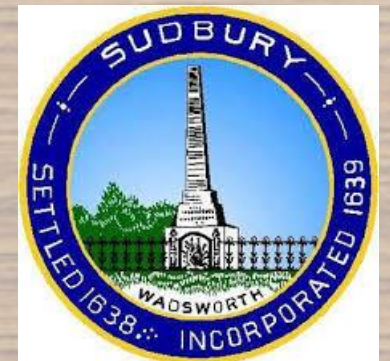




# Sudbury, MA Municipal Vulnerability Preparedness (MVP) Workshop

Craig Pereira, CFM, MVP Certified  
Senior Planner

Horsley Witten Group, Inc.  
May 14, 2019



# Welcome/Introductions

- Maryanne Bilodeau, Assistant Town Manager
- Patricia Brown, Sudbury Board of Selectmen Member
- Janie Dretler, Sudbury Board of Selectmen Member



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# Sudbury MVP Core Team

- Beth Suedmeyer, Environmental Planner
- John Whalen, Sudbury Fire Chief
- Adam Duchesneau, Director of Planning and Community Development
- Dan Nason, Director of Public Works
- Bill Murphy, Health Director
- Bill O'Rourke, Deputy Director of Public Works
- Bill Barletta, Facilities Director
- Mark Herweck, Building Inspector
- Vin Roy, Executive Director Sudbury Water District



# Horsley Witten Group Colleagues

- Ellie Baker, AICP/MVP Certified, Senior Environmental Planner
- Krista Moravec, AICP, Senior Planner
- Gemma Kite, PE, Senior Environmental Engineer
- Kathleen McAllister, Senior Environmental Planner
- Fabiola Alikpokou, Staff Planner



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# SO, who's in the room today?



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**Vulnerability:** the degree to which a system is susceptible to, or unable to cope with, adverse effects of climate change, including climate variability and extremes.

**Resilience:** the ability of a system and its component parts to anticipate, absorb, accommodate, or recover from the effects of a hazardous event in a timely and efficient manner, including through ensuring the preservation, restoration, or improvement of its essential basic structures and functions.

**Adaptation:** the process of adjustment to actual or expected climate and its effects, in order to moderate harm or exploit beneficial opportunities.





# Overview of Project Components

- Municipal Vulnerability Preparedness (MVP)
- Policy/Regulatory Review
- Hazard Mitigation Plan Update



# Purpose of Today's Workshop

Draw upon YOUR knowledge.....

What are the

**MOST IMPORTANT THINGS**

that Sudbury should be doing

to reduce vulnerability and increase resilience?



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# Governor Baker's Executive Order 569 & Recent Climate Change Legislation



- September 2016, directed the state to assist municipalities to reduce vulnerability and improve resilience to climate change
- March 15, 2018: *An Act Promoting Climate Change Adaptation, Environmental and Natural Resource Protection and Investment in Recreational Assets and Opportunity*
  - Puts into law essential components of Executive Order 569
  - \$1.4B to climate change preparedness, environmental protection and community investments



# State Hazard Mitigation and Climate Adaptation Plan

- An update to the Commonwealth's existing 2013 State Hazard Mitigation Plan
  - Addresses the Commonwealth's federally mandated hazard mitigation plan requirements
  - First of its kind statewide climate adaptation plan
  - Published: September 2018



# Municipal Vulnerability Preparedness (MVP) Program

- Provides support for cities/towns in MA to plan for resiliency and implement key climate change adaptation actions for resiliency:
  - Define extreme weather and natural and climate related hazards
  - Identify existing/future vulnerabilities and strengths
  - Develop and prioritize actions for the community
  - Identify opportunities to take action to reduce risk and build resilience (action-oriented resiliency plan)







Maps Data Documents

Search for resources... Search

Providing the most up-to-date climate change science and decision-support tools for the Commonwealth. [More »](#)

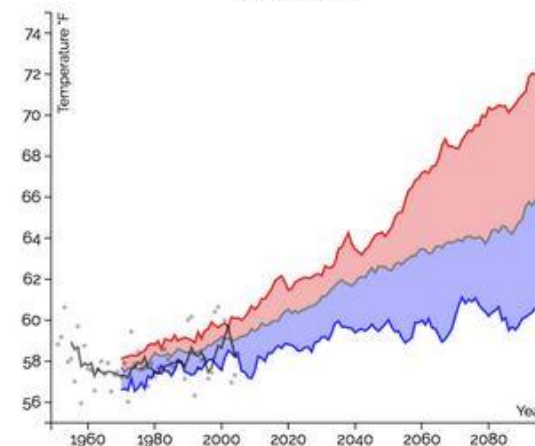
## Climate Change Data

The Baker-Polito Administration is investing in the best science and data to understand how the climate is projected to change and to allow Massachusetts to plan and adapt for the future.

[More »](#)

State: Massachusetts  
Calculated Variable: Maximum Temperature  
Season: Annual

Annual Maximum Temperature Massachusetts



Download Data

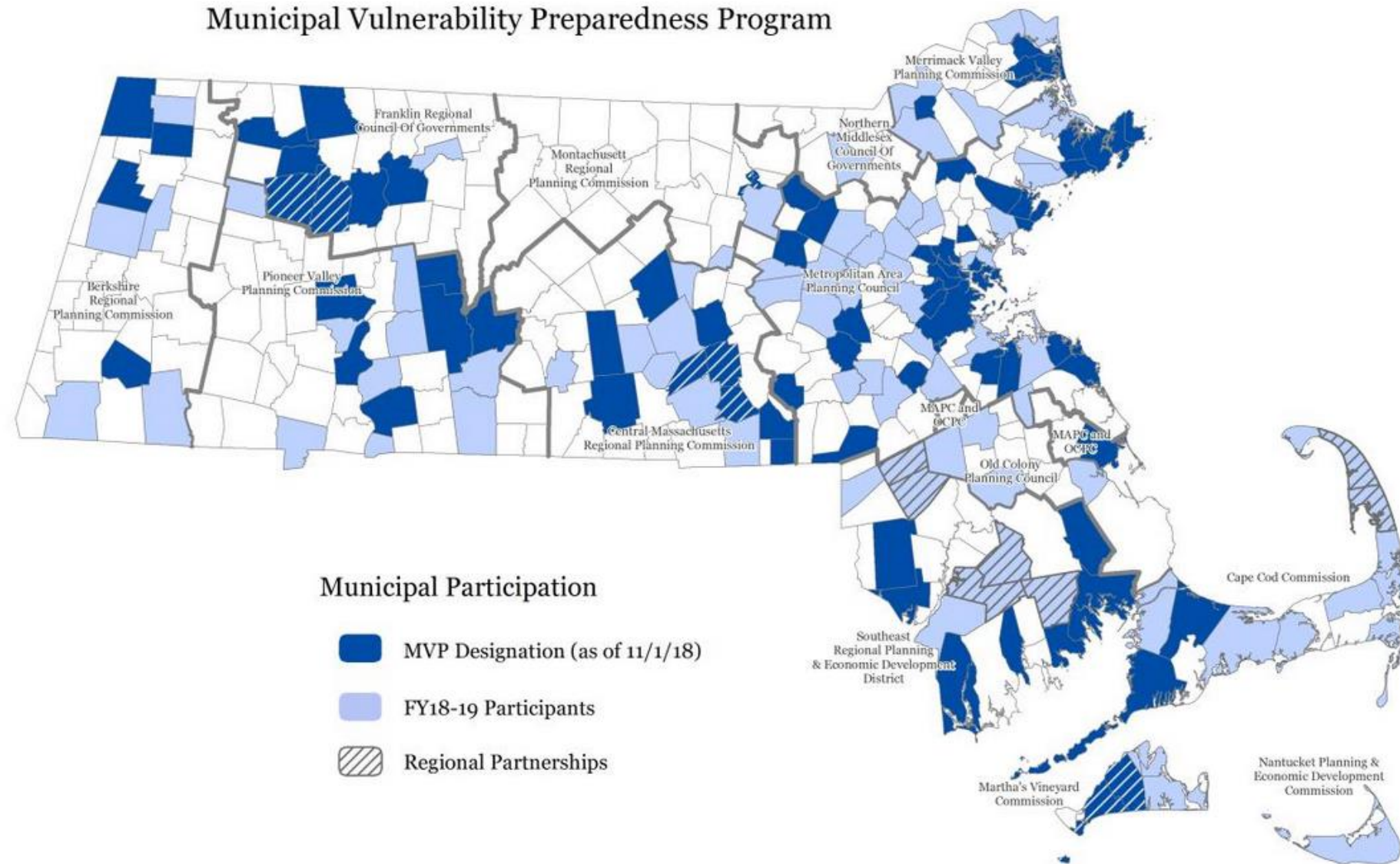
Observed	
5-yr Mean	°F
Modeled °F	
Max	~
Median	~
Min	~
Changes from 1971-2000 for:	
2020 - 2049	3.83°F
2040 - 2069	5.02°F
2060 - 2089	6.14°F
2080 - 2097	6.84°F

