2014

Model Lessons about Geography and Outdoor School

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April Logsdon

See next page for additional authors

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Beginning Plot Mapping and Observation in the Field

Overview: Students will make individual mental and plot maps of a designated outdoor area and then come together and discuss the differences. Then students will make a group map, record cardinal directions and record observations of the area.

National Geography Standards: World in Spatial Terms
2.3 Mental maps are used to answer geographic questions about locations can characteristics of places of regions
3.1 The meaning and use of fundamental spatial concepts. *cardinal directions

Oregon Geography Content Standards:
1.12 Give examples of local natural resources (and describe how people utilize them, extension)
2.10 Use and apply cardinal directions; locate and identify local physical features on maps.

Oregon Science Content Standard:
1-LS1-1 Use materials to design a solution to a human problem by mimicking how plants and/or animals use their external parts to help them survive, grow, and meet their needs.*Structure and Function
2-LS4-1 Make observations of plants and animals to compare the diversity of life in different habitats.

Connections to Common Core:
W1.7 & W2.7 Participate in shared research and writing projects

Objectives: Students should be able to draw a mental and plot map, show understanding of cardinal directions, report observations of trees,
plants, and animals in a plot, begin to identify human impact in the forest and draw conclusions in a shared research report.

**Grade Levels:** 1, 2  
**Time:** 1 hour 45 min (in field)  
30-45 min for report writing in class

**Materials:**

**Teacher Prep:** 3 areas (10x 10’ min.) taped off at forest site  
**Adult leaders for each plot**
- Construction Area Tape/survey tape, hammer, and stakes  
- Clipboards, enough for each student  
- Pencils, crayons  
- 3 sets of signs: North, South, East, West  
- Masking tape  
- Plot map paper, attachment A  
- Observation question sheet, attachment B  
- Extra paper  
- Chart Paper  
- Easel or place to hang chart paper for discussion  
- Markers  
- Forest journals or writing paper  
- Rubric for writing, attachment C

**Background:** Students will have seen, created and discussed why people use mental and plot maps in previous classroom activities. They will also have done some observation activities before the trip to the forest. See attachment D.

**Procedures:**
1. Have 3 areas marked off in forest area (outdoor school, nature trail, or park). Divide students into 3 groups and allow them to go to assigned area and play/walk around for 5-7 minutes. Have students return to central area away from plots and draw a mental map of their assigned area.
2. Before handing students plot map worksheet, discuss why map makers make maps of forests, and how does it help in forestry management. Hand students plot map worksheet on clipboard and have students return to assigned area to make plot map and mark N, S, E, W with given signs. Give them North direction before dismissal.

Adult Volunteers will have tape, group’s mental maps, a blank paper and observation questions in folder for later in lesson. Adult volunteers will facilitate students in answering clarifying questions, offering encouragement, and reading observation questions if necessary.

3. Upon completing plot map, have students from each group gather, partner up and compare their plot maps to their mental maps. Discuss differences and talk about observations and perception. Have students share some of their thoughts with group.

4. Have student partners compare their plot maps to each other and discuss similarities and differences. Gather together and construct a new map in group with agreed upon attributes. Then have students observe their plot and answer observation questions on worksheet.

5. When finished with observations have groups come back together at central area. Compare and contrast the three areas and draw conclusions about what is happening in each area (healthy trees, evenly spaced, any sign of disease, size around, height, human intervention, etc.) Teacher records information on chart paper. Teacher may have to prompt discussion points.

6. Students will complete a short report on their findings from all areas using information compiled during discussion of observations. Teacher will provide scaffolding for student’s writing, depending on grade level. Shared report can be completed on site or done in the classroom the next day.
**Assessment:** Students will write a research report of observations from activity. Students will use information collected from field discussion on observation and conclusions (Chart paper notes). First grade students will complete report with at least 3 facts written in complete sentences. Second grade students will complete report with a topic sentence, with at least 3 facts, and a concluding sentence. Students report will be graded with attached rubric, attachment C.

**Extensions and/or Adaptations:**

**Extensions:**
- Forest management lessons
- Wood products lessons
- Identification of trees and plants in plot
- Plant study
- Continuing visits to same plots to observe change in seasons

**Adaptations/Accommodations:**
- Have students count trees not plot them
- Provide wheelchair access to one plot
- Students could measure plot area themselves and tape off
- Students could complete a scaled plot map
- Students could also identify species within plot
- Students could plot a larger area, noting landforms, trees, water, etc.

**Variations:**
- Plot flower garden or vegetable garden
- Plot playground areas

**Sources:** Second Grade Writing Rubric- Informational Writing - WordPress.com
https://centralwawritingproject.files.wordpress.com/.../second-grade-writing-rubric.do...
Last visited 8/11/16
Plot Map of ______________________
Name___________________

Appendix A
Name______________________________________________

Observation Questions for Plot
You may draw or write to answer, be prepared to share.

1. How many trees are located in your plot?

2. What do you see on the forest floor within your plot?

3. Describe the trees in your plot?

4. What signs of human activity are in your plot?

5. What other things did you observe?
### 1st grade Informative Writing Rubric

<table>
<thead>
<tr>
<th></th>
<th>1-not at all</th>
<th>2-somewhat</th>
<th>3-most of the time</th>
<th>4-yes</th>
</tr>
</thead>
<tbody>
<tr>
<td>Topic named</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>3 or more facts given</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Sentences complete</td>
<td></td>
<td></td>
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<td></td>
</tr>
<tr>
<td>Used capitals correctly</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Used periods correctly</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Focus</td>
<td>Content</td>
<td>Organization</td>
<td>Conventions</td>
<td></td>
</tr>
<tr>
<td>-------</td>
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<td>-------------</td>
<td></td>
</tr>
<tr>
<td><strong>4</strong></td>
<td>Maintains a focus on a single object, person, place, or event.</td>
<td>Clear ideas are well supported with 3 details that inform the reader.</td>
<td>Writing clearly has an introduction, at least 3 details, and a conclusion is clearly defined.</td>
<td>All sentences are complete with very few (0-3) or no mistakes in spelling, punctuation, or grammar.</td>
</tr>
<tr>
<td><strong>3</strong></td>
<td>Maintains a focus on a single object, person, place or event. One or two details may not relate to the object, person, place, or event.</td>
<td>Clear ideas are well supported with 2 details that inform the reader.</td>
<td>Writing has an introduction with supporting details used to support the body. A conclusion is present.</td>
<td>Most sentences are complete with some (4-7) mistakes in spelling, punctuation, or grammar.</td>
</tr>
<tr>
<td><strong>2</strong></td>
<td>Many events and details do not relate to the object, person, place, or event.</td>
<td>Clear ideas are well supported with 1 detail that informs the reader.</td>
<td>Introduction, body, and conclusion appear disorganized with few supporting details.</td>
<td>Some sentences are complete with repeated mistakes in spelling, punctuation, or grammar.</td>
</tr>
<tr>
<td><strong>1</strong></td>
<td>Writing has little or no focus on a single object, person, place, or event.</td>
<td>Almost no details which make it difficult for the reader to understand the information.</td>
<td>Uses no variety of sentences and word choices to inform the reader.</td>
<td>Many incomplete sentences with many mistakes in spelling, punctuation, or grammar making it difficult to read.</td>
</tr>
</tbody>
</table>
Data Collection, Mapping, and Population Pyramids in a Cemetery

Overview:
This lesson is not specific to an Outdoor School but can be conducted outdoors in an urban or rural setting. Students will collect data from the headstones of a local cemetery and then create a grid map of the placement of the burial places for possible use by visitors to the cemetery. Students will also create two population pyramids; one from data collected at the cemetery and another one from data provided by the teacher. Analysis of the pyramids will take place with rubric scoring for both creation and analysis.

National Geography Standards:
1.2 The acquisition and organization of geospatial data to construct geographic representations.
15.1 The characteristics of a physical environment provide opportunities for and impose constraints on human activities.

Oregon Geography Content Standards:
6.15. Explain how people have adapted to or changed the physical environment in the Western Hemisphere.

Connections to Common Core: Math
7.SP.2 Use random sampling to draw inferences about a population. Use data from a random sample to draw inferences about a population with an unknown characteristic of interest.

Objectives:
In completing this activity, students should be able to accurately collect data to plot on a grid map, and create and analyze population pyramids.
Grade Levels:  6-8 (with extension to higher grades or Talented and Gifted Programs)
Time:  Outdoor in cemetery: approx. 1 hour (would vary with the size of the cemetery).
In the classroom: 1-2 periods

Materials:
  Cemetery Data collection chart (Appendix 1)
  Clipboards with pencils
  Large floor paper (rolled paper) for mapping grid
  Markers for floor map
  Data from Unknown Source form (App. 2)
  Population Pyramid template (App. 3) -2 per group
  Population Pyramid Assignment & Rubric (App. 4)

Optional Materials:
  Sample Population Pyramid with definition (App. 5)

Background:  Students need to be proficient with cardinal directions before visiting the cemetery in order to correctly plot the headstone information on the grid map.
Before entering a cemetery, students must be taught proper cemetery etiquette.  See the following website for suggested etiquette guidelines.  
http://iacpinc-org.dbprginc.org/cemeteryetiquette.htm

Note to teachers:  The Unknown Source data is a list of the 9/11 victims on Flight 77 that crashed into the Pentagon.  Students will most likely want to know this information at the end of their pyramid analysis.  Be prepared to answer multiple questions on this subject.

Teachers may also consider enlarging the Cemetery Data Collection form to whatever size your school copier could accommodate, providing more space for students to write.
Procedures:

- Divide students into groups of 2-4 (varies on the size of the cemetery).
- Walk or ride a bus to a nearby cemetery.
- Determine the cardinal directions of your cemetery for data collection purposes.
- Determine which row each group will start on.
- Have students start on the west side and work east across the row.
- Collect data on the Cemetery Data Collection form (more than one per group may be needed).
- Be sure to collect data from all the headstones. Don’t forget someone.
- Upon returning to the classroom, each group will take turns putting the names of the deceased in the proper location on the large paper grid on the floor.
- When not writing on the grid, students will use their data and the additional data supplied to create two population pyramids; one of the cemetery and one from the unknown source supplied data.
- Students will construct a population pyramid on the provided template using the data collected from your cemetery headstones. Use two different colors for the genders. Use data from other groups to have at least 30-40 people from the cemetery to graph on your pyramid.
- Students will construct a second population pyramid from the table of unknown source information provided by your teacher.
- Once the pyramids are complete, students will work in their groups to compare, analyze and make inferences from the two pyramids by answering a set of provided questions.
**Assessment:** The population pyramids will be assessed on a rubric addressing the communication of the information (neatness of the pyramids and conventions of writing) and the application of the information (reflection of correct data values and completeness of written responses).

**Extensions and/or Adaptations:**
- This lesson could be extended by having students collect age data from their immediate and extended family living in the area and then create a classroom population pyramid from the data.
- For Special Education and English Language Learners: Students can be grouped with more capable students to overcome reading and writing difficulties.
- For Talented and Gifted or higher grades: Students could research burial practices of Native Americans or other locations around the US and the world. This ties in with the standard of adapting to the physical environment. An informational comparison would be used to demonstrate the research done and scored on a writing rubric. Students could also create an original population pyramid (without a template) which would require them to research their own list of data and to determine appropriate scale.
- For Younger grades: Modify the amount of data collected and then have students create a bar graph of age at death, comparison of genders, or other data collected.

**Sources:**
International Association of Cemetery Preservationists. “Cemetery Etiquette.”


USA Today. “American Flight 77 Victims at a Glance.”
### Cemetery Data Collection

<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Full Name (F,M, L)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Date of Birth</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Date of Death</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Age at Death</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Images on the Stone</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Location of birth, if avail.</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Location of death, if avail.</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Relationship to person on left or right (if known)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Any additional information on the stone</td>
<td></td>
<td></td>
<td></td>
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</table>
## Data from Unknown Source for Second Population Pyramid

<table>
<thead>
<tr>
<th>Name</th>
<th>Gender</th>
<th>Age at Death</th>
<th>Name</th>
<th>Gender</th>
<th>Age at Death</th>
</tr>
</thead>
<tbody>
<tr>
<td>Paul A.</td>
<td>M</td>
<td>32</td>
<td>Dora M.</td>
<td>F</td>
<td>45</td>
</tr>
<tr>
<td>Bernard B.</td>
<td>M</td>
<td>11</td>
<td>Chris N.</td>
<td>M</td>
<td>38</td>
</tr>
<tr>
<td>Charles B</td>
<td>M</td>
<td>51</td>
<td>Barbara O.</td>
<td>F</td>
<td>45</td>
</tr>
<tr>
<td>Suzanne C.</td>
<td>F</td>
<td>42</td>
<td>Ruben O.</td>
<td>M</td>
<td>39</td>
</tr>
<tr>
<td>Sarah C.</td>
<td>F</td>
<td>65</td>
<td>Robert P.</td>
<td>M</td>
<td>63</td>
</tr>
<tr>
<td>Asia C.</td>
<td>F</td>
<td>11</td>
<td>Lisa R.</td>
<td>F</td>
<td>42</td>
</tr>
<tr>
<td>James D.</td>
<td>M</td>
<td>58</td>
<td>Mari S.</td>
<td>F</td>
<td>35</td>
</tr>
<tr>
<td>Rodney D.</td>
<td>M</td>
<td>11</td>
<td>Hilda T.</td>
<td>F</td>
<td>62</td>
</tr>
<tr>
<td>Barbara E.</td>
<td>F</td>
<td>58</td>
<td>Sandra T.</td>
<td>F</td>
<td>31</td>
</tr>
<tr>
<td>Joe F.</td>
<td>M</td>
<td>39</td>
<td>Leslie W.</td>
<td>F</td>
<td>45</td>
</tr>
<tr>
<td>Bud F.</td>
<td>M</td>
<td>62</td>
<td>Vicki Y.</td>
<td>F</td>
<td>43</td>
</tr>
<tr>
<td>Darlene F.</td>
<td>F</td>
<td>63</td>
<td>John Y.</td>
<td>M</td>
<td>71</td>
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<tr>
<td>Charles F.</td>
<td>M</td>
<td>45</td>
<td>Zoe F.</td>
<td>F</td>
<td>8</td>
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<tr>
<td>Dana F.</td>
<td>F</td>
<td>3</td>
<td>Michelle H.</td>
<td>F</td>
<td>57</td>
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<tr>
<td>Stanley H.</td>
<td>M</td>
<td>68</td>
<td>Bryan J.</td>
<td>M</td>
<td>48</td>
</tr>
<tr>
<td>Jennifer L.</td>
<td>F</td>
<td>38</td>
<td>Ken L.</td>
<td>M</td>
<td>49</td>
</tr>
<tr>
<td>Bryan J.</td>
<td>M</td>
<td>48</td>
<td>Jake J.</td>
<td>M</td>
<td>43</td>
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<tr>
<td>Ann J.</td>
<td>F</td>
<td>49</td>
<td>Karen K.</td>
<td>F</td>
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</tr>
<tr>
<td>Chandler K.</td>
<td>M</td>
<td>29</td>
<td>Jennifer L.</td>
<td>F</td>
<td>38</td>
</tr>
</tbody>
</table>
## Population Pyramid

<table>
<thead>
<tr>
<th>Male</th>
<th>Female</th>
</tr>
</thead>
<tbody>
<tr>
<td>95+</td>
<td></td>
</tr>
<tr>
<td>90-94</td>
<td></td>
</tr>
<tr>
<td>85-89</td>
<td></td>
</tr>
<tr>
<td>80-84</td>
<td></td>
</tr>
<tr>
<td>75-79</td>
<td></td>
</tr>
<tr>
<td>70-74</td>
<td></td>
</tr>
<tr>
<td>65-69</td>
<td></td>
</tr>
<tr>
<td>60-64</td>
<td></td>
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<tr>
<td>55-59</td>
<td></td>
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<tr>
<td>50-54</td>
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<tr>
<td>45-49</td>
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<tr>
<td>40-44</td>
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<tr>
<td>35-39</td>
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<tr>
<td>30-34</td>
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<tr>
<td>25-29</td>
<td></td>
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<tr>
<td>20-24</td>
<td></td>
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<tr>
<td>15-19</td>
<td></td>
</tr>
<tr>
<td>10-14</td>
<td></td>
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<tr>
<td>5-9</td>
<td></td>
</tr>
<tr>
<td>0-4</td>
<td></td>
</tr>
</tbody>
</table>
Population Pyramid Assignment

1. Describe the shape of your cemetery pyramid.

___________________________________________________________________
___________________________________________________________________
___________________________________________________________________
___________________________________________________________________
___________________________________________________________________

2. Describe the shape of your unknown pyramid.

___________________________________________________________________
___________________________________________________________________
___________________________________________________________________
___________________________________________________________________
___________________________________________________________________

3. What are some similarities between your two pyramids?

___________________________________________________________________
___________________________________________________________________
___________________________________________________________________
___________________________________________________________________
___________________________________________________________________
4. How are the pyramids different?

___________________________________________________________________
___________________________________________________________________
___________________________________________________________________
___________________________________________________________________

5. What conclusions could you draw about the causes of death for your cemetery pyramid?

___________________________________________________________________
___________________________________________________________________
___________________________________________________________________
___________________________________________________________________

6. What conclusions could you draw about the causes of death for your unknown pyramid?

___________________________________________________________________
___________________________________________________________________
___________________________________________________________________
___________________________________________________________________

7. Would your conclusion change if you knew that all of your unknown subjects died on the same day? How would you possibly explain that?

___________________________________________________________________
___________________________________________________________________
___________________________________________________________________
___________________________________________________________________
# Rubric: Population Pyramid Assignment

<table>
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<tr>
<th>Criteria</th>
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<th>2-</th>
<th>2+</th>
<th>3-</th>
<th>3+</th>
<th>4-</th>
<th>4+</th>
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<td><strong>Communication</strong></td>
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<td></td>
<td></td>
<td></td>
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</tr>
<tr>
<td>- Construction of Population Pyramid</td>
<td>Pyramid is very messy and difficult to read, or largely incomplete</td>
<td>Pyramid is not very neat and somewhat difficult to read</td>
<td>Pyramid is constructed neatly and is easy to read</td>
<td>Pyramid is constructed very neatly, and is very easy to read, looks professional</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>- Spelling, sentence structure, mechanics of answers are correct and effective</td>
<td>Responses have several errors in terms of structure and mechanics or are incomplete sentences</td>
<td>Responses have some errors that prevent them from being fully effective</td>
<td>Responses have few mechanical or sentence structure errors and are effective</td>
<td>Responses have no mechanical or sentence structure errors and are very effective</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Application</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
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<td></td>
</tr>
<tr>
<td>- The population pyramid bar graphs reflect correct values</td>
<td>The pyramid is mostly incomplete and many values are incorrectly plotted; data collection may or may not be attached</td>
<td>The pyramid is complete but some values are incorrectly plotted and data collection is attached</td>
<td>The pyramid is complete with only 1 or 2 values that are not precisely plotted and data collection is attached</td>
<td>The pyramid is complete with all values plotted very precisely and data collection is attached</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>- The responses to the questions are correct and are supported with effective explanations</td>
<td>Many responses are incorrect and not explained with correct inferences of graphed results</td>
<td>Some responses are incorrect and/or some explanations do not reflect correct interpretations of the graphed results</td>
<td>Most responses are correct and reflect correct interpretation of the graphed results</td>
<td>All responses are correct and fully supported with explanations that reflect correct interpretation of the graphed results with insight</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**Communication:** _______  
**Application:** _______
Appendix 5

Population Pyramids

A population pyramid, also called an age pyramid, is a graphical illustration that shows the distribution of various age groups in a population which forms the shape of a pyramid when the population is growing. Information is most often divided by gender. The age range can be found on the sides (y axis) or up the center of the diagram. The number range is found at the bottom of the diagram (x axis) and varies depending on the size of your population sample.

Example:
TITLE: Exploring a Sense of Place by Understanding Geographical and Outdoor Terms in Spanish

Overview: Upon completion of this lesson, students will be able to read, write, and discuss novice geographic terms (in Spanish) related to observing very specific components of an outdoor setting. Students will then be able to compare that setting to another place within a state or region in which students have a desire to live or visit.

National Geography Standards:

1.4. The use of geographic representations to ask and answer geographic questions.
2.1 The locations, characteristics, and patterns of physical and human features are the basis for mental maps at local to global scales
6.1. People’s different perceptions of places and regions are influenced by their life experiences.

Oregon Geography Content Standards:

Please note: while this lesson is intended for students learning Spanish 1 and 2 who are middle or high school Spanish language learners, the following standard is appropriate to this lesson:
5.7. Identify, locate, and describe places and regions in the United States.


1.2 Interpretive Communication (Key Ideas and Details)- Demonstrate comprehension of content from authentic audio and visual resources.
3.2 Connections- Acquiring new information from other content areas using authentic sources.
5.1: Communities- Beyond the School Setting: Analyze the features of target culture communities (e.g. geographic, historical, artistic, social and/or political).

Objectives: The desired outcomes of this activity are tri-fold:
1. Students will experience and learn in an outdoor location, which is completely different than learning within a classroom setting. The primary goal is that students are outside and ideally, in a green space setting: park, trail, or outdoor school camp; somewhere that takes students away from that which is familiar. However, this lesson may also be performed in an urban setting, as long as it is outdoors!

2. Students will expand their Spanish language skills by asking and answering geographic questions related to the outdoor setting, gaining novice geographical vocabulary knowledge, and further develop observation and map reading skills.

3. Students will expand their spatial awareness related to experiencing an outdoor setting and then use an atlas to identify specific features of an area (within a state or region), as a point of comparison. This step will be especially helpful for students to try to accurately identify where desired geographical features are located, and possibly why these features are personally appealing.

By completing this activity, Spanish language learners will gain many vocabulary terms in the target language. Students will experience and also be able to compare an outdoor environment to a state or region in which s/he would like to live based on personal perception and/or experience with that particular place.

**Grade Levels:** 7 and 8 (or Spanish levels 1 and 2, which means grade levels could also include high school students taking beginning Spanish, grades 9-12).

**Time:** Four to five class periods, with options to extend.

**Materials for each student in class:**

- Paper/pencil
- Clip board
- Students’ journals/notebooks
- For Oregon teachers—Student Atlas of Oregon, hard copy and/or online: [http://www.pdx.edu/geography-education/student-atlas-of-oregon](http://www.pdx.edu/geography-education/student-atlas-of-oregon)
- El Atlas de Oregón para Estudiantes, hard copy and/or online: [http://www.pdx.edu/geography-education/%C3%ADndice-el-atlas-de-oregón-para-estudiantes](http://www.pdx.edu/geography-education/%C3%ADndice-el-atlas-de-oregón-para-estudiantes)
- For teachers outside of Oregon, locate and use an atlas for your state or region.

(Materials, con’t.)
• “Think Like a Geographer” (Appendix A.)
• Vocabulary assessment (Appendix B.)
• Rubric (Appendix C.)
• Dictionary of English to Spanish Key Terms (Appendix D.)
• Leave No Trace principles- teacher to decide whether to print Appendix E. to give students, or go over these ideas via the website: https://lnt.org/learn/7-principles
• Access YouTube to watch a short (less than 10 minutes) video, produced by National Park Service on the Leave No Trace practice: https://www.youtube.com/watch?v=jXO1uY0MvmQ
• “Stop, Look, Listen” for sensory observation activity (field observation activity, Appendix F.)
• Making Comparisons Grid (Appendix G.)
• Writing assessment (Appendix H.)
• Writing assessment rubric (Appendix I.)
• Student-created dictionary or list of key terms
• Snacks/lunches, in order to maximize time outdoors

Background:
• Students will already know and understand basic map reading and key terms in English.
• Having the ability to transfer map reading skills into a second language-learning setting is expected, as one of the primary goals of this lesson is to expand Spanish vocabulary while observing and comparing an outdoor/natural environment.
• Students have had practice making inferences about new word meanings based on other context clues within text, understanding and using cognates (words that look and sound alike, with same meaning in two or more languages) and should be comfortable using various resources, in this case, an atlas from which to pull new information.
• Students will have background knowledge of different types of ecosystems and what attributes make these systems unique and/or considered a desirable place to visit/live.
• Students will have background knowledge of terms and ideas associated with environment, and conservation practices due to earlier units of study.
• Students will already have knowledge of question words and how to ask questions in Spanish.
• Students will have had practice knowing and using prepositions (here, there, above, below, etc.).

Procedures:

Days 1-2, in the classroom setting:
1. Hook: Tell students they will become expert observers and that no one else on the planet will be able to fully describe, the way they will, the spot that will be exclusively “theirs” upon spending time in “their” outdoor
place! Further explain that the upcoming outdoor experience is intended to help establish a sense of physical place by identifying what makes a particular place unique. Help students understand that the focus outside will be to develop observation skills and be able to use geographical terms, using the target language as much as possible.

2. Class discussion in English or Spanish, depending on your class. Initially, English is suggested, due to the unique aspect of this lesson being partially conducted outdoors. If in Spanish, use props to avoid confusion and discuss ideas of place. If possible, work with social studies teachers, so that students may already be thinking about the following types of questions:

- How would you describe the world in which you live?
- Which geographic areas are wet vs. dry, mountainous vs. flat, etc.?
- Where would you most likely find lush vegetation and/or edible plant life?
- Where would you find birds of prey or songbirds?
- What does riparian mean?
- What types of life comprise a riparian area?
- What does arid mean?
- What type of life exists in high (greater than 10,000 feet) elevation areas? Etc.

3. Brainstorm what makes a physical place desirable to visit or live. Address different opinions; ask if the preferences are due to actually visiting these places, or due to seeing them in other forms (magazines, movies, online, etc.). During the discussion, keep track of a possible theme or key words/phrases that may consistently arise and begin creating a list of these words for the class to later use in the target language. (Do not allow students to view this list, prior to taking the pre-assessment.)

4. Distribute: “Piensa Como Un Geógrafo/Think Like a Geographer” to discuss some key ideas that will help guide students on their sensory observation field activity. (Appendix A.)

5. Pre-assessment: vocabulary quiz on geography/outdoor terms to initially identify students’ knowledge level in target language. (Appendix B.) Rubric for this assessment is Appendix C.

6. If in Oregon, distribute El Atlas de Oregón para Estudiantes, (if not, distribute your state’s atlas) having students peruse through various pages, reminding students to pay attention to cognates, and make inferences about words with which they’re not familiar.

(Days 1-2, con’t.)

7. Have students choose 20 words from pages 13-30, copying/defining them wherever they keep their Spanish vocabulary notes. (For teachers in other areas, decide which pages from your atlas are most applicable.) The idea is to add more terms, over time and in future lessons, in order to create a geographical terms dictionary. Be sure to address this, when making decisions on where to keep this information.
8. Merge students together in groups of four, allowing them to discuss each other’s lists and ask each other clarifying questions regarding possible translations. They may also begin to see some similar words from each other’s lists and have conversations about these terms, in the target language.

9. Bring the class back to a full group and give students the geography dictionary (Appendix D.), in order to further practice and study prior to going into the field. Advise students to focus on cognates, as the dictionary is quite comprehensive. You may also want to focus on words specific to site you will be visiting. You may end up adding or taking away from this dictionary, based on what ideas were brought up during the earlier brainstorm session. Be sure to address any vocabulary questions that may still be lingering from small-group work. Make sure students know that they aren’t expected to know all of the terms/ideas for the field activity, but that you want them familiar with these and where to access words when needed.

10. Discuss expectations regarding Leave No Trace principles and when traveling as a full class, each individual is responsible for limiting personal impact to the outdoor location. Show and discuss various points of the Leave No Trace website, watch the video from YouTube and the National Park Service, and/or give each student a brochure to be used as a small pocket-reminder. (Appendix E.)

11. Discuss appropriate clothing, according to whatever weather conditions exist at the time of year you plan to take your students in the field. Remind students to bring snacks/lunches.

**Day 3, in an outdoor setting:**

1. Students should have and bring their own pencils and journals/notebooks, geographical terms dictionary, hard copy of the Spanish atlas, snacks or lunches, and appropriate clothing.

(Day 3, con’t.)

2. Take students to an outdoor setting that works best for your location. (If such a setting is not in walking distance or near your school, be sure to obtain a bus and prepare for all of the associated details, well in advance.)

3. Have students offer reminders about the key principles of the Leave No Trace philosophy. Fill in on what they may miss.

4. Distribute the “Stop, Look, Listen” observation activity (you have already copied it, back-to-back, hole punched, etc.), extra paper, and
clipboards, with instructions explained that this exercise is a key component for being able to perform a comparison to a different state/region. (Appendix F).

