2018 Massachusetts State Hazard Mitigation and Climate Adaptation Plan

Approved September 2018

First-of-its-Kind Integrated State Plan

Innovative, first-of-its-kind statewide plan that fully integrates traditional hazard mitigation plan with climate change adaptation plan

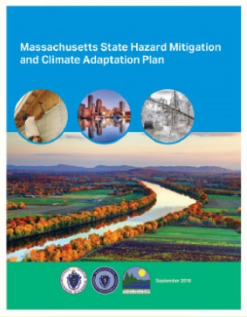
First-of-its-Kind Integrated State Plan

Updates 2013 Massachusetts State Hazard Mitigation Plan

Fulfills requirements for Executive Order 569 climate adaptation plan

Eligibility for Federal Disaster Mitigation Funding

As a condition of receiving non-emergency Stafford Act assistance and Federal Emergency Management Agency (FEMA) disaster mitigation grants, states are required to have an approved State Mitigation Plan following the criteria established in 44 CFR §201.4, including requirements to address the projected effects of climate change on hazard risks.

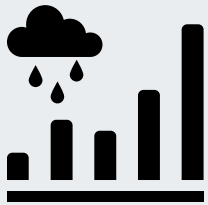
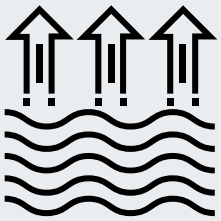


Compliance with Governor Baker's Executive Order 569

Executive Order 569 directs the Executive Office of Energy and Environmental Affairs (EOEEA) and the Executive Office of Public Safety and Security (EOPSS) to coordinate efforts across the Commonwealth to strengthen the resilience of communities, prepare for the impacts of climate change, and proactively plan for and mitigate damage from extreme weather events, including publishing a climate adaptation plan that outlines a statewide strategy to address these impacts through adaptation and resiliency measures and policies.

Climate change is already intensifying natural hazards

Projected impacts to the Commonwealth:

CLIMATE CHANGES	RELATED NATURAL HAZARDS	PROJECTIONS BY THE END OF THIS CENTURY
Changes in Precipitation 	• Inland flooding • Drought • Landslide	• Annual precipitation: Increase up to 16% (+7.3 inches) • Days with rainfall accumulation 1+ inch: Increase up to 57% (+4 days) • Days with rainfall accumulation 2+ inches +: Increase up to 100% (+1 day) • Consecutive dry days: Increase 18% (+3 days) • Summer precipitation: Decrease
Sea Level Rise 	• Coastal flooding • Coastal erosion • Tsunami	• Ocean elevation: Increase 4.0 to 10.5 feet along the Massachusetts coast

Note: This plan also assesses earthquakes, but there is no established correlation between climate change and earthquakes.
Source of Climate Change Projections: Northeast Climate Adaptation Science Center at the University of Massachusetts, Amherst.

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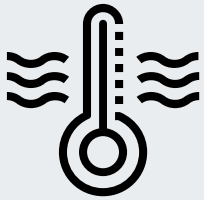
CLIMATE CHANGES	RELATED NATURAL HAZARDS	PROJECTIONS BY THE END OF THIS CENTURY
Rising Temperatures 	• Average/extreme temperatures • Wildfires • Invasive species	• Average annual temperature: Increase up to 23% (+10.8 ºF) • Days/year with daily minimum temperatures below freezing: Decrease up to 42% (-62 days) • Winter temperatures: Increase at a greater rate than spring, summer, or fall • Long-term average minimum winter temperature: Increase up to 66% (+11.4 ºF) • Days/year with daily maximum temperatures over 90 ºF: Increase by up to 1,280% (+64 days) • Growing degree days: Increase by 23% to 52%
Extreme Weather 	• Hurricanes/tropical storms • Severe winter storms/nor'easters • Tornadoes • Other severe weather	• Frequency and magnitude: Increase

