Perspectives:
Through the eyes of an Island

Curriculum for Sucia Island Env. Ed Outdoor School Environment
with Explorations Academy

Huxley College Spring Block 2013

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Contents

Our goals

We, as environmental educators, want to help our high school students broaden their perspectives and develop a sense of place by relating their experience on Sucia Island to other aspects of their lives. Through natural history, exploration and reflection, we will encourage stewardship and a deeper understanding of the natural world.

Objectives

Students will be able to:

- Recognize that different perspectives can change assumptions about, and relationships with, the natural world
- Identify spectrums between ethical extremes
- Think critically and independently in diverse, unfamiliar situations
- Reflect on challenges and adapt their perspectives, approaches, and attitudes toward these challenges
- Develop knowledge, skills, and experience that will foster self-confidence as naturalists
- Identify communities and relationships within and between ecosystems
- Foster methods of self expression
- Creatively express natural history or ethical knowledge they have gain about themselves and/or their environment from their week on Sucia through art, creative writing, music, and/or drama
- Contemplate different perspectives on human relationships to, and roles in ecosystems

Learners/institutional partners

Explorations Academy

Explorations Academy (EA) is a private high school in Bellingham, Washington that uses a model of experiential learning and alternative thinking. Many EA students were not challenged by public school, their learning style didn't thrive in the public school environment, or they simply did not feel comfortable at their previous school. At EA, students' learning is facilitated by self-directed inquiry and discussion, followed by adequate reflection. EA's mission is to "develop experiential learning programs which encourage self-awareness and critical thinking, nurture healthy relationships and community, and foster personal and academic excellence. Our vision is to cultivate diverse communities of healthy, creative, and engaged learners and leaders, working toward a socially just and ecologically balanced world."

Our group consists of 19 students; one is returning for the fifth time and will be working mostly on an independent project, six students are returning for their second time, and the remaining 12 students are newcomers to Sucia. This semester their classes are in three themed "clusters", focusing on: food, shelter, and life/death. In general, these students are capable of higher-level critical thinking and are not afraid to ask questions about complicated issues. Some of the students have had outdoor/backpacking experience with their school. The Exploration teachers are expecting us to challenge these students in a similar manner- making situations physically difficult or mentally challenging.

Washington State Parks

The park system was established in 1913 by the creation of the Washington State Board of Park Commissioners. The first two parks were formed from donated land in 1915, and by 1929 the state had seven parks. In 1947 the State Parks Committee was renamed to the Washington State Parks and Recreation Commission and given authority to oversee the state park system. By 1960 the number of state parks had increased to 130.

Sucia Island State Park is a 564-acre marine park with 14.7 miles of shoreline. In 1952 Washington State Parks acquired about a third of Sucia Island as a marine park; later when developers wanted to parcel up the remainder of the island into "vacation lots", Seattle yachtsman Everett (Ev) Henry spearheaded a drive to collect funds from yacht clubs and boaters throughout Washington to purchase Sucia parcels from developers. In 1960 that land was donated the Washington State Parks for use as a marine park. In 1972 State Parks acquired the remaining parcels of private property and Sucia Island in its entirety became a state marine park.

The current park ranger in Steve Sabine is in charge of several San Juan marine state parks and resides at Moran State Park on Orcas Island. He is organizing service projects for our students, part of which will be Gary oak planting and part of which is yet undecided.

http://www.parks.wa.gov/parks/?selectedpark=Sucia%20Island
http://en.wikipedia.org/wiki/Washington_State_Park_System

SnowGoose

The SnowGoose is a 65 foot marine vessel designed for cruising the Inside Passage. It features a spacious main deck salon with a natural history library, great for large group meetings and discussion. Large windows provide great viewing on all sides with easy access to the deck. The upper bridge deck provides a good vantage point for spotting wildlife and comfortable seating for passengers who wish to get involved with the navigation of the ship. In the winter, it is docked in Squalicum Marina providing marine science and environmental education programs. Coast Guard licensed captain (Dan Liden) and trained deckhand (RJ Rex) transport Spring Blockers and high school students to Sucia Island.

Instructors and contact information:

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Location
Sucia Island is a horseshoe shaped island, 12 miles west of Bellingham and two miles north of Orcas Island. The island serves as a hands-on environment for students to experience many aspects of natural history. The island is small enough to create a sense of place while large enough to contain several different types of ecosystems and microclimates including marine systems, several different terrestrial plant communities, and marine mammals. Sucia's highest point is around 200 feet and the hike from tip to tip is 3 miles. There is no ferry access so access to Sucia is only possible with other boats, and the island has no permanent inhabitants. Some specific locations on the island that we will utilize for education include Shallow Bay, Ewing Cove, Fossil Bay, and Lawson Point. Many lessons will take place in several different locations and along trails. There are several sheltered areas at all campsites in case of rain.

Theme
Perspectives: Through the eyes of an island
Students will consider different perspectives revealed on the island as they explore its depths, including but not limited to: ecological-, relationship/community-, historical-, and self-perspectives. They will apply these diverse perspectives to value judgments, ethical conundrums, and problem solving.

Risk Management:
EA has comprehensive risk management policies outlined that will be followed by students, staff, and spring blockers. The file is attached. Potential hazards on Sucia include slippery logs and rocks, unsafe climbing areas, cold water, bluffs/cliffs, fire, and students wandering off during exploration time. Low perceived risk/low harm hazards include blisters, rainy weather, injuries to poorly protected feet, and scrapes on barnacle-covered rocks. To mitigate these risks, the facilitator, EA leaders, and SB assistants, in addition to following EA's policies, will:

- Require students to stay off of logs and rocks without supervision and to stay within sight of the group unless otherwise directed.
- Utilized the buddy systems for students and staff
- Require closed toed shoes on beaches and trails

- Prohibit climbing above 4 feet without spotters; with spotters, climbers cannot exceed 10 feet
- No swimming, no brawling
- Prohibit drugs and alcohol.
- In case of emergency, notify LOD's who will notify Huxley and EA staff

Explorations Field Risk Management Manual
* Included in the back of curriculum

Schedule:
(Original Lesson Plans in ***Bold Italics***)

