Climate Change and Wetlands

A field investigation focusing on the effect of sea level rise on wetland plant communities

Objective

To explore the effect of marsh elevation on plant distribution in wetland systems.

National Science Education Standards:

9-12 A. Science as Inquiry

- Abilities necessary to do scientific inquiry
- Understandings about scientific inquiry

9-12 C. Life Science

- Interdependence of organisms
- The behavior of organisms

9-12 F. Science in Personal and Social Perspectives

- Environmental quality
- Natural Resources

Background
Wetlands are areas that are inundated with water for a long enough period of time to support plants that are adapted to live in wet conditions. Some wetlands are tidal, meaning the water level rises and falls with the tides each day, while other wetlands are non-tidal. In addition, wetlands can contain freshwater, saltwater, or brackish water—a mixture of fresh and salt water.

Wetlands are very important for a number of reasons. They provide food and habitat for many living organisms and they serve as a nursery for juvenile fish and crabs. Wetlands serve as filters, preventing excess nutrients and sediments from entering bodies of water. They also store flood water, acting as a buffer when floods or storm surges occur. In addition, wetland plants hold together soil, helping to prevent erosion.

In recent decades, sea level rise has been affecting wetlands throughout the world, including those within Blackwater National Wildlife Refuge (www.fws.gov/blackwater/). These wetlands are only 1.5 meters above sea level or less. This means that as sea level rises, the wetlands become increasingly inundated with water. Over time, areas once occupied by wetlands become open water and all of the important services provided by wetlands are lost.

During this field trip, students will explore salt marshes and discuss what makes them such valuable ecosystems. Students will conduct scientific fieldwork to determine how slight changes in elevation affect plant communities. Finally, we'll take a look at topographic maps of our area to determine how sea level rise might affect marshes.

Materials
Rope
Meter stick
Line level
Quadrat
Stakes
Meter tape
Plant identification book/key
Data sheet
Marking pencil

Procedure
A marsh transect will be constructed for this field exercise. Students will divide into groups of 3-4. Each group will collect plant community and marsh elevation data at stations along the transect and record the information on the data sheet provided below.

Part A. Field Experimental Procedure

Constructing the Transect

1. Choose a site that shows obvious changes in elevation. Place a stake in the ground marking the beginning of the transect at the edge of the marsh nearest the water. Tie a line to the stake approximately 1 m. above the surface of the ground.

2. Using a meter tape, place the next stake in the ground at a 3 m. distance (or whatever distance you establish) from the first stake. Stretch the line between the two stakes and level it using a line level.

3. Continue placing stakes at your chosen intervals and level the line until you have traversed the area you want to study.

Note: Depending on the age group, you could either have your students lay out the transect themselves, or you could have a chosen site prepared beforehand.

Transect

A B C D E F

|----- 3 m. -----|----- 3 m. -----|----- 3 m. ----|----- 3 m. -----|----- 3 m. -----|

|---------- 18 m. ----------|

Collecting Plant Community Data

1. Measure the distance from the line to the ground using a meter stick. Record on the *Individual Group Data Sheet* to the nearest centimeter (cm). NOTE**:** Be sure to measure from the string to the surface of the sediment.

2. Randomly drop the quadrat on the ground within 0.5 m. of the stake. Be sure to pull any leaves, stems, etc. from underneath the quadrat so that you can accurately determine the number of plants within that study area.

3. If you must share the quadrat, mark each corner with a flag; then pass it on to the next group.

4. Identify the following, and record it on the data sheet:
- plant species (If you have trouble identifying a plant, take a small sample of it back to identify in the classroom)
- the total number of each plant species within the quadrat

PART B. Data Analysis

1. Each group will report their data (marsh elevation and plant species and number of each species) for their transect interval to the other groups and record all information on the data sheet provided below.

2. Draw a cross section of the transect on the *Summary Data Sheet*, combining the data provided by each group. The cross section should be drawn to scale, including measurement units (cm/m) and labeled with the following items:

a. Interval ID (A, B, C, D, etc.)
b. Distance from line to ground at each interval (centimeters)
c. Plant species observed at each interval and the number of each

Individual Group Data Sheet

Location:_____
___

Interval ID: _____
(Indicates sampling interval along transect, e.g. A, B, C, D…)

Investigators:_____

Distance from the ground to the line: _____ (cm)

