

Weston & Sampson

# COMMUNITY RESILIENCE BUILDING & HAZARD MITIGATION PLANNING STAKEHOLDER WORKSHOP 1

Dunstable, Massachusetts  
October 20, 2023

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## AGENDA

- 01 Welcome, Introductions & Overview
- 02 Overview of Data Resource & Science
- 03 Large Group Exercise: Identify Top Hazards
- 04 Small Group Exercises: Risk Matrix Features & Characteristics
- 05 Report Out

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## WELCOME



**Keep your phone on silent**



**Raise your hand with questions**



**We will have designated breaks for discussion**

 <b>Janet Moonan, PE</b> Project Technical Lead Weston & Sampson	 <b>Michelle Rowden</b> MVP Regional Coordinator EOEEA	<b>Also Joining Us Today:</b>  <b>Jason Silva</b> Town Administrator	<b>Leah Basbanes</b> Selectboard & Con Com
 <b>Nichole Davis</b> Community Outreach Coordinator Hoyle Tanner	 <b>David Langlais, PE</b> Town Engineer Hoyle Tanner	<b>Erik Hoar</b> Police Chief	<b>Jon Crandall</b> Emergency Management Director
		<b>Mike Martin</b> Road Commission Chair	

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## TELL US ABOUT YOURSELF

- What is your name?
- What is your relationship to Dunstable?
- What are you looking forward to accomplishing or learning today?

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## KEY TERMS

<p><b>NATURAL HAZARDS:</b> A source of harm or difficulty created by a meteorological, environmental or geological event. Natural hazards, such as flooding and earthquakes, impact the built environment, including dams and levees.</p> <p><b>CLIMATE ADAPTATION:</b> Actions taken at the individual, local, regional, state, and national levels to reduce risks from changing climate conditions and prepare for impacts from additional changes projected for the future.</p> <p><b>CLIMATE RESILIENCE:</b> The ability to prepare for, recover from, and adapt to climate change and associated impacts.</p>	<p><b>PRIORITY POPULATIONS:</b> People or communities who are disproportionately impacted by climate change due to life circumstances that systemically increase their exposure to climate hazards or make it harder to respond.</p> <p><b>COMMUNITY ASSETS:</b> People, structures (buildings and facilities), systems, natural/historic/cultural resources, the economy, and activities that have value to the community.</p> <p><b>HAZARD MITIGATION:</b> Actions taken to reduce or eliminate the long-term risk to human life and property from natural hazards.</p>
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## WHY WE'RE HERE

**Weather projections:**

<p><b>Changes in precipitation</b></p> <ul style="list-style-type: none"> <li>12-42% more winter precipitation by 2070.</li> <li>Priority Populations have a 57% higher risk of flood damage than the rest of the Commonwealth.</li> <li>Annual economic flood damage increase by \$9.3 million by 2030 in MA.</li> </ul>	<p><b>Rising temperatures</b></p> <ul style="list-style-type: none"> <li>23-29 high heat days expected by 2050.</li> <li>Annual average temperature increase of 5.9 to 7.9 F by 2050.</li> <li>Extreme temps will increase annual transportation infrastructure maintenance cost by over \$140 million</li> </ul>
<p><b>Severe Weather</b></p> <ul style="list-style-type: none"> <li>Precipitation amounts from heaviest storms increased by 55% since 1958.</li> <li>Lightning was responsible for \$20.4 million in damage between 2002 and 2022.</li> </ul>	<p><b>Regional changes</b></p> <ul style="list-style-type: none"> <li>Increase in frequency and magnitude of hurricanes and nor'easters</li> <li>More risk to experiencing tornados.</li> <li>Increased fire potential.</li> </ul>

Source: ResilientMass Plan (2023)

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## WHAT IS MUNICIPAL VULNERABILITY PREPAREDNESS?

PRESS RELEASE

### Baker-Polito Administration Awards \$12 Million to Municipalities to Prepare for Climate Change

71 Percent of Massachusetts Communities Now Enrolled in Municipal Vulnerability Preparedness Program

- The Executive Office of Energy and Environmental Affairs' MVP grant and designation program, which builds on Governor Baker's Executive Order 569 as well as other administration-led state and local partnerships, provides communities with technical support, climate change data and planning tools to identify hazards and develop strategies to improve resilience.
- "Our Administration is committed to partnering with cities and towns to develop practical and cost-effective solutions to build the climate-resilient communities of tomorrow," said Lieutenant Governor Karyn Polito.

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## WHAT IS MVP?