5. Give students parameters for where they need to spread out, away from one another, and allow for what may seem like longer than needed; give at least 15 minutes for students to do this activity individually and silently as they gather as much detailed information as possible. The longer this exercise occurs, the deeper the observations made. When doing this activity, students should write as many words in Spanish, as possible. Instruct students to write everything they can, so if they can’t remember a word in Spanish, write it in English. They will be able to use their dictionaries and atlases later, to incorporate the Spanish vocabulary.

6. Transition from writing observations into allowing time for students to sketch the area they chose to observe, using the extra paper or in their journals/notebooks. Be sure to have them label as much as they can in Spanish. Again, if students struggle with the vocabulary, have them write in English so they’re able to go back and implement the Spanish labels.

7. Maintaining the sense of calm established from both the sensory and sketching activities, students quietly pair up with a partner to compare observations, paying attention to similarities and differences. This will allow them to use and remember words/phrases, as a result of comparing with a partner. Consider assigning partners prior to this exercise, to avoid excessive talking in the field.

8. Gather as a group to identify and discuss common features, observations, and themes that were observed from both the observation form and the student sketches. Have students incorporate as much Spanish as possible, showing the various items as discussed. Example: “En mi dibujo, hay muchas piedras y un montículo de hormigas allá.” (In my drawing, there are a lot of rocks and a mound of ants there.) As students talk, have them try to show various items that are being talked about; in the example, rocks would be shown, and possibly a demonstration a mound of ants crawling around.

(Day 3, con’t.)

9. If time allows, while remaining in the same outdoor setting, have students individually sketch a mental map that shows a state or region that is viewed, by the student, as a desirable place to live or visit. Express that they need to focus on specific components that make the place on their sketch desirable. Again, encourage students to label in the target language, but if accessing vocabulary is a struggle, label in English. They may use their language resource, if time allows. If time does not allow for this activity, do it once you have returned to the classroom setting.

10. Upon returning to the classroom, or as an out of class assignment: students will bring together multiple sources of information in order to
compare and do some analytical thinking regarding “place.” Have students use the Spanish atlas, vocabulary lists/dictionary, mental map created in the field, and observation information to fill in the grid (Appendix G.) from all sources that comprise the following:

- General features found on: mental map and actual map (at least 5-10)
- Adjectives to describe unique and favorable features (at least 5-10)
- Perceptions on why features stand out (at least 3)
- Unfavorable features

11. Be sure to encourage students to study their individually created geography terms dictionary, dictionary list, and utilize the online atlas in order to be prepared for their upcoming post-assessment.

**Day 4-5, Assessments and Wrap-up:**

From the following, choose assessments that work best for your particular classes:

1. Vocabulary post-assessment: give the same pre-assessment vocabulary quiz of map and key vocabulary terms to identify growth in target language. (Appendix B.) Use the rubric for guidance on identifying growth. (Appendix C.)

2. Without any vocabulary or other resources, have students draw a map of the natural outdoor setting that they individually observed, paying close attention to the features that they label. Opt for at least 10-15 features labeled in the target language. Depending on the range of students, you may adjust this requirement, as appropriate. They must include a key, show the cardinal directions, and create a legible product. (Appendix H). Either rubric will work for this assessment (Appendix C or Appendix J).

3. For a written component to this lesson, have students write two paragraphs in the target language about their experience in the field and why a particular region/state/country is deemed as a desirable place to visit or live (Appendix I). Hold students accountable for incorporating new geography and outdoor vocabulary, in the target language. Modify for lower level students, having them focus on adjectives that make an area a desirable place to visit or live. Use rubric for assessing written work (Appendix J).

4. Offer time for reflection through class discussion, using as much Spanish as possible. Talk about why slowing down and being silent in the setting was critical for being able to generate observations. Discuss highlights of being in an outdoor setting to not only practice and use new Spanish vocabulary, but also to think about what comprises “place,” and
how we interact and form relationships to these places. Try to use as much Spanish as possible for this reflective discussion.

Extensions and/or Adaptations:

Extension Activity Focus:
- ethnicity,
- population
- movement and migration.

Use maps on student atlas, pages 52-58 to discuss movement and migration. Ask questions such as: What makes a group of people move and/or congregate? Which states have a growing population of Spanish speakers and why?

Collaborate with social studies teachers regarding concepts surrounding the theme of push-pull factors, so students have a basic understanding in English of these terms and ideas.

The following websites are useful resources:

“What language is spoken in your state?”
http://www.slate.com/articles/arts/culturebox/2014/05/language_map_what_s_the_most_popular_language_in_your_state.html

“Hispanics in the United States”

“Push and Pull Factors of Migration”
http://www.nationalgeographic.com/xpeditions/lessons/09/g68/migrationguidestudent.pdf

(Extensions, con’t.)

Additional idea to extend ideas regarding migration and human movement:

Assign an “investigation” to your students; they will explore their family history, where they will develop a map that traces their ancestors and their travels to other states, regions, or countries. Students should label in Spanish, using their own dictionaries, as well as other resources from this overall lesson. Students need to research the motivations behind the movement by interviewing or looking at old letters, diaries or journals of family members. Students should try to investigate whether or not language was a barrier to the family members’ movement.

Sources:


Appendix A: Think Like a Geographer! ¡Piensa como un Geógrafo/una Geógrafa!

Directions to teachers: You may use this as an anticipatory set of questions, or when you get to your site. Select various questions from the following list to help guide your discussion with students:

1. **Location:** Where is the place? ¿Dónde está el lugar?

2. **Condition:** What is the place? ¿Qué es el lugar?

3. **Connection:** How is the place linked to others? ¿Cómo está relacionado el lugar a otros?

4. **Region:** What nearby places are like this one? ¿Qué son lugares cerca de aquí que son similares a este lugar?

5. **Analog:** What far-away places are like this one? ¿Qué son lugares lejos de aquí que son similares a este lugar?

6. **Aura:** How does one place affect its neighbors? ¿Cómo le afecta este lugar a sus vecinos?

7. **Pattern:** Are there groups, sets or other patterns? ¿Hay grupos, colecciones, o otras tendencias/patrones?

8. **Correlation:** How are some of the patterns alike? ¿Cómo son similares algunas tendencias?

9. **Gradient:** What is it like in transition places? ¿Cómo es este lugar en lugares de transición?

10. **Diffusion:** How do things spread out in the land? ¿Cómo se dispersan cosas en la tierra?

11. **Hierarchy:** How does the place fit with other places (town/state/country)? ¿Cómo encaja este lugar con otros lugares como un pueblo, ciudad/estado/país?

12. **Comparison:** How are the places alike and different? ¿Cómo son los lugares similares y diferentes?
Pre and Post Assessment: Appendix B.

Geographical and Outdoor-Related Terms: Spanish

Teachers: Options for this assessment include, but aren’t limited to the following: give the entire assessment at once, pull various terms and offer a smaller assessment, give as a verbal assessment—you say the word in Spanish, students write the translation in English, etc.

Students: Choose the best option for each Spanish word’s translation. Remember to consider cognates (words that look and sound similarly, and have the same meaning, in two or more languages), and other context clues:

1. fluir
   A. ocean  B. country  C. volcano  D. to flow
2. la inundación
   A. flood  B. forest  C. island  D. freshwater
3. la llanura
   A. mountain range  B. volcano  C. plain  D. (earth) tremor
4. agua salada
   A. valley  B. salt water  C. flow  D. cliff
5. el acantilado
   A. sea bed  B. cliff  C. flood  D. hill
6. el pico, cumbre
   A. jungle  B. wood  C. mountain range  D. peak, summit, top
7. el borde del mar, costa
   A. fresh water  B. jungle  C. coast/shore  D. (earth) tremor
8. el mar
   A. sea  B. peak, summit, top  C. flow  D. wood
9. el bosque (grande)
   A. cliff  B. flow  C. forest  D. plain
10. el valle
    A. valley  B. jungle  C. stream  D. forest
11. el campo, en el
    A. mountain range  B. in the countryside  C. flood  D. west
12. el bosque pequeño
    A. river  B. wood  C. flood  D. saltwater
13. el río
    A. coast, shore  B. rain forest  C. earthquake  D. river
14. la jungla
    A. plain  B. sea  C. jungle  D. peak, summit, top
15. la campiña, el paisaje
    A. in the countryside  B. field  C. hill  D. countryside, landscape
16. la selva tropical
    A. field  B. earthquake  C. rainforest  D. wood
17. el cañón
    A. slope  B. canyon  C. stream  D. river
18. este
    A. west  B. south  C. here  D. east
19. el lago
    A. pond  B. lake  C. water  D. river
20. la colina, la loma
   A. sea       B. hill       C. country       D. flow
21. sur
   A. here      B. there     C. south       D. east
22. el océano
   A. field     B. plain/flatland     C. earthquake     D. ocean
23. el lago
   A. reef      B. lake       C. cliff       D. jungle
24. el barro
   A. dirt      B. sand       C. stone       D. west
25. el norte
   A. above     B. there     C. direction     D. north
26. la piedra
   A. hill      B. rock       C. state       D. country
27. la montaña
   A. volcano      B. freshwater     C. mountain     D. reef
28. el longitud
   A. canyon     B. tree       C. latitude     D. longitude
29. El desierto
   A. beach     B. desert     C. dirt       D. air
30. el oeste
   A. north     B. south     C. east       D. west
31. el latitud
   A. lateral     B. hemisphere     C. longitude     D. latitude
32. la naturaleza
   A. globe       B. nature     C. negative     D. nature
33. la playa
   A. desert     B. arid       C. jungle       D. beach
34. el arroyo
   A. stream     B. river       C. pond       D. lake
35. La cordillera, la sierra
   A. earthquake       B. mountain range     C. field       D. rainforest
36. los animales
   A. mammals      B. reptiles     C. species     D. animals
37. la hierba
   A. sand        B. dirt       C. dust       D. grass
38. el agua dulce
   A. fresh water   B. salt water     C. water       D. hydrogen
39. afuera
   A. here       B. there     C. inside     D. outside
40. el país
   A. city       B. Paris      C. town       D. country

Appendix C. Rubric for either vocabulary assessment and/or written assessment at the end of the lesson.
<table>
<thead>
<tr>
<th>Score</th>
<th>Description</th>
</tr>
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</table>
| 2.5   | You do not seem to understand, and…
|       | - no response is given, leaving many answers blank. |
| 3     | You seem to understand, and…
|       | - can answer/respond with one-word answers. |
| 3.5   | You seem to understand and respond…
|       | - but answer incorrectly. |
|       | - with lots of guidance and support. |
|       | - in broken sentences or with English interference. |
| 4     | You understand and respond…
|       | - appropriately, but minimally. |
|       | - with some repetition. |
| 4.5   | You understand fully and respond…
|       | - appropriately and correctly, most of the time. |
| 5     | You understand fully and respond…
|       | - appropriately and correctly, nearly the full time. |
|       | - elaborate and extend with your response. |
### Appendix D.

**Diccionario de Geografía (Inglés al Español)**

<table>
<thead>
<tr>
<th>English</th>
<th>Spanish</th>
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<tbody>
<tr>
<td>A</td>
<td>climate-clima</td>
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<td>age-era</td>
<td>climap-climograma</td>
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<td>agricultural-agrícola</td>
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<td>Antarctica-Antártica</td>
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<td>Asia-Asia</td>
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<td>atlas-atlas</td>
<td>county-condado</td>
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<td>Australia-Australia</td>
<td>county seat-capital del condado</td>
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<td>average annual-promedio anual</td>
<td>crop-cultivo</td>
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<td>B</td>
<td>cross-section-sección transversal</td>
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<td>basin-cuenca</td>
<td>D</td>
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<td>bay-bahía</td>
<td>dam-presa</td>
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<td>desert-desierto</td>
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east- este
economy- economía
ecoregions- eco-regiones
elevation- elevación
elevation cross section- elevación en sección transversal
employment -empleo
energy production- producción de energía
environment- medio ambiente
equator- Ecuador
Europe- Europa
European- europeo(a)
expansion- expansión
exports- exportaciones
F
farm- granja
farm product- producto agrícola
federal land- territorio federal
fish- pez
flood- inundación
forest- bosque
forest fire risk- riesgo de incendio forestal
fruit crop- cultivo de frutas
G
general reference map- mapa de referencia general
geographer- geógrafo
Geography- geografía
geothermal potential- potencial geotérmico
ghost town- pueblo fantasma
glacier- glaciar
globe- globo
golf- golfo
graduated circles- círculos graduados
growth- crecimiento
H
harvest- cosecha
hatchery- criadero de peces
hemisphere- hemisferio
highway- carretera
hill- colina, loma
historic- histórico
human geography- geografía humana
human systems- sistemas humanos
I
immigrants- inmigrantes
industry- industria
island- isla
isopleth- isopleta

J
jungle- jungla/selva

K
key- clave

L
lake- lago
land- tierra
land ownership- propiedad de la tierra
landforms-accidente geográfico
landscape- paisaje
latitude- latitud
Lewis and Clark Trail- Ruta de Lewis y Clark
longitude- longitude

M
map- mapa
map component- componentes de los mapas
map skills- habilidades para interpretar mapas
mapping- hacer un mapa
meadow- prado/pradería
metropolitan areas- áreas metropolitanas
migratory- migratorio

N
mineral deposit- depósito mineral
minerals-minerales
mountain- montaña
mountain range- cordillera
native americans- indígenas
natural hazard- riesgo natural
natural resources- recursos naturales
north- norte
North America- Norteamérica, América del Norte

O
ocean- océano
ocean current- corriente oceánica
orchard- huerto
Oregon Community Foundation- Fundación Comunitaria de Oregon
Oregon Trail- Ruta de Oregon
peninsula- península
physical geography- geografía física
physical systems- sistemas físicos
place name origins- origen del nombre del lugar
plain/plateau- plano/llano/llanura
planet-planeta/mundo
plate boundaries- límites de placa
plate tectonics - placas tectónicas
plateau- meseta, altiplano, mesa
pond- estanque, charca
population- población
population density- densidad de población
population distribution- distribución de la población
population pyramid- pirámide poblacional
port- puerto
precipitation- precipitación
prime meridian- primer meridiano
private land- terreno particular
product- producto
projections- proyecciones
race- raza
railroads- vías férreas
ranchland- rancho
recreation- recreación
regions- regiones
renewable energy- energía renovable
reservation- reserva
river- río
river bank- orilla
scale- escala
sea- mar
sector- sector
settlement- asentamiento
society- sociedad
solar potential- potencial solar
south- sur
South America- Sudamérica, América del Sur
spatial- espacial
state- estado
state land- territorio estatal
stream- arroyo
student- estudiante
Student Atlas of Oregon- Atlas de Oregon para el Estudiante
swamp- pantano
symbol- símbolo
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temperature thematic map- temperatura mapa temático
title- título
topography- topografía
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<td>town</td>
<td>pueblo (población)</td>
</tr>
<tr>
<td>transportation</td>
<td>transporte</td>
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<tr>
<td>tree</td>
<td>árbol</td>
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<tr>
<td>tree branch</td>
<td>rama del árbol</td>
</tr>
<tr>
<td>tribal land</td>
<td>territorio tribal</td>
</tr>
<tr>
<td>tsunami</td>
<td>tsunami</td>
</tr>
<tr>
<td>universe</td>
<td>universo</td>
</tr>
<tr>
<td>unusual place names</td>
<td>nombres de lugares poco comunes</td>
</tr>
<tr>
<td>urban area</td>
<td>área urbana</td>
</tr>
<tr>
<td>\textbf{Using Data: A Cartographer's Dilemma- Uso de Datos: El Dilema del Cartógrafo}</td>
<td></td>
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<td>\textbf{V}</td>
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<tr>
<td>vegetation</td>
<td>vegetación</td>
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<tr>
<td>vegetation zone</td>
<td>zona de vegetación</td>
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<tr>
<td>valley</td>
<td>valle</td>
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<td>\textbf{W}</td>
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<tr>
<td>waterfall</td>
<td>cascada/catarata</td>
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<tr>
<td>watershed</td>
<td>cuenca</td>
</tr>
<tr>
<td>weather extremes</td>
<td>extremos climatológicos</td>
</tr>
<tr>
<td>west</td>
<td>oeste</td>
</tr>
<tr>
<td>Where do we come from?</td>
<td>¿De dónde venimos?</td>
</tr>
<tr>
<td>\textbf{Z}</td>
<td></td>
</tr>
<tr>
<td>wildlife</td>
<td>vida silvestre</td>
</tr>
<tr>
<td>wind pattern</td>
<td>patrón del viento</td>
</tr>
<tr>
<td>wind potential</td>
<td>potencial de vientos</td>
</tr>
<tr>
<td>zone</td>
<td>zona</td>
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</tbody>
</table>
Appendix E:

Teachers: Make sure you and your students are clear on the principles of Leave No Trace, PRIOR to visiting your site! Decide if you print some of these reminders for students to have in their notebooks, and/or use other resources in class. Offer the following types of reminders:

“When visiting any place, leave it in the same, or BETTER, condition than you found it!! While we are visiting our outdoor site, please remember and follow these principles!”

- **Know Before You Go**- Be prepared for where you’re visiting!
- **Choose The Right Path**- Stay on the trail to protect habitats!
- **Trash Your Trash**- Pack it in, pack it out!
- **Leave What You Find**- Let everyone else enjoy the things you found to be unique and beautiful!
- **Respect Wildlife**- Observe and enjoy it from a distance and do not ever approach or try to feed any wild thing!
- **Be Kind To Other Visitors**- Avoid loud voices, yield to others who are on the trail, be courteous!

Discuss and answer: As a visitor of any wild (or not wild) place, why is it important to follow the Leave No Trace ideas?
Appendix F: Sensory Observation Activity

<table>
<thead>
<tr>
<th>¡Párate, Mira, y Escucha!</th>
</tr>
</thead>
<tbody>
<tr>
<td>STOP, LOOK, LISTEN!</td>
</tr>
</tbody>
</table>

Teachers: Help students understand that by slowing down and being very quiet, they will notice a LOT about their specific location. Regardless of grade level, the act of slowing down has many benefits, especially when in the field. Say something along these lines: “Too often, we rush by, not noticing the world around us. Take ample time to use all of your senses and make the following observations:”

<table>
<thead>
<tr>
<th>¡La OREJA!</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. ¿Cuáles son los sonidos que pueden oír? ¿El silbido de una rama o hoja, el sonido del agua en la distancia? Escribe palabras o frases que describen lo que oyes. No te olvides usar onomatopeya (la imitación de los sonidos en palabras).</td>
</tr>
</tbody>
</table>

What sounds do you hear? The swish of a branch or leaf, the distant sound of water? Write as many words or phrases that describe what you hear. Don’t forget about using onomatopoeia (imitation of sound in words)!
¡La NARIZ!
2. Toma una respiración profunda por la nariz. ¿Qué hueles? Escribe tantos adjetivos como puedas. Take a nice, deep breath through your nose. What do you smell? Write as many adjectives as possible.

¡Los DEDOS/La MANO!
3. Encuentra algo cerca de ti para tocar. Describe cómo lo siente. Find something near you that you can touch. Describe how it feels.
¡LOS OJOS!
4. Usando los ojos, mira alrededor del lugar. ¿Qué ves y qué es interesante o te preguntas? Presta atención en TODAS cosas—vivos o muertos!
Using your eyes, look around! What do you see that is interesting, or makes you wonder? Focus on ALL things, living or not!

¡EL CEREBRO!
5. ¿Qué piensas que vive aquí? Piensa en cualquier cosa desde el más pequeño al más grande. What do you think lives here? Think of anything from the smallest of creatures, to the biggest!
<table>
<thead>
<tr>
<th>6. ¿Lo que hace especial o único a este lugar?</th>
<th>What makes this place unique and special?</th>
</tr>
</thead>
<tbody>
<tr>
<td>La Gente y el Medio Ambiente (People and the Environment)</td>
<td></td>
</tr>
<tr>
<td>7. ¿Cómo se benefician las personas de este lugar?</td>
<td>How do people benefit from this place?</td>
</tr>
</tbody>
</table>

Appendix G: Comparision Grid
Haciendo Comparaciones/Making Comparisons:
Student Directions: Using the Spanish atlas, vocabulary dictionary, sketches, mental map (created in the field), and sensory observation details, please fill in this grid, in Spanish. You are creating a list of factors from all sources that comprise the following:
- General features found on: mental map and actual map (at least 5-10)
- Adjectives to describe unique and favorable features (at least 5-10)
- Perceptions on why features stand out (at least 3)
- Unfavorable features

<table>
<thead>
<tr>
<th>Características generales de mi mapa mental</th>
<th>Características generales de un mapa en mi atlas</th>
<th>Adjetivos: únicos y positivos de las características</th>
<th>Percepciones: ¿Por qué las características destacan?</th>
<th>Características desfavorables</th>
</tr>
</thead>
<tbody>
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</tbody>
</table>

Appendix H. Hora: _______  
Outdoor Site: Map Making Assessment
Teachers: Modify this assessment for your students, as needed.

Student Directions:
Part 1: Without any vocabulary resources draw a map of the outdoor setting, where you were the one and only expert! While you individually observed your site, you paid close attention to many features through the senses, act of slowing down, and making inferences. In Spanish, sketch and label at least 10-15 features that made your site unique. Do not forget to include a key, show the cardinal directions, and create a legible product. If you need more space, use a separate piece of paper.

Turn over for Part 2!

Part 2: Answer, using as much Spanish as possible:
- How does “your” outdoor site benefit humans?
- How do humans use and interact with “your” site?
- What are the benefits to spending time outdoors, in order to learn?
Appendix I: Writing Assessment/Practice

Nombre: _______________   Hora: __________
**Note to Teachers:** Determine what is appropriate for paragraph requirements: length, how many paragraphs, modify for different abilities, etc.

**Student Directions:** On the back of this paper, write 2 paragraphs about your recent outdoor sensory observation and atlas experience, in Español.

- **Paragraph 1:** In Spanish, include as much information as possible about your experience in an outdoor setting and what you observed. Include details of what you:
  - heard
  - felt
  - saw
  - touched
  - smelled
  - your overall experience outside

You are a beginning Spanish language learner, so your paragraphs will be in the PRESENT tense! You will write sentences with, “I hear, see, touch, etc.” Do not worry about writing in the preterite, or past tense! Focus on using your **new vocabulary** and write as much as possible!

- **Paragraph 2:** Write about where you want to live in the state or country. Include as many geography terms as you can and pay attention to the quality of your writing: try to focus on correct verb conjugations and remember that Spanish is spelled how it sounds! As always, try your best!
## Interpersonal Writing, Level 1

<table>
<thead>
<tr>
<th>Task</th>
<th></th>
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</thead>
<tbody>
<tr>
<td><strong>Exceeds Expectations</strong></td>
<td><strong>Meets Expectations</strong></td>
<td><strong>Approaches Expectations</strong></td>
<td><strong>Below Expectations</strong></td>
<td></td>
</tr>
<tr>
<td>Novice-High: 5</td>
<td>Novice-Mid: 4.5</td>
<td>Novice-Low: 4</td>
<td>Novice-Low: 3, 3</td>
<td></td>
</tr>
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<td></td>
<td></td>
</tr>
<tr>
<td><strong>Task</strong></td>
<td>How well do I complete the task?</td>
<td>I complete the task by using a variety of learned statements and/or questions.</td>
<td>I complete the task by using some basic learned statements and/or questions.</td>
<td>I complete the task by using memorized words and high frequency phrases.</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>I complete the task by using only a few very basic memorized words.</td>
</tr>
<tr>
<td><strong>Comprehensibility</strong></td>
<td>How well does the audience understand me?</td>
<td>I can be easily understood. The message is clear.</td>
<td>I can be understood. The message is mostly clear.</td>
<td>I can be somewhat understood. The message is partially clear.</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>I can be understood only with great effort. The message is not clear.</td>
</tr>
<tr>
<td><strong>Vocabulary Use</strong></td>
<td>How extensive and applicable is my vocabulary?</td>
<td>I consistently use extensive vocabulary learned to complete the task.</td>
<td>I use adequate vocabulary to complete the task.</td>
<td>I use limited and/or repetitive vocabulary.</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>I use extremely limited and/or repetitive vocabulary.</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>My native language interferes.</td>
</tr>
<tr>
<td><strong>Language Control</strong></td>
<td>How accurate are my grammatical structures?</td>
<td>I correctly use grammatical structures appropriate to the task, most of the time. Errors do not interfere.</td>
<td>I use grammatical structures appropriate to the task some of the time. Errors occasionally interfere.</td>
<td>I rarely use grammatical structures appropriate to the task. Errors frequently interfere.</td>
</tr>
<tr>
<td></td>
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<td></td>
<td></td>
<td>I do not use grammatical structures appropriate to the task. Errors usually interfere.</td>
</tr>
<tr>
<td><strong>Mechanics</strong></td>
<td>How accurately do I use correct spelling, capitalization, and punctuation?</td>
<td>I make no or almost no errors in spelling, capitalization, and punctuation.</td>
<td>I make occasional errors in spelling, capitalization, and punctuation.</td>
<td>I make frequent errors in spelling, capitalization, and punctuation.</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>I make little or no attempt to use correct spelling, capitalization, and punctuation.</td>
</tr>
</tbody>
</table>

| 5 | x ______ = ____________ |
| 4.5 | x ______ = ____________ |
| 4 | x ______ = ____________ |
| 3.5 | x ______ = ____________ |
| 3 | x ______ = ____________ |

Total = ____________
How a City Street Changes Over Time

Brenda Mahler
Coffenberry Middle School
Myrtle Creek, Oregon

Overview:
This is not a traditional outdoor school lesson plan, but a lesson that can be used in an urban or small downtown setting. Students will create an urban survey map to compare with Sanborn maps to understand change over time. If Sanborn maps are not available, students can still make a mental map and a survey map without the historical comparison. First, students will create a mental map of the area they are going to survey and map. Then, working in small groups, students will travel to the location to measure one side of a city block and record information about what businesses are in each space. Students will then compare changes from the Sanborn maps and record their observations. Additionally, the information will be charted in a bar graph to show how many retail stores, restaurants/food establishments, and service business are in the space.

National Geography Standards:
Geography Standard 2: How to use mental maps to organize information about people, places, and environments in a spatial context.
Developing Mental Maps 1: The locations, characteristics, and patterns of physical and human features are the basis for mental maps at local to global scale

Geography Standard 4: The physical and human characteristics of places
The Characteristics of Places 2: Physical and human characteristics of places change

Oregon Geography Content Standards:
6.14 Identify physical features of the Western Hemisphere and explain their effects on people and events
6.15 Explain how people have adapted to or changed the physical environment in the Western Hemisphere

Connections to Common Core:
6-8.RH.7 Integrate visual information (eg., in charts, graphs, photographs, videos, or maps) with other information in print and digital text.
Objectives:
In completing this activity, students will be able to:
- Create a mental map of a known city street
- Map businesses located on a city street
- Identify changes over time on a city street.
- Make inferences about the cause of these changes

Grade Levels: 6-8  Time: 2 hours

Materials:
- Mental Map #1 handout
- Sanborn maps
- Survey Map handout
- Measuring tape
- Clipboard, blank paper (to draw a “sloppy copy”), several pencils
- Sanborn maps
- Comparison Worksheet
- Mental Map #2 handout
- Mental Map Scoring Rubric
Background:
Students should have an understanding of basic map skills, such as understanding cardinal directions, symbols, and scale, (Students will need to be familiar with direction so they can find the correct side of a street as it relates to the cardinal directions).

Students should be familiar with mental maps, how to make them and what their use is.

As a pre-learning activity, a class discussion should be held to help students gain basic understanding of why things change in a city over time. An example could be why towns had many video rental stores, yet today very few towns even have a video rental store.

Sanborn Maps:
Sanborn maps are detailed maps made during a specific year. These maps were used for fire insurance purposes. What makes these maps a useful teaching tool is that they are labeled with what occupied a building at that given time, such as livery stables, boarding houses, organization meeting places, gas/service stations, homes, churches, police stations, etc. For example, the Sanborn maps of Myrtle Creek, Oregon from 1950s show where the Veterans Housing was located (today that location is a dog park). For more detailed information, please visit this website: https://www.loc.gov/collections/sanborn-maps/about-this-collection/

Sanborn maps of Oregon cities and towns can be obtained from Oregon State University free of charge by visiting this website: http://scarc.library.oregonstate.edu/findingaids/index.php?p=collections/findingaid&id=2107
Find the city you want to use and click on “Add to Shelf”.
Then click on the Contact Us tab at the top and make your request.
Maps will be e-mailed to you in a digital file you can save.

In other states, check with your state universities or look for the maps on-line.

Photos:
If Sanborn maps are not available, check with the local museum to see if there are historical photographs of streets and businesses students can use for comparison.
Procedures:

- Make groups of 3-4 students. Assign each group a section/specific side of a street on a city block in an area they are familiar with, such as a street in their hometown or neighborhood. (e.g., the west side of Main Street between Oak and Pine).

