Interactive Science Learning Program for Elementary School Students at Beazell Memorial Forest in Philomath, OR

by
Reid Smith Sweetkind

A PROJECT
submitted to
Oregon State University
University Honors College

in partial fulfillment of
the requirements for
the degree of

Honors Baccalaureate of Science in Biology
(Honors Scholar)

Presented 4 August 2015
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The FOCUS (Forest, Organisms, Creeks yoU Study) field trip program was developed to provide elementary students in Benton County, Oregon with a hands-on, environmental education experience at Beazell Memorial Forest. Students participated in activities dedicated to specific habitats and organisms found at Beazell that built upon their learning at school. The program was evaluated for its success in creating a valuable learning experience for students, being developmentally appropriate for the grade levels, and introducing people to a natural area they were unfamiliar with. Student learning demonstrations, and teacher and student feedback provided the means of evaluation—all demonstrated that the program was successful.

Key words: environmental education, interactive science learning, Beazell Memorial Forest, FOCUS

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I understand that my project will become part of the permanent collection of Oregon State University, University Honors College. My signature below authorizes release of my project to any reader upon request.

Reid Smith Sweetkind, Author
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Summary

The FOCUS (Forest, Organisms, Creeks yoU Study) field trip program was developed to provide elementary students in Benton County, Oregon with a hands-on, environmental education experience at Beazell Memorial Forest. The program was created to provide valuable, grade-level appropriate, hands-on science learning experience for students, to get youth outdoors, and to introduce students and adults to a local natural area.

Three program dates were held in the spring of 2015—April 21, April 28, and May 19. A total of 164 students participated in the program from Philomath Elementary, Adams Elementary, and Blodgett Elementary. While at FOCUS, students built upon their

Photo 1: A student, from Adams Elementary, makes observations about fallen log near the nurse log on the Plunkett Creek trail. *Photo taken 5/19/2015*

Photo 2: Students from Blodgett Elem. and Adams Elem. use their listening skills to observe the forest around them during Sounds Around activity. *Photo taken 5/19/15*

Photo 3: Reid Sweetkind teaching students, from Philomath Elementary School, about nurse logs. *Photo taken 4/28/15*
learning at school and participated in activities dedicated to specific habitats and organisms found at Beazell. The three major habitat types studied were riparian, Douglas-fir/oak forest, and oak savanna. Activities covered topics of food webs and food chains, organisms as environmental indicators, native species identification, and understanding different habitat types in relation to ecosystem diversity.

The program was evaluated for its success in meeting the aforementioned goals. Demonstrations of student learning accompanied by teacher and student feedback provided the means of evaluation—all verified that the program was successful. Some of the feedback provided created opportunities for improving the FOCUS program in the future.

This program fits with the Oregon Department of Education science standards for students in 3rd through 5th grades.

The FOCUS program was developed for this thesis within a partnership between Oregon State University Extension Service Benton County 4-H and Benton County Natural Areas and Parks Department.
Background

Environmental education goes by many names: natural resources education, informal science and informal environmental science education, outdoor education, and many more\(^1\). All have one thing in common: the goal of bringing nature and science into the lives and education of all people. Organizations that create and run environmental education programs often focus on one demographic, such as students or minorities, to make meaningful experiences possible for the participants of the programs. There are countless organizations nationally that are creating environmental education programs but this diversity has developed over decades of hard work to expand the perception of education.

Environmental education programs are part of a series of historic laws, acts, and nongovernmental movements. The definition of environmental education is broad—encompassing any form of learning that allows individuals to understand more about the environment\(^2,3\). However, there are several components required by every definition: knowledge of the environment and environmental challenges; attitudes and motivation to improve or maintain environmental quality; and skills to identify and resolve environmental challenges\(^2,3\). All of these components mean that environmental education must focus on understanding the needs and processes of the environment. The aim must be to engage people in understanding the need for preservation and restoration of the natural world.

Programs for environmental education are found in both formal, school/classroom based, and informal, non-school based, learning settings and are dedicated to getting students outside and engaging with the environment. Starting in the 1960s, writers
brought attention to the disappearing natural environment and the consumptive, expansionist culture of the United States of America. These feelings spread through society and into the houses of Congress where many new Acts were introduced as law for the sake of environmental protection and preservation. However, most change was implemented in 1970.

In January of 1970, the National Environmental Policy Act of 1969 was signed into law to create “productive and enjoyable harmony between man and his environment.” Furthermore, this Act promoted efforts for better understanding of the environmental and ecological systems—a nod to environmental research and education. The next major advancement came on April 22, 1970—the creation of an education-based sit in, called a teach-in: Earth Day. At nearly fifteen hundred college campuses, nearly 20 million Americans joined together to demonstrate concern for the environment. This grassroots movement brought scientists, academics, and the general public together for the purpose of educating people about the environment and the perils it faced. While not causing any direct change in the legislation, Earth Day increased awareness of environmental issues and expanded access to environmental education; it continues to bring awareness to environmental issues each year. The last major accomplishment of 1970 was the Environmental Education Act. Passed in October, it created an office dedicated to environmental education in schools and gave funding to states for including curriculum about environmental topics. There were faults with this Act, though; its life span was only 5 years long and had very little funding to accompany it. Nonetheless, the steps made in 1970 were important for furthering environmental education.
After the successes in the 1970s came a lull in the governmental attention to environmental education and policy. During this time many non-profit organizations worked to continue the expansion of environmental education and are still actively working for the same goals today. One such organization is the Council for Environmental Education (CEE); the organization has led the development of many environmental education curriculum materials, most notably, Project Learning Tree (PLT). CEE has gone on to create programs like Project Wild which is a wildlife-focused conservation education program with different curricula for different ages of children and students. PLT is now run primarily by the American Forest Foundation (AFF) and the award winning guides are filled with curricula and materials that have adjustments for students of all ages. AFF and CEE both work to promote stewardship in students and young people through a variety of programs. These organizations provide materials to groups and programs across the country for environmental education.

In 1990, the National Environmental Education Act was passed into law to support environmental education through activities based in schools, universities, colleges, and other educational activities. The Elementary and Secondary Education Act, better known as No Child Left Behind (NCLB), started in 2001 and changed the opportunities for environmental education to be incorporated into curricula by teachers and school districts. The rigid standards made it more difficult for teachers to introduce environmental education techniques and programs into their curricula. The new requirements and standardized testing were met with continuing research about the benefits of involving the environment in the learning of children. Connections were
drawn between attention-deficit disorder (ADD) and attention-deficit/hyperactivity disorder (ADHD) in children and the lack of time spent learning outdoors\textsuperscript{3}.

As a response to NCLB, environmental education advocates began lobbying for new legislation under the title of No Child Left Inside (NCLI)\textsuperscript{12}. The advocates introducing this legislation hailed from the Chesapeake Bay Foundation but people around the country became involved\textsuperscript{12}. NCLI would amend NCLB to require states to develop environmental literacy plans for pre-K through 12\textsuperscript{th} grade students\textsuperscript{13}. The NCLI Act was introduced into the House of Representatives, and was passed, in 2008, but was denied in the Senate\textsuperscript{12}. Time passed and, on February 11, 2015, the Act was reintroduced in both the United States Senate and House of Representatives\textsuperscript{13}. NCLI would drastically expand the opportunities for environmental education program to develop nationally.

In Oregon strides are already being made to increase the use of environmental education programs with the passing of legislation requiring Outdoor School for all Oregon 5\textsuperscript{th}/6\textsuperscript{th} grade students\textsuperscript{14}. Outdoor school programs are, defined by the bill (SB 439), six-day hands-on educational experiences that feature field study opportunities about natural resources, ecology, and the relationship between natural resources and economic/career development in Oregon\textsuperscript{15}. This historic bill directs the Oregon State University Extension Service to assist in providing school districts with outdoor school programs\textsuperscript{15}. With this Act being signed into law new programs must be created to meet the needs of all 5\textsuperscript{th} and 6\textsuperscript{th} grade students in Oregon. To adequately prepare students for their time at outdoor school, new environmental education programs for younger students must also be created to meet the new demand. Similarly, students will have a skill set
developed in their time leading up to and at outdoor school that can be utilized by environmental education programs tailored for older students.

The climate for environmental education is changing nationally, and rapidly in Oregon. The increasing support by legislation provides not only opportunity for program expansion and development but also for funding. Environmental education is, once again, being strengthened by governmental action to allow for an increased understanding of the natural and environmental sciences for students, and eventually, all people.
Introduction

In Benton County, Oregon, there are numerous organizations that provide environmental education programs for people of all ages and backgrounds. Many of the programs are created through collaborations and partnerships between groups allowing for a wider audience within the county.

The Natural Resource Educators Working Group was created in 2004 to help environmental education organizations in Benton County make connections. Oregon State University (OSU) Extension Service Benton County 4-H facilitates the group which meets two to three times annually to talk about current programs, develop new skills, and discuss future partnership possibilities. In 2015 two general meetings were scheduled and a class about adapting environmental education programs to public school science education standards.

The following list of organizations and programs is not exhaustive, only chronicling some of the environmental education happening in Benton County and the Corvallis, Oregon area.

Avery House Nature Center has extensive programing ranging from field trips to classroom visits to homeschool programs to summer camps. Their programs all focus on engaging students in the natural world and understanding local ecosystems. Avery House is under the parent organization of the Corvallis Environmental Center (CEC)—a non-profit founded in 1994 by Corvallis community members. The goals of the CEC are to educate and engage people in the creation of a healthy and sustainable community.

The Benton County Soil and Water Conservation District (BSWCD) provides a wide variety of environmental education programs and resources to the Benton County
community. Most of the educational programs that they do provide are for classes to get experience studying science, such as local aquatic and terrestrial ecosystems, soil types, water sheds and aquatic life, in nature. BSWCD also provides support for teachers and other environmental education organizations through trainings, grant opportunities, supplies and equipment, and environmental education lessons. As a Soil and Water Conservation District, the BSWCD promotes stewardship and implements conservation efforts. In 2011 a partnership between BSWCD and OSU Extension Service Benton County 4-H created a program called Teen Weed Spotters. Each year 10th-12th grade students from a Benton County school, changing from year to year, learn about invasive plant species to different habitat types in Benton County. The students also learn about invasive species prevention, management, and eradication while removing weeds from private and public lands.

Oregon State University has several groups creating environmental education programs for the Benton County and Corvallis community. One such group works in the College of Forestry as the OSU Research Forests. This group organizes a community event each year in May as part of National Get Outdoors Day. The event promotes health and activity and gets families into nature. OSU Research Forests works with OSU Extension Service Benton County 4-H to organize activities and other community groups at Peavy Arboretum to create a variety of experiences for participating families. The event is bilingual, English and Spanish, which helps to engage a wide cross-section of the Corvallis and surrounding communities.

Another program from OSU is called STEPs (Scientists and Teachers in Education Partnerships). The program was created to enhance science, technology,
engineering, and math (STEM) education for 6th to 12th grades. The program provides teacher trainings and science learning events for students; additionally, the program has equipment that can be loaned to participating teachers.

OSU Extension Service Benton County 4-H is another OSU affiliated organization that develops programs for students of local schools and provides support to educators, both formal classroom teachers and non-formal environmental educators. Some of the programs are in partnership with organizations listed above including Get Outdoors Day and Teen Weed Spotters. Other programs for student targeted environmental education are the Wildlife Stewards program and the Oregon Season Tracker Schools program. The Wildlife Stewards program works with schools to help students learn about habitats and wildlife on, or near, the school yard. This program hosts a conference, called the 4-H Wildlife Stewards Summit, each year—students research local plant and animal-related topics and create posters or presentations for the Summit. The Oregon Season Tracker Schools program introduces students and teachers to citizen science networks; the students collect rainfall data and plant phenology data at their school for the citizen science networks. Both of these programs integrate scientific thinking and methodology into the everyday learning of students.

OSU Extension Service Benton County 4-H created a new partnership with Benton County Natural Areas and Parks Department for the creation of their newest program, the program developed for this thesis, FOCUS (Forests, Organisms, Creeks yoU Study). The FOCUS program differs from other OSU Extension programs and fills a niche in the Benton County community. This program was created to engage students from underserved schools in environmental education by making the fee affordable and
the curriculum suitable for all students between 3rd and 5th grades. The mission of FOCUS is different from other programs available in 2015.
Project Overview

The goal of this thesis project was to create and evaluate a field trip program that would engage students in science in a natural setting. The program would be evaluated in terms of its success in introducing a diverse cross-section of local students to environmental education, the effectiveness of the education materials, and the applicability to the new program to preexisting and future learning of the students.

The program that was developed was called FOCUS (Forest, Organisms, Creeks yoU Study). FOCUS was created specifically for a Benton County Natural Area, the Beazell Memorial Forest, with the primary goal to expose more students to nature and provide them with hands-on science education.

FOCUS was created through a partnership between OSU Extension Service Benton County 4-H and Benton County Natural Areas and Parks Department. The partnership was beneficial to both parties: for the OSU Extension Service Benton County 4-H, FOCUS could be run without incurring rental fees for using the site, for Benton County Natural Areas and Parks, the program would fulfill part of the forest’s management plan—use of the forest for environmental education\(^\text{26,27}\) and also meet goal of introducing new people, both children and adults, to Beazell.

