I. Initial Campus-Community Resilience Assessment

Project Fellows
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Introduction

Background

Ninety seven percent of scientists agree that climate change is happening and that it is influenced by human actions (Wake et al., 2014). Scientists around the world have spent the last few decades researching and reporting various aspects of climate change, contributing to growing knowledge of some of its impacts. Climate scientists have made the following important points:

1. The concentrations of heat-trapping gases, or greenhouse gases (GHGs) such as carbon dioxide, methane, and nitrous oxide, in the atmosphere have been rising due to human activities since the Industrial revolution (Wake et al., 2014).

2. Ongoing data collection has revealed persistent and increasingly significant changes in climate, including rising atmospheric and ocean temperatures, increasing atmospheric water vapor, increasing precipitation and extreme precipitation events, and rising sea levels (Wake et al., 2014).

3. The climate science community, based on findings of peer-reviewed publications, has concluded that it is highly likely that human activities resulting in the emissions of heat-trapping gases have caused the majority of the warming seen over the last five decades (Wake et al., 2014).

In order to document the effects of this changing climate on a local level, Climate Solutions New England (CSNE) and the University of New Hampshire (UNH) Sustainability Institute partnered to create the report “Climate Change in Southern New Hampshire: Past, Present, and Future.” Additionally, they created a similar report for Northern New Hampshire and databases with climate data for all New England states (go to https://sustainableunh.unh.edu/csne-publications for more info). The following summary of information from the Southern New Hampshire report (Wake et al., 2014) sets the context for this report and the efforts to create a campus-community resilience plan.

- The northeast United States has been warming over the past century, and over the last four decades the rate of warming has increased.
- Regional climate change has been documented in the following ways (Wake et al., 2014):
  - Increases in
    - Temperature (especially in winter)
    - Overall precipitation
    - Extreme precipitation events
    - The proportion of winter precipitation falling as rain (rather than snow)
- Earlier
  - Ice out dates
  - Spring runoff
  - Spring bloom dates for lilacs
- Decrease in snow cover days
- Longer growing seasons
- Rising sea levels

Collaborators from CSNE used global climate models (GMCs) to model potential future impacts of climate change on Southern New Hampshire (Wake et al., 2014). These models indicate the climate of Southern New Hampshire is expected to get warmer and wetter over the next century. If emissions continue to be emitted as they are now, this would lead to:
  - Hotter summers and warmer winters
  - More invasive pests and weeds
  - An increase in precipitation and the frequency of extreme precipitation events

Based on this compelling scientific evidence, it is clear that the climate is and will continue to change on a local level in Southern New Hampshire, and actions must be taken to combat the impacts of this change. There are two main ways to deal with a changing climate: mitigation and adaptation. Mitigation of climate change involves reducing GHG emissions and increasing carbon sinks, and adaptation to climate change impacts includes planning and preparing for future conditions in order to reduce harm and disruption. Both strategies are crucial to a comprehensive climate change response, as they are linked (Wake et al., 2014). *Cam will need to link IPCC mitigation and adaptation to ACUPCC/Second Nature.*

These two responses are key aspects of Second Nature’s Presidents’ Climate Leadership Commitment. The commitment requires signatories to report GHG emissions and reduction efforts with a target of carbon neutrality, and develop a campus-community resilience assessment and plan with a target of reaching identified resilience thresholds (“The Presidents’ Climate Leadership Commitments”, 2017).

Local adaptation efforts are most effective when local knowledge concerning the impacts and consequences of weather disruption is used to inform these efforts. For that reason, any efforts to address climate change must include the opportunity for participation and support from all community members (Wake et al., 2014). Within this report, the information gathered comes from key stakeholder representatives that manage physical assets within and/or whose operations provide resources to the UNH campus and/or local Durham community. These stakeholders include department directors and managers, first responders, planning professionals, and municipal leaders. Their responses have significantly contributed to the current understanding of the complex social and human impacts of climate conditions in Southern New Hampshire, and will be useful for future planning and preparation efforts.
Second Nature

Second Nature is a nonprofit organization that promotes climate action in higher education. It aims to “help build a sustainable and positive global future through leadership networks in higher education” (Secondnature.org) by encouraging institutions to publicly sign bold climate commitments, increase campus sustainability initiatives, and come up with creative climate solutions. Second Nature’s Presidents’ Climate Leadership Commitments are bold, public commitments that presidents of higher education institutions can sign. By doing so, these institutions agree to take certain actions in response to climate change (“The Presidents’ Climate Leadership Commitments”, 2017).

Currently there are three commitments: The Carbon Commitment, the Resilience Commitment, and the Climate Commitment. The Carbon Commitment focuses primarily on mitigating university contributions to climate change and eliminated harmful greenhouse gas emissions. The Resilience Commitment focuses on goals specific to climate adaptation and building the community’s ability to withstand and thrive in the face of climate change and the ensuing extreme weather events. The Climate Commitment (Appendix A), on the other hand, combines these two commitments and requires both carbon neutrality efforts and climate resilience planning, necessitating a systems approach for responding to and preparing for climate change (“The Presidents’ Climate Leadership Commitments”, 2017).

Until 2015, Second Nature only offered two commitments: a carbon-related commitment, and a resilience-related commitment (“Frequently Asked Questions, 2017). In 2007 UNH signed the carbon-related commitment, after which they developed a climate action plan (i.e. WildCAP) detailing a goal of achieving carbon neutrality by 2100 and actions necessary to reach this goal. In 2016, after Second Nature added the third commitment, UNH signed the Climate Commitment (Cleaves, Pasinella, Andrews & Wake 2009). The timeline for the Climate Commitment can be found in Figure 1, and the detailed requirements for the Climate Commitment are in Appendix A.
To help higher education institutions achieve the goals of the commitments, Second Nature provides tools and resources for colleges and universities to make strides towards climate change mitigation and adaptation. The organization has developed, and continuously update, a comprehensive “Climate Guidance” (http://secondnature.org/climate-guidance/) section of its website that has information necessary to address the various aspects of each commitment. The “Climate Guidance” section is broken down into different categories based on action items required by the commitments. Each category explains the importance of that specific action, and recommends how to do it. These thorough explanations and instructions make it easy for institutions to begin addressing the action items required by the commitments.
Progress to Date

Since signing Second Nature’s original American College & University Presidents’ Climate Commitment (ACUPCC) in 2007, UNH has taken the following actions to address the requirements of the commitment:

1. Established Implementation Liaison: Jennifer Andrews
2. Established the existing Energy Task Force as the task force responsible for addressing the requirements of the Climate Commitment
3. Developed first climate action plan, WildCAP, in 2009
4. Updated WildCAP in 2014
5. Signed Climate Commitment in 2016 after Second Nature updated commitments
6. Started working to address resilience aspect of Climate Commitment in 2017

These actions are outlined in Figure 2. The entire left column of the figure are actions that have been completed. The first orange box has also been completed, and now UNH is working on the next step, Initial Resilience and Vulnerability Assessment, which will be completed in May 2018.

Figure 2. Steps of the Climate Commitment. Orange boxes indicate the major requirements of the Climate Commitment
Resilience Plan Framework

While UNH has already developed and updated an initial climate action plan, this plan does not address resilience. Because Second Nature requires a climate action plan to include a resilience assessment, conducting this assessment is the next step towards completing the requirements of the commitment. This report will focus on the recent work done towards developing a campus-community initial resilience assessment.

Before assessing campus and community resilience, a framework was developed following Second Nature’s guidelines in order to identify the steps required to determine current resilience and develop a plan for building resilience. Second Nature’s guidelines identified four key steps: Resilience Assessment, Future Scenarios, Climate Impact & Vulnerability Assessment, and Decision Options & Actions. The framework developed for UNH includes these four steps, but the names were modified to: Initial Resilience Assessment, Determine Future Scenarios, Climate Impact & Vulnerability Assessment, and Create Resilience Plan. A fifth step was added, Revisit the Process, to emphasize the importance of continuous review and revision in order to keep up with new information. The five steps are detailed below:

1. **Initial Resilience Assessment**
   The initial resilience assessment involves looking at past and present weather trends and extreme weather events and assessing their impact on both the built environment and human social systems, as well as determining potential indicators of resilience. In more detail, the steps are as follows:
   a. **Understanding Past & Current Weather**
      In order to determine current resilience, there must be a good understanding of local weather trends and extreme events. This requires obtaining data on historic, current, and projected weather patterns on a local or regional scale (“Climate Resilience”, 2017). CSNE currently maintains a wealth of such information, including detailed historical data and future projections, localized to the Southern New Hampshire region. This has allowed the Sustainability Institute to identify five main climate threats in Southern New Hampshire: heat, cold, snow/ice, drought, and flooding. The data from CSNE ranges from 1895 to 2100 and provides scenarios for both high and low emissions futures. High emissions scenarios indicate no change in GHG emissions over the next century, and low emissions scenarios indicate an achievable reduction in GHG emissions. This data can be used to understand historical trends, recent trends, and potential future trends, which makes it possible to understand the ways in which the climate will be changing over time. The future projections indicate increases in the severity and frequency of extreme events, especially for precipitation and increasing temperatures (Wake et al., 2014).
b. Stakeholder Engagement

The second part of the Initial Resilience Assessment requires identifying current assets, strengths and weaknesses, and areas of vulnerability and resilience as they pertain to the weather events identified by the Sustainability Institute. This can be done by interviewing key campus and community stakeholders that are responsible for managing both physical and social assets. These individuals have the best knowledge of their operations and the assets they manage, and are typically experts of their own departments or entities. Engaging a diverse range of stakeholders - including those who appear to be unaffected by weather events - is important to develop a well-rounded assessment of current resilience (“Climate Resilience”, 2017).

c. Indicators of Resilience

After meeting with stakeholders, initial indicators of resilience should be determined. These indicators should be sorted into five categories: natural, physical, social, human, and financial (for more information see table 3 in context section). These indicators will be used to identify levels of vulnerability or resilience, and can help track progress in building resilience. Selected indicators should be measurable, help build resilience, and provide actionable information. The indicators identified in this step are preliminary, and serve as suggestions for future finalized recommendations (“Measuring Progress”, 2017).

d. Report

The initial resilience assessment should finish with a comprehensive report that identifies all the areas where the campus and community is resilient and where it is vulnerable. This will be the foundation for the Future Impact and Resilience assessment, which will be done in step three. However, since this report is dealing with the actual current state of the system it is important to be as thorough as possible. This will make the process of creating future scenarios much easier.

2. Determine Future Scenarios

In order to better understand likely future climate conditions, it is necessary to evaluate future scenarios, particularly those that relate to the primary climate threats identified in step one (“Climate Resilience”, 2017). Evaluating climate scenarios requires local or regional data about past, current, and future climate change and future weather projections based on different emissions scenarios. While certain events are difficult to predict, global climate change data indicate that weather events will become more extreme in the future, so identifying which of these weather events currently impacts the local area the most is a helpful place to start. Because not all climate events can be projected, projections of related events can be used to estimate the potential impact that an event could have. For example, flooding is difficult to predict because it is influenced by multiple variables, such as duration, intensity, and spatial distribution of rainfall, as
well as soil composition, ground cover, and topography. However, projections of extreme precipitation can provide approximate estimates for flooding potential.

Additionally, it is necessary to consult campus and community plans to get a better understanding of where the university and local municipality plans to be in the future. This is beneficial for understanding what kinds of assets might exist in the future, how space will be utilized, and where development may occur. Master plans, strategic plans, hazard mitigation and emergency response plans can provide much of this information (“Climate Resilience”, 2017).

Since it is nearly impossible to determine future growth and development 50 or more years into the future, it is beneficial to have a range of population and development growth scenarios. These scenarios should illustrate what the UNH campus and town of Durham could look like under predetermined levels of population growth. The model outlined in the 2012 UNH Master Plan utilizes this scenario planning method, preparing for “Level,” “Min,” and “Max” scenarios of faculty, staff, and student population growth (University of New Hampshire [UNH], 2012). A level scenario indicates that population will remain relatively the same, a min scenarios indicates a decreasing campus population and a max scenario indicates a growing campus.

Because spatial needs are dependent on population, campus land use changes and development changes can be estimated using these growth scenarios. Town growth projections can further inform the magnitude of these changes on a community-wide scale. Getting an understanding of where the town and university plan to be in the future is necessary for understanding what the climate impact might be like in the future (“Climate Resilience”, 2017).