- Improved resilience and preparedness
- Collaboration with stakeholders
- Increased education, planning, and implementation
- Funding for resilience-related actions

Source: Massachusetts Executive Office of Energy and Environmental Affairs Climate Grant Viewer

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## WHAT IS MVP?

**MVP Planning Grant**

- Engage stakeholders
- Define climate hazards
- Identify community vulnerabilities and strengths
- Develop and prioritize mitigation actions
- Receive MVP designation

**MVP Action Grant**

- Implement priority adaptation actions identified during the planning process

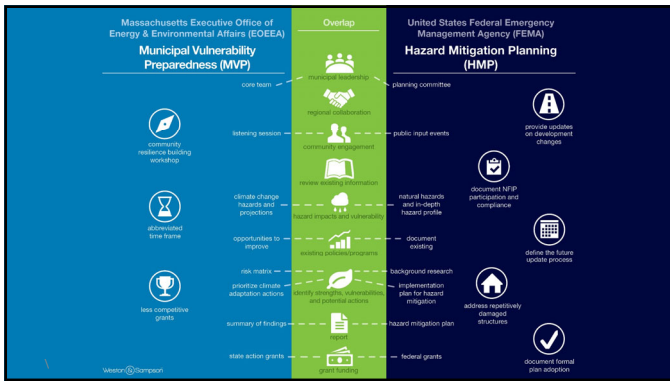
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## WHAT CAN THE MVP ACTION GRANT FUND?

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## WHAT IS A HAZARD MITIGATION PLAN?

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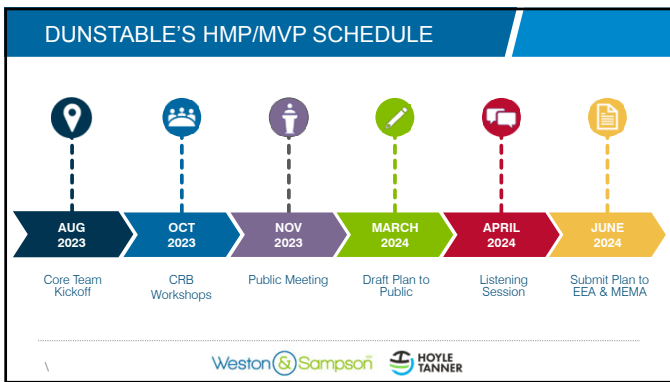
### WHAT IS THE VALUE OF THIS WORK?

- Grant eligibility
- Preparedness planning
- Health & safety
- Equitable outcomes
- Building consensus

**EVERY \$1 SPENT ON MITIGATION SAVES \$6 ON DISASTER RECOVERY**

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### CLIMATE DATA & RESOURCES

- CLIMATE DATA**
  - Resilient Massachusetts State Hazard Mitigation and Climate Adaptation Plan (2023)
  - Massachusetts Climate Change Assessment (EEA, 2022)
  - Climate Resilience Design Standards Tool (RMAAT, 2022)
  - Massachusetts Climate Change Projections (NECSC, 2021 on resilientma.org)
- APPLICABLE PLANS**
  - Town of Dunstable Annual Reports (Dunstable, 2020, 2021, 2022)
  - Town of Dunstable Bylaws (Dunstable, 2021)
  - Dunstable Master Plan (Dunstable, 2018)
  - Dunstable Open Space and Recreation Plan (Dunstable, 2018)
  - Hazard Mitigation Plan for the Northern Middlesex Region (Northern Middlesex Council of Governments, 2015)

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### NEW RESILIENTMASS PLAN

**ResilientMass Plan**  
 2023 MASSACHUSETTS STATE HAZARD MITIGATION AND CLIMATE ADAPTATION PLAN  
 EXECUTIVE SUMMARY | September 2023

The ResilientMass Plan is Massachusetts' 2023 State Hazard Mitigation and Climate Adaptation Plan. It aims to ensure the Commonwealth is prepared to withstand, rapidly recover from, adapt to, and mitigate natural hazard events.