FOCUS was advertised by the staff at the OSU Extension Service in February 2015 to Benton County 3\(^{rd}\) to 5\(^{th}\) grade teachers. Three dates were made available; initially one classroom was expected per program date. Within hours of the advertisement being sent out all of the dates were filled – and not just filled, but double booked. The
plan for one classroom per date was changed to accommodate two classes on the first two dates and three classes on the third date. In total 168 students were expected to attend over the three days; another 160+ students were placed on a waiting list in case another class could not attend. As the FOCUS program was expanding beyond the initial expectations of either of the partner organizations, a similar but separate program was being discussed for development by the OSU Extension Service Benton County 4-H at an OSU Research Forest. The programs were consolidated and this thesis project was created.

The FOCUS program would not have been possible without the work of nearly a dozen volunteers. These people helped to facilitate and lead the activities, organized students, document the program, and provided valuable knowledge about biological topics (e.g., macroinvertebrates, lichens, etc.). All FOCUS volunteers were trained, prior to the program dates, to teach lessons; the volunteers were contacted through their connection with OSU Extension Service Benton County 4-H.

**Project Components**

Work conducted under this thesis project supported development of the FOCUS program student booklet used in the field and learning activity curricula, teaching parts of the curriculum at all of the program dates, evaluation of the effectiveness of the curriculum and overall program, and logistical support (e.g., creating booklets, assembling curriculum supplies, and assembling packets for teachers, etc.).

The student booklet is presented in Appendix 1. All of the curricula for the 2015 FOCUS program are presented in Appendix 2; the developer for each section is identified
History of Beazell Memorial Forest

Each piece of the FOCUS curriculum was specific to Beazell Memorial Forest and reflects the organisms, habitats, and ecosystems found there. The Beazell Memorial Forest was donated to the Benton County Natural Areas and Parks Department in 2000 by Fred Beazell in the name of his wife, Dolores. The Beazells donated it for public use and environmental education purposes. Prior to the ownership by the Beazells the Plunkett Family owned and lived on the land. The Plunkett’s farmhouse still stands in the forest near the parking lot; their barn is also still standing but was renovated in 2005 into an Education Center. The forest is currently operated under a progressive...
ecosystem management plan to
protect, conserve and restore its native
and natural state. In November 2014
an ice storm damaged trees at Beazell
Memorial Forest and in Kings Valley,
where the park is located. The storm
uprooted small trees and caused
breakage of many large tree branches; the county cleared the trails and removed the fallen
branches but the fallen trees along Plunkett Creek remain as a natural element of the
forest.

**Funding**

Funding for development and implementation of the FOCUS program came from
a grant from the Benton County Commissioners. A budget of $5,717.83 was needed—
this covered supplies such as microscopes and clipboards, printing costs for booklets and
evaluations for teachers and students, and bus costs for transportation of students to
Beazell Memorial Forest on the day of their field trip. The developers and leaders of
FOCUS, including Maggie Livesay, Reid Sweetkind, and Adam Stebbins, attended a
meeting with the commissioners to explain the purpose of the program and how it would
integrate into the education and wellbeing of the students. The program was fully funded
by the commissioners. The attendance fee for FOCUS was $3/student; without county
funding the fee per student would have been higher to cover the costs of program creation
and implementation. An additional $1,000 was set aside by the commissioners as
scholarship money for students attending the program. Although the scholarship money
wasn’t used during the 2015 sessions, this fund will remain active for use by future FOCUS participants. Many of the costs incurred during the first year of FOCUS will not be incurred again (e.g., the four microscopes will not need to be repurchased, a majority of the curriculum now exists), making the cost of running the program in the future much less than the cost of the pilot year.

**Demographics**

Students from three different elementary schools within Benton County attended the three program dates. Philomath Elementary sent 107 students from four classrooms; Blodgett Elementary sent 10 students from one classroom; Adams Elementary sent 47 students from two classrooms. As seen in the table of attendees (Appendix 4, Section E), the majority of these students had never been to Beazell Memorial Forest before. Although specific numbers were not collected, many of the adults participating in the program had not been to Beazell before either—this information was provided during conversations with both teachers and chaperones. The connection with Benton County Natural Areas and Parks in this program made introducing new people, both children and adults, to Beazell an important goal for FOCUS.

When the program registration was opened, more classrooms applied than there was space available. The classes from Alsea Elementary and Mountain View Elementary that could not be accommodated were put on a waiting list. The classes that attended FOCUS during spring of 2015 were all 3rd grade or 3rd/4th grade. The classes on the waiting list were between 4th and 6th grades. The age range target was between 3rd and 5th grade students, and the classes that registered show that the FOCUS program is of interest to teachers within, as well as outside, the intended range.
FOCUS Activities Overview

FOCUS was created to get students outdoors and to involve them in hands-on science experiences in a local natural area. Learning activities were created to align with the curriculum that students were learning in school. Because of the grade range target of 3rd to 5th grades, the activities were designed to cover a wide variety of subjects within the realm of life sciences. Beyond these basic teaching goals, it was very important that FOCUS get students engaged and excited about learning outdoors and, specifically, about science.

During FOCUS students were divided into four rotation groups. With an average of around 55 students in attendance at each session, rotation groups ranged between 12 and 14 students. This smaller size allowed for students to get more one-on-one time with instructors and allowed the activities to be exploratory for the students. Each group would rotate through each activity over the course of the day, and the activity instructors stayed at their activity. Rotation groups were named for native species found at Beazell Memorial Forest – long-toed salamanders, gray squirrels, Taylor’s checkerspot butterflies, and Rufous hummingbirds. Volunteers, teachers, and chaperones helped to facilitate the movement of students from one activity to another.

The activities were created to engage students in the study of the environment and other scientific topics. To encourage students to think about the learning activities scientifically, a field journal was created specifically for the FOCUS program. The booklet can be found in Appendix 1. Each page focused on a specific activity—the pages directed students to log location, time, and weather as well as make predictions, write down or draw their observations, make comparisons, and draw conclusions using what
they found. The booklet also contained a map to help students gain understanding about the space around them on a larger scale and a short history of Beazell Memorial Forest.

In addition to the main activities, there were two areas of the booklet that were not extensively used during FOCUS. The first, found on the back cover of the booklet, was designated for a Free Choice Learning exercise was set up inside the Education Center as a “time filler” for students during lunch or breaks between main activities. On the day of the first session, three tables were set up—one with art supplies for nature inspired bookmarks, the second had supplies for nature crafts such as leaf rubbings, and the third held an array of objects that ranged from items that could be found at Beazell (antlers, seed cones, roots, etc.) to items that would have been used by early European settlers of Kings Valley (spindles, cards for cleaning wool, iron tools, etc.) to drawings of animal tracks that might be seen at Beazell or in the surrounding area. Only the last of the three tables was used, so an adjustment was made for the second and third sessions and only the identification table would be set up. At each session, only a few students used this section of the booklet.

The second area that was not used is found at the bottom of the second page of the booklet, called “Un-Nature Trails.” Originally, this section was going to be used as a filler activity after the Fallen Log activity ended. In this activity, small items are hidden along a transect which students walk while looking carefully for the items. The students then report what they saw to an instructor and if they found everything they completed the task, if not then they go back to the beginning and start again. In this activity students do not speak so as not to disclose item locations to their peers. The Un-Nature Trails activity was a back-up activity that was not used at any of the 2015 FOCUS dates.
Explanations of all of the activities that were taught at the 2015 FOCUS dates are below. The complete curricula for all of these activities can be found in Appendix 2.

Earth Manners

The Earth Manners activity was the first of the day and students were introduced to important aspects of environmental stewardship. Instructors talked about an individual’s impact on the forest and stressed the importance of “leave no trace” use of natural areas. Then four tactics for appreciating the environment were introduced: Owl Eyes, Deer Ears, Dog Nose, and Fox Walk. Students would use each of the first three to make observations of the living and non-living things around them and the Fox Walk, walking very quietly, would be used to allow for opportunities to see wildlife. Throughout the day, instructors would call upon the use of these learned skills during the other activities. This activity was adapted from Project Learning Tree (PLT), (activity number 87,29 and an activity developed by the University of Washington Botanical Gardens30

Sounds Around

The Sounds Around activity was designed to improve skills in observation of sounds. To start the activity students were asked to spread out along a trail, face north, be silent and listen carefully. The students wrote their names at the center of their circle and draw an arrow towards the top of the page and then wrote N or north under it. Using the large circle on the second page of their booklets students were to make a map of what they heard. As they heard something they would write the name of that thing down on their circle in the same general direction (i.e. if a student heard a bird directly to their left
they would write down “bird” on the edge of the circle where the marking for east would go on a compass). After around 5 minutes of listening, the instructor would ask students to share what they heard by adding it to a cumulative sound map, a larger version of what was in their booklets, on a laminated poster board. This activity helped students to realize that at different points on a trail different things can be heard and thus that listening is a powerful tool for understanding what is around. This was adapted from the PLT activity 429.

Fallen Log

In the Fallen Log activity, students hiked up the trail along Plunkett Creek to a gazebo next to a fallen log, or nurse log. Before starting with the activity-specific lesson material, all students filled out the top of the Fallen Log journal page (page 5 in the booklet)—detailing time, weather, and habitat type. Students would then review the basics of food webs and food chains with the instructor. At this time, they would be introduced to the concept of decomposers. The review helped students prepare for observing the nurse log and identifying its role in ecosystems. Before observing the log, students would make predictions about what they would see on top of, around, in, and under the log. The students drew or wrote down their observations in the labeled boxes in their journal. Once they had made their observation of the nurse log, students were asked to make comparisons between the nurse log and a recent fall, a tree that had come down in November of 2014. To finish the activity, students were asked to share their observations about the nurse log, their comparisons between the nurse log and the recent fall, and their reflection of the accuracy of their predictions. To end the lesson, students would point out other nurse logs in the area and be able to explain why nurse logs are
important to the natural habitat. This was adapted from Oregon State University Extension Service Education Kits and PLT activity 2329.

Lichen Survey

During the Lichen Survey activity, students were introduced to the different forms of lichen—crustose, foliose, and fruticose. Before detailing the specifics of lichens, all students filled out the top of the Lichen Survey journal page (page 4 in the booklet)—detailing time, weather, and habitat type. After making those observations, the instructors presented examples of the different forms of lichen. Instructors found that most of the students, as well as many of the adults, did not know what lichens were and could not tell the difference between lichens and mosses31. The intention of the activity was to quantify the number of each form of lichen in a survey area and compare lichen abundance to air quality—this lesson had to be expanded to include an overview of lichen biology and comparisons between lichens and mosses along the trail. Students were asked to rate the air quality at Beazell based on proximity to pollution generators (factories, cities, highways, etc.) and were told that the more complex lichen types of foliose and fruticose required high quality air to survive. Once students had a basic understanding of the lichens and of the environment of Beazell, they broke into pairs to survey a tree along the Bird Loop at Beazell Memorial Forest; the survey results were compiled onto a chart. Students compared the abundance of different lichen types to the determined air quality to evaluate which forms were better able to survive at Beazell and in different air quality conditions. Students were encouraged to examine the lichens in their school yard to make a conclusion about the air quality at the school compared to Beazell. This activity was
created as part of Oregon State University Extension Service Willamette Valley Ecology Field Card curriculum and adapted for students attending FOCUS.

**Water Quality and Macroinvertebrates**

During the Water Quality and Macroinvertebrates activity, students were able to explore Plunkett Creek at Beazell Memorial Forest. Before starting with the activity-specific lesson material, all students filled out the top of the Water Quality journal page (page 6 in the booklet)—detailing time, weather, and habitat type. Students took water samples and tested it for pH, dissolved oxygen (DO), and temperature. They recorded the results on the corresponding booklet page. Then, students caught macroinvertebrates living in or around the creek and brought them back to the laboratory space in the Education Center for further study. Each macroinvertebrate was identified by the students using dichotomous keys and identification pages from laminated field identification books. The macroinvertebrates were drawn and students were helped to classify them. They were further classified by their water quality requirements; the three categories of water quality requirement were fair/poor, good, and very good. Students helped to create a graph of how many macroinvertebrates from each classification were found. This graph was compared to the water quality data the students had collected. Students were then able to determine the water quality of Plunkett Creek and to see the relationship between water quality and the types of organism that inhabit the creek. Students were encouraged to use their knowledge about macroinvertebrates to examine a creek near their school to determine its water quality. This activity was created specifically for FOCUS.
Wildlife Investigations

Students were given the opportunity to explore and discover how animals can be found through tracks and other evidence during the Wildlife Investigations activity. This activity was the least structured of the four main activities (Fallen Log, Lichen Survey, Water Quality and Macroinvertebrates, and Wildlife Investigations). Before starting their hike along the Bird Loop, all students filled out the top of the Wildlife Investigations journal page (page 3 in the booklet)—detailing time, weather, and habitat type. As they hiked, students circled animals or organisms they saw and made food chain connections using the pictures provided in their booklets. The instructors pointed out evidence of animal presence as the group hiked along the trail: antlers, tracks near the stream, bird nests, scrapes on tree bark from rubbing of antlers, feathers, burrows, seed cone piles, and anything else they saw. Students were encouraged to ask questions and point out observations throughout the hike. The goal of this activity was to make observations and learn to identify local wildlife by evidence of their presence. Students were encouraged to search for evidence of wildlife when back at school. This activity was adapted from lessons created for the Oregon State University Extension Service Willamette Valley Ecology Field Cards curriculum and from lessons by Outdoor Action.

