Metro Greenspaces Grant ***PROGRAMMATIC FINAL REPORT***	
Project Title: Student and Community Habitat Enhancement Service Learning Project	
Awardee: Lower Columbia River Estuary Partnership 811 SW Naito Parkway, Suite 120 Portland OR 97204	***Grant #:*** 926189

Start Date: December 1, 2004 **End Date:** June 1, 2006

Reporting Period: December 1, 2004 – June 1, 2006

Project Purpose:
To involve students in an inquiry based project involving classroom lessons and field trips to the Water Resources Education Center Wetland in Vancouver, Washington to restore three acres of critical habitat.

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1. WRITTEN SUMMARY OF GRANT ACTIVITY

Project Overview

The goal of this project was to bring 10 classes of 4th and 5th grade students, 300 students total, into an urban Columbia River wetland in order to: increase student understanding of the importance of riparian wetlands, to enhance an important urban habitat, to communicate student understanding and accomplishments to the community, and to compare research questions generated from students guided in inquiry learning to a control group. Through this project, we involved 13 classes of 5th and 6th grade students, 711 students, teachers, and volunteers total. Students received five classroom lessons and two field trips to the Water Resources Education Center wetland where they worked to remove 9.5 truck loads of invasive plants and plant over 900 natives.

Progressive Project Steps

The first step involved recruiting teachers to participate in the project and working with them to develop classroom programs and educational elements of the field trips. Two teachers were recruited to involve their classes in the project during 2004-2005. Both classes received at least two class visits and at least one field trip to the Water Resources Education Center. In spring 2005, ten additional teachers, were recruited to participate in the project during the 2005-2006 school year. One of the two teachers that participated during 2004-2005 also sighed up to participate in 2005-2006 making a total of eleven classes. These eleven teachers would be involved in a more extensive inquiry based project in 2005-2006. Teachers meetings were held in spring 2005 in preparation for the next school year and the project was discussed, including the development of a classroom and field schedule, and the discussion of classroom concepts and

goals, so that classroom and field programs could address these goals. The table below shows the schools, teachers, and number of students involved in this project.

2004-2005	Teachers	Number of Students
York Elementary	Charolette Akin	25
Eisenhower Elementary	Mary Jane Campbell	25
2005-2006	**Teachers**	**Number of Students**
York Elementary	Charolette Akin, Mark O'Connor, Todd Graves	75
Fisher's Landing Elementary	Donna Hansen, Jessica Iverson, Doug Firestone, Patrick Dowell	100
Captain Strong Elementary	Chad Harvison, Sherri Wilson, Lorena Herron	90
Discovery Middle School	Adam Joy	25
Total		**340**

During the summer and fall of 2005 work on classroom and field lessons took place. As these lessons were finalized, a second meeting with teachers took place to discuss the lessons and make any adjustments needed. Estuary Partnership staff worked with the Water Resources Education Center to determine work to be completed at the project site during each field trip, including invasive removal and the planting of natives. Classroom lessons commenced in the winter of 2006, and field trips began in late January of 2006. Students were visited four times in the classroom prior to their first field trip, generally, once a week, but in one instance, daily over the course of the week. A copy of the outlines for classroom lessons can be found in Appendix A. Following the fourth classroom visit, students took their first field trip to Water Resources Education Center. During the first field trip, students participated in two stations. The first station involved removing Himalayan Blackberries. The second station consisted of taking plant and soil data for an upland area and a wetland area so that students could have a sense of what plants were found in each area, and what the soil conditions were. A copy of the data sheets used for the first field trip can be found in Appendix B.

Following this first field trip, Estuary Partnership staff met the students again in the classroom for their fifth and final class lesson. This last class visit was spent developing inquiry questions and plans to implement an experiment. A copy of the worksheets for this last class visit are included in classroom lesson outlines in Appendix A.

Students then participated in a second field trip to the Water Resources Education Center. During this second field trip, students again participated in two stations. The first was a service learning project, which generally involved planting native plants. During the second station, students collected data to answer their inquiry question.

Students participating in this project were invited to participate in the Watershed Congress and Sturgeon Festival to present information about their project to the community. In spring 2005, students from York Elementary presented their project at the Watershed Congress and gave a

tour of their project site at the Sturgeon Festival. In spring 2006, students from York Elementary again presented their project at the Watershed Congress and students from Fisher's Landing Elementary gave an informational tour of the project site to their parents during a parent's night held at the Water Resources Center.

Final Budget

Category	Final Greenspaces Grant Expenses	Final In-Kind Matching Contributions	Final Project Budget
Personnel	$0.00	$16,547.02	$16,547.02
Materials and Supplies	$7,651.98	$4,570.00	$12,221.98
Other	$2,348.02	$2,481.96	$4,829.98
	$10,000.00	$23,598.98	$33,598.98

Total Volunteer Hours, Number of Participants and List of Partners

This project involved local students, teachers, parent volunteers, and partners. During 2004-2005, two classes participated and during 2005-2006 11 classes participated, for a total of 13 classes.

The table below shows the projects partners, the number of participants from each partner that assisted with this project, as well as the number of hours contributed. Other partners not listed in the table included the I Have a Dream Foundation who assisted with some of the restoration work at the site, the Clark County Conservation District and the CASEE Center who supplied the project with natives that were planted at the project site.

Project Partners	Number of Participants	Hours Donated
Water Resources Education Center, City of Vancouver	1	239
Georgia Pacific Corporation	1	49
Discovery Middle School, Vancouver School District	34	60
Eisenhower Elementary, Vancouver School District	27	27
Captain Strong Elementary, Battle Ground School District	118	211
Fisher's Landing Elementary, Evergreen School District	124	222
York Elementary, Evergreen School District	97	175
I Have a Dream Foundation	9	18
Total	**411**	**1,001**

2. WRITTEN EVALUATION

Initially, for the second year of the project, during the 2005-2006 school year, the Estuary Partnership intended to have one set of 4 classes that would be involved in a field based inquiry project, and a second group of 4 classes that would not receive the inquiry component. Changes were made to this initial plan for several reasons.

First, we had intended to look for increased comprehension through scores on the Washington Assessment of Student Learning (WASL). Schools recruited for the project had a vast array of WASL scores to begin with, as can be seen in the table below:

School	% Meeting Standard, 5th grade Science WASL
York Elementary School	18.6%
Fishers Landing Elementary	60.6%
Captain Strong Elementary	31.5%

Because science inquiry is one small component of the WASL, and achievement on the tests are due to a whole range of elements, the Estuary Partnership felt looking at overall WASL science scores would not adequately determine the impact of this particular project on the scores. Additionally, WASL scores are not available until approximately 6-8 months after taking them, which meant they would not be available for Metro reporting purposes.

Secondly, all teachers participating in this project wanted to be involved in the inquiry component. However, the degree to which teachers wished to be involved varied a great deal. For those teachers in the Evergreen School district, where an inquiry project is part of the exit requirements, teachers were interested in having students take an active role in developing and designing their inquiry projects. For these projects, teachers supported classroom instruction by the Estuary Partnership in developing the field based inquiry project. Four classes from Fisher's Landing and three classes from York Elementary utilized this model. Students were broken into groups and came up with questions in their groups. Questions that were used by students for the field based inquiry can be found in Appendix C.

This model was different for those teachers outside the Evergreen school district. This included three classes from Captain Strong in the Battle Ground School District and one class from Discover Middle School in the Vancouver School District. For these teachers, the field based inquiry project was one that was designed by Estuary Partnership staff and consisted of two questions: "Does Himalayan Blackberry prefer to grow in sun or shade?" and "Does Himalayan Blackberry prefer to grow in wet soil or dry soil?"

Following the second field trip, those students that participated in generating their own research question took the data back and interpreted it. In many cases, students made presentation boards and presentations about their research.

Student comprehension

The participating students were given an identical test before they began the project and after completing the project. Administering the test provided an impression of the student's knowledge of wetland characteristics, local flora and fauna, water quality, and basic ecological terms. The test consisted of 10 questions, multiple choice and True or False. A copy of the test is located in Appendix D.

The test consisted of a variety of questions in terms of the depth they covered: 1) comprehensive coverage in the classroom, on the field trips, and in their research projects. 2) Discussed only in the classroom or in the field. 3) Not discussed. The levels provided an in-depth look at the change in base knowledge, acquired knowledge, and mere chance of improved performance. It may be assumed that because some topics were never presented, the post scores remained relatively low.

The results of the pre and post tests suggest that the focus on native and invasive plants both in the classroom, through a focus on this for some students for their inquiry question, and student participation in service learning increased their knowledge.

A total of 249 Students took both the pre and post tests. Several additional students took only 1 test due to absences. These scores were not included. The average for the pretest was 49% and post score was 76%. This is an increase of 27%. Much more impressive is looking at the increase in individual questions. One class of 25 was selected for comprehensive comparison of student answers. The class fit into the overall average with a pre-score average of 52% and post score average of 78%; resulting in an increase of 26%.

Closer examination of certain questions suggests the students became more familiar with the concepts of native species, invasive species and restoration. These topics were covered in the classroom, on the field trips through service learning and educational activities, and were topics in the student's own research.

We selected questions 3, 4, and 6. See below:

3) What is a native plant?
   a. A plant that has thorns
   b. A plant that originated from the area where it now grows
   c. A plant that was brought by people to a new land
   d. A plant that has no natural predators

4) Which is an example of an invasive plant?
   a. Oregon Grape
   b. Himalayan Blackberry
   c. Salal
   d. Big Leaf Maple

6) Which is an activity that would help to restore a wetland?
   a. Remove invasive plants
   b. Let frogs go free in the wetland
   c. Drain the water
   d. Remove native plants

The table below shows the pre and post test results for 25 students on these three questions:

	Question 3	Question 4	Question 6
Pretest Correct	13	8	14
Pre test percentage	52%	36%	56%
Post Test Correct	20	23	25
Post test Percentage	80%	92%	100%

As these sample results show, there was a great deal more comprehension on the post test for those questions that involved a hands on component for students. Comprehension dramatically increased on the question that all students participated in a hands-on component for.

Teacher Evaluations

Teachers participating in this project were given a project evaluation to complete. The evaluation included questions about the classroom lessons, field trip activities, follow-up activities, general project questions, as well as how prepared and organized the Estuary Partnership staff was for each project component. Teachers were asked to rank, using a 1-5 scale, each question based on whether they strongly disagreed (1), strongly agreed (5), or somewhere in between. Below is a table showing the results of four teacher evaluations, two from Fisher's Landing Elementary and two from York Elementary, both of which are in the Evergreen School District and used their participation in this project to meet their exit requirements. This shows the number of questions that each teacher ranked, using the designated ranking scale.

Ranking scale	1 (strongly disagree)	2	3	4	5 (strongly agree)
Fisher's Landing- Teacher 1	0	0	1	3	10
Fisher's Landing- Teacher 2	0	0	0	2	12
York Elementary- Teacher 1	0	0	1	0	13
York Elementary- Teacher 2	0	0	1	2	11

Based on the results of the teacher evaluations, participating teachers agreed strongly, in most instances, that the components of the project were successful and that the Estuary Partnership staff was well prepared and organized the project well. The teacher evaluation is found in Appendix E to view individual questions.

3. PHOTO DOCUMENTATION SHOWING THE ACTIVITIES/PROJECT

Photos of the project can be viewed in Appendix F.

4. MAINTENANCE ACTIVITIES

Since this project did include restoration activities we have developed a maintenance plan to ensure survival of the natives species that were planted at the Water Resources Center wetland. The maintenance plan outlines follow-up activities for the upcoming year including both maintenance and monitoring of the project site. The maintenance plan is located in Appendix G.

5. RESTORATION/ENHANCEMENT

The project included a large habitat restoration component. The project site is located at the Water Resources Education Center in Vancouver, WA and included a wetland/upland system of three acres in the only Columbia River wetlands along the urban stretch of river between the I-5 and I-205 bridges. These highly functioning wetlands, although invaded by invasive plant species like Himalayan Blackberry and English Ivy, still support over 100 species of wildlife including juvenile chum, Chinook and coho salmon and bald eagles. During this project, students, teachers, volunteers, and partners worked to remove invasive plants and to plant native plant species in this three acre area.

Work at the project site included mechanically removing Himalayan Blackberry, English Ivy, and yellow iris using loppers and shovels and the hauling off of plant debris. Once the area was cleared of invasive plants, the Estuary Partnership worked with staff from the Water Resources Education Center to flag the area with metal stake flags to designate where native species would be planted. Native plants were flagged with tape flagging and labeled with plant name. During their second field trip, students worked to plant natives in the designated area. Native species planted at the project site are listed in the table below.

Natives Planted at the Water Resources Center Wetland	# Planted
Bitter Cherry	50
Black Hawthorne	50
Douglas Spirea	70
Indian Plum	50
Nootka Rose	50
Oceanspray	50
Oregon Ash	50
Pacific Crabapple	50
Pacific Dogwood	70
Peafruit Rose	150
Red Alder	60
Red Elderberry	65
Salal	85
Short Oregon Grape	100
Tall Oregon Grape	75
Western Hemlock	30
Western Red Cedar	30
Willow	75
Total	**940**

Over 900 natives were planted and 9.5 truck loads of invasive plants were removed from the site in the 2005-2006 school year. During the spring of 2004-05, over 2 truck loads of invasive Himalayan blackberry was removed.