Community Resilience Building  
WORKSHOP GUIDE



# MVP Program Status

## Municipal Vulnerability Preparedness Program

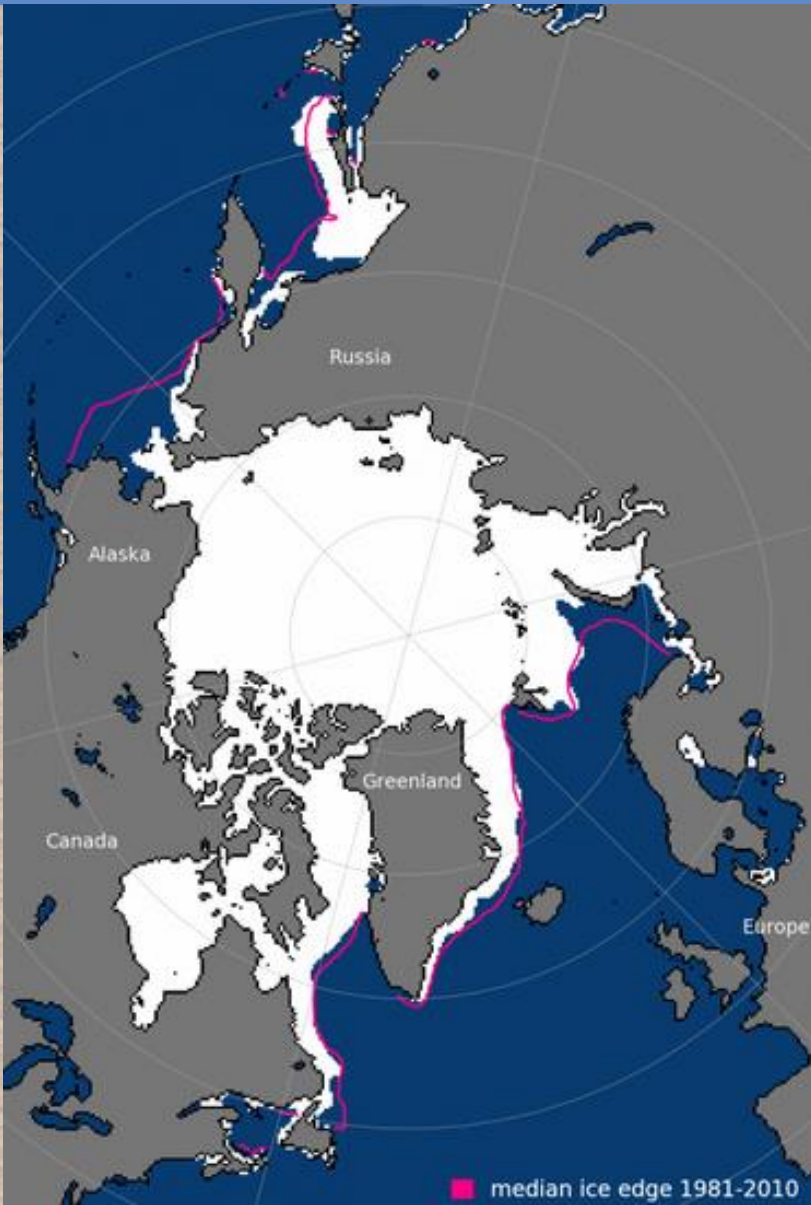


As of October 1, 2018  
MVP Designation:  
73 communities

FY 2018 – 2019  
Completed/Currently  
Completing:  
83 communities



# Climate Change - Global



## Arctic Sea Ice Coverage Hits Record Low

The 1979 to 2019 linear rate of decline for April ice extent is 38,800 square kilometers (15,000 square miles) per year, or 2.64 percent per decade relative to the 1981 to 2010 average

<https://nsidc.org/arcticseaicenews/>



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# Climate Change - Global

## Increased Storm Intensity and Frequency



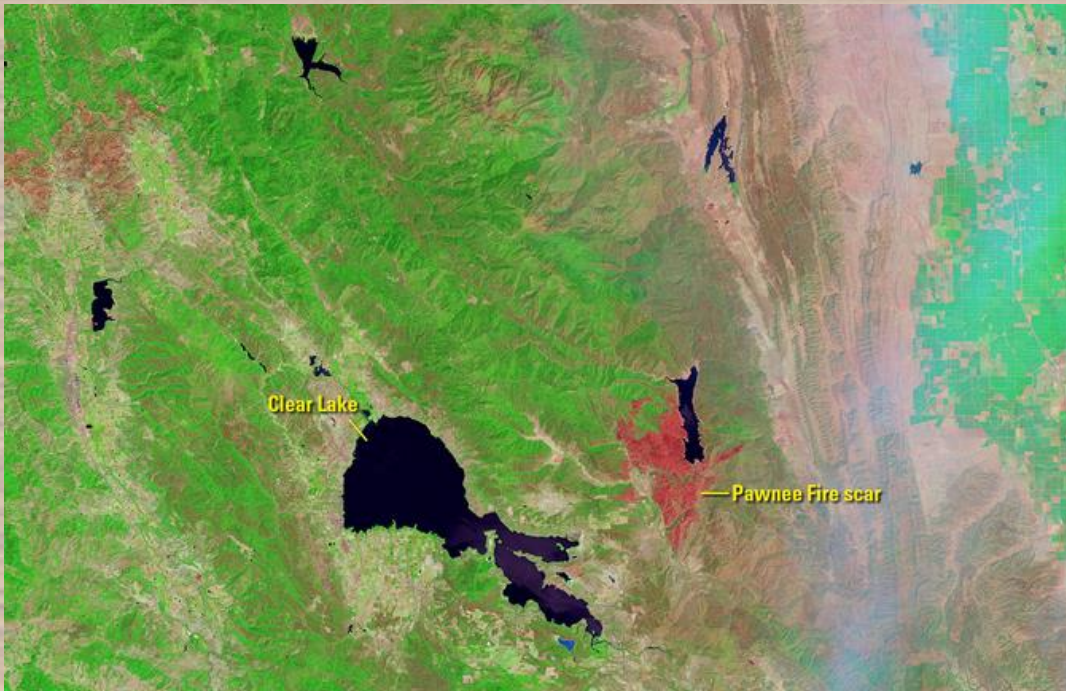
Image: <http://5newsonline.com/2017/09/07/garretts-blog-tracking-irma-katia-jose-lee/>