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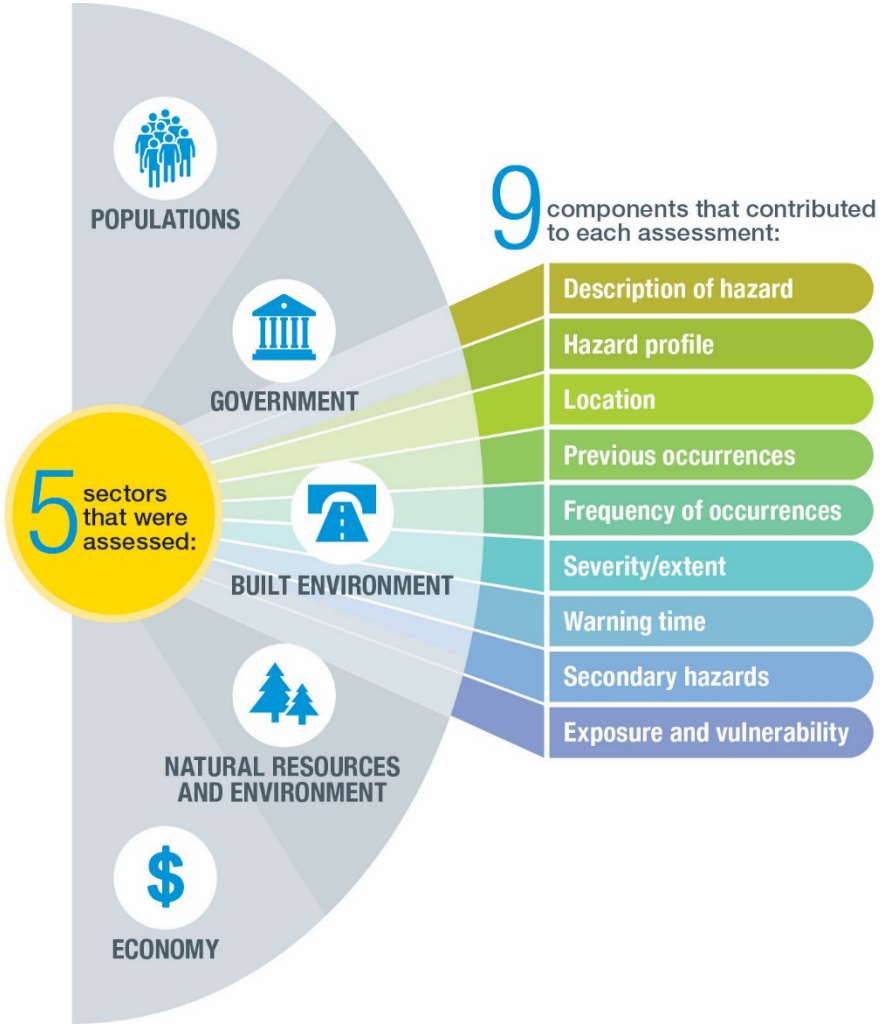
Our risks and vulnerabilities

- State resources and agencies will be affected by climate change and exacerbation of natural hazards
- Degree of exposure and consequences will vary across the Commonwealth

The risk assessment:
- Includes **five key sectors**
- Incorporates **best scientific data** available
- Includes information from **~80 state agency** climate change vulnerability assessments



Our risks and vulnerabilities

Inland flooding

- Areas that are highly developed or within the floodplain are most vulnerable
- Caused an average of over $9.1 million in damages/year between 2007 and 2014
- Essex County experienced the most FEMA flood disaster declarations from 1954–2017
- More intense and frequent downpours will result in more frequent flooding and greater area exposed

Drought

- Entire commonwealth is vulnerable and impacts on all sectors are widespread
- Chance of a Watch level drought occurring in any given month: 8%
- Frequency and intensity projected to increase during the summer and fall

Landslide

- Areas with unstable slopes, such as around Mount Greylock and the US Highway 20 corridor near Chester, are most vulnerable
- Secondary impacts such as road closures can have a significant impact on communities
- More frequent and intense storms will result in more frequent soil saturation conditions that are conducive to landslides

Coastal Flooding

- An average of six events/year have occurred in the last decade
- Highest concentration of events has occurred in Eastern Plymouth County
- Sea level rise will increase the frequency and severity of both routine tidal flooding and storm-related coastal flooding

Coastal Erosion

- Exacerbated by storm surge and development
- Highest erosion rates occur in Eastham, Orleans, and Yarmouth
- Rising waves, tides, and currents will contribute to increased levels of future coastal erosion

Tsunami

- Likelihood of occurring is low (one every 39 years on the east coast), but impact could be extensive
- Sea level rise may increase the area potentially impacted

Average and Extreme Temperatures

- An average of two extreme heat and 1.5 extreme cold weather events/year have occurred over the last two decades
- Young and elderly populations and people with preexisting health conditions are especially vulnerable to heat and cold
- By the end of the century there could be 13–56 extreme heat days during summer

Wildfire

- Massachusetts is likely to experience at least one event/year with noteworthy damages
- Barnstable and Plymouth Counties are most vulnerable due to their vegetation, sandy soils, and wind conditions
- There are over 1,200 state-owned buildings in identified wildfire hazard areas
- Projected increase in seasonal drought and warmer temperatures will increase the risk for wildfire

Invasive species

- Risk to native or minimally managed ecosystems has increased as dispersion of exotic species has increased
- Changes in temperature and precipitation may increase chances of a successful invasion of non-native species

Our risks and vulnerabilities

Hurricanes/Tropical Storms

- Average occurrence of one event every two years
- Coastal areas are more susceptible to damage due to high winds and tidal surge, but all locations are vulnerable
- Vulnerable populations include those who may have difficulty evacuating
- Warmer oceans will likely result in increased intensity of storms

Tornadoes

- Massachusetts experiences an average of 1.7 tornadoes/year
- The most tornado-prone areas of the state are the central counties
- Over 200 critical facilities and 1,500 government facilities are in identified tornado hazard zones
- Increase in frequency and intensity of severe thunderstorms may increase risk of tornadoes

