



Activity 1 – Welcome to the Estuary

<u>PURPOSE:</u>	To introduce students to the idea of estuaries, to basic vocabulary and to the concepts of connections between the watershed and ocean through the estuary.
<u>TIME REQUIRED:</u>	One to two class periods (~45 minutes each)
<u>SUBJECTS:</u>	Science, English, Math
<u>MATERIALS NEEDED:</u>	(Each student) Colored Pencils; 11” x 17” paper; black ball pens or fine tip markers; (Teacher prep) Computer projector; Overhead projector, orthographic photo of estuary with GIS layers, “Living on the Estuary” story
<u>VOCABULARY:</u>	aquifer, benthic, eelgrass, estuary, fauna, flora, habitat, inputs, intertidal, nutrients, ocean, open water channel, river, salinity, sub-tidal, tidal flat, tidal marsh, tides, turbidity, watershed

Outcomes: 1) Students will be able to identify and describe, in simple terms, the three basic life zones of the estuary and the watershed as the main parts of the ecosystem. 2) Students will be able to describe at least two physical factors that influence life forms in the estuary. 3) Students will be able to locate the major life zones and sources of estuary inputs on a map they and their classmates have drawn.

Unifying Concepts and Processes:

- System inputs & outputs
- Evidence of changes over time

Background: During this activity the students are introduced to the idea of estuaries, basic vocabulary and the concepts of connections between the watershed and ocean through the estuary. The basic components of each system such as aquifer, stream & river, marshes, tidal flats, and beaches are incorporated into a classroom model constructed by the students as teams of scientists exploring the land and seascape.

The first chapter of a short story “Living on the Estuary – The View from the Cabin” is included to describe the setting along the Oregon coast where the students will conduct their studies and learn about estuaries and the coastal ecosystem. Following this, a scripted presentation will be used to give students their first view of the estuary and watershed. A vocabulary building activity (crossword puzzle) is included to help students familiarize themselves with the relevant terminology.

Students will each work on creation of a watershed map from headwaters to estuary to ocean. This is the first draft of the map and it will be updated and reviewed throughout the course of the study.



Preparation: Distribute the vocabulary terms sheet with definitions and the crossword puzzle as a homework assignment prior to the day of the activity. The story “Living on the Estuary” may also be assigned for reading prior to the day of the activity with a brief discussion and review at the beginning of class.

A photocopy of the base map included in the Resources folder for this activity may be provided to each student as a guide. Each student will need at least 4 different colored pencils for shading the base map and keying areas to a legend and a dark pencil or fine line marker. Labels and notes will be done in black or blue ink. You will need to have an overhead projector and a computer projector available on the day of the activity.

Activity Description:

1. Read the first chapter of the story “Living on the Estuary” aloud to the class.
2. Show the class the “Welcome to the Estuary” presentation.
3. Assign students as teams or individuals to develop an estuary map by following the instructions listed in this activity.
4. Assign students to choose a vocabulary activity (crossword puzzle, word search, word scramble)

“Living on the Estuary” story

The story “Living on the Estuary” was written to highlight changes that have occurred in coastal communities as our understanding of the land and waters has changed over the past fifty years or so. Chapters from the story will be introduced periodically throughout TIDES to give students a personal context for the studies they are conducting.

The following possible questions are included to foster discussion following the reading of the story.

1. What kinds of work have Beth and Will done to make a living during their lives?
2. How are these jobs connected to life on the Oregon coast?
3. What do they like about the place where they now live?
4. What animals are mentioned in the story and how are they connected to the landscape?
5. How are the cabin and the forested slopes where they live connected to the estuary and the ocean?

“Welcome to the Estuary” presentation

Once the class has listened to the first chapter of “Living on the Estuary”, they will watch a presentation called “Welcome to the Estuary” which is designed to allow the teacher to lead the class through a participatory, introductory activity in estuary studies. This lesson will introduce students to a variety of concepts that will be used throughout the TIDES curriculum including basic physical, biological, and ecological relationships.

Vocabulary terms are an important part of the language skills necessary to accurately and intelligently discuss estuaries and therefore will be emphasized throughout the TIDES curriculum. Students should be expected to interact with the presenter during this activity by asking questions and gathering information that will help them to improve the maps they will be making.



Please review the slide notes and accompanying images (provided as a PowerPoint presentation) prior to class and augment the narrative with your own findings from your study of these fascinating and complex ecosystems.