The plan is online at: [resilient.mass.gov](https://resilient.mass.gov)

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### NATURAL HAZARDS IMPACTING DUNSTABLE

HURRICANES / TROPICAL STORMS   FLOODING FROM PRECIPITATION   EXTREME TEMPERATURES   SEVERE WINTER WEATHER / NOR'EASTERS   LANDSLIDES   CHANGES IN GROUNDWATER

DROUGHT   WILDFIRE / BRUSHFIRE   EARTHQUAKES   TORNADOES   INVASIVE SPECIES

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### HURRICANES & TROPICAL STORMS

Tropical Storms: Maximum sustained wind speed 39 mph or higher  
 Hurricanes: Maximum sustained wind speed 74 mph or higher

**2012: Hurricane Sandy**  
**2017: Hurricane Jose**  
**2018: Hurricane Florence**  
**2019: Hurricane Dorian**  
**2020: Hurricane Isaias**  
**2021: Hurricane Henri**

*Upward trend in North Atlantic hurricane activity since 1970*

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### HURRICANES & TROPICAL STORMS

**Extreme Wind:** Damaging wind, often occurring during hurricanes and tropical storms, that can cause threat to life and property.

**High Wind Threats:**

Extreme	Sustained wind speeds greater than 58 mph
High	Sustained speeds of 40 to 57 mph
Moderate	Sustained speeds of 26 to 39 mph
Low	Sustained wind speeds of 21 to 25 mph
Very Low	Sustained wind speeds around 20 mph
Non-threatening	Breezy conditions

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### HURRICANES & TROPICAL STORMS

**Example Impacts:**

- Power outages
- Impaired public safety response
- Damage to critical facilities
- Disruption of energy services
- Crop damage
- Increased repair and maintenance costs
- Downed trees

HUMAN

INFRASTRUCTURE

NATURAL ENVIRONMENT

GOVERNANCE

ECONOMY

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### SEVERE WINTER STORMS

Severe Winter Storms: heavy snow, ice accumulation, freezing temps & wind chill  
 Nor'easter: Storms or wind blowing from the northeast

**March 2, 2018: Winter Storm Riley**  
**March 8, 2018: Winter Storm Quinn**  
**March 13, 2018: Winter Storm Skylar**  
**January 16, 2021: Winter Storm Uri**  
**February 1, 2021: Winter Storm Orlena**

*Nor'easters along the Atlantic coast are increasing in frequency and intensity*

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### SEVERE WINTER STORMS

**Example Impacts:**

- Isolation due to blocked roadways, storm debris, and power outages
- Increased risk of CO poisoning
- Hypothermia and frostbite
- Damage to roofs from weight of snow and ice
- Business revenue loss
- Damaged natural resources due to severe winds and flooding

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### SEVERE WINTER WEATHER/NOREASTERS


- The blizzard of 2013 left nearly **400,000 Massachusetts residents without power**.
- "Heavy blizzards are among the **most costly and disruptive** weather events for Massachusetts communities."
- Snowpack likely to **decrease annually**, but snowfall will occur with **heavy intensity**
- Extended power outages, cost of snow removal, repairing damages, and loss of business can have a **severe economic impact**.
- The elderly and infirmed** are populations of particular concern during these events

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1. Resident MA Climate Change Obligations for the Commonwealth, Science Review, 2019  
2. Massachusetts State Hazard Mitigation and Resilience Plan, 2018, p.428

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### FLOODING FROM PRECIPITATION



Flooding from Precipitation: Non-coastal flooding, including riverine flooding and stormwater flooding due to rain.

**Stormwater Flooding:**

- Poor and undersized drainage
- High amounts of impervious surface
- Undersized culverts

**Riverine Flooding:**

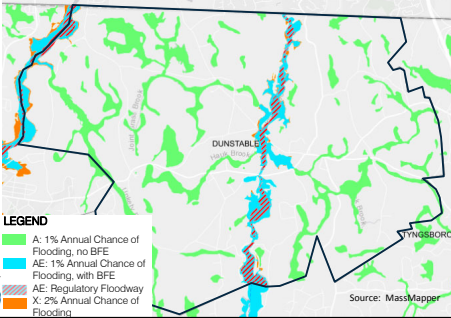
- Overtopping of banks along rivers and other waterbodies
- Can be caused by beaver activity

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### FLOODING FROM PRECIPITATION

**FEMA Flood Zones**  
Geographic areas that FEMA has defined according to varying levels of flood risk



500-year Storm: 0.2% annual chance of occurring  
100-year Storm: 1% annual chance of occurring  
25-year Storm: 4% annual chance of occurring  
10-year Storm: 10% annual chance of occurring

LEGEND

- A: 1% Annual Chance of Flooding, no BFE
- AE: 1% Annual Chance of Flooding, with BFE
- AE: Regulatory Floodway
- X: 2% Annual Chance of Flooding

Source: MassMapper

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### FLOODING FROM PRECIPITATION

**Flood Prone Areas in Dunstable**

- Unkety Brook (limited development in vicinity)
- Salmon Brook (limited development in vicinity)
- Upland till area – 3 intermittent streams that flow into Locust and Flint Ponds
- River Street
- Main Street
- Lowell and Forest Street