3. Future Climate Impact and Resilience Assessment

This step combines the information gathered in the first two steps. Assessing current resilience gives a baseline measurement and makes it possible to then determine what future resilience might look like. Determining future scenarios is necessary for understanding what both climate and developmental conditions will be like in the future (“Climate Resilience”, 2017). The method for determining future climate impact and resilience is similar to determining initial resilience. However, for this, three things must be considered:

1. The projected impacts of the specific weather events
2. The future campus and community assets, physical structures, and demographics
3. The current areas of resilience and vulnerability

Combining these three things is complex but necessary to accurately portray the impact of future climate conditions on the campus and community (“Climate Resilience”, 2017). Interviews - similar to those conducted in the first step, but focused on affected assets and potential impacts of future climate conditions - can inform this assessment.
4. Create Resilience Plan

Information gathered in the Future Climate Impact and Resilience Assessment step should inform an action plan that addresses each identified campus and community entity. This action plan should consist of action items - prioritized by return on investment and feasibility - that align with community plans and will improve resilience to the five identified top climate threats. Additionally, this plan should include actionable, quantifiable indicators of resilience that measure progress, align with community goals and values, and move the community towards its planned future (“Climate Resilience”, 2017). This plan should be distributed to all stakeholders for review, shared with the community, and revisited and revised as necessary.

5. Revisit the Process

Every five years, the resilience plan should be revisited and revised. New information should be incorporated into existing plans as it becomes available, or existing plans should be adjusted to accommodate such information. This information could be about the changing climate, community development, or new technology.

Additionally, each revision should also include a progress evaluation, based on resilience indicators, and a discussion of proposed amendments to the action items.
Initial Resilience Assessment Methods

The entire campus-community resilience plan (first four steps) will be completed at UNH by May 2019. This report focuses on the methods and findings of the first step, Initial Resilience Assessment. This section provides details on the reasoning and methods of the three key parts of the Initial Resilience Assessment: a) Understanding Past & Current Weather, b) Stakeholder Engagement, and c) Determine Indicators of Resilience.

A. Understanding Past & Current Weather:

In order to understand past and current weather, resources on climate and weather in Southern New Hampshire were assessed. The primary source for climate information in this project is a report by CSNE titled “Climate Change in Southern New Hampshire: Past, Present, and Future.”

From this report, five main weather events in the Southern New Hampshire region were identified as top climate threats: heat, cold, snow/ice, drought, and flooding. The report’s extensive data includes both past records and future projections spanning from the years 1895 to 2100, and provides future climate scenarios for both high and low emissions futures. The data from this report was assessed in relation to the five weather events, and brief explanations of the recent and current trends of these events were developed.

B. Stakeholder engagement:

To identify the current impacts of these climate events in the UNH/Durham community, various individuals representing different entities were interviewed. Communication with these individuals was valuable on two levels. First, these individuals explained how different weather events impact very specific operations; such first-hand, individual accounts of climate impacts are powerful and can be more impactful than strictly quantitative data. Second, making connections with these individuals builds community - contributing to overall resilience - and these conversations encourage deeper thought about resiliency and increase awareness about this topic.

Before starting the Initial Resilience Assessment, the UNH Sustainability Institute planned and hosted a preliminary meeting with individuals from important entities on campus and in Durham Individuals that represent important entities on campus and in town. Attendees discussed future climate concerns and the need for a joint resilience plan. This meeting was an important starting point for this project, as it brought independent entities together and started the conversation about resilience.

Two months following this meeting, the framework for this project was developed using Second Nature’s recommendations and the first step was started. Identifying
individuals for stakeholder engagement was done in two ways. First, attendees of the preliminary meeting were identified as priority individuals to contact. Then, other entities and/or individuals were thought of by the individuals leading the first meeting and the individuals working on this project. This was done by considering which entities on campus and in town might be affected by the five weather events identified. Due to the large scale of this project, it was decided that this work should focus on UNH before expanding to the greater community, with some exceptions.

After identifying certain entities or departments, those in leadership roles were selected as the best representatives to contact. This was done either by searching online directories, or with the help of individuals at the Sustainability Institute. Approximately 30 leading stakeholders comprised the final stakeholder list. From this list, priority individuals - including those who attended the preliminary meeting or represented disproportionately affected campus departments - were identified. Then, medium priority and low priority entities were identified (Table 1a and 1b).

<table>
<thead>
<tr>
<th>Interviewed</th>
<th>Provided Useful Information, Not Interviewed</th>
</tr>
</thead>
</table>
| ● Evan Ford - Agricultural Experiment Station  
● Steve Metcalf - Athletics  
● Doug Bencks - Campus Planning  
● Adam Kohler - Energy & Utilities  
● Wesley East - Energy & Utilities  
● Andy Glode - Environmental Health & Safety  
● Jim Malo - Grounds & Events  
● Paul Chaloux - Grounds & Events  
● Ruth Abelmann - Residential Life                                                 | ● Dave Emanuel - Durham Fire Department  
● Dennis Dupuis - Health & Wellness  
● Kathleen Grace-Bishop - Health & Wellness  
● Bill Cote - McGregor Memorial EMS  
● Dirk Timmons - Transportation  
● Jamie Houle - Stormwater Center  
● Mike Mason - Facilities Asset Management                                                                                                      |
| ● Todd Selig - Durham Administration  
● James Burden - Strafford Regional Planning Commission  
● Sam Lingeman - Campus Planning                                                                                                                |

Table 1a. List of individuals and their corresponding departments who were interviewed during the summer of 2017. List of individuals who were contacted to obtain planning, asset, and emergency response documents, but not interviewed.
Once identified, top priority individuals were contacted by email. This email included a description of the project and a request for a 90-minute meeting to discuss the impacts of the five climate events on each stakeholder’s operations. Some individuals responded and agreed to meet, others recommended speaking with other department contacts, and some did not respond. For willing stakeholders, meetings were scheduled for 90, 60 or 30 minutes depending on stakeholder availability.

Before meeting with stakeholders, a document with prepared questions was created. Most stakeholders were asked the same questions in the same general format see Appendix B for sample of interview questions.

Two interviewers were present at all interviews. One took notes while the other recorded and asked questions. After each interview, both interviewers wrote up the responses, added additional notes, and reviewed the audio recording to catch any missed information. The completed document was emailed to the interviewee, who had the opportunity to review the information and note any errors or misinterpretations. Interviewers edited the documents as necessary.

As the interviewers repeated and finished this process with all available priority stakeholders, they contacted medium priority individuals for meetings. Individuals who failed to respond after additional contact attempts were not contacted again.

The perspectives of the individuals/entities categorized as “low priority” are still essential for the completion of a campus-community resilience plan, but given summer time limitations meeting with these individuals was not possible. As this work continues, these individuals should be considered top priority contacts.
C. Determine indicators of resilience:

After meeting with stakeholders and compiling their responses, initial resilience indicators were determined (Table 2). These indicators were sorted into five categories: natural, physical, social, human, and financial (for more information on these categories, see Table 3 in Context section). These indicators provide numerous possible ways to identify and measure aspects and varying degrees of resilience at UNH and in Durham. These indicators were informed by assets and areas of vulnerability and resilience identified by interviewed stakeholders. Some indicators were also recommended by Second Nature. They include things that the community may already be doing well, areas where improvement is needed, and areas for new actions to be taken in order to build resilience. As preliminary suggestions, these indicators do not include measurement methods or current baseline estimates, but they can all be thought of as potential areas for improvement. The University and community can take actions related to these indicators to increase resilience and decrease vulnerability.

<table>
<thead>
<tr>
<th>Natural</th>
<th>Financial</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Ratio of green space (drainage) to impervious surface</td>
<td></td>
</tr>
<tr>
<td>2. Total shaded area/canopy cover on campus</td>
<td></td>
</tr>
<tr>
<td>3. Total sq. ft. of protected natural buffer area around college brook</td>
<td></td>
</tr>
<tr>
<td>a. Minimum setback from brook</td>
<td></td>
</tr>
<tr>
<td>4. Diversified sources of water</td>
<td></td>
</tr>
<tr>
<td>5. Diversified sources of energy</td>
<td></td>
</tr>
<tr>
<td>6. Surface water sources exposed to runoff/contaminants</td>
<td></td>
</tr>
<tr>
<td>7. Presence of invasive species</td>
<td></td>
</tr>
<tr>
<td>8. Makeup of energy portfolio, goal of majority renewable</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Social</th>
<th>Physical</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Number of days curtailed from Snow/Ice</td>
<td></td>
</tr>
<tr>
<td>2. Productivity loss from weather events</td>
<td></td>
</tr>
<tr>
<td>3. Per capita annual water consumption</td>
<td></td>
</tr>
<tr>
<td>4. Resilience meetings held every ~2 years with stakeholder involvement</td>
<td></td>
</tr>
<tr>
<td>5. Collaboration between UNH and Durham in resilience planning</td>
<td></td>
</tr>
<tr>
<td>6. Community engagement in resilience planning</td>
<td></td>
</tr>
<tr>
<td>7. Use of Friday Newsletter (Durham FD) to build community/trust</td>
<td></td>
</tr>
<tr>
<td>8. Increased publicity of free UNH bus rides on</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Financial</th>
<th>Physical</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Percent of emergency fund used</td>
<td></td>
</tr>
<tr>
<td>2. Size of revolving green fund</td>
<td></td>
</tr>
<tr>
<td>3. Yearly expenditures on identified resilience improvement actions</td>
<td></td>
</tr>
<tr>
<td>4. Total estimated savings from investment in resilience improvement projects</td>
<td></td>
</tr>
<tr>
<td>5. Value of assets (or expected damage) that are highly vulnerable</td>
<td></td>
</tr>
</tbody>
</table>

1. Average lifespan of new construction projects and renovations
2. Number of buildings/value of buildings located in floodplain or 100-year storm flood zones
3. Back up energy capacity
   a. Amount of energy capacity (volume) i.e fuel storage; how many days worth
   b. Ability to provide electricity to critical campus systems/buildings (Dining hall, health & wellness, science buildings with labs, EMS, fire and police stations,
Table 2. Initial Indicators of Resilience, categorized.

<table>
<thead>
<tr>
<th>Heat Days</th>
<th>Water Treatment, Whittemore Center, and Dorms</th>
</tr>
</thead>
<tbody>
<tr>
<td>9. Amount of unfilled student worker positions (especially for G&amp;E, farms, Transportation)</td>
<td>without rolling blackouts to those buildings</td>
</tr>
<tr>
<td>10. Ability to host a shelter for the UNH/Durham community</td>
<td>4. Amount of A/C’d sq.ft. space vs. non-A/C for academic buildings and residential buildings</td>
</tr>
<tr>
<td></td>
<td>5. Redundant utility systems (ability to close the loop)</td>
</tr>
</tbody>
</table>

**Human**

1. University Heat Advisory days  
   a. Productivity loss  
   b. Number of people exposed to heat
2. Access to public transportation
3. Access to cooling centers
4. Action plan for vulnerable populations (international students, individuals with disabilities, and those in elder care facilities)  
   a. Informational documents written in native language of international students  
   b. Check-in procedures for individuals with disabilities and those in elder care facilities; ability to transport these individuals to shelters
5. Demographics (Median age/income/education, employment/unemployment, languages spoken, etc.)
6. Number of departments with set procedures & policies for responding to extreme weather events (especially for those exempt from curtailed ops)
7. University-run cooling center for students, faculty, staff and local residents
Context

General Context

In order to conduct a comprehensive resilience assessment that addresses all aspects of a community, Second Nature recommends using these five guiding categories: natural, physical, social, human, financial. These categories represent all aspects of a university or town; all communities have strengths, weaknesses, and assets in these categories (“Measuring Progress”, 2017). These are also known as the five primary types of capital used to measure both tangible and intangible things (“The Five Capitals, n.d.). Definitions and examples of these categories are in Table 3.

<table>
<thead>
<tr>
<th>Type</th>
<th>Definition &amp; Examples</th>
</tr>
</thead>
<tbody>
<tr>
<td>Natural</td>
<td>• Any stock or flow of energy and material that produces goods and services</td>
</tr>
<tr>
<td></td>
<td>• Water, air, soil etc.</td>
</tr>
<tr>
<td>Physical</td>
<td>• Material goods that contribute to a production process</td>
</tr>
<tr>
<td></td>
<td>• Buildings, computers, machinery, etc.</td>
</tr>
<tr>
<td>Social</td>
<td>• Institutions that create and maintain partnerships with others</td>
</tr>
<tr>
<td></td>
<td>• Task forces, organizations, committees, etc.</td>
</tr>
<tr>
<td>Human</td>
<td>• All aspects of an individual</td>
</tr>
<tr>
<td></td>
<td>• Health, knowledge, skills and motivation, etc.</td>
</tr>
<tr>
<td>Financial</td>
<td>• Allows other types of capital to be owned or traded</td>
</tr>
<tr>
<td></td>
<td>• Has no real value itself but is representative of all other capital</td>
</tr>
</tbody>
</table>


Resilience can be assessed using indicators that represent each of these five categories. These indicators should be flexible variables that give a general idea of areas of vulnerability and resilience, and should be things that the community values (“Measuring Progress”, 2017). Examples of potential indicators can be found in Table 2.