Time	Activity	Facilitators	Location
Monday		LOD: Riley & Katlynne	
1:30-2:30	Meet at dock for gear check		Bellwether
2:30-3:00	Start loading boat		Boat
3:00-6:00	Boat ride to Sucia		
	Theme discussion	Demi	
	Crow Lesson	Jordan	
6:00-7:00	Unload boat and pack gear to camp		Sucia
7:00-8:00	Set up camp		N. Shallow
8:00-8:30	Split students into their groups		
8:30-10:00	Night sit/walk with Bio.	Lindsey	Shallow Bay
Tuesday		LOD: Anna & Jordan	
6:30	Breakfast/lunch prep wake up		N. Shallow
7:00-8:00	Wake up/Breakfast/Prep for day		
8:00-8:30	Hike to trail behind camp		
8:30-11:30	***Tree of Life: Cedar OL***	***Demi***	Trail
	Epiphytes OL	***Lindsey***	
11:30	Walk back to camp		
12:00-1:00	Lunch		
1:00-4:00	***River Otter OL***	***Katlynne***	Lawson
	LNT OL	***Freya***	
4:00-4:30	Intro to foraging (optional more)	Demi/Freya	N. Shallow
4:30-5:00	Free time/Dinner Prep/foraging		
5:00-6:00	Free time		
6:00	Dinner	Staff	
7:00-8:00	Free time		
8:00-10:00	Campfire		N. Echo
Wednesday		LOD: Haley & Demi	
6:30	Breakfast/lunch prep wake up		N. Shallow
7:00-8:00	Wake up/Breakfast/Prep for day		
9:00-1:00	Service Project/Lunch		Garry Oaks
1:00-2:30	Slugs & Garry Oak	Katlynne/Skye	
2:30-3:00	Walk back to camp		N. Shallow
3:00-4:30	Map/Compass Lesson	Anna	
4:30-5:00	Free time		
5:00-6:00	Free time/Dinner prep		
6:00	Dinner	Staff	
7:00-8:00	Free time		

8:00-10:00	Campfire		
Thursday		LOD: Freya & Lindsey	
6:30	Breakfast/lunch prep wake up		N. Shallow
7:00-8:00	Wake up/Breakfast/Prep for day		
8:00-8:15	Hike to N. Echo Beach		N. E. Beach
8:15-9:15	Geology Lesson	Haley	
	Honeycomb Lesson	Riley	
9:15-10:00	Hike to Ewing		Ewing
10:00-11:00	Lunch		
11:00-2:00	***Mapping Tide Pools OL***	***Anna***	Ewing/tidepool
	Tide Pools Communities OL	***Haley***	
2:00-3:00	Hike back to camp		
3:00-4:00	Bird story writing time	Jordan	N. Shallow
4:00-5:00	Free time		
5:00-6:00	Free time/Dinner prep		
6:00	Dinner	Staff	
7:00-8:00	Free time		
8:00	Campfire		N. Echo
Friday		LOD: Riley & Katlynne	
6:30	Breakfast/lunch prep wake up		N. Shallow
7:00-8:00	Wake up/Breakfast/Pack up camp		
8:00-10:00	Pack up camp		
10:00-2:00	Scavenger Hunt	All	All (/ewing)
2:00-4:00	Closing Circle		Fossil Bay
4:00-4:30	Load boat		Boat
4:30-7:00/7:30	Leave Sucia/Pickup from dock		Bellwether

Original Lessons:

1) Freya - Leave No Trace
2) Demi - Tree of Life: Cedar
3) Lindsey - Epiphytes
4) Katlynne - River Otters
5) Anna - Mapping Tide Pools
6) Haley - Tide Pool Communities

Exploration groups (for the week):

Dual lesson plan implementation model:

- Green Team
  - Facilitators: Katlynne and Riley
- Purple Team
  - Facilitators: Haley and Demi
- Orange Team

Facilitators: Freya and Lindsey

Blue Team

Facilitators: Jordan and Anna

Example format:
0min-90min

Original Lesson #1: Green and Purple Team
Original Lesson #2: Orange and Blue Team

90min-180min

Original Lesson #1: Orange and Blue Team
Original Lesson #2: Green and Purple Team

Crow Tails

Adapted by Jordan Westerholm

Facilitator: Jordan Westerholm
Subject: Corvids
Duration: 1 hour
Location: cabin of the Snow Goose, on our way to Sucia Island
Group Size: 19 high school age

Goals: To help students develop an understanding of and respect for crows.

Objectives: After this lesson, students will be able to tell a crow apart from a raven, describe the evidence for crow intelligence, explain crows' feeding and social habits, and be able to crow-proof their camp food.

Content Standard Addressed:

- ESE2
  Students engage in inquiry and systems thinking and use information gained through learning experiences in, about, and for the environment to understand the structure, components, and processes of natural and human-built environments."

Methods: This lesson is mostly discussion based. A facilitated discussion follows a folk tale.

Materials:

-whiteboard, dry-erase marker
-pictures of crows and ravens
-note cards with lines

Preparation: Practice the Coast Salish story a couple days in advance. In the first half hour of the boat ride to Sucia, walk around and get to know the students, and mention that they should be thinking about experiences they've had with crows so they are prepared for this upcoming lesson. Organize students in the Snow Goose cabin so they are in a rough circle, leaving a space of floor at the front of the boat for a stage. Ask for volunteers out of the six who've heard the story before to act the roles of the crow and the squirrel. It's preferable to have volunteers who remember what the crow and squirrel say and when, but have flash cards ready with lines if they don't.

Procedure:

0:00 After getting everyone's attention, jump into telling the Coast Salish story called Raven and Crow's Potlatch.

0:15 After the story, explain the name of the story and what culture it comes from. Ask the students who has seen a crow before (most if not all the students should raise their hands). How about a raven? How do you tell apart crows and ravens (supplement student knowledge

with drawings of tails and pictures)? Do you think there is anyone on earth who hasn't seen a crow (Crows are found on every continent except Antarctica)? Most people have, and most of those people have a crow story or two to tell. Tell them that the floor is open for them to describe any experiences of crows that they've had.

:30 Lead a discussion on why crows are so pervasive. When posing questions to the group, call on raised hands. It is typical for many people to have seen (and heard) crows because they are everywhere, and they especially like to gather in places where humans live. Why is this? Why do crows do better than deer in cities? Accept the students' answers, then sum them up by saying that crows succeed in cities because of their adaptability and intelligence. Transition into discussing intelligence, and ask the students what intelligence is (a matter of perspective). Is crow intelligence fact or fiction? Say that intelligence is a shaky concept, that scientists aren't in consensus about what exactly constitutes intelligence. Traditionally, humans are believed to be the apex of intelligence. If we have this perspective, then we can deem crows to be quite intelligent because they share a lot in common with humans. There have been studies done which show that crows have the same cognitive abilities as apes (casual reasoning, prospection, imagination, flexibility; explain each of these). Why might this be (mention similar evolutionary scenarios, as well as Corvid family)? How do we see these abilities demonstrated by crows? What are some other things crows have in common with us?