6. ACTUAL PRODUCTS

Through this project, the Estuary Partnership created Inquiry based curriculum which included five classroom lessons and curriculum for two field trips. The curriculum for the five classroom lessons is attached in Appendix A. Also attached is curriculum from field trip activities in Appendix B.

APPENDIX A

CLASSROOM LESSON OUTLINES

- **Inquiry Class #1 outline, curriculum, worksheets**
- **Inquiry Class # 2 outline, curriculum, worksheet, example of activity**
- **Inquiry Class #3 outline, curriculum, worksheet**
- **Inquiry Class #4 outline and curriculum for activity**
- **Inquiry Class #5 outline and designing inquiry experiment worksheet**

correct answers and cover environmental factors. Have students make observations about wetlands.

Activity 2: The Scientific Method:

a) Introduce the class to the scientific method. Show overhead of the steps.

b) Focus on observations. As a class, settle on a definition for the word. Make some general observations as examples and then ask for some help from the students.

c) Staff will run and experiment pointing out each step in the scientific method, "Will a sponge regulate moisture levels better (like a wetland) than a rock?"

> Experiment
> In one tub place the sponge, the rock in the other. Explain that the sponge will represent wetland soils and the rock represents a parking lot. "Rain" 1 cup of water using a watering can into each tub. This should represent winter rains. Measure the water level of each. Relate the lower level of water in the sponge tub to absorbing flood waters. Next drain the tubs so there is no water left, talk about how this could be summer weather. Next press on the sponge and on the rock. Measure the water levels again. Talk about how wetlands can help prevent drought.

d) Science Journal – Observations
Students will open their science journals to a blank page and title that page, "Observations". Students will record each step in the experiment and all of their observations. If the schools do not stress using a science journal we will provide a guided worksheet.

e) After the experiment. Have the students share their observations. Write observations down. Talk about how data varies, how people may have missed a step. Discuss importance of accurately recording EVERYTHING. Divide the observations into Qualitative and Quantitative. Discuss the differences.

Qualitative	Quantitative
Data is in the form of words, pictures, or objects.	Data is in the form of numbers and statistics.
Researcher is the data gathering instrument.	Researcher uses tools, such as questionnaires or equipment to collect numerical data.

f) Make a conclusion. What knowledge have we gained? Revisit the steps to the Scientific Method.

Inquiry Class #1 Outline
Wetlands & Observations

Time: 1 hour

Materials:
- Overhead images
  - Wetland habitats
  - Steps to the Scientific Method
  - Qualitative v. Quantitative
- Two plastic tubs to serve as wet lands
- Large Sponge
- Hard object to represent paving
- Watering can
- Small plastic ruler

Objectives:
- Students will be introduced to basic wetland habitat features
- Students will use Observation as the first step in the scientific method
- Students will develop their skills of observation through observing an experiment
- Students will understand the difference between Qualitative and Quantitative data

Vocabulary:
- Scientific Method
- Experiment
- Wetland
- Observation
- Conclusion
- Qualitative
- Hypothesis
- Knowledge
- Quantitative

Introduction:

a) Introduce the class to the Metro Green Spaces grant. Stress the idea that they are part of an experiment and explain the hypothesis of this experiment to them. Real scientists conduct experiments and make hypotheses all the time and now they will be learning how to go about doing the same thing. This may be helpful to refer to later on in other Inquiry Classes. Let them know that in addition to being part of an experiment, they will also be conducting their own experiments while on field trips to the Water Resources Center. Before they go to visit WRC, Estuary Partnership staff will be visiting their classroom to teach them about wetlands, plants and soil. EP staff will also help the class design an experiment that follows the scientific method.

b) Pre-Test

Activity 1—Introduction to Wetlands:

Introduce the class to a wetland habitat. Show the overhead images. Have them make observations of what makes a wetland and infer the functions. Write down

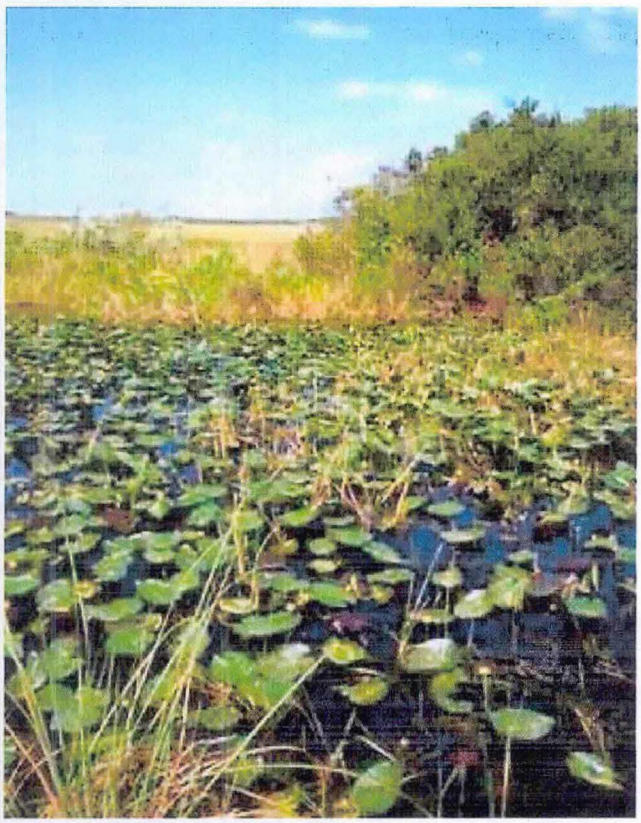
Wrap-Up:
Ask students to explain why observations are important in the scientific method. Remind students that they will be working to a restore a wetland in Vancouver by removing invasive plants and planting native plants. Next time the Estuary Partnership comes to visit, we'll be talking about the importance of native plants and learning how to ask scientific questions.

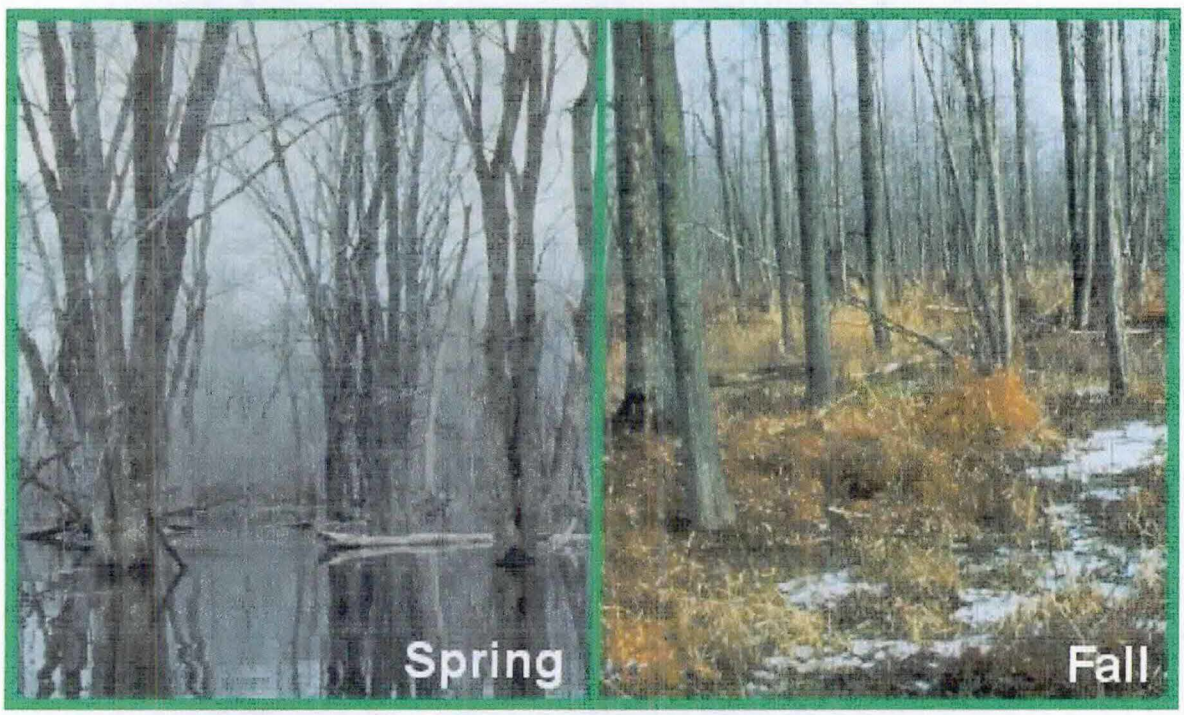
Extension:

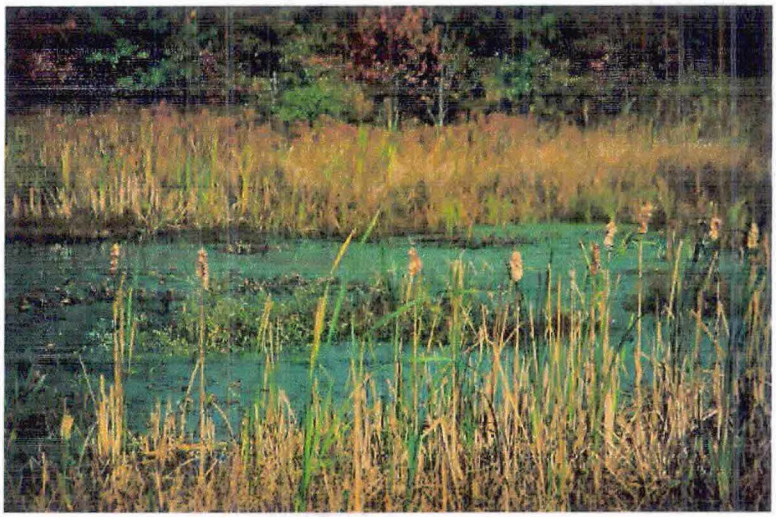
- Set up a "Daily Observation". Choose one item in your classroom that you can easily move to a new position. Every day or every week, move that item and allow time for students to make observations and identify where the object has moved. This could be adapted to a more realistic activity by asking the students to observe something outside. Spend a ten minutes or so outside at least once a week and ask students to observe one specific thing over time, such as a tree (watch the leaves fall) or a shadow (does the length of the shadow change from week to week?) or an ant hill.
- To begin moving students to the next step in the scientific method, require the students to form questions about things they observe. Students could observe other students on the playground and wonder, "Why do so many kids play on the monkey bars?" Students could observe the types of shoes other classmates are wearing and wonder, "Why are there more sandals than tennis shoes?" etc.

Lower Columbia River Estuary Partnership
Created through a Metropolitan Greenspaces Program grant
Sponsored by Metro and U.S. Fish and Wildlife.

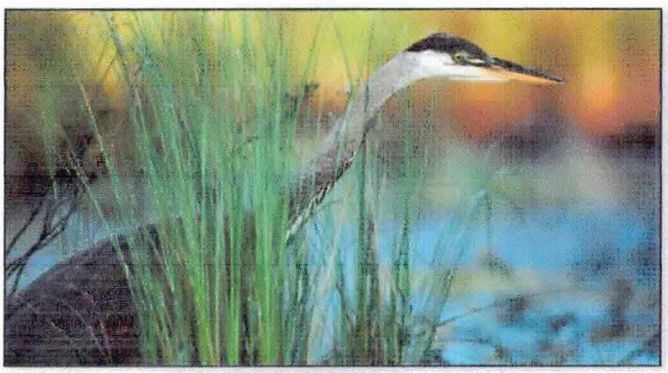
The following are examples of images created into overheads and shown to students during Class 1.

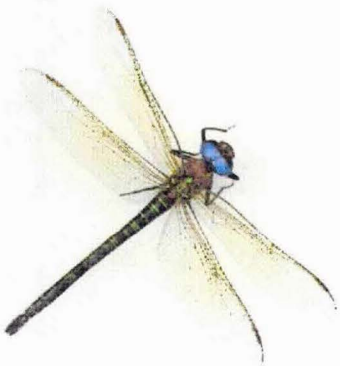







Scud or
sideswimmer
The Xerces Society
www.xerces.org





Steps to Inquiry

1. Observation

2. Ask a Question

3. Experiment

4. Collect data and Record your new observations

5. Conclusion

6. Knowledge

Name: _____ Date: _____

Wetland Experiment worksheet

1) (Observation) What are important things about wetlands that someone might need to know to understand our experiment. Use observations that we made about wetlands in our previous activity.

_____

_____

_____

2) What question are we trying to answer?

_____

_____

3) Experiment: How will we run our experiment? Describe our plan and any modifications that we made while actually conducting the experiment. It might help to write out the plan as a series of steps.

_____

_____

_____

_____

4) Observations from the experiment: what did we notice happened when we did the experiment?

