Salt Marsh Mania

Adapted from South Slough's TIDES Activity 10 "Tidal Marshes, Richness and Diversity".
Time requirement: up to 1 hour of prep, 45 minutes in the classroom, 30-45 minutes for field study.
Summary of Activity: In this activity, students will explore the range of diversity of salt marsh plants. As an introduction, students will learn how to draw and describe key characteristics of familiar plant samples in the classroom. In the field, students will work to observe salt marsh diversity through a variety of sampling techniques using the skills learned in the classroom. While botany, the study of plants, is a complex and expansive discipline, marshes are accessible and excellent starting points for students to begin to appreciate the subtle diversity of structure and the purpose of adaptation. The marsh is generally accessible without specialized footwear or boats. Marsh plants are typically low enough that the entire community of plants can be viewed and examined easily and a sampling transect and plots can be established without difficulty.

Concepts to Teach: Marine and coastal ecosystems, salt marsh communities, cycles, adaptations, classification, data collection.
Standards Addressed: 4.2L.1, 5.2L.1, 4.2E.1, 3.3S.1, 3.3S.3, 5.3S.2, 5.3S.3
Instructional Strategy: Experiential learning, scientific inquiry

Goal: Students will discover the many different types of plants that have adapted to life in a tidal marsh through careful observation and discovery.

Specific Objectives:

- Students will be able to define: adaptation, characteristic and salt marsh
- Students will understand in a simple way to test diversity within one zone of the estuary.
- Students will gain experience making careful observations to distinguish physical difference and characteristics between species of marsh plants
- Students will understand how sampling a subset is used to make observations about a larger area.

Vocabulary: Adaptation, characteristic, community, dilution, gradient, quadrat, sampling area, species, tidal marsh, transect.

Required Materials:

- Multiple clippings of 3 or more common trees or shrubs from around the school
- Field notebooks
- Writing/drawing utensils
- Quadrats or hoops (optional)
- Transect line 10+ meters (optional)
- Cameras with macro setting (optional)
- Field guides (optional)

- Proper field gear

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Background

Tidal marshes are complex **communities** of rooted, flowering plants adapted to flooding by the salty, sediment laden and nutrient rich waters of the estuary. Low, mid, and high elevation marshes sustain different types of plants, yet all are distinguished from species in the adjacent uplands by their ability to survive flooding waters containing some level of salt.

Marshes located near the mouth of the estuary are regularly flooded with salty tidewater that may be only slightly diluted with freshwater runoff from the uplands. In the mid estuary, salt water may be more clearly diluted by freshwater inputs yet still contain significant levels of salts. In the most riverine parts of the estuary, freshwater heavily **dilutes** the flow and very low levels of salt may be detected. The most extreme reach of the seawater is called the head of tide. However, beyond this area, the influence of the ocean is still apparent as freshwater or tidal fresh marshes are formed by the flooding action of the incoming tide.

Low elevation marshes are populated by pioneer species **adapted** to very salty conditions that exclude most types of plants. These **halophytes** such as Pickleweed (*Salicornia virginica)* and Salt Grass (*Distichlis spicata)* possess unique **characteristics** that make them particularly interesting for study. Sparse numbers of smaller plants appear at the upper edge of the mud where currents and tides preclude more dense clusters. However, these individual plants cause the tidal waters to eddy, slowing the current and increasing the rate of deposition. As this gradually increases the elevation, more plants begin to grow, stabilizing the sediment and giving way to a mat of saltmarsh vegetation. Pickleweed is an edible plant with a distinct salty flavor. Small samples can be identified, rinsed and given to students to taste.

Mid-elevation marshes are transitional zones where saltwater inundation periods decrease and the diversity of the marshes grows. Seaside Arrowgrass (*Triglochin maritime)*, Paintbrush Owlclover (*Castellija ambigua ambigua)*, and Fleshy Jaumea (*Jaumea carnosa)* appear at the lower extent. Gradually, this community of succulent plants may transition to grasses, and sedges.

High elevation marshes are more typically meadow-like in appearance with dense communities of grasses, rushes, and sedges dominating. Seldom inundated by the salty high tides of summer, these marshes are flooded in winter with the highly diluted seawater mixing with runoff from winter storms.

Preparation

This activity may be conducted in several different ways depending on the available time, age of the group and the specific objectives the teacher hopes to achieve with the class. Multiple methods are included here to provide clear instructions for simple investigations

of marsh diversity that are well paired with additional field activities to be conducted at an estuary.