The overview is divided into five principle sections:

- 1) Estuary Definition and Orientation
- 2) The Physical Estuary
- 3) The Life Zones of the Estuary
- 4) Life of the Estuary
- 5) Estuary Functions and Impacts

Mapping the Estuary Activity

Steps for developing the estuary map

1. Provide each student or team of students with the materials identified in the activity supply list (11" x 17" paper, colored pencils, black pencil or pen)
2. Draw or trace a shoreline that includes an outer coast, mouth of the bay, and several inlets off of a main bay area (see example included in Activity Resources). *Note: if this is to be a large scale whole class project, make an overhead transparency of the example and project it onto a large sheet of paper to be traced.* The more complex the shoreline the more difficult it will be to color in, however, a natural estuary shoreline is usually somewhat complex. Avoid straight lines unless you intend for this to be an area where filling has occurred such as a city waterfront or a levee. Make sure that inlets where streams or a river will flow into the estuary come to a point.
3. Next, have students draw the streams and rivers using a different color marker or colored pencil. Include several branches for longer, more complex streams. If a river system is included, only include the lower end of the river and make this river mouth entrance to the bay larger than the streams.
4. Now, have students draw the outline of the ridgelines of the watershed. These lines may not cross a creek or river since they represent the high ground dividing watersheds. Precipitation that falls on the same side of the ridge as the lines representing streams or rivers will be a part of the estuary's watershed. Whereas, precipitation that falls on the other side of these lines, falls in a different watershed.
5. Finally, color the various areas of the ocean, estuary, river, and uplands of the watershed with appropriate colors to represent these different life zones. *Note: We will not color marshes, tidal flats, and open water channels at this time. They will be introduced later in the TIDES curriculum.*

Notes: This mapping project may be approached as an individual assignment, a team assignment, or as a whole class project. Adjusting the scale accordingly, an overhead transparency can be made and projected using the image file provided as a base map to trace and color. If a large scale map is being developed, this will be used for other activities later in the curriculum.



Post activity analysis: Review the key vocabulary terms as a class and grade individually assigned vocabulary work using the keys provided.

Individual or team created maps may be turned in for grading and credit. As an alternative, teams can be asked to evaluate and critique each others maps and provide a numeric score. The scoring key on the following page may be used.



Scoring Key

Evaluator's name(s):

Map author's name(s):

Characteristic	Quality	Points assigned
Accuracy	Very accurate	+3
	Fairly accurate	+2
	Accurate	+1
	Somewhat inaccurate	-1
	Very inaccurate	-2
Neatness	Very neat	+3
	Fairly neat	+2
	Acceptable	+1
	Somewhat sloppy	-1
	Very sloppy	-2
Detail	Very detailed	+3
	Somewhat detailed	+2
	Average detail	+1
	Somewhat lacking detail	-1
	Lacking necessary detail	-2
Labels	Very accurate	+3
	Somewhat accurate	+2
	Accurate	+1
	Somewhat inaccurate	-1
	Very inaccurate	-2
Creativity	Very creative	+3
	Somewhat creative	+2

Final Score: _____



Follow up ideas: Using modeling clay, the class may want to construct a three dimensional model of the watershed and estuary to better understand how the estuary works. This can be accomplished for relatively little cost using the following materials.

Estuary watershed model materials list:

- ✓ A small sheet of 1/2" plywood (~ 2' x 3')
- ✓ Three 1" x 4" pieces of wood that will make two sides and one end of the watershed model.
- ✓ Nails or screws to fasten the sides to the plywood base.
- ✓ At least 3 colors of modeling clay (gray, green, and blue suggested - additional colors can be used to add specific features)
- ✓ 1/4" size wire mesh or screening (this will be used to make forms for the watershed)
- ✓ wood screws or heavy duty staples to fasten the mesh to the plywood
- ✓ A base map that will be transferred to the plywood as a guide for placing the clay
- ✓ Clay modeling tools such as a cutting wire, wooden shaping sticks, and spatulas
- ✓ Additional model items such as sticks, rocks, and small scale animals may be added to enhance the understanding of the various zones.

Estuary watershed model construction steps

1. Cut plywood to size and sand edges.
2. Transfer the lines and colors of the base map representing the various zones of the model to the plywood as a guide.
3. Cut, place, and fasten the wire mesh or screening to the outline representing the shoreline of the estuary and outer coast. To do this, make a 1/2" fold at the edge of the material and fasten the folded edge along the line representing the shore. Now fold back the material over top of the fasteners and make more folds and tucks as necessary to achieve a shape and slope that will become the upland hillsides. These pieces of material will then be fastened to the sides and end of the model.
4. Now slice thin (1/2" or so) slabs of clay and gently work these onto the surface of the mesh material to cover the entire upland portion of the watershed.
5. Next, slab and place different colors of clay on the parts of the model representing the estuary and ocean waters.
6. Finally, place thin strips of a different color of clay along the valley bottoms connecting to the estuary clay at the shore and representing the streams.
7. The model is now ready for any enhancements you and your students may wish to add.

Tips

- ✓ Modeling clay is oil-based and therefore resistant to water. It does not come out of clothes easily so students will need to wear work clothing when handling the clay.
- ✓ Modeling clay is also best worked when it is fairly warm. Shaping the clay is much easier if the room temperature is at least 68 degrees. Pre-heating the clay to warmer temperatures (~75 degrees Fahrenheit) before working with it can also be helpful.
- ✓ The clay that is placed on top of the mesh is somewhat fragile and may tend to push through the mesh if it is pressed downward with too much force.
- ✓ Before adding enhancements, consider how the model will be used and whether or not the enhancements can be easily removed.