_____

_____

_____

5) Conclusions: What happened when we did the experiment? What were the results?

6) Knowledge: Write a brief discussion about what we learned from the experiment.

Extra space if needed:

Record Observations

Qualitative

Data is in the form of words, pictures, or objects.
Researcher is the data gathering instrument.

Quantitative

Data is in the form of numbers.
Researcher uses tools and equipment to collect numerical data

Inquiry Class #2 Outline

Native and Invasive Plants & Hypothesis/Asking questions

Time: 1 hour

Materials:

- Native/Invasive plant packets
- Overhead Images
    - Asking Good Scientific Questions (SPAM)
    - Inquiry or Information
    - Research Design Worksheet

Objectives:

- Students will be introduced to characteristics of invasive plants
- Students will recognize asking a question and forming a question/hypothesis as the second step in the scientific method
- Students will develop their ability to ask SPAM questions, "Simple, Practical, Answerable and Measurable" questions through activities

Vocabulary:

- Scientific Method
- Experiment
- Wetland
- Clone
- Observation
- Conclusion
- Invasive
- Hypothesis
- Knowledge
- Native

Introduction:

Review the Metro grant "experiment" and identify the question within it, "Will students improve their WASL scores as a result of having spent time learning outdoors?" Review the scientific method. Nest tell the students that today they will be learning about how to ask scientific questions. Scientific questions are Simple, Practical, Answerable and Measurable (SPAM); we will also call these Inquiry Questions. Other scientific questions are Research questions. Research questions are usually too in depth. Research questions cannot be answered directly by observing the subject within the constraints of the classroom and school year.

*Note: There is some discrepancy between school districts in their preferred language when discussing the Scientific Method. For this reason you will see *Hypothesis* and *Question* used interchangeably. The words *Research* and *Information* question are also used interchangeably.

Activity 1 – Native/Invasive Class:

Teach the pre-written "Natives and Invasives" class. Begin by discussing characteristics and conditions of wetland plants. Then discuss characteristics of Native plants. Next discuss characteristics of Invasive plants. Explain the activity. Students should work in groups. Each group will receive a packet with the name of a plant on the front. Using the information inside the packet and the "Native or Invasive" worksheet, students will be

able to conclude whether their plant is native or not. During this process they will practice using observations (clues) to help them answer the question, "Is their plant native or invasive?"

Activity 2 – Hypotheses/Asking questions
Use the overhead image of "Asking Good Scientific Questions". Go over the difference between Inquiry questions and Information/Research questions. Discuss the characteristics of designing strong inquiry questions. Next use the "Inquiry or Information" overhead to hold a group discussion on which questions can be considered SPAM questions and which are not. Be sure to tie in the relevance of the students' upcoming work at the Water Resource Center.

Activity 3:
Have the students review information they learned about invasive plants. Use that information to practice writing research questions. Use the "Research Design Worksheet" Overheard to illustrate the process of using knowledge/observations to lead into writing a research questions. Start discussing the idea of procedure and supplies.

Wrap-Up:
Ask students again whether the question, "Is this an invasive plant?" is a research or an inquiry question. It is a research question. Brainstorm inquiry questions that could be asked about whether a plant is invasive. Ideas can easily center on the Characteristics of Invasive Plants information and/or on information learned through the activity.

Extension:

- Set aside time for observations outside within a set boundary. Have the students work in pairs and ask them to spread themselves out within the outside area. Students will be asked to generate 10 questions about things they observe within the area. Encourage students to take into account their own prior knowledge about an object or occurrence. A student should not ask a question they already know the answer to, such as "Will a potato bug curl up if I touch it?" Most kids know it will. But using that knowledge, they could rephrase the question to something like, "Will a potato bug curl up if a leaf falls nearby?"

Asking good scientific questions

Questions should be inquiry questions and not information questions.

- **Inquiry** questions can be answered by directly observing subject matter and running experiments.
- **Information** questions are in-depth. They cannot be answered by a simple experiment project. They require a large amount of time and study.
- **Inquiry** questions usually start with **"do," "is," or "are."**
- **Information** questions usually start with **"why," "how,"** or **"what."**

Remember SPAM when designing inquiry questions. Questions should be:

Simple

Practical

Answerable

Measurable

??Inquiry or Information??

- Do house sparrows spend more time in the upper or lower branches of trees?

- Why do birds fly south in winter?

- Do more cottonwood trees or willow trees grow near the water in our study area?

- Does fast-moving water contain more dissolved oxygen than slow-moving water?

- How do aquatic organisms reduce pollution?

- Do cottonwood trees 4 feet from the water's edge grow taller than cottonwood trees which grow 16 feet from the water's edge?

- How do leaves decompose on the bottom of the pond?

- Do cottonwood tree cuttings grown in commercial potting soil produce more branches than those grown in wetland soil?

- How do macroinvertebrates digest their food?

- How are the materials on the creek bottom formed?

Research Design Worksheet

Knowledge: *Invasive species often grow fast, have vines, and take over other plants.*

Research Question: *Is the Himalayan blackberry and invasive plant?*

Experiment Procedure: *Determine a test site. Measure the height and length of the plant every week for several months. Make observations about habitat: Are there other plants? Does the site look disturbed?*

Supplies: *Measuring tape, Data Sheet, Pencil*

Knowledge _____

Research Question _____

Experiment Procedure _____

Supplies _____

Knowledge _____

Research Question _____

Experiment Procedure _____

Supplies _____

Characteristics of Invasive Plants

- Often grow as vines
- Plants can often clone themselves in addition to having seeds
- Often have tasty berries for the birds
- Are able to grow in disturbed areas, or along trails, clearings, roads
- Grow really fast
- Have a big, strong root system
- Produce a lot of seeds or have seeds that will grow after years of being a seed

Name: _____

Native or Invasive

Name of plant: _____

OBSERVATION: Make observations of your plant by first looking at the pictures. Use the information you learned from the "Characteristics of Invasive Plants" overhead to make a prediction if your plant is: (circle) Native or Invasive.

Write down the observations or clues that lead you to the prediction.

_____

_____

QUESTION: *Is my plant native or Invasive?*

RESEARCH/EXPERIMENT: Now you will do research, by reading the plant clues, to answer the question. Answer the following questions about your plant.

Valuable to wildlife	1 not really	2	3 somewhat	4	5 valuable

How do animals use this plant? _____

Speed that plant spreads	1 fast	2	3 medium	4	5 slow

How does this plant spread? _____

Found only in the Pacific NW (Oregon, California, Washington, Canada)	1 no	2	3 maybe	4	5 yes

Other Observations:_____

CONCLUSION:

Total points (add each category): ☐ + ☐ + ☐ = ◯

If you score 10 or more points your plant is Native!

Where Red Elderberry grows: It prefers full sun and moist soil. Often located near wetlands and along streams. Its range is from Vancouver to California.

How animals use Red Elderberry: Many birds and mammals enjoy eating the fruit. Deer browse the foliage.

How Red Elderberry spreads: It relies on animals to spread its seeds.

How Red Elderberry grows: Grows as a shrub (2-5 meters tall). It has thick stems that are dry and spongy inside. It blooms from May to July.

Interesting Fact about Red Elderberry: Even though birds can eat the fruit, they are poisonous to humans. Humans do however the wood to make flutes.

Where Yellow Iris grows: Can be found in areas with permanent shallow water. Often it's located along the shores of streams and ponds and in roadside ditches.
It grows in the United States and in Europe.

How animals use Yellow Iris: This plant is poisonous to many animals, including humans.

How Yellow Iris spreads: It spreads by seeds. The seeds may be carried by water to new locations.

How Yellow Iris grows: It grows quickly in dense clumps with thick rhizomes. Each plant can reach up to 1 meter (3 feet) tall.

Interesting Fact about Yellow Iris: As a result of its strong, thick rhizomes (connected roots) it is a valuable species for reducing erosion.

Where Oregon Ash grows: Deep, moist soils along streams and wetlands. It can tolerate full sun or partial shade.

Interesting facts about Oregon Ash: It is used to make tools and furniture, as well as, for smoking salmon.

How animals use Oregon Ash: Grosbeaks eat the seeds of the female tree. Cedar waxwings and purple martins use the tree for food. The seeds and wood provide food for the Douglas chickaree. The tree also provides habitat for cavity nesters and dwellers.

How Oregon Ash grows: It is one of the first trees to grow in a disturbed wet land area. It can reach up to 20 meets (66 feet). Like most trees it grows relatively slow.

How Oregon Ash spreads: Birds eat and spread its fruits and berries.

Where Lady Fern grows: Along marshy areas, wet forests, and along streams from Puget Sound area in Washington to California.

How animals use Lady Fern: Minimal use to wildlife

How Lady Fern spreads: Spores that are found in clusters on the underside of the leaves.

How Lady Fern grows: In clustered fronds, growing straight up to 2 meters tall.

Interesting Fact about Lady Fern: Humans eat the young curled fiddle heads.

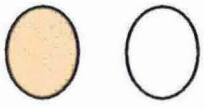
Where Snow Berry grows: It is found in the Western states. It prefers upland sites, but can tolerate fluctuating water tables. It prefers to live on the edges of woodlands where light is more available.

How animals use Snow Berry: Many birds eat the fruits, which are available through winter months. Herbivores, such as deer also eat on the twigs and foliage.

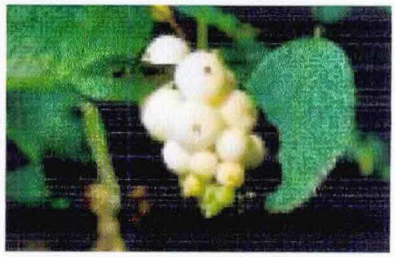
How Snow Berry spreads: It spreads by seeds; however each berry contains only two seeds.

Interesting facts about Snow Berry: The leaves of a single plant can vary from smooth to coarsely toothed, to lobed. Its flowers can be pink or white.

How Snow Berry Grows: A deciduous shrub that grows from 1-2 meters tall. It grows lots of thin opposite-branching twigs.

Soil: Snow berry grown in moist and dry soils. 

Sun: Snow berry grows in all light conditions. 



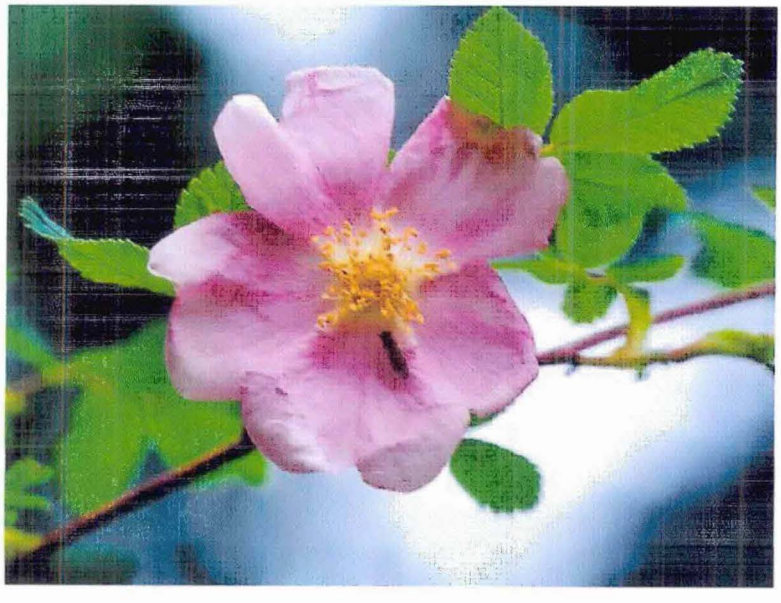
Where Nootka Rose grows: Lives in upland wooded regions and in open shrub wetlands throughout Oregon and Washington.

How animals use Nootka Rose: Birds and other animals eat the fruits. Browsers (like deer) also eat the leaves and twigs. The stems also provide nesting habitat for songbirds.

How Nootka Rose spreads: It spreads by seeds. The seeds may be carried by water to new locations.

How Nootka Rose grows: It grows to be 3 meters tall. Its stems are with green with a reddish hue.

Interesting Fact about Nootka Rose: The Rosehips are a good source of vitamin C.



Where Indian Plum grows: It grows along stream banks near the Pacific Coast from British Columbia to northern California.

How animals use Indian Plum: The fruits are eaten by birds. Birds also us it as nesting habitat. The fruits are edible to humans.

How Indian plum spreads: It spreads by seeds.

How Indian plum grows: It grows as a shrub or small tree, up to 5 meters tall.

Interesting Fact about Indian plum: It is one of the first shrubs to flower in the spring. The female flowers smell good; however the male flowers smell like cat urine.