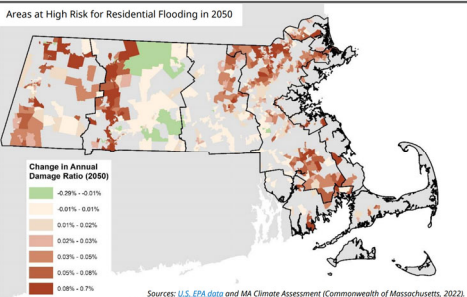
PRECIPITATION DURING HEAVY EVENTS IN THE NORTHEAST  
**INCREASED BY MORE THAN 70%**  
BETWEEN 1958-2010

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### FLOODING FROM PRECIPITATION

**Areas at High Risk for Residential Flooding in 2050**




Change in Annual Damage Ratio (2050)

- 0.01% - 0.01%
- 0.01% - 0.01%
- 0.01% - 0.02%
- 0.02% - 0.02%
- 0.02% - 0.03%
- 0.03% - 0.03%
- 0.03% - 0.04%
- 0.04% - 0.7%

Sources: U.S. EPA data and MA Climate Assessment (Commonwealth of Massachusetts, 2022).

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### FLOODING FROM PRECIPITATION

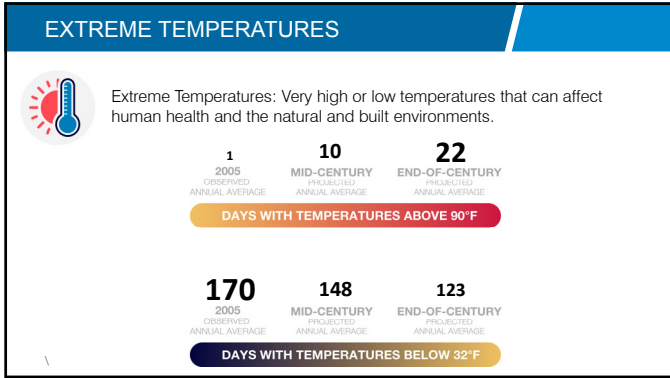


**Example Impacts:**

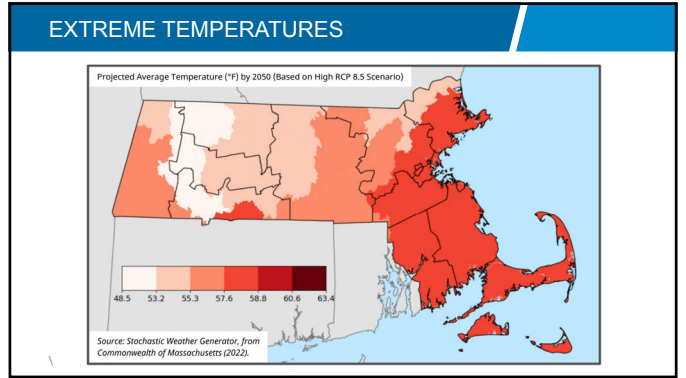
- Basement flooding
- Closed roadways
- Physical injury or death
- Risk of dam overtopping
- Economic loss from commercial structure damage and business interruptions
- Reduced ability to work, lost wages
- Demand for state and municipal government services could increase

