat stress.
    - <u>Education</u>
        - **Information Resources**
            - Vermont Energy Education Program, or VEEP - this program gives Vermonters of all ages opportunities to learn about different sustainability issues, including energy, environmental conservation, and the effects of climate change

- Human Health Effects of Climate Change training (Department of Health and the University of Vermont) - free online course to learn how human health is impacted by climate change and gain formal public health knowledge that is especially useful for public health workers and anyone involved with work at the intersection of health and environmental concerns.
- Department of Health "Climate & Health" resources - The Climate & Health program offers a variety of resources to Vermonters with information on the impact of climate on health and offers specific context on risks in Vermont. Resources include the Climate and Health Profile Report, the Climate Change and Health in Vermont White Paper, the Climate Change and Your Health page, the Improving Health through Transportation report, the Weatherization + Health Technical Report, and the Heat Impacts on Health in Vermont page. Primary authors of these resources working for the State have been invited to specifically support other state officials with efforts like forming the State Hazard Mitigation Plan.