- In the classroom, each student, will individually, create a mental map of the section of street their group has been assigned. Use the Mental Map #1 handout. This can be considered a pre-test, but students should take the mental map with them to the actual street so they can reference it when working on the Comparison Worksheet.

- Students will travel to their destination in their group with their individual Mental Map #1, a clipboard, blank paper, pencils, tape measure, Survey Map, Comparison Worksheet, and Sanborn map of the street section. It is recommended that students are taught desired expectations and that behaviors are modeled before going to town.

- In their group, students will work together to create a survey map of the street section that has been assigned to them, (the same section where they made their Mental Map #1). Students will measure the city street and record on the Survey Map handout what is located in each 10-foot section and label it with the type of business that is located in that space. These should be ground level drawings to allow students to add details of what the building looks like. Sanborn maps are a birds-eye view, so students will need to understand the difference. An additional map could be drawn at birds-eye view.

- Working with their group, students will then compare the map they created from their measurements (Survey Map) with the Sanborn map. Using the Comparison Worksheet students will work together to record their observations and inferences about these changes. They will also need to reference their individual Mental Map #1 for this activity.

- Back in the classroom, students, will individually, create a new mental map on the Mental Map #2 worksheet to compare to the Mental Map #1.

- Conclusion activity will be a class discussion about how the town has changed over time. How has the town changed to fit the needs of the people living there? What impact do the changes of the town have on people? How have businesses changed over time? What has caused these changes?
Assessment:

- Use the Mental Map Scoring Rubric to assess the First and Second Mental Maps. *This assessment is for each individual student’s mental map
- The Comparison Worksheet can be assessed at the teacher’s discretion. Answers will vary depending on the site. *This worksheet should be considered a group grade as it was completed by the small group.

Extensions and/or Adaptations:

- If Sanborn maps are not available, follow the procedure, but substitute the Comparison Worksheet for the Observation Worksheet. Students will still make a mental map, work in a group to create a Survey Map, but use the Observation Worksheet to record their observations. Assessment will be the same.

- Make predictions to future development or possible destruction.

- Students can create a bar graph on a separate sheet of paper to show how many retail stores, restaurant/food establishments, and service businesses are on that street.
How a City Street Changes Over Time
Mental Map #1

From what you can remember about the section of city street assigned to you, draw a map of what is located in that space. You need to draw a street view and only include the ground level (if a building is multi-level, just draw the first level). Draw to scale as best you can.

Label each business with the name and what is sold or offered. Label each street (the street that you are assigned and the two side streets). Label any other important features you feel are important (plants, signs, light poles, parking meters, basically non-building things).
Name of group members:

How a City Street Changes Over Time
Survey Map

Draw what you see in each segment of 10 feet. You need to draw a street view and only include the ground level (if a building is multi-level, just draw the first level). Draw to scale as best you can.

Label each business with the name and what is sold or offered. Label each street (the street that you are on and the two side streets). Label any other important features you feel are important (plants, signs, light poles, parking meters, basically non-building things).
Name of group members:

How a City Street Changes Over Time
Comparison Worksheet

Using the information from the map of the city street you just created (Survey Map), compare this to the Sanborn Map. Answer the following questions to guide your thinking.

Why are these businesses located in this location?

____________________________________________________________________________
____________________________________________________________________________
____________________________________________________________________________

What has changed over time?

____________________________________________________________________________
____________________________________________________________________________
____________________________________________________________________________
____________________________________________________________________________
For what reasons do you think caused these changes to happened? (make an educated guess)
____________________________________________________________________________
____________________________________________________________________________
____________________________________________________________________________

What do these businesses say about the people who would shop/eat/get a service here?
____________________________________________________________________________
____________________________________________________________________________
____________________________________________________________________________

List any other observations you can about what was in this location and what is there now.
____________________________________________________________________________
____________________________________________________________________________
____________________________________________________________________________
Use your Mental Map #1 to answer these questions. You can do this as a group and share answers. OR have each person write their answer as individuals. Be sure to put your name by your response if you do it this way!

What is here (on this street section) that was not included on your mental map?

____________________________________________________________________________
____________________________________________________________________________
____________________________________________________________________________
____________________________________________________________________________
____________________________________________________________________________

What was added to your mental map that is not here (on this street section)?

____________________________________________________________________________
____________________________________________________________________________
____________________________________________________________________________
____________________________________________________________________________
____________________________________________________________________________
How a City Street Changes Over Time
Mental Map #2

Now that you are familiar with the section of city street assigned to you, draw another map from what you remember about that space. You need to draw a street view and only include the ground level (if a building is multi-level, just draw the first level). Draw to scale as best you can.

Label each business with the name and what is sold or offered. Label each street (the street that you are assigned and the two side streets). Label any other important features you feel are important (plants, signs, light poles, parking meters, basically non-building things).
How a City Street Changes Over Time
Mental Map Scoring Rubric

<table>
<thead>
<tr>
<th>Grade</th>
<th>Neatness</th>
<th>Labeled</th>
<th>Accurate</th>
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</thead>
<tbody>
<tr>
<td>A</td>
<td>Shows excellent neatness in what is represented</td>
<td>All (90-100%) buildings, streets, and other details are labeled and spelled correctly</td>
<td>All (90-100%) buildings, businesses, and other features are drawn correctly</td>
</tr>
<tr>
<td>B</td>
<td>Shows good neatness in what is represented</td>
<td>Many (80-89%) buildings, streets, and other details are labeled and spelled correctly</td>
<td>Many (80-89%) buildings, businesses, and other features are drawn correctly</td>
</tr>
<tr>
<td>C</td>
<td>Shows average neatness in what is represented</td>
<td>Most (70-79%) buildings, streets, and other details are labeled and spelled correctly</td>
<td>Most (70-79%) buildings, businesses, and other features are drawn correctly</td>
</tr>
<tr>
<td>D</td>
<td>Shows below average neatness in what is represented</td>
<td>Few (1-69%) buildings, streets, and other details are labeled and spelled correctly</td>
<td>Few (1-69%) buildings, businesses, and other features are drawn correctly</td>
</tr>
<tr>
<td>F</td>
<td>Too sloppy to understand what is represented</td>
<td>No buildings, streets, and other details are labeled and spelled correctly</td>
<td>No buildings, businesses, and other features are drawn correctly</td>
</tr>
</tbody>
</table>

This rubric should be modified to fit the points possible at the teacher's discretion.
How a City Street Changes Over Time
Observation Worksheet

Using the information from the map of the city street you just created answer the following questions.

Why are these businesses located in this location?

____________________________________________________________________________
____________________________________________________________________________
____________________________________________________________________________

What do these businesses say about the people who would shop/eat/get a service here?

____________________________________________________________________________
____________________________________________________________________________
____________________________________________________________________________
List any other observations you can about what was in this location.

____________________________________________________________________________

____________________________________________________________________________

____________________________________________________________________________

What is here (on the city street) that was not included on your mental map?

____________________________________________________________________________

____________________________________________________________________________

____________________________________________________________________________

What was added to your mental map that is not here (on the city street)?

____________________________________________________________________________

____________________________________________________________________________

____________________________________________________________________________
Human Interaction and the Life Cycle of the Salmon

Overview:
In an outdoor school-type setting, students make observations and learn about the life cycle of the salmon and the environment that the salmon needs in order to thrive. Students will also participate in an activity where they represent salmon and progress or perish as they pass through the stages of life, demonstrating the drastic number of salmon that do not survive each stage. Reasons for survival or death will also be discussed along the way. Students will also work with threat cards. They will place the dangers presented on those cards in a cause and effect chart and discuss, with a partner, what the possible impacts of that event could be on the salmon population. Finally, as an assessment, students will create a community service poster that promotes positive human impact on the environment.

National Geography Standards:
- Standard 8: The characteristics and spatial distribution of ecosystems and biomes on Earth’s surface.
- Standard 14: How human actions modify the physical environment.

Oregon Geography Content Standard:
- 6.16: Explain how technological developments, societal decisions and personal practices influence sustainability in the Western Hemisphere.

Oregon Science Content Standard
- MS-LS2-1: Analyze and interpret data to provide evidence for the effects of resource availability on organisms and populations of organisms in an ecosystem.

Common Core Standards:
- SL.6.1: Engage effectively in a range of collaborative discussions, (one-on-one, in groups, and teacher-led) with diverse partners on grade 6 topics, texts, and issues, building on others’ ideas and expressing their own clearly.

Objectives:
In completing this activity, students should be able to describe how the components of ecosystems, particularly the ecosystem of the salmon, are connected and contribute to the
energy of their own cycles. They should also be able to describe and explain how human-induced changes in one place can affect the physical environment and life cycle of the salmon.

**Grade Levels:** 6  **Time:** 1.5 hours

**Materials:**
- An environment where salmon are or could be found.
  - Environmental elements include small coastal or freshwater streams with elements such as trees or long grasses on the bank; rocks fit for hiding in the water; tributaries; gravel, pebbles or small rocks where salmon might spawn.
  - In Oregon, some possible places to view salmon:
    - Herman Creek
    - Eagle Creek Trail
    - Big Bottom Unit of the Clackamas Wilderness
    - Bonneville Dam
- Writing utensil
- “Observation” Worksheet, Appendix A
- Diagrams of the Individual Phases of the Life Cycle of the Salmon, Appendix B
- Life Cycle Chart, Appendix C
- “Survival Rates” Information, Appendix D
- “Cause and Effect” Worksheet, Appendix E
- “Threat Cards,” Appendix F, if you want to make the cards with a title, included is a sheet of covers to use.
- Rubric for Scoring Assessment, Appendix G
- Thermometer to measure water
- Poster paper
- Markers
- Clipboards
- 2500 pieces of paper or other items, divided into groups of 100, and placed in bags or envelopes ahead of time

**Background:**
Undoubtedly, you will have a student ask why studying the salmon is so important, especially if it is not a part of their diet. Here’s what they need to know:
- When salmon spawn and die at the end of their life cycle, they are a source of nutrition that allows other animals, like bear, eagle, mink, and otter, to survive harsh winters.
- The salmon are also a source of nutrients to the plant life as they decompose.
- The salmon are a critical element to the food chain. They are the energy that fuels the natural environment.

Procedures:

1. Once students have arrived at the “Salmon Environment,” distribute the “Observation” worksheet (Appendix A). Ask them to get their writing utensil and spread out within a certain boundary and observe and record their surroundings using sights, smells and sounds in the “Observation” worksheet. Direct them to pay special attention to the area where salmon could be without letting on that you’re talking about salmon. Remind students that observation does not include inference. It should be obvious, fact based observation. The hope is that they will take note of items like trees or tall grasses along the river bank. For pictures of salmon environments you can download the following: [www.dfw.state.or.us/.../E2F_Volunteer_Guide_PP3_Salmonid_Habitat.ppt](http://www.dfw.state.or.us/.../E2F_Volunteer_Guide_PP3_Salmonid_Habitat.ppt)

2. Discuss what students have observed, placing special emphasis on the elements of the salmon habitat.

3. Hand out the life cycle chart (Appendix C). Go through the life cycle of the salmon using the diagram card (Appendix D). Students should draw pictures and write notes in the ellipse and name the stage in the rectangle below it. In the brief notes, items that can be included are things that are essential to the environment of a thriving salmon habitat and where the salmon lives throughout its various stages. As the group continues this process, start to link the observations to the life cycle lesson. After talking about the perfect water temperature, as a part of their thriving environment, students could be sent to measure the water.

4. To demonstrate the drastic death rates of salmon as they progress through the stages of life, ask students to put down their materials and line up shoulder to shoulder in an open area. Use the base number of 2,500. Figure out how to divide your students. Maybe some are partners, but it is easiest if you have 25 “teams.” Give each student or pair of students a bag with 100 items, like paper squares or counters. All students and their 100 items start out as eggs, so all students get to take a giant step forward. When continuing to the next level, for example, eggs to alevins, 375 survive. That means that the class needs to get rid of 2,175 pieces. If they know they have 100 pieces a piece, it’s easy to
count. When a student runs out of pieces, they have perished. Only four groups should have survived at this point if you have used 25 groups. Those students get to take a giant step forward while all other students have to stay behind because they “die.” A student only perishes if all of their pieces are gone. Continue through the stages until all students have perished.

5. Get back together as a group and discuss their thoughts. In what stages did the most salmon perish? What are some possible causes of death? This would be a great chance to connect their observations to the death rate. Reveal other causes of death that have not been presented.

6. Present the students with another worksheet, “Cause and Effect” (Appendix E). Partners will work best for this so students have someone to discuss ideas with. Lay the “Threat Cards” (Appendix F) out in a wide space with the word, “THREAT” facing up. These cards contain possible threats to the salmon. The student pairs will each select one card at a time and write the threat in the cause box. Then the pairs need to discuss the effect that this may have on the salmon and their environment. For example, a student may draw a card that says, “A local company has accidentally released some chemicals into the local stream.” Students could simply say, as an effect, that the chemicals traveled downstream and poisoned a group of fry who will not survive. Another example might be that they draw a card that says, “The climate change has caused a low snowpack this last winter. This snowpack feeds into a local stream.” The student could respond that the water temperature might rise where the salmon are living and that could bring disease. Encourage students to use their best guesses and common sense and let them you will discuss the answers. Encourage student to look at the environment they are in to come up with effects from the threats.

7. When students have had enough time to complete the activity, bring them back together to discuss and check for correct thinking. Take the students back to the location where they did their observation and discuss what elements are present or missing to make this area conducive for salmon.

Assessment:
Students will be asked to break up into pairs. You could use different pairings than before to get more interaction and ideas generated. Students will work on a community service advertisement poster. Give the students the following prompt: The local salmon population has been declining.
Please make a poster with your partner that informs the community about things they can do to help increase the number of salmon. A rubric has been included to assist with scoring. (Appendix G)

Extensions:

- Students can participate in a “Salmon in the Classroom” project where the local soil, water, and conservation district of department of fish and wildlife brings in eggs and a complete tank set-up for the class to try to raise salmon. Students chart data, such as water temperature, and watch the fish progress or perish.

- Return back to the cause and effect worksheet and threat cards and have students find articles related to the topic. They can do small group presentations and reports.

- The local department of fish and wildlife will often have a program where they bring fish and lead the students through a dissection.

- Students can test water quality of the local rivers and streams. Often the local soil and water conservation district will have materials for classes to borrow for this. They may even send someone to help your class through this process.

- There are many fun activities relating to the ones in this lesson, including an obstacle course designed to simulate the challenges of the salmon as they travel through life. [http://www.troutintheclassroom.org/teachers/library/survival-salmon](http://www.troutintheclassroom.org/teachers/library/survival-salmon)

Sources:


Herkamp, Kevin. *Salmon Life Cycle*. Salem, OR: Oregon Department of Fish and Wildlife, 7 Nov. 2012. PPT.
Appendix A

Observations - Record what you are observing as far as sight, sound, and smell. Remember that an observation is the obvious and factual.

<table>
<thead>
<tr>
<th>Sights</th>
<th>Sounds</th>
<th>Smells</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
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</tbody>
</table>
Spawners lay eggs in gravel, creating redds. Adult salmon create spawning beds known as redds to deposit fertilized eggs in the gravel. The eggs are hidden and incubate in the spaces between the rocks. The eggs are deposited and then covered. Otherwise, the eggs would suffocate and die.

The eggs are typically constructed in clean gravel with good flow of clean water, and redds are usually found near the edge of fast water in the river. Spawning salmon die after spawning.
**EGGS**

- Average number of eggs deposited per hen is around 3,000 eggs.
- Can be clearly seen.
- Embryos, and the baby salmon's eyes can be clearly seen.
- During this time they develop into embryos and the baby salmon's eyes can be clearly seen.
- Salmon eggs stay in the gravel for 2-3 months before hatching.

**Essential Elements Needed:**
- Salt, food, cold, clean, oxygenated
- Lethal temperature: 77 degrees is a lethal temperature.
- Gravel, pebbles, and other similar things to hide the eggs.

**Diagram:**
- Egg
- Smolt
- Adult
- Allevin
- Death
- Spawner
- Redd
- Spawner
in the stream.
Swimming up from the gravel to live another 1-2 months before remaining in the gravel for Alevins remain in the gravel. Still attached to their bodies, the gravel and feed off the yolk sac. After hatching from the egg, young salmon, known as alevin remain in the gravel before becoming fry.
Stay in freshwater for many months or years.

- Pink and Chum salmon out-migrate to the ocean as fry while other species may stay in freshwater for many months or

- Fry are typically 1-2 inches in length.

- Recently left the gravel are known as fry.

- Young free-swimming salmon that

- When they emerge from the gravel they

- until they learn to feed.

- The yolk sack continues to nourish them as a small amount of

- Fry are called "sac fry" as a small amount of

- spawn

- death

- adult

- FRY
As salmon mature into a smolts, their bodies decrease and their parr marks (parr marks) along their bodies disappear.

Young salmon typically between 2-5 inches that are not yet smolts are known as parr.

PARR

- Hide from the enemy
- Thickets are also used to hide from predators
- Trees for shade and used to boulder, logs, tall grass or cold, clean water

Essential Elements:

- Fry
- Smolt
- Allevine
- Adult
- Spawn
- Death
Many salmon smolts spend some time in estuaries before heading to the ocean.

- Smolts lose their fry marks and the open ocean.
- Change camouflage from stream to the body becomes sleekly in color. This is to
- Other elements needed:
  - Phytoplankton
  - Invertebrates
  - Insects
  - Food!

Smolts
- Smolting typically happens from 4-10.
- Freshwater to the ocean, they become
- Allevia
- Adult
- Spawners
- Eggs
- Death

SMOLT

Juvenile Chinook Salmon
Salmon travel vast distances to Alaska and even Russia or Japan yet still return home.

Conditions:
- Depending on species and environmental prey species available in the ocean.
- Salmon spend 1-5 years in the ocean.
- Most salmon spend more than 80% of their lives in the ocean where they grow big on the

Essential Elements Needed:
- Shrimp
- Eels
- Squid
- Other fish
- Food

Adult

Spawner

Red

Death

Subadult

Parr

Smolt

 Fry

Allevin

Allevin

88
Food for the young salmon, including insects some of which in turn provide web. The carcasses feed many organisms. Carcasses play an important role in the food web. Fortunately this death will bring life. The spawning. Salmon and many steelhead adults will die after making their return journey and going through the hurdles and physical changes all Death
### Example of Survival Rates for Actual Salmon

<table>
<thead>
<tr>
<th>Stage of Development</th>
<th>Number</th>
<th>Deaths</th>
<th>Survivors</th>
<th>Percentage</th>
<th>Possible causes of death</th>
</tr>
</thead>
<tbody>
<tr>
<td>Eggs to Alevins</td>
<td>2500</td>
<td>2125</td>
<td>375</td>
<td>15%</td>
<td>● Unfertilized eggs ● Gravel movement ● Low oxygen in the water ● Drastic changes in water temperature ● Pollution ● Disease ● Predators</td>
</tr>
<tr>
<td>Alevins to Fry</td>
<td>375</td>
<td>245</td>
<td>30</td>
<td>12%</td>
<td>● Lack of adequate food ● Predators ● River blockage ● Pollution</td>
</tr>
<tr>
<td>Fry to Smolts</td>
<td>30</td>
<td>25</td>
<td>5</td>
<td>20%</td>
<td>● Predators</td>
</tr>
<tr>
<td>Smolts to Adults</td>
<td>5</td>
<td>3</td>
<td>2</td>
<td>67%</td>
<td>● Harvesting ● Predators</td>
</tr>
<tr>
<td>Adults to Spawners</td>
<td>2</td>
<td>2</td>
<td>0</td>
<td>0%</td>
<td>● High or low water levels ● Predators ● Obstructions ● Diseases ● Death after spawning</td>
</tr>
</tbody>
</table>
Appendix E

Cause and Effect

Directions: With your partner, select one “Threat” card at a time. Describe the threat, or cause, in the arrow. Then in the rectangle, describe how that might be harmful for the salmon and their habitat.
Threat Card

Threat Card

Threat Card

Threat Card

Threat Card

Threat Card
There has been a dam altered the flow of the water. They don't want to drastically change the stream in their nets that happen to catch many fish, but the kind of fish they're looking for a certain group of fish. Some river banks have caused flooding. This has washed away the cattle to new ground. This winter, which rains heavily, have been heavy on the cattle. A rancher has moved his cattle nearby that releases hot water into the river stream. Some local farms have washed into the field and used some of the pesticides and control weeds and pest control. There is a power plant.
Stream-side plants have been infested by a disease, causing them to start disappearing.

Dumping in the river is being caused by logging in the area and soil erosion is being exacerbated, harming insects and other life in the water, causing livestock field erosion and run-off from the river.

A dam has been built along the riverway, which is blocking access for the salmon. A lot of new neighborhoods are spotted along the local coromarants’ area, which is a sea bird. There have been many spawn to the stream where salmon water is often filtered on its way to the edge of a wetland where is being built right on. One in the town.
<table>
<thead>
<tr>
<th>Change: a dam built upstream of water</th>
<th>deep pools of water</th>
<th>forest cover which has depleted the timber harvesting factor</th>
</tr>
</thead>
<tbody>
<tr>
<td>A new dam has been built but it has caused releases and retreats of water, as it generates power, causing the flow of water to constantly change.</td>
<td>The Department of Fish and Wildlife has increased the fishing limit allowing more fish to continue to grow, where the young salmon population has been sustained damage sustained by weather and has encountered foul weather in the ocean.</td>
<td>The seal and sea lion</td>
</tr>
</tbody>
</table>
Climates are extremely back to spawn.
Stream pools, or ponds.

Estuaries rise as well.

Making low-lying areas on the rise.
The sea level, oceans.

Winter fires have been increasing in the forests. This is leading to warmer weather because of warmer happening more often.

Winter floods have been burning out roots of trees. This caused a low snowpack.

Local streams flows and washing gravel away. This is leading to erosion in the rivers.

Pollution in pollution, stream beds and washing.
### Appendix G - Rubric for Assessing the Posters

<table>
<thead>
<tr>
<th>Demonstrates Knowledge About Human Impact on Salmon Populations</th>
<th>1-2</th>
<th>3-4</th>
<th>5-6</th>
<th>Comments</th>
</tr>
</thead>
<tbody>
<tr>
<td>The student demonstrates knowledge effectively by identifying an impact that humans have or can have on salmon.</td>
<td>The student demonstrates some knowledge by identifying an impact that humans have or can have on salmon. Details may be slightly inaccurate.</td>
<td>The student demonstrates little knowledge of human impact on salmon. Information or details are inaccurate or not based on reliable information.</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Demonstrates Knowledge About Salmon and Ecosystems</th>
<th>1-2</th>
<th>3-4</th>
<th>5-6</th>
<th>Comments</th>
</tr>
</thead>
<tbody>
<tr>
<td>The student effectively demonstrates knowledge of the ecosystem of a salmon by providing accurate information.</td>
<td>The student demonstrates some knowledge of the ecosystem of the salmon by providing some information or information that is may be slightly inaccurate.</td>
<td>The student demonstrates little or no knowledge of ecosystem of the salmon. Little information has been provided or it is not accurate.</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Demonstrates the Ability to Effectively Collaborate in Group Discussion*</th>
<th>1-2</th>
<th>3-4</th>
<th>5-6</th>
<th>Comments</th>
</tr>
</thead>
<tbody>
<tr>
<td>The student was observed actively listening and speaking when appropriate. The student contributed useful ideas and solutions.</td>
<td>The student was observed actively listening most of the time and speaking on occasion. The student contributed some ideas and maybe a solution.</td>
<td>The student was observed actively listening only sometimes and rarely spoke. The student may have only contributed one item of use in conversation.</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Effort and Creativity</th>
<th>1-2</th>
<th>3-4</th>
<th>5-6</th>
<th>Comments</th>
</tr>
</thead>
<tbody>
<tr>
<td>The student’s project is complete, has an effective amount of detail that draws attention and is colorful.</td>
<td>The student’s project is complete, has sufficient detail and some color.</td>
<td>The student’s project may be unfinished, have little detail and no color.</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Score</th>
<th>Final Score:</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
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</tbody>
</table>

*This can be assessed during almost any of the activities and allows the teacher the opportunity to observe each student at some point in the lesson.*
Identifying Native American Cultural Regions- Observation Activity

In this activity, students will observe the natural environment as present day students and as pre-colonization Native Americans. Students will be asked to identify aspects of the landscape, climate, and natural resources that they witness currently, and then apply their knowledge to speculate if Natives lived in this area pre-1492.

Procedure:

1) Give students “Observation Sheet.” Have students bring their sheet, a pencil, and a clipboard and find a quiet place to sit outside.

2) Ask students to close their eyes and sit quietly for five minutes in order to hear and smell their environment.

3) Ask students to open their eyes, and without talking, answer the questions on the Observation Sheet. This is an individual activity. Give students approximately 15-20 minutes.

4) Have students partner up and compare sheets, adding details that they missed or did not notice. Give students approximately ten minutes.

5) Lead a class discussion with the following questions:
   a. What are vital resources Natives would have had available to them in this area?
   b. What are limitations or dangers of this area?
   c. Based on what we discussed, do you think Native Americans inhabited this area pre-1492?

Assessment:

See attached rubric.
Observation Sheet - Cultural Regions

Name: ______________________________________________________ Period: _____

PART 1 DIRECTIONS: Sit quietly and observe the environment around you. Answer the following questions with as much description and detail as you can.

1) What landmarks do you see? Landmarks are the natural formations on the Earth’s surface.

2) What natural resources do you see? Natural resources are things that humans can use for survival or for monetary gain.

3) What plants can you identify?

4) What animals and insects can you identify?

4) Describe the weather today. What do you know about the climate of this area? What are some items of clothing you should be wearing to be comfortable and functional in this environment?
5) Transport yourself to 1490. If you lived here, what are things you could eat?

6) What could you use for shelter?

7) What other resources could you use for survival?

8) What would you wear in order to be comfortable and functional?
## Identifying Native American Cultural Regions Rubric

<table>
<thead>
<tr>
<th></th>
<th>Highly Proficient</th>
<th>Proficient</th>
<th>Approaching Proficient</th>
<th>Not Proficient</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Content</strong></td>
<td>• Answered all questions thoroughly and thoughtfully</td>
<td>• Answered all questions with some thought</td>
<td>• Answered most questions with some thought</td>
<td>• Answered less than 60% of questions</td>
</tr>
<tr>
<td><strong>Grammar, Punctuation, and Spelling</strong></td>
<td>• Zero errors</td>
<td>• One error</td>
<td>• Two errors</td>
<td>• Three or more errors</td>
</tr>
<tr>
<td><strong>Vocabulary</strong></td>
<td>• Skillful and accurate vocabulary</td>
<td>• Adequate and appropriate vocabulary</td>
<td>• Vague and/or weak vocabulary</td>
<td>• Ineffective and/or incorrect vocabulary</td>
</tr>
</tbody>
</table>
TITLE: Just Plain Water

Overview: The purpose of this lesson is to solidify the concept of Acid Rain. Students will investigate the acidity of a natural water source, compile data, and draw conclusions based on their findings and knowledge of acidity levels.

National Geography Standards:
- Standard 14: (1) Human modifications of the physical environment in one place often lead to changes in other places.
- Standard 14: (2) Use of technology has changed the scale at which people can modify the physical environment.

Oregon Geography Content Standards:
- Standard 6.15: Explain how people have adapted to or changed the physical environment in the western hemisphere.

Connections to Common Core:
- Standard 6-8.RH.2: Determine the central ideas or information of a primary or secondary source; provide an accurate summary of the source distinct from prior knowledge or opinions.

Objectives:
- Students will be able to identify the acidity level of a natural water source using pH balance strips.
- Students will be able to define what can cause acid rain.
- Students will also be able to conclude the effects of a high/low acidity level in natural water sources.

Grade: 6TH

Time: (4) 60 minute lessons (Outdoor School)/ 1day field trip

Materials:
- Paper
- pencils
- pH Balance strips bought at a local pool supply store / amazon.com
- clipboards
• old blanket or sheet for sitting.
• natural water source
• Acid Rain – Students Site Reading: What is Acid Rain? What Causes Acid Rain? Why is Acid Rain Harmful? - (Appendices A – C)
• Acid Rain review reading (Appendices D-F)
• Station Test Worksheet (Appendix G).
• Acid Rain Assessment (Appendix H)
• Acid Rain Rubric (Appendix I)
• Wildlife species specific to local area/ outdoor school

**Background:** Water cycle, Fossil Fuels, Fresh Water / Salt Water Species, Acid Rain reading (covered in classroom with Appendices A – C)

**Resource:**
https://www3.epa.gov/acidrain/education/site_students/whatisacid.html
• Site used for original Acid Rain Appendices (A – F)

**Preparation:**
• You can have students practice testing the pH level in your classroom.
• Discussion about water safety is important prior to going on the field trip.
• Also, remind students and parents about field trip appropriate clothing.
• If possible, scout the area you are visiting before your students to mark or note your three stations moving down the river.