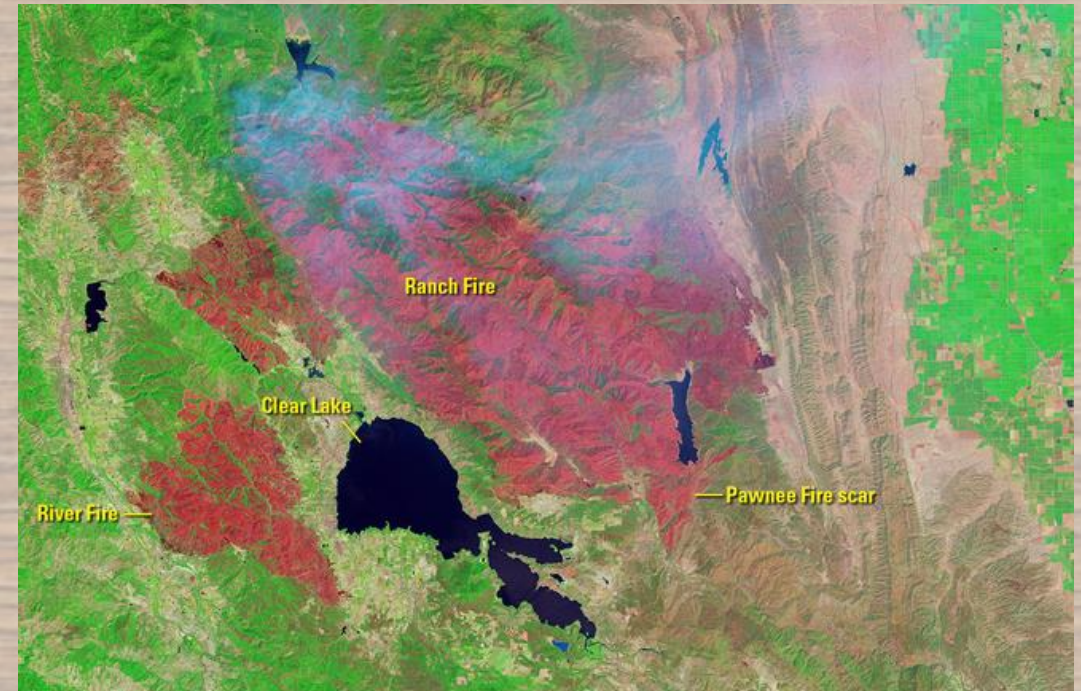


# Climate Change – United States

## Mendocino Complex Wildfires



July 2018 prior to fires



August 2018 after fires



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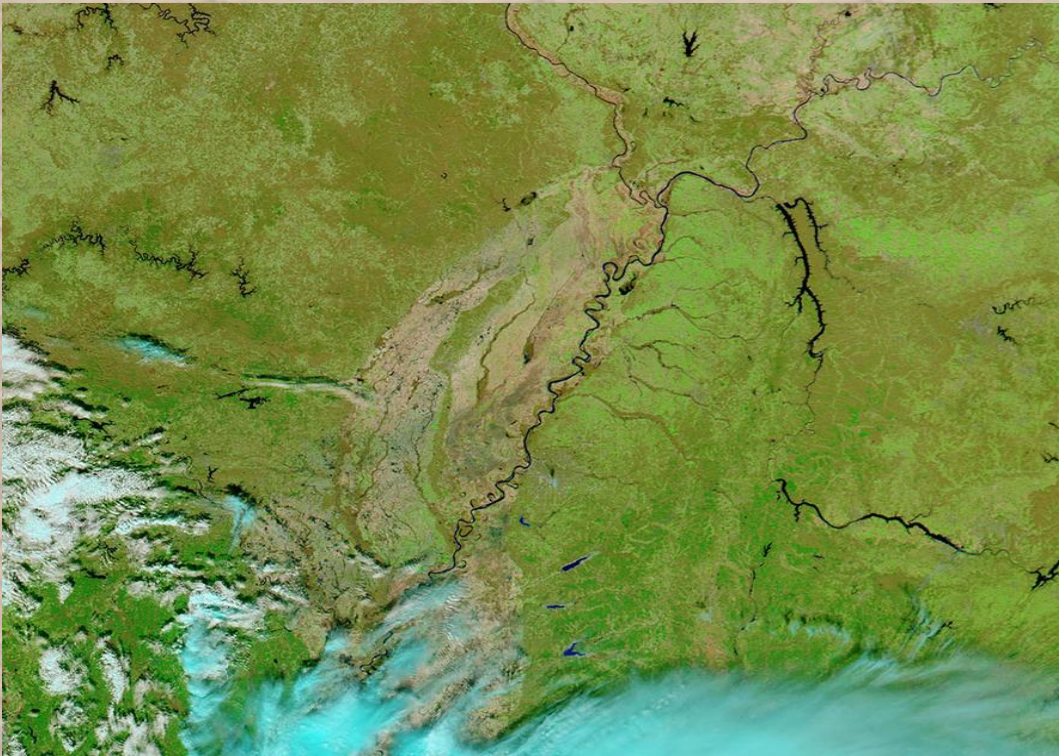
Image [https://climate.nasa.gov/images-of-change?id=677#677-mendocino-complex-california%E2%80%99s-largest-wildfire:](https://climate.nasa.gov/images-of-change?id=677#677-mendocino-complex-california%E2%80%99s-largest-wildfire)