Inquiry Class #3 Outline
Soils

Time: 1 hour

Materials:
- Soil folder
- Overheads: WAMO, Particle size, pH scale
- Samples of Sand, Silt, and Clay
- Student Worksheet
- Supplies for 4 soils stations:
  - Station signs
  - pH: Cola, baking soda, tap water, 3 jars, pH testing papers
  - Compaction: Picture of 3 plants in test tubes, packing peanuts
  - Soil Nutrients: Sample of soil
  - Jars with soil and water mixed, layers settled

Objective:
- Students will be introduced to soil science and basic soil concepts.
- Students will visit 'hands on' stations where they will closely examine soil concepts.
-

Vocabulary:
- Sand
- Porosity
- Phosphorous
- Saturation
- Silt
- Nutrients
- Potash
- Quantitative
- Clay
- Nitrogen
- Particle
- Qualitative

Introduction:

Soil Science

Here you will need to touch on: particles and their size, w.a.m.o. and soil nutrients
Ask students what they think of when they hear the word soil; inevitably someone will say "dirt". Explain that dirt is misplaced soil; it is what gets brought in on the bottom of your shoes when you come back in from recess. Soil is important and valuable. Why? Brainstorm ideas if there is time.

1. There are three main components (**particles**) in soil – sand, silt and clay. Show students samples of sand, silt and clay soils. Ask the students to think of a time when they may have felt these types of soil – at the beach, at the bottom of a lake bed, digging in the garden, etc. Sand particles are large, draw a basketball sized circle on the chalkboard. Silt particles are slightly smaller, draw a tennis ball sized circle on the black board. Clay particles are smallest, draw a golf ball sized circle on the blackboard. Do you usually find soils that are all sand, all silt or all clay? No, there is usually some kind of mixture of the three. Particle size and

porosity may also be demonstrated by having three students stand up together. First they will be about a foot apart and another person will weave through them demonstrating how water moves through sand. The students will then move closer-repeat for silt and clay.

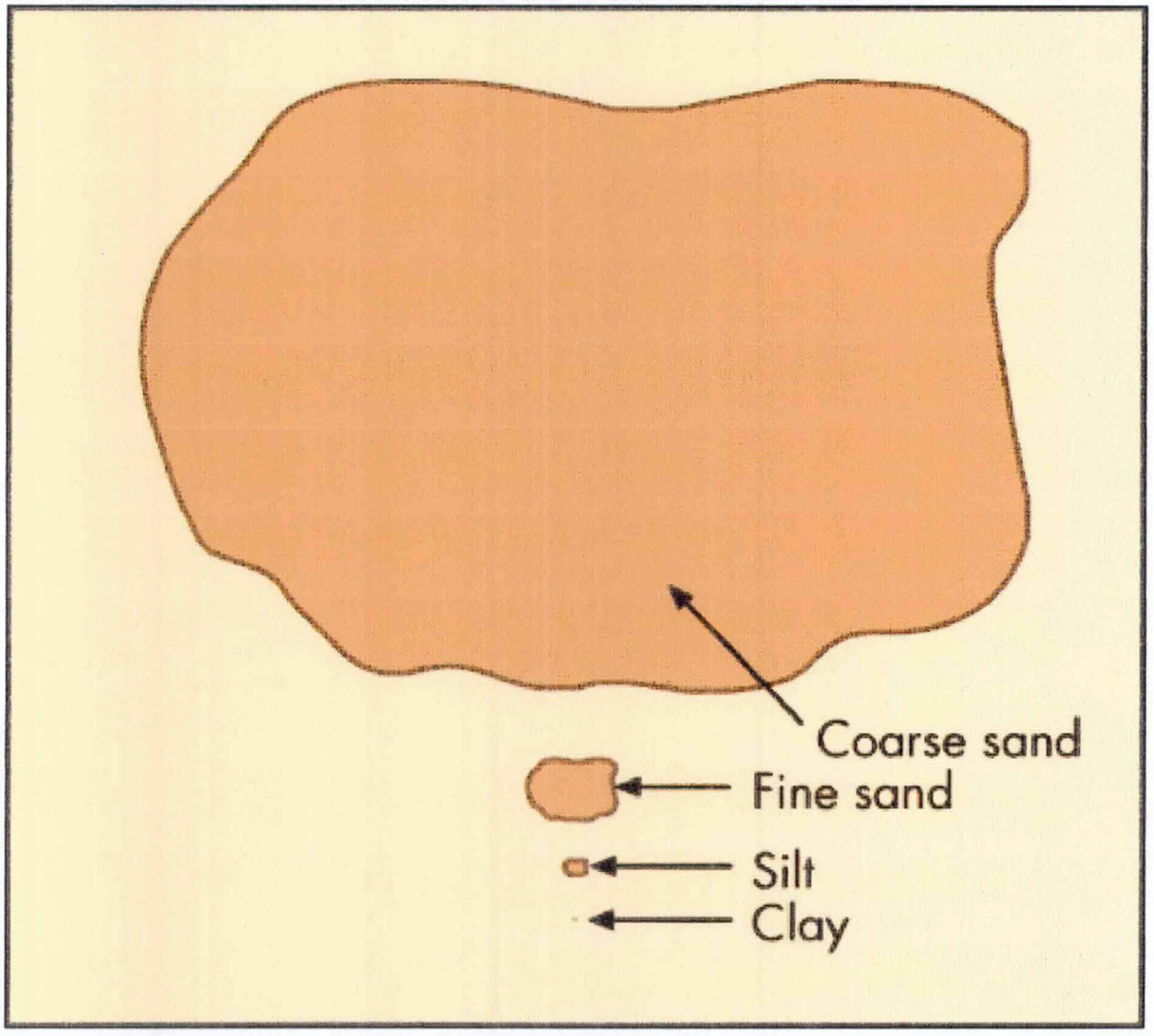
2. What else can you find if you look closely at a sample of soil? You will find water, air, minerals and organics. Show Soil Particle Size overhead. What could be in the spaces? Water and air. Can some types of soil hold more air and water than others? Minerals are carried in the water within the soil. Organics are things that are living, like the tiny creatures in soil, and things that were once living, like old leaves and needles. Look at soil texture by feel as way to measure what soil particles are present in a sample? Perform jar shaking experiment.

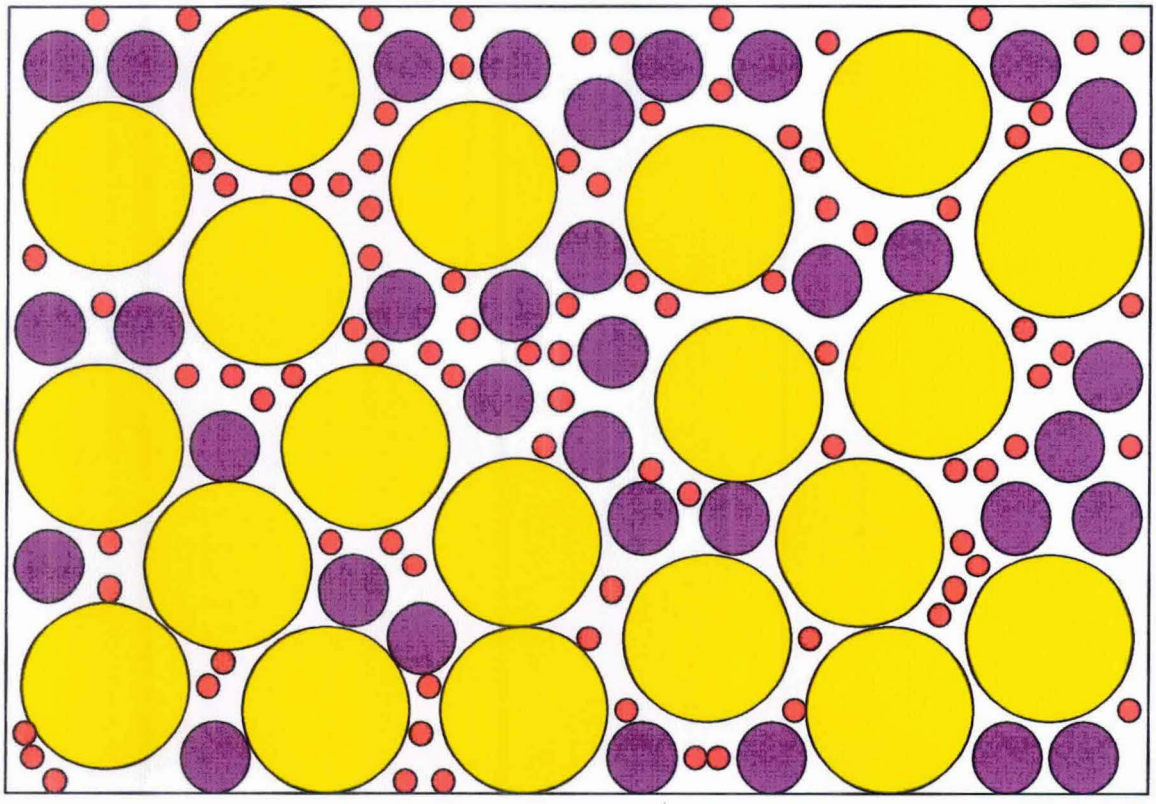
3. Discuss parameters, or characteristics about soils that could be measured.
    a. Soil compaction—Use packing peanuts to show how soil could be compacted. Talk about how this might impact the soil and things living in the soil.
    b. Soil temperature – how would the temperature be impacted?
    c. Soil moisture levels—What types of soil would most likely hold the most moisture? Do percolation tests in the classroom, using mixtures of clay and sand, use jars or glasses.
    d. Soil nutrient levels – how would more nutrients get into the soil? How would that change things growing in the soil?
    e. Soil pH – look at pH chart, talk about how soil pH might change. Why would that be bad for those things that live in the soil.

4. Discuss how wetland soils are different.
    a. Hydric
    b. Anaerobic respiration
    c. Dark color
    d. Clayish/gooey from organic matter
    e. Mottled color

Class Activity:

In groups, students will visit 4 stations: nutrients, particle size, pH, and compaction. They will use the station information to complete the Soils Worksheet.

