Mapping the Future of Our Coasts

Grade: Grade 6
Place of Focus: Carson Beach
Citizen Science Protocol: Intertidal Monitoring: GLOBE Observer (Capture Land), Bivalve Quest, & Quadrats

Massachusetts Curriculum Framework for Science and Technology/Engineering Standards

- **3-LS4-4**. Analyze and interpret given data about changes in a habitat and describe how the changes may affect the ability of organisms that live in that habitat to survive and reproduce.
- **4-ESS1-1**. Use evidence from a given landscape that includes simple landforms and rock layers to support a claim about the role of erosion or deposition in the formation of the landscape over long periods of time.
- **4-ESS2-2**. EARTH'S SYSTEMS. Analyze and interpret data from maps to describe patterns of Earth's features.

Learning Objectives

By the end of the field lesson, students will:

- Identify and estimate land cover within a selected area, compare estimates to satellite measurements
- Identify and log coastal species, particularly bivalves
- Set quadrats for coastal species identification

Pre-Visit Learning

Prior to the site trip, students should understand:

- How climate change and sea level rise transform the topography of a place, particularly the Boston shore.
  - Watch videos about cartography and how people make maps.
  - View satellite maps from Google Lapse, discuss how the Boston shore has changed over time.
- What citizen science is and how elementary students can contribute to science research.
  - Review examples of Citizen Science (i.e., iNaturalist).
- How the app GLOBE Observer and particularly the Land Cover feature works.
  - Visit observer.globe.gov and review steps prior to the visit.
- What information the Bivalve Survey looks for and how it collects the data.
  - Review the survey beforehand and learn about types of bivalves.
- What makes a good picture for scientific protocols such as GLOBE Observer and Bivalve Quest.
  - Learn about photo composition and scientific photography.
- Extension: How climate change affects species and particularly marine species.
  - Using materials such as those found in the Stone Living Lab, identify species that are at risk in the Boston Harbor.

Essential Questions

- What is climate change?
- What is biodiversity?
- What types of species reside in coastal ecosystems?
- How are coastal species and environments affected by climate change?
- How can maps be used to keep track of changes over time?

Guiding Questions

1. How will climate change affect Carson Beach?
2. What is citizen science and how can elementary students contribute to science research?
3. What type of landforms, animals, and vegetation can we find at Carson Beach?
4. What species are at risk due to climate change? (Extension)

Field Visit Preparations

Time

- Whole Unit: 6 weeks (6 lessons). I see students once a week for 48 minutes.
- Field Trip Visit Duration: 3 hours (including commute time). Students work in small groups performing 4 different activities. Each activity lasts approximately 20 minutes and there is time included for rotations and a short break.

Materials and Supplies

- Activity 1
  - 4 small tablets with a functioning version of GLOBE Observer: Land Cover (one for every group of two-three students). Alternatively, we will use 4 larger iPads for data collection.
  - 4 laminated copies of the Land Identification Field Guide/Checklist
  - Pencils

(see next page)

Materials and Supplies (cont.)

- Activity 2
  - 5 meter string (from school)
  - 4 small tablets with the link to the Bivalve Survey. Alternatively, 4 Paper prototypes of the Bivalve Quest app and data will be input after.
  - Clip boards
  - Pencils
- Activity 3
  - 4 hula-hoops **or** 4 strings attached to form 4 different circles of about a 1 meter diameter each
  - 4 Laminated copies of Intertidal Biodiversity Monitoring Field Guide
  - Checklist
  - Clip boards
  - Pencils
- Activity 4
  - Drawing paper
  - Clip boards
  - Pencils, markers

Logistics

- Carson Beach has a parking space, but we might not need it with a bus drop-off and pick-up.
- Public bathrooms and water fountains are available at the Carson Beach bathhouse.
- The ride from the school to the place takes approximately 20-25 minutes. We will reach Carson Beach by 11:00 a.m. so that we have time to register at least Part A (app protocol) at noon.
- We should be sure to incorporate time for unstructured beach exploration.

Scientific Protocol

The students will complete four different activities during the field trip, which will be set up at separate stations. The first three activities are related to intertidal monitoring (GLOBE Observer, Bivalve Quest, Quadrats) and the last one is related to land identification (drawing).

A. GLOBE Observer App: This activity requires the use of the app GLOBE Observer, specifically for the Land Cover feature. This feature is designed to help citizen scientists record what is on the land around them (trees, water, etc). In general, land-cover maps are helpful for assessing risks from natural disasters and defining habitats, among other uses.

