Municipal Vulnerability Preparedness Workshop
Town of Essex, MA April 5, 2018

Day-long Community Resilience Building Workshop
Led and facilitated by Kristen Grubbs, Environmental Planner
Ipswich River Watershed Association

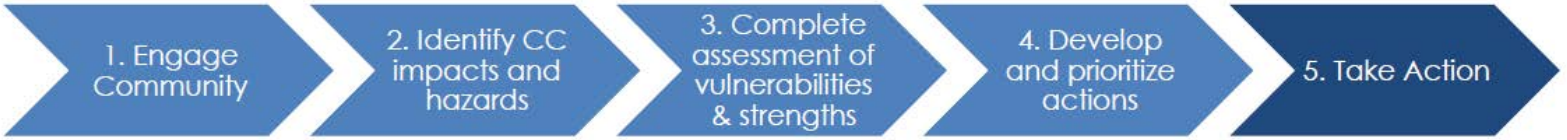
IPSWICH RIVER
WATERSHED ASSOCIATION

Commonwealth of Massachusetts

Executive Office of Energy and Environmental Affairs

Municipal Vulnerability Preparedness Program

State and local partnership to build resiliency to climate change



The Municipal Vulnerability Preparedness (MVP) program helps communities in Massachusetts to:

- Define extreme weather and natural and climate related hazards
- Identify existing and future vulnerabilities and strengths
- Develop and prioritize opportunities to take action to reduce risk and build resilience

Community Resilience Building

- led by Ipswich River Watershed Association
- all day workshop with data, science, presentations, and discussions
- 35 attendees
- 3 small discussion groups
- facilitated by staff from Mass Audubon, Metropolitan Area Planning Council, and Mass Bays/8 Towns & the Great Marsh

Community Resiliency Building Workshop Matrix

Step 1: We identified the Top 4 Hazards for Essex

Coastal storm surge & sea level rise

Inland flooding

Extreme cold/winter storms/snow

Heat/fire/drought

Community Resilience Building Workshop Risk Matrix

H-M-L priority for action over the Short or Long term (and Ongoing)
V = Vulnerability S = Strength

Features	Location	Ownership	V or S	Coastal Flooding				H - M - L	Short Long Ongoing
Infrastructural									
Societal									
Environmental									

Extreme cold/winter storms/snow

Here's where you can track power outages being reported in Massachusetts

Strong winds and heavy snow from the nor'easter have brought down trees and power lines in the state, knocking out power to thousands of homes and businesses.

A police vehicle blocks a road near downed power lines, Thursday in Natick. –*Steven Senne / AP*


Coastal storm surge & sea level rise

Inland flooding

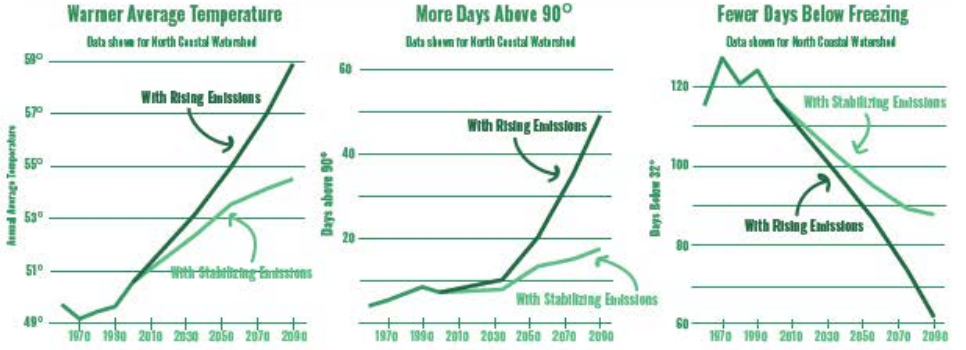
Heat/fire/drought

Climate Change

Essex and the North Coastal Watershed

Our climate is regulated by "greenhouse gases (GHGs)" that trap heat, including carbon dioxide, methane, and nitrous oxide. In the past century, the combustion of fossil fuels, our primary energy source in the age of industrialization, has increased the concentration of GHGs in the atmosphere, which has caused global temperatures to rise. If people stabilize GHG emissions, global temperatures may rise more slowly. If emissions continue increasing at the same rate, we can expect more extreme changes in the climate.

