Climate Change and Public Safety

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Impacts and Vulnerabilities

The anticipated changes in Vermont's climate in the upcoming decades carry significant ramifications for public safety. Changes in precipitation patterns, including increases in the frequency of sudden, extreme precipitation events, pose some of the most significant challenges for state agencies and hazard planners, threatening increases in loss of human life, damage to infrastructure, and the spread of disease.

The northeastern United States, from Pennsylvania and New Jersey to Maine, has experienced an average annual increase of 0.5°F per decade since 1970 (Hayhoe et al., 2007). Over the same timeframe, winter temperatures have risen at a faster rate of 1.3°F per decade (Fromhoff et al., 2007). Warming temperatures are reducing the ratio of snow-to-total precipitation, the amount and density of the winter snow pack, and the duration of ice cover on lakes and rivers. As a result in these changes in precipitation patterns, researchers predict more severe but shorter duration storm events, resulting in more intense winds and flash flooding. The frequency of flooding has already measurably increased in Vermont, and the probability of high-flow events may increase by as much as 80% (Frumhoff et al., 2007). Increased flooding could lead to an increasing number of landslides due to instability of soils, crop and insect changes, as well as an increase in human, plant and animal diseases associated with shifting climate.

Anticipated increases in the amount of precipitation, changes in precipitation timing, and current land use practices all contribute to Vermont's increasing vulnerability to flood hazards. The US Global Change Research Program's *The New England Regional Assessment of the Potential Consequences of Climate Variability and Change*, published in 2006, reports that New England is expected to experience increases in periodic flooding associated with an increase in regional precipitation of as much as 30%. More sudden, violent rainstorms in the summer and faster melting of snowpack in the spring both increase the likelihood of flood events, when the rain falls too quickly or the ground is too cold to absorb the precipitation. Fluctuating temperatures in the winter months also increase the likelihood of ice jams, which can cause devastating floods (Beltaos, 1997; 1999). Vermont's historic settlement patterns, including the widespread channelization of rivers, has resulted in the loss of functioning flood plains by not allowing rivers the necessary space to maintain their natural equilibrium following flood events. Altering natural river banks and building on natural floodplains has made Vermont particularly vulnerable to climate change-related increases in flood frequency and magnitude. Predicted increases in the frequency and severity of flood events are likely to compromise human

infrastructure located on floodplains or along rivers and streams. This includes roads, bridges, and buildings which may be inundated or damaged by fluvial erosion or landslides.

Changes in precipitation patterns also pose daunting challenges to agencies in charge of predicting and planning for natural disasters. An unfamiliar climate pattern severely hampers officials' ability to accurately predict and plan for floods, droughts, and other natural disaster events, so local hazard mitigation and emergency operations plans need to eb revised to consider the increased uncertainty. Increasing communities' capacity for storage of drinking water, diversion of stormwater runoff, and prevention of negative impacts on infrastructure will all be necessary to prepare communities to deal adapt to the challenges to come.

Warmer temperatures and flooding also increase the spread of pest species and disease. Climate change may also affect the frequency and severity of cyanobacteria (blue-green algae) blooms, as well as the spread of insect-born disease such as Lyme disease and the West Nile Virus. The overflow of sewage and stormwater treatment plans, caused by flooding events, can also quickly spread disease associated with *E.coli* and other bacteria.

In sum, extreme weather events brought about by the change in the regional climate are predicted to lead to significant economic and societal challenges, including more localized flooding, landslide events, and negative agricultural effects, all of which have significant public safety implications.

What are we already doing?

- Vermont Emergency Management (VEM) maintains and updates the Vermont Hazards Inventory Risk Analysis (HI/RA) as a part of the State Hazard Mitigation Plan and Emergency Operations Plan. This analysis aims to identify the primary hazards confronting Vermonters, and is reviewed on an annual basis and revised every three (3) years.
- The Vermont State Emergency Operations Plan (SEOP) provides a framework to coordinate and support local response to emergencies, such as floods, that are likely to result from frequent, more extreme storm events.
- VEM also provides technical assistance to local jurisdictions to:
    - Develop and maintain local hazard mitigation plans and emergency operations plans.
    - Coordinate multi-level preparedness, response and recovery activities with federal, state, local and public partners.

Adaptation Strategies

While it is critical that communities across the globe take action to reduce or mitigate their greenhouse gas emissions, the degree of impact that Vermont municipalities will experience as a result of extreme weather events will primarily be a function of the steps taken by municipalities to safeguard their communities and the environment from these impacts.

Vermont Emergency Management (VEM) collaborates with other state agencies to provide information regarding flood and fluvial erosion hazards. It also provides tools and information for municipalities and landowners to help manage impacts from flooding, and to enhance local

resilience to future impacts of climate change. This information is essential to help reduce the risk to lives and property by natural hazards.

VEM recognizes the following specific opportunities to continue improving state and municipalities' resilience to climate change:

- Collaborating with ANR and other state and local partners to conduct proactive outreach and educational efforts with the goal of mitigating the negative public safety stresses due to climate change;
- Providing municipalities with educational materials on pre-disaster hazard mitigation and ice jam mitigation;
- Advocating for more accurately delineated, digitized FEMA flood maps;
- Developing mitigation measures that prevent or discourage development in hazard-prone areas;
- Securing greater local and State legislative support for important mitigation priorities, including: risk avoidance, remediation of recurring flood loss areas, river corridor protection, and attention to areas affected by chronic fluvial erosion and severe flooding;
- Aiding local initiatives to adopt fluvial erosion hazard and enhanced floodplain protection ordinances;
- Supporting efforts to provide technical assistance and financial incentives to local governments for the adoption and implementation of river corridor protection ordinances and other strategies to help reduce vulnerabilities to climate change related impacts at the state and local levels;
- Developing a monitoring, assessment plan to identify and mitigate the risks of climate change on developed property and infrastructure;
- Supporting efforts to enlarge culverts to accommodate increasing flow and sediment continuity to reduce the risk of blockages; and,
- Promoting a personal preparedness message to help landowners, town residents, and local government to take responsibility and be ready to adapt and respond when needed.

References

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