**Procedures:**
1. **Hook the lesson:** On the bus ride to the natural water source, have students identify which objects were on the road that use gasoline or diesel. Did they notice any odd smells on the trip? Can these items be harmful to the earth?
2. Once you’re off the bus, have students get into groups of 3 or 4.
3. Give each group the following material sets: clipboard, pencil, water test strips, Station Test Worksheet (APPENDIX G). **Time:** 10 minutes
4. Introduce the lesson: “Today, you are going to test the pH Balance of the Willamette River (or nearby water source). You will take three samples from three different locations along the river. It is important that you pay attention to the people and space around you”. **Time:** 5 minutes
5. **Task 1** - Take students to the first water station. One student from each group should form a line to take their sample.

6. Once the student has a sample, they take it back to their group, label the strip, and begin the Station Test Worksheet by answering the first question set.

7. Give students time to answer the question before moving on to the next station.

8. At the next station, a new set of students should be lining up to take a water sample. Once the student has the water sample, remind students to label the sample and answer the second question set.

9. Walk the class to the last sample station. A new set of students should be lining up to take the last sample. Have students take the strip back to their group and complete the process from steps 6 and 8. That will finish the last question set. **Time:** 60 minutes

10. Now that students have their data, they will need to compile it into a bar graph. Question 4 on the Station Test Worksheet provides the students with space to organize their data.

11. Assist students with discerning the colors on their test strips. **Time:** 15 minutes

12. Now that students have the data organized, introduce the review reading (Appendices A – C or D – F modifications) and the Acid Rain Assessment (Appendix H).

13. “Now that you have the data collected, you can review the ways that acid occurs and predict what would happen if avid levels become too high or too low. Also what it would take to maintain neutral pH levels in natural water systems”. **Time:** 5 minutes

14. **Task 2** – Give students the modified reading for their groups.

15. Instruct students to read the information before they begin their group writing section. **Teacher note:** Students can also work in pairs to improve equal involvement. **Time:** 15 minutes

16. Once students have had a chance to review the reading, give them the Acid Rain Assessment (Appendix H).

17. **Task 3** - Go over the writing assignment instructions with your students. Clarify any questions that they may have about the assessment.

18. While your students are writing, assist them with any questions they may have or need to think through the scenarios. **Time:** 30 Minutes

19. Have students share out their ideas once they are done writing. Work through each scenario even if the students didn’t write about it. Make sure to cover the repercussions to their full event. If the pH is too high
or low, it is harmful to the natural species that inhabit the water and the surrounding forests. It could also be harmful to humans, if acid rain (precipitation) actually occurs with a high enough acidity level.

20. Collect student papers to be graded based on the assessment rubric (Appendix I) which can be done in the classroom after the day’s field trip or the outdoor activity.

21. Before you leave the Willamette River (or nearby water source), please make sure that all materials are collected, or thrown away as needed.

**Assessment:**
Students will be expected to construct a response to one of the following prompts in their groups.

**Prompt:** Pick a number and write two paragraphs about the provided scenario.

Paragraph 1 should state how the levels could change. Paragraph 2 should state the outcomes from the changes.

1. Describe what would happen to the forests, wildlife and humans if the water became too acidic causing acid rain?
2. Explain what would happen to the forests, wildlife, and humans if the water became too basic.
3. Detail in what ways it would be possible to maintain neutral pH levels in our natural water systems.

**Extensions and/or Adaptations:**

Task 1:
- Analyze the pH levels of more than one naturally occurring water source if it is possible.
- This task can also be done in the classroom by having students bring in water sources from home. The teacher should also bring in water samples from various sources as well to add variety to student samples. The samples could be labeled anonymously. This would give students the opportunity to guess their water source.
- Students can research in the classroom or the computer lab possible causes for abnormal levels such as nearby factories, run offs, and watersheds.
Task 2:
- The literacy/text portion of this lesson can be taught prior to the trip in the classroom. The modified readings can be used with SPED/ELL students that require adaptations. Original copies can also be used to modify for TAG as well.
- Matching the vocabulary with pictures to increase understanding.
- Students can perform a web-quest using the source site for the readings. Pre-determined questions can be used to guide the students through the readings.

Task 3:
- The assessment doesn’t need to be done on site. It can be done in the classroom if preferred or necessary.
- The writing portion can be done individually, pairs, or groups as listed.
- If the class has had practice working in fish bowls, allowing the group to observe and listen to student ideas to the prompts. – A fish bowl is an exercise where a small group of students sit in a circle while being surrounded by the rest of the class. They discuss the topic at hand. Teacher helps to guide the discussion when it stalls. The outside group takes notes about the discussion/ or writes down questions that they have for the group at the end of the fishbowl.
Appendix A

**What is Acid Rain?**

Acid rain is rain that has been made **acidic** by certain pollutants in the air. Acid rain is a type of **acid deposition**, which can appear in many forms. Wet deposition is rain, sleet, snow, or fog that has become more acidic than normal. Dry deposition is another form of acid deposition, and this is when gases and dust particles become acidic. Both wet and dry deposition can be carried by the wind, sometimes for very long distances. Acid deposition in wet and dry forms falls on buildings, cars, and trees and can make lakes acidic. Acid deposition in dry form can be inhaled by people and can cause health problems in some people.

**What is acidity?**

Acidic and basic are two ways that we describe chemical compounds. Acidity is measured using a pH scale. A pH scale runs from zero (the most acidic) to 14 (the most **basic** or **alkaline**). A substance that is neither basic or acidic is called "neutral", and this has a pH of 7.
Appendix B

What Causes Acid Rain?

Sources of Acid Rain
Acid rain is caused by a chemical reaction that begins when compounds like sulfur dioxide and nitrogen oxides are released into the air. These substances can rise very high into the atmosphere, where they mix and react with water, oxygen, and other chemicals to form more acidic pollutants, known as acid rain. Sulfur dioxide and nitrogen oxides dissolve very easily in water and can be carried very far by the wind. As a result, the two compounds can travel long distances where they become part of the rain, sleet, snow, and fog that we experience on certain days.

Human activities are the main cause of acid rain. Over the past few decades, humans have released so many different chemicals into the air that they have changed the mix of gases in the atmosphere. Power plants release the majority of sulfur dioxide and much of the nitrogen oxides when they burn fossil fuels, such as coal, to produce electricity. In addition, the exhaust from cars, trucks, and buses releases nitrogen oxides and sulfur dioxide into the air. These pollutants cause acid rain.

Acid Rain is Caused by Reactions in the Environment
Nature depends on balance, and although some rain is naturally acidic, with a pH level of around 5.0, human activities have made it worse. Normal precipitation—such as rain, sleet, or snow—reacts with alkaline chemicals, or non-acidic materials, that can be found in air, soils, bedrock, lakes, and streams. These reactions usually neutralize natural acids. However, if precipitation becomes too acidic, these materials may not be able to neutralize all of the acids. Over time, these neutralizing materials can be washed away by acid rain. Damage to crops, trees, lakes, rivers, and animals can result.
Appendix C

**Why is Acid Rain Harmful?**

**Acid Rain Can Cause Health Problems in People**

Air pollution like sulfur dioxide and nitrogen oxides can cause respiratory diseases, or can make these diseases worse. Respiratory diseases like **asthma** or chronic **bronchitis** make it hard for people to breathe. The pollution that causes acid rain can also create tiny particles. When these particles get into people’s lungs, they can cause health problems, or can make existing health problems worse. Also, nitrogen oxides cause ground-level **ozone**. This ground-level ozone causes respiratory problems, like **pneumonia** and **bronchitis**, and can even cause permanent lung damage. The health effects that people have to worry about are not caused by the acid rain, but are caused when people breathe in these tiny particles or ozone. Swimming in an acidic lake or walking in an acidic puddle is no more harmful to people than swimming or walking in clean water.

**Acid Rain Harms Forests**

Acid rain can be extremely harmful to forests. Acid rain that seeps into the ground can dissolve nutrients, such as magnesium and calcium, that trees need to be healthy. Acid rain also causes **aluminum** to be released into the soil, which makes it difficult for trees to take up water. Trees that are located in mountainous regions at higher elevations, such as spruce or fir trees, are at greater risk because they are exposed to acidic clouds and fog, which contain greater amounts of acid than rain or snow. The acidic clouds and fog strip important nutrients from their leaves and needles. This loss of nutrients makes it easier for infections, insects, and cold weather to damage trees and forests.
Appendix C continued

Acid Rain Damages Lakes and Streams

Without pollution or acid rain, most lakes and streams would have a pH level near 6.5. Acid rain, however, has caused many lakes and streams in the northeast United States and certain other places to have much lower pH levels. In addition, aluminum that is released into the soil eventually ends up in lakes and streams. Unfortunately, this increase in acidity and aluminum levels can be deadly to aquatic wildlife, including phytoplankton, mayflies, rainbow trout, small mouth bass, frogs, spotted salamanders, crayfish, and other creatures that are part of the food web. This problem can become much worse during heavy downpours of rain or when the snow begins to melt in the spring. These types of events are known as episodic acidification.

Acid Rain Damages Buildings and Objects

Acid rain can also have a damaging effect on many objects, including buildings, statues, monuments, and cars. The chemicals found in acid rain can cause paint to peel and stone statues to begin to appear old and worn down, which reduces their value and beauty.
What is Acid Rain?

**Acid rain** is rain that has been made acidic by certain pollutants in the air. Acid rain is a type of acid deposition, which can appear in many forms. **Wet deposition** is rain, sleet, snow, or fog that has become more acidic than normal. **Dry deposition** is another form of acid deposition, and this is when gases and dust particles become acidic. Both wet and dry deposition can be carried by the wind, sometimes for very long distances. Acid deposition in wet and dry forms falls on buildings, cars, and trees and can make lakes acidic. Acid deposition in dry form can be inhaled by people and can cause health problems in some people.

**What is acidity?**

Acidic and basic are two ways that we describe chemical compounds. **Acidity** is measured using a pH scale. A pH scale runs from **zero (the most acidic)** to **14 (the most basic or alkaline)**. A substance that is neither basic or acidic is called "neutral", and this has a pH of **7**.

**Key Words:**

**Acid Rain**: Rain that has been made more acidic than normal.

**Wet Deposition**: Wet deposits that include rain, snow, hail and fog.

**Dry Deposition**: Dry deposits that are gases and dust particles that have been made more acidic.

**Acidity**: excessive acid quality

**Acidic**: a compound that has a less than a 7 on a pH scale.

**Neutral**: meaning that the water has no excessive characteristic of being too acidic or basic.
What Causes Acid Rain?

Acid rain is caused by a chemical reaction that begins when compounds like sulfur dioxide and nitrogen oxides are released into the air. These substances can rise very high into the atmosphere, where they mix and react with water, oxygen, and other chemicals to form more acidic pollutants, known as acid rain. Sulfur dioxide and nitrogen oxides dissolve very easily in water and can be carried very far by the wind. As a result, the two compounds can travel long distances where they become part of the rain, sleet, snow, and fog that we experience on certain days.

Human activities are the main cause of acid rain. Over the past few decades, humans have released so many different chemicals into the air that they have changed the mix of gases in the atmosphere. Power plants release the majority of sulfur dioxide and much of the nitrogen oxides when they burn fossil fuels, such as coal, to produce electricity. In addition, the exhaust from cars, trucks, and buses releases nitrogen oxides and sulfur dioxide into the air. These pollutants cause acid rain.

Acid Rain is Caused by Reactions in the Environment

Nature depends on balance, and although some rain is naturally acidic, with a pH level of around 5.0, human activities have made it worse. Normal precipitation—such as rain, sleet, or snow—reacts with alkaline chemicals, or non-acidic materials, that can be found in air, soils, bedrock, lakes, and streams. These reactions usually neutralize natural acids. However, if precipitation becomes too acidic, these materials may not be able to neutralize all of the acids. Over time, these neutralizing materials can be
washed away by acid rain. Damage to crops, trees, lakes, rivers, and animals can result.

**Key Words:**

**Compounds:** A substance formed by two or more elements.

**Acidic Pollutants:** Chemicals that are excessively acidic and pollute the air/earth.

**Fossil Fuels:** Petroleum – oil, coal and natural gas that has been naturally made from ancient plants and animals.
Why is Acid Rain Harmful?

Acid Rain Can Cause Health Problems in People
Air pollution like sulfur dioxide and nitrogen oxides can cause respiratory diseases, or can make these diseases worse. Respiratory diseases like asthma or chronic bronchitis make it hard for people to breathe. The pollution that causes acid rain can also create tiny particles. When these particles get into people’s lungs, they can cause health problems, or can make existing health problems worse. Also, nitrogen oxides cause ground-level ozone. This ground-level ozone causes respiratory problems, like pneumonia and bronchitis, and can even cause permanent lung damage. The health effects that people have to worry about are not caused by the acid rain, but are caused when people breathe in these tiny particles or ozone. Swimming in an acidic lake or walking in an acidic puddle is no more harmful to people than swimming or walking in clean water.

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Acid Rain Damages Lakes and Streams

Without pollution or acid rain, most lakes and streams would have a pH level near 6.5. Acid rain, however, has caused many lakes and streams in the northeastern United States and certain other places to have much lower pH levels. In addition, aluminum that is released into the soil eventually ends up in lakes and streams. Unfortunately, this increase in acidity and aluminum levels can be deadly to aquatic wildlife, including phytoplankton, mayflies, rainbow trout, small mouth bass, frogs, spotted salamanders, crayfish, and other creatures that are part of the food web. This problem can become much worse during heavy downpours of rain or when the snow begins to melt in the spring. These types of events are known as episodic acidification.

Acid Rain Damages Buildings and Objects

Acid rain can also have a damaging effect on many objects, including buildings, statues, monuments, and cars. The chemicals found in acid rain can cause paint to peel and stone statues to begin to appear old and worn down, which reduces their value and beauty.

Key Words:

Asthma/Bronchitis: Respiratory or breathing disease.

Ozone: a layer of specific oxygen in the atmosphere that absorbs ultraviolet rays preventing them from reaching the surface of the earth.

Phytoplankton: a cluster/group of plants or plantlike organisms.
Station Test Worksheet (G)

**Directions:** Write the station number on each strip. Identify the acidity level of each station by matching the test strip to the Scale color gauge. The color indicates the level of acidity.

1. What color is the strip of Station 1? What is the acid level number based on the color? Based on the pH scale, describe the quality of the water.

   __________________________________________________________
   __________________________________________________________
   __________________________________________________________
   __________________________________________________________
   __________________________________________________________
   __________________________________________________________

2. What color is the strip of Station 2? What is the acid level number based on the color? Based on the pH scale, describe the quality of the water.

   __________________________________________________________
   __________________________________________________________
   __________________________________________________________
   __________________________________________________________
   __________________________________________________________
   __________________________________________________________

3. What color is the strip of Station 3? What is the acid level number based on the color? Based on the pH scale, describe the quality of the water.

   __________________________________________________________
   __________________________________________________________
   __________________________________________________________
   __________________________________________________________
   __________________________________________________________
   __________________________________________________________
4. Graph the levels for Station 1 - 3 below?

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<tr>
<th></th>
<th>Station 1</th>
<th>Station 2</th>
<th>Station 3</th>
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</thead>
<tbody>
<tr>
<td>14</td>
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<tr>
<td>13</td>
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<td>1</td>
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<td>0</td>
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</tbody>
</table>

If possible, circle the stations with the highest and lowest numbers.
**Acid Rain Assessment - Appendix H**

**Prompt:** Pick a number and write two paragraphs about the provided scenario. **Paragraph 1** should state how the levels could change. **Paragraph 2** should state the outcomes from the changes.

1. Describe what would happen to the forests, wildlife and humans if the water became too acidic causing acid rain?
2. Explain what would happen to the forests, wildlife, and humans if the water became too basic.
3. Detail in what ways it would be possible to maintain neutral pH levels in our natural water systems.

________________________________________________________________________________
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<table>
<thead>
<tr>
<th>Paragraph 1</th>
<th>Paragraph 2</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>3</strong></td>
<td><strong>3</strong></td>
</tr>
<tr>
<td>It has been clearly detailed how the pH balance of a natural water source has been maintained or extremely altered to be acidic or overly basic based on human actions.</td>
<td>It has been clearly paraphrased from the reading and student conclusions how the changes to the water effects the local forests, wildlife, and humans.</td>
</tr>
<tr>
<td><strong>2</strong></td>
<td><strong>2</strong></td>
</tr>
<tr>
<td>It has been detailed that the natural water source has been maintained or changed by human actions.</td>
<td>It has been paraphrased from the reading how the changes to the water source effects the local forests, wildlife, and humans.</td>
</tr>
<tr>
<td><strong>1</strong></td>
<td><strong>1</strong></td>
</tr>
<tr>
<td>It has been simply explained that the natural water source has been maintained or changed by human actions.</td>
<td>Based solely on the reading, it has been described that the local forests, wildlife, and humans will be effected.</td>
</tr>
<tr>
<td><strong>0</strong></td>
<td><strong>0</strong></td>
</tr>
<tr>
<td>It has been stated that the natural water source has been maintained or altered.</td>
<td>Taken directly from the reading, it has been copied which forests, animals, and objects will be effected by acid rain regardless of location.</td>
</tr>
</tbody>
</table>
Milkweed and Monarch Migration

Overview: Students will observe and identify plants (milkweed) and any monarch presence in an outdoor habitat, and map the migration of monarchs east and west of the Rocky Mountains. Students will explain the impacts humans have had on monarch populations and determine ways to help the population recover.

National Geography Standards:
Standard 1: How to use maps and other geographic representations, geospatial technologies, and spatial thinking to understand and communicate information.
Standard 14: How human actions modify the physical environment

Oregon Geography Content Standards:
5.7. Identify, locate, and describe places and regions in the United States.
5.8. Use various types of maps to describe and explain the United States.

Oregon Science Content Standard (if appropriate).
5-ESS3-1. Obtain and combine information about ways individual communities use science ideas to protect the Earth’s resources and environment.

Connections to Common Core:
CCSS.ELA-LITERACY.RI.5.9. Integrate information from several texts on the same topic in order to write or speak about the subject knowledgeably.
Objectives:
In completing this lesson, students should be able to:

- Identify milkweed (or substitute another plant that is essential for another migrating species in your area) in the field, while also recording any evidence of the migrating species (monarchs).
- Explain the migration patterns of monarchs by drawing and using a map, and explain the impact of humans on the decline (and potential recovery) of the monarch population.

Grade Levels: 5th-6th    Time: 45-60 minutes, plus assessment

Materials:
For each group:
- string (40’ lengths, marked at 10’ intervals)
- 4 stakes to mark plots for observation
- rubber mallets to pound stakes
- directions and 10x10 grid on back (Appendix A)
- pencils
- clipboards with paper

For each student:
- One of several reading handouts (Appendix C lists several website options for these handouts) --laminated for durability, so they can be re-used)
- One copy of the classroom assessment (Appendix E) and rubric (Appendix F)
For the teacher:

- One copy of Key Questions and Information Graph (Appendix D)

**Background:** Students need to be able to identify monarch butterflies and explain the life cycle of a butterfly. They need an understanding of plant growth and plant identification skills. They also need basic map skills, a general knowledge of climate and temperature variances across the USA, some practice with staking a plot of land, and an elementary knowledge of herbicides and pesticides and farming practices.

**Procedures:**

1. Divide students into groups of 3-5 people.
2. Give students the reading handouts (one per student, so that each group has at least one copy of three different readings—given out according to their reading skill level), and summarize the key things they learn about monarch migration for their group mates (5-10 minutes).
3. Have student groups return the handouts to you and give you a quick oral summary of their readings.
4. Give each group a string, mallet, and 4 stakes, along with a direction sheet (Appendix A), field guide (Appendix B), clipboard, paper, and pencil.
5. Assist students as they choose their plots (5 minutes).
6. Give students 15 minutes to map their plot and search for any milkweed plants (or substitute species) within the plot.
7. Gather in a circle to share findings from plot observations. (5 min.)
8. On a roughly-to-scale “map” of North America (scratch an outline into the soil or mark out with string and stakes ahead of time), have students identify where the Rocky Mountains would be. Have adult volunteers stand on the map to represent the mountains. Then, have students choose locations and walk the “migration” routes to their winter location, as if they were monarch butterflies. (5 min).
9. Discuss key questions (Appendix D) about migration and changing monarch populations. (5-20 min.)
Assessment: There is a brief informal assessment in step 3, when students give an oral summary of what they read. A formal assessment can be given later, back in the classroom. Given a prompt (Appendix E), students will be able to sketch a map of North America and indicate the migration patterns of monarch butterflies. They will also write a paragraph explaining the concerns about monarch decline and ways that humans can help the population recover. This assessment can be evaluated using the rubric (Appendix F).

Extensions and/or Adaptations:

Extensions:
- Have students grow a monarch habitat or waystation at school and observe over time whether monarchs find their new plants.
- Consider raising monarchs in your classroom (make sure you have a source of milkweed).
- Have students do additional research and write persuasive essays about whether farming methods (or other land use practices, such as keeping habitat along roadways) should change to help milkweed return.
- Have students research, compare and contrast monarch migration with migration of another local species (such as cranes).
- Have students research and consider the impact of political systems on migrating species, i.e. how do Mexico’s decisions affect monarch populations?

Adaptations:
- Assign the reading tasks at appropriate levels (high, average, low texts are included), and have struggling students read with a partner rather than independently.
• If a large-scale map of North America is not a possibility, have individual or group laminated maps and sharpies for students to sketch the migration routes from various locations, based on their readings.

• If space is limited, or student mobility is limited, hula hoops could be used to quickly provide a plot boundary.

• If botany is the focus, students could simply observe what plant life is found in their 10’x10’ plot.

• Students who struggle with mental maps could be provided a blank outline map for question #1 on the formal assessment.

Sources:


**Field Observation (appendix A)**

1. Choose your plot.

   Tie your string onto your first stake. Choose a place you’d like to plot, and put your stake into the ground. Then, note where the 10-foot mark is on the string, wrap the string around the second stake, and put it in the ground. Make a right angle, and continue mapping your plot by wrapping the string around the third stake and putting it in at the next 10-foot mark. Make another right angle, and put the fourth stake in the ground at the last 10-foot mark. Return to the beginning stake with the last section of your string and complete your plot boundary.

   ![Diagram of plot boundary]

2. Sketch a map of your land, noting any key features (trees, rocks, streams, mounds, holes, etc.). Be sure to include a title, compass rose, and legend. You may use the 10 x 10 grid on the back of this page to help you.

3. Using the field guide, search carefully to see if there are any milkweed plants in your plot of land. If you find one or some, mark their location(s) on your plot map.

4. If you have time, see if there are other plant species you can identify. Map them if you find them.

5. Be prepared to share your observations when you hear the whistle to return to the meeting area.

(You may want to replace this with materials for your state. An excellent resource can be found at: http://www.xerces.org/milkweed/)
Appendix C—Grade Level Reading Handout Options (Accessed August 16, 2016)
http://fs.fed.us/wildflowers/pollinators/Monarch_Butterfly/habitat/index.shtml

Particularly appropriate if you are located East of the Rocky Mountains:

Challenging reading materials for advanced students:
http://thelensnola.org/2016/01/22/oops-effort-to-save-monarch-butterflies-hastens-their-possible-extinction/

Easier reading handout option for struggling readers:
https://www.fws.gov/savethemonarch/pdfs/migration-map.pdf
Key Questions (Appendix D)

1. Where do monarchs migrate in winter if they are seen here in the summer?
2. To where do they migrate if they summer in Minnesota (or some other state across the Rocky Mountains from your location)?
3. How can you determine to where a monarch will migrate? (Location relative to the Rockies)
4. Why is the milkweed plant essential for monarchs?
5. What has happened to the monarch population in recent years? (Share graphed data)
6. Why do you think this is so?
7. What do you think has happened to the milkweed population?
8. Why do you think this is so?

1. Sketch a map of North America. Then indicate the patterns of monarch migration on your map.

2. On the back of this paper, write a paragraph explaining reasons why monarch decline might be a concern, and offer ideas of ways humans can help the monarch population recover. Include observations from your day at Outdoor School.
### SCORING RUBRIC FOR MILKWEED AND MONARCH MIGRATION ASSESSMENT
(Appendix F)

**Part 1. Map of migration. Are these included?**

<table>
<thead>
<tr>
<th></th>
<th>Absent</th>
<th>Poor</th>
<th>Proficient</th>
<th>Outstanding</th>
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<tbody>
<tr>
<td>Rocky Mountains</td>
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<tr>
<td>U.S.A.</td>
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<tr>
<td>Mexico</td>
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<tr>
<td>California</td>
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<tr>
<td>Eastern Migration</td>
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<tr>
<td>Western Migration</td>
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<td>Map Title</td>
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<td>Legend</td>
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<tr>
<td>Compass Rose</td>
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</table>

**Part 2. Paragraph.**

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<thead>
<tr>
<th></th>
<th>Absent (not yet proficient)</th>
<th>One reason or example (partially proficient)</th>
<th>Two reasons or examples (proficient)</th>
<th>Three or more reasons or examples (outstanding)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Monarch decline</td>
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<tr>
<td>Recovery ideas</td>
<td></td>
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<tr>
<td>Examples from Outdoor School</td>
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</tbody>
</table>
TITLE: Moving to Oregon, and Assessing Outdoor School

Overview: Using a variety of geographic representations, students will analyze and assess different maps representing the same area. They will then use the maps to decide which region of Oregon would be most appropriate for them to move, based on various situations, and present and justify their decision to the rest of the class.

Following this, students will use maps and collect data to determine the effectiveness of their Outdoor School location.

National Geography Standards:
- Geography Standard 1: How to use maps and other geographic representations, geospatial technologies, and spatial thinking to understand and communicate information.
- Geography Standard 4: The physical and human characteristics of places

Oregon Geography Content Standards:
6.11. Distinguish among different types of maps and use them to analyze an issue in the Western Hemisphere.
6.14. Identify physical features of the Western Hemisphere and explain their effects on people and events

Connections to Common Core:
6-8.WH.7 Conduct short research projects to answer a question (including a self-generated question), drawing on several sources and generating additional related, focused questions that allow for multiple avenues of exploration.
6-8.WH.9 Draw evidence from informational texts to support analysis, reflection, and research.

Objectives:
In completing this activity, students will be able to:
- Analyze and interpret various maps of Oregon in The Student Atlas of Oregon
• Use the maps to determine which region of Oregon they should move to, based on a specific situation.
• Interpret information from The Student Atlas of Oregon to explain and justify their decision to move to that region.
• Identify and explain which maps in The Student Atlas of Oregon would not be helpful in making the decision on where to move.
• Use maps and collect data to determine the suitability of an Outdoor School site.

Grade Levels: 6

Time: Approximately three 50-minute class periods, depending on size of class.

Materials:
• One copy of the Student Atlas of Oregon per student (or access to a computer in order to use the online copy, http://www.pdx.edu/geography-education/table-of-contents-student-atlas-of-oregon-english)
• One copy of the “Situation Sheet” (appendix A) per group.
• One copy of the “Where Should You Move?” assignment (appendix B) per student.
• One copy of the Presentation Scoring Guide (Appendix C) per group
• Access to a projector for the presentation.
• One copy of the worksheet, “What Makes a Good Outdoor School?” (Appendix D) per student.
• One copy of the worksheet, “Did Our Outdoor School Make the Grade?” (Appendix E) per student.

Background: Prior to starting the lesson, students will to be generally acquainted with the Student Atlas of Oregon and basic geography terms.
Procedures:

PART I – Using maps to understand and communicate information

1) Start with warm-ups. Project the Climographs map (page 26) of the Student Atlas of Oregon on the board. Have students write 2-3 sentences answering the question, “If you liked warm weather and did not like rain, where in Oregon would be a good place for you to live? What would not be a good place to live?”

2) After a few minutes, discuss student ideas. Ask them to explain why a place would either be a good or bad place for someone who liked dry, warm weather.

3) Explain to students that they will be divided into groups of 3-4.

4) Ask the students to imagine that they do not live in Oregon, but tell them that they are facing a situation that will require them to move somewhere within the state.

5) Group students into 3-4, either randomly or by having them select their own.

6) Hand copies of the “Situation Sheet” to each group (Appendix A). Try to make sure that each group has a different situation. Give only one situation to each group.

7) Give the students 2-3 minutes to read through their situation and discuss it with each other.

8) Hand out the assignment sheet “Where Will You Move?” to each student (Appendix B). Read through the directions with them and answer any questions that arise.

9) Hand out the scoring guide for the presentation. (Appendix C) Allow time for groups to go through the atlas, select relevant maps, and create a presentation to deliver to the class.

10) Once groups have had time to complete the assignment, begin presentations. Have a projector or document camera available so that groups can show their maps to the rest of the class.