B. Bivalve Quest: This protocol requires students to make observations within a 5-meter area to help document the bivalves of the Boston Harbor and determine their abundance in the given area. These bivalves are molluscs, and they include species such as oysters, mussels, clams, and scallops.

C. Quadrat: This activity requires participants to choose a random focus area by the sea and identify the species they find within a framed circle built with rope. They will reference a field guide, provided in advance, to identify the species.

D. Drawing: This activity is not based on a scientific protocol, but it is an artistic outlet that will help students to solidify ideas gathered from protocol A and give them tools for the elaboration of their 3D maps once they are back to school. In the drawing activity, students visually record with paper and pencil what they see in a chosen 100-meter area, determined for protocol A: GLOBE Observer App.

Field Visit Outline

Introduction

- **9:30 a.m:** Departure from school.
- **10:00 a.m:** Arrival at Carson Beach. We will gather by the trees to discuss expectations for the visit, the specific rotations, and the area that will be covered. We will have 4 groups of students, each with approximately 12 individuals. Each group will remain with one assigned chaperone. The specific activities will be reviewed with the chaperones before the visit. Rotations are indicated by letters. There will be approximately 5 minutes during each rotation to switch materials and locations. Halfway through the rotations, students will have a short 10-15 minute break for snacks and individual exploration.

Group norms and safety rules:

1. Stay out of the water – We will not be swimming or going in the water, but there will be plenty to do up on the beach.
2. Sight and Sound – Explain that we are remaining near the area we are currently standing unless you are accompanied by an adult to the restroom. If you can't "see or hear" an adult, you are too far away.
3. Call and Response – Review the class' call and response or attention signal.
4. Track the Speaker or PROPS – Respect others when they are speaking so everyone can participate and learn.
5. (If students seem particularly interested in rock skipping/throwing) – We cannot throw/skip rocks during the activities, but if there is good behavior and expectations are met, a rock skipping session before lunch will be allowed.
6. Materials stay at each station. Turn them in as you receive them.

Learning Tasks

A. GLOBE Observer App: This protocol includes:
- Identifying a 100-meter area (50 meters in each direction).
- Taking a picture.
- Selecting the types of land-cover seen and estimating their respective percentages (this part could be optional).
- Compare measurements to satellite measurements.

B. Bivalve Quest: This protocol requires students to:
- Set up their rope traversal to the water.
- Take a picture of their work area.
- Find different molluscs and try to identify them using the field guide.
- Complete the citizen science protocol using either the app or the paper prototype.

C. Quadrat: This activity requires participants to identify which species they find in a framed circle space, chosen at random, by the sea, and compare their findings with the field guide reference provided in advance. This activity requires participants to:
- Set up their hula-hoop/circle on a random area.
- Use their Field Trip guide to identify their findings.
- Use a checklist to report their findings (could be a scavenger hunt).

D. Drawing: This is meant to be a relatively quick sketch that registers the overall landscape and some other details, such as the plants and animal species present on it. This 2D drawing will be used later to help them build the 3D maps.

- **10:30 a.m:** Rotation 1 starts (A).
- **10:55 a.m:** Rotation 2 starts (B).
- 11:20 a.m: Break
- **11:40 a.m:** Rotation 3 starts (C).
- **12:05 p.m:** Rotation 4 starts (D).
- **12:30 p.m:** Time to debrief (whole group).
- **12:50 p.m:** Departure.
- **1:20 p.m:** Arrival at school/lunchtime.

Reflection

- Group debriefing (10 min)
  - Prompts may include:
    - What were some of the key observations made in their group's selected sites?
    - How did their group work together? What went well, what could use some improvement?
    - For second, third, and fourth visits: What are some trends you have noticed in your site observations? How have the areas changed?
  - Share 2D drawings with the group
- Collect materials and prepare for dismissal (10 min)
  - Students check their site locations and make sure nothing has been left behind (Leave No Trace Principles)

Post-Visit Learning

The field visit lesson plan outlined above will be completed four times throughout the school year to analyze seasonal changes in landscape and biodiversity, as well as to predict future trends. Students will also use their field observations and drawings to build 3D map versions of Carson Beach, including species they found in the area. Throughout this process, students will collaborate in groups to gather their data and create their maps/models.

Full Unit Outline

In this unit, students explore the concept of climate change and how it impacts coastal species and topography. The field visit lesson will allow students to explore the local biodiversity of Carson Beach and plot changes in plant and animal species over time.