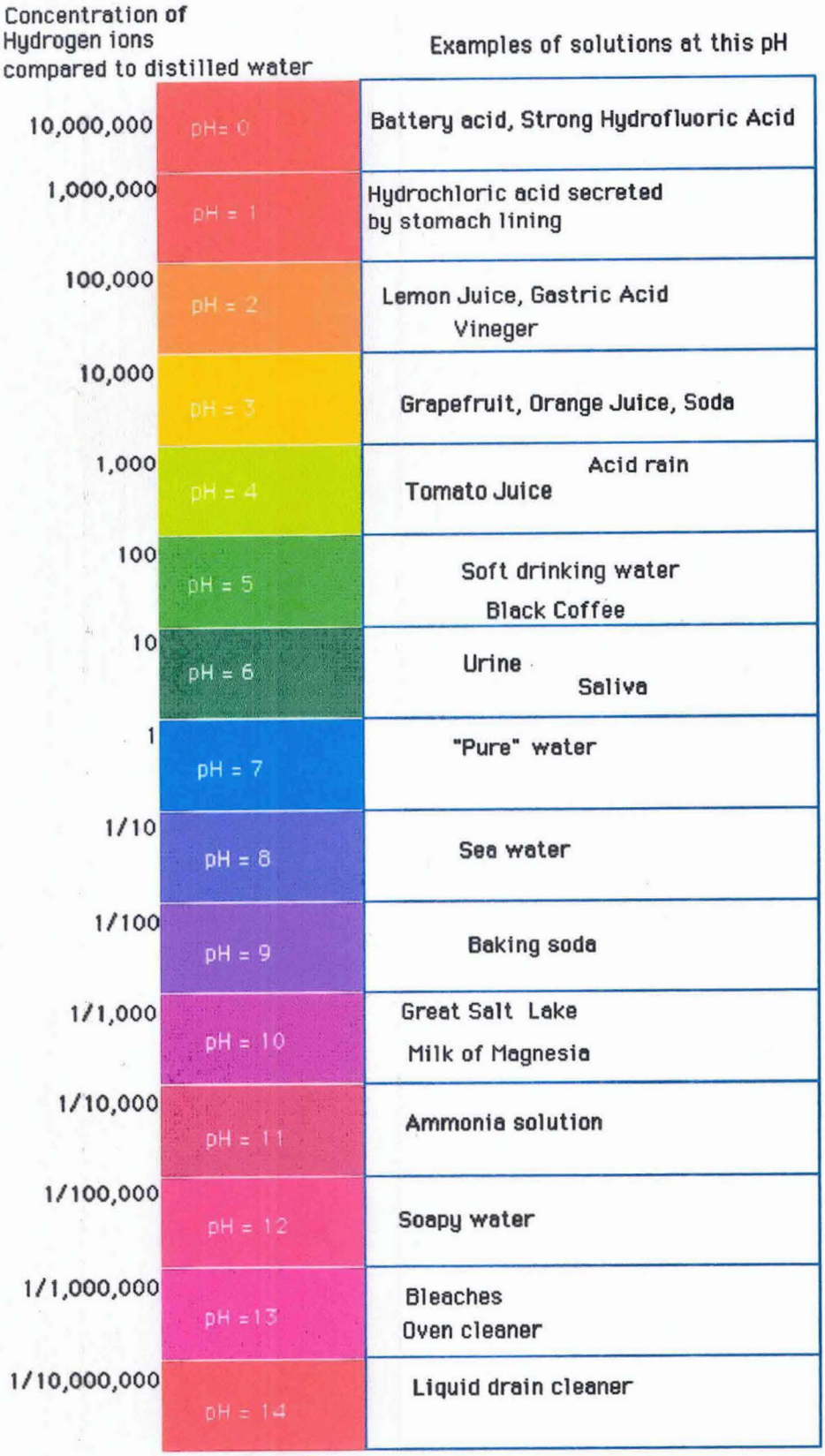

Coarse sand
Fine sand
Silt
Clay



= CLAY

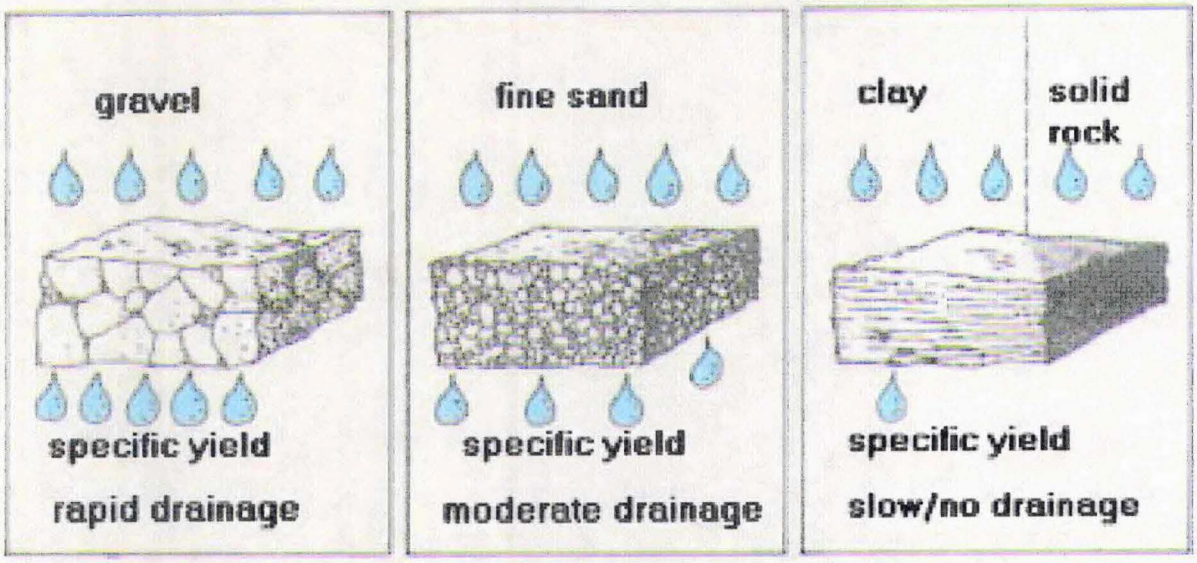
= SILT

= SAND

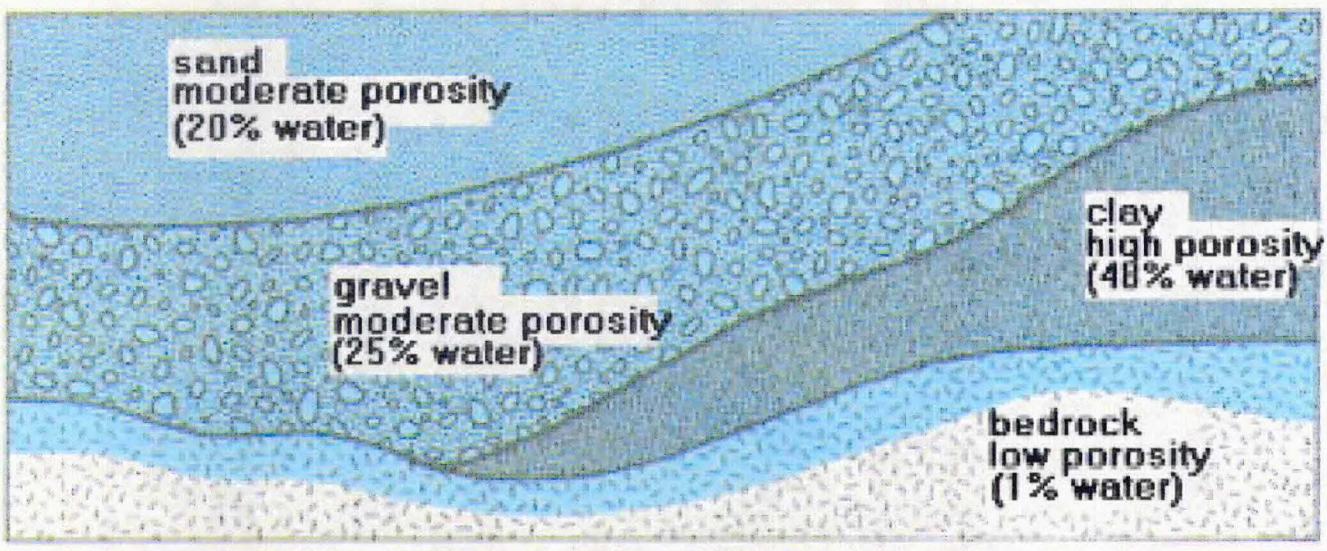

Concentration of Hydrogen ions compared to distilled water
Examples of solutions at this pH
10,000,000
pH= 0
Battery acid, Strong Hydrofluoric Acid
1,000,000
pH = 1
Hydrochloric acid secreted by stomach lining
100,000
pH = 2
Lemon Juice, Gastric Acid
Vineger
10,000
pH = 3
Grapefruit, Orange Juice, Soda
1,000
pH = 4
Acid rain
Tomato Juice
100
pH = 5
Soft drinking water
Black Coffee
10
pH = 6
Urine
Saliva
1
pH = 7
"Pure" water
1/10
pH = 8
Sea water
1/100
pH = 9
Baking soda
1/1,000
pH = 10
Great Salt Lake
Milk of Magnesia
1/10,000
pH = 11
Ammonia solution
1/100,000
pH = 12
Soapy water
1/1,000,000
pH =13
Bleaches
Oven cleaner
1/10,000,000
pH = 14
Liquid drain cleaner

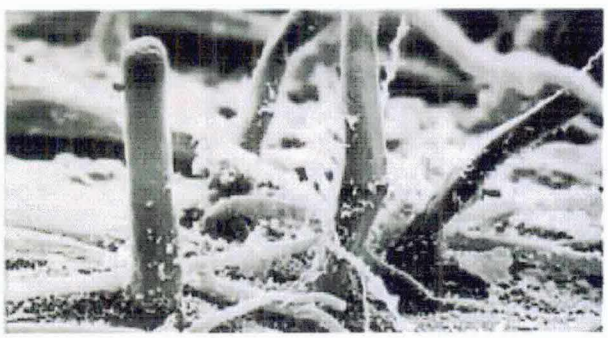

LOW
MEDIUM
HIGH

Permeability



Porosity





Inquiry Class #4 Outline

Pre-field Trip

Time: 1 hour

Materials:

- Aerial photos of Water Resources Center wetland
- Seasonal photos of the Water Resourced Center wetland
- Overhead of project site photos, invasive plants to be removed, and natives present at the site.
- "Plant who am I?" game supplies

Objectives:

- Students will be introduced to the Water Resources Center wetland, including how the site has changed over the year and how the wetland water levels fluctuate seasonally.
- Students will learn to identify invasive plants that they will be removing from the project site as well common native plants found at the site.

Introduction:

Water Resources Education Center staff introduces the students to the Water Resources Center wetland by showing a series of aerial photos of the wetland, which displays how the wetland has changed over time. Students are asked to brainstorm how these changes occurred. The concept of deposition is introduced and discussed in relation to the Water Resources Center wetland. Seasonal photos of the wetland are shown and fluctuating water levels in the wetland and the effect this has on wetland plants and animals is discussed. Invasive plants found in the wetland and common native plants are introduced.

Activity:

Students will work with partners and play the "Plant who am I? game. A series of eight plants introduced, including three invasives and five natives. A photo of one of the eight plants is placed on each students back with a cloths pin. Students then work with their partners to identify the plant on their back by asking yes or no questions.

Wrap-Up:

Students are introduced to the activities they will be involved with during their first field trip to the Water Resources Education Center, which includes removing Himalayan blackberry and English Ivy, and running through an inquiry experiment. The tools that the students will be using to remove the invasives are introduced and safety concerns are discussed. Students are asked to dress appropriately for the field trip and proper field trip attire is discussed. Any questions about the field trip are answered.

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Soils worksheet

Name: _____ Date: _____

1. Soil is made up of W_____, A_____, M_____, and O_____
2. The three sizes of soil particles are _____, _____, and _____.
   Which is the biggest? _____ Which is the smallest? _____.
3. Water moves through (percolates) particle size _____ the fastest.

Station 1: pH

pH is a measure of how basic or acidic a substance is.

Use the pH strips to measure the pH levels of following household items.

Soda: _____ this is basic/ acidic/ neutral

Tap water: _____ this is basic/ acidic/ neutral

Baking soda solution: _____ this is basic/ acidic/ neutral

Do you think the soil pH will affect plant growth? How?_____

_____

Station 2: compaction

Compacted soils mean soils that have been pressed together tightly.

1) Look at the picture of plants growing in low compacted soils as compared to those growing in highly compacted soils. What happens to plants in more compacted soils? _____

2) What might make the soils compacted? _____

_____

3) Compacted soils will cause water to move through the soil more_____ (quickly or slowly). Why?_____

Station 3: soil nutrients

Plants need nutrients found in soils.

1) In WAMO, which letter adds nutrients?_____

2) What is something that people sometimes add to their lawns or gardens that give plants nutrients? _____

3) Look at the soils sample in the bag. What types of organics are present in this soil sample? _____ What percentage of this soil sample would you estimate is organic material? _____

Station 4: soil particle size

1) If you put a soil sample in water and shake it up, which particle size will settle out first? _____Why? _____

_____

Which particle size settles second? _____Which particle size will settle last, and may still be floating in the water? _____

2) Compare soil sample 1 and soil sample 2. Do you think they have the same types of soils in each mixture? Why or why not? _____

_____

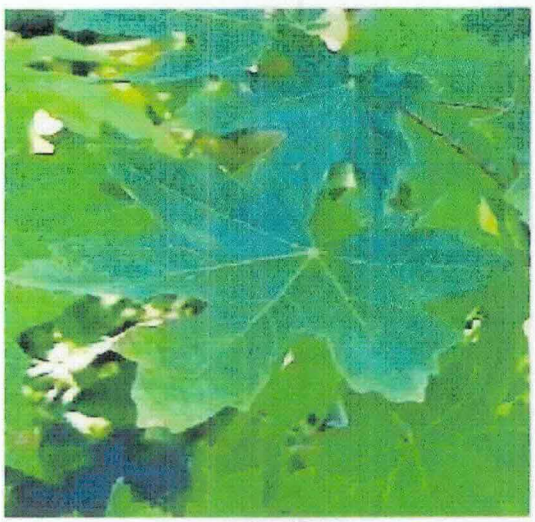
Think about how wetlands soils might be different from those soils found elsewhere (often called upland soils). We know wetlands soils are wet most of the year, and don't drain water very well. What might you predict about the particle size of most wetlands soils if they don't drain water well?

_____

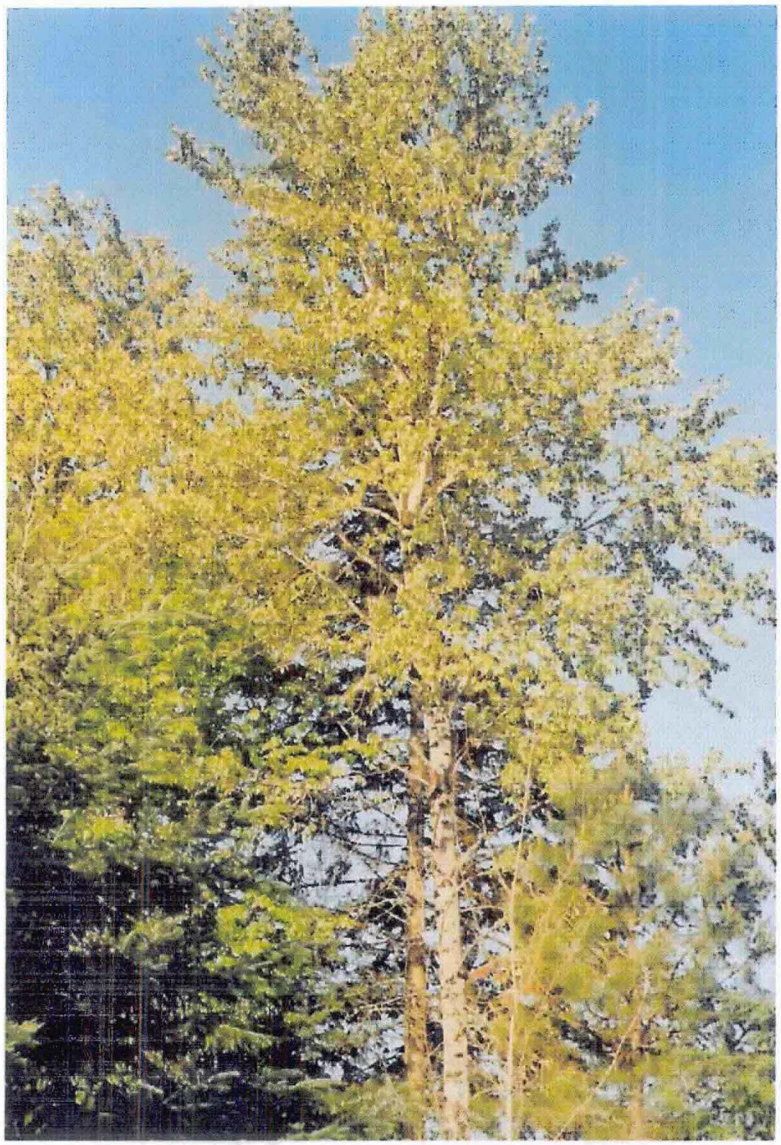
Plant Name: Red Elderberry

- This plant grows as a shrub (2-5 meters tall). It has thick stems that are dry and spongy inside. It blooms from May to July.
- The berries of this plant are eaten many birds and mammals.
- This plant prefers full sun and moist soil. Often near wetlands and along stream.
- This plant grows from Vancouver BC to California.