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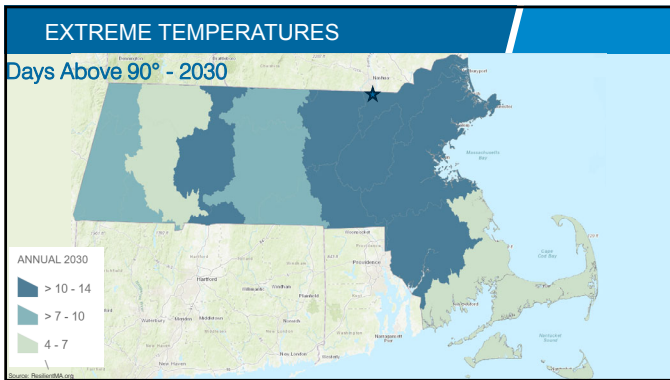
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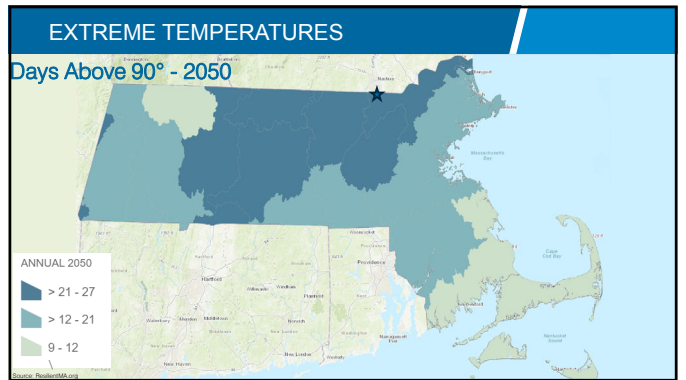
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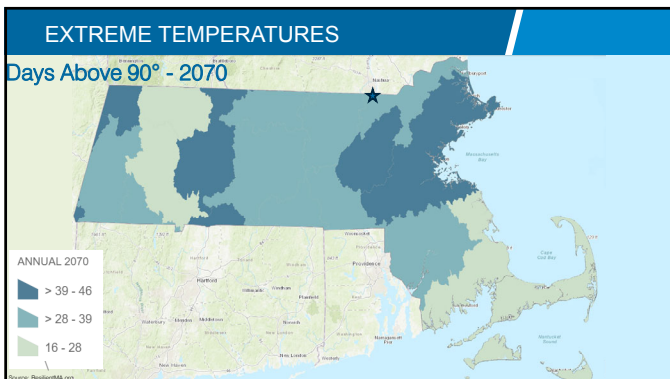
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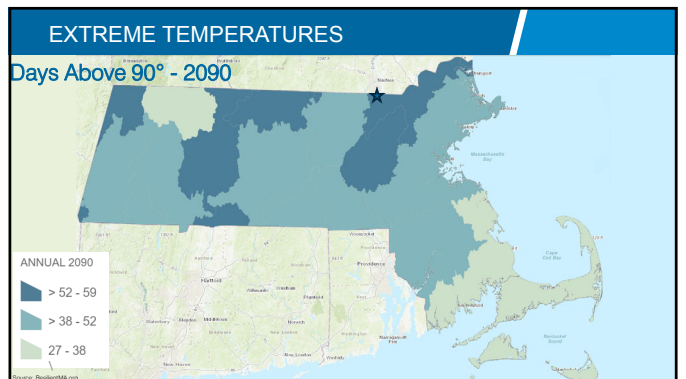
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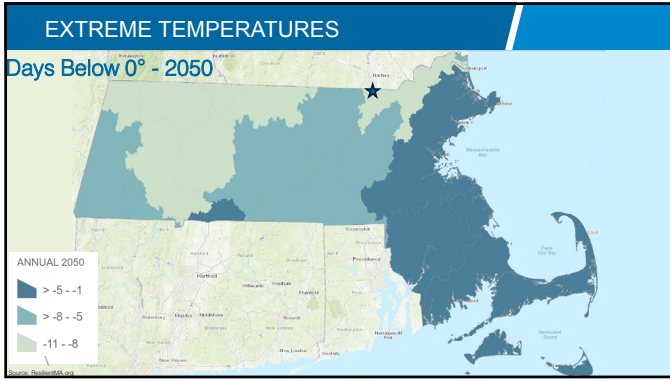
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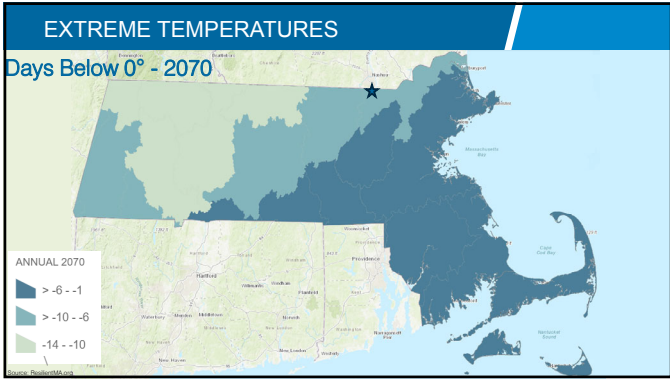
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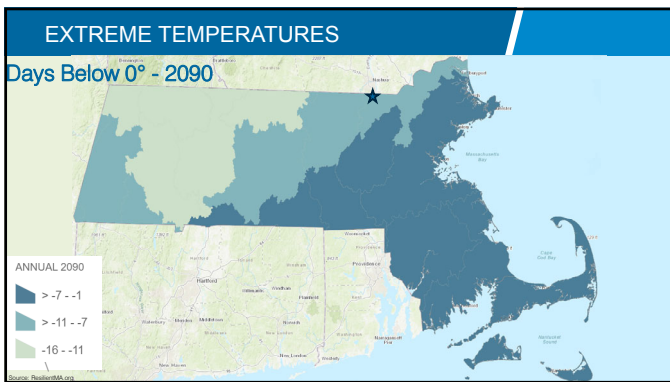
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### EXTREME TEMPERATURES

