



HAZARD MITIGATION CURRICULUM FRAMEWORK

Developed in conjunction with the Center for Coastal Studies' Mapping Storm Tide Pathways in the Six Towns of Martha's Vineyard: Assessing Coastal Resiliency to Storms and Sea Level Rise: CZM Coastal Resiliency Grant 2020-2022

Center for Coastal Studies

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Mapping Storm Tide Pathways in the Six Towns of Martha's Vineyard: Assessing Coastal Resiliency to Storms and Sea Level Rise: Hazard Mitigation Curriculum

Introduction

The Center for Coastal Studies education program has worked for over four decades to bring relevant science-based education programs to students on Cape Cod and beyond. For the past eleven years, the Center has worked with local area schools developing a robust water quality in-school program at seven area schools. The lessons developed herein are part of the Center's Mapping Storm Tide Pathways in the Six Towns of Martha's Vineyard: Assessing Coastal Resiliency to Storms and Sea Level Rise: Coastal Resiliency Grant funded project and utilize the scientific expertise and data from the project in development of a curriculum on the topics of coastal storms, sea level rise, climate change and hazard mitigation. The lessons developed herein will be delivered by the Center's education director at one Martha's Vineyard middle schools in year two of the coastal resiliency grant, but are designed so that educators at this middle school and other schools on Martha's Vineyard can utilize the curriculum in future classes. The lessons herein serve as a framework for teaching students about local coastal process and sea level rise impacts along the towns on Martha's Vineyard. Each lesson contains an introduction discussion question, to connect the student to coastal changes along Martha's Vineyard. Activities are created to introduce the students to the subject areas of coastal processes, sea level rise, coastal hazards and climate change. Students should have a basic understanding of storms and sea level rise, so the curriculum is best suited for the part of the year after which those topics have been covered, which is part to the Massachusetts Curriculum Frameworks for 7th grade science. Each lesson incorporates a conclusion activity which ranges from classroom discussions and presentations to projects the students can continue outside of school. These activities, discussion questions and extension activities serve as recommendations for teachers for future years.



7th GRADE LESSON PLANS

Edgartown Middle School

Hazard Mitigation from the Impacts of Storms and Sea Level Rise

Time: 50 min.

Standard: 7.MS-ESS3-2. Obtain and communicate information on how data from past geologic events are analyzed for patterns and used to forecast the location and likelihood of future catastrophic events. Examples of data typically analyzed can include the locations, magnitudes, and frequencies of the natural hazards.

Question: How can using sea level rise data combined with the Center's Storm Tide Pathways App, predict coastal flooding and how could towns use this app to mitigate future coastal hazards.

Background: Students should have a basic understanding of storms, coastal inundation and sea level rise.

Materials: [Center for Coastal Studies Storm Tide Pathway App](#), [NOAA Sea Level Rise Viewer](#), [NOAA Tides and Currents](#)

Introduction: Martha Vineyard's geography and low-lying coasts make it vulnerable to coastal flooding during storm events. During the winter months Martha's Vineyard coastline is routinely affected by Nor'easters and other winter storm events. Martha's Vineyard, though not generally directly impacted by tropical hurricanes is more likely to be impacted than Cape Cod to the north. The famous hurricane of 1938 crossed Long Island a little over a hundred miles to the west, and Hurricane Sandy in 2012 affected parts of Martha's Vineyard causing coastal erosion and storm surges. Storm intensity, both winter storms and hurricanes are thought to be increasing due to global climate change, and thus the impacts from those storms on the coast. In addition, sea level rise caused by thermal expansion of the ocean place more coastal structures at risk now and into the future.

Main Lesson:

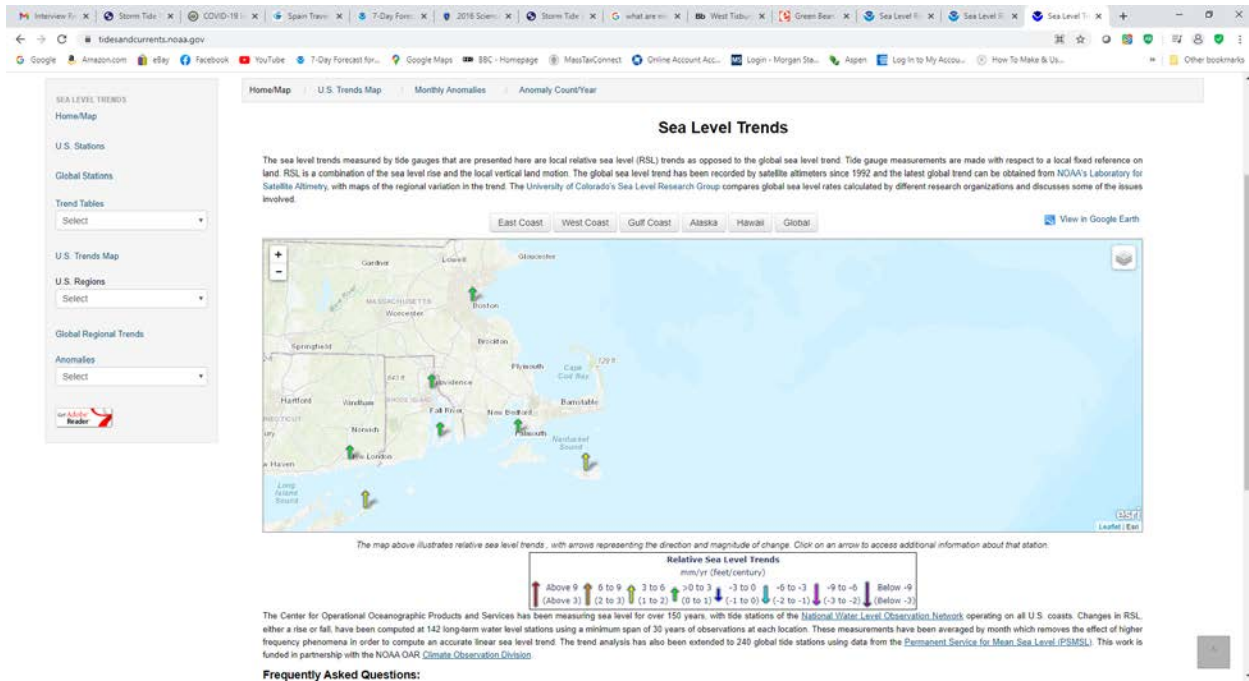
Have a brief discussion on storm events that students remember and the impacts on their town/towns. In March 2018, there were three major storm events that affected Martha's Vineyard, that students may recall. Hurricane force winds whipped through the island and tides were at extreme high levels.



Discussion Questions:

1. Do you recall major storm events in your town?
Ex. March 2018 series of three Nor'easters.
2. If so, do you recall what damage was caused during those storms i.e. to roads, beaches, buildings, etc?

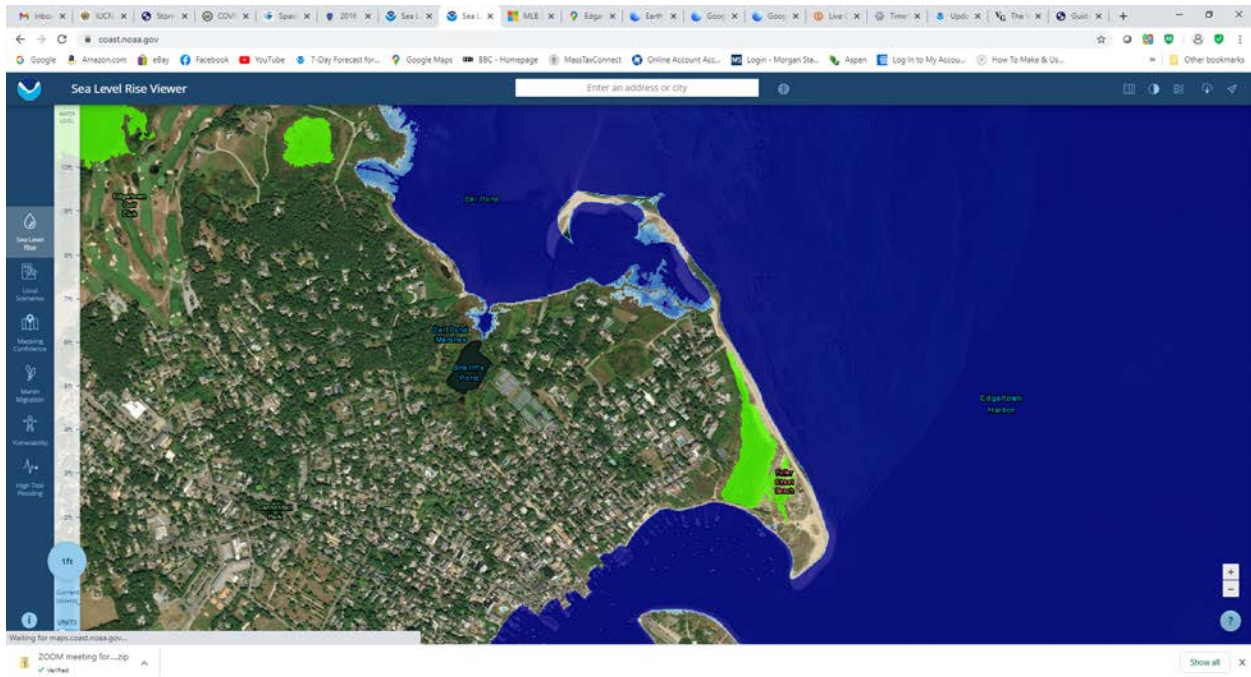
Next the students will be introduced to sea level rise using NOAA's tide and current webpage looking at current trends in sea level rise. Relative sea level rise is measured by tidal gauges located at coastal locations around the world. Sea level is not rising uniformly around the globe. Students will be presented with the relative pace of sea level rise for Martha's Vineyard. Also, it is important to make the distinction here of long-term sea level rise, which is caused by factors such as thermal expansion of the oceans, and short-term sea level rise associated with storm events.