11) Once all groups have concluded their presentations, students will independently write a 4-5 sentence paragraph that summarizes the situation they were given, where in Oregon they and their group chose to move, and which map or maps helped them make their decision. This will show that all members of the group understood
and contributed equally to the assignment, rather than let one person do all the work.

**Assessment:** Have students use their atlases to determine which two ecoregions of Oregon best support the career of farming in Oregon, and explain which maps informed their decision.

**Extensions and/or Adaptations:** This lesson will extend into the “Where should Outdoor School Be?” data collection activity, as students will now be familiar with how to use appropriate maps to make informed decisions.

The assignment can be adapted for higher-level students by requiring them to find a map outside of the Student Atlas of Oregon, in addition to at least one of the maps from the atlas.

The assignment can be adapted for special education or ELD students by providing a limited number of pages from which they can choose, rather than potentially overwhelming them by having them go through the entire atlas.

**PART II – Use maps and data to come to an informed decision**

12) Inform students that soon they will in fact be moving, but on a temporary basis and to an Outdoor Site located within Oregon.

13) As a whole group, ask students to brainstorm what characteristics they believe a good Outdoor School Program should have. Write answers on the board.

14) Explain that just as someone moving to Oregon from another state has to carefully consider physical and human geographic characteristics, a school must also consider similar concepts when selecting an Outdoor School.

15) Hand out the worksheet “What makes a good Outdoor School?”, one per student (Appendix D).

16) Complete the first column, “Accessible by Road” as a whole class. Ideas may include “easier to get supplies in”, “easier to get injured people out”, or “easier to get students there”.
17) In partners or small groups, have students work on the rest of the sheet.
18) After students appear to be done (or when enough time has passed) reconvene as a whole group and discuss their answers.
19) Using the website http://www.natgeomaps.com/trail-maps/pdf-quads or Google Earth, show students on the screen where their Outdoor School program is located. Be sure to point out roads, approximate location in relation to larger population centers, and distance from their school. Inform them that one of the assignments they will complete at Outdoor School is a data collection assessment of the Outdoor School site.

Part III – Using data to assess their Outdoor School (to be completed after they get back from Outdoor School)

20) In small groups, have students review and discuss their individual observations and data collections.
21) Complete the “Did Our Outdoor School Make the Grade?” sheet. (Appendix E)
22) Use the data and number totals to determine if the Outdoor School site they attended met the criteria established in Appendix D.

Assessment: In a 4-5 sentence paragraph, describe to the class if this school should continue or discontinue attendance at this Outdoor School, and explain why. Be sure to refer to at least one map in your justification.
Situation 1
You work in the timber industry as a logger and need to move to Oregon. Where in Oregon do you think you would most likely find work?

Situation 2
You are a cattle farmer looking to relocate to Oregon. You have many cattle and need lots of open space. Although you have some milking cows, most of your livestock is used for beef. Where in Oregon do you think would be the best place for you to move?

Situation 3
You have worked as a ski instructor, and are interested in moving to Oregon. Identify a place where you could most likely continue to do this kind of work.

Situation 4
You are a teacher who works with students between the ages of 10-14. You like warm temperatures, but nothing too cold.

Situation 5
You are a wheat farmer, but you also like being close to large cities.

Situation 6
You want to open a restaurant. You need access to population centers, freeways for easy transportation, and a drier climate so your customers can eat outside most of the year.

Situation 7
You love to fish, hike, and camp, and do not want to have to travel too far to enjoy any these activities. However, you usually do construction work during the summers so you need to be somewhat close to a city.

Situation 8
You are an expert on dams and hydroelectric energy, and you’ve dreamed of one day having either a hazelnut or a Christmas tree farm.
Where Should You Move?
You and your group are moving to Oregon!

However, Oregon is a big state, and you will need to figure out where the best place for you to move will be!

Your group has received a specific situation. Using the Student Atlas of Oregon, you will:

1) Find at least one map that shows where a good place for you to settle might be. For example, if you are a fruit farmer the maps on page 68 might be very helpful to you! Be able to explain why the map you have selected makes sense.

2) Find at least one map that would not be helpful to you, and be able to explain why it is not helpful. For example, a fruit farmer looking for a place to live would not be helped by the maps on page 34. Why?

3) Create a presentation that shows the rest of the class where you have decided to live, and why that place would be good for you based on your situation. Refer to the scoring guide to make sure your presentation is a good one!

4) Present your conclusions to the class in which each person of the group contributes equally. This means every member of your group has to speak!!!
### Scoring Guide:

<table>
<thead>
<tr>
<th>Score:</th>
<th>4</th>
<th>3</th>
<th>2</th>
<th>1</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Where have you chosen to move?</strong></td>
<td>You and your group have selected a location that makes good sense based on your situation.</td>
<td>You and your group have selected a location that makes some sense, but may not address all the needs of your situation.</td>
<td>You and your group have selected a location that does not really make sense, and does not address the needs of your situation.</td>
<td>You and your group have selected a location completely unsuited to your situation.</td>
</tr>
<tr>
<td><strong>Which map justifies your decision?</strong></td>
<td>You and your group have found a map that clearly justifies why you should move to a specific place. You are able to completely explain your choice to the rest of the class, using your map as evidence.</td>
<td>You and your group have found a map that partially justifies your choice in location, although the reasoning may be unclear. You do not fully explain how the map helped you make your decision.</td>
<td>You and your group have selected a map that does not justify your decision or fit with your situation. You are not able to clearly describe why you have chosen this map.</td>
<td>You have not selected a map, or have offered no explanation as to which map you should choose, or why.</td>
</tr>
<tr>
<td><strong>Which map would not be helpful?</strong></td>
<td>You and your group have found a map that offers no information relevant to your situation. You are able to clearly explain why this map does not help make a logical decision.</td>
<td>You and your group have found a map that is not helpful, but you are not able to clearly explain why it does not address your situation.</td>
<td>You and your group have found a map that does not address your situation, but you offer little to know explanation as to why it is not helpful.</td>
<td>You have not selected a map, or offer no explanation as to why the map would not address your situation.</td>
</tr>
<tr>
<td><strong>Group Participation</strong></td>
<td>Each person in the group presents some relevant information or explanation to the class.</td>
<td>Most of the people in the group present relevant information or explanations to the class.</td>
<td>Fewer than half of the people in the group present relevant information or explanations to the class.</td>
<td>One or fewer members of the group presents any information to the class.</td>
</tr>
</tbody>
</table>
What Makes a Good Outdoor School?
Try to list up to three reasons why each of the following categories is important to making a good outdoor school!

<table>
<thead>
<tr>
<th>Accessible by road, because...</th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Close enough to our school, because...</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Far enough away from large population centers, because...</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Surrounded mostly by nature, with limited human interference, because...</td>
<td></td>
<td></td>
</tr>
<tr>
<td>A place with abundant animal life, because...</td>
<td></td>
<td></td>
</tr>
<tr>
<td>A place with abundant plant life, because...</td>
<td></td>
<td></td>
</tr>
<tr>
<td>A place with streams, creeks, or rivers, because...</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Adequate facilities for visitors, because...</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Activities for students that are both fun and educational, because...</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Did Our Outdoor School Make the Grade?

10 – Yes  8 – Mostly  6 – Kind of  4 – Not really  2 – No

There were roads that made it relatively easy to get to the Outdoor School site

10  8  6  4  2

The Outdoor School was close enough to our school to get there in a reasonable amount of time (2 hours or less)

10  8  6  4  2

The Outdoor School location was far enough away (60 miles or more) from a population center of more than 10,000 people. (See page 56 of the Student Atlas of Oregon.)

10 – More than 60 miles away
8 – About 60 miles away
6 – About 40-60 miles away
4 – About 20-40 miles away
2 – Less than 20 miles away

A) Total Score:________

B) Total Scores from ALL the assessment sheets:________

C) Number from “B” divided by number of people in your group:________

D) Add up “A” and “C”:________
TITLE: River Stream Flow

Overview: The U.S. Geological Survey (USGS) has thousands of stream flow monitoring stations throughout all 50 states; In this lesson, students will understand what stream flow is, analyze stream flow data related to a specific site, and collect stream flow data during an outdoor school experience. Finally, students will create an infographic using stream flow data and relate it to salmon migration.

National Geography Standards:
Standard 1: How to use maps and other geographic representations, geospatial technologies, and spatial thinking to understand and communicate information

Standard 14: How human actions modify the physical environment.

Oregon Geography Content Standards:
HS.14. Create and use maps, technology, imagery and other geographical representations to extrapolate and interpret geographic data.

HS.20. Analyze the impact on physical and human systems of resource development, use, and management and evaluate the issues of sustainability. (this standard is primarily covered in the lesson extensions and/or adaptations).

Oregon Science Content Standard:
HS-ESS2-2 Earth's Systems - Analyze geoscience data to make the claim that one change to Earth's surface can create feedbacks that cause changes to other Earth systems.

HS-ESS3-5 Earth and Human Activity - Analyze geoscience data and the results from global climate models to make an evidence-based forecast of the current rate of global or regional climate change and associated future impacts to Earth systems.
Connections to Common Core:
CCSS.ELA-LITERACY.RST.9-10.7
Translate quantitative or technical information expressed in words in a text into visual form (e.g., a table or chart) and translate information expressed visually or mathematically (e.g., in an equation) into words.

Objectives:
In completing this activity, students should be able to understand the concept of stream flow, analyze and translate stream flow data into an infographic, and relate stream flow data to Salmon migration patterns and the human impacts of climate change.

Grade Levels: 8-10 Time: 4-6 50 minute periods

Materials:
The USGS website, specifically USGS Current Water Data for the Nation (accessible at http://waterdata.usgs.gov/nwis/rt)
Salmon migration data (fish counts) from the Oregon Department of Fish and Wildlife

For extensions:
Glacier data related to the river where stream flow is being monitored

Background:
Flow Rate: Flow rate is the volume of water passing a point in a fixed period of time. Flow rate is usually measured in cubic feet per second (cfs or ft³/sec) but could also be measured in gallons or liters per minute or second. For example, if a running faucet took one minute to fill a gallon container, its flow rate would be 1 gallon per minute. Water flow in a stream, river or pipe also has a flow rate. The flow rate in a river, stream or pipe can be determined by multiplying water velocity by the cross-sectional area. For example, if water was flowing through a 1 foot diameter pipe (area = 0.8 ft²) at 5 feet per second, the flow rate would be 0.8 ft² x 5 ft/sec = 4 ft³/sec.

Procedures:
(Using the USGS website and creating an infographic about stream flow can be performed as a stand alone lesson or it can be a supplement to an outdoor school stream flow monitoring activity. If you are collecting stream flow data at an outdoor school site, please first follow the attached procedures for the outdoor data collection activity).
1. Arrange for a full 3 periods of computer time allowing two students per computer.

2. Direct students to the USGS website (specifically USGS Current Water Data for the Nation (accessible at http://waterdata.usgs.gov/nwis/rt) You may want to familiarize yourself with the USGS site in advance to learn about possible pitfalls that students might encounter while using the website.

3. Students will download / print stream flow data for the chosen site, please see attached example for Sandy River data. (If you are going to relate the stream flow data to salmon migration, it is best to use monthly data throughout the course of a year; If you are going to relate stream flow data to glacier changes as it pertains to the source of the river, you may want to direct students to use yearly data).

4. Students should also research fish counts data from the Oregon Department of Fish and Wildlife for a site near the stream flow monitoring site to be able to relate stream flow and salmon migration.

5. Provide students with examples of infographics (see sites below) and discuss with students ways to create an infographic related to stream flow data. Infographics are a visual representation of data. When students create infographics, they are using information, visual, and technology literacies.

6. Here are some infographic resources and tools for educators:

   Kathy Schrock’s seven-step guide for creating infographics is a simple, but thorough summary of the process that is ideal as an assignment handout. http://www.schrockguide.net/infographics-as-an-assessment.html

   Piktochart is a Web-based infographic software that has a vast selection of themes, graphics, and easy-to-use editing tools. The service is free to get started, then offers special pricing for educators. https://piktochart.com/
   Hubspot offers five free, fully customizable PowerPoint templates with which to create infographics. http://offers.hubspot.com/how-to-create-infographics-in-powerpoint

   Easel.ly is another Web-based infographic tool that gives users 12 complimentary templates to start. The templates are customizable and allow users to add their own graphics with one click. http://www.easel.ly/
7. Allow students to work on developing their infographic and provide students with a copy of the assessment rubric.

**Assessment:** Students’ infographics can be assessed with the INFOGRAPHIC RUBRIC found here: http://www.schrockguide.net/uploads/3/9/2/2/392267/schrock_infographic_rubric.pdf

**Extensions and/or Adaptations:**
Provide students with additional data sets related to stream flow monitoring sites such as water temperature, glacier data for the stream’s source, or human made impacts on the stream or river such as commercial development. The goal here is to analyze data overtime and reflect on possible relationships that may occur. With that being said, remind students that correlation does not imply causation. Just because two things occur together does not mean that one caused the other, even if it seems to make sense. For additional information regarding causation vs correlation, please read the following article: http://www.stats.org/causation-vs-correlation/

**Sources:**
The USGS website, specifically USGS Current Water Data for the Nation (accessible at http://waterdata.usgs.gov/nwis/rt)
**Rock Study and Identification in the Field Study**

**Overview:**
In this lesson students will use previous knowledge of different kinds of rocks and will travel to an outdoor environment where these can be viewed in person. They will be asked to identify three distinct kinds from the natural landscape. In this lesson the rocks discussed are columnar and pillow lava basalt and erratic rocks but the lesson can be modified to the study of rocks in any area. Students should already have a foundational knowledge of this before this field trip experience.

**National Geography Standards:**

7. The physical process that shape the patterns of Earth’s surface

17. How to apply geography to interpret the past

**Oregon Geography Content Standards:**

2.7. Use basic information on maps and other geographic tools to locate and identify physical and human features of the community.

3.10. Identify and compare physical features of Oregon and other Northwestern states.

**Oregon Science Content Standard:**

2-ESS1-1. Use observations from several sources to provide evidence that Earth events can occur quickly or slowly.

**Connections to Common Core:**

2.RI.3   Describe the connection between a series of historical events, scientific ideas or concepts or steps in technical procedures in a text.
Objectives:
In completing this activity, students should be able to:

- With assistance, use a map to locate rock formations they see in person
- Describe how pillow lava ended up in the area we are studying
- Identify three different types of rock (columnar, pillow and erratic) in the natural environment
- Sketch and label the landscape noting the different rock types

Grade Levels: 2-3 Time: All day field trip

Materials:
- Several copies of maps of the area, in this case Columbia River Gorge (See Appendix A)
- Several student compasses
- Photo examples of different rocks, in this case columnar, pillow lava, and erratic (see Appendix B)
- Clip boards
- Pencils
- Erasers
- Assessment rubric for teacher (Appendix C)
- Lunches for the field trip (optional, depending on length of trip)
- Background information page and provoking questions for chaperones (Appendix D)

Background:
Students should already have had at least a week of instruction on the Missoula Floods, how long ago they happened, how rocks from far away places ended up in the Gorge, and how these rocks formed. Teachers can see referenced sources below and the embedded hyperlinks for Wikipedia pages on Missoula Floods, columnar basalt, pillow lava
basalt, erratic rocks, Latourell Falls, and Multnomah Falls for background information.
This lesson is a field study so they can observe evidence of this in person.
Students should be reminded of appropriate field trip expectations in regards to academic output and behavior. Students will be assigned into groups of 3-5 with chaperones who are responsible for the maps, compasses and clipboards. Chaperones should also be somewhat familiar with the vocabulary and concepts so they can help students. This information (Appendix D) can be distributed the week before so they can prepare for this trip.

**Procedures:**
Before leaving on the field trip, students will get a refresher on the information they have already learned on the different types of rocks they can and will see in the Columbia River Gorge.

5 minutes: Teacher will lead a reminder discussion about the types of rocks they have learned about, how they ended up in the area they are, and how this happened as a fast, catastrophic event, as opposed to a long, gradual change over time.

10 minutes: Students will sit in table groups with photo examples of each rock (Appendix B) and they need to decide together if they are columnar, pillow lava or erratic rocks. Teacher should walk around the room and monitor for understanding.

5 minutes: Teacher will call on a student to remind everyone what the differences between these rocks are and how you can know for sure. Teacher will ask students to remember how the erratic rocks got to Oregon since they originated somewhere else. Teacher will let students know that they are going to go out in the field to find examples of
columnar, pillow lava and erratic rocks. Teacher should place students into chaperone groups and remind them of expectations.

If you are not located in the Columbia River Gorge area, teachers can look up local examples of the common rocks in the area. The example below is for the Columbia River Gorge/Multnomah County area but the same procedure can be carried out for any rocks.

30 minutes: Buses will arrive at the first rock location. For the Columbia River Gorge Multnomah Falls is a great example of pillow lava basalt. Students will bring their clipboards, paper and pencils and gather around the teacher. When they get with their chaperone groups, they will be instructed to first find the direction of north on the compass and then to find where they are on the map. After this they are to face the rocks and sketch what they see. They should label as much as possible as well and discuss with their chaperone groups if they think this particular rock is pillow lava or columnar and how they know.

30 minutes: Buses will arrive at Latourell Falls in Corbett, OR (6 miles away) to observe columnar basalt. They will do the same compass, map, sketch, and discuss procedure.

30 minutes: Buses will arrive at the Erratic Rock State Natural Site, South of McMinnville, OR. Same procedure as previous stops.

30 minutes: Back at school, students will meet back as a whole group and the teacher will lead a discussion about what they saw, which rock was which and how they could tell. Students will complete a labeled diagram as part of the assessment of this activity.
Assessment:
When the students get back to class they will be asked to diagram and label what they saw that day using their rough field sketches. They should include labels of the areas we were, the types of rocks, and draw them with enough detail to show they know the characteristics. See rubric (appendix C) for further details.

Extensions and/or Adaptations:
Human Geography Extension - Over the next several lessons, students can continue their investigation and discussion of the formation of the Gorge through the Missoula Floods. Students can learn about how these floods created the Land Bridge located in what is now Cascade Locks and how the Chinook and other native tribes used this to access the north bank of the river until this was washed away when other waves of the floods came through. They can can compare this to the Bridge of the Gods which is in the same location at present day. Students can discuss the similarities and differences between these two bridges and methods of crossing the river.

ELD or SPED - Students who are not able to write can verbally explain their diagram. They should still be able to tell the locations we visited and show they understand the difference between the rocks using their drawings. The teacher can add labels.

Gifted or Advanced - Students who are more advanced should write a paragraph telling about the rocks, their differences, where they were located, and how they got there.
Sources:


Appendix A

Maps of Columbia River Gorge
Appendix B

Photo Examples: Pillow Lava
Columnar Basalt
Erratic Rocks
## Appendix C

### Assessment Rubric: Scientific Drawings: Rock Identification in the Field

<table>
<thead>
<tr>
<th>CATEGORY</th>
<th>4</th>
<th>3</th>
<th>2</th>
<th>1</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Title</strong></td>
<td>Title is informative, centered, and larger than other text.</td>
<td>Title is informative and larger than other text.</td>
<td>Title is informative and centered.</td>
<td>The title is incomplete and does not clearly indicate what organism is pictured.</td>
</tr>
<tr>
<td><strong>Labels</strong></td>
<td>Every item that needs to be identified has a label. It is clear which label goes with which structure.</td>
<td>Almost all items (90%) that need to be identified have labels. It is clear which label goes with which structure.</td>
<td>Most items (75-89%) that need to be identified have labels. It is clear which label goes with which structure.</td>
<td>Less than 75% of the items that need to be identified have labels OR it is not clear which label goes with item.</td>
</tr>
<tr>
<td><strong>Drawing - general</strong></td>
<td>Lines are clear and not smudged. There are almost no erasures or stray marks on the paper. Color is used carefully to enhance the drawing. Stippling is used instead of shading. Overall, the quality of the drawing is excellent.</td>
<td>There are a few erasures, smudged lines or stray marks on the paper, but they do not greatly detract from the drawing. Color is used carefully to enhance the drawing. Overall, the drawing is good.</td>
<td>There are a few erasures, smudged lines or stray marks on the paper, which detract from the drawing OR color is not used carefully. Overall, the quality of the drawing is fair.</td>
<td>There are several erasures, smudged lines or stray marks on the paper, which detract from the drawing. Overall, the quality of the drawing is poor.</td>
</tr>
<tr>
<td>---</td>
<td>---</td>
<td>---</td>
<td>---</td>
<td>---</td>
</tr>
<tr>
<td><strong>Drawing - details</strong></td>
<td>All assigned details have been added. The details</td>
<td>Almost all assigned details (at least 85%)</td>
<td>Almost all assigned details (at least 85%)</td>
<td>Fewer than 85% of the assigned details are</td>
</tr>
<tr>
<td></td>
<td>are clear and easy to identify.</td>
<td>have been added. The details are clear and easy to identify.</td>
<td>have been added. A few details are difficult to identify.</td>
<td>present OR most details are difficult to identify.</td>
</tr>
<tr>
<td>------------------------------</td>
<td>---------------------------------</td>
<td>-------------------------------------------------------------</td>
<td>-----------------------------------------------------------</td>
<td>-------------------------------------------------</td>
</tr>
<tr>
<td><strong>Accuracy</strong></td>
<td>95% or more of the assigned structures are drawn accurately and are recognizable. All assigned structures are labeled accurately.</td>
<td>94-85% of the assigned structures are drawn accurately and are recognizable. All assigned structures are labeled accurately.</td>
<td>94-85% of the assigned structures are drawn accurately and are recognizable. 94-85% of the assigned structures are labeled accurately.</td>
<td>Less than 85% of the assigned structures are drawn AND/OR labeled accurately.</td>
</tr>
<tr>
<td><strong>General Formatting</strong></td>
<td>Unlined paper is used. The drawing is large enough to be clear (about 1/2 of a page)</td>
<td>Unlined paper is used. The drawing is large enough to be clear</td>
<td>Unlined paper is used. The drawing is a little too large or a little too</td>
<td>Lined paper is used AND/OR the drawing is much too</td>
</tr>
</tbody>
</table>


| of typing paper). Student name, class, and date are in the lower left corner. There is a figure caption that describes the drawing. The caption includes information about magnification, when appropriate. (about 1/2 of a page of typing paper). Student name, class, and date are in the lower left corner. small. Student name, class, and date are in the lower left corner. small or much too large. |
Appendix D

Chaperone Information Guide

Thank you for taking time to spend time in the field with the kids! Please read the below information so that you are better able to answer questions and direct discussion out in the field.

The three types of rocks we are studying are:

Pillow lava basalt is lava that contains characteristic pillow-shaped structures that are attributed to the extrusion of the lava under water. Pillow lavas in volcanic rock are characterized by thick sequences of discontinuous pillow-shaped masses, commonly up to one metre in diameter. They form the upper part of 'Layer 2' of normal oceanic crust. We will see this at Multnomah Falls.

![Pillow lava basalt](image)

Columnar basalt is a geological structure where sets of intersecting closely spaced fractures, referred to as joints, result in the formation of a regular array of polygonal prisms, or columns. Columnar jointing occurs in many types of volcanic rocks and forms as the rock cools and contracts. Columnar jointing can occur in cooling lava flows.

The columns can vary from 3 meters to a few centimeters in diameter, and can be as much as 30 meters tall. They are typically parallel and straight, but can also be curved and vary in diameter. We will see this at Latourell Falls.
Erratic rocks are a piece of rock that differs from the size and type of rock native to the area in which it rests. "Erratics" are carried by glacial ice, often over distances of hundreds of kilometres. Erratics can range in size from pebbles to large boulders such of 15,000 tonnes. We will see an erratic rock outside McMinnville.

When we are in the field you will be helping student to:

- Use a compass - find north
- Use a map - using the compass, the known location of north, and any natural features such as the river, locate where we are on the map
• Provoke discussion about these rock formations and map skills. You could ask them:
  ○ Where is north? How do you know?
  ○ Do you see anything else on this map here in real life?
  ○ What types of rocks do you see?
  ○ Where do you think the erratic rock came from?
  ○ How did it end up where it did?
  ○ How can you tell the difference between columnar and pillow lava?
  ○ Could you tell the difference between columnar and pillow lava if you could only feel them?
  ○ Which was your favorite type of rock and why?
• Students will be making field sketches of the rocks they see and the area surrounding them. Please monitor and encourage them to add as much detail as possible while working within the time frame. Remind them to add labels and be legible as they will have to read it once we get back to class

Thank you again for coming on our trip and making learning meaningful for our students! You are appreciated!
Stream Observation Exercise

Overview:
This lesson will allow students to observe a river that is part of their local or outdoor school location. Students will record findings of natural and human interaction.

National Geography Standards:
Standard 14: How human actions modify the physical environment. 
Standard 15: How physical systems affect human systems.

Oregon Geography Content Standards:
6.12. Collect and analyze data to describe regions of the Western Hemisphere
6.15. Explain how people have adapted to or changed the physical environment in the Western Hemisphere.

Objectives:
The objective of this lesson is for the students to observe and record the physical and human interaction on the environment, specifically a stream. Students will become aware of natural and human made changes to the stream.

Grade Level: 6 Time: 60 minutes

Materials:
Blank White Paper, Pencil, Appendix 1, 2 and 3

Background:
Students will be given Appendix 3. This picture is of a stream that has human made objects and signs of natural and human created erosion. The picture also contains examples of animals and various plant life indicative to the area of a stream. The instructor will ask the students to create a list of 10 things the students see in the picture. The instructor will then ask for volunteers to share their lists. After a student has shared the instructor will ask if anything on their list was made by people. Instructor will also inquire if anything from their lists can be classified as natural vegetation or signs of
animal life. Lastly, instructor will inquire for signs of natural or people made erosion were found, and if not can they find any now, to add to their lists.

**Procedures:**
Students will be taken to a stream. Next students will use Appendix #2 to label what they find. Example; student finds a frog, and then labels it on their map, checking it off on handout one, in the animal category. Students will get into groups of 3-4 and share their findings with others of the group. Last, students will complete the bar graph and questions of their findings on the stream observation. Example students will color the bar line to six if they found six human made objects. Students will also give thoughtful answers to the four assessment questions.

**Assessment:**
Students will complete appendix 1, containing a bar graph activity and critical thinking questions. This is to be assessed via the assessment rubric.

<table>
<thead>
<tr>
<th>Category</th>
<th>4</th>
<th>3</th>
<th>2</th>
<th>1</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Interpretation</strong></td>
<td><strong>Answers are mostly correct and demonstrate excellent comprehension. Opinions are always fully justified.</strong></td>
<td><strong>Answers are often correct and demonstrate good comprehension. Opinions are adequately justified.</strong></td>
<td><strong>Answers are occasionally correct and demonstrate an incomplete comprehension of the topic. Opinions are sometimes justified.</strong></td>
<td><strong>Answers do not reflect accurate comprehension of the topic(s). Opinions are unjustified.</strong></td>
</tr>
<tr>
<td><strong>Detail</strong></td>
<td><strong>Answers are mostly complete, extensive, and include many details.</strong></td>
<td><strong>Answers are usually complete and include several details.</strong></td>
<td><strong>Answers contain some details.</strong></td>
<td><strong>Answers lack the required detail or are incomplete.</strong></td>
</tr>
<tr>
<td><strong>Use of Information</strong></td>
<td><strong>Answers mostly include supporting evidence from the text/lesson when necessary. Quotations or paraphrases are often included in answers.</strong></td>
<td><strong>Answers usually include supporting evidence from the text/lesson when necessary. Quotations or paraphrases are sometimes included.</strong></td>
<td><strong>Answers include occasional supporting evidence from the text when necessary.</strong></td>
<td><strong>Answers do not include supporting evidence from the text when necessary.</strong></td>
</tr>
<tr>
<td><strong>Clarity</strong></td>
<td><strong>Answers are very easy to understand. They are clear and concise.</strong></td>
<td><strong>Answers are always easy to understand.</strong></td>
<td><strong>Answers are sometimes understandable, but need to be more to the point.</strong></td>
<td><strong>Answers are difficult to understand.</strong></td>
</tr>
</tbody>
</table>
Extensions and/or Adaptations:
Instruction can use this information, and then do the lesson again in a different stream area for compare and contrast exercise. Instructor can also have students draw the stream itself as an alternative for various student groups.
Stream Observation Activity

Appendix 1
Record your findings below

1. What do think would happen to the plant life of this stream if more human made objects were present?
2. How would or is this stream beneficial to humans. Why might you want to build a farm near it?
3. What have humans done to change or alter this stream?
4. If you were in a different state, how do you think this stream might be different?
## Appendix 2
### Observation Exercise: Stream Observation Activity: Scavenger Hunt

Students, observe this form, record findings in the appropriate box.

