

# Health impacts of extreme weather events and climate change

## Perspectives from Waterbury, Vermont, USA



January 2020

This executive summary describes research conducted between November 2017 and July 2018 by University of Vermont researchers to understand the short and long-term health impacts of extreme weather events and climate change in Waterbury, Vermont, and possible solutions.

We also offer recommendations for how municipal government entities, non-profit organizations, and citizens can use these findings to guide future dialogue and policies.

### Study motivation

The National Climate Assessment (2018) documented an increase in heavy rainfall events in several regions of the U.S., particularly the Northeast U.S., between 1958 and 2016 (Figure 1). Heavy precipitation events are defined as “an episode of abnormally high rain or snow” that “varies depending on location, season, and length of the historical record.” Communities like Waterbury, Vermont that have experienced extreme storms like Tropical Storm Irene can use insights gained during these past events to better address and avoid future health threats.

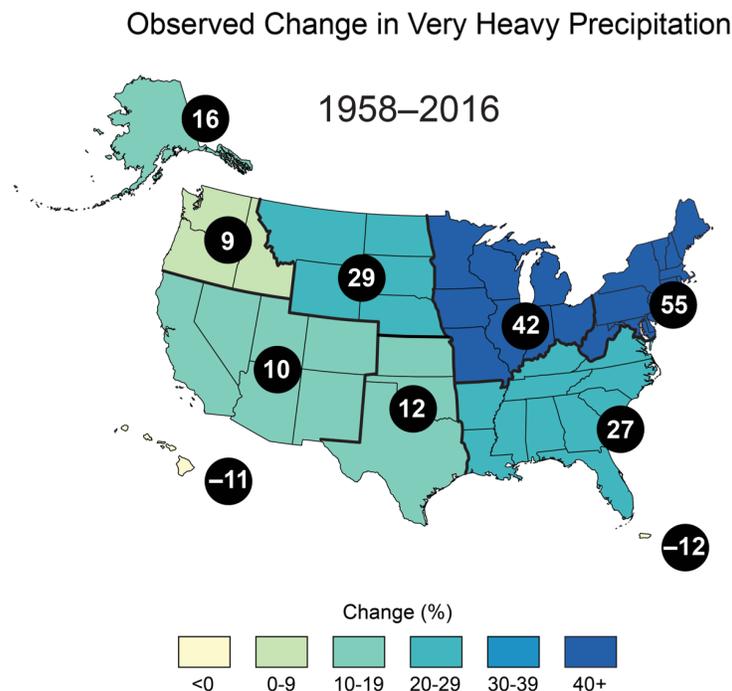


Figure 1. Most regions of the U.S. saw an increase in very heavy precipitation events between 1958-2016. The northeast region experienced the greatest increase in these events (55%).

Source: <https://nca2018.globalchange.gov/chapter/2/>

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## Methods

- Between November 2017 and February 2018, UVM researcher Christine Carmichael interviewed 15 Waterbury residents affected by Tropical Storm Irene to document health impacts experienced from this event, as well as any concerns about how climate change could affect the health of Waterbury residents in the future. She also asked residents to share their perspectives on possible solutions to these health threats.
- Data were also collected through observation of dialogue at community events, including community planning processes organized by city government and forums co-organized by the city and other organizations.
- Dr. Carmichael analyzed the transcribed interviews with UVM researchers Dr. Cecilia Danks and Dr. Christine Vatovec to identify themes in responses, which are presented in the Results section below. While 15 interviews is too few to analyze statistically, interviewees were carefully chosen to capture a diversity of perspectives.

**Table 1.** Fifteen residents who lived in Waterbury for varying amounts of time, and from below and above median income (\$59,564 in 2016), provided data via audio-recorded interviews.

<i>Income</i>	No income data provided	Below median income	Above median income
<b><i>Length of residence</i></b>			
<i>40 years or more</i>	1	2	1
<i>30-39</i>		1	1
<i>20-29</i>		1	3
<i>10-19</i>		2	2
<i>0-9 years</i>	1		
<b><i>Total interviews</i></b>	<b>2</b>	<b>6</b>	<b>7</b>
	<b>15</b>		

## Results

Residents expressed several health concerns linked to climate change (Figure 2), such as:

### 1. Stress, depression, and other mental health impacts due to extreme rainfall events

*Immediate:* “I don't know if it was quite traumatic stress syndrome but it was close. During the first two weeks, I was working 18 hours a day and I would wake up in the middle of the night with my heart beating, like, "Bump bump bump bump bump," wide awake, that kind of thing because there was so much going on and so much that had to be done.”

*Long-term:* “It’s just there all the time, in the background. Is it going to happen again? The more there’s more of these weather events. And am I going to be able to pitch in?”

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## 2. Contaminated water, food, and/or air following extreme storms like TS Irene

Water: “We were all wading through dirty water on Monday morning. I remember looking down around my legs and seeing that the water had red streaks in it. Later, I found out that was the fuel tanks from basements...I went on to have serious troubles with my legs, with the tissues in my legs.”

Food: “My wife and her friend had a garden that was in the flood plain that was flooded and they couldn’t harvest anything from the end of August on that year.”

Air: “They found that I developed COPD. So they’re thinking because of the poison in the air, the mold, the mildew, the wetness, I got an infection. The infection never went away, and now I’m taking medicine every month. It’s \$1500 a month.”

## 3. Vector-borne disease (such as Lyme disease spread by ticks)

“I mean, when I was growing up, there was no such thing as Lyme Disease and now it's fairly common. I know a couple people who've had Lyme Disease, and I actually have a friend who was just diagnosed with it.”