Using NOAA's Sea Level Rise Viewer, focusing on Edgartown, illustrate what happens to surrounding areas as sea level rises. NOAA's Sea Level Rise Viewer is a web mapping tool to visualize community-level impacts from coastal flooding or sea level rise (up to 10 feet above average high tides). Photo simulations of how future flooding might impact local landmarks are also provided, as well as data related to water depth, connectivity, flood frequency, socio-economic vulnerability, wetland loss and migration, and mapping confidence. Explain to students that gradual sea level rise is a natural process but during storm events sea level can be much higher than the normal high tide



mean water. Using the Sea Level Rise Viewer, focus in the Eel Pond and Sheriff Pond areas and see where flooding occurs as sea level rises.

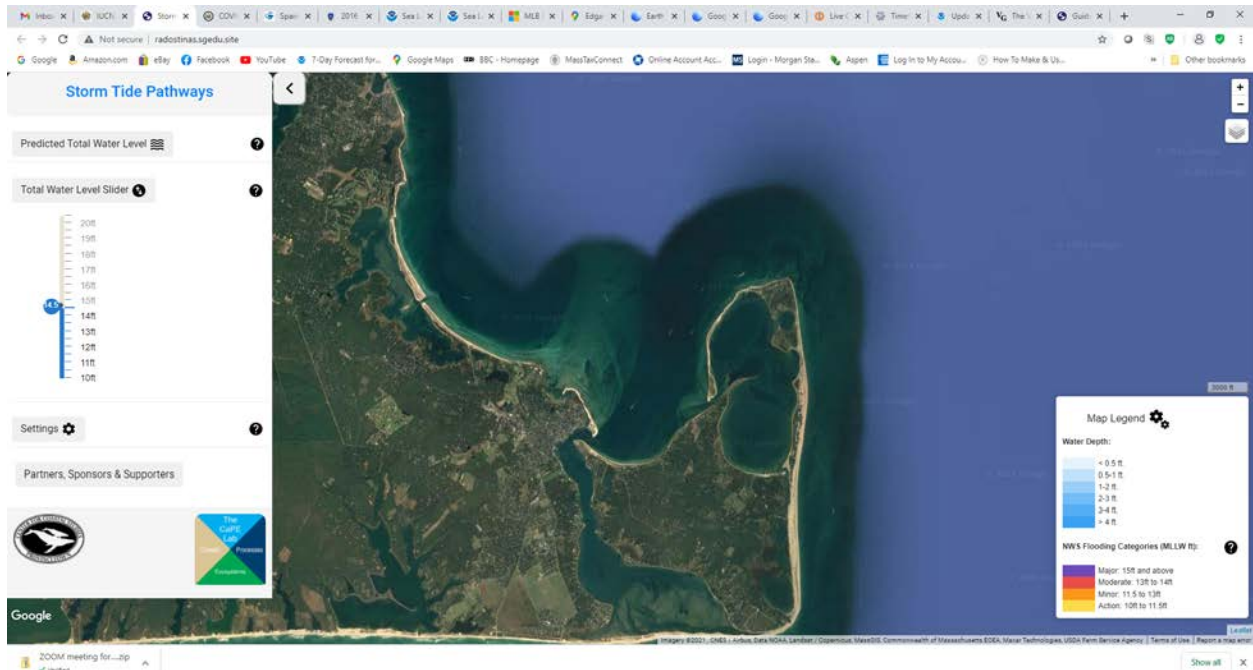


1. Which locations are most vulnerable to sea level rise?
Ex. Eel Pond but particular around Sheriff Pond.
2. What happens between 2 feet and 4 feet of sea level rise?
Ex. At 2 feet flooding is there is no flooding at Sheriff Pond, but, at 4 feet sea level rise the pond is flooded as well as the surrounding area.
3. How would the town be able to mitigate flooding during rises of 5 feet or more, potentially during winter storms?
Ex. Perhaps building structures, but where would you put them.

Discuss that while this tool is important for looking at where flooding would occur due to certain sea level heights, whether due to storm events or over time, it is not fine scale enough to indicate which “pathways” the waters would use to flood.

Students will now be introduced to the Center’s Storm Tide Pathway App, a web-based app that pinpoints pathways for flooding. The App uses the same flooding data from NOAA’s Sea Level Rise Viewer, but at a finer scale which pinpoints exact locations or “pathways” the flood waters would take.





Note* Currently the Center does not have Stormtide Pathway Data for Martha's Vineyard, but it is expected to be completed in year two of grant and before the class.

4. While using the Storm Tide Pathways App, list the number of locations where flooding will occur at different sea levels. The average mean high water is 10 feet, so above 10 feet indicates extreme high tide events or storm events.

| Sea Level Height | Number of Flooding Pathways |
|------------------|-----------------------------|
| 10' | |
| 10.5' | |
| 11' | |
| 11.5' | |
| 12' | |
| 12.5' | |
| 13' | |
| 13.5' | |



Flooding—the covering or submerging of normally dry land with a large amount of water.

Natural Hazards—all the atmospheric, hydrologic, geologic (especially seismic and volcanic), and wildfire phenomena that, because of their location, severity, and frequency, have the potential to affect humans, their structures, or their activities adversely.