<table>
<thead>
<tr>
<th>Make a Checkmark for animal tracks or signs. (100 points each)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Write down any animals that you see in the area. (100 points each)</td>
</tr>
<tr>
<td>Write down signs of natural erosion. (100 points each)</td>
</tr>
<tr>
<td>Write down signs that humans have been in this location. (100 points each)</td>
</tr>
<tr>
<td>Write down various plant life found. (20 points each)</td>
</tr>
</tbody>
</table>
Appendix 3
Background Activity Picture
Teaching the layers of the forest through poetry and writing
By Beth Chitwood

Overview: This lesson will introduce participants to the layers of the forest through sensory observations and poetry.

National Geography Standards:
Essential Element: Places and Regions
Geography Standard 6: How culture and experience influence people’s perceptions of places and regions

Essential Element: Physical Systems
Geography Standard 8: The characteristics and spatial distribution of ecosystems and biomes on Earth’s surface

Essential Element: Environment and Society
Geography Standard 15: How physical systems affect human systems.

Oregon Geography Content Standards:
6.12 Collect and analyze data to describe regions of the Western Hemisphere.

Oregon Language Arts Content Standard: Common Core: Text Types and Purposes Writing Standard 3
6.W.3 Write narratives to develop real or imagined experiences or events using effective technique, relevant descriptive details, and well structured event sequences.

6.W.3.d. Use precise words and phrases, relevant descriptive details, and sensory language to convey experiences and events.

Connections to Human Geography:
When people think about Oregon they often think about lush green forests and visually stunning old trees. The feeling we get when we go camping and hiking not only helps our mental health, but studies show experiences with nature improve overall self-esteem, community involvement, academic performance, and personal health.

Forests provide us a place for recreation and relaxation. Forests also supply renewable resources for lumber, paper and heating. How would our daily life change without forests? In Oregon, almost 50% of our states 61 million acres is forestland. In 1971, Oregon was the first state in the nation to enact forest protection laws. These laws are continually reviewed in response to new scientific research. The Oregon Forest Practices Act requires:

- Reforestation within 6 years
- Protection of water sources close to streams to protect fish and drinking water
- Protection of wildlife habitat including trees, snags, and fallen logs
- Limits on clear-cuts to no more than 120 acres by the same owner
Objectives:
In completing this activity, participants should be able to:
   1. Recognize the layers of the forest including emergents, canopy, understory, and forest floor.
   2. Use sensory images and descriptive language to write an “I Am” Poem based in the setting of a forest, from either the student’s perspective or a creature’s perspective.

Grade Levels: 6th    Time: 2 days (45 min. periods)

Materials:
Sensory chart (see appendix A)
Old Growth Forest photo (appendix B)
“I Am Poem” template (appendix C)
“Layers of the Forest” (appendix D)
“I Am Poem” Scoring Rubric (appendix E)
Pens
Clip board or something hard to write on.

Background for teachers:
The Pacific Northwest old-growth forest is dominated by conifers. The old-growth forest trees are generally 350-750 year old. The Pacific Northwest forest is unique because of the size and age of the trees. The climate includes mild wet winters and warm dry summers.

Using the O.W.L.S. acronym below, introduce kids to the parts of the forest. Parts of the old-growth forest include: Old trees, Woody debris, Layers in the canopy, Snags

The old-growth forest has 4 main components:
Old trees- The huge trees bring energy into the forest through photosynthesis. Each tree stores organic material and nutrients which are eventually recycled back into the ecosystem. The ancient trees eventually produce snags.

Woody debris- As a tree falls onto the forest floor, it creates woody debris. This decay process takes decades to complete. During the decomposition process, the tree becomes home for a variety of living creatures including shrews, salamanders, centipedes, carpenter ants and spiders. Eventually the rotting tree becomes a “nurse log” for new trees to grow on. Mushrooms and other fungi also like to grow on “nurse logs”. “Nurse logs” tend to help specific species such as Western Hemlock.

Layers- The old-growth forest has many layers in the canopy. The old large branches require the younger smaller trees to spread their branches to reach the sun light. The historic Pacific Northwest forest is very different from the dominant Douglas Fir forest of today. Douglas Firs need lots of light and don’t do well in a layered forest. Logging has changed our forests over time because of the value of Douglas Fir Trees. Shrubs such
as rhododendrons create another layer. The picture in Appendix B shows a natural setting including the four layers of the forest.

The four layers from the top are:

- Emergent
- Canopy
- Understory
- Forest Floor

Appendix D give an example of plants, trees and animals that might live in each level of the forest.

**Snags** - Snags are standing dead trees that serve a critical role in the forest. A tree can die for a variety of reasons, including: insect, disease, lightening, wind or snow damage. As it dies, it becomes a snag. Young trees also can become snags through fire, disease or other forces. Snags provide homes for wildlife such as spotted owls or the pileated woodpecker.

Ancient old-growth trees are part of a special ecosystem. An ecosystem is dynamic and alive. Energy, organic materials, or living organisms in the ecosystem fuel all the life and activity. Trees and plants bring life and energy into the ecosystem through photosynthesis. Trees provide organic matter in their wood and needles. The soil stores huge amounts of water. Did you know recycling happens in the forest as well? As an animal or tree decomposes, the organic material provides nutrients to become food or energy for the living organisms in the ecosystem. If these forests were cut down, imagine the massive impact this has on the plant life, wildlife, and healthy living for us all.

**Procedures:**

1. In class, have a discussion about the five senses. Brainstorm what they are and examples of using each. Introduce the “I Am Poem” (Appendix C) in class. Students use descriptive language and their imagination to write a poem about him or herself using the template provided. This poem should represent who they really are and things they dream or think about.

2. In the old-growth forest students will observe the layers of the forest using the O.W.L.S. acronym and record data on the sensory chart provided. (Appendix A)

3. At camp or back at class, students will use the data they collected and sensory observations to create another “I Am Poem” based on the observation data they recorded in the forest setting. This poem could be written from the perspective of an animal that lives in the forest or from the student’s point of view of how the forest impacts them.

**Assessment:**

Using the rubric provided, the student’s writing is scored based on the Oregon Writing Scoring guide and the assignment requirements. Along with exceptional writing practices, students will include four of the five senses not including taste. The writing will relate to the old-growth forest.
Extensions and/or Adaptations:
Students needing an extension will write a 3-5 paragraph narrative story as if they are an animal living in the forest. The story should include the parts of the forest along with tree/shrub identification.

Sources:

<table>
<thead>
<tr>
<th>Sights</th>
<th>Smells</th>
</tr>
</thead>
<tbody>
<tr>
<td><img src="image" alt="Eye" /></td>
<td><img src="image" alt="Nose" /></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Touch</th>
<th>Sounds</th>
</tr>
</thead>
<tbody>
<tr>
<td><img src="image" alt="Hand" /></td>
<td><img src="image" alt="Ear" /></td>
</tr>
</tbody>
</table>
Appendix B

http://pages.uoregon.edu/ecostudy/elp/ee_forest_07/Educational_Resources.
### Appendix C

**Writing an "I Am" Poem**

**Model**

**First Stanza**
- I am (2 special characteristics you have)
- I wonder (something of curiosity)
- I hear (an imaginary sound)
- I see (an imaginary sight)
- I want (an actual desire)
- I am (the first line of the poem repeated)

**Second Stanza**
- I pretend (something you actually pretend to do)
- I feel (a feeling about something imaginary)
- I touch (an imaginary touch)
- I worry (something that bothers you)
- I cry (something that makes you sad)
- I am (the first line of the poem repeated)

**Third Stanza**
- I understand (something that is true)
- I say (something you believe in)
- I dream (something you dream about)
- I try (something you really make an effort about)
- I hope (something you actually hope for)
- I am (the first line of the poem repeated)

**Example**

- I am polite and kind
- I wonder about my kids’ future
- I hear a unicorn’s cry
- I see Atlantis
- I want to do it all over again
- I am polite and kind

- I pretend I am a princess
- I feel an angel’s wings
- I touch a summer’s cloud
- I worry about violence
- I cry for my Gram
- I am polite and kind

- I understand your love for me
- I say children are our future
- I dream for a quiet day
- I try to do my best
- I hope the success of my children
- I am polite and kind.
<table>
<thead>
<tr>
<th>CATEGORY</th>
<th>4</th>
<th>3</th>
<th>2</th>
<th>1</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Ideas and Content</strong></td>
<td>The entire writing is related to the assigned topic. The writing is exceptionally clear, focused, and interesting. It holds the reader's attention throughout.</td>
<td>Most of the writing is related to the assigned topic. The writing is clear and focused. The reader can easily understand the main ideas.</td>
<td>Some of the writing is related to the assigned topic, but slightly off topic.</td>
<td>No attempt has been made to relate the story/poem to the assigned topic. The writing lacks a central idea or purpose.</td>
</tr>
<tr>
<td><strong>Organization</strong></td>
<td>The writing is very well organized. One idea or scene follows another in a logical sequence with clear transitions.</td>
<td>The writing is pretty well organized. One idea or scene may seem out of place. Clear transitions are used.</td>
<td>The writing is a little hard to follow. The transitions are sometimes not clear.</td>
<td>Ideas and scenes seem to be randomly arranged.</td>
</tr>
<tr>
<td><strong>Creativity</strong></td>
<td>The writing contains many creative details and/or descriptions that contribute to the reader's enjoyment. The author has really used his imagination.</td>
<td>The writing contains a few creative details and/or descriptions that contribute to the reader's enjoyment. The author has used his imagination.</td>
<td>The writing contains a few creative details and/or descriptions, but they distract from the story. The author has tried to use his imagination.</td>
<td>There is little evidence of creativity in the story. The author does not seem to have used much imagination.</td>
</tr>
<tr>
<td><strong>Conventions</strong></td>
<td>Writing is easy to read aloud. The writing demonstrates exceptionally strong control of conventions (e.g., punctuation, spelling, capitalization, grammar). Errors are so minor that the reader can easily skim right over them.</td>
<td>Minor errors, while perhaps noticeable, do not impede readability. The writing demonstrates control of standard writing conventions (e.g., punctuation, spelling, capitalization, grammar and usage).</td>
<td>The writing demonstrates little control of standard writing conventions. Frequent, significant errors impede readability.</td>
<td>Numerous errors in usage, spelling, capitalization, and punctuation repeatedly distract the reader and make the text difficult to read.</td>
</tr>
</tbody>
</table>
Observation Exercise: Layers of the Forest

Directions:
In the old-growth forest you will find a quiet location and observe the layers of the forest using the four senses (sight, smell, sound, touch). You will have 15 minutes to record data on the sensory chart provided.

At camp or back at class, you will use the data collected on the sensory chart to create another “I Am Poem”. This poem should be written from the perspective of an animal that lives in the forest or from your own point-of-view of how the forest makes you feel.

Take 15 minutes to find a quiet spot to record observations. Use the Sensory Observation sheet on the next page.

Follow up discussion questions:

1. What would happen if there were no snags?

2. How would our daily life change without forests?

3. How would the forest change if there were no salamanders, centipedes, or carpenter ants?

Be prepared to share your sensory observations with a partner and discuss observations with the class. Volunteers will be asked to read their poem to the class.
Model Lesson: Tree Identification and Growth Study at Outdoor School

**Overview:** Students will identify tree species, collect and analyze tree growth data from two different sites, discuss human impacts on the forest, and predict forest growth as the climate changes. As an extension, students will evaluate the forest as a forest manager to plan for the future. This lesson is designed to be used in mid-elevation coniferous forests in the Cascades of Oregon, dominated by mature Douglas-fir, Western Hemlock, Western Redcedar, and Pacific Yew. The measurements, analysis, discussion questions, and activities can be used in any forest, with modifications taking into account the tree species of the Outdoor School location.

**General information:** This particular lesson has been developed in cooperation with K-12 educators (science, language arts, social studies, math, and geography) in an effort to enhance 6th grade students’ Outdoor School experience and increase their awareness of geography. When the connection a young person has with the natural world is fostered, the young person flourishes academically, mentally, and physically. A connection with our natural world, whether in an old-growth forest, or a city park, both grounds a person and sparks curiosity for the natural world. Being able to name and identify the trees of Oregon, will give students a connection or perhaps a feeling of ownership and thus will encourage stewardship of our natural resources.

**National Geography Standards:**
- **Standard 8**: The characteristics and spatial distribution of ecosystems and biomes on Earth’s surface.
- **Standard 14**: How human actions modify the physical environment.

**Oregon Geography Content Standards:**
- **Standard 6.12**: Collect and analyze data to describe regions of the Western Hemisphere.

**Oregon Science Content Standard:**
- **Standard LS2.A**: Organisms and populations are dependent on their environmental interactions both with other living things and with nonliving factors, any of which can limit their growth.

**Science Practices:**
1. Planning and carrying out investigations
2. Analyzing and interpreting data
3. Obtaining, evaluating, and communicating information

**Connections to Common Core:**
- **Writing W.6.7**: Conduct short research projects to answer a question.

**Objectives:**
Students will be able to:
1. Correctly identify tree species
2. Measure the diameter of trees and determine the density of the trees in a given area (extension: compare diameter distribution between sites)
3. Analyze the differences and similarities between two sites
4. Observe and predict human influences on the forest
5. Make predictions of tree growth as the climate changes
6. (Extension) Make recommendations for future forest management

**Grade Levels:** 6th

**Time:**
- 1 class period (30-40 minutes) prior to Outdoor School
- 2 hours at Outdoor School

**Materials:**
1. Samples of tree species at Outdoor School (Douglas-fir, Western Hemlock, Western Redcedar, Pacific Yew)
2. Dichotomous Key (Common Trees of the Pacific Northwest or other tree identification publication)
3. Tools to measure tree growth (pencil, 100 foot tape measure, DBH [diameter at breast height] tape measure)
4. Clipboard (a hard surface to write on in the forest)
5. "Into the Forest" booklet, OFRI publication
6. Datasheets (see appendices)

**Background:**
Prior to Outdoor School, introduce students to the major tree species they will encounter in the Outdoor School setting. Students should have experience measuring with a tape measure and completing simple calculations. There are various methods of introducing students to trees and other vegetation. Google Earth is a great resource to show students the vegetation and physical geography of an Outdoor School site. The Student Atlas of Oregon is another resource that has both vegetative and physical geography maps.

**Procedures:**
Prior to Outdoor School: (30-40 minutes, approximately)

**Introduction to trees and geography:**
1. Show students the location and physical geography of the Outdoor School site, using satellite images within Google Earth or the Student Atlas of Oregon.
2. Using tree samples, work through a dichotomous key of the tree species to demonstrate how a key is used and to show the characteristics that will be used to determine tree species at Outdoor School (needles, cones, bark, size).

At Outdoor School:

**Tree Identification:** (30-45 minutes approximately) The duration will depend on the distance of the hike to be determined by the teacher. (Use the Observation Sheet from Appendix A.)

1. In small groups, lead students on a forest hike to observe and learn the major tree species. Stop periodically on the hike and show students the individual characteristics of the trees. *Needles and cones are very different between tree species.*

2. Make sure that each student has a chance to observe specific characteristics of tree needles, bark, and growth habit, of all tree species being studied. *The growth habit “droopy-top” of Western Hemlock is much different than that of a straight Douglas-fir tree. Western Hemlock is shade-tolerant and seedlings can grow in shade, Douglas-fir seedlings must have direct sun to grow successfully.*
3. During the hike, collect individual tree samples for each species. Collect part of a branch to allow students to closely examine needles, and pick up cones that have fallen from the ground. Make sure that you are collecting the correct cones associated with the correct tree. In a forest, it is common for cones to be moved by wind or animals.

4. Following the hike, allow students to use the tree samples, and record their observations on the sensory observation sheet (Appendix A).

5. Allow students to share observations with the group, and work through the discussion questions together. With this practice identifying trees, students will be ready to test their new knowledge as they measure trees.

Discussion Questions:

1. What do you notice about all the tree species? What is similar? What is different? They all have green needles. The Western Hemlock needles are various lengths, but the Douglas-fir needles are all the same length.

2. Do the trees smell different? Have students share what they have recorded. If students need help with this question, crush the needles in your hand to release an odor.

3. Sometimes there are tricks to remembering tree species, do you have any ideas about what is special about Douglas-fir or Western Redcedar? Talk about the unique Douglas-fir cone, that looks like a mouse has run back into the cone and its tail and feet are showing. Western Redcedar bark looks stringy on the older trees.

Tree Measurement: (45 minutes at two locations, so a total of 90 minutes) Teachers that are not familiar with forest surveying (measuring trees) should read and watch the videos within the “Virtual Cruiser Vest” publication by Kevin Zobrist (see the resources section). An alternative to learning from Kevin Zobrist is to recruit your local forester to come work with the students during Outdoor School. Two different plots should be marked, prior to having students measuring trees (The different plots could have different aged trees, have been partially logged or an old burn.) Use the data collection sheet (Appendix B). (If you have the benefit of a forester include the height measurement using a clinometer. Tree height is often the more difficult task to measure accurately.)

1. Demonstrate how to use the tools and allow time for students to practice and ask questions. Provide equipment to each group of 3-4 students. Remind students the importance of careful observations and data collection.

2. Within each group have one student record tree growth data, and 2 to 3 other students take the actual measurements.

3. Spend 20-30 minutes collecting and recording data, then stop the students to allow them to explain the data they gathered with the group. As a group, discuss the questions and share ideas.
4. Extension: If there is a group that finishes early, you may have them record data using Appendix C (Looking at their diameters, have the students make a comparison between the sites. *Example: there are 3 DH that are between 16 and 20 inches in diameter*).

**Discussion Questions:**

1. What do you notice about the trees in this plot? Are the four species we learned earlier all growing here? What species are most of the seedlings? Why? *You could draw on their knowledge of which species are shade-tolerant, Pacific Yew and Western Hemlock are very shade-tolerant.*

2. What species has the largest diameter? Why do you think that is the case?

3. What are the challenges of collecting data in the forest? *If the trees are very large, it can be hard to measure with a DBH tape.*

4. Do you see evidence of human activity? *Stumps from logging, logging debris, fires.*

5. Do you see evidence of wildlife? *Elk can rub (rack) seedlings with antlers, elk and deer scat may be present.*

*Following the discussion, take the group to the other site/plot and collect the same data on a new data sheet and ask the same questions.*

**After visiting both sites, discuss the following questions:**

1. How are the 2 sites similar? How are they different?

2. Why are they similar/different? *The 2 sites may be too close together to show any differences. Is there evidence of logging, fires, animal damage?*

3. What evidence did you observe of human influence on this forests? *There may be a path for recreation, stumps, or burned stumps.*

4. If more people use this forest, what do you predict will happen to the trees? *They could be protected if they are old-growth, or logged.*

5. What is missing from the sites that you expected to find? *It always surprises me what the students say. Maybe there are very few Pacific Yew trees.*

6. What are some other measurements that we could take to quantify the differences? *Temperature, soil water, slope of the land, soil nutrient, etc…*

7. With increased temperatures, as the climate changes, how will these sites change? *Students may talk about the lack of water.*
8. As the climate changes, how will the forest change on these two sites? Different species may be introduced or perhaps there will be more insects.

9. What does it mean when a forester says they “manage” the forest? Discuss how a good manager is thinking about a sustainable resource, whether that is lumber or wildlife.

10. What kinds of things do forest managers do?

11. What are some of the different reasons people manage forests? Should all forests be managed? People may manage for wood products, wildlife habitat, or recreation.

Assessment:
Formative assessment:
1. Using a dichotomous key to identify trees.
2. Datasheet for the tree growth (Appendix B)
3. Discussion questions

Summative assessment:
1. Sensory observation for tree identification (Appendix A)
2. Extension Activity: “Tree Diameter Comparison of Two Sites” (Appendix C)
3. Extension Activity: “Your Forest Plan” Worksheet (Appendix D)

Adaptations:
For the first part of the lesson, when students are writing their observations, students with limited writing abilities may draw pictures to communicate their observations. When dividing students into groups, partner ELD and SPED students with supportive and helpful peers. Check for understanding as the lesson is being implemented and guide students as needed. As the groups are working, check-in frequently with the ELD and SPED students.

Extensions:
1. “Tree Diameter Comparison of Two Sites” (Appendix C), this activity can be completed by groups that finish early, or the more advanced students that need a challenge.
2. “Your Forest Plan” (Appendix D), this is an activity to be done in small groups and will require small group discussion and take into account the previous activities and learning.
3. Other lessons for Outdoor School have been written by middle school teachers, that would enhance students educational experience. They include: Tread Lightly (human impact) by Anna Hart, Teaching the Layers of the Forest through Poetry and Writing (by Beth Chitwood.

Sources:


http://forestandrange.org/Virtual%20Cruiser%20Vest/lessons/lesson_06/Lesson_6_PDF.pdf
Appendix A

Tree Identification Observation Sheet - use word phrases to describe how the tree specimen looks, smells and feels. Draw and label the tree sample.

<table>
<thead>
<tr>
<th>Sights - describe what the tree looks like</th>
<th>Smell - describe how the needles smell</th>
</tr>
</thead>
<tbody>
<tr>
<td>![Eye Image]</td>
<td>![Smell Image]</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Touch - describe how the needles feel</th>
<th>Drawing of the tree sample</th>
</tr>
</thead>
<tbody>
<tr>
<td>![Hand Image]</td>
<td></td>
</tr>
</tbody>
</table>
## Rubric: Sensory Observation of Tree Species

<table>
<thead>
<tr>
<th>CATEGORY</th>
<th>4</th>
<th>3</th>
<th>2</th>
<th>1</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sight</td>
<td>There are more than four distinct and specific observations recorded.</td>
<td>There are at least three distinct and specific observations recorded.</td>
<td>There are at least two specific observations recorded.</td>
<td>There is one observation recorded.</td>
</tr>
<tr>
<td>Touch and Smell</td>
<td>Combining these two boxes, there are more than six distinct and specific observations recorded.</td>
<td>Combining these two boxes, there are five distinct and specific observations recorded.</td>
<td>Combining these two boxes, there are four specific observations recorded.</td>
<td>Combining these two boxes, there are three observations recorded.</td>
</tr>
<tr>
<td>Drawing of tree species</td>
<td>Drawing includes 4 or more characteristics of the tree to include needles, bark and/or cones all clearly labeled.</td>
<td>Drawing of at least 3 characteristics of the tree (needles, bark or cones) are clearly labeled.</td>
<td>Drawing of at least 2 characteristics of the tree (needles, bark or cones) not labeled.</td>
<td>Drawing of 1 characteristic of the tree (needles, bark or cones) not labeled.</td>
</tr>
</tbody>
</table>

Date Created: Aug 22, 2016
### Appendix B
Datasheet: Tree growth

<table>
<thead>
<tr>
<th>Site Location</th>
<th>Date</th>
<th>Names of data collectors</th>
</tr>
</thead>
</table>

<table>
<thead>
<tr>
<th>Tree Species (Common Name)</th>
<th>Number of trees</th>
<th>Diameter (dbh)</th>
<th>Height of tallest tree</th>
<th>Density (number of trees per site)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Western Redcedar (WR)</td>
<td></td>
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<tr>
<td>Western Hemlock (WH)</td>
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<tr>
<td>Douglas-fir (DF)</td>
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</tr>
<tr>
<td>Pacific Yew (PY)</td>
<td></td>
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<td></td>
</tr>
</tbody>
</table>

Tree species list:
- Western Redcedar (WR)
- Western Hemlock (WH)
- Douglas-fir (DF)
- Pacific Yew (PY)
## Appendix C
Extension Activity (Tree Diameter Comparison of Two Sites)

<table>
<thead>
<tr>
<th>DBH (inches)</th>
<th>Tree Species from your plot whose DBH is found within this range</th>
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<td></td>
<td>SITE ______________________  SITE ______________________</td>
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<tr>
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<td>6-10</td>
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<td>46-50</td>
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<tr>
<td>51+</td>
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</tr>
</tbody>
</table>

Tree species list:
- Western Redcedar (WR)
- Western Hemlock (WH)
- Douglas-fir (DF)
- Pacific Yew (PY)
Appendix D

Your Forest Plan

Imagine that your group owns and manages 100 acres of forest. This forest is made up of conifer trees that are all about the same age, and has a stream running through it.

What is your goal for this forest?

____________________________________________________________________________
____________________________________________________________________________

What would your forest look like if your goal is being met? Draw a picture of it.

Are there any natural benefits forests provide, such as storing carbon, that could help you achieve your goal? (Look through Into the Forest for ideas.)

____________________________________________________________________________
____________________________________________________________________________

What forest management activities would you do in the next year to move toward your goal?

____________________________________________________________________________
____________________________________________________________________________

What would you do in the following five years?

____________________________________________________________________________
____________________________________________________________________________

What would you do to ensure that your forest remains healthy for the next 25 years and more, while also meeting your goal?

____________________________________________________________________________
____________________________________________________________________________

Oregon Forest Resources Institute
INTO THE FOREST (TEACHER’S GUIDE)
<table>
<thead>
<tr>
<th>CATEGORY</th>
<th>4</th>
<th>3</th>
<th>2</th>
<th>1</th>
</tr>
</thead>
<tbody>
<tr>
<td>Goal</td>
<td>The goal of the forest plan is clearly identified and stated.</td>
<td>The goal of the forest plan is identified, but is stated in a somewhat unclear manner.</td>
<td>The goal of the forest plan is partially identified, and is stated in a somewhat unclear manner.</td>
<td>The goal of the forest plan is erroneous or irrelevant.</td>
</tr>
<tr>
<td>Drawings/Diagrams</td>
<td>Clear, accurate diagrams are included and make the future forest easier to understand. Diagrams are labeled neatly and accurately.</td>
<td>Diagrams are included and are labeled neatly and accurately.</td>
<td>Diagrams are included and are labeled.</td>
<td>Needed diagrams are missing OR are missing important labels.</td>
</tr>
<tr>
<td>Management Activities and Questions</td>
<td>Activities are listed in clear steps. Questions are answered in complete sentences.</td>
<td>Activities are listed in a logical order, but are not in complete sentences.</td>
<td>Activities listed but are not in a logical order or are difficult to follow.</td>
<td>Activities not accurately listed.</td>
</tr>
</tbody>
</table>
TITLE: Understanding Topographic Maps, Watersheds, and the Water Cycle

Overview: This lesson is intended to be done as part of an Outdoor School program and therefore done outside. This lesson includes four distinct activities to better understand the water cycle, topographic maps and watersheds. The activities include:
- Observation activity
- Learning about and exploring the features of a topographical map
- Water cycle discussion
- Hands on activity building a model watershed in which students apply their understanding of topography, the water cycle, and human interactions with the system.

National Geography Standards:
#1. How to use maps
#7. Shaping the earth's systems
#14. Human actions modify the environment

Oregon Geography Content Standards:
6.11. Distinguish among different types of maps and use them to analyze an issue in the Western Hemisphere.

6.14. Identify physical features of the Western Hemisphere and explain their effects on people and events.

Oregon Science Content Standard (NGSS):
MS-ESS2-2 Construct an explanation based on evidence for how geoscience processes have changed Earth’s surface at varying time and spatial scales.

MS-ESS2-4 Develop a model to describe the cycling of water through Earth’s system driven by energy from the sun and the force of gravity

Objectives:
To understand how topography, the water cycle, and watersheds all interact and how humans impact water health and movement.
In completing these activities, students should be able to:
- Describe topographic features on a topographic map
- Describe the main elements of the water cycle
- Be able to describe how topography, the water cycle, and watersheds all interact
- Describe how humans can impact water and water movement within a watershed
Grade Levels: 6th (can be adapted for other grade levels)
Time: 2-3 hours

Materials:
- An outdoor space with access to sand or dirt for digging
- 1 thin plastic table cloth or other thin plastic sheet (at least a few feet wide/long) per group
- 1 spray bottle per group
- Food dye or other substance that you can introduce as “pollution” to the watershed
- Small shovels or other tools to dig (optional)
- 1 topographic map per group (at least one of your local watershed suggested). Can print free ones here: http://www.natgeomaps.com/trail-maps/pdf-quads
- Either the attached student notebook (Appendix A) or a clipboard and paper for each student to write on
- Writing utensil
- Poster depicting the water cycle (examples can be found online)

Background:
Watersheds are defining physical features of any area or region. Understanding watersheds is critical to understanding water as a resource and how humans both benefit from and impact the flow of water through the landscape. The flow of water is impacted both by the energy of the sun and the force of gravity and moves both underground and on the surface of the earth. For more information on watersheds please visit:

http://water.usgs.gov/edu/watershed.html
http://www.thewatershedproject.org/LearnMore/LearnMore.html

Procedures:
This lesson is intended to be done as part of an outdoor school program and therefore done outside. Being near a water feature (pond, river, lake, etc. is best, but if no water feature is available it will still work). However, some kind of sand or dirt is necessary for building the model watersheds (for an alternative please see the extensions section at the end of this document). There is a field journal (Appendix A) that can be used for this lesson and there are pages for each activity.