In order to determine indicators in these five categories, it is helpful to categorize information. For this reason, information gathered from stakeholders was sorted by weather event, and then again by capital category in order to get a thorough understanding of how each capital category is impacted by each weather event. This
categorization makes it easier to directly see the ways in which different types of capital are affected by different weather events.

Climate Events

*Extreme Heat*

Since 1990, there have been an average of eight days per year where the temperature reaches above 90°F with about one of those days above 95°F in Southern New Hampshire, but since 2010 alone there have been on average 10 days above 90°F with 1.5 of those days above 95°F (Wake et al., 2014). Extreme heat can cause human health issues, lead to a loss of productivity, and cause mechanical stress and failures (interviews). Under a high emissions scenario, by the end of the century Southern New Hampshire could experience on average 67 days a year with temperatures above 90°F, with about 34 of those days above 95°F (Wake et al., 2014).

In recent history, high heat has not been a major concern for Southern New Hampshire. However, roughly 20 years ago, the University transitioned from using air conditioning to cool equipment to using it to cool people. This has been in part due to a warming climate, but also due to increased campus space utilization in the summer. The top concerns on high heat days are outdoor workers, and sometimes indoor workers whose buildings lack A/C. For outdoor workers, there are health concerns that come with high heat days, but most outdoor workers modify their work schedules so they are not outside during the hottest part of the day. Additionally, UNH issues heat advisory days to outdoor workers, requiring them to take frequent breaks. For indoor workers, the main concern on high heat days is a loss of productivity.

*Extreme Cold*

Currently, Southern New Hampshire experiences about 16 days per year with temperatures below 0°F and 160 days with temperatures below freezing (Wake et al., 2014). Like extreme heat, extreme cold can lead to human health concerns, loss of productivity, and building system and mechanical failures (interviews). With warming climate trends, the number of cold days is expected to decrease dramatically, especially for days below 0°F. Under a high emissions scenario, it is predicted that at the end of the century there will be only 2 days on average below 0°F, and 120 days below freezing (Wake et al., 2014).

Historically, UNH-Durham has been heavily exposed to cold weather events. The primary concern of extreme cold on the physical environment is the freezing of pipes. This is often a result of poor building design or maintenance, causing poorly ventilated or poorly climate-controlled spaces to become too hot and stuffy. This leads to people opening windows, which often get left open overnight. The pipes then freeze at night causing breakages, which flood the building when the heat comes back on. The primary
human concern of cold weather is exposure. This ranges from minor frostbite to more extreme exposure from spending long periods of time outdoors.

**Ice and Snow**

Since 1990, there have been an average of 99 snow covered days per year. Snow and ice are typical for New England, but extreme ice and snow weather events, like winter storms, are of particular concern for this region. In the near term, projected increases in precipitation in combination with winter temperatures remaining below freezing will lead to increased snowfall. Additionally, extreme precipitation events have been increasing and are expected to increase further in the future, which could lead to more severe winter storms. However, by the end of the century snow and ice cover will be significantly reduced (Wake et al., 2014).

Ice and snow events have been heavily present in Durham’s history. There are three main physical concerns associated with ice and snow: accessibility of roads and buildings, buildup on roofs, and freezing mechanical systems. Roads and walkways are cleared efficiently at UNH, and is primarily the responsibility of Grounds and Events. Snow and ice buildup on roofs presents a safety concern for pedestrians and increased maintenance cost on buildings. Freezing of mechanical systems causes a safety concern in lab buildings and can lead to pipe freezes and subsequently building flooding. During ice and snow events the primary human concern is overall safety and wellbeing. Ice and snow leads to poor roadway and walkway conditions, which increase the likelihood of motor vehicle incidents, and slips and falls.

**Drought**

Southern New Hampshire has not experienced too many significant droughts in the past, but there have been a few. The most recent drought was during the summer of 2016. Many communities in Southern New Hampshire had water use restrictions (Sullivan, 2016), and produce farmers were faced with increased costs from the labor and energy necessary to run water pumps that pull water from rivers (Mountain, 2016). While drought is not currently seen as a major concern in this area (interviews), warmer summer temperatures could lead to an increase in drought due to increases in evaporation, heat waves, and short term precipitation events (Wake et al., 2014).

Durham was not significantly impacted by the 2016 drought because of the many available water sources in the area. These include the Lamprey River, Oyster River, Spruce Hole Artificial Recharge Station, and Lee Well. However, during a drought, activities that require water, such as irrigation and recreation, are monitored more heavily. These activities are the most likely to be impacted by water restrictions.

**Flooding**

Flooding is influenced by multiple variables, but typically events that generate over four inches of precipitation in 48 hours result in flooding. Events like these have
been increasing over time; from 1973-1992, Durham had eight events resulting in four inches over 48 hours, whereas from 1993-2012 these events more than doubled, with 17 (Wake et al., 2014). Since 2005, there have been five notable flooding events: 2005 Alstead/Keene Floods, 2006 Mother’s Day Flood, 2007 Patriots Day Flood, 2011 Hurricane Irene, and 2012 Hurricane Sandy. All of these resulted in either presidentially declared disasters or emergency declarations in New Hampshire (FEMA, 2017).

Because flooding is influenced by multiple variables, it is harder to predict. However, as precipitation and extreme precipitation events are more likely to occur in the coming century, flooding is also more likely to occur. In recent history, UNH and Durham have been exposed to a considerable amount of flooding. Various individuals have indicated that there have been three “hundred year” floods since 2000: the Alstead/Keene Floods of 2005, the Mother’s Day Floods of 2006, and the Patriots Day Floods of 2007. However, UNH is more protected from flooding due to its elevation. Durham also has some protection due to its elevation, but the following roads have vulnerable areas: Rt. 108, Rt. 4, Rt. 155A, Bennett Rd., Long Marsh Rd., and Packers Falls Rd. Because of this, a primary concern during extreme rain events is roadway accessibility caused by flooding. Inaccessible roads not only prevent individuals from doing daily activities, but also prevent first responders from accessing certain areas in their districts. Other threats of flooding include damage to buildings and facilities and power outages.
Findings

Each interview included questions about assets and the impacts of each of the five identified weather events on operations and assets. Sorted by department or entity, this section includes the information gathered in these interviews. Assets and areas of resilience and vulnerability were reported on, sorted into the five categories of capital (Table 3). The information in this section was provided by the individual(s) representing each department or entity during interviews.

1. - Agricultural Experiment Station

1.1 - Assets

<table>
<thead>
<tr>
<th>Natural</th>
<th>Physical</th>
</tr>
</thead>
<tbody>
<tr>
<td>Tillable acres</td>
<td>● Fencing around both farms</td>
</tr>
<tr>
<td>● Kingman farm 20+ acres,</td>
<td>● Tractors with tillage and snow removal equipment</td>
</tr>
<tr>
<td>Farm services uses some of this</td>
<td>(both farms)</td>
</tr>
<tr>
<td>● Woodman Farm 10-15 acres,</td>
<td>● Kingman:</td>
</tr>
<tr>
<td>approximately 5 in production at</td>
<td>○ Barn</td>
</tr>
<tr>
<td>this time</td>
<td>○ 3 Greenhouses for aquaponics</td>
</tr>
<tr>
<td></td>
<td>○ Composting facility</td>
</tr>
<tr>
<td></td>
<td>○ Irrigation Well; Irrigation pond</td>
</tr>
<tr>
<td></td>
<td>● Woodman:</td>
</tr>
<tr>
<td></td>
<td>○ Barn</td>
</tr>
<tr>
<td></td>
<td>○ Clubhouse</td>
</tr>
<tr>
<td></td>
<td>○ 2 Greenhouses, 2 High tunnels</td>
</tr>
<tr>
<td></td>
<td>○ Pumphouse to pump water from Durham reservoir</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Social</th>
<th>Human</th>
<th>Financial</th>
</tr>
</thead>
<tbody>
<tr>
<td>● Attached directly to the college through the dean's office</td>
<td>● Historically upwards of 10 employees but this summer around 6/7</td>
<td>● Funding and management for Woodman and Kingman farms comes from the experiment station, along with an appropriate contribution by the UNH College of Life Sciences and Agriculture.</td>
</tr>
<tr>
<td></td>
<td>● 10+ researchers at any given time</td>
<td></td>
</tr>
</tbody>
</table>

1.2 - Resilience

A. Heat

Human

1. Response to heat days is to slow down and focus on hydration
   a) Do work in the shade, limit intensive activities
B. Cold; Ice/Snow
Physical & Social
1. Do snow removal in the winters using the tractors
2. Portable generators for use in power outages (both farms)

Social
1. Grounds & Events only comes by about once a day to do snow removal, the rest is up to them and farm services

C. Drought
Natural & Physical
1. They have access to many water sources, none which have been stressed to the point of failure in the past
   a) There is an additional well at the bottom of woodman, but they are unsure if this is connected to the pumphouse.
      ○ Creates a potential additional water source, but not if it’s drawing from the same reservoir as the pumphouse
   b) At Kingman farm there is a new well for the aquaponics facilities

Social
1. Operations are not hugely affected if sufficient water is available
   c) During droughts restrictions are placed on researchers on when they can water; but does not affect crops

D. Flooding
Physical
1. Both farms are on higher ground, lands would not be severely affected by flooding

1.3 Vulnerability
A. Heat
Natural
1. Weeds become a bigger issue in the heat when there is moisture in the ground
2. High heat places high stress on crops, but as long as they are well hydrated this does not impact crops too much
3. Peppers and tomatoes are unable to fruit in weather with extended 90+ days
   a) Pollen for strains we use become sterile in heat above 90 degrees

Physical
1. Loss of power in the summer would lead to plants in greenhouses being compromised (overheating of greenhouses)

Social
1. Lowers labor productivity during the extremely hot hours of the day (mid-day)

B. Cold; Ice/Snow
Natural
1. Extreme cold without snow is detrimental to any winter crops
   b) Snow creates insulation - without it plants are vulnerable
   c) Frost reaches deeper into the ground without snow cover
2. Loss of power would compromise any crops in greenhouses
   a) Lose heat far quicker than a building
   b) Alarm system alerts manager if temperatures exceed parameters (either too low or too high)
3. During extreme cold at certain thresholds perennials and fruit trees will experience fruit loss
   ○ Some plants will die out altogether

Physical
1. Kingman farm now has aquaponics facilities so the farm roads will have to be cleared to maintain access
2. Biggest damage during these events is to fences on surrounding grounds
   b) Expensive to fix

C. Drought

Physical
1. There are not existing meters to monitor water usage from the wells
2. They are only supplied by well water, not connected to the town/university water system

Social
1. During the spring when making beds the soil needs to have moisture
   c) This means they may have to irrigate the soil just to set the beds if it is a dry spring

D. Flooding

Natural
1. Over saturation of soil can flood the beds and drown plants
   a. Eliminates oxygen level of the soil can cause root rot
2. Erosion risk during heavy rains on fields
   a. This occurs even with fields that are cover cropped
   b. Makes fields less productive in the future
3. Saturated soil is less sturdy, so with a combination of heavy winds trees with shallow root structures such as apple trees are susceptible to blow overs (crop loss), this includes pine trees on the borders of the farm (property damage)
4. Fertility decreases during heavy rain either from washing out or being driven into the ground

Physical
1. Back road to Woodman farm floods during extreme rain, entrance has potential for flooding and wash-outs

Social
1. When there is excess moisture there is nothing they can do except wait for the fields to dry out
2. - Athletics

2.1 - Assets

<table>
<thead>
<tr>
<th>Natural</th>
<th>Physical</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>● Whittemore arena&lt;br&gt;● Cowell Stadium&lt;br&gt;● Various smaller fields&lt;br&gt;● Television broadcasting equipment&lt;br&gt;● Well and pump house (unused)</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Social</th>
<th>Human&lt;br&gt;● Around 525 student athletes&lt;br&gt;● Approximately 100 employees</th>
<th>Financial&lt;br&gt;● Alumni donations</th>
</tr>
</thead>
<tbody>
<tr>
<td>● 300,000 - 400,000 people in attendance to facilities annually</td>
<td></td>
<td></td>
</tr>
<tr>
<td>● Broadcasting capability</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