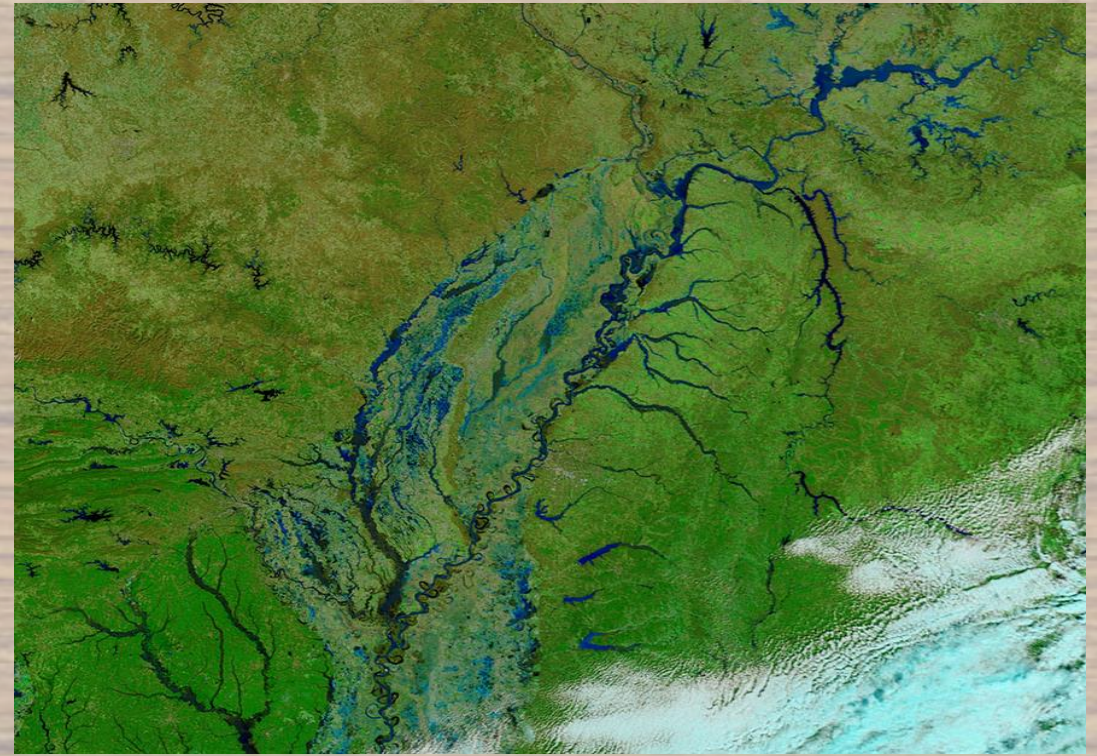
# Climate Change – United States

Flooding of the Ohio and Mississippi Rivers after intense rain in February 2018

February 2017



February 2018



Images: <https://climate.nasa.gov/images-of-change?id=639#639-flooding-of-ohio-and-mississippi-rivers>



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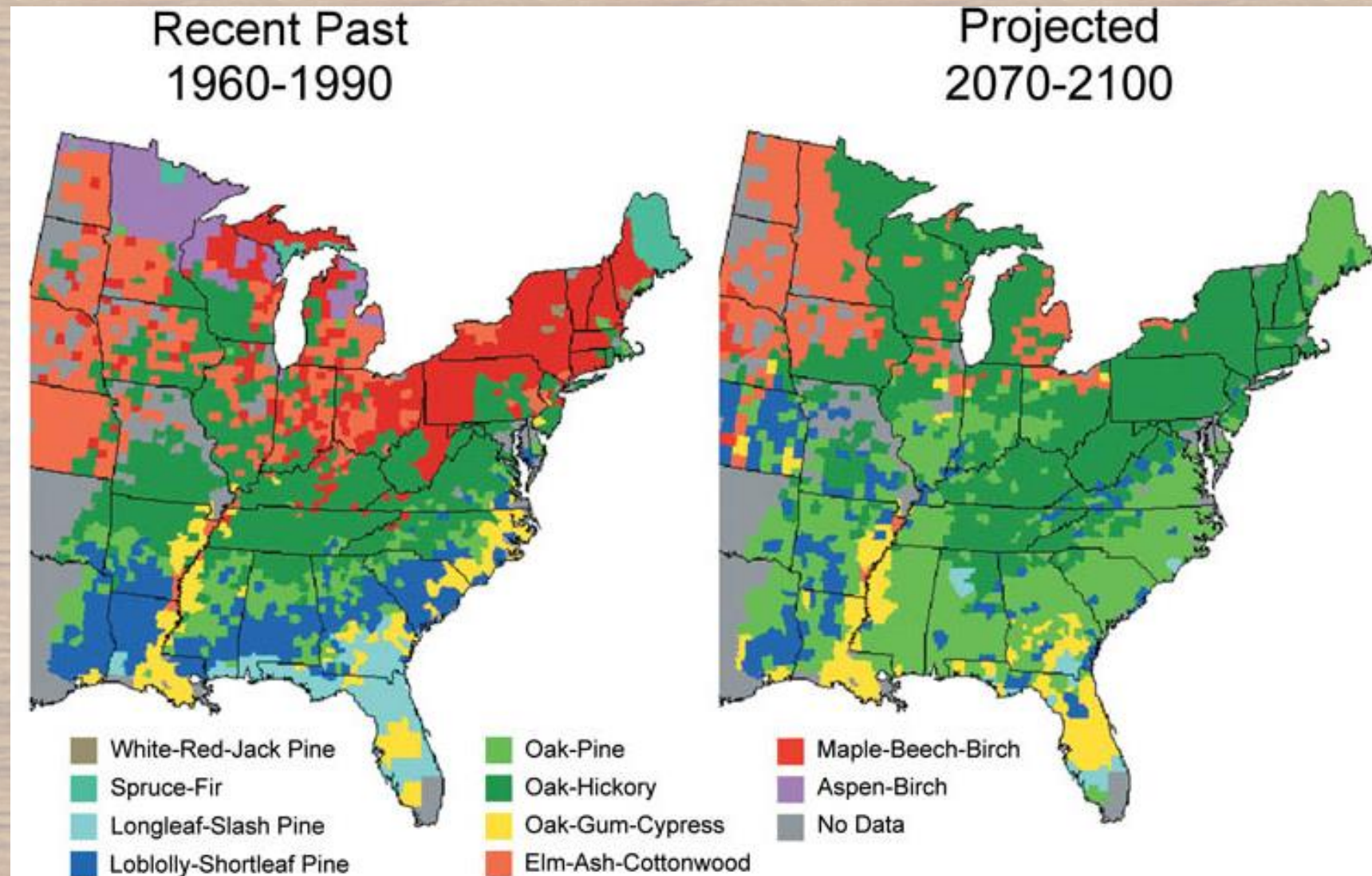


# Climate Change – United States

In the Northeast, maple-beech-birch forest is projected to be displaced by the oak-hickory forest type.