Essential Questions:
Question #1: Why is water important?
Question #2: How does water move around the globe and how do physical and human features make an impact on that movement?
Question #3: How do topography, the water cycle and watersheds all interact?
**Intro (10 minutes):**

Student should already have been introduced to the idea of a watershed and the water cycle in class. Explain that today the goal is to learn how to read a topographic map and to understand how the topography of an area, a watershed, and the water cycle all interact. Additionally, explain that they will be doing four different activities. Before starting the first activity, ask students to have a discussion about what they already know about the topics that will be covered. Listen for understanding and misunderstandings.

**Part 1 (20-30 minutes): Observation Activity-Sit Spot**

Students will be asked to find a place to sit to make observations of their surroundings. They should be away from other students, but within view of the teacher and within the given boundaries. Have them stay in their spot for a minimum of 10 minutes, however longer is better. The longer they are able to sit, the more they will observe. Many teachers worry about students not being able to sit for this long, but in fact most students love the activity and describe it as one of the most important parts of their time at Outdoor School. Rarely do students have the opportunity to just sit and observe and this will give them time to connect with their surroundings and develop observation skills. They will have their field journals with questions to consider and they can be told that once they do thorough observations, they can just sit quietly to think, reflect, or daydream. Remind the students to use all of their senses (taste is optional or can be off limits depending on your students and the surroundings).

Once students are called back from their sit spot have a group discussion about what students observed. Review the journal prompts and answer any questions that arose.

**Part 2 (15 minutes): The Water Cycle**

Ask students to spend about 30 seconds thinking to themselves about what they already know about the water cycle. Ask for a few volunteers to share. Next, have a full discussion about the water cycle using a visual model (poster), and include the vocabulary: evaporation, condensation, precipitation, percolation, and runoff. Have students take notes in their field journals during the discussion.

For additional information and ideas for teaching about the water cycle:


Part 3 (30 minutes): Exploring Topographic Maps

Give each group a topographic map and ask them to spend 5-10 minutes making observations about their maps. Have them use the questions in their journals and record their observations and thoughts.

After the set amount of time, bring students back together for a discussion and lesson about topographic maps. Ask students to discuss the questions they answered in their field journals. Once the discussion has finished, use what came out of the discussion to teach the key components of what makes a topographic map unique. Discuss the map’s key, the contour lines, and landscape features depicted. One way to help students understand how contour lines works, is by drawing them on your hand. When your hand is in a fist, that represents the landscape, when it is flat, it represents the map. A map is flat and therefore the contour lines depict a 3-D landscape, in a 2-D model (a map). Here is an example:

After the discussion and lesson on topographic maps, ask student to draw an example of a topographic map in their journals. Remind them that they must include a key and the cardinal directions.

For more information on teaching about topographic maps here are a few links:


1 http://www.scouterlife.com/blog//2012/05/topographic-map-activity.html
Part 4 (45 min): Building a model watershed

This is the most hands on part of the lesson in which students have the opportunity to get their hands dirty and demonstrate understanding!

Begin by talking about your local area and what watershed you are in. Discuss the idea that there are watersheds, within watersheds. For example, Portland, OR is in the Bull-Run Watershed, which is within the Columbia River Watershed, that covers multiple states and river systems. Give the definition of a watershed and ask students if they could describe what a watershed is to a partner.

In small groups (2-6 students) ask students to work together to build a model watershed in the sand/soil. The model should include a variety of landscape features, including hills and valleys.

Once students have completed building their model watershed, have them all gather around one model at a time for the final demonstration. Take a plastic sheet and carefully place it over the model watershed, so that it molds to the contours of the model. Ask students to predict where the water will flow and pool when sprayed from above to mimic “rain”. Next, spray the model and have students make observations about what is happening.

Finally, introduce “pollution” to the watershed by adding a drop of dye or other colored substance. Have students observe what happens.

Repeat the process with each model watershed and have students observe similarities and differences with each model. How does the topography differ between models and how does that affect the flow of water? Add “pollution” to different places in each model. How does the placement of “pollution” affect where it ends up and who is impacted?

Here is more information about teaching with watershed models:

http://wd.northwestern.edu/assets/Activity-2-Watershed-Model-ALL.pdf

Discussion Questions (also found in the student journal):

- What force was acting upon the water that had the water travel where it did?
- How does water get back to the top of the watershed?
- What would happen if water fell on the other side of the top ridge in your model watershed?
- When “pollution” was introduced to the watershed what happened? How are people/ecosystems downstream affected?
• What might happen if people along the watershed were to remove water from the system either through catchment or diversion?
• How does the topography affect the flow of water? For example: steeper slopes.

**Wrap-up (10-15 min):** Conclude the lesson with a group discussion, linking ideas and the activities.

Possible questions to ask:
• What did you learn?
• What was surprising?
• What happened when water was sprayed on your model watershed? Why did the water move where it did?
• How can people help to protect their watersheds?
• How do the actions of people upstream affect people/ecosystems downstream?
• How does the topography of an area affect how water moved through the landscape?
• How does the water cycle affect how water moves through the landscape?

**Assessment:** Students will complete work in a field journal that will include their observations, notes, predictions, and analysis. A rubric is attached (Appendix B) that can be used to assess student performance.

**Extensions and/or Adaptations:**
The watershed activity could be adapted to be done without access to sand or dirt. Instead of using sand or dirt, students can use crumpled up paper or other similar material and then place the plastic sheet on top of the paper.
Appendix A.

Student Field Journal:
Understanding Topographic Maps, Watersheds, and the Water Cycle

Essential Questions:

1. Why is water important?
2. How does water move around the globe and how do physical and human features make an impact on that movement?
3. How do topography, the water cycle and watersheds all interact?

Observation Activity:

• What do you see, hear, smell, and feel? Be detailed.
• Write and/or draw your observations.
• What do you observe around you that depends on or interacts with water in someway? How does it depend on or interact with water? Are there non-living things that interact with water? What are they?
The Water Cycle:

Understanding Topographic Maps:

Questions to think about while exploring your map:

- What do you notice about your map?
- How is it different or similar to other maps you have seen before?
- Find North, East, West and South?
• What is the “scale” of the map?
• What do you think the map is depicting?
• Do you see any rivers?
• Where is the map’s key? Is there anything that stands out to you?

Notes:

Use this space to create your own topographic map:
(Be sure to create a key!)
Building your Watershed:

With your team, develop a model watershed in the soil/sand with a variety of topographic features. Create hills, valleys, a flat area, etc.

Once you are finished, make predictions about where you think water will run and pool in your watershed if it were to “rain”.

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2 [http://www.thewatershedproject.org/LearnMore/LearnMore.html](http://www.thewatershedproject.org/LearnMore/LearnMore.html)
Discussion Questions:

- What force was acting upon the water that had the water travel where it did?

- How does water get back to the top of the watershed?

- What would happen if water fell on the other side of the top ridge in your model watershed?

- When “pollution” was introduced to the watershed what happened? How are people/ecosystems downstream affected?

- What might happen if people along the watershed were to remove water from the system either through catchment or diversion?

- How does the topography affect the flow of water? For example: steeper slopes.
Appendix B.

Assessment Rubric:

<table>
<thead>
<tr>
<th>Objective</th>
<th>Met objective</th>
<th>Partially met objective</th>
<th>Did not meet objective</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Be able to describe topographic features on a topographic map</strong></td>
<td>Journal is complete and accurate. Fully participated in activity and group discussion.</td>
<td>Journal is partially complete and/or information is not fully accurate. Partial participation in activity and group discussion.</td>
<td>Journal is incomplete and/or inaccurate. No participation in activity or discussion.</td>
</tr>
<tr>
<td><strong>Be able to describe the main elements of the water cycle</strong></td>
<td>Journal is complete and accurate. Fully participated in activity and group discussion.</td>
<td>Journal is partially complete and/or information is not fully accurate. Partial participation in activity and group discussion.</td>
<td>Journal is incomplete and/or inaccurate. No participation in activity or discussion.</td>
</tr>
<tr>
<td><strong>Be able to describe how topography, the water cycle, and watersheds all interact</strong></td>
<td>Journal is complete and accurate. Fully participated in activity and group discussion.</td>
<td>Journal is partially complete and/or information is not fully accurate. Partial participation in activity and group discussion.</td>
<td>Journal is incomplete and/or inaccurate. No participation in activity or discussion.</td>
</tr>
<tr>
<td><strong>Be able to describe how humans can impact water and water movement within a watershed</strong></td>
<td>Journal is complete and accurate. Fully participated in activity and group discussion.</td>
<td>Journal is partially complete and/or information is not fully accurate. Partial participation in activity and group discussion.</td>
<td>Journal is incomplete and/or inaccurate. No participation in activity or discussion.</td>
</tr>
</tbody>
</table>
Water Erosion Exploration

Overview: In this lesson students will understand the natural process of water erosion on a landscape region in the Pacific Northwest, and will understand the impacts that human interaction with the natural environment may have on this natural processes.

National Geography Standards:
Geography Standard 7: The physical processes that shape the patterns of Earth's surface.

Geography Standard 14: How human actions modify the physical environment.

Oregon Geography Content Standards: 6.14. Identify physical features of the Western Hemisphere and explain their effects on people and events.

New Generation Science Standard: MS-ESS2-2 Earth’s Systems: Construct an explanation based on evidence for how geoscience processes have changed Earth’s surface at varying time and spatial scales.

Objectives:
In completing this activity, students should be able to:
- Understand how a landscape's physical features impact the effects of water erosion.
- Understand the how human actions influence the impact of water erosion on the natural environment.
- Identify areas in the natural environment that have been impacted by water erosion, and/or human intervention.

Grade Levels: 6th Grade Time: 1 week at outdoor school
4 - 60 minute exploration exercises.
Materials:
Before planning this activity be sure to verify with outdoor school site that you and your students will be able to gather natural elements at the site.

Each exploration group will need:
- Cardboard/plywood that will act as erosion board approximately 24in x 40in (does not need to be exact).
- 50 gallon heavy duty garbage liners - to cover the erosion board.
- Soil - Approximately 4ft³ - this should be enough to cover the surface with a minimum of 6 inches (the landscape height can be adjusted as desired by students).
- Natural elements gathered at the outdoor school site (suggested that students are responsible for gathering all elements except for the soil - under the guidelines of the outdoor school site.
  - Sticks, twigs, grass, moss, rocks, etc.
- Something to angle the erosion board - (suggested ideas, rocks, logs, and or campfire wood that can be used after the week).
- Water Erosion Simulation Graphic Organizer (Attached as resource 1)
- Water Erosion Observation and Proposal Graphic Organizer (Attached as resource 2)
- Writing utensils to record their observations.
- Clipboard/Writing Surface for students

Background: Prior to Outdoor School, students will have studied water erosion as a physical process impacting the earth's surface. Students should be familiar with causes of water erosion, as well as what the effects of water erosion look like.

Students should also know examples of how both natural events and human intervention may change a region.
Students will also have studied/have prior experience with the geographic features of landscapes similar to that found in ecoregions similar to that of the Outdoor School site.

**Procedures:**
Group sizes may be created as desired; however, it is suggested that students are partnered in groups of two. Small groups provide each person in the pair ample opportunity to participate in the creation of their water erosion board and allows the opportunity for keen observation and accurate recording of data.

**Day 1**
In pairs, students will design their erosion board with physical features similar to those found in the ecoregion of their outdoor school site.

**Erosion Board Design** - Depending on time during outdoor school, students should have between 40 minutes and an hour to design their erosion boards.

- Angle erosion board (suggested use a downed log, firewood, or rocks).
- To waterproof the erosion board, cover with large garbage bag.
  - Depending on the size of the erosion board, the bag can be cut and draped over, or slid over. There should be no need to affix, as the weight of the soil will hold in place.
- Have students begin designing their erosion boards by placing soil first.
  - Encourage students to be creative with their design. Build peaks, valleys, plateaus, use more tightly packed and loosely packed soil, etc.
- Have students utilize natural elements that they have gathered to design their erosion board. These elements should help simulate the natural environment. Encourage students to
be creative and detailed with the design of their erosion boards, and to try to incorporate different features that they may have seen, or that they know exist in this region (forest, grassland, river valley, etc.)
  ○ Ideas for how to simulate these regions: students may use moss to represent dense vegetation, or rocks to simulate mountains, cliffs, hillsides, etc.

Primary Erosion Simulation:
As groups finish the design of their erosion boards, assist students in introducing water to their erosions boards. This can be done by using a hose, watering can, or a bucket of water.
  ● Depending on the goals of your simulations, you may want to choose a controlled way to introduce water to all groups, or you may want groups to experience variability in the way that water is dispersed onto their erosion boards (discussed as an extension activity).

Recording Observations
As water is introduced to erosion boards have students observe and record the impact that the water had on the various features of their erosion board on their Water Erosion Simulation Graphic Organizer.
  ● You may want students to observe each other's erosion simulations - or have them all do this step independently.

   Days 2-4 (repeat this process each day)

Modification of Erosion Boards
Have students use between 30 and 40 minutes to make modifications to their erosion boards. This time includes the time for students to gather materials that they may need.
  ● You may want students to modify their designs based upon their previous observations, or students may be given specific modifications (discussed as an extension activity).
Be sure that throughout the week students’ modifications include at least one natural change to the ecosystem (forest fire) and at least one human intervention to the ecosystem (river dam).

**Hypothesis of Impacts of the Modifications**

Have students record the modifications made to their erosion boards on their Water Erosion Simulation Graphic Organizer.

Students should hypothesize as to the impact of the changes that have been made. These hypotheses should be recorded on their Water Erosion Simulation Graphic Organizer.

**Erosion Simulation After Modifications**

Introduce water to students erosion boards.

- You may choose to introduce the same amount of water at a similar rate each day, or vary the amount and/or rate that water is introduced. (discussed as an extension activity)

**Recording Observations**

As water is introduced to erosion boards have students observe and record the impact that the water has on the environments on their Water Erosion Simulation Graphic Organizer.

- Have students make specific note of how things may have changed as a result of the changes to the natural environment that have been introduced.

**Assessment:** Use the attached Water Erosion Observation and Proposal Activity and Scoring Guide

Students will learn how to observe a large natural environment and identify evidence of water erosion within this environment using natural indicators as evidence of water erosion.

**Procedures:**

Find a place where students have a larger landscape view of the region.
Give students a writing utensil, clipboard, and Water Erosion Observation and Proposal Graphic Organizer (resource 2). Have students sketch the greater landscape of the outdoor school site and surrounding areas in the provided space of the graphic organizer.

When sketches are completed have students identify locations where evidence of water erosion is present. Students should be able to indicate the evidence of the erosion.

Have students propose at least one human intervention that could help positively impact at least one of the areas that has been impacted by water erosion, OR describe why human intervention should not occur in this location despite the impacts of water erosion.

As a class, discuss students sketches with a specific emphasis on:
- where there is evidence of water erosion
- similarities/differences and disagreements that groups may have with each other in regards to where water erosion has occurred.
- students’ proposal for human interventions or lack thereof.

**Extensions and/or Adaptations:**
This activity can be extended in several different ways:

You may choose to have various methods (rate and amounts) of having water introduced to students erosions boards each day. These various methods may help indicate different type of precipitation events (rain, drought, flooding, etc.). Students may be able to hypothesize how these different events may impact water erosion in different ways.

You many choose to intentionally set up students’ erosion boards at different angles to simulate differences in the change of
elevation that occurs in nature. Students can hypothesize as to how the differences in angle (gradual vs. immediate changes in elevation) will impact water erosion differently.

Instead of having students make modifications to their erosion boards by their own choice. You may choose to introduce changes to students’ erosion boards by giving (randomly or intentionally) students various scenarios that determine the modifications that will occur. Examples of these modifications may include:

- Forest Fire removes 80% of a forest’s trees
- Clear Cutting
- Damming a river or lake to provide flood control downstream.
- Development of housing/commercial buildings
- Laws/Policies introduced limiting logging, or restricting locations of roads, housing, etc.

Erosion Simulation Observation
<table>
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<tr>
<th>Day</th>
<th>Changes Made to Erosion Board</th>
<th>Hypothesis: Impact of the Changes Made</th>
<th>Observation of Water Erosion</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Initial design:</td>
<td>Where will water flow?</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>What changes will it make to the landscape?</td>
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</tr>
<tr>
<td>2</td>
<td></td>
<td></td>
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</tr>
</tbody>
</table>

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1 Resource 1
Based upon your observations, what things - natural or human interventions, have the largest impact on whether or not water erosion will occur in a given region?

<table>
<thead>
<tr>
<th>Day 3</th>
<th></th>
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</table>

<table>
<thead>
<tr>
<th>Day 4</th>
<th></th>
<th></th>
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</thead>
</table>
Observation Exercise: Water Erosion Observation

Objective:
Students will learn how to observe a large natural environment and identify evidence of water erosion within this environment using natural indicators as evidence of water erosion.

Procedures:
Find a place where students have a larger landscape view of the region.

Give students a writing utensil, clipboard, and Water Erosion Observation and Proposal Graphic Organizer (resource 2). Have students sketch the greater landscape of the outdoor school site and surrounding areas in the provided space of the graphic organizer.

When sketches are completed have students identify locations where evidence of water erosion is present. Students should be able to indicate the evidence of the erosion.

Have students propose at least one human intervention that could help positively impact at least one of the areas that has been impacted by water erosion, OR describe why human intervention should not occur in this location despite the impacts of water erosion.

As a class, discuss students’ sketches with a specific emphasis on:
- where there is evidence of water erosion
- similarities/differences and disagreements that groups may have with each other in regards to where water erosion has occurred.
- students’ proposal for human interventions or lack thereof.

Water Erosion Observation and Proposal

2 Resource 2
Sketch the landscape area that you can view, be sure to include prominent geographic and/or man made features

Indicate on your sketch, areas of the landscape that have been impacted by water erosion.

Based upon your observations and knowledge of water erosion, propose at least one intervention that could be beneficial to this region OR propose why human intervention should not occur in this region.

______________________________________________________________________________
______________________________________________________________________________
______________________________________________________________________________
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______________________________________________________________________________

Water Erosion Observation and Proposal (Scoring Guide)

3 Resource 2
<table>
<thead>
<tr>
<th></th>
<th>4 Highly Proficient</th>
<th>3 Proficient</th>
<th>2 Close to Proficient</th>
<th>1 Developing Proficiency</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Observation Sketch</strong></td>
<td>Student’s sketch is complete, and includes all prominent geographic features. Students sketch contains detail of less prominent geographic features.</td>
<td>Student’s sketch is complete, and includes all prominent geographic features. Students sketch contains some detail of less prominent geographic features.</td>
<td>Student’s sketch has most prominent geographic features, but may be missing one or more prominent features. Sketch contains little to no detail for less prominent features.</td>
<td>Student’s sketch is not complete. Sketch is missing both prominent and less prominent geographic features.</td>
</tr>
<tr>
<td><strong>Water Erosion Identification</strong></td>
<td>Student’s sketch has identified all possible locations where water erosion has occurred, and has included proper evidence of the erosion.</td>
<td>Student’s sketch has identified possible locations where water erosion has occurred, and has included proper evidence of the erosion.</td>
<td>Student’s sketch has identified possible locations where water erosion has occurred, and has included evidence of the erosion, however the evidence may not be consistent with water erosion or the landscape.</td>
<td>Student’s sketch has not identified possible locations where water erosion has occurred.</td>
</tr>
<tr>
<td><strong>Proposal</strong></td>
<td>Student’s written proposal discusses details and evidence of the water erosion in this specific site. Proposal to intervene or refrain from intervention is well thought out AND considers the potential specific and realistic consequences of both sides of the argument in its proposal.</td>
<td>Student's written proposal discusses details and evidence of the water erosion in this specific site. Proposal to intervene or refrain from intervention provides potential specific and realistic consequences of the proposed actions.</td>
<td>Student's written proposal discusses details and evidence of the water erosion in this specific site. Proposal to intervene or refrain from intervention provides some consequences of the proposed actions however these consequences may not be specific or realistic</td>
<td>Student's written proposal indicates intervention, or lack of intervention, however does not discuss the details and evidence of the water erosion in this specific site.</td>
</tr>
</tbody>
</table>
Water Quality and Human Activities

Overview: In this lesson, students will collect data about the levels of dissolved oxygen, temperature, pH, and macroinvertebrates and use this data to determine the health of a stream or river. Next, students will divide into small groups to brainstorm the impacts that a proposed development would have on the water quality and present their “Environmental Impact Statement” to the group.

National Geography Standards:
#8 The characteristics and spatial distribution of ecosystems and biomes on Earth’s surface
#14 How human actions modify the physical environment

Oregon Geography Content Standards:
6.15 Explain how people have adapted to or changed the physical environment in the Western Hemisphere.

Oregon Science Content Standard:
MS-LS2-4 Construct an argument supported by empirical evidence that changes to physical or biological components of an ecosystems affect populations.

Connections to Common Core:
6-8 WH.1 Write arguments focused on discipline-specific content.
6-8 WH.9 Draw evidence from informational texts to support analysis, reflection, and research.

Objectives:
In completing this activity, students should be able to
• gather evidence of stream quality by collecting data and sampling macroinvertebrates.
• use a key to identify aquatic organisms.
• explain how human’s actions and land use practices could affect stream health.

Grade Levels: 6 - 8  Time: 2 hours (plus travel time)
Materials:
Taxonomic keys or identification books for aquatic macroinvertebrates (available online at http://www.stroudcenter.org/education/MacroKeyPage1.shtml or http://www.creekfreaks.net/sites/default/files/attachments/key%20to%20stream%20macroinvertebrates.pdf)

Sampling equipment (such as seine nets, sieves, fish nets) (Directions on how to build your own can be found here: http://www.creekfreaks.net/sites/default/files/attachments/How%20To%20nets.pdf)

Assorted containers (such as tubs, ice cube trays or buckets)
Eye droppers
Forceps or tweezers
Magnifying lenses
Thermometers
Water quality test kits (for dissolved oxygen, pH, and nitrates) – usually available from your local watershed education council or university or from a scientific supply store.
Worksheets #1, #2, Role Sheets and hints (found at the end of this lesson).

Background for the teacher:
The teacher will need to determine the stream site before the lesson to make sure it is appropriate. He/she should have some knowledge about how streams are affected by changes in temperature, dissolved oxygen, pH, soil compaction, erosion, and pollution. The teacher should have a basic understanding of life stages of insects. This website has Great background for teachers as to how DO, pH, temperature and turbidity affect the health of a stream: http://www.longwood.edu/cleanva/world_water_monitoring_va/resized%20images/water_quality_parameter_info_acb.pdf. This one explains how the different measurements collected can indicate the health of a stream: http://www.hawaii.edu/gk-12/evo/erinb.streams.factors.htm. Another great resource is Stream Scene: Watersheds, Wildlife and People, which is published by the Oregon Department of Fish and Wildlife and is available as a PDF file at this website: http://www.fs.fed.us/outdoors/naturewatch/implementation/Curricula/Stream-Scene.pdf

Background for the student:
Students should have background knowledge about pH (specifically the scale and what the numbers mean generally) before going out to collect stream data.

It would be helpful, but not necessary, for students to understand that aquatic insects go through life stages (egg/larva/pupa/adult) and can look very different in the larval stage versus the adult stage.
Vocabulary for students:
- macroinvertebrates
- aquatic
- riparian
- organisms
- erosion
- sediments
- organic matter (detritus)
- microorganisms
- migration
- biodiversity
- pH
- dissolved oxygen (BOD = biological oxygen demand)

Procedures:
1. Select a nearby stream to conduct the sampling which is accessible for the group size and abilities. Be sensitive to the impact your students will have on the stream. Discuss safety with students and show them how to use the sampling equipment ethically and safely. (Adult supervision for each of the tests is recommended.)
2. Start by observing the water, looking for organisms that might be on the surface or in the depth. Using the sampling equipment, have the students collect as many different forms of animal life as possible. Ask them to look under rocks, in the riffles as well as in the pools. Place the organism caught in one of the trays for observation after mentally noting the location where it was found.
3. Have the students identify and sketch each different species of animal collected. (Assign each student or student pair one animal to sketch and identify). They should do this on worksheet #1 (found at the end of this lesson).
4. Ask them to count the total number of their species collected by the entire group and record that on worksheet #1 as well. Then, ask them to figure out how many different species the group collected and record that on the worksheet. Carefully return all of the organisms to the stream, in the same location that they were found (as close as possible).
5. Assign each group of students a test to complete – dissolved oxygen, pH, nitrates, temperature. Have one person be the “Project Manager” and each sampling group should report their findings to that person who will record on worksheet #2 (found at the end of this lesson).
6. Gather the group together and discuss their findings. Help the students understand that the values for pH, water temperature, dissolved oxygen and nitrates affect the diversity of life forms found in aquatic environments. Ranges that support aquatic life can be found in the Aquatic Project Wild (or Project Wet) Education Activity Guide in the activity titled “Water Canaries”. (Workshops for teachers are offered at http://projectwild.org/)
7. Together as a class, determine how healthy this stream is. Discussion questions could include:
**pH:** What organisms have a limited pH range? What do you think would happen if the pH of this stream increased? What might cause this to happen?

**Temperature:** What organisms do well in really cold water? Did we find any of these in this stream? What might cause the water to become warmer? Is it the same temperature all year?

**Dissolved Oxygen:** Why do organisms need oxygen? Is it possible to have too much oxygen?

**Biodiversity:** Are there many different types of organisms, or mostly all of the same species?

**Other:** What other factors might affects these organisms? (run-off, erosion, flooding, pollution, etc.)

8. In teams of 2 – 3, students will brainstorm the impacts that a proposed development would have on the water quality. Hand each group a role sheet (*found at the end of this lesson*) and have them discuss how the water quality would change if this development occurred upstream of this spot. Give them ten or fifteen minutes to work before passing out the “hints” sheet to each group.

9. Students groups present their ideas to the whole class. (This can be done back in the classroom).

**Assessment:**
Students will be able to list things that humans do that decrease water quality in streams as well as explain how these actions affect the organisms that live in the ecosystem. Assessment and scoring rubric can be found at the end of this lesson.

**Extensions:**
1. Have students read the essay “Putting the Dead Trees Back Where They Belong” in the Level 6 Forest Essays booklet available from Oregon Forest Resource Institute ([http://oregonforests.org](http://oregonforests.org)). A digital copy of this essay can be found at [http://learnforests.org/sites/default/files/OFRI_essaybooklet_gr6_WEB.pdf](http://learnforests.org/sites/default/files/OFRI_essaybooklet_gr6_WEB.pdf)

2. Have students work on a stream restoration project with a local conservation group.

3. Have students map the habitat of the stream from the perspective of one of the animal’s that they captured. What are the important parts of its habitats and where are they located?

4. Students could research “extremophile” which are organisms that live in extreme environments (like fish that live in highly acidic or alkaline water) and answer questions such as: If the stream environment changed, would other organism move in? Is this a bad thing? Why or why not?
Sources:


Worksheet #1: Macroinvertebrate Identification

Group Members:________________________________________________________

Use the key to identify your organism:

Where in the stream was this organism found?

Sketch your organism here:

How many total of these organisms were caught by the entire class? __________

How many different species of organism were caught by the entire group? __________
Worksheet #2

Water Quality Data for _________________________________________
(stream name and/or sampling location)

<table>
<thead>
<tr>
<th>Test Conducted</th>
<th>Sample #1</th>
<th>Sample #2</th>
</tr>
</thead>
<tbody>
<tr>
<td>Water Temperature</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Air Temperature</td>
<td></td>
<td></td>
</tr>
<tr>
<td>pH</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Dissolved O₂</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Nitrates</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
**Role Card #1: Hydroelectric Company**

You are an hydroelectric company that wants to build a dam at a site upstream of this spot. You’ll need to complete an environmental impact statement before you build your dam. Work together with your group to brainstorm what this statement might say.

What are some reasons people build dams?

What impacts do you think your activities will have on the water quality of the stream? List as many as you can.

Which of these impacts will make the stream healthier? Put a smiley face by each of these.

Which of these impacts will negatively affect the health of the stream? Circle each of these.

What do you think could be done to minimize the negative impacts?
Role Card #2: Lumber Company

You are a lumber company that wants to log trees at a site upstream of this spot. You’ll need to complete an environmental impact statement before you cut down any trees. Work together with your group to brainstorm what this statement might say.

What are some reasons people cut down trees?

What impacts do you think your activities will have on the water quality of the stream? List as many as you can.

Which of these impacts will make the stream healthier? Put a smiley face by each of these.

Which of these impacts will negatively affect the health of the stream? Circle each of these.