**Example Impacts:**

- Reduction in air quality
- Heat exhaustion or stroke
- Hypothermia or frostbite
- Decrease in agriculture productivity
- Loss of tree cover
- Pipes freezing and bursting
- Damage to rail and transit services
- Increased demand for state and municipal government services

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ECONOMY

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### INVASIVE SPECIES

Invasive Species: A non-native organism (disease, parasite, plant, or animal) that spreads and can cause harm to the environment, economy, or human health.

**Invasive species impacting Massachusetts include:**

- Asian long-horned beetle
- Emerald ash borer
- Dutch elm disease
- Phragmites

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### INVASIVE SPECIES

**Example Impacts:**

- New diseases and aggravated existing health problems
- Impacts to agriculture
- Destruction of natural resources
- Increased cost for management/removal
- Loss of vulnerable species, species of concern, and endangered species
- Decreased streambank stability
- Contribution to topsoil erosion

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## DROUGHT



Drought: A prolonged period of very low rainfall, leading to a shortage of water.

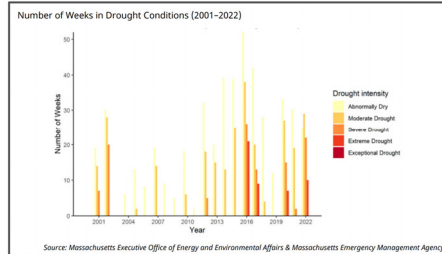
**Rising temperatures and changes in precipitation patterns are expected to increase the length, frequency, and intensity of droughts.**

**Reduced snowpack will affect the ability of groundwater and the availability of water for the growing period.**

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## DROUGHT



Source: Massachusetts Executive Office of Energy and Environmental Affairs & Massachusetts Emergency Management Agency


A level three, "extreme drought" was declared in Middlesex County from August to October, 2022.

The occurrence of droughts lasting 1 to 3 months could go up by as much as **75% over existing conditions** by the end of the century.


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## DROUGHT





**Example Impacts:**


- Decrease in water supply in private wells
- Increase in prices and water rationing for public water
- Decrease in agricultural productivity
- Loss of tree cover
- Decline in groundwater recharge
- Increased incidence of wildfires

  
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## CHANGES IN GROUNDWATER




Changes in Groundwater: Groundwater levels are the height of the water table below the ground surface. This height can change depending on a multitude of conditions.

**Changes in groundwater can occur as increases in groundwater levels, groundwater resource depletion, and contamination of groundwater by pollutions and salinity changes from sea level rise and flooding.**


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## CHANGES IN GROUNDWATER





**Example Impacts:**


- Flooding and damage to basements and below-ground structures
- Reduced access to and increased cost of drinking water
- Mobilization of contaminants
- Increased repair and relocation costs
- Damage to agriculture
- Damage to habitats, natural areas, and wetlands

  
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## BRUSHFIRE





Brushfire: An unplanned, destructive fire that spreads quickly over woodland, brush, or an urban environment.

**In 2019, nine fires occurred in Dunstable:**

- 7 structure fires
- 1 vehicle fire
- 1 other fire

**Total damage was \$68,801**

<https://www.mass.gov/doc/2019-mfrs-annual-report/download>

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## BRUSHFIRE

### Brushfire Hazard Areas

**Interface:** Structures are adjacent to wild vegetation

**Intermix:** Structures intermingle with wild vegetation

Legend:  
■ Interface  
■ Intermix

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## WILDFIRE

Wildfire: A fire that spreads rapidly through natural areas and are difficult to contain.

2022 Wildfire Hazard Potential for Massachusetts  
 Source: Map created by ERG using data from Northeast Midwest Wildfire Risk Explorer (2022)  
 Source: ResilientMass Plan (2023)

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## BRUSHFIRE/WILDFIRE

**Example Impacts:**

- Reduced air quality
- Increased risk to people who are unable to evacuate quickly
- People lacking fire insurance or resources to repair and replace damaged structures
- Loss of energy production and resources
- Damage to homes and infrastructure
- Forest degradation

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## EARTHQUAKES

Earthquake: A sudden or violent shaking of the ground as a result of volcanic activity or movements within the earth's crust.