State Science Standards met by the FOCUS Curriculum

The curriculum for this program was created with the goal of meeting the state science standards for all students that participated in FOCUS. The science standards this program met during 2015 sessions were from the Oregon Department of Education Science Standards 2014. These standards reflect the Next Generation Science Standards.
(NGSS) for all public school students. The standards met by this program meet are listed below:

- **3-LS4-2** Use evidence to construct an explanation for how the variations in characteristics among individuals of the same species may provide advantages in surviving, finding mates, and reproducing.

- **3-LS4-3** Construct an argument with evidence that in a particular habitat some organisms can survive well, some survive less well, and some cannot survive at all.

- **3-LS4-4** Make a claim about the merit of a solution to a problem caused when the environment changes and the types of plants and animals that live there may change.

- **4-LS1-1** Construct an argument that plants and animals have internal and external structures that function to support survival, growth, behavior, and reproduction.

- **5-LS1-1** Support an argument that plants get the materials they need for growth chiefly from air and water.

- **5-LS2-1** Develop a model to describe the movement of matter among plants, animals, decomposers, and the environment.

**FOCUS Learning Goals**

Students were provided with information about many different topics while at FOCUS and each activity met some of the state science education standards. Specific goals for student learning from the complete program were developed to allow for evaluation of the program. Other goals of the program have been discussed previously.
The student learning goals are listed below:

- Better knowledge of Douglas-fir/oak forest, oak savanna, and riparian ecosystems
- Understanding of diverse wildlife habitats and native biodiversity
- Use of critical thinking skills
- Gain sense-of-place for Beazell Memorial Forest
- Learn about food chain/food web interactions of native species
- Learn about biological indicators of environment quality

The first four goals listed relate to all of the learning activities; the last two goals relate to one or two of the activities.
Evaluations

The evaluations for the FOCUS program were created to gain understanding of the successes and deficiencies of the activities and overall programing. This year we assessed the FOCUS program for areas of program delivery that were well received by the students and teachers and areas that needed improvement. Due to the compressed timeline between receiving funding and delivering the program, assessment of student learning outcomes was not the first priority; the program needed to be created and launched, development of assessments is a priority for year two of the program. For the first year of FOCUS, the evaluations were created as a mechanism to receive general feedback from students and teachers; feedback from instructors and volunteers was received verbally. This section describes the different evaluations that were used and summarizes the results. Blank evaluation forms are provided in Appendix 3 and evaluation data are presented in Appendix 4.

Student Evaluations

The evaluation given to students was structured to gauge grade appropriateness of activities and effective delivery of information in an outdoor setting. The student evaluation form is found in Appendix 3, Section A. All of the evaluation forms were separated by classroom but were otherwise anonymous. The information from these assessments could not be compared to any other data set nor could it quantify any individual’s learning. As no pre-trip assessment of learning was created, no conclusions can be made about how much of the information was learned during FOCUS versus other experiences. Rather the results illustrated which activities, or aspects of activities, were
well represented with high scores from all students—and, thus, it can be inferred that these activities were successful.

It is important to recognize the possibility of a bias when comparing the schools or sessions because not all students have the same background of scientific knowledge; each teacher meets the required standards differently which means that students from each class will have a slightly different experience going into FOCUS. Another bias may come from the location of the schools the students attend: Blodgett Elementary students go to school in a forested area while students from Philomath Elementary and Adams

![Score Distribution Graphs](image)

**Figure 1:** Learning assessment of students from overall score on evaluation. Score is the number of points earned out of the 8 possible for correct answers. (A) All students from Philomath Elementary School, (B) all students from Adams Elementary School, (C) all students from Blodgett Elementary School, (D) all students that participated in FOCUS during Spring of 2015.
Elementary go to school in more urban settings. This may give Blodgett students more first-hand opportunity to see the organisms or processes discussed during FOCUS than students from the other two schools.

Prior to creating the activities, the FOCUS team researched the standards that all third, fourth, and fifth graders were expected to meet. By understanding the classroom standards, the activities at FOCUS were designed to tie into topics that students were learning about or already knew. Activities were created for this age group and specifically for Beazell Memorial Forest. The questions on the evaluation were directed at each individual activity. When combined, they assessed learning throughout the whole program.

To understand the success of the FOCUS program as a tool for student learning, each question on the evaluation was graded for correctness. There were eight questions for students to answer and each was given one point possible. Each assessment was scored out of the possible 8 points.

Figure 1 separates the total assessment scores by school (A) Philomath Elementary School, (B) Adams Elementary School, and (C) Blodgett Elementary School. The x-axis of all of the graphs in Fig. 1 is the number of points a student scored out of 8 possible; the y-axis of these graphs is the percent of

<table>
<thead>
<tr>
<th>School</th>
<th>Mean Score</th>
<th>Median Score</th>
<th>St. Deviation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Philomath</td>
<td>4.6</td>
<td>5</td>
<td>1.8</td>
</tr>
<tr>
<td>Blodgett</td>
<td>5.7</td>
<td>6</td>
<td>1.5</td>
</tr>
<tr>
<td>Adams</td>
<td>6.3</td>
<td>7</td>
<td>1.2</td>
</tr>
<tr>
<td>Overall combined</td>
<td>5.2</td>
<td>5</td>
<td>1.8</td>
</tr>
</tbody>
</table>

Table 1: Students answered questions about information they learned during their trip to FOCUS as part of their evaluation; these questions were graded for correctness. Each blank or question part had one point associated with it—there were eight points possible on the evaluation.
students that received a particular score within that sample of students (i.e. sample being all students from a school or all students that participated in the program). All students from all schools are represented on the cumulative graph (D) of Fig. 1. From the graphs in Fig. 1 and the data in Table 1 it can be seen that students from Adams scored higher overall than students from other schools. However, this information may reflect the biases of teacher emphasis, classroom experience with topics, and location rather than information learned during FOCUS. The trend seen in the cumulative graph (Fig. 1. D.) of most students scoring 5, 6, or 7 points out of 8 possible gives the impression that students learned most of the information taught at FOCUS but, because of the structure of the evaluation, it is impossible to differentiate between prior knowledge and what was learned during their time at FOCUS. The overall scores do not give useable information about student learning outcomes from the program.

For an understanding of the successes of the individual activities, which can be extrapolated to understand the success of the FOCUS program, the assessments were broken down into the categories of the four major activities: Fallen Log, Lichen Survey, Water Quality and Macroinvertebrates, and Wildlife Investigations. Each activity related category was then graded for correctness and scores for each activity were compiled by school and by program session that the students attended. As with the overall assessment score, biases between the schools and teachers make direct comparisons difficult; overall trends in the scores give more information about the success of the activity.
Starting in third grade, students were expected to have an understanding of food chains and food webs – this prompted the Fallen Log activity to be included in the program. It was expected that most students would be able to demonstrate the ability to make a food chain as part of the assessment. Students were asked to fill in three blanks (for primary producer, herbivore, and carnivore). Each blank was given one point—three points could be earned by creating a completely correct food chain. Points were given for any correct food chain including ones that did not occur at Beazell Memorial Forest. In Fig. 2 are the scores for the food chain evaluation question of all students that participated in the program. The information is separated in two ways: by the session the students attended (April 21, April 28, or May 19, 2015), in (A), or by the school they attend, (B). Most students were able to create a food chain comprised of a primary producer, herbivore, and carnivore – indicating that this activity was able to reinforce learning about food chains and food webs.
The activity about lichens had little background in the state science standards for students to draw upon. This meant that the instructor had to spend more time discussing the basic biology of lichens and less time discussing lichens as indicators of air quality. Students were asked to identify a lichen form based on a drawing and which air quality that type of lichen required. The two questions allowed for two points possible for this part of the assessment. In Fig. 3 the collective scores for the lichen questions on the student evaluations are in (A) and (B) separated by the session that students attended or by school that the students attended, respectively. There is an overall trend that most students got only one of the two parts correct; (C) was created to identify which of the two parts was answered correctly most frequently. Considerably more students were able...
to identify the type of lichen drawn on the evaluation (97.67%) but were unable to identify its tolerance to air pollution. Only 2.33% of students had the correct air pollution tolerance but the incorrect lichen type. This makes it clear that students needed more help digesting information about air quality indication during the activity.

Students are exposed to the idea of environmental features relating to organismal survivorship starting in third grade; this concept was a main topic for the Water Quality and Macroinvertebrates activity. During the activity, students were asked to connect the types of macroinvertebrates found in Plunkett Creek to the water quality and in the assessment students were asked to recall the concluded water quality. This was the only question relating to this activity on the assessment so there was one point possible for students to earn. In Fig. 4 the scores from the student evaluations on the water quality question are presented. Fig. 4 (A) has the scores separated by session that the students attended; (B) shows the scores separated by the school that the students attended. Overall,

![Figure 4: Assessment of student learning of Plunkett Creek water quality from the Water Quality and Macroinvertebrates activity. (A) Student scores separated by FOCUS program date they attended. (B) Student scores separated by school.](image-url)
most students were able to correctly identify that the water quality of Plunkett Creek was “very good.”

The Wildlife Investigations activity was developed to encourage students to think about how the different habitats throughout Beazell supported different organisms and why some habitats were better suited for certain animals. The students were exposed to different kinds of tracks as well as other evidence of animals through different habitat types; these clues were then used to identify what animals had been in the area and why it was a desirable habitat for them to live. On the assessment, students were asked to identify two tracks, deer and raccoon, which they had seen along the trail during this activity. Students in session 2 (April 28, 2015) did not see raccoon tracks during this activity as the track was not placed along the trail for students to observe; for sessions 1 and 3 a volunteer planted raccoon tracks for identification. The two identifications on the assessment meant there were two points possible for this activity. Student scores from the evaluation questions about animal track identification are seen in Fig. 5. Graph (A) has

![Figure 5: Assessment of student learning of animal tracks from the Wildlife Investigations activity. (A) Student scores separated by FOCUS program date they attended. (B) Student scores separated by](image)
the scores separated by the session that the students attended; (B) has the scores separated by school. It is important to note that the students who attended the second session were not shown a raccoon track during the Wildlife Investigations activity. This put those students at a disadvantage when answering the questions on the evaluation. Knowing the imposed bias, the overall trend was that students were able to recognize tracks that they learned about at FOCUS.

To understand the success of introducing students to a local natural area, all students were asked on the evaluation whether they had been to Beazell Memorial Forest previously. As seen in Table 4 (Appendix 4, Section D) only 23% of the 164 students had been to Beazell before the FOCUS program. Adults attending FOCUS were polled during their trip and showed a similar frequency of previous use of Beazell.

Information collected from the evaluations created by the organizers of the FOCUS program for the 2015 sessions can only be used as a general guide. Understanding the true successes and failings of FOCUS had to be drawn out of other sources including teacher feedback and experiences of FOCUS instructors and volunteers.

**Teacher Evaluations**

Teachers were asked to comment on the program through a series of open-ended questions on their evaluation form. The intent of this form was to get feedback from the teachers about the successes and shortcomings of the program. A blank teacher evaluation form is found in Appendix 3, Section B. The responses the teachers gave were not kept anonymous. The questions on the form are directed towards student experience, engagement, and learning, as well as the applicability of the program to their classroom
curriculum. The information gained from these evaluations will be used to improve activities and other parts of FOCUS.

The evaluations for teachers were much different than the student evaluations as it was feedback based. Table 2, in Appendix 4, Section D, highlights the responses from the teachers that participated in the program; quoted comments can be found in Appendix 5. All of the teachers responded that they would return to FOCUS in the future and remarked that the program was “developmentally appropriate” for the participating 3rd-4th grade students.

Several teachers gave specific advice on how to improve the program which are discussed further in the Improvements section of this paper.

**Field Trip Evaluations from Mr. Behrens’ Third Grade Class**

One teacher that brought his class to FOCUS, Mr. Gerhard Behrens from Adams Elementary School, included additional evaluations of the program from his students. His students are asked to fill out evaluations that Mr. Behrens creates after every field trip. The questions included on this evaluation are open-ended and ask what students learned at FOCUS versus what they already knew, what they would change about the program, and their favorite thing about the field trip. The format that Mr.
Behrens used was similar to writing a field journal page about the trip—students were asked to draw pictures about their observations and write their conclusions about the trip. Overall the format allowed for a good understanding of what his students learned as well as giving the students an opportunity to react to their experience during FOCUS.