List Plant Species and Total Numbers

SHRUB species TOTAL #

_____

_____

_____

_____

_____

HERBACEOUS species TOTAL #

_____

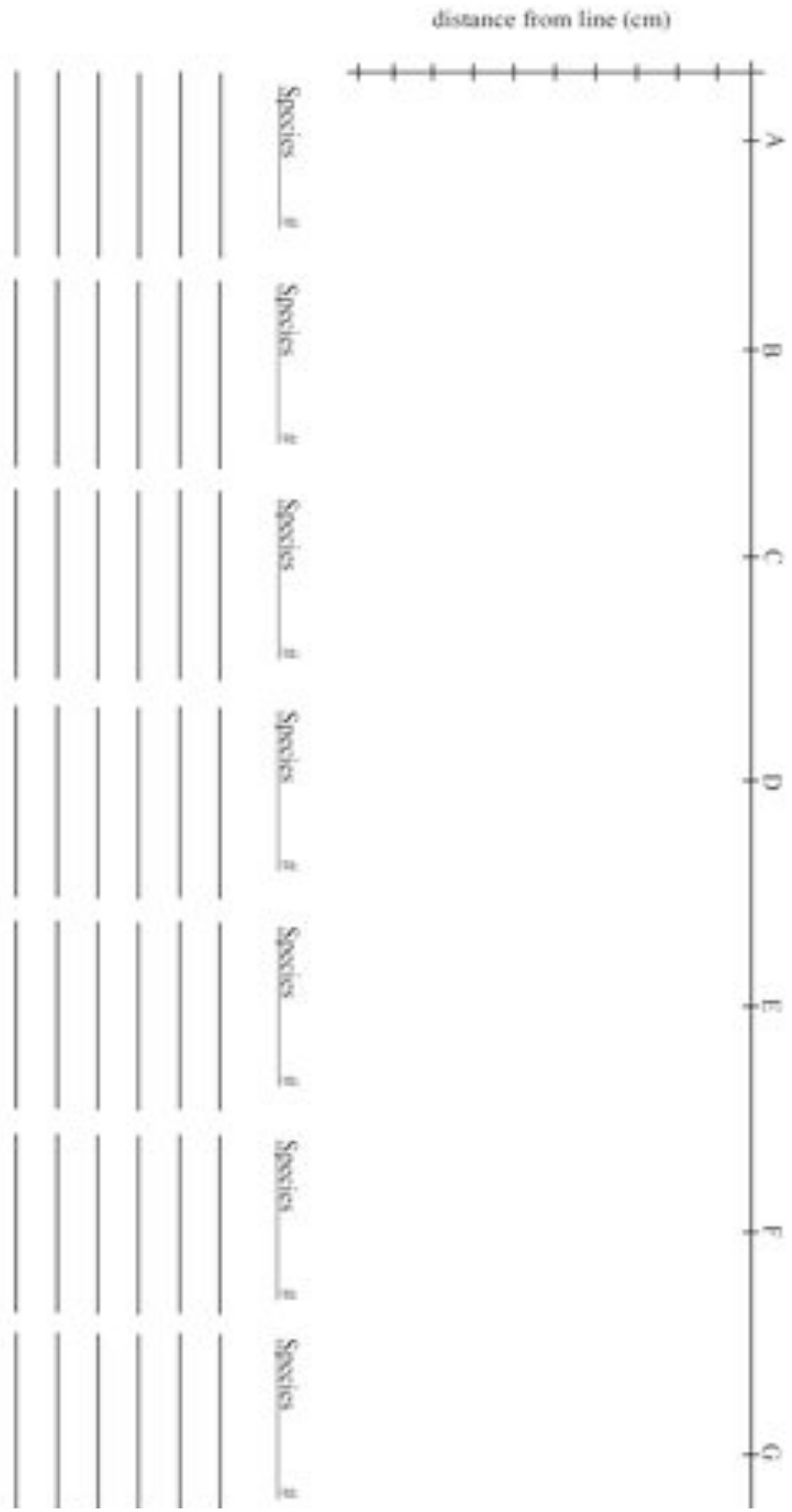
_____

_____

_____

_____

Summary Data Sheet



Questions and Conclusions

1. Which plant species were most abundant in lower elevations in the marsh?

2. Which were most abundant in higher elevations?

3. Why were different species found at different elevations?

4. How might the species composition of the marsh change as the sea level continues to rise?

Post Trip Activity
How will Sea Level Rise Effect Wetlands?

Materials
Graphs and charts of calculated and actual estimates of sea level rise
Topographic maps of local areas 1:24000 scale with 5 ft contour lines, (available at your county Natural Resources Conservation Service office)
Non-permanent marking pens

Procedure

PART A. Becoming familiar with topographic maps

1. Locate the following on your topographic map and note the color (some maps may not contain every item listed):

Land Type	**Map Color**
Water	
Wetland	
Forest	
Towns	
Agricultural land	
Contour lines	
Major Highway	
Secondary Road	
Buildings	

2. Using the non-permanent markers, trace the shoreline of the area, circle major buildings such as schools, churches, and mark several main roads. Outline wetland areas if you find any.

PART B. Determining flooded areas from sea level rise

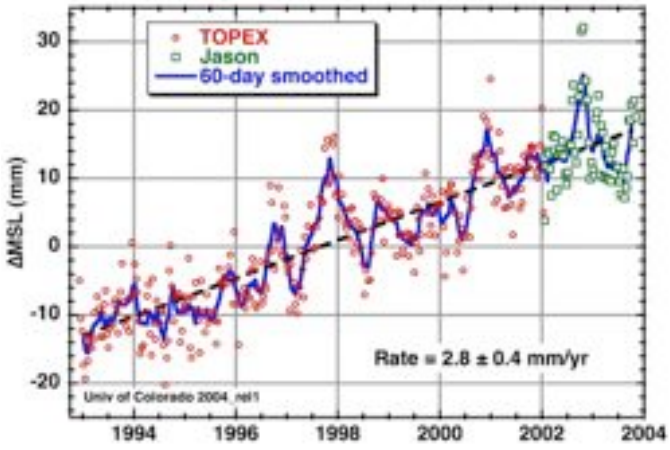
1. Using the data and information provided in the graph below, calculate the annual average sea level rise in mm per year. _____

2. Determine how many years it will take to flood the following areas. First, figure out the elevation of each area. Then, based on your average sea level rise/year calculation above, determine how many years it will take for the sea level to reach each area.

Area	**Elevation (mm)**	**Years to flooding**
School	_____	_____
Hospital	_____	_____
Highway	_____	_____
Farm	_____	_____
Wetland	_____	_____

3. Use the contour lines on your topographic map to draw in the new coastline after 100 years. To do this you will need to calculate how high the sea level will rise in 100 years.

Data for Sea Level Rise



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