(Low emissions scenario)

Source: [USGCRP \(2009\)](#)





# Climate Change – United States

## Hurricane Irma (2017) Damage in Florida





# Climate Change – New England

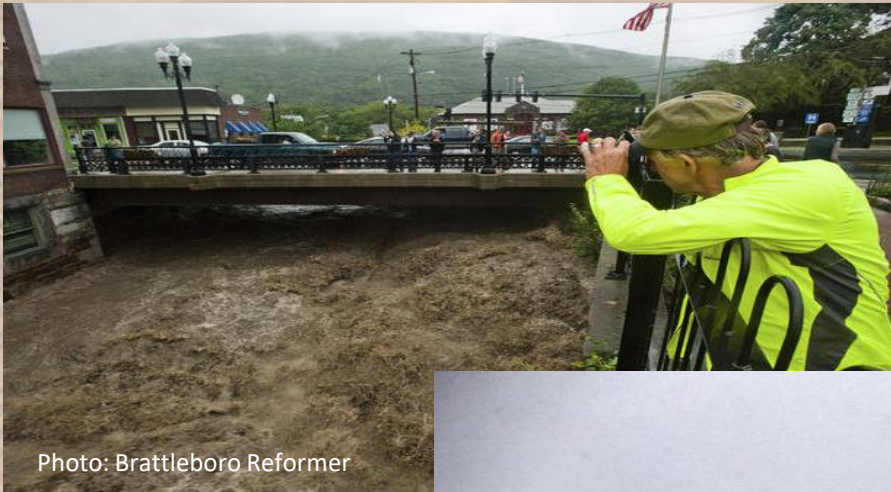


Photo: Brattleboro Reformer



Photo: WBUR



Photo : Boston Globe



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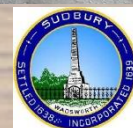




# Local Impacts – Flooding



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# Local Impacts – Flooding





# Local Impacts – Winter Storms



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# Local Impacts – High/Strong Winds

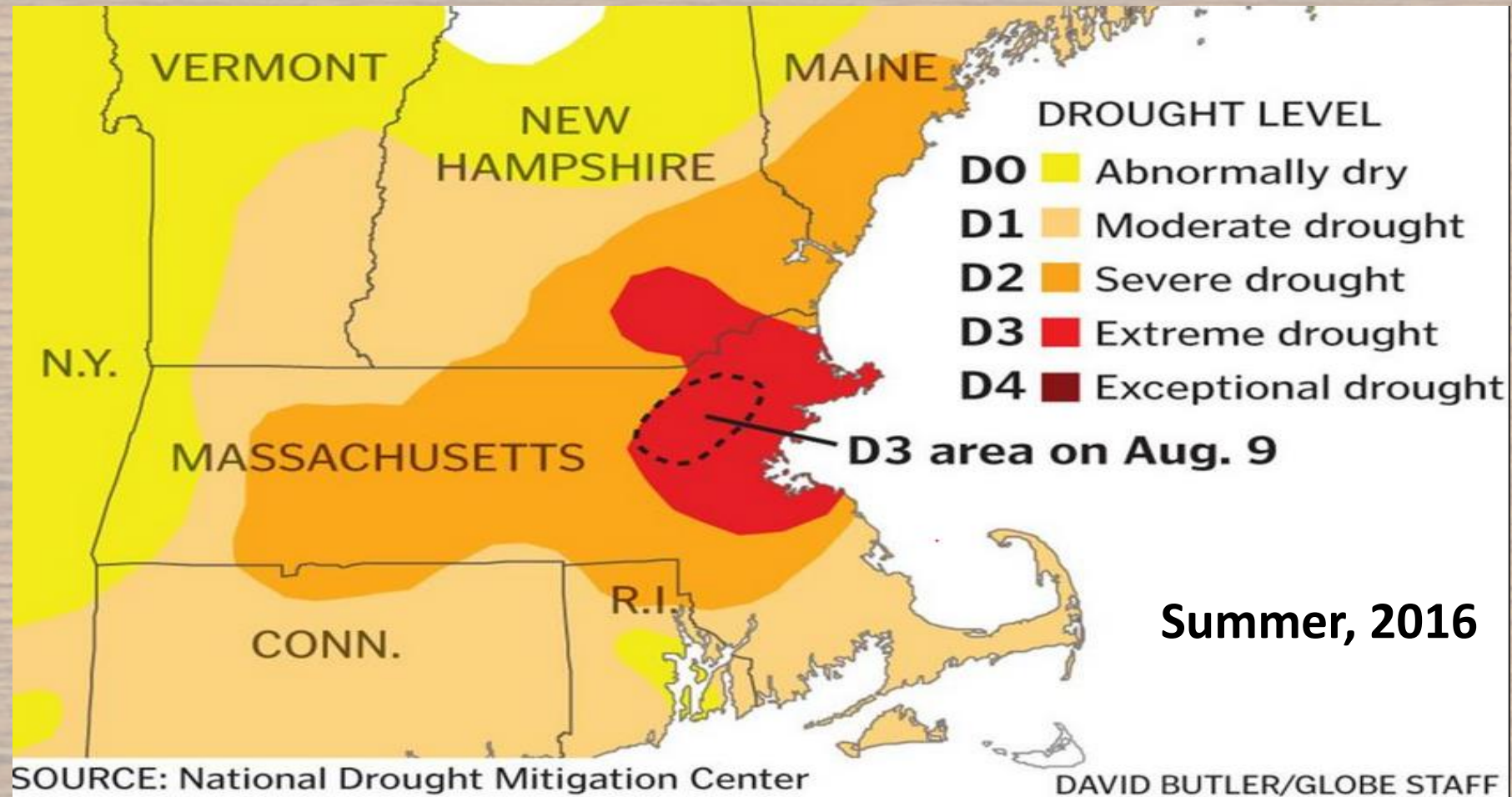


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# Local Impacts - Drought





# Sudbury's Hazard Risk Index

	<u>Frequency</u>	<u>Severity</u>
• Flood-Related Hazards		
- Riverine/Flash Flooding	Low	Serious
- <b>Inland/Urban Flooding, Heavy Rain</b>	High	Extensive
- Dam Failures	Low	Serious
• Winter-Related Hazards		
- <b>Blizzards/Snow</b>	High	Extensive
- Ice	Low	Serious
- Extreme Cold	Low	Serious



# Sudbury's Hazard Risk Index

• Wind-Related Hazards	<u>Frequency</u>	<u>Severity</u>
- Hurricanes	High	Extensive
- High/Strong Winds	High	Serious
- Tornadoes	Low	Catastrophic
- Lightning/Thunderstorms	High	Minor
- Hail	High	Minor
• Geologic-Related Hazards		
- Earthquakes	Low	Extensive



# Sudbury's Hazard Risk Index

- Drought-Related Hazards

- Drought
- Extreme Heat

Frequency

High  
Low

Severity

Serious  
Serious

- Wildfire

- Brush Fires

Medium

Minor

- Landslides

- Landslide

Low

Minor





# Recent Disaster Declarations

- Hurricane Irene – August 2011 (FEMA EM-330)
  - 1 fatality
  - \$127.3 million in property damage
- Severe Winter Storm – February 2013 (FEMA DR-4110)
  - 2 to 2.5 feet of snow
  - Power outages, downed trees
- Severe Winter Storm – January 2015 (FEMA DR-4214)
  - 2 to 3 feet of snow
  - Power outages, downed trees



# Climate Projections – NE Climate Center (Umass)

**Table 1: TEMPERATURE PROJECTIONS**

Climate Parameter	Baseline (1971-2000)	Mid-Century (2050s)	End of Century (2090s)
Average Annual Temperature (°F) <i>Sudbury/Assabet/Concord</i>	48.7	51.6 – 55.0	52.5 – 59.6
Maximum Annual Temperature (°F) <i>Sudbury/Assabet/Concord</i>	59.6	62.3 – 65.9	63.0 – 70.5
Minimum Annual Temperature (°F) <i>Sudbury/Assabet/Concord</i>	37.9	41.0 – 44.3	42.0 – 48.9
Annual Days with Max Temp over 90°F <i>Sudbury/Assabet/Concord</i>	8	18 - 42	22 - 84
Annual Days with Min Temp below 32°F <i>Sudbury/Assabet/Concord</i>	143	103 - 124	78 - 119
Annual Heating Degree-Days (Base 65°F) <i>Sudbury/Assabet/Concord</i>	6,535	4,948 – 5,789	4,075 - 5551
Annual Cooling Degree-Days (Base 65°F) <i>Sudbury/Assabet/Concord</i>	585	870 – 1,356	743 - 983
Annual Growing Degree-Days (Base 50°F) <i>Sudbury/Assabet/Concord</i>	2,525	3,138 – 3,866	3,321 – 5,067