What do you think could be done to minimize the negative impacts?
Role Card #3: Cattle Rancher

You are a cattle rancher that wants to let your cattle graze at a site upstream of this spot. You’ll need to complete an environmental impact statement before you are allowed to have cows range on the land. Work together with your group to brainstorm what this statement might say. What are some reasons people raise cattle?

What impacts do you think your activities will have on the water quality of the stream? List as many as you can.

Which of these impacts will make the stream healthier? Put a smiley face by each of these.

Which of these impacts will negatively affect the health of the stream? Circle each of these.

What do you think could be done to minimize the negative impacts?
Role Card #4: City Planner

You are a city planner that wants to build a wastewater treatment plant at a site upstream of this spot. You’ll need to complete an environmental impact statement before you build your plant. Work together with your group to brainstorm what this statement might say.

What are some reasons cities need wastewater treatment plants?

What impacts do you think your activities will have on the water quality of the stream? List as many as you can.

Which of these impacts will make the stream healthier? Put a smiley face by each of these.

Which of these impacts will negatively affect the health of the stream? Circle each of these.

What do you think could be done to minimize the negative impacts?
Role Card #5: Recreation Enthusiast

You are a recreation enthusiast that wants to build a campground at a site upstream of this spot. You’ll need to complete an environmental impact statement before you build your campground. Work together with your group to brainstorm what this statement might say.

What are some reasons people build campgrounds?

What impacts do you think your activities will have on the water quality of the stream? List as many as you can.

Which of these impacts will make the stream healthier? Put a smiley face by each of these.

Which of these impacts will negatively affect the health of the stream? Circle each of these.

What do you think could be done to minimize the negative impacts?
Role Card #6: Civil Engineer

You are a civil engineer that wants to build a bridge at a site upstream of this spot so that cars can cross the stream. You’ll need to complete an environmental impact statement before you build your bridge. Work together with your group to brainstorm what this statement might say.
What are some reasons people build bridges?

What impacts do you think your activities will have on the water quality of the stream? List as many as you can.

Which of these impacts will make the stream healthier? Put a smiley face by each of these.
Which of these impacts will negatively affect the health of the stream? Circle each of these.

What do you think could be done to minimize the negative impacts?
Hints! These activities might affect the streams by….

#1 Dams
Dams are important to control flooding, provide water for irrigation during dry seasons, and to produce electricity. However, they can also interrupt the natural cycles of the river, which might change the riparian vegetation. Dams remove sediments (and therefore nutrients) from the river because they cause the water upstream to slow and drop their sediment loads. Dams can increase or decrease the temperature of the water, depending on whether the water is released from the top or the bottom of the dam. Warm water holds less dissolved oxygen and promotes bacteria growth. Dams block fish migration (although a fish ladder can be added to enable fish to still move upstream). When water is released in large amounts (to produce electricity or to prevent future flooding), there may be increased erosion of the riverbanks downstream. More erosion may mean that there are more sediments in the stream, which reduces light for the aquatic plants so that they produce less oxygen. In addition, filtering macro-invertebrates can be harmed by the increased amount of sediments.

#2 Logging
Wood and wood products are important because we use them for building our homes as well as making paper. Trees are considered a renewable resource, as they can be replanted and grown relatively quickly. Harvesting timber often requires building roads so that the lumber can be removed via logging trucks. In addition, the removal of trees can increase soil erosion as tree roots are important to keep soil in place. More erosion may mean that there are more sediments in the stream, which reduces light for the aquatic plants so that they produce less oxygen. In addition, filtering macroinvertebrates can be harmed by the increased amount of sediments. Because trees provide shade, the removal of trees might increase the temperature of the stream (especially in the summer). Warm water holds less dissolved oxygen and promotes bacteria growth. Logging removes organic matter (such as leaves, needles, branches), which are a food source for macro-invertebrates.
#3 Grazing
Cattle are important for food. Most people enjoy steaks and hamburgers – both of which come from cows. Feeding cows in a pasture can be expensive, so ranchers often get permission to let their cattle graze on federal lands. When cows graze on an open range, they need to drink water. Therefore, they may walk into a creek. Cows can cause the soil to become compacted, so that the riparian plants have a harder time growing and rainwater can run-off faster. This may cause erosion. More erosion may mean that there are more sediments in the stream, which reduces light for the aquatic plants so that they produce less oxygen. In addition, filtering macroinvertebrates are harmed by an increased amount of sediments. Cows can cause destruction of riparian vegetation. Their wastes might increase the amount of nitrogen in the streams, which could initially cause an increase in algae, but eventually the algae dies, settles, and uses up dissolved oxygen.

#4 Wastewater Treatment Plants
It is important that people have wastewater treatment plants to clean the sewage and remove the wastes from where they live. However, treatment plants often release warm water back into the stream, thus changing the temperature. Warm water holds less dissolved oxygen and promotes bacteria growth. The large amounts of organic matter might mean there will be less dissolved oxygen for macroinvertebrates that live downstream. Treatment plants may increase the amount of nitrogen in the streams, which could initially cause an increase in algae, but eventually the algae dies, settles, and uses up dissolved oxygen. The treatment plants may change the pH of the stream, and some use chlorine to treat the water.
#5 Campgrounds
Campgrounds are important to get people out into nature and have fun with their friends and family. A campground built on the banks of a river or stream may cause the soil to become compacted when people access the stream for recreation activities, such as swimming or boating. If the soil becomes compacted, the riparian plants have a harder time growing and rainwater can run-off faster. Fewer streamside plants may increase the water temperature of the stream. Warm water holds less dissolved oxygen and promotes bacteria growth. Humans may cause pollution (from dishwashing, campfires or pet wastes) or drop litter, which could enter the stream and harm the aquatic organisms. There will most likely be an increase in fishing if a campground is built, so there will be a change in the fish population, which might affect the food chain. Increased noise from a campground could also impact the wildlife.

#6 Bridges
Bridges are important so that people can travel easily from one place to another. They increase the access for humans to use the river for recreation activities, such as boating, swimming and fishing. Construction of the bridge will increase the amount of erosion. More erosion may mean that there are more sediments in the stream, which reduces light for the aquatic plants so that they produce less oxygen. In addition, filtering macroinvertebrates are harmed by the increased amount of sediments. Once the bridge is built, it may block the nutrients that are coming from upstream or stop migration of organisms upstream, especially if it is routed through a culvert. In addition, human activities may cause the soil to become compacted. If the soil becomes compacted, the riparian plants have a harder time growing and rainwater can run-off faster. The cars that cross the bridge may cause pollution from their exhaust or leaking oil.
Assessment: Water Quality and Human Activities

What are some human activities that could negatively affect the water quality of a stream? Complete the chart below with as many examples as you can.

<table>
<thead>
<tr>
<th>Human Activity that Decreases Water Quality</th>
<th>What is the negative effect of this activity? (Identify at least two for each activity).</th>
<th>How does this affect the organisms that live in the stream?</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td></td>
<td></td>
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<tr>
<td>2.</td>
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<tr>
<td>3.</td>
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<tr>
<td>4.</td>
<td></td>
<td></td>
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<tr>
<td>5.</td>
<td></td>
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</tr>
</tbody>
</table>

**Bonus:** Explain ways that humans can *improve* the water quality of a stream.
## Scoring Rubric for Water Quality and Human Activities

<table>
<thead>
<tr>
<th></th>
<th>Mastery</th>
<th>Proficient</th>
<th>Not Yet Proficient</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>List Human Activities</strong></td>
<td>Student is able to list 3 or more human activities that could decrease the water quality of a stream.</td>
<td>Student is able to list 2 human activities that could decrease the water quality of a stream.</td>
<td>Student is not able to list at least 2 human activities that could decrease the water quality of a stream.</td>
</tr>
<tr>
<td><strong>Identify Negative Impact</strong></td>
<td>Student is able to identify at least two negative effects for each activity listed. <strong>AND</strong> Student is able to explain why the effect negatively impacts the organism.</td>
<td>Student is able to identify at least two negative impacts for each activity listed.</td>
<td>Student is not able to identify at least two negative impacts for each activity listed.</td>
</tr>
</tbody>
</table>
What Is an Ecoregion?

Overview: Using provided resources, students will create a map of their state’s ecoregions to deepen their understanding of the state’s natural resources and how humans use them. Students will then head outdoors and make observations of the plants, animals, physical features and climate to help them determine the ecoregion, and how humans utilize the natural resources of the place.

National Geography Standards:
- Standard 8: Identify and describe the characteristics of ecosystems (ecoregions)
- Standard 15: How physical systems affect human systems: The physical environment provides opportunities for and imposes constraints on human activities

Oregon Geography Content Standards:
- 2.10: Locate and identify local physical features on maps
- 3.12: Identify and analyze Oregon’s natural resources and describe how people in Oregon and other parts of the world use them

Oregon Science Content Standard:
- 2-LS4-1—Make observations of plants and animals to compare the diversity of life in different habitats.

Connections to Common Core:
- Writing: Research to Build and Present Knowledge: CCSS.ELA-LITERACY.W.2.7: Participate in shared research and writing projects

Objectives:
In completing this activity, students will be able to map the ecoregions of their state, and identify 3 common plants, animals, and physical features of each ecoregion, and how humans use the resources of the different ecoregions. They will be able to use this map to determine which ecoregion they are in by making observations of the plants, animals, and physical features around them, at school or outdoor school.

Grade Levels: 2-3 (can be adapted for any grade level)
Time: Three 60-minute sessions
Materials for classwork (Day 1 and 2):

- Large blank state map with ecoregions outlined for class display. [http://conservationdistrict.org/wp-content/uploads/Ecoregions-AITC.jpg](http://conservationdistrict.org/wp-content/uploads/Ecoregions-AITC.jpg) (Use poster maker to enlarge, or use projector to outline on butcher paper 5’ x 3’)
- Student Atlas of Oregon, pages 29, 30
- Picture Vocabulary Cards (attached)
- Student Sheets for each ecoregion (attached)
- Glue sticks, scissors, writing utensil for each student

Materials for field work (Day 3):

- Completed state ecoregions map (laminated)
- Blank paper or journal
- Pencils and erasers
- Clipboards

Teacher Background: Understanding of ecoregions and natural resources of state.

Student Background: Background knowledge of mapping skills--locations of continents, countries, states on a map. Knowledge of world biomes (rainforest, desert, tundra, taiga, grassland, deciduous forest, coniferous forest) and physical features (mountain, valley, gorge, basin, plateau, plain, temperate, marine, alpine). Review these definitions with picture vocabulary cards.

Procedures:

**DAY 1**

1. Gather students together around the large blank ecoregions map. Explain that today students are going to be studying the ecology of the state.
   b. What is an ecologist? **Ecologist definition**: An ecologist is a scientist who is concerned with the relation of living organisms (plants, animals, humans) to one another and to their physical surroundings.
   c. Display Ecology and Ecologist picture vocabulary cards, and discuss why these are important.
2. Ask students to think of different places in the state that they have been to. Ask for volunteer to describe the plants, animals, climate, and physical features of the place that they remember. Can they identify where the place is on the large map of state?
3. Explain that in each state there are areas where different plants and animals live, depending on the climate and physical features of the area. These different areas are called ecoregions.
   a. Discussion questions: What do you think an ecoregion is? Display Ecoregion picture vocabulary card. **Ecoregion definition:** an abbreviated form of "ecological region", an area of land with similar climate, vegetation, geology, geomorphology, soils, and ecosystem processes.
   b. If you have studied world biomes, explain how ecoregions and biomes differ. Display Biome picture vocabulary card, and remind students of the biome of the state. If you have not studied biomes, skip to 4.
      i. **Biome definition:** a large community of plants and animals that occupies a distinct region. Both biome and ecoregion are ecological terms, but an ecoregion is smaller than a biome. Each biome consists of several ecoregions.
4. Ask students if they know what a natural resource is. Define and give examples.
   a. **Natural resources** are minerals, forests, water, and fertile land that occur in nature and can be used for economic gain. Examples include timber, agriculture, livestock, medicine, iron, oil, natural gas.
   b. Display Natural Resources vocabulary picture card. Explain that there are many ways that people use different resources across the state too. Ask students to give examples of how people use the state’s natural resources.
5. Explain that today, as ecologists, we are going to discover the different plants, animals, physical features and climates of the ecoregions of our state, and how people use these for different reasons.
6. Have students go to their seats and take out a pencil and glue stick. Pass out blank student ecoregion map and Ecoregion Student Sheet #1 to each student.
7. Demonstrate on the large class map how to use the Student Sheet to complete their map.
   a. Match the name of the ecoregion station to the ecoregion on the map, and label the ecoregion.
   b. Read the description of the physical features and look at the pictures of landforms of the ecoregion. Cut these out and paste into the correct ecoregion, and label.
   c. Read description of the common plants and animals of the ecoregions, look at the pictures. Cut these out, paste onto map, and label.
   d. Discussion Questions: How might people used these natural resources?
8. Check for understanding. Repeat process with next 3-4 ecoregions.
DAY 2
1. Review the procedures from Day 1. Complete ecoregion map.
2. After all students have completed their maps, gather at large class map again. Students need to bring their map, a pencil and a clipboard. Explain that we are going to play a game to learn more about how humans use resources in each ecoregion.
3. Game for revealing the resources used:
   a. Divide class into 9 groups, give each group a different ODF Ecoregion flyer. [http://www.dfw.state.or.us/conservationstrategy/ecoregion_flyers.asp](http://www.dfw.state.or.us/conservationstrategy/ecoregion_flyers.asp)
   b. Have groups take 10 minutes to read the flyer and highlight the main use of natural resources in the ecoregion. Help groups with reading as needed.
   c. Have groups present their findings to the class without naming the ecoregion, and have class guess which ecoregion. Write results on class map and student maps.

DAY 3
1. Explain to students that today they will be doing a Still Hunting Observation Activity, where they will go outside and find a spot to sit quietly and make observations about the area around them. They will have a piece of paper and draw what plants and animals they see, paying attention to what they hear, smell and feel.
2. Go out to a predetermined outdoor area (near school, field study site, or at outdoor school), and use Still Hunting technique to make observations of the plants, animals, physical features of the area.
3. Classroom discussion following still hunting activity--discuss plants, animals, physical features observed. Identify the ecoregion they live in and how humans use the resources here.
4. Repeat Still Hunting activity with ecoregions map at outdoor school and on field studies.

Assessment:
- State Ecoregions Map: Completed maps will be assessed using the rubric attached to assess their understanding of the names of the plants, animals, physical landforms, and climates of the state’s ecoregions.
- Still Hunting observation activity: Classroom discussion following still hunting activity--discuss plants, animals, physical features observed. Identify the ecoregion they live in and how humans use the resources here.
Extensions and/or Adaptations:

- Create small groups and have students complete map by rotating through stations.
- Have students work in small groups (of 2-4) to complete one map instead of individual maps.
- Study and map different Native American tribes, and research how they used resources and compare to how the resources have changed and are used today.
- Use ecoregion map to figure out ecoregions of different field trips and discuss how humans use the resources of the region pre- or post-field trip.

Sources:

- Oregon Department of Fish and Wildlife Ecoregional Conservation strategy http://www.dfw.state.or.us/conservationstrategy/docs/document_pdf/A_5.pdf

ECOREGIONS RUBRIC (2nd-3rd Grade)

<table>
<thead>
<tr>
<th>Category</th>
<th>2</th>
<th>1</th>
<th>0</th>
</tr>
</thead>
<tbody>
<tr>
<td>Map Heading</td>
<td>Map has the correct heading</td>
<td>Map has a heading that is incorrect</td>
<td>Map does not have a heading</td>
</tr>
<tr>
<td>Ecoregions Labels</td>
<td>All ecoregions are correctly labeled</td>
<td>Some ecoregions are correctly labeled</td>
<td>No ecoregions are labeled</td>
</tr>
<tr>
<td>Ecoregion Information Accuracy</td>
<td>All information is complete and accurate for each ecoregion</td>
<td>Most information is complete for each ecoregion</td>
<td>Information is incomplete or inaccurate for each ecoregion</td>
</tr>
<tr>
<td>Neatness</td>
<td>Map is neat</td>
<td>Map is mostly neat</td>
<td>Map is sloppy</td>
</tr>
</tbody>
</table>
Ecology: the study of living things, their environment, and the relation between them. (noun)

Ecologist: an ecologist is a scientist who is concerned with the relationship of living organisms to one another and to their physical surroundings. (noun)

Ecoregion: an ecoregion is an area of land with similar climate, plants and animals that interact to create an environment distinct from other areas. (noun)
**Biome:**
A biome is a large community of plants and animals that occupies a distinct region. (noun)

**Natural Resources:**
Materials or substances such as minerals, forests, water, and fertile land that occur in nature and can be used for economic gain. (noun)
COAST RANGE ECOREGION STUDENT SHEET #1

**Climate:** Mild and moist, cool dry summers, mild wet winters

**Physical Features:** Ocean, Volcanic Mountains, Temperate Rainforest, Sand dunes, rivers, streams

<table>
<thead>
<tr>
<th>Ecola Beach</th>
<th>Nestucca River</th>
<th>Oregon Dunes</th>
</tr>
</thead>
<tbody>
<tr>
<td><img src="image1.jpg" alt="Ecola Beach" /></td>
<td><img src="image2.jpg" alt="Nestucca River" /></td>
<td><img src="image3.jpg" alt="Oregon Dunes" /></td>
</tr>
</tbody>
</table>

**Plants**

<table>
<thead>
<tr>
<th>Western Redcedar</th>
<th>Sitka Spruce</th>
<th>Douglas Fir</th>
</tr>
</thead>
<tbody>
<tr>
<td><img src="image4.jpg" alt="Western Redcedar" /></td>
<td><img src="image5.jpg" alt="Sitka Spruce" /></td>
<td><img src="image6.jpg" alt="Douglas Fir" /></td>
</tr>
</tbody>
</table>

**Animals**

<table>
<thead>
<tr>
<th>Black Tail Deer</th>
<th>Douglas Squirrel</th>
<th>Black Bear</th>
</tr>
</thead>
<tbody>
<tr>
<td><img src="image7.jpg" alt="Black Tail Deer" /></td>
<td><img src="image8.jpg" alt="Douglas Squirrel" /></td>
<td><img src="image9.jpg" alt="Black Bear" /></td>
</tr>
</tbody>
</table>
**WILLAMETTE VALLEY ECOREGION STUDENT SHEET #2**

**Climate:** Warm-hot dry summers, cool wet winters, 37-60 inches of rain per year, long growing season

**Physical Features:** Oak savannahs, Douglas Fir groves, grassland prairies, wetlands along the river floodplains, rivers, streams, rolling foothills and low mountains, urban areas

<table>
<thead>
<tr>
<th>Wetlands</th>
<th>Willamette Valley Farmland</th>
<th>Willamette River</th>
</tr>
</thead>
<tbody>
<tr>
<td><img src="image1" alt="Wetlands Image" /></td>
<td><img src="image2" alt="Farmland Image" /></td>
<td><img src="image3" alt="River Image" /></td>
</tr>
</tbody>
</table>

**Common Plants**

<table>
<thead>
<tr>
<th>Camas</th>
<th>Garry Oak</th>
<th>Christmas Tree Farms</th>
</tr>
</thead>
<tbody>
<tr>
<td><img src="image4" alt="Camas Image" /></td>
<td><img src="image5" alt="Garry Oak Image" /></td>
<td><img src="image6" alt="Christmas Trees Image" /></td>
</tr>
</tbody>
</table>

**Common Animals**

<table>
<thead>
<tr>
<th>Pacific Salamander</th>
<th>Beaver</th>
<th>Osprey</th>
</tr>
</thead>
<tbody>
<tr>
<td><img src="image7" alt="Salamander Image" /></td>
<td><img src="image8" alt="Beaver Image" /></td>
<td><img src="image9" alt="Osprey Image" /></td>
</tr>
</tbody>
</table>
KLAMATH MOUNTAINS ECOREGION STUDENT SHEET #3

**Climate:**  Drier than Coast Range, moist temperate rainforests, long summer drought

**Physical Features:**  High elevation forests, alpine grasslands, river, mountains

<table>
<thead>
<tr>
<th>Klamath Mountains</th>
<th>Crater Lake</th>
<th>Rogue River</th>
</tr>
</thead>
<tbody>
<tr>
<td><img src="image1.png" alt="Klamath Mountains" /></td>
<td><img src="image2.png" alt="Crater Lake" /></td>
<td><img src="image3.png" alt="Rogue River" /></td>
</tr>
</tbody>
</table>

**Plants**

<table>
<thead>
<tr>
<th>Mountain Hemlock</th>
<th>Pacific Yew</th>
<th>Douglas Fir</th>
</tr>
</thead>
<tbody>
<tr>
<td><img src="image4.png" alt="Mountain Hemlock" /></td>
<td><img src="image5.png" alt="Pacific Yew" /></td>
<td><img src="image6.png" alt="Douglas Fir" /></td>
</tr>
</tbody>
</table>

**Animals**

<table>
<thead>
<tr>
<th>Elk</th>
<th>Spotted Owl</th>
<th>Bald Eagle</th>
</tr>
</thead>
<tbody>
<tr>
<td><img src="image7.png" alt="Elk" /></td>
<td><img src="image8.png" alt="Spotted Owl" /></td>
<td><img src="image9.png" alt="Bald Eagle" /></td>
</tr>
</tbody>
</table>
CASCADES ECOREGION STUDENT SHEET #4

**Climate:** Moist, temperate cool dry summers, mild wet winters

**Physical Features:** Mountainous, Cascades Volcanic Arc (Mt Hood, Mt Jefferson, Mt Washington, Mt Bachelor), Temperate Rainforest, Subalpine at higher elevations, steep valleys, rivers and streams

<table>
<thead>
<tr>
<th>Temperate Rainforest</th>
<th>Forest and Volcanic Mnt</th>
<th>Subalpine Meadow</th>
</tr>
</thead>
<tbody>
<tr>
<td><img src="image1" alt="Temperate Rainforest" /></td>
<td><img src="image2" alt="Forest and Volcanic Mnt" /></td>
<td><img src="image3" alt="Subalpine Meadow" /></td>
</tr>
</tbody>
</table>

**Plants**

<table>
<thead>
<tr>
<th>Moss</th>
<th>Western Hemlock</th>
<th>Douglas Fir</th>
</tr>
</thead>
<tbody>
<tr>
<td><img src="image4" alt="Moss" /></td>
<td><img src="image5" alt="Western Hemlock" /></td>
<td><img src="image6" alt="Douglas Fir" /></td>
</tr>
</tbody>
</table>

**Animals**

<table>
<thead>
<tr>
<th>Chinook Salmon</th>
<th>Skunk</th>
<th>Coyote</th>
</tr>
</thead>
<tbody>
<tr>
<td><img src="image7" alt="Chinook Salmon" /></td>
<td><img src="image8" alt="Skunk" /></td>
<td><img src="image9" alt="Coyote" /></td>
</tr>
</tbody>
</table>
EASTERN CASCADES ECOREGION STUDENT SHEET #5

Climate:  Dry summers, frequent wildfires, cold winters, in the rainshadow of the Cascades

Physical Features:  Eastern slopes of Cascades Volcanic Arc (Mt Hood, Mt Jefferson, Mt Washington, Mt Bachelor), volcanic cones, rivers and lakes

<table>
<thead>
<tr>
<th>Eastern Slopes of Cascades</th>
<th>Deschutes Forest Fire</th>
<th>Klamath Wildlife Refuge</th>
</tr>
</thead>
<tbody>
<tr>
<td><img src="image1" alt="Eastern Slopes of Cascades" /></td>
<td><img src="image2" alt="Deschutes Forest Fire" /></td>
<td><img src="image3" alt="Klamath Wildlife Refuge" /></td>
</tr>
</tbody>
</table>

Plants

<table>
<thead>
<tr>
<th>Ponderosa Pine</th>
<th>Lodgepole Pine</th>
<th>Giant Sagebrush</th>
</tr>
</thead>
<tbody>
<tr>
<td><img src="image4" alt="Ponderosa Pine" /></td>
<td><img src="image5" alt="Lodgepole Pine" /></td>
<td><img src="image6" alt="Giant Sagebrush" /></td>
</tr>
</tbody>
</table>

Animals

<table>
<thead>
<tr>
<th>Bighorn Sheep</th>
<th>Longbilled Dowitcher</th>
<th>Red Crossbills</th>
</tr>
</thead>
<tbody>
<tr>
<td><img src="image7" alt="Bighorn Sheep" /></td>
<td><img src="image8" alt="Longbilled Dowitcher" /></td>
<td><img src="image9" alt="Red Crossbills" /></td>
</tr>
</tbody>
</table>
**BASIN AND RANGE ECOREGION STUDENT SHEET #6**

**Climate:** Arid, little water, cool

**Physical Features:** Rolling hills, lava plains, valleys, scattered mountain ranges, arid playas, wetlands

<table>
<thead>
<tr>
<th>Summer Lake</th>
<th>Hart Mountain</th>
</tr>
</thead>
<tbody>
<tr>
<td><img src="image1" alt="Summer Lake" /></td>
<td><img src="image2" alt="Hart Mountain" /></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Plants</th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Giant Sagebrush</td>
<td>Needle and Thread Grasses</td>
<td>Black Greasewood</td>
</tr>
<tr>
<td><img src="image3" alt="Giant Sagebrush" /></td>
<td><img src="image4" alt="Needle and Thread Grasses" /></td>
<td><img src="image5" alt="Black Greasewood" /></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Animals</th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>American Avocet</td>
<td>Western Rattlesnake</td>
<td>Sage Grouse</td>
</tr>
<tr>
<td><img src="image6" alt="American Avocet" /></td>
<td><img src="image7" alt="Western Rattlesnake" /></td>
<td><img src="image8" alt="Sage Grouse" /></td>
</tr>
</tbody>
</table>
**BLUE MOUNTAIN ECOREGION STUDENT SHEET #8**

**Climate:** Desert like and dry near John Day Fossil Beds, subalpine, riverbanks and wetland, wide temperature ranges (hot and cold).

**Physical Features:** Mountain ranges, rivers, deepest gorge in US (Hells Canyon)

<table>
<thead>
<tr>
<th>John Day Fossil Beds</th>
<th>Lakes and Meadows</th>
<th>Wallowa Mountains</th>
</tr>
</thead>
<tbody>
<tr>
<td><img src="john_day_fossil_beds.jpg" alt="Image" /></td>
<td><img src="lakes_and_meadows.jpg" alt="Image" /></td>
<td><img src="wallowa_mountains.jpg" alt="Image" /></td>
</tr>
</tbody>
</table>

**Plants**

<table>
<thead>
<tr>
<th>Bluebunch Grasses</th>
<th>Juniper</th>
<th>Western Larch</th>
</tr>
</thead>
<tbody>
<tr>
<td><img src="bluebunch_grasses.jpg" alt="Image" /></td>
<td><img src="juniper.jpg" alt="Image" /></td>
<td><img src="western_larch.jpg" alt="Image" /></td>
</tr>
</tbody>
</table>

**Animals**

<table>
<thead>
<tr>
<th>Williamson’s Sapsucker</th>
<th>Pronghorn</th>
<th>Mule Deer</th>
</tr>
</thead>
<tbody>
<tr>
<td><img src="williamson_sapsucker.jpg" alt="Image" /></td>
<td><img src="pronghorn.jpg" alt="Image" /></td>
<td><img src="mule_deer.jpg" alt="Image" /></td>
</tr>
</tbody>
</table>
**COLUMBIA PLATEAU ECOREGION STUDENT SHEET #9**

**Climate:** Dry, little rain, cold winters, hot summers

**Physical Features:** Lowlands, grasslands, sagebrush steppe, wetlands, riparian and wetland aquatic, rivers

<table>
<thead>
<tr>
<th>Columbia River Plateau</th>
<th>John Day River</th>
<th>Wheat field</th>
</tr>
</thead>
<tbody>
<tr>
<td><img src="image1" alt="Columbia River Plateau" /></td>
<td><img src="image2" alt="John Day River" /></td>
<td><img src="image3" alt="Wheat field" /></td>
</tr>
</tbody>
</table>

**Common Plants**

<table>
<thead>
<tr>
<th>Chokecherry</th>
<th>Teasel</th>
<th>Fescue (grasses)</th>
</tr>
</thead>
<tbody>
<tr>
<td><img src="image4" alt="Chokecherry" /></td>
<td><img src="image5" alt="Teasel" /></td>
<td><img src="image6" alt="Fescue (grasses)" /></td>
</tr>
</tbody>
</table>

**Common Animals**

<table>
<thead>
<tr>
<th>Western Rattlesnake</th>
<th>Bighorn Sheep</th>
<th>Steelhead</th>
</tr>
</thead>
<tbody>
<tr>
<td><img src="image7" alt="Western Rattlesnake" /></td>
<td><img src="image8" alt="Bighorn Sheep" /></td>
<td><img src="image9" alt="Steelhead" /></td>
</tr>
</tbody>
</table>