PLANT NAME: Big Leaf Maple



- This plant usually grows to be about as tall as a three-story building
- This plant likes to grow in drier places, often near Douglas firs
- This plant produces seeds that spin down to the ground like little helicopters



Plant Name: Cottonwood

- This plant is fast a growing tree that obtains heights of 180 feet
- This plant needs moist to wet sites to grow best
- This plant is browsed by deer and beavers, and birds feed on the buds, flowers, and seeds.
- Many animals including wood ducks and raccoons use the dead, often hollow snags for nesting and shelter.

Plant name: Snowberry

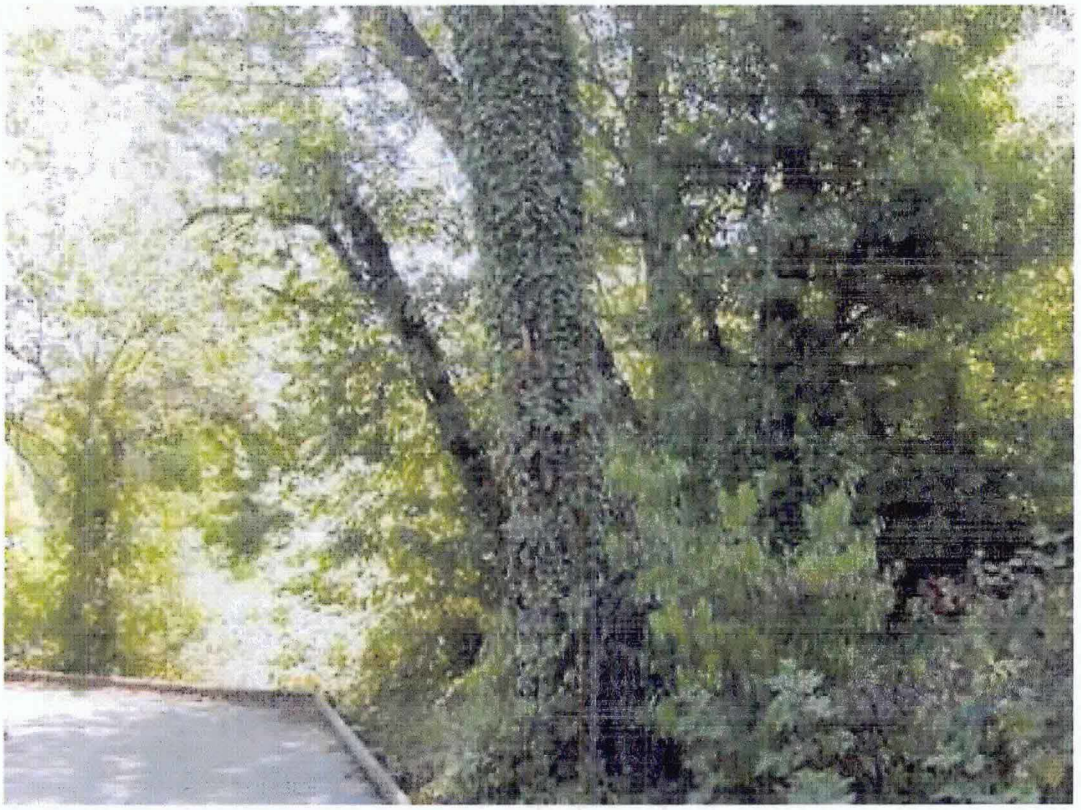
- This plant usually grows to be about as tall as an adult
- This plant likes to grow in open forest areas
- This plant has white, poisonous berries

PLANT NAME: Oregon Grape

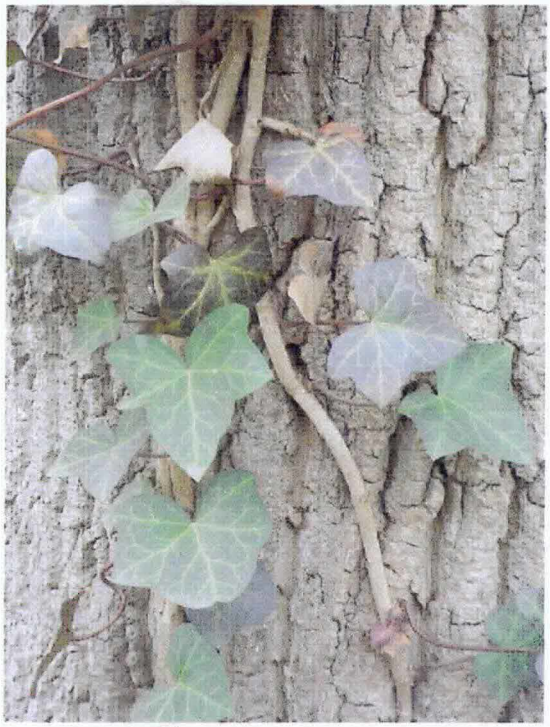
- This plant usually grows to be about as tall as your desk
- This plant likes to grow in shady, damp places
- This plant has yellow flowers in spring and is the state flower of Oregon

PLANT NAME: Himalayan Blackberry

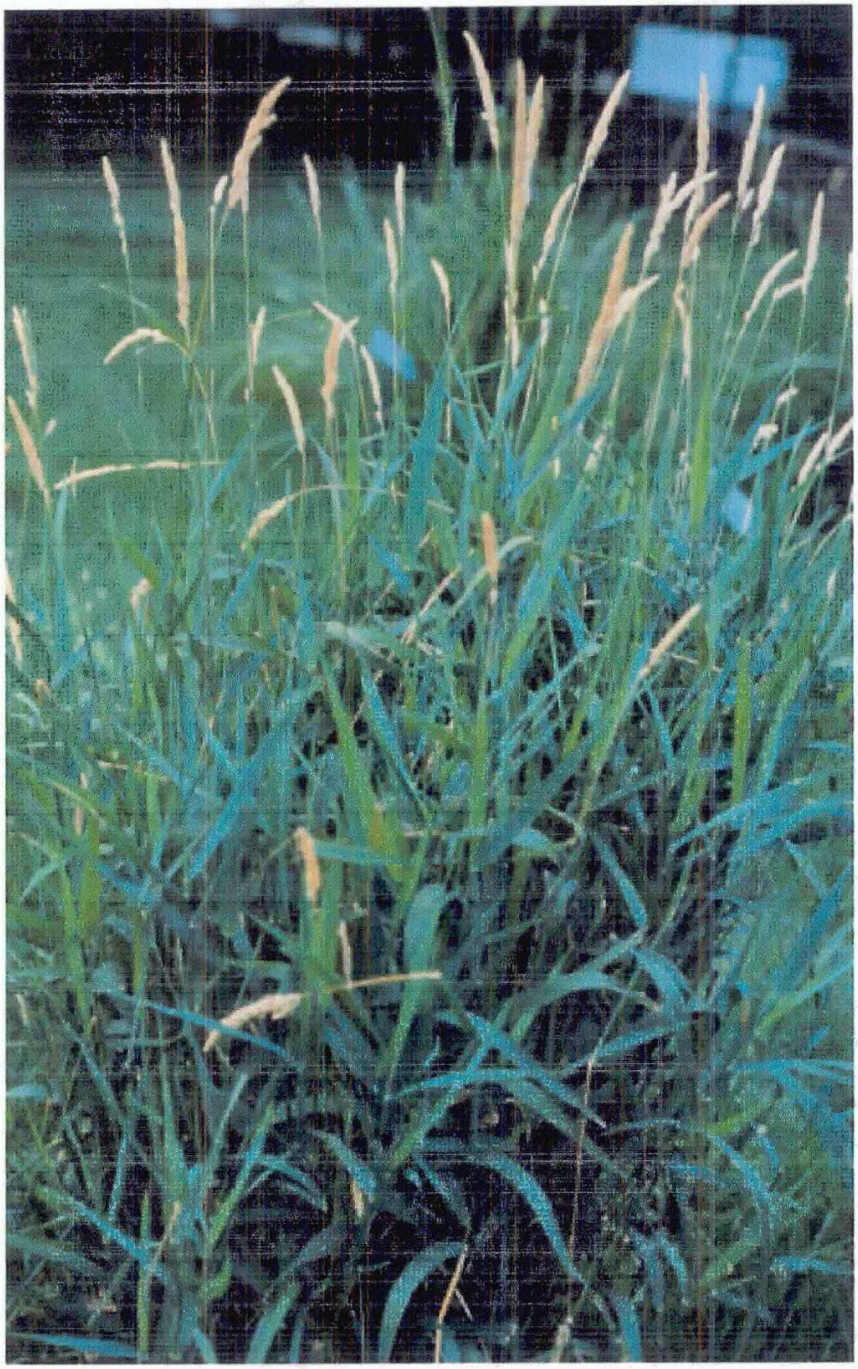
- This plant usually grows into a large bush
- This plant likes sun
- This plant makes tasty black berries in the summer
- This plant is not originally from the Northwest and can take over an area very quickly



PLANT NAME: English Ivy



- This plant grows on the ground, but can also climb up other very tall trees
- This plant likes to grow in mostly sunny places
- This plant is not originally from the Northwest. This plant takes over large areas.



Plant Name:
Reed Canary Grass

- Grows like a weed, really fast and sends out lots of new plants through its roots.

- This plant can spread by seed or by cloning itself.

- This plant is not originally from the Northwest. This plant takes over large areas.

Inquiry Class #5 Outline

Designing the Experiment

Time: 1 hour

Materials:

- Experiment Design worksheet
- Overhead of Inquiry Process

Objectives:

- Students will review field trip 1. Specifically discuss wetland observations and pretest results.
- Students will design their own experiment to conduct during their second field trip to WREC.

Vocabulary:

- Variable
- Manipulated Variable
- Controlled Variable

Introduction:

Review field trip 1. List student observations on the board. Make sure to write down everything that may be a research variable. Next ask students to make observations/predictions based on their experience, i.e. Is the soil more moist in the wetlands or uplands? Then ask students how they would write this into a question and then design an experiment to research the observations. Repeat this process with several of the student's own questions to guide them through the process.

- Question
- Hypothesis (prediction)
- Materials/methods needed
- What observations will we make?
- What information do we need to record?
- Units of measurement?
- Can this experiment be repeated?
- Are there safety precautions to consider?
- How will this information be presented?
- What do we hope to learn by conducting this experiment?

Activity:

Students will work in groups. Using a worksheet they will be guided to create their own research question which they will collect data for on Field trip 2. The will also create their own Data sheet. Students will write their question, make a prediction/hypothesis, write down their materials, and procedure.

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Wrap-Up:
Students will share their experiments with the class. If necessary, together we will brainstorm experiment improvement/scope concepts as well. Discuss the procedures for Fieldtrip 2.

Extension:
Have the class do research on elements of their experiment. Has a similar experiment been conducted somewhere else? Will studying one aspect of the experiment give students a better understanding of the outcomes of their own experiment?

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Designing Inquiry experiment for Water Resources Education Center

Name: _____

When developing questions, it is helpful to determine what the controlled, manipulated, and measured variables will be. Here are some possible choices to help you in your thinking.