Higher Temperatures



As the climate changes, Essex can expect...

More Large Storm Events

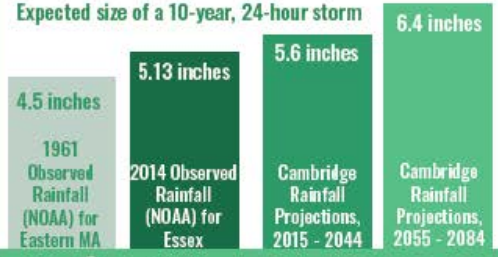
In addition to increasing annual precipitation, climate change will bring more large storm events.

This will lead to more stormwater flooding, as most stormwater drainage has been sized to 1961 standards.

10-year, 24 hour storms refer to the 24-hour rainfall total for the biggest storm expected in a 10-year period.

Storm drains built for 1961 standards will be inadquate

Expected size of a 10-year, 24-hour storm



More Annual Precipitation

But less in the summer and fall...

While total annual rainfall and large rainfall events are projected to increase, summer and fall rain is projected to decrease slightly.

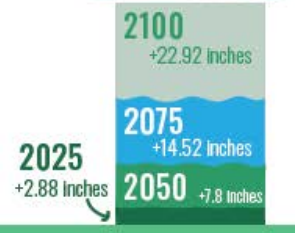
And more frequent droughts...

Due to the combined effects of earlier snowmelt, less rain, and higher temperatures, summer and fall droughts may become more frequent.

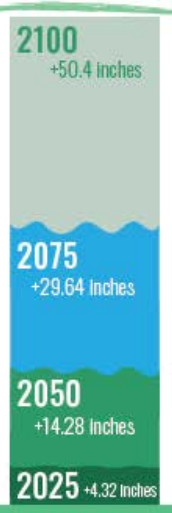
Rising Seas

Projections for sea level rise vary dramatically depending on future greenhouse gas emissions, melting ice in the arctic, ocean currents, and other factors. The charts below represent high, intermediate high, and intermediate low scenarios.

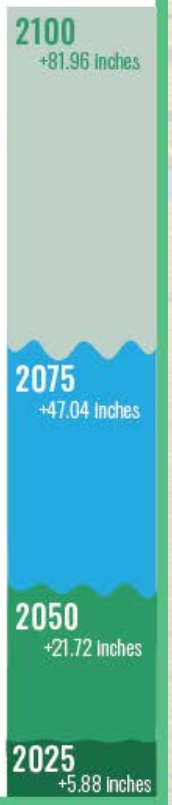
Intermediate low sea level rise scenario



Intermediate high sea level rise scenario



Highest sea level rise scenario



Sources
BioMap2: Conserving the Biodiversity of Massachusetts in a Changing World; Massachusetts Department of Fish and Game; Massachusetts Department of Environmental Protection; MassGIS (Bureau of Georgraphic Information); National Land Cover Database (NLCD)

MAPC

Essex
Social Vulnerability

Social vulnerability refers to social, economic, demographic, or health factors that may make groups of people less resilient to climate change impacts. Certain vulnerabilities tend to be correlated; for example, older adults are more likely to have a disability and live alone than younger adults.

Our strategies for adapting to a changing climate should protect these populations in addition to our natural and built environment.

Who is most at risk from climate change impacts?

People who may be more susceptible to negative health effects: These can include older adults, young children, pregnant women, people with disabilities, and people with pre-existing health conditions, as they are more likely to be physically vulnerable to the health impacts of extreme heat and poor air quality caused by climate change. Individuals with physical mobility constraints, such as people with disabilities and seniors, may need additional assistance with emergency response.

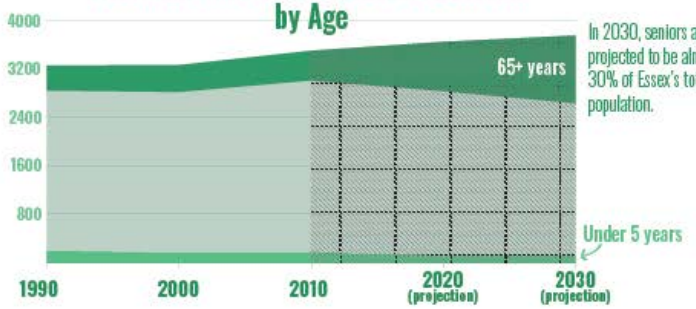
People who may have more difficulty adapting to, preparing for, or recovering from extreme weather events: Socioeconomic characteristics such as income and race can influence vulnerability to climate change. Low-income people are often more susceptible to financial shocks, which can occur after extreme weather and which can impact financial security and the ability to secure safe shelter and meet medical needs. Social isolation can also influence vulnerability, as it limits access to critical information, municipal resources, and social support systems. People at the most risk for social isolation include those living alone and people with limited English language proficiency.