Quadrats can be used to help students accomplish their marsh study. The quadrat is used to introduce the concept of sampling a small area to draw inference about a population covering a larger area. Quadrats can be constructed out of PVC pipe to form a square, small hoops, coat hanger wire, etc. For more information on constructing quadrats for your students please visit: http://www.oregon.gov/DSL/SSNERR/tides_A8.shtml where the link to "Explorer Kits" will direct you to directions on assembling field quadrats. **Transects**, a clearly defined and measurable sampling line, are used to locate random plots where the students will explore the plant community using a sampling technique.

Incidental observations such as sediment deposits on the leaves of the plants, detritus and indirect indicators of other estuary inhabitants such as crab molts are valuable to the study and can be recorded during the course of the students work. These artifacts from different zones of the estuary or ocean can help students to recognize how tidal waters flood the marsh periodically with the tides.

Depending on the extent of the marsh activity, students will need the different types of materials indicated with each level of activity below. All students should be equipped with proper field gear, writing utensils, field notebooks to record data and observations. Cameras are useful for documenting what the plants look like to verify them in the classroom with field guides. Field guides may be useful for instructors and chaperones, but often not as useful for students just learning to identify plants. Teaching students how to find key characteristics from observation will be more meaningful for their learning.

Several considerations are important when selecting the study site for this activity. First and foremost permission of the land owner is essential. In the case of public lands, contacting the agency responsible for the care and management of the area is necessary unless unrestricted public access is already an accepted use in the area. Many of Oregon's tidal marshes are publically owned, however, many private in-holdings do exist and trespass is illegal unless otherwise posted by the owner. If you have a question about the owner of the study site, you may wish to contact the Oregon Department of State Lands for assistance. More information about this agency may be found at http://www.oregon.gov/DSL/Pages/index.aspx.

Ease of access is important since any time taken to hike to the site will diminish the amount of time the students will have to conduct the study. Availability of restrooms and a non-tidal open area to give instructions in close proximity to the marsh is also desirable.

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Lesson Procedure/Activity Description

Introduction:

Students should have an understanding of what a salt marsh is prior to the sampling activity. This can be done in a variety of ways including reading some of the above background information aloud or viewing videos found here: http://estuaries.noaa.gov/EstuaryLive/VideoGallery.aspx . It may also be appropriate to identify field sites with students using a map and locating the source of salt water and the source of fresh water influencing their study site.

Several key concepts should be reviewed with students prior to the conduct of the sampling:

- First, students should be reminded to make careful observations and look closely for differences between various plants. Teams of two or three typically work well for this activity since each observer may add something the other has missed.
- Since tidal marshes are dominated by rooted, flowering plants, a quick review of the various plant organs (roots, stems, leaves) and their functions may help the students with their observations.
- Students can learn how to ID key characteristics on plants by providing them with sample clippings of common plants found around the school. Key characteristics are those that are unique enough to distinguish them from other plants in a community.
    - Clip small branches of at least 3 plants, two of which are similar in look or shape (ex: conifer branch, vine maple and big leaf maple). Challenge students in groups of 2-4 to describe the plant clippings so that someone who is not looking at the plants could then identify them from the group of plants.
    - Have students draw the 3 samples labeling the key characteristics as practice for the field study.
- Describe how sampling a subset of a larger group provides data that may be used to characterize the larger community. Include a quick discussion of sampling bias and the risks involved in extrapolation using a small amount of data.

Main Activity: (30-40 minutes)
Upon arrival at the marsh, go over some guidelines with students:

- *The marsh may be wet and squishy, tread lightly through the marsh to prevent heavy trampling and accidents!*
- *Watch where you step! Sometimes holes or small channels will be found in the marsh*. (The marsh should have been surveyed prior to student arrival to check for these potential hazards. Cones or flags can work well to mark them).
- *The edge of the marsh may be unstable. Please keep two steps back from the edge of the marsh as Oregon tideflat's can be made up of unstable, very sticky sediment.*
- *Stay inside the boundaries I have given to you.*

Allow 5-10 minutes for students to explore the marsh. Encourage them to draw or write down anything interesting they see, or questions they may have in their field notebook.