2.2 - Resilience

A. **Heat**

  **Physical**
  1. All newer buildings have air conditioning

  **Social**
  1. Response to high heat is to modify activities and practices

  **Human**
  1. Athletic trainers at all practices and sports events constantly monitoring athletes.

B. **Cold**

  **Human**
  1. Athletic trainers at all practices and sports events constantly monitoring athletes
  2. Make sure all athletes are appropriately dressed and prepared

C. **Ice/Snow**

  **Social**
  1. Athletics operates independently from university closures
     a. Often still hosts events games during closures

D. **Drought**

  **Physical**
  1. Have a well and pump house; from back when fields were mostly grass

E. **Flooding**

2.3 - Vulnerability

A. **Heat**
Physical
1. Field house is affected by heat and congestion
2. Practice and play almost exclusively on turf fields
   a. These fields are much hotter than grass
3. No indoor spaces large enough to facilitate practicing indoors
   a. This is especially true for larger sports teams (i.e. football)

Human
1. No strict policy for canceling practices or games in high heat

B. Cold

C. Ice/Snow

Social
1. Getting snow off the fields to be able to play games and practice
   a. Grounds & Events plays a key role in this after their primary responsibilities are taken care of
2. Snow and Ice lead to accessibility problems that have an impact on scheduling and cancellations

D. Drought

Physical
1. Field hockey field is a special kind of turf that needs to be watered
   a. FH team is affected by this, not being able to play or practice if the field is not watered

E. Flooding

F. General Vulnerability

Natural
1. Lightning is a weather event that poses a big issue on athletic events
   a. If lightning strikes within 8 miles athletic activities must be stopped for 30 minutes

Physical
1. Power outages
   a. Can’t play or practice
      i. Inability to play games can cost anywhere from $5,000 to $100,000
   b. Ice in the Whittemore arena can melt
      i. Takes a week to 10 to remake the ice if this happens

Social
1. Athletes or coaches may push themselves past the point of personal safety because of the competitive nature of sports (primarily concerned with the cold)
3. - Campus Planning

3.1 - Assets

<table>
<thead>
<tr>
<th>Natural</th>
<th>Physical</th>
</tr>
</thead>
</table>
|         | ● Ritzman Lab (main office)  
|         | ● Campus Mapping  
|         | ● Comprehensive Plans  
|         | ○ Planning for adaptability |

<table>
<thead>
<tr>
<th>Social</th>
<th>Human</th>
<th>Financial</th>
</tr>
</thead>
<tbody>
<tr>
<td>● Facilitative relationships in the design process with many departments’ stakeholders around campus</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

3.2 - Resilience

A. Heat
   Physical
   1. University building standards for new construction and major renovations that increase efficiency
   Human
   1. Buildings are becoming increasingly more air conditioned
      a. Allows higher building utilization during summer
   Financial
   1. Air conditioning in the few summer months accounts for more energy consumption than cooling the rest of the year.

B. Cold
   Physical
   1. University building standards for new construction and major renovations that increase efficiency
   Social
   1. Project planning is designed around cold winter months when:
      a. The ground is frozen and harder to work on
      b. Weather conditions may not permit outdoor work
         i. People work outdoors in the winter but this is minimized

C. Ice/Snow

D. Drought

E. Flooding
   Physical
1. Buildings have historically had very little damage due to flooding
2. Continuous improvement of existing stormwater infrastructure
   a. Utilizing methods such as rain gardens
      i. Gets stormwater into the ground and keeps it out of surface water
   b. Has developed a ‘Ravine Action Plan’ to restore college brook

3.3 - Vulnerability

A. Heat
   Physical
   1. Not enough air conditioned space to effectively utilize classroom space for a summer term
      a. Do so would decrease the overall building space the university needs by redistributing class hours

B. Cold
   Social
   1. More extreme fluctuations in temperature
      a. This would limit the amount of work that can be done

C. Ice/Snow
   Physical
   1. Main concern is dealing with getting ice/snow off and away from buildings
      a. This has to place emphasis on the safety of pedestrians below

D. Drought

E. Flooding
   Physical
   1. Flooding of roadways is the primary concern
      a. Creates accessibility issues
4. - Energy & Utilities - Energy

4.1 - Assets

<table>
<thead>
<tr>
<th>Natural</th>
<th>Physical</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>● All Utility Infrastructure</td>
</tr>
<tr>
<td></td>
<td>● Heating equipment &amp; boilers</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Social</th>
<th>Human</th>
<th>Financial</th>
</tr>
</thead>
<tbody>
<tr>
<td>● Third party vendor running rochester landfill gas plant</td>
<td></td>
<td></td>
</tr>
<tr>
<td>● EMCOR</td>
<td></td>
<td></td>
</tr>
<tr>
<td>○ Runs co-gen</td>
<td></td>
<td></td>
</tr>
<tr>
<td>○ Oversees Philbrick Chiller Plant</td>
<td></td>
<td></td>
</tr>
<tr>
<td>● Facilities operations group</td>
<td></td>
<td></td>
</tr>
<tr>
<td>○ Building specific power distribution</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

4.2 - Resilience

A. Heat

Physical
1. Buildings with cooling systems can easily handle 90 degree heat
2. Many buildings have their own chiller systems (not district)
3. Air exchange systems have “economizer” mode
   a. This allows exchange of already cool air that does not need to be cooled
      i. Essentially “free cooling”

B. Cold

Physical
1. Redundancy in heating system
   a. If turbine won’t work there are four boilers able to provide heat
      i. Just 3 boilers can provide campus heat on a 0 degree day
2. District heat is provided in 85% of buildings
   a. Not worried about being unable to meet heating demand, even up to -20

C. Ice/Snow

Physical
1. Working towards creating a full-loop with utility lines
   a. This allows E&U to supply power from either direction in the event power lines are compromised

D. Drought
E. Flooding
  Natural
  1. UNH generally on higher ground

4.3 - Vulnerability

A. Heat
  Physical
  1. Chilled water and electrical infrastructure are taxed the most
     a. Philbrick chiller plant essentially maxed out on 95 degree days
     b. Consecutive days of high heat do not let systems to reset and prevent them from catching up to cooling load
  Financial
  1. Cooling days are expensive
     a. Requires more purchased energy
     b. Demand load is higher, which increases energy cost

B. Cold
  Physical
  1. Heating coils can be overtaxed and freeze
  Social
  1. People leaving windows open causes pipes to freeze and burst
     a. Result of human error (not shutting windows)
     b. Also building sickness; buildings are running too hot, people have to open windows
  Financial
  1. Heating is more expensive on the coldest days
     a. Have to purchase additional natural gas
        i. Natural gas is on a spot market so prices are higher on high demand days

C. Ice/Snow
  Physical
  1. Greatest concern is damage to power lines; power outages
     a. Not as much concern if temperatures are above 35 degrees
  2. Utility power only has one connection point to the university system
     a. Additional points would create more redundancy

D. Drought
  Financial
  1. Net metering with hydro generators in the state
     a. This provides UNH with cheaper electricity
  2. During droughts we lose the cost savings from these contracts

E. Flooding
  Physical
  1. Has potential to overwhelm stormwater infrastructure
  2. Main issue is flooding of roads
     a. Causes an accessibility issue
5. - Energy & Utilities - Water

5.1 - Assets

<table>
<thead>
<tr>
<th>Natural</th>
<th>Physical</th>
<th>Water sources</th>
</tr>
</thead>
<tbody>
<tr>
<td>● Water</td>
<td>● Plant</td>
<td>○ Lamprey River</td>
</tr>
<tr>
<td></td>
<td>● Pump stations</td>
<td>○ Oyster River</td>
</tr>
<tr>
<td></td>
<td>● Intake</td>
<td>○ Lee Well</td>
</tr>
<tr>
<td></td>
<td>● Distribution systems</td>
<td>○ Spruce Hole Artificial Recharge Station</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Social</th>
<th>Human</th>
<th>Financial</th>
</tr>
</thead>
<tbody>
<tr>
<td>● Relationship with the town</td>
<td></td>
<td></td>
</tr>
<tr>
<td>○ UNH runs water treatment plant for campus &amp; town</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

5.2 - Resilience

A. Heat

B. Cold
   Physical
   1. Significant infrastructure to prevent against freezing

C. Ice/Snow

D. Drought
   Natural
   1. Various sources of water
   2. In drier conditions, Lee Well & Spruce Hole pick up the slack of the rivers
   3. Last year 2016 we were one of approx. two systems that did not declare drought restrictions
   4. After 1-2 years of drought we have to implement drought measures

   Social
   1. UNH Durham is considered the poster child for conservations measures in NH

E. Flooding
   Physical
   1. A new treatment plant will be built in the coming years on higher ground, providing flood protection
F. General Resilience
   1. UNH utilizes many water conservation measures within buildings
   2. All Groups get together during construction (utilities etc.) to make sure best systems are in place
   3. Decreased/similar water demand since 1980 despite population growth
      a. Student body has increased by 5000-6000 and demand is equivalent to what it was in 1980
      b. They do distribution monitoring (because of requirements); Have been able to reduce the amount of lost water since monitoring
   4. The main facility is attached to back up generators
   5. Lee well does not need to be treated because it's a groundwater source, and does not have backup generators but one could be used; Spruce hole does have hook-ups to attach generator

5.3 - Vulnerability
   A. Heat
   B. Cold
   C. Ice/Snow
   D. Drought
      Natural
      1. Drought places stress on natural sources of water since they're unable to get replenished
   E. Flooding
      Physical
      1. The current water plant is located within the floodplain but has not been compromised yet - building a new plant over the next year
      2. Extreme floods compromise the Lamprey River pump station, making it an unusable source of water
         a. When this happens they have to switch to Oyster River supply, which takes a while to do because there is more sediment in the OR water and they need to treat it more - it's a 16 hour day for them when this happens
         b. Lamprey could be comprised for 1-2 weeks in such an event. Shutting down the water supply is easy, but getting it back up takes time, especially because other companies involved take a long time to fix problems
F. General Vulnerability
   1. Life expectancy of this system, before having to look for another water source - Up to 20 years, Under stressful conditions this could look more like 12-15
   2. lamprey pump station does not have generator backup in case of power outage
6. - Environmental Health & Safety

### 6.1 - Assets

<table>
<thead>
<tr>
<th>Natural</th>
<th>Physical</th>
<th>Social</th>
</tr>
</thead>
<tbody>
<tr>
<td>● Equipment access to do testing for all of the specialty areas (ie radiation)</td>
<td>● Hazardous waste facility - central accumulation area</td>
<td>● Overall relationships with organizations on campus are key; within both research and facilities ○ As a result get good compliance and good collaboration</td>
</tr>
<tr>
<td>● Physical operations offices</td>
<td></td>
<td>● Rely heavily on the safety committee structure at UNH</td>
</tr>
<tr>
<td></td>
<td></td>
<td>● Occupational safety committee</td>
</tr>
<tr>
<td></td>
<td></td>
<td>● Radiation safety committee</td>
</tr>
<tr>
<td></td>
<td></td>
<td>● Chemical safety committee</td>
</tr>
<tr>
<td></td>
<td></td>
<td>● Biological Safety Committee</td>
</tr>
<tr>
<td></td>
<td></td>
<td>● EHS committee</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Human</th>
<th>Financial</th>
</tr>
</thead>
<tbody>
<tr>
<td>● Staff; 10-11 FT - staff are absolutely essential</td>
<td>● Access to funding for mitigation of health and safety issues; H&amp;S Mitigation Fund - comes from R&amp;R</td>
</tr>
<tr>
<td>● The number of staff is directly related to the amount of research happening on campus</td>
<td></td>
</tr>
</tbody>
</table>

### 6.2 - Resilience

**A. Heat**

**Physical**

1. Maintain a hazardous waste accumulation area where waste is stored for pick-up - On days when it's extremely hot or cold they monitor these materials to make sure they're stable; Incompatible materials are stored away from each other and materials are stored in secondary containment within the facility

**Human**

1. Heat stress monitoring program runs from EHS, primarily to advise for outdoor work and working areas without air conditioning

**B. Cold**

**C. Ice/Snow**

**D. Drought**
E. Flooding
Physical
1. Pre-emptive efforts would focus on removing materials from these facilities before the event occurred.