Possible controlled variable:

Soil
Plant species (Snowberry, Elderberry, etc)
Biodiversity

Possible manipulated variable:

Upland or wetland
Canopy cover (full or none)
Soil moisture (drier or wet)
Soil composition
Invasive Plants or native plants

Possible measured variables:

Soil pH
Soil moisture
Soil composition
Soil compression
Soil nutrients
Number of species of plants
Presence or absence of plant species
Soil Color

Question: (Inquiry questions should start with do, does, is or are and pass the Simple, Practical, Answerable, Measurable test)

_____

Prediction: Control: _____

Manipulated variables: _____

Measured variables: _____

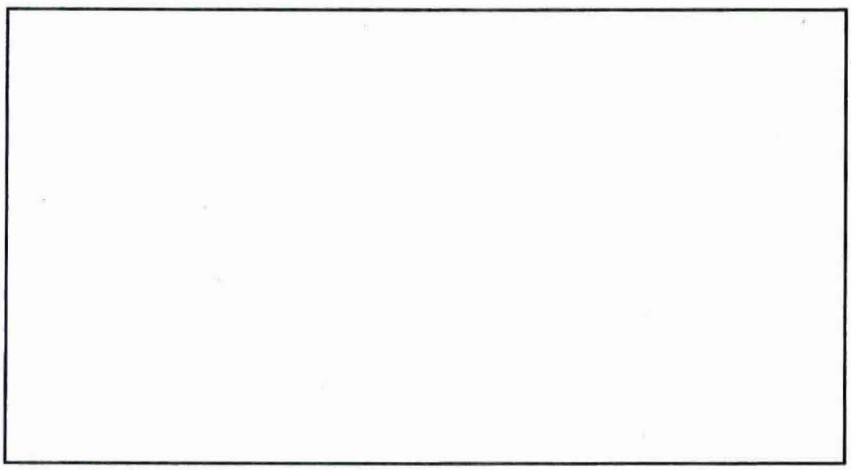
Materials:

1. _____
2. _____
3. _____
4. _____
5. _____

Procedure:

1. _____
2. _____
3. _____
4. _____
5. _____
6. _____

Draw Procedure



What data will I collect? _____

_____

_____

How am I going to record my data? _____

_____

What will the data tell me about the question and my prediction? _____

_____

_____

APPENDIX B

FIELD TRIP DATA SHEETS and ACTIVITIES

- **Outline for field trips**
- **Scavenger hunt**
- **Compass Challenge**
- **Plant identification key**
- **Plant transect data sheet**
- **Soil experiment data sheet**
- **Inquiry experiment data sheet**

Outline for Field Trips to Water Resources Center

Field Trip 1

Objectives

- Students will participate in Service Learning by removing invasive Himalayan Blackberry.
- Students will learn about the wetlands at the water resources center.
- Students will practice collecting data using instruments and procedure.

Overview

The students will be split into two groups. The first group will begin with service. The education team will demonstrate tool safety and blackberry removal technique. Students will explain why we are removing Himalayan blackberry and summarize some of the characteristics of invasive plants.

The second group will explore the wetlands and the upland woodlands areas. The students will be given a data collection worksheet. The education team will discuss the importance of recording data, demonstrate tool use, procedures and plant identification. Students will perform collection in defined plots in both the uplands and wetlands. They will compare their data and discuss. After 1 hour the students will be given a break and then switch stations.

Data collection:

- Plant identification and dominance
- Canopy and sunlight
- Soil temperature
- Soil Texture
- Soil nutrients
- Soil Moisture
- Soil pH
- Soil Compression

Field Trip 2

Objectives

- The students will participate in Service Learning planting native plants in the areas where they removed invasive species during Field Trip 1.
- Students will collect data to answer the inquiry question they created during class visit 5.

Overview

The students will be presented with a planting demonstration; along with information about the native species they will be planting to restore the area where they removed Himalayan Blackberry. Students will summarize information from classroom lessons and explain why we are planting native species and the habitat value they provided. During the planting time, smaller groups will be taken out to conduct research for their inquiry question.

Water Center Scavenger Hunt

Plants + Trees

- ☐ lichen
- ☐ mushrooms
- ☐ stinging nettle
- ☐ blackberry
- ☐ bedstraw
- ☐ buttercup
- ☐ seed that travels by wind
- ☐ willow catkins
- ☐ oak tree
- ☐ hawthorne
- ☐ cottonwood tree
- ☐ horsetail
- ☐ Maple flowers / catkins

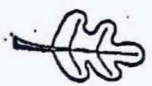
Animals

- ☐ spider
- ☐ woodpecker hole
- ☐ squirrel
- ☐ slug
- ☐ beaver chew
- ☐ feather
- ☐ nest
- ☐ animal tracks
- ☐ animal burrow

Birds

on back → of paper

Leaves

- ☐  leaf with "toothed" edges
- ☐  leaf with "lobed" edges
- ☐  lance-shaped leaf
- ☐  heart-shaped leaf
- ☐  palmate leaf

Humans

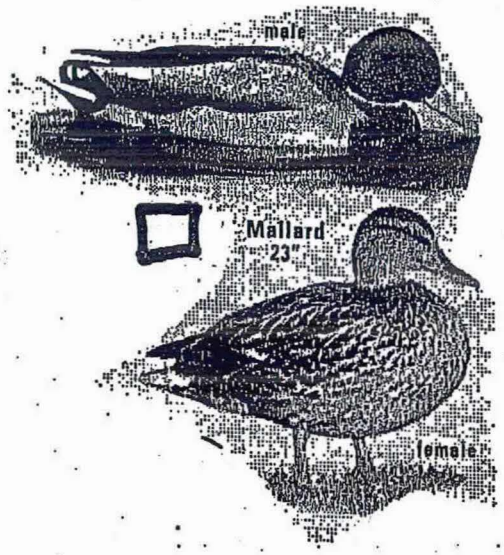
- ☐ 3 signs of humans:
  1. _____
  2. _____
  3. _____
- ☐ garbage

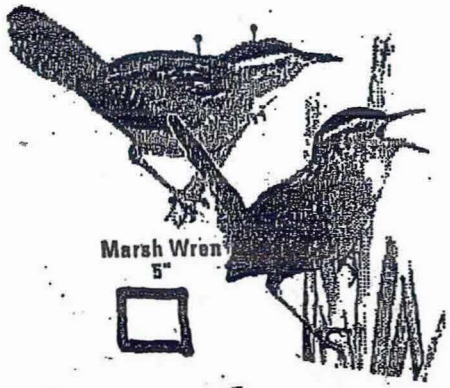
Extra

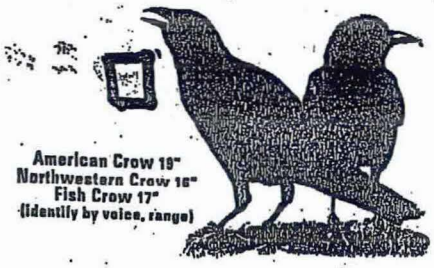
- ☐ something fuzzy
- ☐ something straight
- ☐ something camouflaged

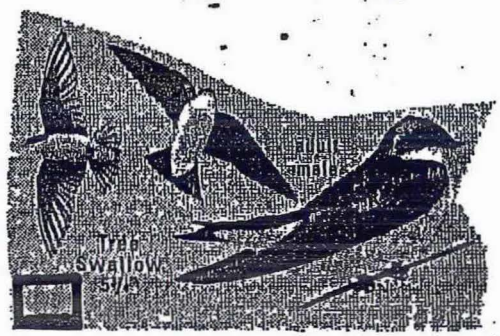
Name: _____

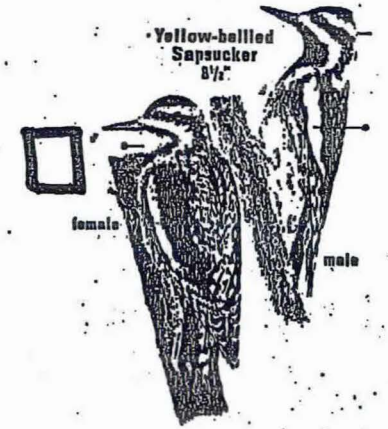
Bird Check List

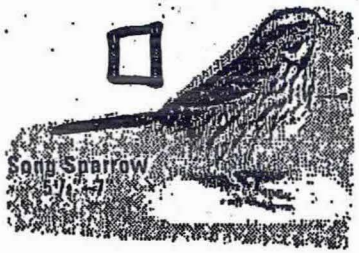


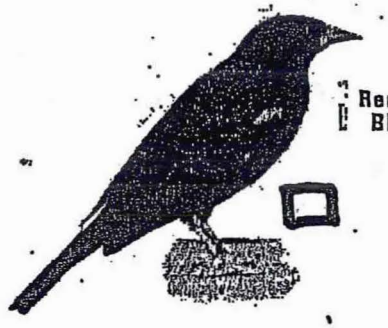


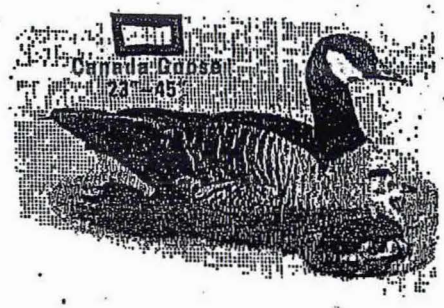


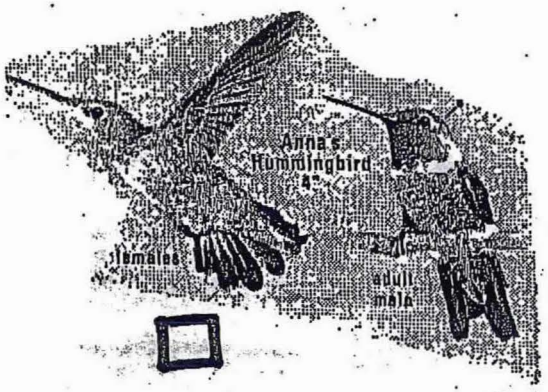


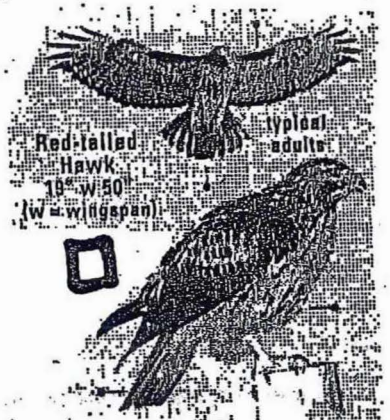


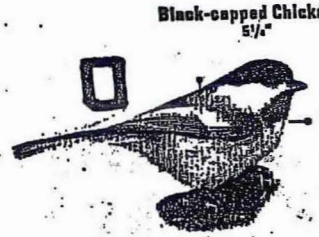


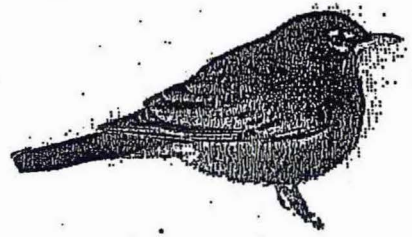












Compass Challenge

Begin course at marker L

Set compass to 178°

Travel to marker _____

Set compass to 236°

Travel to marker _____

Set compass to 305°

Travel to marker _____

Set compass to 29°

Travel to marker _____

Set compass to 100°

Travel to marker _____

Course complete, great job!!!

Compass Challenge

Begin course at marker U

Set compass to 140°

Travel to marker _____

Set compass to 198°

Travel to marker _____

Set compass to 252°

Travel to marker _____

Set compass to 320 °

Travel to marker _____

Set compass to 42°

Travel to marker _____

Course complete, great job!!!

Water Resources Education Center Plant Identification Key

Name: _____

1a. This plant is a large tree (has one trunk and is over 10 feet tall)	Cottonwood
1b. This plant is not a large tree	2
2a. This plant is a small tree or shrub	3
2b. This plant is vine like with lobed leaves	English Ivy *
3a. This plant has one or two trunks and is greater than 7 feet tall	4
3b. This plant has multiple trunks and is shorter than 7 feet tall	5
4a. This shrub or small tree is very red at the tips of the branches	Red Osier Dogwood
4b. This shrub or small tree is not red at the tips of the branches.	6
5a. The branches of this plant have thorns	7
5b.The branches of this plant do not have thorns	8
6a. This shrub or small tree has smooth edged leaves and white flowers	Indian Plum
6b. This shrub or small tree has toothed edged leaves that are just starting to emerge	Red Elderberry
7a. This plant has large thorns and square shaped branches, leaves are evergreen	Himalayan Blackberry *
7b. This plant has many, many small thorns and leaves just emerging	Nootka Rose
8a. The leaves on this plant are toothed and evergreen	Oregon Grape
8b. This plant has smooth edged leaves which are small and just emerging	Snowberry

Plant "A" is called_____

Plant "B" is called_____

Plant "C" is called_____

Plant "D" is called_____

Plant "E" is called_____

Plant "F" is called_____

Plant "G" is called_____

Plant "H" is called_____

Plant "I" is called_____

Data Sheet

Name:_____ Teacher:_____ Date:_____

Time:_____ Location:_____Air Temperature: _____

Plants

1) *IDENTIFY THE PLANTS IN YOUR PLOT.*
2) *COUNT HOW THE NUMBER OF EACH PLANT.*

Himalayan Blackberry Invasive shrub Stems up to 10 meters long 3 to 5 leaves prickles on leaf and stem		Number of plants in upland: _____ Number of plants in wetland: _____
Cottonwood Tall tree Heart shaped leaves Older bark deeply grooved, dark grey		Number of plants in upland: _____ Number of plants in wetland: _____
Snow Berry Shrub, .5 to 2 meters tall Opposite branching Fine twigs White berries		Number of plants in upland: _____ Number of plants in wetland: _____
Red Elderberry Shrub or small tree Reddish bark, warty Very straight branches Leaves compound, toothed		Number of plants in upland: _____ Number of plants in wetland: _____
Indian Plum Shrub or small tree Starting to leaf Leaves smooth, oblong		Number of plants in upland: _____ Number of plants in wetland: _____
Red Osier Dogwood Shrub with many stems End of stems bright red Leaves smooth		Number of plants in upland: _____ Number of plants in wetland: _____
English Ivy Climbing Evergreen Vine 3 lobes on most leaves Leaves shiny green		Number of plants in upland: _____ Number of plants in wetland: _____

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Thistles Hollow stem .3 meters tall grows individually		Number of plants in upland: _____ Number of plants in wetland: _____
Reed Canary Grass		Number of plants in upland: _____ Number of plants in wetland: _____
Other Plant		Number of plants in upland: _____ Number of plants in wetland: _____
Other Plant		Number of plants in upland: _____ Number of plants in wetland: _____

	Wetland	**Upland**
How many different plant species (types) do you have in your plot?	_____	_____
Can you see any bare ground in your plot?	YES NO	YES NO
What percentage of the ground would you estimate is bare?	_____	_____

CANOPY

LOOK UP FROM YOUR PLOT. ESTIMATE THE PERCENT OF SUNLIGHT THAT MOST LIKELY REACHES THE FLOOR WHERE YOU ARE NOW STANDING. REMEMBER IT IS WINTER AND MOST DECIDUOUS TREES HAVE LOST THEIR LEAVES.