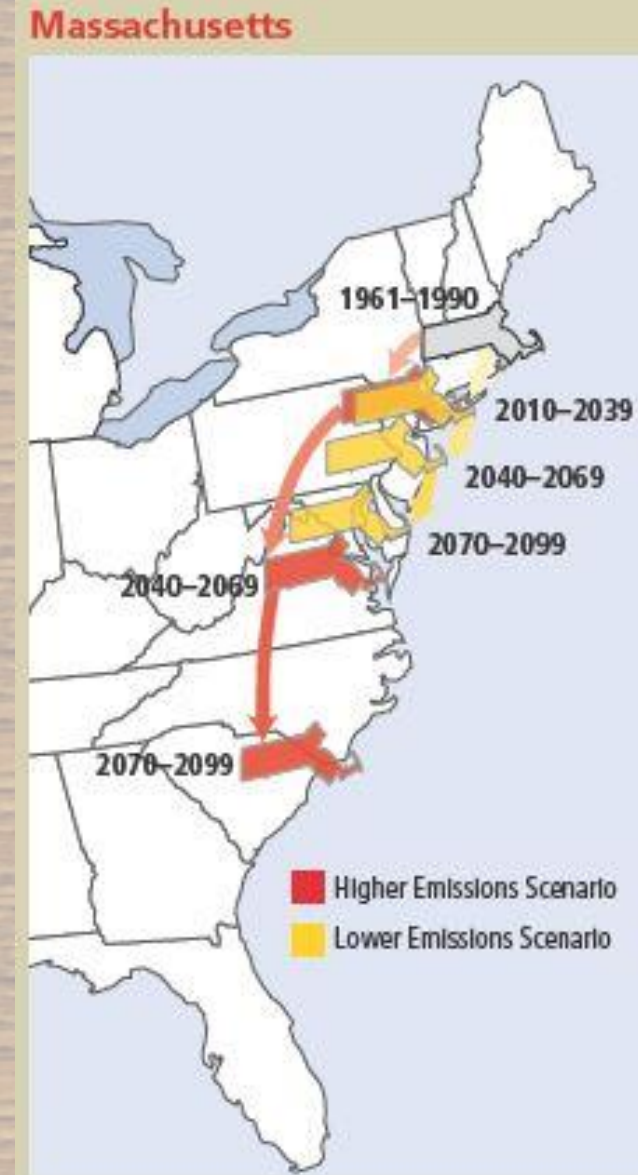
# Climate Projections

Similar to Maryland

Similar to North Carolina

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# Climate Projections

Up to 10X more very hot days

5x more very hot days

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# Climate Projections

28% fewer  
freezing days

45% fewer  
freezing days

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Less energy required for indoor heating

More energy required for cooling



# Climate Projections

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Growing season doubles  
by end of century

# Climate Projections

**Table 2: PRECIPITATION PROJECTIONS**

Climate Parameter	Baseline (1971-2000)	Mid-Century (2050s)	End of Century (2090s)
<b>Total Precipitation (inches):</b>			
<b>Annual</b>			
<i>Sudbury/Assabet/Concord</i>	45.4	50.0 – 51.5	46.6 – 53.4
<b>Winter</b>			
<i>Sudbury/Assabet/Concord</i>	11.2	11.3 – 13.8	11.6 – 15.3
<b>Spring</b>			
<i>Sudbury/Assabet/Concord</i>	11.6	11.6 – 13.7	11.8 – 14.2
<b>Summer</b>			
<i>Sudbury/Assabet/Concord</i>	10.8	10.3 – 13.0	9.7 – 14.0
<b>Fall</b>			
<i>Sudbury/Assabet/Concord</i>	12.0	10.7 – 13.7	10.5 – 13.4
<b>Annual Days with Precipitation over 1 inch</b>			
<i>Sudbury/Assabet/Concord</i>	7	8 - 10	8 - 11
<b>Annual Days with Precipitation Over 2 inches</b>			
<i>Sudbury/Assabet/Concord</i>	1	1 - 2	1 - 2
<b>Annual Days with Precipitation Over 4 inches</b>			
<i>Sudbury/Assabet/Concord</i>	0	0 - 0	0 - 0
<b>Annual Consecutive Dry Days</b>			
<i>Sudbury/Assabet/Concord</i>	17	17 - 19	16 - 20

Largest increase is expected in winter

Greater number of significant rain events and longer dry periods



# Demographics

Significantly lower than statewide

Population	18,697 people (ACS, December 2018)
Age	0-19 = 32% 20-34 = 7% 35-64 = 47% 65+ = 15%
Income	<\$40K = 10% \$40-60K = 6% \$60K+ = 84%
% Below Poverty Line	2%
Race	White = 87% Black = 1% Asian = 9% Other = 3%
Ethnicity	Hispanic = 2% Not Hispanic = 98%
Environmental Justice	0% (U.S. Census 2010)
% Population Over 65 Living Alone	2.2%
Heart Attack Hospitalizations	11.8 (age-adjusted rate per 10,000 people)
Asthma Emergency Department Visits	3.2 (age-adjusted rate per 10,000 people)
Pediatric Asthma Prevalence	8.9% of all children enrolled in grades K-8
Heat Stress Emergency Department Visits	0 (age-adjusted rate per 10,000 people)

Significantly lower than statewide

Lower than statewide

# Health Impacts of Climate Change



Extreme Heat

Rising temperatures will lead to an increase in heat-related deaths and illnesses



Outdoor Air Quality

Rising temperatures and wildfires and decreasing precipitation will lead to increases in ozone and particulate matter, elevating the risks of cardiovascular and respiratory illnesses and death.



Flooding

Increased coastal and inland flooding exposes populations to a range of negative health impacts before, during, and after events



Vector-Borne Infection  
(Lyme Disease)

Ticks will show earlier seasonal activity and a generally northward range expansion, increasing risk of human exposure to Lyme and disease-causing bacteria.



Water-Related Infection  
(Vibrio vulnificus )

Increases in water temperatures will alter timing and location of *Vibrio vulnificus* growth, increasing exposure and risk of water-borne illness.



Food-Related Infection  
(Salmonella)

Rising temperatures increase *Salmonella* prevalence in food, longer seasons and warming waters increase risk of exposure and infection.



Mental Health and Well-Being

Changes in exposure to climate- or weather-related disasters cause or exacerbate stress and mental health consequences, with greater risk for certain populations.