6.3 - Vulnerability
A. Heat
Physical
1. Research equipment may not operate within certain temperature thresholds

Human
1. For research - Can have a high impact on the safety of researchers; people are less willing to wear protective gear due to personal comfort
   a. Potential issue of replicability for certain research if space is not air conditioned - may impact results
2. Air conditioning becomes a need to maintain productivity within these spaces since it's not just about safety but also personal comfort
3. The issue can still exist in building with air conditioning as people dress for the outdoor temperatures

B. Cold
Physical
1. Freeze-ups could affect ventilation in labs and mechanical equipment in general (often related to snow as well); there is a large amount of air that has to go into laboratory buildings
2. Every piece of ventilation equipment has coils that warm air as it enters. If these freeze up the equipment is compromised; This means making sure lab reactions are short term and they’re not running over night when extreme cold events are predicted, because these require ventilation
3. Supply air ventilation system heating coils are protected with temperature sensors; when these sensors detect near freezing temperatures, the system automatically shuts the supply air fan down so the coils don’t freeze and burst.
   a. Failure at the supply means that exhaust air has to be stopped (which is automated, mostly) otherwise air will be pulled from the building envelope.
      i. Creates conditions where exit routes are inoperable due to vacuum conditions in the building

C. Ice/Snow
Physical
1. Travel and accessibility are a major concern - Not just getting to work but also having emergency response access in case of a lab accident
2. Huge added cost to combat instances where the ventilation can be compromised
   a. Additional snow clearing procedures, Additional equipment and Additional spatial needs for equipment

D. Drought
   Human
   1. Work operations - for example the silica rule just changed. Guidelines changed for levels that people can be exposed to airborne silica. So as dust becomes a bigger concern in drought conditions this could be a concern.
   2. Drinking water could be a concern and freshwater available for safety equipment such as eye wash stations etc.

E. Flooding
   Physical
   1. Power distribution system impact is a main concern
   2. Accessibility issue due to washed out roads/flooding
   3. Risk of water intrusion into research facilities- depends on the structure and the equipment within the structure
   4. Flooded basements
   5. Mold issues, and indoor air quality
   6. Coastal operations; Jackson marine lab, coastal marine lab in new castle, and shoals marine lab
      a. These are at sea level and would be hit really hard in coastal flood events
      b. EHS would be worried about oil storages, battery storage, and chemical storage.
   7. Primary concern is staff and then mitigating environmental issues.

F. General Vulnerability
   1. Always concerned from a laboratory safety perspective about fumes in laboratory environment; Fume hood in a chemistry lab for example
   2. Interruption of workflow for researchers disrupts EHS
   3. If researchers are having to rush their work due to perceived interruptions, accidents happen (which is unwanted and unneeded)
   4. If research is unable to be done due to weather events this may cause issues with grant funding which directly affects funding for EHS; as less grants are received for research, research decreases which decreases some of the need for EHS
7. - Facilities Asset Management

7.1 - Assets

<table>
<thead>
<tr>
<th>Natural</th>
<th>Physical</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>● Office on Leavitt lane</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Social</th>
<th>Human</th>
<th>Financial</th>
</tr>
</thead>
<tbody>
<tr>
<td>● UNH Campus Assets Tool (UCAT)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>● Stakeholder relationships w/ various departments</td>
<td>● 3-4 employees</td>
<td>● Emergency Fund</td>
</tr>
<tr>
<td></td>
<td></td>
<td>● Repairs and Maintenance fund</td>
</tr>
</tbody>
</table>

7.2 - Resilience

A. Heat
   Natural
   1. The college ravine is a huge asset to help reduce heat island effect

B. Cold
   Social
   1. Have a slight ability to reduce salt levels on campus due to central main heating tunnel right down main street - less ice builds up there because the tunnel is emitting heat and heating the sidewalk
   Financial
   1. Free cooling for science buildings - Early October to March/April

C. Ice/Snow

D. Drought

E. Flooding
   Physical
   1. Porous pavement and permeable brick pathways
      a. Great for drainage
      b. Can create problems with icing

7.3 - Vulnerability

A. Heat
   Physical
1. Major concern = Steam line failure - not vulnerable because of the heat but would exacerbate the issue of heat on campus
   i. Specifically the on feeding the philbrick chiller plant
2. Asphalt shingle roofs
   a. Frequently the ones that face south absorb tremendous amount of heat and dry up quickly; makes them very soft susceptible to damage from servicing

Social
1. People neglect sidewalks and create own walkways “goat paths”
   a. Have to add hardscapes to combat these paths, financial burden

B. Cold
   Physical
1. Asphalt shingle roof
   a. With cold very cold conditions and no snow; makes the shingles brittle and susceptible to breakage
2. Insulation in some buildings is very low (poor/limited insulation, single pane windows)
   a. Buildings from 1955-1980 are typically bad buildings - the way they are constructed makes it difficult to add additional insulation

Social
1. People neglect sidewalks and create own walkways “goat paths”
   a. Have to add hardscapes to combat these paths, financial burden
2. Pipes freeze and break when windows are left open, this is an unnecessary social problem (caused by building sickness).

C. Ice/Snow
   Physical
1. Roof damage
   a. Ice dams, and there are pedestrian hazards from snow on roofs
2. Road damage due to plowing operations

D. Drought
   Physical
1. Residential facilities primarily impacted due to high water use
   a. Have to have running sinks and toilets but not showers
   b. To reduce concern, efficiency measures would be the first step, then operational policies would be implemented, like designated shower days for different floors

E. Flooding
   Physical
1. Major concern = Clovis road (next to athletic fields)
   a. College brook enters the main culvert there
b. If this gets blocked up, the grass soccer field, Greg hall, Ritzman lab and that whole area would flood

c. There is also a large sewage lift station
   i. If this floods and fails it would be messy and expensive

2. Backside of the Whittemore center
   a. Stormwater lift station/pump station
      i. Pumps water back into the stream from the surround foundation - If this fails the ice area will flood

F. General vulnerabilities
   Physical
      1. Population change from baby boomers 1960s, led to post-war construction
         a. Things built were built quickly and cheaply

   Human
      1. Asbestos is a huge concern in buildings 1950-1980
8. - Fire Department

8.1 - Assets

<table>
<thead>
<tr>
<th>Natural</th>
<th>Physical</th>
</tr>
</thead>
<tbody>
<tr>
<td>● Water</td>
<td>● Apparatus</td>
</tr>
<tr>
<td></td>
<td>○ 4 Support/Chief's Vehicles</td>
</tr>
<tr>
<td></td>
<td>○ 2 Engines; 1 Tank</td>
</tr>
<tr>
<td></td>
<td>○ 1 Ladder Truck</td>
</tr>
<tr>
<td></td>
<td>○ 1 Rescue &amp; 1 Medic vehicle</td>
</tr>
<tr>
<td></td>
<td>○ 1 Forestry truck, 1 Utility truck</td>
</tr>
<tr>
<td></td>
<td>○ 1 ATV; 2 Jet Skis</td>
</tr>
<tr>
<td></td>
<td>● Hydrants - in town core but not entire district</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Social</th>
<th>Human</th>
<th>Financial</th>
</tr>
</thead>
<tbody>
<tr>
<td>● Relationships</td>
<td></td>
<td></td>
</tr>
<tr>
<td>o EMS - DFD contracts McGregor Memorial EMS for services</td>
<td></td>
<td></td>
</tr>
<tr>
<td>o Police</td>
<td></td>
<td></td>
</tr>
<tr>
<td>o Nearby fire departments- automatic &amp; mutual aid</td>
<td></td>
<td></td>
</tr>
<tr>
<td>o UNH - contracts DFD for services</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>● 5 people on duty at all times</td>
<td></td>
</tr>
</tbody>
</table>

8.2 - Resilience

A. Heat

Human

1. Use misting fans and canopies to keep first responders cool during events
2. Follow UNH’s lead on heat days, do not send people out on rigorous training during these days

B. Cold

Physical

1. Use diesel from gas stations so no concern with gelling

Human

1. Do extra welfare checking during extreme cold, Especially with vulnerable populations

C. Ice/Snow

Physical

1. Ask residents to work on clearing fire hydrants to help keep them visible and accessible
2. They have a plow truck to break through snowbanks on driveways
3. During power outages they check residents for proper generator operation - indoor operation leads to harmful exhaust fumes

D. Drought

E. Flooding
   Social
   1. State emergency management plan, helps for additional coordinating of services and resources

8.3 - Vulnerability
A. Heat
   Physical
   1. Fire alarm protections systems and smoke detectors often go off during high humidity because systems confuse this with smoke
   Human
   1. No policy/procedure to staff up on hot days so there is added strain on the resources. People HAVE to sit out and cool down to remain effective on the job
   3. Medications and medical equipment have temperature thresholds that need to be kept aware of.
   4. Have a second set of gear available because wet equipment does not protect against heat

B. Cold
   Physical
   1. Anything related to fire suppression is susceptible to cold - Gauges, Pumps, Hoses
      a. During prolonged events they must keep the water moving to prevent freezing

C. Ice/Snow
   Physical
   1. Impacts transportation system which impacts ability to respond to calls
   2. One major concern is staffing, they sometimes put additional staff on. This is influenced by the budget.
   3. Power outage is a primary concern - people do not maintain trees with branches over power lines frequently enough to prevent this problem

D. Drought
   Natural
   1. More sensitive to training; do not do high flow scenarios
   2. Can come with an increased chance of fires, but not always
E. Flooding

Physical
1. Public works actively working to get funds from FEMA to repair vulnerable roads
   a. Bennet Road is very vulnerable, Rt. 108 and Rt. 4 in some areas

Social
1. Called for flooded basements, so they have sump-pumps, and help residents with flooding - however, this service is overused by some individuals, and it could prevent them from responding to other calls

F. General Vulnerability
1. Core of town has hydrants and branches going out to major sites, but not all of town.
9. - Grounds & Events

9.1 - Assets

<table>
<thead>
<tr>
<th>Natural</th>
<th>Physical</th>
<th>Equipment</th>
</tr>
</thead>
<tbody>
<tr>
<td>● Natural landscape</td>
<td>● Space managed</td>
<td>○ 2 backhoe loaders</td>
</tr>
<tr>
<td>○ 16 miles of sidewalk</td>
<td>○ 16 miles of sidewalk</td>
<td>○ two 5 tons</td>
</tr>
<tr>
<td>○ 9 miles of road</td>
<td>○ 48 acres of parking space</td>
<td>○ six 1 tons</td>
</tr>
<tr>
<td>○ 48 acres of parking space</td>
<td>○ 42 acres of greenspace</td>
<td>○ 5 Wacker Neuson wheel loaders</td>
</tr>
<tr>
<td>○ 42 acres of greenspace</td>
<td>○ Stairwells</td>
<td>○ tractors</td>
</tr>
<tr>
<td>○ Stairwells</td>
<td>● Adding a new barn next month to keep equipment protected</td>
<td>○ plows</td>
</tr>
<tr>
<td></td>
<td></td>
<td>○ snow blowers</td>
</tr>
<tr>
<td></td>
<td></td>
<td>○ Looking to get 5 new trucks this year</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Social</th>
<th>Human</th>
<th>Financial</th>
</tr>
</thead>
<tbody>
<tr>
<td>● Employees: 27 full time employees, about 3-5 part time employees</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

9.2 - Resilience

A. Heat

Natural

1. Have processes in place (self-watering pots) to help reduce number of times plants are watered. During heat events the amount of watering increases.

Human

1. During heat events operations change to reflect less intense activities - i.e. mowing vs. shoveling - they don’t really ever stop their operations because of heat, they just modify them
2. Flexible hours (working in the morning) to avoid the hottest parts of the day - one way they have become more resilient to heat, working 6-12

B. Cold

1. Do indoor work on extremely cold days as long as they don’t have to do snow removal

C. Ice/Snow

Human
1. Have dealt with extreme snow events despite having half the employees they should have

D. **Drought**
   Natural
   1. During drought G&E waters in the morning hours to prevent evaporation

E. **Flooding**
   Physical
   1. When heavy rain events are coming G&E goes and checks all drains and makes sure systems are clear - preventative action

### 9.3 - Vulnerability

A. **Heat**
   Financial
   1. Loss of productivity, can't do as much on high heat days

B. **Cold**
   Physical
   1. Diesel fuel gels up and causing constant issue with tractors.
      a. There is an alternative fuel (B-20) for cold weather, but this does not run well in equipment and causes bogging issues

C. **Ice/Snow**
   Physical
   1. Salt is a big problem for equipment, shortens equipment life -- but they are working on getting a garage built to protect the vehicles
   2. Campus is not designed for plowing, it is designed around aesthetics which does not always translate to functionality during snow removal - ex. Light posts get hit by plows or make it harder to plow
      a. Things such as road paint getting scraped up is a concern, they have to repaint every year

Social
   1. A large issue is having to deal with people that are unhappy during these events.