PERCENTAGE OF SUNLIGHT THAT REACHES THE FLOOR

Upland _____% Wetland_____%

Other Observations:

☞☞☞☞☞☞☞☞☞☞☞☞☞☞☞Turn Over ☞☞☞☞☞☞☞☞☞☞☞☞☞☞☞

NAME: _____

SOIL

Note: These tests will all be completed with soil probes. Insert the probe ½ way into the soil. If the soil is compacted DO NOT force the probe into the ground.

SOIL TEMPERATURE:

Soil temperature upland: _____

Soil temperature wetland: _____

SOIL TEXTURE BY FEEL:

Upland_____

Wetland_____

FERTILIZER

(upland)	TOO LITTLE	IDEAL	TOO MUCH
(wetland)	TOO LITTLE	IDEAL	TOO MUCH

LIGHT (1000X)

(upland) 0 - - - 1 - - - 2 - - - 3 - - - 4 - - - 5 - - -6 - - -7 - - - 8 - - - 9 - - - 10

(wetland) 0 - - - 1 - - - 2 - - - 3 - - - 4 - - - 5 - - -6 - - -7 - - - 8 - - - 9 - - - 10

SOIL MOISTURE: *Do twice, in different areas of the plot*

(upland) 1 2 3 4 (upland) 1 2 3 4

(wetland) 1 2 3 4 (wetland) 1 2 3 4

SOIL pH:

(upland) 9 8 7 6 5 4 3 2 1 0

(wetland) 9 8 7 6 5 4 3 2 1 0

SOIL COMPRESSION:

(upland)_____

(wetland)_____

☞☞☞☞☞☞☞☞☞☞☞☞☞☞☞☞Turn Over☞☞☞☞☞☞☞☞☞☞☞☞☞☞☞☞

Name: _____

Question: Do wetland soils have more clay than upland soils?

Prediction: Control: soil
Manipulated variables: wetland habitat, upland habitat
Measured variables: amount of clay in each soil sample

Materials:

1. Soil texture by feel cards
2. Soil charts
3. Clear container

Procedure:

1. take soil sample from wetland
2. Run through soil texture by feel procedure (see other sheet)
3. Determine soil type based on soil texture by feel procedure
4. After determining type of soil, look up composition on chart
5. Take sample of wetland soil and place in glass jar with water to confirm results.
6. Repeat procedure for upland soils.

Data:

Upland soil type:_____

Percentage sand: _____

Percentage silt: _____

Percentage clay: _____

Wetland soil type: _____

Percentage sand: _____

Percentage silt: _____

Percentage clay: _____

Conclusions:

_____

_____

_____

APPENDIX C

FIELD BASED INQUIRY QUESTIONS

- **Field Inquiry Questions outline**

Field Inquiry Questions used during the Metro project

Fisher's Landing Elementary, Team One

1. Is there more sand in the soil of wetlands or uplands?
2. Is there more clay in the soil of wetlands or uplands?
3. Does the upland have a different pH level than the wetlands?
4. Do cottonwoods prefer wet or dry soils?
5. Does soil composition affect the number of plants growing in the uplands?
6. Does moisture affect the number of plants growing in the uplands?
7. Is there more plant cover or bare ground in the uplands?
8. Does thick ivy affect the number of other plants growing in the uplands?
9. Does thick blackberry affect the number of other plants growing in the uplands?
10. Does snowberry grow better in shady or light areas?
11. Does Oregon grape grow better in shady or light areas?
12. Does red osier dogwood grow better in shady or light areas?
13. Does reed canary grass grow more thickly near the water or farther away from the water in the wetlands?

Fisher's Landing Elementary, Team two

1. Are the soil colors the same in the wetlands and the uplands?
2. Is the soil texture different in the wetland and uplands?
3. Is the nutrient level the same in the wetland and the upland?
4. Does elderberry grow better in the open canopy or the closed canopy?
5. Does snowberry grow in open canopy or closed canopy?
6. Do Himalayan Blackberries grow in open or closed canopy?
7. Do invasive species lower plant diversity?

York Elementary

Questions for Mrs. Akin's Class at York

1. Does compaction affect where Reed Canary grass grows?
2. Do Snowberry and Red Elderberry need the same nutrient and moisture conditions?
3. Does Snowberry prefer an open canopy?
4. Does Dogwood grow in moist or dry soil?
5. Do blackberries grow in the shade?
6. Does moisture affect where snowberry grows?
7. Do Cottonwoods grow in a wetland?

Questions for Mr. O'Connor's Class at York

1. Does Blackberry grow in shade or sun?
2. Does the presence of invasive plants lower plant diversity?
3. Is there more plant diversity in the wetlands or uplands
4. Is reed canary grass found in the shade?

Questions for Mr. Greve's Class at York

1. Is the soil color different in the wetlands than the uplands?
2. Is the soil more compact on the trail than in the wetland?
3. Is there more clay in the wetland or upland soils?
4. Does the soil moisture affect the soil texture?

APPENDIX D

SAMPLE TEST

Name: _____ Teacher: _____

1) Which of the following is NOT a type of wetland?
   a) Swamp
   b) Marsh
   c) Bog
   d) Tidepool

2) Wetlands serve which important function?
   a) Habitat for animals
   b) Flood control
   c) Water filtration
   d) All of the above

3) What is a native plant?
   a) A plant that has thorns
   b) A plant that originated from the area where it now grows
   c) A plant that was brought by people to a new land
   d) A plant that has no natural predators

4) Which is an example of an invasive plant?
   a) Oregon Grape
   b) Himalayan Blackberry
   c) Salal
   d) Big Leaf Maple

5) T/F: There are more wetlands today than 100 years ago.

6) Which is an activity that would help to restore a wetland?
   a) Remove invasive plants
   b) Let frogs go free in the wetland
   c) Drain the water
   d) Remove native plants

7) What is a native animal that uses wetlands in the Pacific Northwest?
   a) Platypus
   b) Beaver
   c) Nutria
   d) Bullfrog

8) True/False: Biodiversity is the same in a natural wetland area and in a landscaped park.

9) Choose the best description of an wetland soil
   a) Wetland soils are dry and dark-colored
   b) Wetland soils are wet and rocky
   c) Wetland soils are wet and dark-colored
   d) Wetland soils are rocky and reddish

10) True/ False: Dissolved oxygen is oxygen added to the water through motion and turbulence.

APPENDIX E

TEACHER EVALUATIONS

- **Blank teacher evaluation**

Water Resources Center Wetland Service Learning Project Evaluation

We really appreciate your participation in this project and look forward to hearing your thoughts about what went well and things that we could do to improve the project. Below are a list of questions for you to answer.

Pre-project questions

You were adequately informed of the components of the project including classroom lessons and field trips?

1 2 3 4 5

Strongly disagree *Strongly agree*

The Estuary Partnership staff is easily accessible to answer questions?

1 2 3 4 5

Strongly disagree *Strongly agree*

Was there other information, including background information, that would have been helpful prior to field trips and class visits?

Inquiry Project

The material presented in the classroom was informative and interesting, with an activity that was engaging to your students.

1 2 3 4 5

Strongly disagree *Strongly agree*

The material was appropriate to grade level.

1 2 3 4 5

Strongly disagree *Strongly agree*

Classroom presentations and materials helped prepare students for their exit project.

1 2 3 4 5

Strongly disagree Strongly agree

The Estuary Partnership staff were well prepared and organized for each class visit.

1 2 3 4 5

Strongly disagree Strongly agree

The Estuary Partnership staff were dressed professionally for classroom lessons.

1 2 3 4 5

Strongly disagree Strongly agree

Inquiry activities taking place during field trips were appropriate to help students meet their exit project.

1 2 3 4 5

Strongly disagree Strongly agree

Are there ways to improve the project to help you meet exit project requirements?

Field trips

The field trip length and number of field trips were adequate for this project.

1 2 3 4 5

Strongly disagree Strongly agree

The service learning activities, including invasive plant removal and the planting of natives, were appropriate for the grade level and engaging for the students.

1 2 3 4 5

Strongly disagree Strongly agree

The educational activities during the field trip were appropriate for the grade level and interesting for the students?

1 2 3 4 5

Strongly disagree Strongly agree

The Estuary Partnership staff were well prepared and organized for each field trip.

1 2 3 4 5

Strongly disagree Strongly agree

The Estuary Partnership staff were professional and dressed appropriately for field trip activities..

1 2 3 4 5

Strongly disagree Strongly agree

What changes, if any, would you make to the field trips?

Follow-up

It would have been helpful to have been given follow-up activities to enhance student learning?

1 2 3 4 5

Strongly disagree Strongly agree

Are there ways we could better tie our activities to your curriculum?

Are there other ways, such as teacher workshops, that we can assist your efforts in the classroom?

Are there other topics you would like to see classes on?

What are strengths of our programs? Weaknesses?

Comments or suggestions to improve the class visits and field trips.

APPENDIX F

PHOTOS

- **Photos of project site and students working in the field**

Above: Students from Discovery Elementary School display life-sized example of a bald eagle. Students observed a nesting pair of bald eagles and other wildlife at their restoration site. *Below Left*: Estuary Partnership staff demonstrating planting technique to students from York Elementary School. *Below Right:* Estuary Partnership Staff assisting students from Captain Strong Elementary in compass course designed to improve geography and outdoor skills.

Above: Students from Fisher's Landing Elementary removing invasive Himalayan blackberry. *Below*: Planting site after blackberry stems and roots are removed. Site is flagged for planting native trees and shrubs.

APPENDIX G

MAINTENANCE PLAN

Water Resources Education Center Wetland Maintenance Plan

The maintenance plan for the Water Resources Education Center (WREC) enhancement project will focus on preventing the reestablishment of non-native invasive plants, mainly Himalayan blackberry and English ivy, and monitoring the health of planted native species.

Because the lower wetland site and upland site are both adjacent to public walkways and are used by transient populations, litter removal will also be an ongoing priority.

The WREC offers learning opportunities for school-aged children and adults. We hope to integrate volunteer service as appropriate with our maintenance plan. Volunteers are particularly helpful with weed removal and once properly trained, plant health monitoring. The plan will be implemented by WREC staff and interns.

1 year maintenance plan

May 2006

- Establish upland and lowland photo points.
- Monitor plant health, determine pre-summer survival (overall and by species)
- Manual weed-removal, focusing on Himalayan blackberry and English ivy
- Trash removal

June 2006-October 2006

- Photo-point monitoring
- Lowland and upland sites irrigation as-needed, using soaker hose.
- Manual weed-removal, focusing on Himalayan blackberry and English ivy.
- Trash removal
- Control herbivory as needed.

November 2006-February 2007

- Photo-point monitoring
- Monitor plant health, determine survival.
- Replant dead species
- Install informative signage at upland site for public education.
- Trash removal
- Control herbivory as needed

March 2007-May 2007

- Photo-point monitoring
- Monitor plant health, determine post-winter survival
- Manual weed-removal, focusing on Himalayan Blackberry and English ivy.

- Trash removal
- Control herbivory as needed.

Year-end

- Determine overall plant survival (including replants) and evaluate which species are best suited for future plantings at upland and lowland sites.
- Determine the need for irrigation during the summer of 2007, and potentially 2008. Repair and/replace damaged irrigation equipment for future use.
- Continue with scheduled trash removal and herbivory control.