:50 Conclude by tying everything back to the daily theme of Fact vs. Fiction. See "conclusion" section.

Conclusion
Say that the Coast Salish culture is an oral one, knowledge passed down through stories. In a way, the Coast Salish people teach and learn through their stories (example of Raven and Crow's Potlatch). In contrast, modern Western culture seems to teach and learn through science, through facts and hard evidence. Can you say that either fact or fiction is better in this case? As for tying into the theme of perspectives, what perspective do you think the Coast Salish culture has of the crow? How about Western culture? Is either one of these "correct?"

Assessment:
The discussion is an assessment in itself. Students can be determined to have absorbed this lesson's objectives by what they say in the discussion.

Extensions:
To add some more movement to this lesson, students could be divided into two groups. One group could act like a group of scientists reporting on crows, and the other group could play the role of some crows reporting on humans, to illustrate discussion on crow intelligence.

Glitch Plan:
If none of the students want to partake in the telling of the Coast Salish folk tale, be ready to tell the whole thing. Rain won't be a problem, since the whole lesson is inside the boat.

Risk Management:
Little risk involved in terms of physical risk, because everyone is sitting. Emotionally, there may be a risk of offending people in the discussion. Adequate attention and respect must be given to everyone's point of view, both on the student's part and the instructor's part.

Background Information:
Cognitive abilities of crows:
-casual reasoning (developing and using tools)
-flexibility (knowing that there's more than one way to accomplish one task)
-prospection (the ability to imagine future events)
-imagination (situations never seen before can be formed in the mind's eye)
Corvidae:
Crows are of the Corvidae Family, along with magpies, ravens, nutcrackers, jackdaws, rooks, and jays. Corvids are of the Order Passeriformes, which is composed of perching birds and songbirds. Crows and Ravens have their own Genus, Corvus, underneath Corvidae.

"Raven and Crow's Potlatch"

..... a Salish tale from Washington .....

Raven used to live high up in the upper Skagit River country. He was very lazy. In the summer when the other animals were busy gathering food for the winter, he would be flying from rock to stump to rock making fun of them. Raven just laughed when Crow (his cousin) urged him to follow Squirrel's example-but Raven never prepared for the cold months, when the snow would drift over the ground and cover the remaining food.

But now Raven was in trouble. Winter had come and the snows were deep. He was hungry and Raven loved to eat. He had to find someone who would share their food with him.

Raven went to see Squirrel. He had a huge supply of pine nuts and seeds and other food hidden all over the place. Raven poked his head into Squirrel's nest in an old fir tree.

Squirrel had lots to eat. Raven politely begged for some food. Squirrel scolded him - that was always Squirrel's way - "You refused to work and save for winter and you poked much fun at me. You deserve to starve!"

Raven went looking for Bear but he was sound asleep in his cave and could not be awakened. Raven looked around for some food but it was all in Bear's belly. He had already eaten it all and was sleeping till spring.

Raven was now very hungry. He thought, "Who can give me something to eat? Everyone is either stingy like Squirrel or sleeping like Bear and Marmot, or they have gone south for the winter like the snowbirds." Then he thought of Crow. He would be easy to fool.

Raven flew to Crow's nest. "Cousin Crow, we must talk about your coming potlatch!" Crow answered, "I have not planned a potlatch."

Raven ignored his response. "Crow, everyone is talking about your potlatch. Will you sing at it?" "Sing?" Crow had not known that anybody really cared for his singing voice, even though in those days his song was much more like that of Wood Thrush than it is today.

Raven continued to talk of Crow's potlatch. "You are very talented and possess a beautiful voice. Everyone will be so disappointed if you don't sing at your potlatch."

"What potlatch?" Crow inquired. "Do you really like my singing?"

"We love your singing, Crow," Raven answered. "The winter's cold has chilled the forest and we're cold and hungry and singing will help us forget our cold feet and empty stomachs. "Now you get started fixing the food - looks like you have plenty here - and I will go invite the guest to your potlatch. You can practice your songs as you cook!"

Crow's hesitation now overcome, he began to prepare all the food he had collected for winter and as he prepared it, he practiced his songs. The more he thought about the feast and how everyone wanted to hear him sing, the more excited he became.

Meanwhile, Raven was offering invitations to all the animals of the forest. (Of course Marmot and Bear and Beaver were sleeping, and Robin and Goose had gone south.) To each he said the same thing, "Come to MY potlatch! I have worked hard to prepare it. There will be much food at Raven's potlatch and Crow is helping and will sing for us. There will be fern roots and wild potatoes, dried berries, fish and meat. Come to MY potlatch! It will be a great occasion." Raven did not invite Squirrel however, since he had refused to share his food with him, but all of the other animals were invited to Raven's Potlatch.

When he returned to Crow, he was still busy cooking and singing. Raven told him, "Everyone is coming - be sure and fix all your food - they will be hungry after their journey. Your songs are sounding good. Crow's potlatch will be a great feast!"

As the guests arrived, Raven welcomed each one to his potlatch. There was Deer and Mountain Goat and Mouse, Rabbit, Grouse, and Jay. The guests were seated and the food was brought out. Crow started to sit and eat but Raven asked him for a song first. "It's not good to sing on a full stomach, Crow," he encouraged.

Crow began to sing. Every time he would stop to eat Raven would insist that he sing another song. "You can't sing with your mouth full, Crow!" Encouraged again and again by

the guests who were busy stuffing themselves with his food, Crow sang song after song after song - all day until night - and Crow's voice became hoarser and hoarser until all he could do was "Caw - Caw".

As was the custom, the leftover food was collected by the guests and taken by them for their homeward journey. Even Raven had taken his share and left as Crow was cleaning up. Crow had nothing left to eat. "At least," Crow thought, "I won't go hungry. I will be invited to their feasts." For it was the custom that having been entertained, each guest was now obliged to return the favor and invite the host for a return potlatch.

But the invitations never came. Since all the guests thought it was Raven who hosted the feast, Raven was invited to enough dinners to keep his belly full for several winters and he never went hungry.

Poor Crow, who had been fooled, had been reduced to starving and never regained his singing voice either. He was destined to spend his winters begging in all the camps of men for scraps of food. And that's where we find him today - squabbling over scraps in grocery store parking lots. Caw! Caw! Caw!