Human
   1. Large Handicap presence on campus so this is the biggest priority - plowing the accessible routes
   2. Shoveling staff is hard to come by, however it is also hard to generate work for these employees when there is no snow

Financial
   1. Between half and ¾ of budget goes towards winter storm clean-up.
   2. Most equipment is bought for winter events, but also used for other things during the other seasons (like mulch transportation in the summer)

D. **Drought**
1. High increase in need for water during drought. They water with a 100gal tow behind tank. Expected to keep up with campus aesthetics.
2. Trees and shrub plantings are supposed to be watered for a whole year after they are planted, huge demand on water
3. Lawns should be continuously water or as much as possible to keep aesthetic appeal.
4. Heavy rain is an issue after a long drought because there is increased erosion, water doesn’t percolate into the ground

**E. Flooding**

**Natural**
1. White pine trees are susceptible to falling during heavy rains and winds
2. Heavy rain is an issue after a long drought because there is increased erosion, water doesn’t percolate into the ground

**Physical**
1. Sandbagging and any flood prevention measures such as this falls under G&E

**F. General Vulnerability**
1. Financial resources (Capital fund) go towards most important or fixing worst issues first.
   a. There is a never-ending list of things that need fixing, and every year only the top priority things get funded, so they are always behind
2. They are underappreciated by campus community, especially faculty and staff - mostly during the winter, people just complain
10. - Health & Wellness

10.1 - Assets

<table>
<thead>
<tr>
<th>Natural</th>
<th>Physical</th>
</tr>
</thead>
<tbody>
<tr>
<td>● Main Health &amp; Wellness building</td>
<td></td>
</tr>
<tr>
<td>● External Dept. in Hamel Rec. Center</td>
<td></td>
</tr>
<tr>
<td>● Hot water and electricity/A/C</td>
<td></td>
</tr>
<tr>
<td>● Backup generator</td>
<td></td>
</tr>
<tr>
<td>● Backup hot water heater</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Social</th>
<th>Human</th>
<th>Financial</th>
</tr>
</thead>
<tbody>
<tr>
<td>● Relationship with McGregor Memorial EMS</td>
<td></td>
<td></td>
</tr>
<tr>
<td>● Social media and flyers used to educate students &amp; employees</td>
<td></td>
<td></td>
</tr>
<tr>
<td>● University emergency response team:</td>
<td></td>
<td></td>
</tr>
<tr>
<td>○ Connected to EHS and HR for staff</td>
<td></td>
<td></td>
</tr>
<tr>
<td>○ Connected to Healthy UNH, Athletics and Campus Rec for students</td>
<td></td>
<td></td>
</tr>
<tr>
<td>● About 9 clinicians and 9 support staff on a typical day; fewer in the summer</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

10.2 - Resilience

A. Heat

1. They are well equipped for heat days, they just need to know that it’s really hot and people are working outside so they can be ready to handle any potential emergencies

B. Cold

C. Ice/Snow

1. Not particularly concerned with snow/ice, drought, or flooding in regards to outreach and education.

D. Drought

E. Flooding

1. Initially has no impact on health services as they would likely be closed due to curtailed operations and emergencies would be fed to hospitals or emergency care facilities, but in the case of extreme flood health services could change general procedures to accommodate emergency situations.
2. At the very least the facilities could be used by ‘other’ emergency personnel.

10.3 - Vulnerability

A. Heat
   Human
   1. Response is dependent on what the university activities are, because health services has to respond to these events
   2. Dehydration is the primary concern for heat days followed by stroke
   3. In summer months staffing is lower to accommodate the needs for UNH, not likely to be able to support additional community needs.

B. Cold

C. Ice/Snow
   Human
   1. Slips and falls are the most common injuries that people need the health center for
   2. Health center is closed when UNH curtails

D. Drought

E. Flooding

F. General Vulnerability
   1. Resilience has decreased among incoming students over time (this is both from national data and general trends that health & wellness notices)
      a. Students are very much focused on safety as an issue - it is among their top concerns
      b. Anxiety and depression are number 1 & 2 health issues on this campus, and the nation is following this trend.
11. - McGregor Memorial EMS

11.1 - Assets

<table>
<thead>
<tr>
<th>Natural</th>
<th>Physical</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>• 3 Ambulances</td>
</tr>
<tr>
<td></td>
<td>• Paramedic Intercept Vehicle</td>
</tr>
<tr>
<td></td>
<td>• Supervisor Vehicle</td>
</tr>
<tr>
<td></td>
<td>• Back up generator at station</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Social</th>
<th>Human</th>
<th>Financial</th>
</tr>
</thead>
<tbody>
<tr>
<td>• Nearby Hospitals:</td>
<td>• Approximately 75 volunteer EMTs</td>
<td></td>
</tr>
<tr>
<td>○ Wentworth Douglass Hospital</td>
<td>• Paramedics</td>
<td></td>
</tr>
<tr>
<td>○ Portsmouth Regional Hospital</td>
<td>• 1 Operations manager</td>
<td></td>
</tr>
<tr>
<td>○ Exeter Hospital</td>
<td>• 1 Business manager</td>
<td></td>
</tr>
<tr>
<td>○ Frisbee Memorial Hospital</td>
<td>• 2 clerical personnel</td>
<td></td>
</tr>
<tr>
<td>• Nearby Fire Departments/Ambulance Companies for mutual aid:</td>
<td></td>
<td></td>
</tr>
<tr>
<td>○ Durham, Barrington, Dover, Newmarket</td>
<td></td>
<td></td>
</tr>
<tr>
<td>• UNH community - supplies volunteers</td>
<td></td>
<td></td>
</tr>
<tr>
<td>• NH Drag way - lends ambulances</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

11.2 - Resilience

A. Heat

Physical
1. EMS Station is all air conditioned
2. All vehicles are air conditioned, in large part to protect medications
   a. Redundancy within paramedic vehicles to help keep these medications protected

Human
1. Keep a water cooler stocked as well as other beverages
2. Keep ambulance and facility stocked with water and some food, keep nourishment up
3. Hospitals also provide EMS Break Rooms with food, snacks and drinks
4. On very hot days an ambulance will go around and distribute water to people on detail (construction, police etc.)
5. Hotels in town (“holiday Inn”) have offered to take people in on high heat days

B. Cold
Physical
1. Full protective gear for members in the winter, provide extra gear
2. Whole rack of extra gear for additional responders so they can be adequately equipped

C. Ice/Snow
Physical
1. Some trucks have ‘Onspot chains’ to help accessibility in ice events
Social
1. Additional staffing in snow events - will staff all three ambulances instead of two

D. Drought

E. Flooding
Social
1. Have received help from the National Guard in the past

11.3 - Vulnerability
A. Heat
Human
1. Primary concern is the elderly
   a. Susceptible to respiratory issues in heat
   b. Will be about 400 beds for elderly housing in Durham in the coming years

B. Cold
Human
1. Biggest concern is being outside with a patient in the extreme cold - exposes everyone; patient and members

C. Ice/Snow
Social
1. #1 concern - Access to patients
2. #2 concern - getting there safely
Human
1. Primary snow/ice related incidents are motor vehicle accidents and slips and falls
2. Commuting crowd that has to get to work is the primary population of concern for incidents

D. Drought
Social
1. Only going to affect us in the standpoint of assisting the fire department if they get additional woods or brush fires (or fires in general)

E. Flooding
Physical
1. Accessibility is a huge concern for EMS
2. During past events they have relied on the national guard to help gain access to isolated areas
3. New market road, rt. 155 by TC farm is susceptible to flooding, and especially at Bennett road
12. - Residential Life

12.1 - Assets

<table>
<thead>
<tr>
<th>Natural</th>
<th>Physical</th>
</tr>
</thead>
</table>
|         | • Residence halls  
|         | • Backup generator to supply all buildings |

<table>
<thead>
<tr>
<th>Social</th>
<th>Human</th>
<th>Financial</th>
</tr>
</thead>
</table>
| • Relationship with housing  
| • Relationship with counseling center  
| • High access to students - email, newsletters, bulletin boards | • 22 Full time hall directors  
| | • 4 Assistant hall directors  
| | • 6 central staff members  
| | • 148 RAs  
| | • 5000 students in residence halls  
| | • Strong values, positive outlook, responsive vs. reactive |

12.2 - Resilience

A. Heat
   Physical
   1. Every new hall (last decade or so) is air conditioned, Mils, Sercs, Congreve
   Human
   1. Housing deals with summer programs & those staying in dorms for programs

B. Cold
   Physical
   1. Huge emphasis on closing windows and raising awareness for this in the winter

C. Ice/Snow
   1. University is accustomed to dealing with it

D. Drought
   No previous impacts

E. Flooding
   1. Not a concern

F. General Resilience
   1. A large part of dealing with these events in debriefing
      a. Asking important questions: What did we do right? What did we do wrong? How can we do it better? How are you? What do you need?
2. Employees are taught the chain of command to respond to during an emergency
   a. Know how to take orders and who to contact when they don't otherwise know what to do
3. Backup generators
4. Access to students is incredibly valuable - through RAs or bulletin boards in residence halls

12.3 - Vulnerability

A. Heat
   Human
   1. No specific procedures for heat advisory days

B. Cold

C. Ice/Snow
   Human
   1. Main concern is accessibility, specifically for students with disabilities (many are housed in Congreve Hall)
   2. Snow days can sometimes be a concern - students may be partying/up to no good

D. Drought
   1. No real impact

E. Flooding
   1. No real impact
13. - Stormwater

13.1 - Assets

<table>
<thead>
<tr>
<th>Natural</th>
<th>Physical</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>● Field Facility</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Social</th>
<th>Human</th>
<th>Financial</th>
</tr>
</thead>
<tbody>
<tr>
<td>● Heavy involvement with facilities dept.</td>
<td>● 2 employees</td>
<td>● Funding from NOAA and/or EPA</td>
</tr>
<tr>
<td>● National recognition</td>
<td>● Faculty support</td>
<td></td>
</tr>
</tbody>
</table>

13.2 - Resilience

A. **Heat**
   No significant impact on stormwater infrastructure.

B. **Cold**

C. **Ice/Snow**
   
   1. Winter snow and ice feeds aquifers and groundwater sources
   2. Pressure is taken off stormwater infrastructure when water is in a frozen state

D. **Drought**
   
   1. Increase green space leads to more groundwater
      a. This makes both natural systems and drinking water resources more resilient to drought.

E. **Flooding**

13.3 - Vulnerability

A. **Heat**

B. **Cold**

C. **Ice/Snow**
   
   1. Irregular snow patterns can create conditions where spring flooding is more likely
a. Water levels are already high from snow melt
b. Late spring rains increase water levels and if snow is still on the ground this pushes the system past its natural levels.

2. Spring snow events lead to a lot of erosion
   a. The ground is thawed and snow removal causes soil and infrastructure to become pushed around.