**The probability of a magnitude 5.0 or greater earthquake centered in New England in a 10-year period is about 10–15%.**

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## EARTHQUAKES

Seismic Site Classification Map  
 NEHRP\* Classes  
 A  
 B  
 C  
 D  
 E  
 \* National Earthquake Hazards Reduction Program  
 Source: Pentrelli et al. (2023)  
 Source: ResilientMass Plan (2023)

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## EARTHQUAKES


**Example Impacts:**

- Emergency service delays and disruptions
- Direct health risks
- Damage to cultural resources
- Damage to infrastructure
- Economic loss
- Secondary impacts (liquefaction, flooding, landslide, fire)
- Physical changes to an ecosystem

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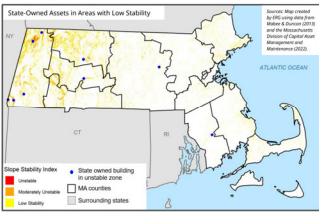
## LANDSLIDES/MUDFLOW



Landslide/mudflow: Sliding of a mass of earth, rock, or mud down a steep slope.

**Landslides are common in New England, but mostly limited to mountainous and hilly terrain.**


**Landslides are a low risk for northern Middlesex County and Dunstable.**



Source: ResilientMass Plan (2023)


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## LANDSLIDES/MUDFLOW




**Example Impacts:**

- Higher risk to people living near steep slopes or unstable soil
- Potential loss of life
- Damage to roads
- Loss of energy production and resources
- Reduced potability of water
- Increased demand for state and municipal services



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## TORNADOS



Tornados: A funnel-shaped vortex of violently rotating wind advancing beneath a large storm system.

**Massachusetts experiences an average of two to five tornadoes per year.**

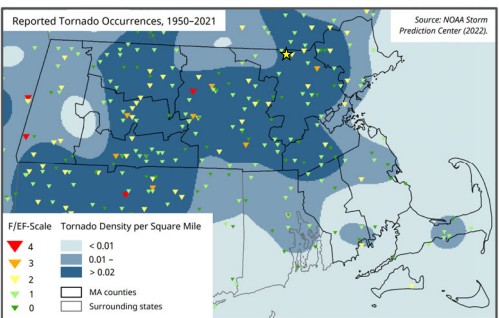
**Supercells: severe, long-lived thunderstorms are most likely to create a tornado.**

**It is unclear if tornado frequency will increase with climate change. (Some studies suggest there will be a decrease in the number of tornado days, but an increase in the number of tornadoes per day.)**

<b>TORNADO:</b> A violent, rotating column of air with winds ranging from 65 to over 200 mph	<b>TORNADO WATCH</b> CONDITIONS ARE FAVORABLE FOR TORNADOES TO DEVELOP	<b>TORNADO WARNING</b> A TORNADO HAS FORMED AND IS IMMINENT
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## TORNADOS



Source: NOAA Storm Prediction Center (2022)


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## TORNADOS



**Example Impacts:**

- Higher risk to populations who might have difficulty evacuating
- Severe injury or death
- Heavy building damage or destruction
- Significant recovery and clean up costs
- Tree/forest damage



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## RISK MATRIX

The screenshot shows the 'Community Resilience Building Risk Matrix' interface. It is divided into three main sections: 'Step 1: Top hazards' (top right, green), 'Step 2: Features' (middle left, blue), and 'Step 3: Strategies (Workshop 2)' (middle right, green). The interface includes a header with the website URL and a sub-header with instructions for using the tool.

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## RISK MATRIX: HAZARDS

This screenshot shows the 'RISK MATRIX: HAZARDS' section of the tool. It features a table with columns for 'Features', 'Location', 'Ownership', and 'Vulnerability or Strength'. The 'Features' column is highlighted in green, and the table is currently empty.

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## NATURAL HAZARDS IMPACTING DUNSTABLE

The infographic displays ten natural hazards with corresponding icons: HURRICANES / TROPICAL STORMS, FLOODING FROM PRECIPITATION, EXTREME TEMPERATURES, SEVERE WINTER WEATHER / NOR'EASTERS, LANDSLIDES, CHANGES IN GROUNDWATER, DROUGHT, WILDFIRE / BRUSHFIRE, EARTHQUAKES, TORNADOES, and INVASIVE SPECIES.

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## RISK MATRIX: FEATURES

This screenshot shows the 'RISK MATRIX: FEATURES' section of the tool. It features a table with columns for 'Features', 'Location', 'Ownership', and 'Vulnerability or Strength'. The 'Features' column is highlighted in green, and the table is currently empty.