People who live or work in vulnerable locations: Historic or predicted floodplain, urban flooding locations, areas prone to wildfire, heat islands, neighborhoods prone to power outages. Outdoor workers, first responders, those working in hot indoor environments.

Older Adults and Young Children

Adults over 65 and children under 5 are more likely to develop health problems on very hot days or during heat waves. Older adults are also more likely to have disabilities or mobility contraints and may need additional assistance during emergencies. They are also more likely to live alone than younger adults.

Essex Recent and Projected Population by Age

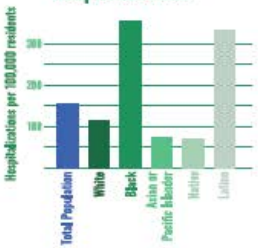


In 2030, seniors are projected to be almost 30% of Essex's total population.

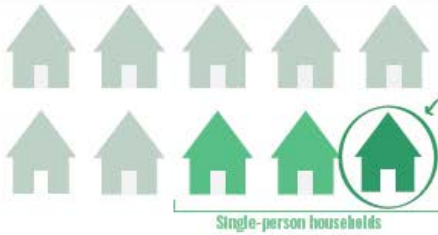
People with Health Conditions

People who are already in poor health are more likely to be harmed by hot weather and resulting poor air quality.

Massachusetts Asthma Hospitalizations



People Living Alone



As of 2010, approximately 30% of Essex households consisted of someone living alone.

About one-third of people living alone were over 65.

Communities of Color

Particular racial or ethnic groups may also be more likely to have certain social vulnerabilities than others. For example, Black and Latino populations have a much higher rate of asthma hospitalizations than other groups.

Essex is becoming more diverse...

Although over 96% of the town's population is white...

Populations of color have increased since 1990.

11x
African American population increase since 190

2.5x
Asian population increase since 1990

3x
Latino population increase since 1990

People Who Work Outside

People who primarily work outside, such as parcel delivery people, construction workers, or farmers, may be at added risk from extra exposure to high heat and poor air quality.

Low Income Households

Households that earn low incomes are more susceptible to financial shocks triggered by extreme weather, which can cause long-lasting financial insecurity and can make it hard to secure safe shelter, sufficient food, and medical care.

29.6% ± 8%
Households in Essex that are low-income

*A four-person household earning less than $54,200 is considered low-income

MAPC

Sources:
American Community Survey (ACS) 2012-2016; United States Census 1990, 2000, 2010; MAPC Projections; Massachusetts Department of Public Health Asthma Data, 2008-2012

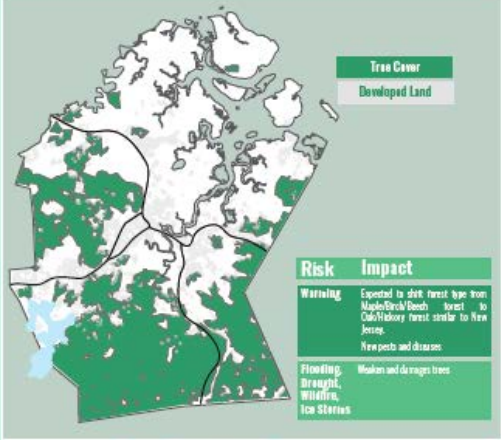
Essex

Natural Resources

Natural Resources lessen climate impacts by absorbing and storing carbon dioxide and by serving vital protective functions. Forests, open space, wetlands, rivers, and streams protect drinking water quality and quantity, provide flood control, and give relief from extreme heat. Healthy ecosystems are more resistant to stresses from a changing climate and better able to protect against heat and flooding.