# Workshop Agenda

- Presentation to **set the stage** for our discussion
- Determine which **climate change hazards** to focus on
- Identify the most **vulnerable features** in Sudbury
- Identify the **features that provide strength**
  
- Develop **actions** – what can the Town do to address vulnerabilities and protect/enhance strengths?
- Prioritize the **most important actions** for Sudbury



# Resilience & Adaptation

## Overarching Goal for the Workshop

To identify the 5-6 Highest Priority actions that the Town of Sudbury should take to increase *resilience* and *adapt* to climate change





# Recommendations: 2010 Hazard Mitigation Plan

## High Priority Mitigation Measures

- Enhance Flood Plain Bylaw enforcement assistance. *(Not completed, carry forward)*
- Revise wetlands bylaw to provide better wildlife habitat protection and comply with new DEP Stormwater regulations. *(Completed, ongoing)*
- Increase Town emergency response to imminent storms and during winter storms.  
*(Completed, ongoing)*
- Elevate the grade of Concord Road two feet (between Lincoln Road to Old Sudbury Rd.). *(Not completed, carry forward)*
- Elevate Concord Road two feet (eastern end of Concord Rd.). *(Not completed, carry forward)*
- Remove beaver dam and conduct beaver trapping/removal as needed.  
*(Completed, ongoing)*



# Recommendations: 2010 Hazard Mitigation Plan

## High Priority Mitigation Measures

- Develop inspection/maintenance plans: Carding Mill and Stearns Mill Dams.  
(Completed)
- Establish a regular tree inventory and maintenance plan. (Not completed, carry forward)
- Establish microwave link communications system with repeater at Nobscot Mountain. (Completed)
- Establish a municipal HAM radio station and provide training/licensing for operators.  
(Not completed, remove)





# Recommendations: 2010 Hazard Mitigation Plan

## High Priority Mitigation Measures

- Build a municipal Emergency Operations Center as part of the redesign of Fire Dept. or new Police Station. (Completed)
- Reconfigure generators at Lincoln-Sudbury High School to include heating capability. (Not completed, carry forward)
- Install a large-capacity, multi-fuel generator at the Curtis Middle School.  
(Not completed, carry forward)
- Acquire a large, mobile diesel generator for the Fire Dept. (Completed)



# Recommendations: 2010 Hazard Mitigation Plan

## Measures to Ensure Compliance with NFIP

- Adopt new regulations for the Water Resource Protection District bylaw.  
(Not completed, carry forward)
- Develop/Adopt new Stormwater bylaw in conjunction with MAPC. (Completed)
- Develop/Adopt new Earth Removal Bylaw. (Not completed, carry forward)
- Acquire wetlands parcels in the Sudbury River floodplain. (Completed)
- Increase funding for preventative practices on drainage infrastructure.  
(Not completed, carry forward)





# Recommendations: 2010 Hazard Mitigation Plan

## Medium Priority Mitigation Measures

- Continue ongoing education for town residents on stormwater and wetland resources. (Completed, ongoing)
- Complete repairs and develop Operations and Management Plan for Pantry Brook Dam. (Not completed, carry forward)
- Elevate Concord Rd. near Nashawtuc Country Club. (Not completed, carry forward)
- Upgrade older drainage systems in town. (Not completed, carry forward)
- Beaver dam removal, beaver trapping/removal as needed. (Completed, ongoing)
- Establish more frequent maintenance schedules for town-owned drainage facilities. (Completed)
- Acquire Soft Suction pond water drafting system. (Completed)



# Recommendations: 2010 Hazard Mitigation Plan

## Medium Priority Mitigation Measures

- Devote more resources to privately-owned drainage facilities. (Not completed, carry forward)
- Relocate overhead electrical/cable utility lines underground. (Not completed, carry forward)
- Conduct feasibility study to investigate options for all public buildings to be earthquake proof. (Not completed, carry forward)
- Add manpower to the Fire Dept. and provide homeowner education on fire prevention using building/landscaping best management practices.. (Completed, ongoing)

## Low Priority Mitigation Measures

- Increase outreach and education on subsidence, erosion, stormwater and BMPs to landscapers and contractors. (Completed, ongoing)





# Hazards Exacerbated by Climate Change

Intense Rain/Flooding

Fire

Wind Events

Drought

Hurricanes or Nor'easters

Winter Storms (Snow/Wind/Cold)

Extreme Cold

Heat Waves/Extreme Heat







# Vulnerabilities - Examples

## INFRASTRUCTURE

- Main road floods during storms, blocking emergency response.
- Power outages during heat waves lead to health concerns.
- Wildfire and high winds resulting in supply chain interruptions.
- Sewer pump stations become submerged and inoperable.

## SOCIETAL

- Senior housing without backup generators during heat waves.
- Residents without access to transportation during hurricane evacuation.
- Household contamination and sewage mobilization during flooding.
- Limited areas of refuge in elementary schools during tornados.

## ENVIRONMENTAL

- Proliferation of subdivisions in wildfire and flood prone areas.
- Lack of urban tree canopy increasing heat island effect.



# Strengths - Examples

## INFRASTRUCTURE

- Critical road elevated and passable by emergency management.
- Hurricane roof installed at school with improved sheltering capacity.
- Hardened utility lines reduce outages due to ice storms.
- Undersized culvert replaced to reduce flooding in key intersection.

## SOCIETAL

- Reliable communications protocols across departments for all employees.
- “Neighbor-helping-neighbor” program aligned with emergency operations.
- Faith-based and civic groups with hazard preparedness plans.

## ENVIRONMENTAL

- Forested watersheds maintain drinking water supply during droughts.
- Native, vegetated slopes remain stable after intense 24hr rain events.
- Floodplains provide stormwater storage and downstream flood reduction.