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## RISK MATRIX: FEATURES

FEATURES	LOCATION	OWNERSHIP	VULNERABILITY OR STRENGTH
People	Town wide	State	Vulnerability
Structures	Multi- vs. Single-neighborhood	Town	Strength
Systems	Specific location (e.g. address, cross-streets)	Private	Both
Historic/ Cultural/ Natural Resources		Shared	
Economic & Community Activities			

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### COMMUNITY ASSETS

People Structures Systems

Historic / Cultural / Natural Resources Economic & Community Activities

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### RISK MATRIX: PEOPLE

- Older Adults
- Children
- Visiting Populations & Tourism
- Health Centers
- Schools
- Daycare
- Community members with disabilities
- Religious Centers

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### RISK MATRIX: PEOPLE

	Dunstable	Massachusetts
<b>Population</b>		
2021	3,369	6,984,723
2010	3,076	6,547,790
<b>Age</b>		
Under 18 years	21.0%	19.5%
65+ years	14.7%	17.4%
<b>Economics</b>		
Median household income	\$177,803	\$89,645
Persons in poverty	1.2%	10.4%
<b>Additional Information</b>		
Bachelor's degree or higher	51.6%	49.3%
With a disability	5.1%	11.7%
Limited English speaking households	0.0%	6.1%

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US Census Bureau, ACS 2011 Estimates

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### RISK MATRIX: STRUCTURES

- Emergency Services
- Drinking Water
- Dams
- Emergency Shelters
- Municipal Buildings
- Gas Stations
- Grocery Stores

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### RISK MATRIX: STRUCTURES

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### RISK MATRIX: SYSTEMS

- Drinking Water
- Stormwater
- Electrical & Communications Network and Infrastructure
- Culverts and Bridges
- Roadways
- Natural Gas
- Cable/Internet

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### RISK MATRIX: NATURAL, HISTORIC & CULTURAL

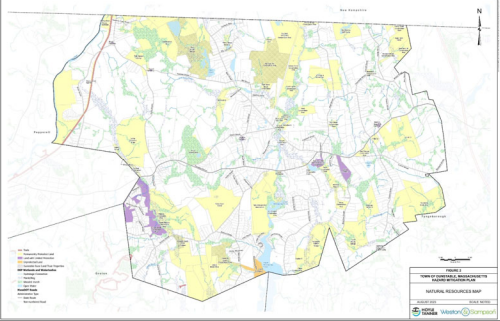
- Agriculture
- Historic Villages and Buildings
- Trails
- Community Gardens
- Open Space
- Places of Worship
- Public Art
- Memorials
- Parks
- Natural Resources
- Invasive Species



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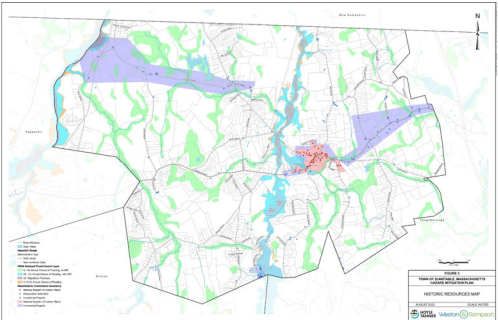
### RISK MATRIX: NATURAL RESOURCES



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### RISK MATRIX: HISTORIC RESOURCES



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### RISK MATRIX: ECONOMIC & COMMUNITY

- Town Businesses
- Parks
- Go-to places
- Tourism
- Local Events



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### RISK MATRIX: FEATURES

FEATURES	LOCATION	OWNERSHIP	VULNERABILITY OR STRENGTH
People	Town wide	State	Vulnerability
Structures	Multi- vs. Single-neighborhood	Town	Strength
Systems	Specific location (e.g. address, cross-streets)	Private	Both
Historic/ Cultural/ Natural Resources		Shared	
Economic & Community Activities			

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### AGENDA

- 01 Welcome, Introductions & Overview
- 02 Overview of Data Resource & Science
- 03 Large Group Exercise: Identify Top Hazards
- 04 Small Group Exercises: Risk Matrix Features & Characteristics
- 05 Report Out

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## SUMMARY & WRAP UP

- Questions?
- Next Steps
  - Next workshop: Mitigation Actions & Priorities
  - Thursday October 26, 8:30 AM to 12:30 PM
- Ways to stay involved
  - Public Meeting: November 2023
  - Listening Session: Spring 2024
  - Review Draft Plan: Spring 2024

# thank you

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