Story from Costal Salish People, found on this website:
http://www.northwest-art.com/NorthwestArt/WebPages/StoriesRaven&CrowsPotlatch.htm

Bioluminescence Lesson and Night Sit
(Monday Campfire)

Facilitator: Lindsey Parkinson
Subject: Bioluminescence
Duration: 1:30
Location: Shallow Bay
Group Size: 19 students

Objectives
To have students
- See bioluminescence if they haven't before.
- Give students the opportunity to be alone in the dark outside.

Materials
- Book to read a quote out of - something about time, light, sunset

- Boots for wading into the ocean

Procedure

:00 Walk to shallow bay.

:15 Have the students spread out down the beach doing solo sit spots as it gets darker.

:45 Gather the students back together to tell them about the bioluminescence they are hopefully beginning to see. Ask for theories as to why it lights up. Tell them some of the other theories to introduce a piece of mystery. TAs with boots can walk around the shallows and stir up the water

1:00 Play with the water stirring up the plankton.

1:15 Head back to camp

Background

In the waters around the San Juans bioluminescent plankton commonly known as Sea Sparkle (*Noctiluca scintillans)* thrive. When disturbed these tiny organisms light up. One theory is that they light to show off their predators so their predators are more likely to be eaten. Another is that they are attempting to imitate the night sky.

Noctiluca scintillans is an unarmoured, marine planktonic dinoflagellate species. This large and distinctive bloom forming species has an associated with fish and marine invertebrate mortality events.

Noctiluca scintillans is a nonphotosynthetic heterotrophic and phagotrophic dinoflagellate species; chloroplasts are absent and the cytoplasm is mostly colorless (Figs. 1, 2). The presence of photosynthetic symbionts can cause the cytoplasm to appear pink or green in color (Sweeney 1978).

Noctiluca scintillans is a strongly buoyant planktonic species common in neritic and coastal regions of the world. It is also bioluminescent in some parts of the world. This bloom-forming species is associated with fish and marine invertebrate mortality events. *N. scintillans* red tides frequently form in spring to summer in many parts of the world often resulting in a strong pinkish red or orange discoloration of the water (tomato-soup). Blooms have been reported from Australia (Hallegraeff 1991), Japan, Hong Kong and China (Huang & Qi 1997) where the water is discolored red. Recent blooms in New Zealand were reported pink with cell concentrations as high as 1.9 X 106 cells/L (Chang 2000). In Indonesia, Malaysia, and Thailand (tropical regions), however, the watercolor is green due to the presence of green prasinophyte endosymbionts (Sweeney 1978; Dodge 1982; Fukuyo et al. 1990; Hallegraeff 1991; Taylor et al. 1995; Steidinger & Tangen 1996). This large cosmopolitan species is phagotrophic, feeding on phytoplankton (mainly diatoms and other dinoflagellates), protozoans, detritus, and fish eggs (Fig. 2)(Dodge 1982; Fukuyo et al. 1990; Hallegraeff 1991; Taylor et al. 1995; Steidinger & Tangen 1996).

80-90% of deep sea animals use bioluminescence in some way.

Tree of Life: Cedar

Original Lesson by Demi Fair

Facilitator: Demi Fair
Subject: Ethnobotany, cultural history, human ecology.
Duration: 90 Minutes
Location: Sucia Island- forested area near Shallow Bay campground
Group Size: 10 students

Objectives
Students will be able to:
1. Discuss the significance of the cedar tree in Coast Salish culture.
2. Identify the various ways Coast Salish used cedar in transportation, shelter, cooking, clothing, ceremonies, spirituality, and medicine.
3. Develop observation skills using alternative senses other than vision.
4. To instill in the students that giving and taking goes beyond the physical realm.

Content Standards Addressed:

- EALR 2: Inquiry
  Expand and refine skill and abilities of inquiry to gain a deeper understanding of natural phenomena.
- EALR 3.1
  Understands the physical characteristics, cultural characteristics, and location of places, regions, and spatial patterns on the Earth's surface.
- EALR 3.2
  Understands human interaction with the environment.

Materials

5 bandanas for blindfolds, journal, pen/pencils, cedar bark

Preparation

- Gather 10 pieces of cedar bark
- Fold 10 bandanas into blindfolds

Procedure
:00 Gather students in a forested area near cedar trees. Have them close their eyes and pass out a small piece of cedar bark to each student. Ask them to feel, smell, and taste the bark. Read the first two pages of *People of the Cedar* from the book "Cedar" by Hilary Stewart while they keep eyes closed and hold the bark.

:05 Ask them to open eyes. What did they feel, smell, taste? Open a discussion with the following questions: What do you know about cedar? How is it different than other trees we see nearby? How does it look? Feel? Smell? Where do they grow? What do you think the Coast Salish people used cedar for?

:10 Discuss the ideas the students shared on how the Coast Salish used cedar and expand by covering each section:

- **Shelter:** poles and planks in longhouses, smokehouses, salmon caches.
- **Transportation:** canoes made with single piece of cedar. Typical family canoe could hold 15 people and their supplies! One large tree could make 2 canoes.
- **Clothing:** Inner bark used to weave clothing and hats. Very waterproof and warm.
- **Technology:** basketry, mats, cordage, bowls, tools, drying racks, kindling for fire.
    - Bentwood boxes for food storage and cooking. Cooking box sat beside fire partly filled with water, then a woman dropped heated stones into the box to bring water to boil.
- **Medicinal:**
    - For kidney problems, the Coast Salish would drink an infusion made by boiling the leaves, bark, and twigs of the cedar. They also chewed the cedar's green cones and swallowed the juice to prevent conception.
    - Lummi people would chew the buds and swallow them for sore lungs.
    - Skagit people would boil leaf ends for coughs. Leaves and limbs were also used for scrubbing body when bathing.
- **Ceremonial:** totem poles, large masks.
    - Games! For example, a small bat made of cedar board would be used to bat a shuttlecock made of feathers attached to a piece of thimble-berry stem. Just like modern badminton!

:15 The Coast Salish took a lot from the cedar tree. How did they give back to the cedar? Read the following words of gratitude:

Look at me friend!
I come to ask for your dress.
You have come to take pity on us,
for there is nothing for which you cannot be used,
because it is your way that there is nothing
for which we cannot use you,
for you are really willing to give us your dress.
I come to beg you for this, Long Life Maker,
for I am going to make a basket for lily roots out of you.
I pray, friend,
to tell your friends about what I ask of you.
Take care friend.
Keep sickness away from me that I may not be killed
in sickness or in war, O friend.
-A prayer from a Kwakiutl women

The Coast Salish had a deep understanding and profound spiritual respect for the cedar tree. Before felling the tree or taking bark, they would acknowledge this spiritual bond by thanking the tree and telling it what they were going to use it for.