Have students get into their group of 2 or 3 students. Choose the appropriate sampling method below:

1) Once the groups have spread out in different zones of the marsh have the individual groups form a small circle. The marsh inside of their feet will be the focus area for sampling. If quadrats or sampling hoops are available, they may be used to define the area of study, instead of their feet. Students should gently toss them into the marsh so that their sampling is random. An instructor or chaperone can also choose to toss them while students are exploring the marsh and then assign groups to quadrats
    a. Have them estimate how far away they are from the nearest edge of the marsh.
    -or- have them measure how far away they are from the edge of the marsh
    b. Using the marsh within their circle or quadrat, students will count the diversity of the plants in their circle (how many different kinds/species of plants they see, not the number of plants they see).
    c. Have students identify the most common plant they saw, they should draw this plant labeling key characteristics.
    -or- identify the 3 most common plants in their sample area and spend time drawing and labeling each of the plants.
    d. While students are working on counting their diversity, collect enough samples of pickleweed and salt grass so that each group has a sample of each. Students should then draw and label the key characteristics of those plants if they have not already. They should compare and contrast the two plants as a group. If desired and it is identified properly, pickleweed may be eaten with instructor approval after drawing the sample.

2) If a transect is available (a meter tape 10+ meters long), students can sample the marsh along the tidal **gradient** from the high end that is less affected by salt water to the lower end that is frequently flooded by the incoming tide. Student groups can line up along the transect at regular intervals then place their quadrat or sample area near the transect line (1 or 2 meters away from the line). The same data can be collected above, but students will be able to more accurately see a pattern along the tidal gradient. This works well for older students who have experience with data collection.

Give students 5-10 minutes more to explore the marsh before leaving or allow that time for them to reflect in a field notebook.

Conclusion:
Depending upon the method chosen for this activity, evaluation will take a variety of forms. Collection and charting or graphing data as a class can be a good method for reviewing observations found in the field. Sharing photos on a projector and using field guides students can properly identify the plants they sketched in the field. While

reviewing field notebooks with students, be sure to address any questions or misconceptions students may have.

As a class or in small groups students can research more about marshes and wetlands. These areas are important to help control flood waters, filter waters, cycle nutrients and provide vital habitat to many of Oregon's coastal species. Have students create a drawing or painting and a short summary of why salt marshes are important habitat to protect.

Assessment

- Assess student field journals and data graphs for completeness

Adaptations & Extensions

- While in the field collect a small sample of all of the different types of plants students found. Place each sample in bags to preserve them. Back in the classroom work to identify each of the plants using field guides.
- Students can develop a student authored field guide to the marsh. Photos of properly identified marsh plants, a brief listing of key characteristics and statistics such as height, color, appearance and a few points of interest can be developed for the ten or fifteen most common plants. If students are interested in illustration, colored pencils, watercolor and simple line drawings can accompany or take the place of photos. This can be approached with each student being responsible for one plant or with teams of students taking responsibility for areas where they feel most comfortable: photography, illustration, description development, research, graphic design, or fabrication. Color photo copying and lamination are much more affordable than they once were and make for a nice finished product that can be placed in ring binders for use by future classes.

Additional Resources:

-Vocabulary terms

Adaptation- A characteristic that has modified to be more fit for existence under conditions of its current environment. Ex: Saltmarsh plants have multiple adaptations to survive in tidal marshes frequently flooded by salt water.

Characteristic- a distinguishing quality or feature of an organism

Community- a group of interdependent organisms inhabiting the same region and interacting with each other

Dilution- weakening a substance by the addition of water or a thinner

Estuary- **An** estuary is a partially enclosed body of water (such as bays, lagoons, sounds or sloughs) where two different bodies of water meet and mix.

Gradient- the spatial change of a physical quantity ex: temperature, salinity, etc.

Quadrat- a measured and marked rectangle, often a square, used in ecology to isolate a sample

Sampling area- the defined area of study or data collection

Species- plants or animals having similar structure and descent

Tidal marsh- a type of marsh that is found along coasts and estuaries of which the flooding characteristics are determined by the tidal movement of the adjacent estuary, sea or ocean
Transect- a path along which one counts and records observations.

-Standards addressed
4.2L.1- Describe the interactions of organisms and the environment where they live.
5.2L.1- Explain the interdependence of plants, animals, and environment, and how adaptation influences survival.
4.2E.1- Compare and contrast the changes in the surface of the earth due to slow and rapid processes.
3.3S.1- Use the data collected from a scientific investigation to explain the results and draw conclusions.
3.3S.3- Explain why when a scientific investigation is repeated, similar results are expected.
5.3S.2- Identify patterns in data that support a reasonable explanation for the results of an investigation or experiment and communicate findings using graphs, charts, maps, models, and oral and written reports.
5.3S.3- Explain the reasons why similar investigations may have different results.