Severe Winter Storm/Nor'easter

- Currently the most frequently occurring natural hazard in the state
- High snowfall and ice storms are greater in high elevations of Western and Central Massachusetts, while coastal areas are more vulnerable to nor'easters
- Over 1,000 state-owned facilities are in coastal locations that are vulnerable to nor'easters
- Increases in the intensity and frequency of extreme weather events as the climate changes may include more nor'easters and higher precipitation amounts during winter storms

Other Severe Weather

- The coastal zone is most frequently impacted by high-wind events
- Massachusetts experiences 20–30 thunderstorm days/year, high winds occur more frequently
- Road closures and power outages are common impacts
- Expected increase in the intensity and frequency of severe weather events

Earthquakes

- Cannot be predicted
- Probability of a magnitude 5.0 or greater earthquake centered in New England is about 10–15% in a 10-year period
- Tall buildings, high population, and soil characteristics contribute to vulnerability

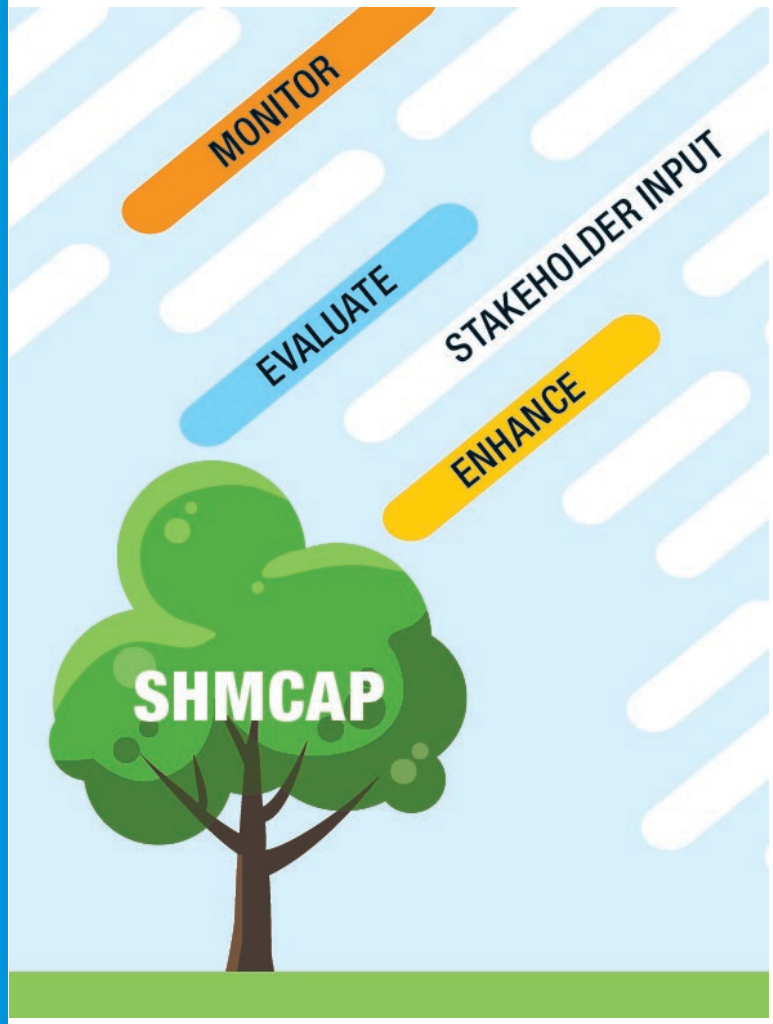
Our Strategy
Goals

1. Enhance Commonwealth's resiliency to natural hazards and climate change by **integrating programs and building institutional capacity**.
2. Minimize impacts of natural hazards and climate change with **forward-looking policies, plans, and regulations**.
3. Understand vulnerabilities and risks and develop immediate and long-term **risk reduction strategies for current and future conditions** using best available science.
4. Increase resilience of state and local government, people, natural systems, built environment, and economy by investing in **performance-based solutions**.
5. Support implementation of this plan through increased **education, awareness, and incentives** for action for state agencies, local governments, private industry, non-profits, and general public.

Our Strategy
Actions

- Identified for all Executive Offices and more than 20 state agencies
- Address at least one of the primary climate change interactions and associated climate change impacts identified in risk assessment
- Include specific details, such as completion time frame, lead agency, agency priority score, and possible funding sources
- Vetted by tiger team

A Living Plan



SHMCAP is a living document.

- Will maintain relevancy, evaluate progress, and improve long-term resiliency
- Evolve as specific hazard mitigation and climate adaptation actions are implemented
- Will respond to ongoing dialogue with stakeholders

What's Next?

SHMCAP was FEMA Approved and published in September 2018

To promote SHMCAP:

- Standalone Executive Summary
- Hosted on resilient MA Climate Change Clearinghouse

To implement and maintain SHMCAP:

- Establish Resilient MA Action Team
- Establish Action Tracker
- Implement actions
- Maintain and update the plan