## 4. Injury during floods, hurricanes, or extreme storms

“I mean, I guess one thing I'd like to see here is some type of horn or alerting system, something like that. Something that-- awareness, that alerts people a little bit before it [a storm] happens. I mean, the town was real apologetic for not making it down to tell us [during Tropical Storm Irene]. They forgot all about us.” (mobile home park resident)

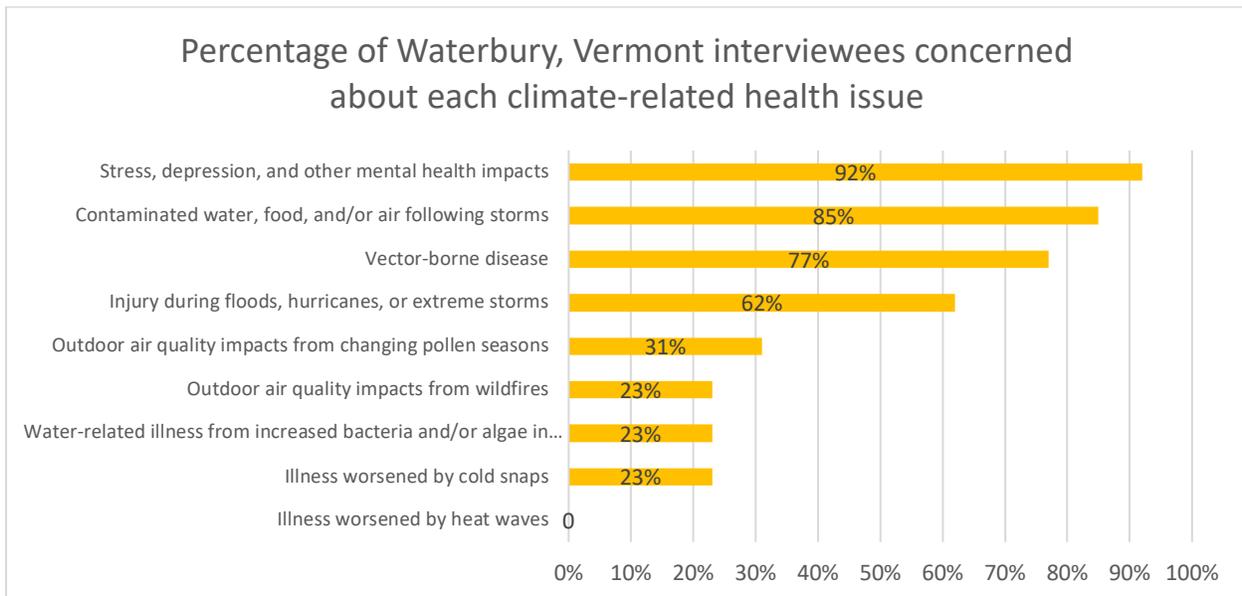


Figure 2. Thirteen residents interviewed indicated whether they were concerned about each of the nine health threats linked to climate change listed in the chart above.

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There were four perceived causes of flooding, and several possible solutions proposed

Table 2. Four perceived causes of flooding (column 1) resulted in some solutions **based** on these causes (column 2) and some solutions agreed upon **regardless** of the cause (column 3).

Perceived <b>causes</b> of flooding	Solutions offered <b>based</b> on causes	Solutions offered <b>regardless</b> of causes
1. Government mismanagement of infrastructure and/or land	<ul style="list-style-type: none"> <li>Better regulate new development to minimize erosion</li> </ul>	<ul style="list-style-type: none"> <li>Flood-proof and/or elevate new builds</li> <li>Reshape land to widen rivers</li> <li>Make sure people are aware of emergency notification system</li> <li>Dredge the river</li> </ul>
2. Climate change	<ul style="list-style-type: none"> <li>Decrease greenhouse gas emissions</li> </ul>	
4. Topography	n/a	
5. Nature/God	n/a	

- Some residents blamed climate change: “My understanding is that the warming of the Earth’s climate leads to these storms picking up a lot of increased moistures that go over oceans.”
- Primarily residents below median income perceived government mismanagement of land: “I think if they dredge the rivers it would help...a lot of the stuff that happened here in town backed up because the bridges caught the debris.”
- Often, residents blamed more than one factor, and therefore agreed on some solutions.

### Recommendations:

- Vulnerability to health impacts from extreme weather events and climate change depends upon three factors:
  - Level of *exposure* to a risk + *sensitivity* to that risk + capacity to *adapt* to the risk<sup>1</sup>

Effective solutions should address all three of these factors. This involves understanding climate and non-climate contributors to vulnerability. In Waterbury, non-climate drivers of vulnerability include geographic residence (**exposure to risk**), pre-existing health conditions and age (**sensitivity to health impacts**) and income level (**capacity to adapt**).
- Government institutions and regulators responsible for managing rivers and erosion need to consider how their strategies affect lower income residents who live in floodplains, and better articulate how their policies incorporate these considerations.
- Facilitated dialogue and collaborative decision-making between residents and government entities could ease tensions and build consensus on solutions. Dialogue should include both climate change and local environmental management issues.

**If you have any questions about this study, please contact:**

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<sup>1</sup> Patz, J. A., Gibbs, H. K., Foley, J., Rogers, J., and Smith, K. R. (2007). Climate Change and Global Health: Quantifying a Growing Ethical Crisis. *EcoHealth*, 4(4), 397-405.