:20 Cedar was just as much a part of death as it was life. Ask students how they think cedar may have been used in death.

Share examples:

- Lummi men burying a corpse would chew cedar tips to avoid nausea. Singed cedar limbs were used to sweep off the walls of a house after removal of a corpse.
- In Skagit tradition, they burned cedar limbs at night and waved them through the house to scare the ghost after death.
- When a person died, the body was often placed in a bentwood cedar box and placed in a type of gravehouse, on top of a platform of planks, or top of a mortuary pole.

:25 Cedar was a strong aspect in new life, whether that was childbirth or coming of age rituals. Ask students to share about any coming of age rituals they know. Are there any plants associated with the ritual?

Share the following Lummi traditions:

- The Lummi ensured a long life for a newborn child by placing the afterbirth in the stump of a large, long-lived cedar tree. To make the child grow up brave, they fastened the afterbirth to a cedar's topmost limbs.
- In Lummi tradition, a boy would take the boughs he has rubbed himself with before going on a guardian spirit quest and fasten them to the top of a cedar tree.

:30 Inform the students that they are each going to get to know a tree more intimately, similar to the way the Coast Salish knew the cedar. We are going to do this through our own coming of age ritual!

- Set up scene: For many cultures, there are coming of age rituals or rites of passage that mark the transition from adolescence to adulthood. One coming-of-age rite of passage challenges each youth to be blindfolded and led out of their village, miles into the wilderness to a place they are unfamiliar with. When they arrive, they are taken to a tree and asked to sit with it and get to know it. They sit at their tree blindfolded for three or four days before being led back to the village. Once they return, they are able to take off their blindfolds. They are then instructed to walk out into the hundred of square miles of wilderness near their village and find their specific tree. When they succeeded in finding their tree, the elders knew they were ready to be an adult. Explain that we are going to do an extremely shorter version of this ritual.

:33 Explain that the leader should guide them in such a way that confuses their sense of direction, such as going in circles or confusing patterns. Give example with fellow spring blocker on how to gently lead their partner in a confusing way. Have the students break up into pairs. One partner will be blindfolded first.

:38 Instruct the blindfolded students that once they are at the tree they must use all their available senses to get to know this particular tree. What does the bark feel like? Do you feel any moss or other plants? What do you smell? What do you hear? Are their birds nearby? Encourage them to really use their senses to get to know this tree.

:40 Inform students that they will have 15 minutes to explore this tree and then their partner will guide them back. While the first group is with their trees, give the students waiting a writing prompt: what do you take away from a tree that is not physical? what can you give a tree?

:60 Once the time is up, have their partners lead them back to the group and take off their blindfold. Then instruct them to go out and find their tree, letting them know they will only have 5 minutes.

:65 Call them back and have partners switch, giving the writing prompt to the students who have just returned.

:85 Have the second group of students return, take off their blindfolds, and give them 5 minutes to find their tree.

Conclusion
After the second group has met their tree, have the group gather in a circle. Each student shares about their tree and it's characteristics. Ask students to share how it felt to depend on their other senses to become familiar with this tree.

Assessment
Ask students to raise hands if they couldn't find their tree. Then ask students to raise hands if they could find their tree. Have them share about what the experience was like for them. What were the biggest challenges? What was easier that you expected? What was harder than you expected? If you didn't find your tree, what would you do differently next time? Have students share their writing reflections: What do you take from a tree? What do you give? How did this perspective shift between the two groups?

Extensions
1. Have students return to their tree for a longer sit spot (1 hour) in which they can use all of their senses to further connect with the tree. Have them journal about this experience.
2. Have students write a poem of gratitude to their trees.
3. Have the students introduce their trees to other students, noting all the characteristics they discovered about the tree.
4. Have students create a mythology story, creative dance, skit, song, or drawing about their connection to the tree.

Glitch Plan
In case of extremely heavy rain, we will gather underneath the campground shelter for discussions.

Risk Management

Students could trip while being led to their tree. This can be prevented by clearly demonstrating how students should guide their blindfolded partners. There are four spring block students who are certified Wilderness First Responders, including the facilitator of this lesson, in case of an accident.

Background Information

- Western Red Cedar
  Needles: soft and flat; fernlike sprays with tiny brown upright cones
  Outer bark: plated, soft, and runs in strips vertically up the tree
  Smell: pleasant, aromatic smell
  Location: moist habitats; cool, wet climates; between sea level and 3500 feet
  Cedar wood is very light compared to other types of wood and splits very easily

Cypress family (Cupressaceae). Native trees growing to 50 (-75) meters tall, often buttressed at base, with a conical to irregular crown, old individuals frequently with many leaders and many dead spike tops; branches arching, branchlets pendent, flattened, in fan-shaped sprays; bark gray to reddish-brown, 10-25 mm thick, fibrous, separated into flat, connected ridges. Leaves are evergreen, scale-like and sharply pointed, (1-) 3-6 mm long, opposite in alternating pairs (in 4 rows), glossy green above, white-striped on the lower surface, with a spicy fragrance when crushed. Seed cones are ellipsoid, 10-14 mm long, brown; seeds 8-14 per cone, 4-7.5 mm long, with lateral wings about as wide as the body. The common name pertains to the western distribution and cedar-like appearance.

- Red cedar was a major medicinal herb for these Pacific Northwest cultures, although it is not much used today.