D. Drought

E. Flooding
   Natural
   1. Increasing amounts of precipitation make flooding more likely
   Physical
   1. The greater the amount of impervious surface there is the greater potential of flooding
      a. Impervious surface prevents stormwater from entering groundwater
   2. Outdated and undersized stormwater infrastructure lead to increased flooding
   3. Municipalities typically design for 25-year flood events because designing for 50 and 100-year events is too expensive

F. General Vulnerabilities
   Physical
   1. We are still “playing catch up” with stormwater management - still trying to get people into the 21st century, so we need to figure that out before we can start thinking about climate change

Social
   1. People are so attached to their homes that they look for “quick fixes” or alterations that do nothing to fix/help with the problem (coastal areas)
      a. Example: In Rhode Island there is an island with one road for egress. The community wanted to put in rain gardens to help with flooding (which is crazy) the reality is they need evacuation plans
   2. The engineering part is easy - stormwater infrastructure is easy to put in - but getting people to change is much harder
      a. Need to find communities that are early adopters of change in order to get more modern infrastructure/approaches to climate change happening in those towns, then eventually work our way to those who are not early adopters of change
14. - Transportation

14.1 - Assets

<table>
<thead>
<tr>
<th>Natural</th>
<th>Physical</th>
</tr>
</thead>
<tbody>
<tr>
<td>Service Garage</td>
<td>○ Necessary tools</td>
</tr>
<tr>
<td></td>
<td>○ Tow Truck; pickup truck</td>
</tr>
<tr>
<td>Visitor building</td>
<td></td>
</tr>
<tr>
<td>Over 400 university vehicles</td>
<td></td>
</tr>
<tr>
<td>35 buses varying in size</td>
<td></td>
</tr>
<tr>
<td>Parking has 2 pickups and 3 sedans</td>
<td></td>
</tr>
<tr>
<td>Transit has 3 vehicles</td>
<td></td>
</tr>
<tr>
<td>Compressed Natural Gas fueling station</td>
<td></td>
</tr>
<tr>
<td>24 Bus shelters on campus</td>
<td></td>
</tr>
<tr>
<td>Digital signs that rely bus schedule</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Social</th>
<th>Human</th>
<th>Financial</th>
</tr>
</thead>
<tbody>
<tr>
<td>Rental contracts</td>
<td>● 110 employees for transportation</td>
<td></td>
</tr>
<tr>
<td>Bus service contracts</td>
<td>● 25 employees for parking</td>
<td></td>
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<tr>
<td>IContact questionnaire app</td>
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14.2 - Resilience

A. Heat

Physical
1. There is a large spare fleet due to summer operations reduction

Social
1. Buses are free to everybody on state issued heat advisory days

B. Cold

Physical
1. Buses have pro-heaters to keep fuel warm overnight
   a. Eliminates the need for idling in the AM and increases driver comfort

Social
1. Ridership increases (positive thing)

Human
1. Provide winter gear for parking attendants and garage attendants
   a. Parking attendants work short shifts 2-3 hours

Financial
1. State now adds diesel fuel additive which save time and labor for transportation

C. Ice/Snow
Social

Transit
1. Excellent training program to prepare drivers for the road
2. Dirk immediately holds a staff meeting when inclement weather is coming
   a. They call in senior drivers and drivers with experience driving in the region to take over
3. Ridership increases (positive thing)
4. Winter parking ban shuttle
   a. Transports people to and from designated parking ban lots (ie. west edge)
5. When the university is planning for early release they involve transportation in the conversation to ask what road conditions are like

Parking
1. Emergency parking ban allows grounds & events to clean up snow much quicker and more effectively

D. Drought

E. Flooding

Social
1. Alternative routes to many that could be compromised by flooding

F. General Resilience

Social
1. The New Hampshire State emergency team has put into a contract that they will take over UNH buses to use for emergency services.
   a. Dirk believes UNH emergency management has made it so that what is left over after our needs are met will be available for state use.
   b. Been on standby multiple times with town of Durham to take people from senior centers to shelter facilities
   c. Also train with SWAT for terrorist emergency planning

14.3 - Vulnerability

A. Heat

Physical
1. Has caused stress and failure of vehicles in the past

Social
1. Garage is affected by heat
   a. They follow university heat day protocols
2. Parking attendants are affected by heat advisory days
   a. Loss in productivity; spend less time outside
3. Reduction in operators during summer months
   a. 30 drivers in summer
Financial
1. Impact on fuel consumption during high heat
   a. Maybe a 20% reduction in fuel efficiency
   b. Also increased maintenance on vehicles

B. Cold
Physical
1. A primary concern frozen pipes
   a. Too much heat in visitor building (building sickness) leads to open windows and increased chance of pipe freezes
2. Occasionally has issues with biodiesel pumps in vehicles
   a. Only happens when fuel providers are switched (lower quality fuel; due to mixing)

C. Ice/Snow
Social
Transit
1. Safe operations rely on snow removal efforts of campus, Durham and surrounding communities
   a. *** Snow removal is of increased importance for individuals that are handicap or have disabilities
      i. Transportation makes sure they’re being dropped off in locations that are accessible for them - want to know they’ve arrived safely to their destination, not just gotten off the bus
2. Responsible for shoveling and snowblowing all on-campus bus shelters

Parking
1. If snow emergency is put into effect there is no parking in almost every lot on campus
2. Just a dusting of snow is almost worse than heavy snow, because everything is open but parking lines aren’t visible
   a. This creates a mess of people trying to park

Garage
1. Increased need for towing due to stuck university vehicles
2. Mechanics have to come in early to help with additional preparations needed with snow cover

D. Drought

E. Flooding
Physical
1. Accessibility is the primary issue
   a. Route 108 to Newmarket - primary concern
   b. Route 4 is vulnerable, but buses can go through dover
   c. CNG filling station is in a floodplain; no issues to date
Analysis

A. Framework Assessment
   a. Second Nature Framework
      The framework developed for creating a Campus Community Resilience Plan at UNH was largely adopted from Second Nature’s framework. This was done for two reasons. One is that UNH is developing a resilience plan is because it is required by Second Nature’s Climate Commitment, which UNH signed. Because the plan is a requirement of Second Nature, it makes sense to follow their recommendations. Additionally, there are currently very few university resilience plans, so adopting the approach of another university would be challenging.

   b. Second Nature as a Resource
      The Second Nature website not only has detailed instructions on how to complete each requirement of the commitments, but also explains the importance of these requirements, the impact they will have, and why the methods suggested for completing the requirements are important. This is incredibly valuable for colleges and universities that are just beginning to address issues related to climate change. For this project, the resources on the Second Nature website related to greenhouse gas inventories and climate action plans were not utilized, because UNH has already completed these projects. However, the resources related to resilience planning were incredibly valuable. They provided helpful explanations and suggestions for the steps required to complete a resilience assessment, which had not yet been done at UNH. However, it should be noted that while Second Nature’s website has a lot of helpful information, some of it is redundant, confusing or difficult to read.

   c. Areas for modification
      I. Emphasis on capital categories
         Second Nature’s resources for completing a resilience assessment placed an emphasis on incorporating the five categories of capital (Table 3) into the assessment. It was recommended that when determining assets on campus, these assets be sorted into the five categories. However, sorting assets into these five categories is reductionist and prevents one from seeing these assets as part of a complex system. All communities have assets in each of these categories, but some assets overlap or are not defined by only one category of capital. In this report assets were categorized in this way, but it is important to note that this categorization does not fully represent the complexity of some assets that may involve multiple areas of capital.

         However, it is important to keep these categories in mind when conducting a resilience assessment. It can be easy to focus on the financial or physical impacts of an event and ignore the intangible social or human impacts. When assessing resilience, all
aspects of a community must be considered, and resilience planning approaches that address issues in each of these categories will be stronger and more effective.

I. SWOT Analysis

Second Nature recommends that the initial resilience assessment should look similar to a SWOT (strengths, weaknesses, opportunities and threats) analysis. However, thinking about strengths, weaknesses, opportunities and threats in relation to different weather events can sometimes prevent big-picture thinking about the various impacts of the event. A SWOT analysis is a good place to start, but should be adapted to encourage a systems thinking approach.

For example, instead of thinking about the strengths or weaknesses of a department when it comes to flooding, a better strategy is to consider how flooding has or could impact the department, what the response was or would be, and which assets were or would be impacted the most. Instead of thinking of the threats flooding poses, it is better to consider which assets have been damaged in the past or are most at risk, and what the top concern is when flooding occurs. Thinking of the impacts of certain events in this way makes it easier to understand how they affect a system as a whole, rather than individual aspects of the system. By analyzing events in this way, it is easier to work towards building a resilient system rather than resilient pieces of a system.
B. Big Picture Themes/Problems

a. AC/Electricity

Moving forward, a top priority at UNH must be air conditioning (AC). Currently, the typical New England climate does not require AC on a daily basis during the summer and the majority of campus activity does not occur during the summer months. Because of this, UNH has not placed much emphasis on providing AC in buildings or spaces, and has limited AC infrastructure in buildings. However, future climate projections indicate that there could be an average of 67 days a year with temperatures above 90°F at the end of the century, compared to an average of only 10 in the current decade (Wake et al., 2014). This increase in extreme temperatures will present the need for more ACd spaces.

Additionally, the UNH 2012 Master Plan states that should the student population continue to grow, the university should expand instructional hours to evenings and summers in order to avoid facilities expansion. This will increase the number of students and activity level on campus during the summer months, which compounded with extreme temperatures will make AC a necessity not only for comfort, but also for health, safety, and productivity.

The need for AC means there is a need for a reliable source of power and electricity. In order to have AC running on campus, even during extreme weather events, UNH needs a more resilient electricity system so that during a power outage students, faculty, and staff do not suffer in the heat. This means energy storage and the ability for the university to island for multiple days is needs to be a top priority.

b. Student Employees

A common theme across some departments is the lack of student labor. Not only is there a lack of general labor, but these positions also have high turnover rates. These tend to be Federal Work Study (FWS) positions, which employ students that are eligible for work study funding. FWS is a financial aid benefit that subsidizes a student's labor, enabling more opportunity for work on campus. Departments seek students with work study funding because the subsidy covers half of the students wage. This allows departments to operate under strict budgets while still offer competitive wages. However, by employing only or mostly FWS students, departments limit their access to available labor from the general population, which may explain the lack of labor. Because of FWS benefits, it is cheaper to offer work study students higher wages than to open positions to the general population.

An example: a department pays their work study students $12/hr but, 50% of this is covered by FWS funds, so the department is only paying $6.00/hr from their funds. They could open these positions up to the general population, but to maintain competitive wages they would have to pay the full $12/hr equating to a difference of
$6.00/hr more. If department contributions to FWS were set at minimum wage ($8.75 in NH; only $2.75/hr more) then the total FWS wage would be $17.50.

This is an example of how using FWS benefits to increase work study wages for students rather than opening positions to non-FWS students or the general population is less expensive, and has potential to make positions more competitive. Increasing these wages would likely lead to more labor.

c. Accessibility

I. Snow Removal

Snow removal is massive undertaking and campus snow removal is one of the main priorities of Grounds and Events (G&E). Snow removal is a major challenge for G&E, and it is exacerbated by other specific challenges.

One specific challenge is that labor is limited and unreliable because shoveling is a labor intensive job in a harsh environment. To address this issue, G&E could increase demand for shoveling jobs by increasing work study wages.

Another challenge is community perception and engagement. Many university community members do not appreciate the snow removal efforts that take place on campus despite the lack of labor, and frequently make complaints to G&E. Additionally, G&E is often asked to satisfy individual requests for snow removal, which reflects a misunderstanding of the services provided by G&E and the amount of effort G&E puts into snow removal. In terms of engagement, community members need to understand that their actions - particularly making sure cars are not parked in lots with parking bans before snow events - have a huge impact on snow removal efforts.

II. Flooding

Flooding creates a major accessibility concern in specific areas of Durham. Some particularly vulnerable roads are Rt. 108, Rt. 4, Rt. 155A, Bennett Rd., Long Marsh Rd., and Packers Falls Rd. These roads need special attention during heavy rain events, and could benefit from proactive responses, such as frequent maintenance and repairs, and sandbagging when a heavy rain event is expected. The Town of Durham Hazard Mitigation Plan addresses some of these issues. Funding for maintenance and repairs come from tax revenue, or state and federal grants. In order to better understand the how the community will be impacted by flooding in these vulnerable areas, there must be more collaboration between the town and university.

d. Town Involvement

Town involvement in resilience planning efforts needs to be a priority moving forward. The work reflected in this report was focused on developing a resilience planning framework and beginning an initial resilience assessment at the University. While this made it possible to gain momentum on the project without involving too many
stakeholders, a resilience plan must be community-based. There are many critical assets shared between the University and the town, and a comprehensive resilience plan must account for this. Moreover, in order to complete the initial resilience assessment to a level that satisfies the Second Nature requirements, stakeholders from the town need to be included to the same degree as university stakeholders.

e. Building Renovations
Renovations and continued maintenance are an essential part of ensuring the longevity and operational efficiency of the built environment. Within the last decade, UNH has added the division of Facilities Asset Management (FAM) to handle renovation and maintenance needs throughout the majority of campus. FAM oversees the prioritization and implementation of these projects. The initial resilience assessment revealed the importance of FAM in decreasing long term deferred maintenance costs and improving operational efficiency of buildings. Expanding FAM’s reach on campus and increasing its funding could improve the maintenance of university assets and increase resilience.

f. Long-Term Water Availability
UNH utilizes various sources of water, making it more resilient to drought than other areas in the region. However, the current system may only be able to maintain the same level of water security for the community for the next 15-20 years. In order to maintain this level of water security, increased efficiency measures need to be implemented and the community should seek additional water sources. The Spruce Hole Artificial Recharge Station is a key piece in the resiliency of the current water system, and similar technology should be explored for water storage in the future.

g. Building Freezing
   I. Mechanical issues
Many buildings on campus require high volumes of air turnover, particularly lab buildings. These air exchange systems heat the air through hot water coils, which are especially vulnerable during cold weather events. When these systems fail and freeze, this affects the heating of the building and the safety of the occupants inside. Failed air exchange systems cease to provide the turnover needed to allow for safe laboratory conditions. In addition, this causes imbalances in the system and can lead to instances where exits are forced shut by building pressurization. Making sure these systems are properly protected is essential for occupant safety.

h. Research Operations
An inventory of all current research operations on campus should be completed to indicate which of these operations are vulnerable to any of the five identified weather
events. If possible, a potential loss in dollars should be calculated, taking into consideration equipment, supplies, time, funding, and other aspects that may be disrupted by the specific weather event. The most vulnerable operations should be a priority for protective measures. Additionally, sensitive documents or resources in storage should also be considered for protection.

i. **Collaborating Resources**

During extreme events, the UNH Transportation department could work with the community and first responders to transport individuals to cooling centers, emergency shelters, or other safe places. McGregor Memorial EMS expressed the ability and desire to provide transportation for community members during high heat events. However, this is secondary to emergency response duties. Additionally, on state-issued heat days, Wildcat Transit rides are free to all community members. If the EMS department can identify the vulnerable populations in need transportation but not medical attention, the Transportation Department could use extra buses to transport these individuals to cooling centers, emergency shelters or other safe places.

j. **Monitoring & Tracking**

I. **Water Monitoring**

The Agricultural Experiment Station (AES) does not meter or track water usage coming from its well. This is important because AES operations are water intensive and could be particularly vulnerable to drought. Water for AES operations is pumped directly from wells, ponds, and reservoirs, with no connection to the town water supply. In order to track consumption, meters should be installed at pumping sources. To increase operational and equipment efficiency, additional sub-meters could be installed.