A typed example of this evaluation is found in Appendix 3, Section C; a picture of a filled out evaluation is found in Photo 12. As these evaluations were not standard to all classes that participated the information gained cannot be extrapolated to all students of the spring 2015 FOCUS program; however the feedback from the students is valuable for creating a program that students want to attend. The information from these evaluations can be found in Table 3. Students learned new information from every activity and over all felt that the Fallen Log, Wildlife Investigations, and Water Quality and Macroinvertebrates activities provided the most review (frequency of answers in descending order). Students were able to pinpoint many important reasons for public natural areas to exist—all of which are consistent with the management plan goals for Beazell Memorial Forest. Students were generally happy with the program and would not change how it was run although some asked for more downtime in between activities and more time to play and explore.
Table 3: Students from Mr. Behrens’ third grade class at Adam Elementary provided feedback about their experiences at FOCUS. Each column contains a different question that was found on the evaluation and all of the topics that students answered that question with.

<table>
<thead>
<tr>
<th>Which activity taught you the most new things?</th>
<th>Which activity was most a review of what you already knew?</th>
<th>Why is a place like Beazzell Forest important in our community?</th>
<th>If you could change one thing about the trip what would you change if you were a teacher?</th>
</tr>
</thead>
<tbody>
<tr>
<td>Lichen Survey • Water Quality and Macroinvertebrates • Wildlife Investigations • Fallen Log</td>
<td>Fallen Log • Wildlife Investigations • Water Quality and Macroinvertebrates</td>
<td>Public hiking space • Wildlife habitat • Environmental cleanliness • Teaching people about natural ecosystems and habitats</td>
<td>Nothing! • More game time/play time • More hiking • Get to go in the creek/explore fallen log</td>
</tr>
</tbody>
</table>
Improvements and the Future of FOCUS

The first year of FOCUS, spring of 2015, was a pilot program to develop curriculum specific to Beazell Memorial Forest and solve any problems in a new environmental education program. Through feedback from teachers and volunteers, many ideas on how to improve FOCUS for future years have been introduced. All statements of “under development” or “under consideration” are current to the time of publication.

Several of the improvement ideas came directly from the teachers who participated in the program. The first suggestion focused on logistical issues: make the registration and organizational documents available electronically, including letters to parents, photo release forms, permission slips, steps for teachers, etc. The teachers felt that this would make it easier to combine with their standard field trip permission slips as well as reducing the amount of waste paper created. The implementation of this idea would be very simple with the correct organization by the staff at OSU Extension Service Benton County 4-H.

The second idea from the teachers was to separate the post-trip extension activities from the FOCUS booklet. This would allow students to take booklets home on the day of their trip without requiring teachers to have students bring the booklets back to class on a subsequent day. Implementing this idea would greatly improve the experience for students when back at school after the trip; the creation of a separate booklet with copies of the needed information and activities could be sent to teachers prior to the trip allowing them to plan their classroom science lessons to fit with the extension activities. Instructors and volunteers observed that the students who had gone outside for scientific studies at school were better prepared for and better able to
participate in the learning activities at FOCUS. Due to both sources of feedback a booklet of this type is under development.

The third request from participating teachers was to have lessons/materials for use prior to the field trip. Teachers feel that recommendations or guidance on activities to prepare students for the topics they would encounter during FOCUS would help students connect the field trip to their classroom studies. To create this requires more work through the development of new curriculum. Each learning activity at FOCUS would need to be represented in the pre-trip lessons and teachers would need to have access to any lesson materials, such as magnifying glasses or organism samples. The working idea is to create a kit of supplies for teachers to use with their students to fill out a pre-trip booklet prior to arriving at Beazell; teachers would return the lent kit on the day of their field trip. The booklet and kits are under development.

The FOCUS volunteers raised a concern for continuity among information being disseminated at each activity—they suggested that one FOCUS volunteer remain with the same group throughout the day to help students use information from the morning activities in the afternoon. This practice would create continuity throughout the program for each group of students, but would not create continuity throughout all students attending the FOCUS program. The infrastructure of the FOCUS program would need to be changed to accommodate this suggestion as all volunteers would have to be able to help the FOCUS leaders at every station—requiring more time for training the volunteers. This is being considered but is not in the plans for the immediate future of FOCUS.
The last main improvement that is being developed for the FOCUS program is an expansion to the curriculum. With the newer standards (NGSS) being integrated into classroom curricula, the development of new learning activities is needed to maintain the appropriate range of topics for the 3rd to 5th grade range. Topics will focus on environmental effects on the development and behaviors of organisms, the life cycles of organisms, or critical thinking and scientific thinking skills. Development of new curricula require creation of the activity and obtaining materials for use during FOCUS, development of a booklet page for use at FOCUS, and development of pre- and post-trip booklet pages and materials. In future years, new curricula may be created to expand the grade range that FOCUS is able to serve. Currently being developed is a curriculum about birds found at Beazell and in the Oregon coast range. Any additional activities could be substituted in for any of the existing activities depending on the age of the students participating and which activities fit best with the classroom learning for their grade.

The FOCUS program will continue to change as standards and laws evolve and as new resources and tools become available. The program will be offered in the spring of 2016, once again, as a partnership between OSU Extension Service Benton County 4-H and Benton County Natural Areas and Parks. Classes that were put on the waiting list for the spring 2015 FOCUS dates will be given the first opportunity for registration. In the case that there is space remaining, the registration will open to other 3rd-5th grade teachers in Benton County. A main goal is to make the program sustainable for the foreseeable future and to continue to engage students in the science all around them.
FOCUS Statement

FOCUS was created to provide hands-on science learning experiences for students that were appropriate for the grade levels participating and to introduce students and adults to a local natural area. The responses from teachers and demonstrations of student learning indicate the high value of this program within the Benton County community. The opportunities for improvement indicated by teachers and volunteers will ensure that FOCUS grows and progresses in future years to better serve teachers and students.
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APPENDICES
This booklet was designed to engage students with the curriculum and the environment they were studying. Each activity has a page in the booklet, and students used each as a field journal page. Students were first asked to indicate time, weather, location, and habitat type at each activity to encourage scientific approach—by recording this information students were recognizing the variables of studying science outside and developing the habit of recording observations prior to any field work. After those observations were made, students continued with each activity. The booklet also includes a map to help give students a sense of where they were within Beazell Memorial Forest.

The booklets were printed at the OSU Extension Service Benton County 4-H office for each student prior to each session. Upon arrival to Beazell Memorial Forest, students were given a booklet and a clipboard with a pencil attached for their use throughout the day.

The booklet was created by Reid Sweetkind in the model of booklets created previously by OSU Extension Service Benton County 4-H. Design of each activity page was done, by Sweetkind, to reflect the written curriculum. The information page, the second page of the booklet, was written by Sweetkind, and the map on that page was created by the Benton County Natural Areas and Parks Department for this booklet. The back cover, the eighth page of the booklet, was created by Sweetkind for use at the Free Choice Learning table which had no curriculum. The Free Choice table allowed students to predict the uses of historical household items, to determine the animal from which a pelt or antler came, or identify animals by drawings of tracks.
FOCUS
Beazell Memorial Forest
2015

Journal of:

____________________

Date: ________________

http://extension.oregonstate.edu/benton/natural

OSU Extension Service,
Benton County
4077 SW Research Way
Corvallis, Oregon 97333
541-766-6750

Benton County
4-H
Beazell Memorial Forest

Beazell Memorial Forest was donated in 2000 to Benton County for public use and environmental education purposes. There are a variety of habitat types throughout the Park—the three dominant types are upland prairie, mixed woodland, and riparian. Each area hosts a diversity of organisms including the endangered Taylor Checkerspot butterfly. The Park is located in Kings Valley in the Central Oregon Coast Range; it is 10 miles north-west of Corvallis, OR.

Trail Map:
**Sounds Around**

---

**Un-Natural Trails**: Check off what you find!

<table>
<thead>
<tr>
<th>Clothes pin</th>
<th>Pipe cleaners</th>
<th>Spoon</th>
<th>Straw</th>
<th>Plastic bug</th>
<th>Thumb tack</th>
<th>Pencil</th>
<th>Binder clip</th>
<th>Rubber band</th>
<th>Ball-chain</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Wildlife Investigations

Location/Habitat: **Bird Loop**

Time ______________ Weather ______________

Where tracks were found: ______________________

Draw the animal tracks you see in the space below:

What type of animal do you think left this sign?

________________________

Circle the species you find at Beazell and connect the species below to create a food chain!

What species do you see at your school?

________________________

________________________
Lichen Survey

Location/Habitat: Bird Loop/

Time ____________________ Weather ____________________

How clean is the air? Look for factors in this list:

- Far from human influence
- Industrial area
- Park
- Busy highway nearby
- Residential small town
- Near major pollution source
- City (large)

Rate your area on this scale (circle your answer):

<table>
<thead>
<tr>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
<th>6</th>
<th>7</th>
<th>8</th>
<th>9</th>
<th>10</th>
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</thead>
<tbody>
<tr>
<td>Clean air</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Dirty air</td>
</tr>
</tbody>
</table>

Types of lichen:

- Crusty (crustose)
- Leafy (foliose)
- Shubby (fruticose)

Based on the lichens you observed, rate your area on this scale (circle your answer):

<table>
<thead>
<tr>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
<th>6</th>
<th>7</th>
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<th>9</th>
<th>10</th>
</tr>
</thead>
<tbody>
<tr>
<td>No lichen</td>
<td>Crust-like</td>
<td>Leafy</td>
<td>Some small shubby</td>
<td>Abundant large shubby</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

How do your scales compare? ______________________________

What is different between Beazell and your school?

______________________________________________________
Fallen Log

Location: Plunkett Creek Trail

Time ________________ Weather ________________

Habitat type: _______________________

Label these levels on the food webs:
1) Primary Producer
2) Herbivore
3) Carnivore/Predator
4) Decomposer

Write or draw 4 observations for each area of the nurse log:

IN the log

ON the log

UNDER the log

AROUND the log

How is the fallen nurse log different from other fallen logs in the area?

________________________________________________________________________

________________________________________________________________________

________________________________________________________________________
Macroinvertebrates and Water Quality

Location: Plunkett Creek

Time: ____________  Weather: _______________

Habitat type: _______________________

1. What do you think is the overall water quality health of Plunkett Creek? (circle one)
   
<table>
<thead>
<tr>
<th>Very Good</th>
<th>Good/Fair</th>
<th>Poor</th>
</tr>
</thead>
</table>

Record the following:

<table>
<thead>
<tr>
<th>pH</th>
</tr>
</thead>
<tbody>
<tr>
<td>Dissolved Oxygen</td>
</tr>
<tr>
<td>Water Temperature</td>
</tr>
</tbody>
</table>

Draw, label and identify the parts of a macroinvertebrate using the guides on your table.

The macroinvertebrate I studied is a _______________________

2. After your group completed data collection what do you think is the overall water quality health of Plunkett Creek? (circle one)
   
<table>
<thead>
<tr>
<th>Very Good</th>
<th>Good/Fair</th>
<th>Poor</th>
</tr>
</thead>
</table>

3. What do you think is the overall water quality health of the stream near your school? (circle one)
   
<table>
<thead>
<tr>
<th>Very Good</th>
<th>Good/Fair</th>
<th>Poor</th>
</tr>
</thead>
</table>
## Free Choice Learning Table!

1. 
2. 
3. 
4. 
5. 
6. 
7. 
8. 
9. 
10. 
11. 
12. 
13. 
14. 
15. 
16. 
17. 
18. 
19. 
20. 

What is this your favorite item? Why?

[Blank lines for answers]
APPENDIX 2 – Curricula

The curriculum for this program was synthesized from a variety of sources by three primary creators: Reid Sweetkind, Maggie Livesay, and Jody Einerson. Each piece of the curriculum was made specifically for the FOCUS program and took into account the Oregon Department of Education Science Standards (Standards by Design) from 2014 for third, fourth, and fifth grade students in Benton County, OR. All references to the Project Learning Tree guide (PLT) are included in the bibliography as are any other references. The curricula in Sections A, B, and C were written and researched by Reid Sweetkind.
Earth Manners – adapted from PLT #87 and University of Washington Botanical Gardens

**Learning Objectives**

- Learn how to act appropriately on a trail to preserve the environment.
- Learn techniques for finding wildlife.

**Grade Level**

Grade 3-5

**Activity Time**

5 minutes

**Space Required**

Large enough area to gather students into a circle.

**Background Information**

It is important to help students understand how to respect the environment they are in. There are many ways to appreciate an environment while preserving it for others to enjoy. There are four easy ways to preserve the natural landscape while hiking:

- **Owl Eyes**: Owls and other birds rely on their sight to find food. Students can use keen eyesight to find flowers, small animals, and other details of the forest around them.
- **Deer Ears**: Deer use their hearing to stay alert for danger. Students can use their ears to find birds and other wildlife around them.
- **Dog Nose**: Dogs have a strong sense of smell and this helps them track animals or smell bacon cooking in the kitchen. There are lots of smells in the forest; the smells are different depending on where students are.
- **Fox Walk**: Foxes are very quiet when they walk so they don’t scare away their food. Students can use this kind of walking to allow them to see what an owl might see or hear what a deer might hear.