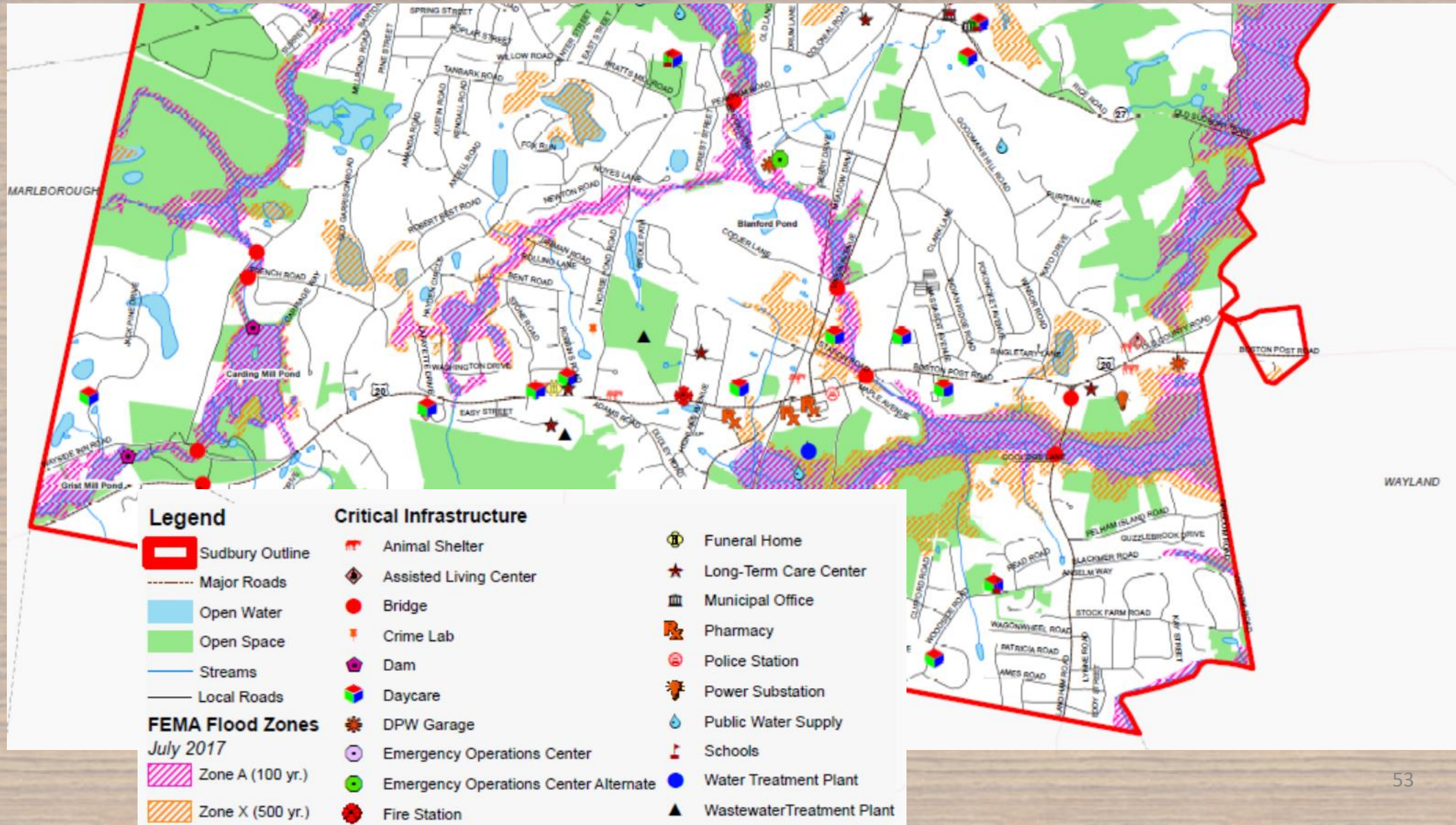


# Potential Actions - Examples

- Engineering/Construction
- Protection/Conservation
- Retreat/Avoidance
- Preparations/Planning
- Policy/Regulatory Changes
- *[Short-term, Long-term, ongoing]*

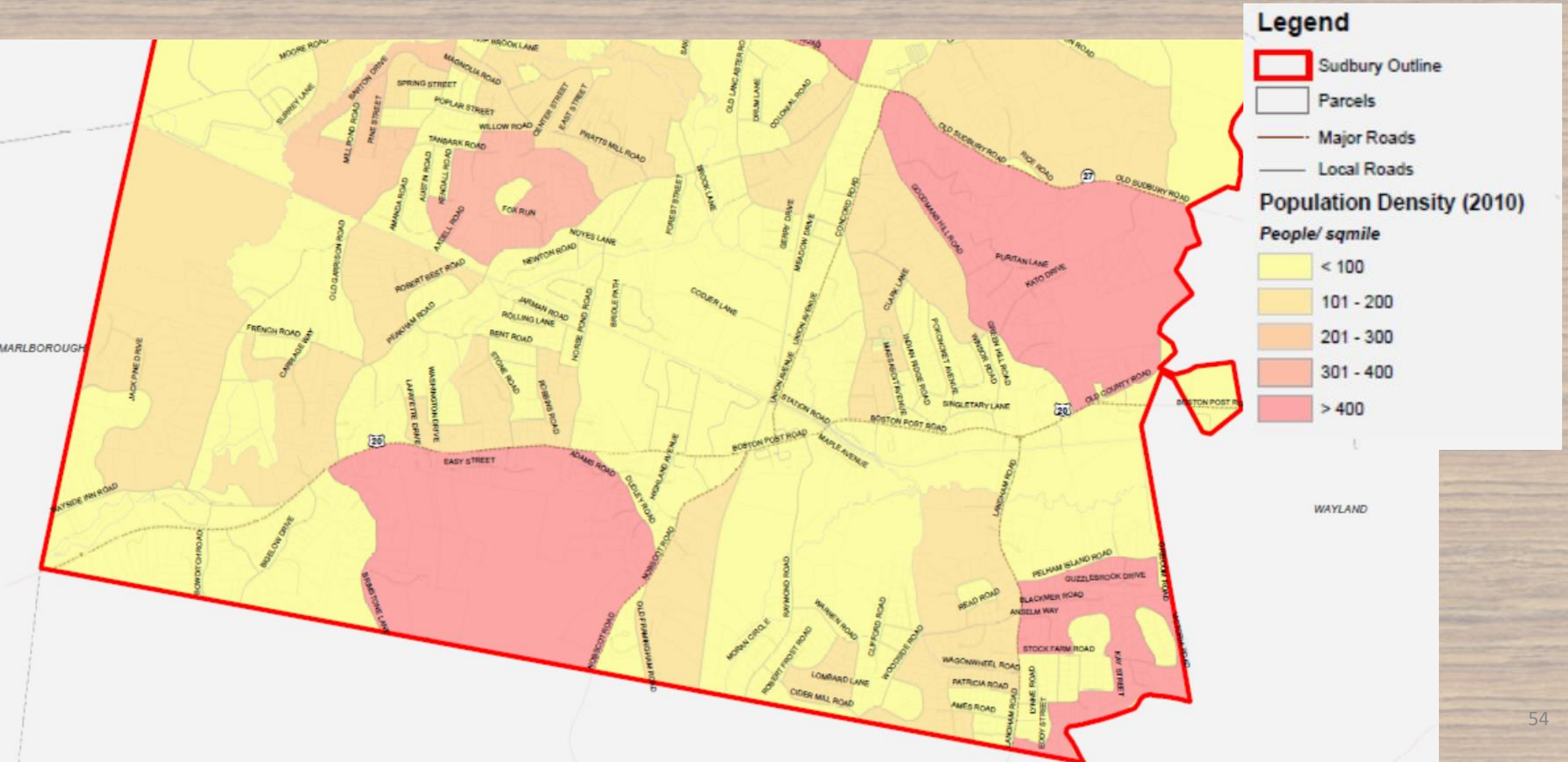


# Map Provided





# Consider where people live & work, and major travel routes



# Handouts – handy reference information

- Agenda
- Prior Recommendations from 2010 Hazard Mitigation Plan
- On Tables:
  - Map of Sudbury (Critical Facilities/FEMA Flood Zones/Population)
  - Climate Change Projections Data (Temperature and Precipitation)
  - Examples of Vulnerabilities and Strengths
  - Selected Demographic Data about Sudbury





# Ground Rules for Group Discussions

**Share the stage:** Everyone should have an equal opportunity to talk.

**Focus:** Focus on the questions asked and your group's discussion.

**Land the Plane:** Respect limited time.

**Respect:** Listen, be honest, and avoid criticizing others' ideas.

**One mic:** One person speaks at a time.

**Phone etiquette.** Phones are off or on vibrate, take calls in the hall.



# Large Group Discussion #1

What natural hazards should we focus on today?

What are the natural hazards most important to Sudbury in the face of climate change?

Let's pick 4.



# Thank You!

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