Native American tribes used the twigs, leaves, roots, bark, and leaf buds of red cedar to treat many different symptoms. Internal uses include:

- boiling limbs to make a tuberculosis treatment
- chewing leaf buds for sore lungs
- boiling leaves to make a cough remedy
- making a decoction of leaves to treat colds
- chewing leaf buds to relieve toothache pain
- making an infusion to treat stomach pain and diarrhea
- chewing the inner bark of a small tree to bring about delayed menstruation

- making a bark infusion to treat kidney complaints
- making an infusion of the seeds to treat fever
- using a weak infusion internally to treat rheumatism and arthritis

External uses include:

- making a decoction of leaves to treat rheumatism
- washing with an infusion of twigs to treat venereal disease, including the human papilloma virus and other sexually transmitted diseases
- making a poultice of boughs or oil to treat rheumatism
- making a poultice of boughs or oil to threat bronchitis
- making a poultice or oil from inner bark to treat skin diseases, including topical fungal infections and warts
- using shredded bark to cauterize and bind wounds

Scientific research supports some of these traditional uses of red cedar. Extracts of red cedar have been shown to have antibacterial properties against common bacteria. Compounds with antifungal properties have also been isolated.

http://www.altmd.com/Articles/Red-Cedar--Encyclopedia-of-Alternative-Medicine

Native healers used red cedar for treating fevers, sore throats, coughs, colds, bronchitis, pneumonia, tuberculous infections, diarrhea, boils, heart and kidney problems, menstrual disorders, ringworm and other fungal skin infections, toothaches, arthritis, sore muscles, vaginitis, and bladder irritation. Eclectic physicians and herbalists in America and Europe have exploited Western Red and Northern White Cedar for many of the same maladies, as well as prostate problems, incontinence, and syphilis and other sexually transmitted diseases.

Modern research confirms the antifungal, antiviral, antibacterial, and antioxidant activities of thujaplicin, as well as the immune-stimulating effects of various red cedar extracts. Red cedar enhances phagocytic activity in human granulocytes (a special class of white blood cells), which is important for fighting off bacterial and fungal infections.

-http://herbalcountrydoc.com/2/post/2012/3/western-red-cedar-antibacterial-antifungal-purifier-dreamweaver.html

Taking a Likin' to Lichen

Original lesson by Lindsey Parkinson

Subject: Epiphytes
Duration: 90 minutes **Location**: Echo Bay
Age of Students: 14-18 yrs **Group Size**: 9 Students; any

Objectives:
Students will be able to:

- Recognize lichens
- Say what separates a lichen from a fungus
- Tell some of the benefits of lichen to people and the ecosystem

Content Standards Addressed

EALR 2: Inquiry

Big Idea: Inquiry (INQ)

Core Content: *Conducting Analyses and Thinking Logically*

In prior grades students learned to revise questions so they can be answered scientifically. In grades 9-12 students extend and refine their understanding of the nature of inquiry and their ability to formulate questions, propose hypotheses, and design, conduct, and report on investigations. Refinement includes an increased understanding of the kinds of questions that scientists ask and how the results reflect the research methods and the criteria that scientific arguments are judged by. Increased abilities include competence in using mathematics, a closer connection between student-planned investigations and existing knowledge, improvements in communication and collaboration, and participation in a community of learners.

EALR 4: Physical Science

Big Idea: Energy: Transfer, Transformation, and Conservation (PS3)

Core Content: *Transformation and Conservation of Energy*

In prior grades students learned to apply the concept of "energy" in various settings. In grades 9-11 students learn fundamental concepts of energy, including the Law of Conservation of Energy—that the total amount of energy in a closed system is constant. Other key concepts include gravitational potential and kinetic energy, how waves transfer energy, the nature of sound, and the electromagnetic spectrum. Energy concepts are essential for understanding all of the domains of science (EALR 4), from the ways that organisms get energy from their environment, to the energy that drives weather systems and volcanoes.

EALR 4: Life Science

Big Idea: Structures and Functions of Living Organisms (LS1)

Core Content: *Processes Within Cells*

In prior grades students learned that all living systems are composed of cells which make up tissues, organs, and organ systems. In grades 9-11 students learn that cells have complex molecules and structures that enable them to carry out life functions such as photosynthesis and respiration and pass on their characteristics to future generations. Information for producing proteins and reproduction is coded in DNA and organized into genes in chromosomes. This elegant yet complex set of processes explains how

life forms replicate themselves with slight changes that make adaptations to changing conditions possible over long periods of time. These processes that occur within living cells help students understand the commonalities among the diverse living forms that populate Earth today.

EALR 4: Life Science

Big Idea: Ecosystems (LS2)

Core Content: *Maintenance and Stability of Populations*

In prior grades students learned to apply key concepts about ecosystems to understand the interactions among organisms and the nonliving environment. In grades 9-11 students learn about the factors that foster or limit growth of populations within ecosystems and that help to maintain the health of the ecosystem overall. Organisms participate in the cycles of matter and flow of energy to survive and reproduce. Given abundant resources, populations can increase at rapid rates. But living and nonliving factors limit growth, resulting in ecosystems that can remain stable for long periods of time. Understanding the factors that affect populations is important for many societal issues, from decisions about protecting endangered species to questions about how to meet the resource needs of civilization while maintaining the health and sustainability of Earth's ecosystems.

Methods:

- Introduce personal history with lichens. What lichens are and how research is done.
- Have them explore the surrounding wooded area looking for lichens and counting the number of species they can find
- Bring them back to tell what they found. Teach them about how lichens grow and under what sort of conditions. Send them back out to try and create theories of how they spatially differentiate and speciate
- Discuss more of what they found. Why do they think lichens are important to the ecosystem?

Materials:

- journals
- writing utensils
- field guides
- pictures of research
- copy of Sucia Island plant list
- pictures of alders with and without lichen (whatcom creek?)

Procedure:

:00 Introduction Part 1 (15-20 minutes)

Anecdote:

This past summer I had a great opportunity to spend a month doing field research in the Siberian arctic. My job while there was to assist in the study of the terrestrial ecosystem around where we were stationed. Specifically I created a field guide to the local flora- as much as I was able to picture and identify in my short time there. I quickly realized I needed to begin collecting samples from mosses and lichens if I wanted to create a truly all encompassing guide. My first day focusing on the little guys I found five different species of white lichen. Five in the same

general area. This small discovery opened up so many more questions. Specifically: What causes speciation? And how do the lichens distribute themselves spatially?

- Show a few pictures of terrestrial research in Siberia
- Can anyone tell me what makes a moss a moss? What about lichen? Have you ever thought about the much before?
- Discuss what epiphytes, bryophytes, and lichens are
- Mention how mosses and lichens are understudied in many places. As far as I'm aware they have never been studied on Sucia.
- Show the plant list of Sucia. Anything missing? No mention of moss or lichen anywhere on it. For all we know we could be discovering new species every time we see some.
- Note: Limit picking of lichen. It is slow growing. Some is fine but practice LNT and return to the ground around where it was found with the hope of regrowth.

:15 Activity 1 (20-30 minutes)

- Give the students 10 minutes to explore the area looking for mosses and lichens
- Bring them back after 10 minutes. How many did you find? Where do they grow? What color are they? How are they shaped? How did you tell them apart?
- Introduce how lichens and mosses grow. Mosses need water where as lichens can survive quite a while without. Lichens grow in some of the most stressful environments on the planet. Also that lichens act as bioindicators of air quality.