There are some things in the forest that students must be mindful of, such as poison oak. It is also important that students are mindful of what they leave behind. Students can learn about Leave No Trace during this activity to maintain a clean environment. Packing out any trash they have or find is a good way to leave the trail as nice, or nicer, than when they arrived.

Through this activity students should become aware of their surroundings and how to appreciate them as a group. This activity should also bring their attention to what they should leave behind and what they should take with them.
Activity Instructions

1. Gather the students into a circle outside.
2. Introduce the four techniques outlined above: Owl Eyes, Deer Ears, Dog Nose, and Fox Walk. Have students:
   a. hold hands like binoculars for Owl Eyes
   b. cup their hands behind their ears for Deer Ears
   c. take a deep breath in for Dog Nose
   d. walk quietly around in a circle for Fox Walk – walk heal to toe, setting your foot down very quietly
3. Talk about how it is important to not touch plants or other parts of the environment unless they are shown to. This is to prevent poison oak reactions and splinters.
4. Introduce Leave No Trace. Talk with students about picking up their items, including trash, when they are outside and using their four techniques to enjoy the trails. (Note that it is important to leave flowers as they are so other people can enjoy them.)

University of Washington Botanic Gardens:
http://depts.washington.edu/uwbg/education/Youth/Scavenger_Hunt_Animal_Senses.pdf
Section B – Sounds Around Curriculum

Sounds Around –adapted from PLT Guide

Learning Objectives
- Exclusively use sense of hearing to gain information about the environment.
- Gain spatial awareness through mapping of sounds.

Grade Level
Grades 3+

Activity Time
15 – 20 minutes

Space Required
Outdoor area large enough for each student to sit with 5 feet of space around them.

Preparation
Create circles for each student to use with a line in the center (found in field notebook) and a large circle for a cumulative map (poster boards are pre-made).

Overview
Students will explore the environment around them using their hearing to gain an understanding of the diversity of sounds. This activity will also develop awareness of space by making a map of what they hear and then translating their map into a cumulative depiction of the area.

Background Information
Sounds vary in loudness and softness as well as in pitch. The different combinations of these factors create the distinctive sounds that people are able to identify. In this activity students are asked to identify sounds in their surrounding environment and what direction each sound comes from. Each student will create a map of what they hear around them.

There are two techniques to help students focus on listening: (1), listen with eyes closed, and (2), cup hands behind ears. By closing their eyes, students will reduce the number of distractions they experience and allow for better concentration on what they hear. The second technique is called “focused hearing” and is done by cupping hands, thumbs up, behind ears, with the elbows out; this creates a parabolic reflector which gathers the sound in the ears. This is most helpful for identifying sounds directly ahead.

Through this activity students should become more aware of their surroundings while outdoors. It is important to discuss what each student heard and encourage their spatial awareness. To create this sense of space each student will combine their sound map with the others from their group on one cumulative sound map.
Fallen Log Activity at Beazell Memorial Forest

Learning Objectives

- Identify living and non-living interactions.
- Understand the roles of microorganisms in decomposition.
- Make predictions and evaluate them based on observations.

Grade Level
Grade 3-5

Activity Time
35 minutes includes travel time to fallen log

Space Required
Outdoor area with fallen log(s) and other decaying materials.

Materials

- Magnifying glasses
- Field Notebooks and pencils
- Chart papers for introduction and debrief – include example food chains and food webs and the final observation chart
- Large micrographs of typical microorganisms

Preparation
Educators should visit the site and identify the organism types on, in, under, and around the log.

Vocabulary Words

- Producers
- Consumers
- Predators
- Herbivores
- Carnivores
- Omnivores
- Food chain
- Food web
- Decomposers
- Energy cycling (discuss with older students)
Overview
Students will explore a decomposing log through use of the scientific method. This activity will include discussions of trophic levels, energy cycling, food webs, and organism distribution.

Background Information
Food chains and food webs are the depictions of interactions that occur between trophic levels in order to get energy. Trophic levels are divided into three levels: primary producers, usually plants, are the first; organisms that feed on plants, called herbivores, form the second trophic level; and organisms that feed on the herbivores are the third level, called carnivores. There is one further class of organism: the omnivores feed on both plants and other animals. Food chains are the interactions of one primary producer, one herbivore consumer, and at least one carnivorous predator—omnivores can be included as well but only serve plant-eating or animal-eating roles. There are primary and secondary predators. Primary predators feed on the herbivores and they can be omnivores; secondary predators feed on the primary predators and hold the top spot on the food chain. Food webs are connections between multiple food webs include interactions of herbivores with multiple producers, interactions of omnivores with both plant and animal food sources, and interactions of all organisms with decomposers. Decomposers feed on dead or decaying organisms to make space for new organisms as well as make nutrients available, again, for use by the primary producers. All feeding interactions between living organisms are based on gaining energy. Energy cycling is the movement of energy from one organism to another. Plants have all of the energy from the sunlight available for their use. Herbivores have a smaller amount of the original energy input available because the plants, their food, have already used some of it up. Carnivores have an even smaller amount available because the herbivores and omnivores have already used some of what they ate up.

Activity Directions
1. Have students gather near the fallen nurse log. Discuss the background information about trophic levels—highlighting decomposers, food webs and the energy cycling that happens in food webs. Use the example food chain and food web to explain.
2. Food Web Activity:
   a. Choose one student as the primary producer. Give this student the grass cutout.
   b. Choose two students as the herbivores. Give these students grasshopper and mouse cutouts.
   c. Choose two students as carnivores. Give these students lizard and snake cutouts.
d. Choose two students as decomposers. Give these students the fungi and earthworm cutouts.
e. Using the string provided, have students show the interactions between trophic levels. For example: ask students what herbivores eat then have the two herbivores take the unattached ends of the primary producer strings. Continue with the carnivores and decomposers.

3. Ask students to make predictions based on the following questions:
   a. What kind of life is supported by the fallen log?
   b. Is the distribution of organisms the same for all areas of the log?

4. Using a chart with four quadrants—in the log, on the log, under the log, around the log—have students write or draw their observations. Encourage students to use hand lenses and jewelers loops to see more detail.
   a. To help students focus on the different areas of the fallen log system, spend 2 minutes on each quadrant. Ask the students to write down or draw four things in each quadrant that are different from what the student next to them is writing.
   b. Have students compare the wood of the decaying nurse log to the wood of a recent tree fall. Ask specifically about textural differences and differences in the plant life around/on each log.

5. After ten minutes of observation (adjustable) bring students back to discussion area. Create one large chart with observations from many students included. Then ask the students if they found what they expected in each of the four areas.

Activity Reflection
After the group has discussed the observations, bring the discussion back to the big picture. How are fallen logs important to the health of forest ecosystems? How do each of the trophic levels interact with the fallen log?

Extension of this Activity
If students are remaining outdoors after this activity they may be asked to look for other decomposing logs in other areas. If one is found ask students to observe the plants around this log and compare it to the previous one.
If students have been broken up into groups to explore the log have each group, or a representative from each group, describe four organisms they saw—one from each section. Encourage the groups to list organisms that haven’t been mentioned by others as much as is possible.

Adapted from PLT Guide and OSU Extension Education Kits
Section D – Lichen Survey and Cultural History Curriculum

This curriculum was written by Jody Einerson, OSU Extension Service Benton County 4-H. It is included here as reference for how FOCUS was created and the activities that were done during the spring of 2015. The “Not Lichen Air Pollution” curriculum was also developed by Einerson. This lesson is available to the public through purchase or check out of Willamette Valley Ecology Field Card Kits from the OSU Extension Service Benton County 4-H office.
Bird Loop Trail – west side Lichen and Cultural History Activities (35 minutes including hike time on the west half of the bird loop)

Stop at edge of the forest area for Lichen Activity

Lichen Activity (20 minutes)

Learning Objectives:

- Understand lichen is made up of two different organisms
- Recognize and sort lichens into three types
- Make a prediction and test it
- Perform a simple survey to support prediction and interpret results

Time: 20 minutes

Materials:

- Types of lichen line drawing, Ecology field cards, and samples
- Hand lens
- Survey data sheet in booklet
- Clipboard & pencil
- Marking tape

Overview: Students will learn about a unique organism. They will practice simple scientific method, make a prediction, conduct a simple survey, and interpret the results.

Background Information: See attached Not “Lichen” Air Pollution lesson

Directions:

- Gather students and introduce lichens and how they are different from moss (see background information in Not “Lichen” Air Pollution lesson).
  - Discuss places to find lichen in the forest and back at the school yard (trees & shrubs, rocks, cement curbing).
- Show different lichen types (line drawings, Field Ecology cards and samples from box).
- Introduce the concept that lichens can be used as an indicator of air pollution.
  - Ask the students what they predict the air quality is at Beazell.
- Walk to marked tree and as a group point out and sort the different types of lichen you find (crust, leafy, or shrubby). Fill out an inventory sheet as you demonstrate this activity. It is not necessary to name the lichen, you just to divide it into one of the three different categories.
• Explain that they are to survey the number of lichen they find from the ribbon down to the ground. They count each lichen organism separately and make a tally mark on the inventory under type.
• Break students into pairs and have them find a marked tree along the path. Trees will be marked with a bright ribbon.
• Gather the students and discuss their findings. What did they find? Does it support their air quality prediction?
  o Suggest they do this activity in town at their school and compare their findings.
• Have student watch for lichen as we continue our hike – point out the lichen on the rock pile as you go by

Walk to Gazebo (5 min.)

**Cultural & Natural History of the Oak Savanna**

**Learning Objectives:**

• Understand a savanna is maintained by fire
• Understand resources provided by an oak savanna
• Understand the historical human uses of this location

**Standards:**

**Time:** 5-10 minutes

**Materials:**

• Pictures of resources and wildlife of the savanna
• Hands on visuals

**Overview:** Students will learn about the historical human uses and the wildlife that inhabitant an oak savanna.

**Directions:**

• Gather in the gazebo and look out over the oak savanna.
  o Point out the large oak trees and how this habitat has historically been maintained by fire. Fires set by Native Americans to keep this open type habitat.
• Ask them what would be the benefits of having an open habitat?
  o Increased visibility for hunting, open habitat for growing food (e.g., camas, tarweed, roots), reduce competition for oaks which would produce more acorns.
- Show pictures and hands on visuals (camas & tarweed photos, camas bulb, basket, acorns) demonstrating human uses before European settlement.
- Discuss what wildlife has adapted to this type of habitat and why. (acorn woodpeckers, scrub jays, gray squirrels, elk, snakes, butterflies and pollinators).
  - Why: many depend on acorns for primary supply of food, open area provides good forage for elk, reptiles can gather warmth from sun, meadow flowers are source of food for pollinators.
- Show pictures of wildlife and acorn granary
Not “Lichen” Air Pollution

By Jody Eilerson

Learning Objective
- Be able to recognize general types of lichens.
- Perform a survey for lichens.
- Make predictions about air quality in survey area.

Overview
This activity introduces students to the role lichens play in the environment.

Background Information
Lichens are an organism with a symbiotic relationship between a fungus and its photosynthesis partner (a green alga and/or cyanobacteria). This relationship forms an organism that looks very different than its component parts. Lichens are often confused with moss, but mosses have leaves and stems.

Lichens are a known indicator species, sensitive to acidic air pollution in general and specifically documented in regards to sulfur dioxide (SO₂) levels. The major source of SO₂ is burning fuels high in sulfur such as coal and oil. High levels of SO₂ are found in the air near power plants, paper and chemical manufacturing plants, and areas of high automobile usage. A natural source of SO₂ is volcanic eruptions. SO₂ reacts in the atmospheres to form a major component of acid rain.

Scientists have studied different species of lichens and their reactions to SO₂ levels, and have developed a rating of lichen tolerance. More detailed information on specific lichen species and their tolerance of SO₂ can be accessed on the website http://www.fs.fed.us/rd/og/lichen/. For this activity we will use the rating system of “sensitive,” “intermediate,” or “tolerate.” Generally, hanging, shrubby, nitrogen producing lichens (fruticose type) are most sensitive, leafy lichens (foliose type) are intermediate, and crusty lichens (crustose type) are considered tolerant. In addition, the size of the thallus (or body) of a pollution stressed lichen can be stunted in size. Comparison of lichen size is therefore also indicative and can be used when surveying multiple sites.

Vocabulary Words
- Thallus
- Foliose
- Fruticose

Oregon Educational
Benchmarks
Life Sciences
Understand the relationships among living things and between living things and their environments.

Science Inquiry
Design a simple scientific investigation to answer questions or test hypothesis.

Game Directions
Present background information to students. Discuss what a lichen is, what an indicator species is, what air pollution is.

Have students practice identifying different species of lichen and classifying them in one of the three general lichen types from samples you have collected or from photographs (card #23 and #24 are examples to two types).

Divide students into teams to survey areas for lichens, hand out worksheet, and define area they are to survey.

