

# Town of Duxbury Climate Vulnerability Assessment and Action Plan

April 2018



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## EXECUTIVE SUMMARY

Climate change is the most compelling environmental, economic, and social issue of our time. Duxbury contains a rich fabric of cultural and natural assets the community through time has had the foresight to protect. Duxbury Beach is a critically important resource affording shoreline protection to the Town and neighboring communities, supporting threatened and endangered species habitat, enabling diverse recreation opportunities, and supporting economic vitality. However, Duxbury routinely experiences coastal flooding and inundation with even just a lunar high tide. Projected sea level rise and changes in intensity of storm and precipitation events compel the need to assess the vulnerability of Duxbury's people and places as well as plan for protecting its future. This report summarizes the latest climate risks, evaluates the vulnerability of Duxbury's critical infrastructure and resources, and creates an action for incremental steps toward greater resilience and community vibrancy in an uncertain future.

### Climate Change: Our Uncertain Future

2017 was the second warmest year on record and the period from 2006-2015 was the warmest decade since temperature has been measured. This has translated into an increase in the growing season by 10 days since 1980<sup>1</sup> and model temperature projections anticipate more frequent heat waves.<sup>2</sup>



Duxbury could experience five to 23 days over 90° by 2050 and nine to 58 days over 90° by 2100.<sup>2</sup>

Depending on various greenhouse gas emission scenarios, warming temperatures will cause ocean expansion and melting glaciers resulting in sea level rise. Sea level has risen by 11 inches over the last century and scientists anticipate this rate to accelerate.



Duxbury could experience an additional eight inches sea level rise by 2030 and six and a half feet by the end of the century.<sup>1,3</sup>

In the last 50 years, precipitation in the Northeast US increased 71% in the amount of rain that falls in the top 1% of storm events. Projections suggest an increase in total precipitation, changes in precipitation patterns, and increased frequency of extreme storms such as hurricanes and nor'easters.<sup>3</sup>



Duxbury could experience an increase of five inches of precipitation annually by 2050 and six inches by 2100 with the greatest increase during the winter.<sup>1</sup>



Flooding during Winter Storm Riley, March 2018.

<sup>1</sup> U.S. Environmental Protection Agency. 2016. Climate Change Indicators in the United States, 2016. Fourth meditation. EPA 430-R-16-004. [www.epa.gov/climate-indicators](http://www.epa.gov/climate-indicators) Northeast Climate Science Center.

<sup>2</sup> Northeast Climate Science Center. UMass Amherst. Massachusetts Climate Change Projections. December 2017

<sup>3</sup> Sea Level Rise Study. *The Towns of Marshfield, Duxbury, Scituate, MA*. 2013. Kleinfelder.

## Duxbury's Strength and Vulnerability

Projected climate impacts are an intensification, increased frequency, or geographic expansion of existing challenges. Duxbury already has significant planning, experience and strengths to bring to these challenges.



Duxbury's seniors comprise 16% of the population and are the residents at greatest risk to climate change. Many seniors are vulnerable to extreme heat and coastal flooding. But the Town is well prepared with programs that connect seniors to programs, cooling centers, and resources for their well-being and safety.



Duxbury is at risk to increased occurrences of vector-borne diseases with warmer winters, standing flood waters, and extended growing seasons. But it has significant strengths in preventing heat-related illness with 50% tree canopy cooling the town, mitigating air pollutants, capturing stormwater, and sequestering carbon. There is a nominal risk to toxic exposure from flooding of hazardous materials storage sites.



Duxbury has over 1,200 acres of salt marsh meadows providing critical shoreline protection. The majority are healthy, intact ecosystems with the exception of the Bay Farm marsh showing signs of degradation and erosion. However, since 1995, Duxbury has experienced 1,000-acre loss of eelgrass meadow, an important natural shoreline protection system. Duxbury also contains 14,474 acres of State-designated BioMap2 Aquatic Core habitat demonstrating viable wetland systems able to withstand the impacts of climate change.



Duxbury's water comes from wells and the Town of Marshfield. It is vulnerable to scarcity during periods of drought, aquifer salinization from sea level rise, and well infrastructure damage/salinization from coastal flooding and sea level rise. Three of its shared waste water system leaching fields are located within a 1% Annual Chance Flood Zone and the flood risk increases greatly with sea level rise in 2038 and 2088.



Duxbury has suffered 423 flood insurance claims totaling nearly \$5.5 million. There are two dams vulnerable to hurricane storm surge and sea level rise in 2038. No critical facilities are located in SLR 2038 or 2088 except the Powder Point Bridge and 22 dams are located in a 1% Annual Chance Flood. Businesses vulnerable to sea level rise are valued today at over \$12 million.

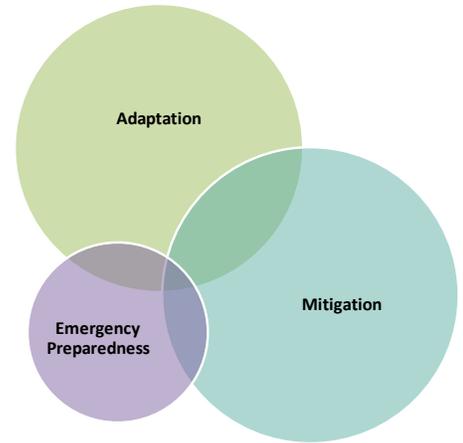


There 68 historic structures at risk to flooding in a 1% Annual Flood Chance Flood and approximately 54 historic structures vulnerable to sea level rise in 2088 with a category 1 hurricane.

## Duxbury's Climate Action Plan

This climate action plan builds upon previous completed plans for hazard mitigation, coastal flooding, emergency management and open space protection. It takes an adaptive management approach that combines emergency preparedness, mitigation, and adaptation. The Town's Climate Vulnerability Steering Committee created the prioritization of suggested climate actions agreed upon four guiding principles:

1. Balance growth, preservation, and resilience to enhance our vibrant community and ensure its livability into the next century.
2. Invest in infrastructure that promotes multiple benefits that address climate risks as well as safety, beautification, economic growth, natural resource protection, and public health.
3. Leverage the resources of multiple disciplines and sectors within municipal departments and across sectors to generate layers of resilience.
4. Approach Duxbury's climate resilience as an ongoing effort to ensure the Town's vibrancy and livability which considers changing climatic conditions.



## Duxbury is committed to Resilience

The top climate action priorities were those receiving the most significant concern and sense of urgency for Duxbury's future livability and were recommended to be implemented as soon as possible. A subset of the climate action priorities are as follows:

- Incorporate climate resilience into all local and regional plans as well as capital improvement plans.
- Update Climate Action Plan every five years.
- Hire a consultant to fully assess the risk of salinization to Duxbury's Drinking Water.
- Prepare a list of key utility facilities that require critical power restoration and include the physical locations of the facilities to the power company during an outage to expedite electricity restoration.
- Identify location of and create a plan for vulnerable populations with limited mobility (seniors, handicap, and individuals without vehicles) or limited English proficiency during emergency response that may need transportation.
- Collaborate with and provide financial support to the Duxbury Beach Reservation, Inc. for ongoing beach nourishment, sacrificial dunes, sand fences, road improvements, and other coastal infrastructure investments to ensure Duxbury remains protected from high energy storm surge into the future while protecting an important recreational and economic amenity.
- Collaborate with the residents and businesses in the near- and long-term most vulnerable areas to examine potential zoning, regulatory, incentive, mitigation or cooperative-based approaches to dealing with the issues that sea level rise presents for existing structures and infrastructure, exploring funding opportunities to examine feasibilities of alternatives and to implement best practices.