:40 Activity 2 (30-40 minutes)

- Send them back out for 15 minutes with their new knowledge and the observations of their peers. This time have them look at where they grow in relation to one another. Can we find any patterns? What do they think could cause speciation? eg. Rocks v. Trees; surface v. crevice; dry v. wet. Can species relationships be mapped or drawn?
- What did they discover this time? Any theories as to why they grow the way they do? What causes speciation and spatial differentiation?
- This can be expanded to take up general discussion time

:70 Discussion: (30-40 minutes)

- Think about the lichens you have seen today and others you may have seen in the past. If three quarters of the species in Washington disappeared would you notice? Would anyone? What could that mean for us?
- Have you ever considered lichens or mosses before? Positively or negatively?

Conclusion

- Have them discuss what they learned today. Specifically how the study of lichens may be important to biodiversity studies

Assessment/Evaluation:

Based primarily on the discussion, was there any changes in viewpoint between initial discussion and later discussion? What theories did they have of spatial differentiation and speciation?

Extension
Discuss more

Glitch Plan
If it's raining, that's just an opportunity to see rehydrating lichen

Risk Management
Tell the students to not climb trees while introducing the activity in order to limit problem activities. Set up exploration boundaries. WFR certified people will be available with first aid kits in case of issues.

Background:
Epiphyte: Plant that grows on another plant
epi - Greek: upon (eg. epidermis)
phyton- Greek: plant (eg. bryophyte, phytoplankton)
Bryophyte: Non-vascular plant
bryon - Greek: tree-moss, oyster-green
Lichen: a composite organism formed of a partnership between a fungus and a photosynthetic organism

Epiphytes are plants that grow on other plants in a non-parasitic way. It is estimated that 10% of all plants in the world are epiphytes. In the northern hemisphere epiphytes are primarily lichens, mosses, and ferns. In 1950 a study on the Olympic peninsula found 105 lichens, 36 liverworts, 48 mosses, 1 lycopsid, and 5 ferns. Worldwide there are an estimated 20,000 species of lichen and 11,000 species of bryophytes.

Lichens independently evolved several times throughout biological history. So some lichens aren't even very closely related! This independent evolution is evidence of the extreme favorability of having a fungal plant relationship. The photobiont creates sugars suing the suns energy and the fungal portion fixes nitrogen and other nutrients from the air.

Lichens are used as monitors of air quality due to the fact they gain all of their nutrients through interactions with the atmosphere. They are sources of food for reindeer and certain butterfly larvae and can be used as sources of food, water and nesting material by the northern flying squirrel. Also major sources of nitrogen in older and old growth forests.

When studying lichens the biomass of lichen litter on the ground can be used as an indicator of lichen biomass in the canopy.

With increased capabilities of genetically classifying new organisms morphology (recognizing species by outward appearance) is disappearing to phylogony (species by molecular/genetic characters) in lichens. Some of the finer classifications may be difficult to see but there is still much that can be learned visibly.

Factoids:
- It has been estimated that 10% of all global plants are epiphytes
- estimated 20000 spp of lichens globally and 11000 spp of bryophytes (non-vascular plant)
- lichens can survive in the vacuum of space! Once in orbit the capsules were opened and the lichens were directly exposed to the vacuum of space with its widely fluctuating temperatures and cosmic radiation. After 15 days the lichens were brought back to earth and were found to be in full health with no discernible damage from their time in orbit
- lichens are a source of food, dyes, and medicines.

River Otter Crawl

Original Lesson by Katlynne Schaumberg

Facilitator: Katlynne Schaumberg
Subject: North American River Otter
Duration: 90 minutes
Location: Sucia Island -- Shallow Bay North Camp to Lawson Point
Group Size: 19 students split in 2

Objectives:
Students will develop a deeper understanding of the North American river otter. They will look at different perspectives of the river otter and be able to empathize with the river otter through imitating the it. Students will develop skills for recognizing the signs of river otter presence.

Methods:
- Share previous experiences with the North American river otters to contribute to group knowledge about diet, habitat, behavior, physical adaptations, and ecological importance of the marine mammal
- Discuss the different perspectives of how the river otter can be viewed (docile and lovable, ruthless killer, or from the non-psychological, scientific standpoint)
- Be able to identify the 3 major signs of river otter presence and activity
- Be able to empathize with river otters

Materials:
- pictures of river otter
- mammal tracking/ guide books
- binoculars
- nerdy glasses
- optional: two additional helpers

Preparation
- Scout for otter signs prior to bringing group on trip.

- Additional help from two others to act out the perspectives on river otters.

Procedure:
00:00 - 00:10 Walk to Lawson Point. Ask students to make observations about their surrounds as they walk. Tell them that a major thing we hope to instill in them is how to be a natural historian. One of the most important skills of a natural historian is observing patterns in nature, posing hypotheses to explain those patterns, and evaluating the hypotheses using additional observations. “Look at what is the same within the area you are examining, look at what is different with in the area you are examining and also compare those similarities and differences to other sites, organisms, species etc.” Look for relationships of interconnectedness and causation. Look for the links between patterns and ask questions to further develop your ecological perspective.

00:10 - 00:15 Arrive at Lawson Point. Ask students to share their observations and any patterns they found.

00:15 - 00:30 Introduce the North American river otter. Hopefully all students noticed the scat and scent mounds along the trails, regardless of whether or not they knew what they were. Tell students that they walked by many signs of the river otter. Ask students to share some of their personal experiences or sightings of otter. Acknowledge each story and provide more indepth information for either the behavior or adaptation described in the story. If they don’t have many stories to contribute tell them about my personal sightings on Sucia. Use this time to get students excited about river otters. Show picture of river otter. Make sure to supply some interesting facts (fur density, tail 1/3 of body length, delayed implantation, hold breath for 8 minutes, dive 60 feet down, opportunists, etc.) Explain that river otter abundance is directly dependent on habitat quality and food availability (indicator species). Refer to background information.

00:30-00:40 Ask students to make generalizations about how we currently view the river otter. Ask students why they think that way about the river otter. Introduce the idea of situated knowledge. Do they think their perspective is right/correct? Introduce three very different perspectives of the river otter through theatrical impersonations. Have two other Spring Blockers help act them out.