Students will need to observe and record their predicted score of air pollution on their worksheet. Have them keep a tally of each type of lichen found in their survey area.

Did the student predictions of air quality match what the lichen survey indicated? If not have the students speculate why or why not. Explain that not all air pollution may be visible by just looking.

Extensions
- Have students do further research on lichens as an air pollution indicator. Have them look at different areas as they travel to gauge the air quality.
- Lichens are fascinating organisms. Have students diagram the parts of a lichen, examine lichens with hand lens.
- Lichens play an important part in the environment. Have students research wildlife uses of lichens. Can they include lichens in a food web? Do wildlife use lichens for other things besides food? What are some of those uses?
- Lichens have many human uses. Have students research and report on how they are used (medicinally, dyes, etc.).
- Have the students make a journal of lichens found in their area. Take photos, measurements, note locations found.

Bibliography and Excellent Sources of Information
www.lichen.com - lots of good general information about lichens, and lichen/wildlife and human use. Includes resources with links to other useful websites.
http://mgd.fasco.org/hyperSQL/lichenland/ - Oregon State University Lichenland website geared to students.
Macrolichens of the Pacific Northwest by Bruce McCune and Linda Geiser 1997, Oregon State University Press, Corvallis OR
General Types of Lichens

Crustose (crust) - grows flat and tightly attached to surface; found on ground, rocks, cement, and bark.

Foliaceous (leafy) - has somewhat leaf-like and a general ruffly appearance; found on rock and woody plants.

Fruticose (shrubby) - usually round in cross-section and multi-branching, hangs down or grows upward in a shrub type form; found on woody plants.

Lichen Survey Worksheet

1. Make your prediction! How clean is the air? Many factors can affect air quality. Make a visual survey of your area looking for the factors listed below.
   - Far from human influence
   - Park
   - Residential small town
   - City (large)
   - Industrial area
   - Busy highway nearby
   - Downwind from a major source
   - Additional factors

   Now rate your area on the scale (circle the number) and list factors found.

   Clean air: 1 2 3 4 5 6 7 8 9 10 Dirty air

2. Survey your area and use the chart to record the number and types of lichens found.

<table>
<thead>
<tr>
<th>Lichen Type</th>
<th>Number Found</th>
</tr>
</thead>
<tbody>
<tr>
<td>Gray-Green or Orange Curst (Crustose)</td>
<td></td>
</tr>
<tr>
<td>Foliaceous Lichens (Foliaceous)</td>
<td></td>
</tr>
<tr>
<td>Fruticose Lichens (Fruticose)</td>
<td></td>
</tr>
</tbody>
</table>

3. Using the lichen data collected above, rate your area on the scale below.

   No lichen - crust-like - leafy - some small - abundant shrubby large shrubby

   1 2 3 4 5 6 7 8 9 10

4. How does your predicted rating (question 1) match your lichen data rating (question 3)? Tell why you think they match or not.
Section E – Water Quality and Macroinvertebrates Curriculum

This curriculum was written by Maggie Livesay, OSU Extension Service Benton County 4-H. It is included here as reference for how FOCUS was created and the activities that were done during the spring of 2015.
Plunkett Creek Water Quality Health Study

Learning Objectives:
- Examine water quality of Plunkett Creek
- Draw and label parts of an aquatic organism
- Identify aquatic macroinvertebrates that inhabit the creek
- Understand the relationship of certain aquatic species/group to water quality

Activity Time:
- 35 minutes including travel time to Plunkett Creek gazebo (5 minute travel time)

Space Required:
- Lab at Education Center/Outdoors on Picnic tables

Materials:
- Large plastic tub for macroinvertebrates
- Small water Pump
- Water from stream
- Stickers (or other data point)
- Graph for data display
- Guide to Pacific Northwest Aquatic Invertebrates
- pH paper
- Dissolved Oxygen test
- Temperature

Preparation:
- Basic ecology – how organisms interact with their environment

Vocabulary Words:
- ecology
- invertebrate
- water quality
- pollution
- sensitive
- tolerant
- data
- 2 graph charts pre-prepared

Overview: Students investigate the water quality of Plunkett Creek (pH, DO, temp) and watch the collection of macroinvertebrates. Proceed to lab to classify and draw macroinvertebrates found in the creek. Students will contribute data to a graph and discuss overall water quality of the creek, how invertebrates are impacted by their environment, and consider other factors, such as season, human activity, etc. that may influence data.
**Activity Directions**

1. Introduce the watershed. Explain how we all live in a watershed – what watershed do you live in? (Mary’s River Watershed) and how human activities can impact overall stream health and those that live downstream.

2. What are some things that impact a watershed? Ask students and then refer to the logging and agriculture/gardening/livestock management graphic to discuss how buffers provide riparian protection from pollution by sediments, fertilizer and manure. Ask what human uses might impact this watershed? Not a lot – maybe logging, dogs, humans...

3. Introduce Ecology - The study of the relationships between organisms and their environment. In this activity we are all **Ecologists** and we are going to investigate the water quality health of Plunkett Creek.

4. Follow this science skill process:
   a. **Ask a question** – What do you think is the overall health of Plunkett creek? Very Good, Good or Poor? Circle your answer in your field book.
   b. **Investigation** – We will collect a water sample and test it for:
      - pH, see pH Ranges for Aquatic Animal and Plant Life chart
      - **DO** - dissolved oxygen - all aquatic animals need oxygen to survive. Amount in water can be affected by altitude, temperature, plants, light exposure, aeration and suspended sediments. Colder water can hold more oxygen. DO is measured in parts per million (ppm) or milligrams/liter (ml/l) AS DO range of 5-6 is acceptable for most aquatic life.
      - Temperature – very important to water quality - direct effect of DO in water. Temp can affect rate of photosynthesis by aquatic plants and sensitivity of organisms to disease & parasites. Salmon and trout prefer water temp between 40-65 degrees F.

   Collect 3 water samples and get 3 volunteers, one for each test. Students record data in your field book.
   c. **Collect macroinvertebrates** – show use of D-net in stream. Put rocks in tubs and take to lab.

5. **In the lab** – What are macroinvertebrates? Picture of life cycle. Depending on the type of macros that lives in the stream we can learn more about water quality and stream health.
   - What are the different types of invertebrates and what do they tell us about water quality? Show students the 8 ½ x 11 charts that show different aquatic bugs.
   - **Group 1**: Pollution sensitive – stonefly, caddisfly, riffle beetle…
   - **Group 2**: Somewhat pollution tolerant – crayfish, alderfly larvae, scud, clams
   - **Group 3**: Pollution tolerant aquatic worm, blackfly, leeches,
   - Go over the three groups of macroinvertebrates using the identification charts and what they indicate about water quality:
6. **Collect data:** Now we are going to look more closely at what we collected. Please very gently use the paint brush to loosen the bug from the rock and into the dish.

   OR examine the organisms in the ice cube trays.
   - Choose a single organism to classify and pick up with paint brush and place in petri dish w/water.
   - Draw the organism in your field book
   - Compare the organism to the identification charts – write the name next to your bug.
   - Determine the category it belongs to – Group 1, 2, 3.
   - Place a data point (mark or sticker) on the graph according to the macro group number 1, 2, 3
   - Students can continue to collect data if time allows.

a. **Analyze results**

   - Have each student share the names of organisms they collected and describe what that indicates about overall water quality.
   - Look at the graph to see which macro group was collected most often. Which macro group was collected the least often?

   Discuss what the data on the class’ graph indicates about water quality:
   - Group 1 is greater than groups 2 and 3 – water quality is good.
   - Group 2 is greatest – this could represent increased or decreased pollution
   - Group 3 is greatest – water quality is poor.

   If all three groups are equal the water quality may be good because Group 1 is present or could be shifting.

b. **Share information**

   Discuss why it is important for ecologists to understand the organisms they are collecting; other factors may be influencing data, such as:

   - Food web – something may be feeding on certain macros and skewing the data, time of year that data was collected, weather, human activity that caused die off, etc…
Section F – Wildlife Investigations Curriculum

This curriculum was written by Maggie Livesay, OSU Extension Service Benton County 4-H. It is included here as reference for how FOCUS was created and the activities that were done during the spring of 2015.
Wildlife Investigations along the Bird Loop

Learning Objectives

- Observe and record signs of wildlife along the north side of Bird Loop
- Use evidence collected to identify wildlife species that are seen in this area of Beazell Memorial Forest
- Understand relationships between species and their environment
- Compare and contrast a managed forest and an adjacent natural area

Activity Time

35 minutes includes travel time to trail

Materials

- Ecology Field cards that correlate with Bird Loop
- Clipboards with pencils
- Wildlife Track and Scat book
- Oak Galls
- Nests, tracks, other items to place along trail

Overview

Students will hone their observation skills and discover evidence of wildlife that inhabit this section of Beazell Memorial Forest. Students will also be looking for species interactions and food webs.

Background Information

Finding evidence that wildlife live or have passed through an area is exciting for students. Using observation skills to identify areas in which animals have been feeding, sleeping, raising young, or merely passing through the area.

Tracks along the trail or in muddy areas along the intermittent creeks are perhaps the easiest to spot.

Deer, raccoon, coyote (tracks)

Piles of eaten Doug-fir cones – Douglas squirrel – may hear this sentinel of the Forest

Antler, Broken or nipped branches – Black-tailed deer

Scattered feathers – there are owls, coyotes, hawks

Bones-coyote

Scat with rabbit hair – coyote (Discourage students from handling scat – use a stick)

White droppings - birds
**Activity Directions**

1. Walk with your students from the Barn across Plunkett Creek (point out poison oak and caution them to stay on the trail) to the kiosk at the head of Bird Loop. Remind students when they are walking in the woods especially with a group that if they want to see anything they need to practice the fox walk, deer ears and moth mouth.

2. Encourage the students to relax and use all of their senses for nature observation.
   - We tend to use focal vision about 95% of the time and wide-angle vision only 5%. Animals use the reverse (5% and 95%). Practice using your wide angle vision to gather information.
   - Practice looking beyond the main thing you see in your vision – what is behind it, below it, above it?
   - Show example of how to focus your hearing: We can increase our hearing by 10x by cupping our hands, thumbs up, behind our ears, with the elbows out. This creates a parabolic reflector which gathers the sound in to our ears. This technique is important in locating animals and finding out what lies ahead of you.

3. Open their field journal to the Wildlife Investigation page. Record Location, Time & Weather. Explain to students that we will be heading north and taking a walk around the Bird Loop. We will be looking for evidence of wildlife along the way. If you see something – say _ wildlife sign_ and … We are going to spread out along the trail a bit so we can hear and see more wildlife.

   Chaperone please stay at the back of the group as the sweep.

**Stop 1:** Stop at the creek. Discuss what you might see, why is the creek a good place to look for tracks? Spread out students along creek and let them investigate area – looking for tracks you have seeded or those that are in the mud along the creek. Have students draw track and discuss.

**Discussion Questions for Track Study**

**When you find some tracks – stop and let the students draw the track and discuss:**
- What shape is the track?
- How many toes did this animal have?
- What animal do you think might have made the track? If you are not sure, what are two or three possible animals?
- When you are finished, ask if anyone wants to share their drawing.
- How are these animal tracks the same? How are they different?

**Stop 2:** Stop at the Oak tree (oak trees are sturdy fire resistant long lived hardwood trees – they provide food (acorns) for many species of wildlife and humans). Show
the students an oak gall and talk about the Oak Gall wasp. (Female Oak Gall Wasp injects her eggs into the underside of the oak leaf. eggs hatch, feeding larvae irritate tree causing gall to form, gall protect larvae from most predators, larvae metamorphoses into adult, chews its way out of the gall.

Along the trail look for:

- Mole or Gopher mounds gopher- fan shaped mole –round
- May see dark-eyed Juncos in managed forest,
- See many squirrel eating mounds-pick up cone and discuss how long it took to create the pile of cones –one season? Two? Years?
- Douglas Squirrel nests in Douglas –fir trees
- Deer beds in grassy area- spot the antlers – talk about males shedding antlers each year – grow need branch each time they grow back

Stop 3: Managed Forest vs. Native Forest

Do you think this area provides good habitat for wildlife? Why or Why not?

Do you think there are more animals living on the managed forest side of the trail or the less managed side.

What area has the greatest biodiversity?

Stop 4: Prairie/Oak Savanna – History of Kings Valley

Bench at north end of loop - if time- Kings Valley has been settled for hundreds of years. First by the Kalapuya Indians and then by farmers/settlers. North of Beazell is another park called Ft. Hoskins. Ft Hoskins was built during the late 1800’s to house the army who was called in to keep peace between the settlers and the native people. Why was there a conflict between these two groups?

As you look out over the meadow what human impacts do you see?

Tire tracks, fence, bottle on post, fence posts, …..

Travel on to the meadow near the Gazebo where you will switch groups, reverse your lesson and take the trail back to the Ed Center with the next group.