Trees

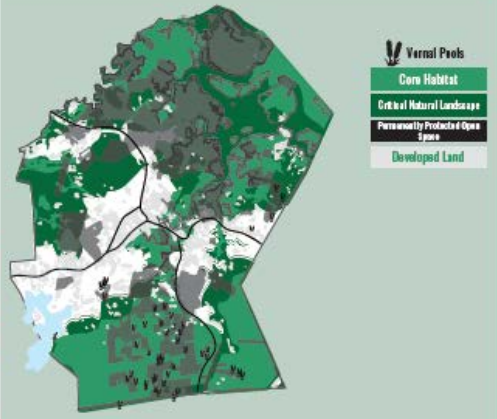
Trees are important in mitigating the impact of heat waves. According to the EPA, suburban areas with mature trees are 4-6 degrees cooler than new suburbs without trees. Shaded surfaces can be 25-40 degrees cooler than the peak temperatures of unshaded surfaces. Trees also absorb remarkable quantities of precipitation. Research has shown that a typical medium-sized tree can intercept as much as 2,380 gallons of rain per year (USDA Forest Service).



Risk	Impact
Warming	Expected to shift forest type from Maple/Birch/Beech forest to Oak/Hickory forest similar to New Jersey. New pests and diseases
Flooding, Drought, Wildfire, Ice Storms	Weaken and damages trees

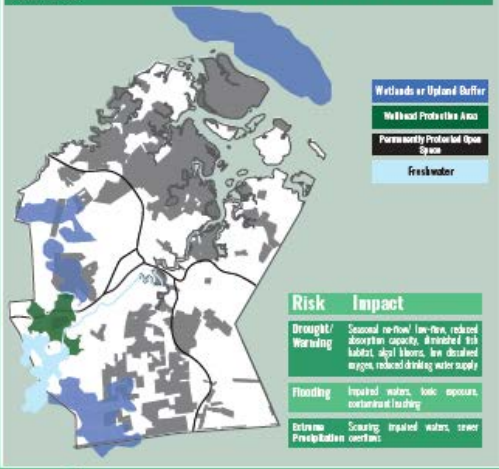
Terrestrial Resources

The areas of Core Habitat and Critical Natural Landscape in Essex demonstrate a contiguous track of exemplary ecosystems that weave a fabric of resilience. These areas can endure climate change stressors to continue to provide important ecosystem services such as flood control, clean water, clean air, species diversity, and cooling temperatures. They also sequester and store carbon dioxide. Vernal pools, or small seasonal wetlands, are crucial habitats for species such as salamanders.



Freshwater Resources

Essex contains, healthy, intact freshwater wetland systems that sustain critical ecosystem functions in climate change. These ecological assets protect drinking water quality and quantity, provide flood control, and maintain overall ecosystem health for climate resilience.

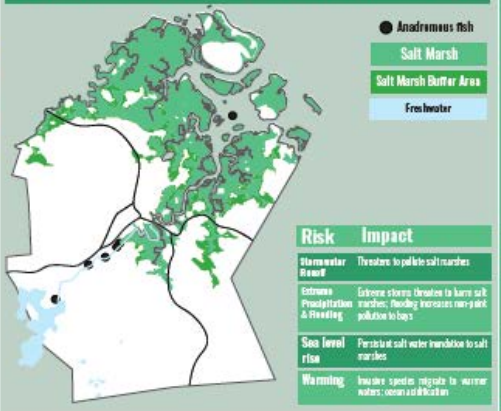


Risk	Impact
Drought/ Warming	Seasonal no-flow/ low-flow, reduced absorption capacity, diminished fish habitat, algal blooms, low dissolved oxygen, reduced drinking water supply
Flooding	Impaired waters, toxic exposure, contaminant leaching
Extreme Precipitation	Scouring, impaired waters, sewer overflows

Coastal Resources

Salt marshes and estuaries are complex and highly productive ecosystems generally resilient to wide variations in temperature, salinity, and inundation. Ecological benefits of salt marshes include: floodwater storage, storm surge protection, carbon sequestration/storage, nutrient removal, water quality improvements, and commercial fish and shellfish habitat.

Coastal bays host critical ecosystems for coastal resilience: shellfish growing areas, eel grass meadows, anadromous fish (saltwater fish that spawn in fresh water), and resident and migratory birds, some of which are threatened and endangered.