II. **ACd Space**

One challenge in assessing vulnerability to heat is that there is no accurate estimate of the number or approximate area of ACd spaces on campus. An inventory should be done to determine which spaces have central AC, which spaces currently utilize window AC, and which spaces have neither. Identifying spaces cooled with window units could result in energy efficiency improvements.

III. **Productivity**

A major impact of extreme heat is productivity loss in people. Working in hot buildings does not necessarily pose any major health concerns, but when occupants are uncomfortable, they are much less productive. Productivity loss is also a concern in older buildings that may have poor ventilation, inadequate climate control, and poor lighting, all of which contribute to productivity. Monitoring productivity in these buildings could be an additional measure used to determine the need for building renovations or...
modifications. Additionally, the cost of productivity loss associated with climate change could encourage investments in resilience measures such as AC.

k. Policies, Procedures & Practice

I. Student Athletes

Currently, UNH Athletics has no written policy for canceling practices and sporting events based on weather conditions. If they are experiencing inclement weather during or before an event, staff will meet to determine the best course of action. While this communication is important, there are no clear thresholds for when events should be canceled. This lack of predetermined limits could lead to practices or games being held in dangerous weather, threatening the health, safety, and well being of athletes, coaches, and staff.

II. Residential Life

Residential Life is an excellent resource to UNH in the event of an emergency. RAs are always on campus communicating with students, and they are in leadership roles. RAs could be utilized to disseminate important information to students regarding weather events, and in emergencies their leadership abilities could be utilized on campus or in the community. While it may be unrealistic to train RAs in exact responses to specific weather events, a general weather emergency event training or basic first aid training would not only make RAs better able to handle severe weather events, but also reduce reliance on other entities, like first responders, which would allow them to attend to the needs of the community.

III. Closing Windows

Many of the older buildings on campus are designed poorly, causing things such as poor ventilation and overheating. As a response to overheating, occupants open windows, even in the winter months. This is not only inefficient, but also could result in significant infrastructural problems. At night, when the building temperature is lowered, open windows cause pipes to freeze and subsequently burst. As buildings return to a warmer operating temperature the following day, the frozen pipes thaw and flood the building.

In response to this problem, windows in buildings that frequently encounter this problem have been screwed shut to prevent extensive damages and repair costs. However, this does not address the problem of occupant discomfort, which contributes to loss in productivity. UNH needs to focus both on structural changes to prevent the overheating of buildings, and social changes to prevent windows from being left open.
C. Areas for Collaboration

A critical aspect of resilience is collaboration. Both town and university collaboration are essential for building resilience, especially in this community, where the two are geographically, economically, and socially intertwined. A resilience plan for Durham must address aspects of the town and university, and entities and individuals that represent both must work together to achieve the goals of the plan.

Town and university collaboration requires open communication, trust, and collective action towards a common goal. First, both entities must agree on a common goal and methods for achieving it. Then, frequent and inclusive meetings must be held so that continuous and open communication can occur.

Additionally, collaboration between individual departments is essential. The initial resilience assessment revealed that this is something some departments do very well and others need to improve on. For instance, smaller departments and divisions under the umbrella of UNH Facilities have very specific duties and their own management structure, but they do an excellent job of communicating across departments and staying informed on their colleagues’ operations.

Durham and UNH already have various emergency response plans in place. Not only should these response plans be more integrated to reflect a campus-community emergency response, but the individuals involved in dealing with non-weather emergencies should be involved in weather emergency responses. Using the existing social structures and procedures for responding to other emergencies would make collaborative planning for weather event responses more streamlined.
References


→ need to figure out how to cite endnotes 3, 5, 6 and 7 (written in order in this document and highlighted)

Endnote 3 - The concentrations of heat-trapping gases, or greenhouse gases (carbon dioxide, methane, and nitrous oxide), in the atmosphere have been rising due to human activities since the Industrial revolution (Wake, et al., 2014). - 3

Endnote 5 - Ongoing data collection has identified persistent and increasingly significant changes in climate, including rising atmospheric and ocean temperatures, increasing atmospheric water vapor, increasing precipitation and extreme precipitation events, and rising sea levels (Wake, et al., 2014). - 5

Endnote 5 - The climate science community, based on findings of peer-reviewed publications, has concluded that it is highly likely that human activities, resulting in the emissions of heat-trapping gases, have caused the majority of the warming seen over the last 5 decades (Wake, et al., 2014). - 5

Endnote 6 - Regional climate change has been documented in the following ways: (everything below this bullet)

Endnote 7 - Collaborators from CSNE used global climate models (GMCs) to model potential future impacts of climate change on Southern New Hampshire (Wake, et al., 2014 - CSNE source 7). This work resulted in simulations that indicate the climate of Southern New Hampshire is expected to get warmer and wetter over the next century. This means
Appendix A

Second Nature Climate Leadership Statement

We, the undersigned presidents and chancellors of colleges and universities, believe firmly in the power, potential, and imperative of higher education’s key role in shaping a sustainable society. Not only are we deeply concerned about the increasing pace and intensity of global climate change and the potential for unprecedented detrimental impacts, but we also understand that technology, infrastructure, global interconnectedness, and our greatest asset – engaged, committed, smart students – allow us to explore bold and innovative solutions and to lead in climate action and sustainable solutions.

We have begun to experience the effects of climate change in our communities and we understand that these effects are projected to become more severe and damaging. We recognize that mitigation and adaptation are complementary strategies for reducing the likelihood of unmanageable change, managing the risks, and taking advantage of new opportunities created by our changing climate.

We believe colleges and universities must exercise leadership in their communities and throughout society by providing the knowledge, research, practice, and informed graduates to create a positive and sustainable future. Along with other aspects of sustainability, campuses that address the climate challenge by reducing greenhouse gas emissions and by integrating resilience into their curriculum, research, and campus operations will better serve their students and meet their social mandate to help create a vital, ethical, and prosperous civil society.

We further believe that exerting leadership in addressing climate change will reduce our long-term energy costs and the costs of climate disturbance, increase our quality of life, attract excellent students and faculty, and build the support of alumni and local communities.

We have resolved to take action in one of the following Presidents’ Climate Leadership Commitments. We believe carbon neutrality and resilience are extremely high priority areas of action for all institutions and we aim to lead the nation in these efforts. We urge others to join us in transforming society towards a sustainable, healthy, and more prosperous future.

Climate Commitment:
An integrated climate commitment including carbon neutrality and resilience

1) Develop a comprehensive Climate Action Plan
   a. Within two months of signing this document, create internal institutional structures to guide the development and implementation of the Plan
b. Within one year of the implementation start date, actively support a joint campus-community task force (or equivalent) to ensure alignment of the Plan with community goals and to facilitate joint action, and complete a greenhouse gas emissions inventory, also identifying near term opportunities for greenhouse gas reduction. Report these in the first annual evaluation of progress

c. Within two years of the implementation start date, lead and complete an initial campus-community resilience assessment including initial indicators and current vulnerability

d. Within three years of the implementation start date complete the Plan, (also reflecting joint community-campus components), which will include:
   • A target date for achieving carbon neutrality as soon as possible
   • A target date by which defined thresholds of resilience will be met
   • Interim target dates for meeting milestones that will lead to carbon neutrality and increasing resilience
   • Mechanisms and indicators for tracking progress (including those that cut across campus-community boundaries)
   • Actions to make carbon neutrality and resilience a part of the curriculum and other educational experiences for all students
   • Actions to expand research in carbon neutrality and resilience

e. Review, revise if necessary, and resubmit the climate action plan not less frequently than every five years

2) Submit an annual evaluation of progress
   a. Within one year of the implementation start date, and every year thereafter, complete an annual evaluation of progress
   b. Make the action plan, annual evaluation of progress (including greenhouse gas inventory, resilience assessment etc.), publicly available by submitting them to Second Nature’s reporting system for posting and dissemination
Appendix B

Interview Questions

Opening questions:
- Do you mind if we record this?
- We looked online and saw that your department is responsible for...
- What are some of the assets (tangible or intangible) that are crucial to your department?
- How do curtailed operations affect your department?

Extreme Heat
Current situation -
Since 1990, we’ve had on average 8 days per year where the temperature reaches above 90 and on average 1 day above 95, and since 2010 alone we’ve have on average 10 days above 90 and 1.5 days above 95

Questions -
- How has extreme heat impacted your department in the past?
- How do your operations change during extreme heat?
- What are your biggest concerns on high heat days?
- Do high heat days result in any financial or social impacts for your department?
- How do these events change the way in which you work with other people around campus?
- How do these events change the way in which you work with other people around campus?
- Does UNH serve as a resource for the town/community in this event?

Extreme Cold
Current situation
Since 1990, there have been an average of 14 days per year with temperatures below 0 and 160 days with temps below freezing.

Questions
- How has extreme cold impacted your department in the past?
- How do your operations change during extreme cold?
- What are your biggest concerns on extremely cold days?
- Does extreme cold result in any financial or social impacts for your department?
- How do these events change the way in which you work with other people around campus?
- Does UNH serve as a resource for the town/community in this event?
Ice & Snow
Current situation
Since 1990, there have been an average of 99 snow covered days per year and 160 days with temps below freezing. Snow and ice are typical for New England, but we are interested in the impacts of extreme ice and snow weather events, like snow and ice storms (a large amount of ice or snow in a short period of time; eg. more than 8” in 24hrs; Winter Storm Stella in March)

Questions
● How has ice/snow impacted your department in the past?
● How do your operations change during ice/snow storms?
● What are your biggest concerns on extreme ice/snow days?
● Do you have a response plan in place for extreme ice/snow?
● How do your operations change/how are they impacted by extreme ice/snow?
● Do extreme ice and snow result in any financial or social impacts for your department?
● How do these events change the way in which you work with other people around campus?
● Does UNH serve as a resource for the town/community in this event?

Drought
Current situation
Last year this region experienced a pretty severe drought that lasted for months and led to water use restrictions in some areas

Questions
● How has drought impacted your department in the past?
● How does a drought impact your operations?
● What are your biggest concerns during drought?
● How do these events change the way in which you work with other people around campus?
● Does UNH serve as a resource for the town/community in this event?

Flood
Current situation
Flooding is influenced by multiple variables, but typically events that result in over 4 inches of precipitation in 48 hours can result in flooding. Events like these have been increasing over time; from 1973-1992, Durham had 8 events resulting in 4 inches over 48 hours, whereas from 1993-2012, there were 17. Since 2005, some of the most
notable floods in this region that resulted in presidentially declared disasters or emergency declarations in NH are:

- 2005 Alstead/Keene Floods
- 2006 Mother's Day Flood
- 2007 Patriots Day Flood
- 2011 Hurricane Irene
- 2012 Hurricane Sandy

Even more recently than these extreme events we have seen more examples of flooding in the New England region, especially flash floods caused by storms.

Questions

- How has flooding impacted your department in the past?
- What are your biggest concerns during a flood?
- How do your operations change/how are they impacted by a flood?
- Do you have a response plan in place for a flood?
- What are the financial or social impacts of a flood?
- How do these events change the way in which you work with other people around campus?
- Does UNH serve as a resource for the town/community in this event?