Lesson sources:


Website -https://outdooraction.princeton.edu/nature
APPENDIX 3 – Evaluations

Section A – Evaluation of Students

This evaluation form was created for students to fill out after participating in the FOCUS program. The evaluations were anonymous and were returned in an envelope by the teacher. The four main activities (Fallen Log, Water Quality and Macroinvertebrates, Lichen Survey, and Wildlife Investigations) were included on this evaluation. It is important to note that only parts of each activity were included. None of the following were included on the evaluation: Earth Manners, Sounds Around, or the Cultural History component of the Lichen Survey activity.

This evaluation form was created by Reid Sweetkind.
FOCUS Program Evaluation for Students

For the following questions circle the answer that you most agree with:

Do you like studying science outside?

YES    NO

Had you been to Beazell Memorial Forest before your field trip with FOCUS?

YES    NO

Do you feel that FOCUS has helped you to be better at science?

YES    SOMEWHAT    NO

In the spaces below write in one basic food chain that you learned during FOCUS.

Primary Producer → Herbivore → Carnivore

In the blanks below write in the animal that made the tracks shown.

Front foot

Hind foot

What was the water quality of Plunkett Creek? (circle the best answer)

VERY GOOD    GOOD/FAIR    POOR

What type of lichen is this? How tolerant to air pollution is it? (circle the best answers)

Crust (Crustose)    Leafy (Foliose)    Shrubby (Fruticose)

It’s very tolerant to air pollution.

It’s somewhat tolerant to air pollution.

It’s intolerant to air pollution.
Section B – Teacher Evaluations

This evaluation form was created for teachers to fill out after participating in the FOCUS program with their students. The comments given on these forms were not anonymous. This form was created by Maggie Livesay and Reid Sweetkind.
FOCUS Program Evaluation for Teachers

What did your students learn during the FOCUS program at Beazell Memorial Forest?

The goal of the FOCUS program is to engage students in science learning outdoors. On a scale of 1-5 how successful were we in reaching this goal?

1---------------------------------------------3-----------------------------------------------5

Poor Good Excellent

Were your students more engaged with science in the outdoors than in the classroom? Explain your observations.

In the FOCUS booklet there is an opportunity to look at the lichen, water quality and wildlife you might find at your school. Did you take your students outdoors for the suggested activities? What did you do?

Would you return to FOCUS with your class in the future? If so, please write a few words we can share with others?
Section C – Field Trip Evaluations from Mr. Behrens’ Third Grade Class

This evaluation page was created by Mr. Gerhard Behrens, a third grade teacher at Adams Elementary School in Corvallis, OR. He has his students fill out evaluations like this one after each field trip and then sends the feedback to the organizers of the trip. This evaluation makes reference to Ellie’s Log as an explanation to the students about how to fill out the evaluation. Ellie’s Log: Exploring the Forest Where the Great Tree Fell is a book by Judith L. Li published by Oregon State University Press (copyright 2013), and it tales of a young girl using scientific methods to explore the forest near her home; Ellie keeps a field journal which is what Mr. Behrens is referencing in his evaluation. Only students from Mr. Behrens class completed this evaluation, and the evaluations are not anonymous. Mr. Behrens hand wrote the evaluations the students filled out, a typed copy is below.
Beazell Forest FOCUS

Name:

1. You had 5 stations: Fallen Log, Macroinvertebrates and Water Quality, Lichen Loop, Wildlife Investigations, Sounds

   ★ Which one taught you the most new things? List at least 2 things you learned. Can you add a sketch like Ellie’s Log?

   ★ Which one was most a review of things you already knew? List 2 things you knew and heard again. Add a sketch!

2. Why is a place like Beazell Forest important to our community?

3. If you could change one thing about today, what would you change if you were a teacher?

ON THE BACK: Draw a picture, with labels, of your best memory or most important learning of the day.
APPENDIX 4 – Evaluations Data

All of the following was collected using the evaluations in Appendix 3 Section A.

Section A: Evaluation of Students—Scores by School

This table shows the average (both mean and median) scores for all students coming from each school. The scores were determined by adding up the number of correct answers given by each student then determining the average for all students from a particular school. The cumulative average score for all students that attended the program was also calculated. The standard deviations were calculated to determine the spread about the mean for an understanding of how different the scores were from each other within the sample (i.e. the school or overall).

Table 1: Students answered questions about information they learned during their trip to FOCUS as part of their evaluation; these questions were graded for correctness. Each blank or question part had one point associated with it—there were eight points possible on the evaluation.

<table>
<thead>
<tr>
<th>School</th>
<th>Mean Score</th>
<th>Median Score</th>
<th>St. Deviation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Philomath</td>
<td>4.6</td>
<td>5</td>
<td>1.8</td>
</tr>
<tr>
<td>Blodgett</td>
<td>5.7</td>
<td>6</td>
<td>1.5</td>
</tr>
<tr>
<td>Adams</td>
<td>6.3</td>
<td>7</td>
<td>1.2</td>
</tr>
<tr>
<td>Overall combined</td>
<td>5.2</td>
<td>5</td>
<td>1.8</td>
</tr>
</tbody>
</table>
Section B: Evaluation of Student Learning—Overall Scores

Figure 1 shows all of the total scores from each school or of all participants of the FOCUS Program during spring of 2015. The figure is scaled by the number of points a student scored on their evaluation (x-axis) by the number of students that scored that number of points on their evaluation (on the y-axis). Fig. 1 (A) includes only the students from Philomath Elementary; (B) only includes Adams Elementary students; (C) only includes the students from Blodgett Elementary; and (D) includes all students from all session dates.
Figure 1: Learning assessment of students from overall score on evaluation. Score is the number of points earned out of the 8 possible for correct answers. Philomath Elementary School from overall score on evaluation. (A) All students from Philomath Elementary School, (B) all students from Adams Elementary School, (C) all students from Blodgett Elementary School, (D) all students that participated in FOCUS during Spring of 2015.
Section C: Student Evaluation Scores for Each Activity by Session and School

Fallen Log Activity: Create a Food Chain

Figure 2 shows the scores for the food chain evaluation question of all students that participated in the program. The information is separated in two ways: by the session the students attended (April 21, April 28, or May 19, 2015), in (A), or by the school they attend, (B). Most students were able to create a food chain comprised of a primary producer, herbivore, and carnivore.

Figure 2: Assessment of student learning about food chains and food webs from the Fallen Log activity. (A) Student scores separated by FOCUS program date they attended. (B) Student scores separated by school.
Lichens Activity: Lichen Identification and Connection to Air Quality

Figure 3 (A) and (B) show the collective scores for the lichen questions on the student evaluations. (A) shows the scores separated by the session that students attended; (B) shows the scores separated by school that the students attended. There is an overall trend that most students only got one of the two parts correct; (C) was created to identify which of the two parts was answered correctly most frequently. By far students were able to identify the type of lichen drawn on the evaluation (97.67%) but were unable to identify its tolerance to air pollution. Only 2.33% of students had the correct air pollution tolerance but the incorrect lichen type.
Figure 3: Assessment of student learning of lichen types from the Lichen Survey activity. (A) Student scores separated by FOCUS program date they attended. (B) Student scores separated by school. (C) Distribution of correct answers for students who scored 1 out of the 2 points possible — Question part A: lichen identification, Question part B: air quality indication.
Water Quality and Macroinvertebrates Activity: Water Quality of Plunkett Creek

Figure 4 shows the scores from the student evaluations on the water quality question. Fig. 4 (A) has the scores separated by session that the students attended; (B) shows the scores separated by the school that the students attended. Overall, most students were able to correctly identify that the water quality of Plunkett Creek was “very good.”

![Figure 4: Assessment of student learning of Plunkett Creek water quality from the Water Quality and Macroinvertebrates activity. (A) Student scores separated by FOCUS program date they attended. (B) Student scores separated by school.](image-url)
Wildlife Investigations Activity: Animal Track Identification

Figure 5 presents the scores from the student evaluations for animal track identification. Fig. 5 (A) has the scores separated by the session that the students attended; (B) has the scores separated by school. It is important to note that the students who attended the second session were not shown a raccoon track during the Wildlife Investigations activity. This put those students at a disadvantage when answering the questions on the evaluation.

![Diagram showing animal track score frequency by session and by school.](image)

Figure 5: Assessment of student learning of animal tracks from the Wildlife Investigations activity. (A) Student scores separated by FOCUS program date they attended. (B) Student scores separated by school.
Section D: Teacher Feedback from Evaluations of FOCUS Program

Teachers were asked to fill out evaluations for FOCUS to give feedback about how the program worked for their students. Their comments were compiled into Table 2, shown on the next two pages.
<table>
<thead>
<tr>
<th>Teacher Name</th>
<th>School Name</th>
<th>Date</th>
<th>What did your students learn?</th>
<th>How successful was FOCUS in engaging students in science learning outdoors? (1 being poor and 5 being excellent)</th>
<th>Were your students more engaged with science in the outdoors than in the classroom?</th>
<th>Did you take your students outside to do the suggested extension activities?</th>
<th>Would you return to FOCUS?</th>
<th>What would you share with other teachers interested in the program?</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cari DenHerder</td>
<td>Philomath Elem.</td>
<td>April 21</td>
<td>types of lichen trail etiquette</td>
<td>3</td>
<td>Yes, they were asking questions and making connections; less side, off topic conversations</td>
<td>Not this time</td>
<td>Yes</td>
<td>It was a very engaging experience for my students. They were excited to be out there and made some great connections</td>
</tr>
<tr>
<td>Byron Holroyd</td>
<td>Philomath Elem.</td>
<td>April 21</td>
<td>pH looking for food webs in nature, natural relationships, stages of decomposition, how to identify various kinds of lichen, cardinal directions in nature, observational skills</td>
<td>5</td>
<td>On the whole, but only because there were more activities outside. They loved the examination of macroinvertebrates in the classroom using magnifying glasses.</td>
<td>Yes, we looked at it, recorded, discussed it as a class</td>
<td>Yes</td>
<td>What an engaging, hands-on experience for students. My class was immersed in nature, learning and observation and loved every minute of it!</td>
</tr>
<tr>
<td>Molly Bell</td>
<td>Philomath Elem.</td>
<td>April 28</td>
<td>macroinvertebrates and water quality, connections in a forest ecosystem</td>
<td>4</td>
<td>My students love science so engagement in the classroom is high. I saw them appreciate exploring and discovering on their own.</td>
<td>No - many students wanted to take the booklet home that day.</td>
<td>Yes</td>
<td>Great site and close to Philomath.</td>
</tr>
<tr>
<td>Jennifer House</td>
<td>Philomath Elem.</td>
<td>April 28</td>
<td>Philomath/Kings Valley area including plants and some history, food web learning was reinforced</td>
<td>5</td>
<td>Yes, so much more fun than always sitting.</td>
<td>We don't have many trees within the boundaries of the school, but I encouraged the kids to look at home and at the park.</td>
<td>Yes</td>
<td>The program was well organized and smoothly run. The instructors were knowledgeable and patient with the students.</td>
</tr>
<tr>
<td>Teacher</td>
<td>School</td>
<td>Date</td>
<td>What did your students learn?</td>
<td>How successful was FOCUS in engaging students in science learning outdoors? (1 being poor and 5 being excellent)</td>
<td>Were your students more engaged with science in the outdoors than in the classroom?</td>
<td>Did you take your students outside to do the suggested extension activities?</td>
<td>Would you recommend this to other teachers interested in the program?</td>
<td>What would you share with other teachers interested in the program?</td>
</tr>
<tr>
<td>------------------</td>
<td>--------------</td>
<td>---------</td>
<td>-----------------------------------------------------------------------------------------------</td>
<td>-------------------------------------------------------------------------------------------------------------------</td>
<td>-----------------------------------------------------------------------------------</td>
<td>---------------------------------------------------------------------------------</td>
<td>-----------------------------------------------------------------------------------</td>
<td>---------------------------------------------------------------------------------------------------</td>
</tr>
<tr>
<td>Amber Eaton</td>
<td>Blodgett Elem.</td>
<td>May 19</td>
<td>ecosystems and lifeforms they had never seen before application of learned concepts to real-world environments</td>
<td>5</td>
<td>Yes. Hands-on learning is engaging and my students easily retained new information more quickly than in the classroom.</td>
<td>Yes. We explored the forest area near our playground to see if we could identify ecosystems/lifeforms that we saw on the field trip. We compared the two forest areas.</td>
<td>Yes</td>
<td>I would love to do this trip again. It was well-developed, child-centered, and developmentally appropriate.</td>
</tr>
<tr>
<td>Susan Reeves</td>
<td>Adams Elem.</td>
<td>May 19</td>
<td>macroinvertebrate identification and location animal print identification</td>
<td>5</td>
<td>Yes! Anything we can do to get them hands-on, real life experience is important.</td>
<td>Yes, we took them out to practice observing the environment. Now I would like to do a follow up activity to look at lichen, water quality and wildlife near our school.</td>
<td>Yes</td>
<td>It was engaging and fun for everyone.</td>
</tr>
<tr>
<td>Gerhard Behrens</td>
<td>Adams Elem.</td>
<td>May 19</td>
<td>macroinvertebrates as sign of water quality lichens as sign of air quality, review of food chain/food webs excellent emphasis on recording observations</td>
<td>5</td>
<td>Outdoors complements indoors. Sometimes being outdoors is so fun they don't focus on what is important. The classroom environment allows for a focus on a concept or observation. Outdoor activities solidify, excite, inspire...all complementary to the classroom.</td>
<td>Yes - on our next field trip (a walk to SAGE garden and Sunset Wetlands) we compared lichen and did wildlife investigation. It was great!</td>
<td>Yes</td>
<td>Bring your 3rd grade life science to life!</td>
</tr>
</tbody>
</table>
Section E: FOCUS Program Attendee Information