Risk	Impact
Stormwater Runoff	Threatens to pollute salt marshes
Extreme Precipitation & Flooding	Extreme storms threaten to harm salt marshes; flooding increases non-point pollution to bays
Sea level rise	Persistent salt water inundation to salt marshes
Warming	Invasive species migrate to warmer waters; ocean acidification

Sources
MassGIS (Bureau of Geographic Information)- BioMap2: Conserving the Biodiversity of Massachusetts in a Changing World; Massachusetts Department of Fish and Game; Massachusetts Department of Environmental Protection; MassGIS (Bureau of Geographic Information)- National Land Cover Database (NLCD); Trust for Public Land; MAPC; University of Vermont

Step 2: We identified Important Community Features:

What are our biggest STRENGTHS relative to weather-related impacts?

- Infrastructure that facilitates a vibrant economy
- Unique or rare habitats and species
- Natural areas that provide recreational benefits
- Services that natural systems provide
- Human infrastructure that assists in our health and safety
- Social & community resources

Step 2 continued: Important Community Features

What features and resources in Essex are most VULNERABLE to weather-related impacts?

- Infrastructure: e.g. buildings, roads, bridges, wells
- Society/people: e.g. elderly citizens living in flood zones
- Environment/natural resources: e.g. salt marsh, clam beds

Step 3: We identified actions to address these vulnerabilities

For example: Main Street Causeway

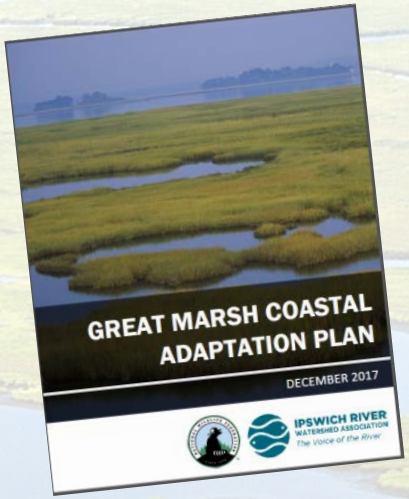
Vulnerabilities:

- Tidal flooding
- Storm surge flooding
- Sea level rise

STRATEGIES & ACTIONS:

- Causeway reconstruction in 2012
- Emergency vehicles
- Engage business owners
- Green Infrastructure & Low Impact Development
- Explore alternate routes: Apple Street?
- Long-term: raise road?
  move businesses to higher ground?

A Menu of Adaptation Strategies



Problems facing towns	Nature-based solutions
Riverine flooding	Open space preservation
Coastal flooding	
Coastal erosion	Ecosystem restoration
Stormwater flooding	Low Impact Development
Heat island effects	

Findings: Highest Priority Actions

Environmental Features

1. **Salt marsh restoration and management –** including protection of shellfish, addressing erosion, study of sediment and movement of sand throughout the marsh) (17)
2. **Mouth of the Essex River –** study of sediment and movement of sand (14)
3. **Beaver management (12) –** plan for municipal stewardship
4. **Chebacco Lake Watershed -** protection of ecosystem, wildlife habitat, and water supply (8)
5. **Forest management**, both public and private lands, and resiliency to address disease and threats of forest fire (4)

Findings: Highest Priority Actions

Infrastructural Features

1. **Apple Street –** planning and management so as to keep it a safe and useable alternate transportation route when Causeway/Route 133 floods (21)
2. **Safe Drinking Water** - study of vulnerabilities related to assuring safe and plentiful drinking water in the future (10)
3. **Causeway/Route 133 Resiliency Planning**, including Main Street bridge repairs – working with the State and with Business groups (20)
4. **Multi-faceted emergency warning system** for the public (6)

Findings: Highest Priority Actions

Societal Features

1. **Municipal outreach & education program**, including Preparedness Training (led by strategic planning committee) (18)
2. **Emergency services & sheltering plan, supplies & communications plan** (14)
3. **Adoption of Great Marsh Plan** (11)
4. **Create database of vulnerable citizens** (7)
5. **Business Community & Chamber of Commerce,** education and knowledge sharing, including best practices (5)

Attendee workshop evaluations:

What was your favorite part of today's workshop?

"Knowledge that was only superficial now comes to the forefront."

"Very interesting day. Learned a lot. Great energy in the groups."

"Getting fresh ideas because of the cross-section of people in the room who were involved – different viewpoints."

"Working together for our town & community."