Table 4 is a record of the students that attended the FOCUS Program. Through this information, it can be seen that more students attended the program dates than we had expected from the rough numbers that were given upon registration by the teachers. Furthermore, the majority of the students (79%) had never been to Beazell Memorial Forest prior to attending the FOCUS program. This demonstrates to the Benton County Natural Area and Parks Department that we were successful in bringing students out who were unfamiliar with the area to Beazell.
<table>
<thead>
<tr>
<th>Session 1</th>
<th>number registered</th>
<th>number attended</th>
<th>number received evaluations</th>
<th>% students attended</th>
<th>% of students that have been to Beazell before</th>
<th># of students that have been to Beazell before</th>
<th>% students that have received evaluations with</th>
<th>% of students that attended</th>
</tr>
</thead>
<tbody>
<tr>
<td>DenHerder</td>
<td>28</td>
<td>26</td>
<td>22</td>
<td>85%</td>
<td>93%</td>
<td>6</td>
<td>93%</td>
<td>23%</td>
</tr>
<tr>
<td>Holroyd</td>
<td>28</td>
<td>27</td>
<td>25</td>
<td>93%</td>
<td>96%</td>
<td>9</td>
<td>96%</td>
<td>33%</td>
</tr>
<tr>
<td>totals</td>
<td>56</td>
<td>53</td>
<td>47</td>
<td>89%</td>
<td>95%</td>
<td>15</td>
<td>95%</td>
<td>28%</td>
</tr>
<tr>
<td>Session 2</td>
<td>number registered</td>
<td>number attended</td>
<td>number received evaluations</td>
<td>% students attended</td>
<td>% of students that have been to Beazell before</td>
<td># of students that have been to Beazell before</td>
<td>% students that have received evaluations with</td>
<td>% of students that attended</td>
</tr>
<tr>
<td>House</td>
<td>28</td>
<td>27</td>
<td>26</td>
<td>96%</td>
<td>96%</td>
<td>3</td>
<td>96%</td>
<td>11%</td>
</tr>
<tr>
<td>Bell</td>
<td>28</td>
<td>27</td>
<td>25</td>
<td>93%</td>
<td>96%</td>
<td>7</td>
<td>96%</td>
<td>26%</td>
</tr>
<tr>
<td>totals</td>
<td>56</td>
<td>54</td>
<td>51</td>
<td>94%</td>
<td>96%</td>
<td>10</td>
<td>96%</td>
<td>19%</td>
</tr>
<tr>
<td>Philomath</td>
<td>subtotal</td>
<td>112</td>
<td>107</td>
<td>98</td>
<td>92%</td>
<td>25</td>
<td>96%</td>
<td>23%</td>
</tr>
<tr>
<td>Session 3</td>
<td>number registered</td>
<td>number attended</td>
<td>number received evaluations</td>
<td>% students attended</td>
<td>% of students that have been to Beazell before</td>
<td># of students that have been to Beazell before</td>
<td>% students that have received evaluations with</td>
<td>% of students that attended</td>
</tr>
<tr>
<td>Eaton</td>
<td>8</td>
<td>10</td>
<td>7</td>
<td>70%</td>
<td>125%</td>
<td>1</td>
<td>125%</td>
<td>10%</td>
</tr>
<tr>
<td>Blodgett</td>
<td>subtotal</td>
<td>8</td>
<td>10</td>
<td>7</td>
<td>70%</td>
<td>1</td>
<td>125%</td>
<td>10%</td>
</tr>
<tr>
<td>Behrens</td>
<td>24</td>
<td>23</td>
<td>23</td>
<td>100%</td>
<td>96%</td>
<td>6</td>
<td>96%</td>
<td>26%</td>
</tr>
<tr>
<td>Reeves</td>
<td>24</td>
<td>24</td>
<td>21</td>
<td>88%</td>
<td>100%</td>
<td>5</td>
<td>100%</td>
<td>21%</td>
</tr>
<tr>
<td>Adams</td>
<td>subtotal</td>
<td>48</td>
<td>47</td>
<td>44</td>
<td>94%</td>
<td>11</td>
<td>98%</td>
<td>23%</td>
</tr>
<tr>
<td>totals</td>
<td>56</td>
<td>57</td>
<td>51</td>
<td>89%</td>
<td>102%</td>
<td>12</td>
<td>98%</td>
<td>21%</td>
</tr>
<tr>
<td>overall FOCUS totals</td>
<td>number registered</td>
<td>number attended</td>
<td>number received evaluations</td>
<td>% students attended</td>
<td>% of students that have been to Beazell before</td>
<td># of students that have been to Beazell before</td>
<td>% students that have received evaluations with</td>
<td>% of students that attended</td>
</tr>
<tr>
<td>168</td>
<td>164</td>
<td>149</td>
<td>91%</td>
<td>98%</td>
<td>37</td>
<td>23%</td>
<td>98%</td>
<td>23%</td>
</tr>
</tbody>
</table>
APPENDIX 5 – County Commissioners Report

This report was created to give the Benton County Commissioners information about the FOCUS program as they were the main funding source. This document contains information about the time input of each of the four FOCUS leaders, quotes from participating teachers, and other information contained in the main body of this thesis. Reid Sweetkind wrote this report with the help of Maggie Livesay and Jody Einerson.
FOCUS Program Summary Report
(Forest, Organisms, Creeks yoU Study)
Final report on FOCUS – a field-based program for 3-5th grade youth held at Beazell Memorial Forest, Benton County Oregon.

Prepared June 23, 2015

Project Coordinators:
Reid Sweetkind, Oregon State University Student
Maggie Livesay, OSU Extension Service Benton County 4-H
Jody Einerson, OSU Extension Service Benton County 4-H/Forestry
Adam Stebbins, Benton County Natural Areas and Parks
Dates: April 21, 28, and May 19, 2015

Location: Beazell Memorial Forest, Benton County Oregon

Attendees: 164, 3rd-4th grade students from Benton County, OR—three schools were represented: Philomath Elementary, Blodgett Elementary, and Adams Elementary

Partners: OSU Extension Service Benton County 4-H & Benton County Natural Areas and Parks

Funding source: Benton County Commissioners grant ($5,717.83), additional $1000 for student scholarships.

Program Goals:
- Emphasis on Douglas-fir/oak forest, oak savanna, and riparian ecosystems
- Understanding of diverse wildlife habitats and native biodiversity
- Emphasis on critical thinking skills
- Learn about food chain/food web interactions of native species
- Learn about biological indicators of environment quality

Program Hours:

Preparation time by Leads:

Reid Sweetkind: approximately 215 hours
Maggie Livesay: approximately 160 hours
Jody Einerson: approximately 33 hours
Adam Stebbins: approximately 16 hours

Total volunteer hours during program dates: approximately 78 hours
Total lead staff hours during program dates: approximately 90 hours

Science Standards Met Through FOCUS Program

Meeting educational standards is a critical element of any out-of-school, field-based program that is provided by non-formal educators. The FOCUS program introduced some new concepts to students as well as reinforcing classroom
science learning with hands-on field experiences. The 2014 Oregon Department of Education Science Standards that this program addressed are listed below.

**Oregon Department of Education Science Standards (Standards by Design) 2014:**

**Life Science**

- 3-LS4-2 Use evidence to construct an explanation for how the variations in characteristics among individuals of the same species may provide advantages in surviving, finding mates, and reproducing.
- 3-LS4-3 Construct an argument with evidence that in a particular habitat some organisms can survive well, some survive less well, and some cannot survive at all.
- 3-LS4-4 Make a claim about the merit of a solution to a problem caused when the environment changes and the types of plants and animals that live there may change.
- 4-LS1-1 Construct an argument that plants and animals have internal and external structures that function to support survival, growth, behavior, and reproduction.
- 5-LS1-1 Support an argument that plants get the materials they need for growth chiefly from air and water.
- 5-LS2-1 Develop a model to describe the movement of matter among plants, animals, decomposers, and the environment.

**Program Results:**

Student evaluation scores from 149 of the 164 students showed that most students retained information learned at FOCUS, Fig. 1. The average (median) score of all students was 5 points out of 8 possible. Scores were higher for students in the 3rd session at 7 points out of 8; the 1st and 2nd sessions had averages of 5 points. In the 3rd session students from both Adams and Blodgett Elementary schools attended—the students from Adams had higher average scores (7 points) than students from Blodgett (6 point average), Fig. 2. This suggests some difference between schools in curriculum relevance and incorporation of key concepts into curriculum.

Based on this observation it seems reasonable to create curricula and materials for pre- and post-trip classroom activities to better prepare all students for FOCUS.
Feedback from Teachers:

What did your students learn during the FOCUS program?

“Fabulous review of food chain/food web concepts (e.g. herbivore, carnivore, decomposer), excellent emphasis on recording observations, [and] lots of new information: macroinvertebrates as sign of water quality, lichens as sign of air quality.”—Gerhard Behrens, Adams Elementary

“My class was immersed in nature, learning, and observation and loved every minute of it!”—Byron Holroyd, Philomath Elementary

Would you return to FOCUS with your class in the future?

100% replied Yes!

What would you share with other teachers about this program?

“Anything we can do to get [our students] hands on, real life experience is important.”—Susan Reeves, Adams Elementary

“Bring your 3rd Grade life science to life.”—Gerhard Behrens, Adams Elementary

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Fig. 1 Results from 149 student evaluations - right skew to the bell curve demonstrates an overall high level of retention of concepts taught at FOCUS.

Fig. 2 Average and overall scores by school. Due to the greater proportion of higher scores, the median was used for assessment over the mean. Standard deviations show how different the scores were — students from Adams all scored more similarly to each other than students from other schools.

<table>
<thead>
<tr>
<th>Session</th>
<th>School</th>
<th>Median Score</th>
<th>St. Deviation</th>
</tr>
</thead>
<tbody>
<tr>
<td>1st and 2nd</td>
<td>Philomath</td>
<td>5</td>
<td>1.8</td>
</tr>
<tr>
<td>3rd</td>
<td>Blodgett</td>
<td>6</td>
<td>1.5</td>
</tr>
<tr>
<td>3rd</td>
<td>Adams</td>
<td>7</td>
<td>1.2</td>
</tr>
<tr>
<td>Overall combined</td>
<td></td>
<td>5</td>
<td>1.8</td>
</tr>
</tbody>
</table>
“The program was well organized and smoothly run. The instructors were knowledgeable and patient with the students.”—Jennifer House, Philomath Elementary

“Hands-on learning is engaging and my students easily retained new information more quickly than in the classroom.”—Amber Eaton, Blodgett Elementary

“I would love to do this trip again. It was well-developed, child-centered, and developmentally appropriate.”—Amber Eaton, Blodgett Elementary

What could we improve?

“[Activities] should be on the side of over exploration – letting the kids touch, smell, and investigate on their own.”—Molly Bell, Philomath Elementary

Send pre-trip documents electronically so the photo release and permission slips can be combined to save paper and time. —Cari DenHerder, Philomath Elementary
Left: This is the set up outside of the education center at Beazzell Memorial Forest for each of the three program dates. The signs denoted meeting points for each of the four groups before and during rotations. *Photo taken 5/19/2015*

Right: This photo is of Reid Sweetkind showing students from Philomath Elementary School a sample from inside the nurse log on the Plunkett Creek loop trail. The students used magnifying glasses to observe organisms decomposing the wood; students were also asked to make observations about the feel and smell of the decomposing wood. *Photo taken 4/28/15*

Left: Here Aidan, from Philomath Elementary School, examines a macroinvertebrate he collected from Plunkett Creek to help determine the water quality. Students were asked to make sketches of the macroinvertebrates and identify them—the different types of macroinvertebrate reflected the water quality of the creek. *Photo taken 4/21/15*
Left: Taylor and Ryland, from Adams Elementary School, examine an oak gall while hiking during the Wildlife Investigations activity. During this activity students were on the hunt for evidence of animal life while also exploring the diverse ecosystems found on the Bird Loop at Beazell Memorial Forest. *Photo taken 5/19/15*

Right: Students were given the opportunity to use their listening skills to observe the forest around them during an activity called Sounds Around. These students, from Blodgett and Adams Elementary Schools, made notes of what they heard and, from which direction on a sound map in their field journals. *Photo taken 5/19/15*

Left: Banan, a student at Adams Elementary School, makes observations about a fallen log near the nurse log on the Plunkett Creek loop trail. *Photo taken 5/19/15*