1 Otter lover: (Binoculars and sun hat) It’s just sooo cute! Look at how furry and cuddly it looks! Oh, it looks like its having just all the fun playing the water! It looks like its just here to have fun!
2 Scientist: (put on nerdy glasses) Well, yes it appears that *Lontra canadensis* does display some rather unique behavioral characteristics that do not necessarily support evidence for pure survival. But my observation and research tell me that this marine mammal actually plays a key role in nutrient transport on terrestrial communities. For coastal river otters in particular they transfer high doses of nitrogen.
3 Ruthless killer: (Discovery channel/ nature moment) Ask students to imagine being that same Bufflehead bird sitting on the calm water in Shallow Bay this morning and without warning get viciously pulled down underwater! You can feel their sharp teeth (like the

blades of my knife) clamp down on your body and neck and the otter begins to pull you under. You start gasping for breath but you inhale water and begin to suffocate. The otter drags you to land right before you drown to death, only to be barbarically ripped apart and eaten. Blood and guts and feathers lay disgustingly all over the grass. The river otter is a not a cute, cuddly creature but a cold hearted killer with gluttonous eating habits. They they tear up the trail and moss, grass and piss all over it (scent mounds). They leave piles of shit everywhere.

00:40 - 01:00 Ask students to share their thoughts about river otters after hearing these three very different perspectives. Where is the balance between good and bad, and where on that spectrum are river otters? Is it okay for river otters violate LNT rules but wrong for us to do similar actions? How might their behaviors impact their environment and Sucia island specifically? Consider the nutrient transport by coastal river Otters on terrestrial communities. What perspective of the river otter should we take on? Is it okay to have emotion for making these kinds of judgements? Leave discussion open, but ask students to consider these ideas because we will be talking about similar perspectives in the following days.

Conclusion:
01:00 - 01:30 Tell students they are transitioning to the next lesson but in order to get to the next location they must move like a river otter (Otter Crawl). They must embody the river otter on their journey back. Ask them to physically, mentally and emotionally get on the level of a river otter, imitating their movements, behaviors, and personalities. Even if you've never seen a river otter moving on land, how do you think it would move its long body, tail, short arms and legs? Go over risk management (not going too far off trail or sliding down super steep slide trails) and the LNT. Space students out about every 50 feet along the trail.
While students are waiting to do the otter crawl lead an animal form stretch session where we embody other different animal. Go around in a circle and take turns being their spirit animal from first day name game.

Assessment:
Based primarily on students sharing ideas and experiences during discussion. Identify broadened perspectives of the river otter from the start of the lesson to the last discussion. changes in viewpoint between initial discussion and later discussion? Assessment of journal entries and observations of what it was like to be an otter. Evidence for empathizing with river otters will be shown through embodying the animal in the Otter Crawl.

Extension:
- Include a 10 minute tracking lesson where students learn the basics to tracking. Information found in *A Field Guide to Mammal Tracking in North America* by James Halfpenny.
- Ask students to journal about their perspectives of river otters and how the interact and impact their environment. Have them write down observations and patterns they noticed while doing the Otter Crawl.

Glitch Plan:
Otter Crawl is dependant on weather conditions. Students will most likely not want to get muddy if its raining and cold. Instead of asking them to get on all four and crawl around, break students into smaller groups and track the river otter together. Have them search for the three main indications of their presents (scat, scent mounds, and slide trails). Tell students to use all their senses (especially sight, smell, and perhaps even taste) to explore these signs and imagine a river otter moving through this landscape. Position yourself at a trail leading up to a den and allow students to follow it briefly. Point out how low the trail is and where in deeper brush you can see a tunnel of branches and sticks form, but only if you get down to otter eye level.

Risk Management:
Set boundaries for Otter Crawl. Although they should embody the river otter to the fullest, ask that they do not slide face first down slide trails. They may briefly follow otter trails off the main trail but must stay within 100 ft of main trail.

Background Information:
Basic information of the North American river otters (*Lutra canadensis*):

- Long, streamlined bodies, short legs, webbed toes, and long, tapered tails—all adaptations for their mostly aquatic lives. Their short thick fur is a rich brown above, and lighter, with a silvery sheen
- Fur: guard hairs average 23.8 mm (0.94 in), with a density of about 57,800 hairs/cm^2 (373,000 hairs/in^2)
- River otters are sometimes mistaken for their much larger seagoing cousin, the sea otter (*Enhydra lutris,* Fig. 2). However, male sea otters measure 6 feet in length and weigh 80 pounds. Sea otters are acclimated to salt water, and come to shore only for occasional rest periods and to give birth. In comparison, river otters can be found in fresh, brackish, or salt water, and can travel overland for considerable distances. Unlike sea otters, they never float on their back.

  Four ways to tell distinguish a river otter from a sea otter.

Sea Otter	*River Otter*
1. True ocean dweller	Both land and water mammals
2. Swim belly-up	Swim belly-down
3. Sleep in water, kelp beds	Sleep in their dens on land
4. Diurnal	Nocturnal

- River otters are *Carnivores* and feed on:
  - Fish- trout, bass, salmon, sculpins
  - Crustaceans- crayfish
  - Reptiles/Amphibians- frogs, salamanders, newts, garter snakes
  - Birds- mallards, waterfowl
  - Insects-dragonflies, beetles, aquatic invertebrates
  - some Mammals- muskrats, voles, cottontails
- River otters can smell concentrations of fish in upstream ponds that drain into small, slow moving creeks, and will follow the smell to its origin, even in urban areas.
- pups....

- River otters have what is called *delayed implantation*; the fertilized egg does not attach to the uterine wall for a period of time after breeding. Thus, gestation ranges from 285 to 375 days.
- *Habitat:* river, lake, swamp, coastal shoreline, tidal flat, estuary
- Puget Sound provides a distinctly, virtually predator free optimal foraging habitat for otters:
    - year round food availability
    - abundance of rocky, intertidal shoreline
    - (and now conservation efforts directed at these unique ecosystems)
- *Threats:* Most of their struggle for habitat, resources, and food is inherently tied to recreational, commercial, residential and tourism activity.. HUMANS!
- River Otter are *Indicator Species,* they are very sensitive to pollution. Act as wake up call if something is off balance in their ecosystem. Because the otter is a strict carnivore and contaminants that occur in the environment may concentrate in the otter over time in a process known as biomagnification.

Quick and interesting Facts:

- River otters can hold their breath underwater for up to eight minutes.
- Dive to a depth of 60 feet!

Three major signs of River Otter Presence:

1. Scat: Tells us a lot about what they have been eating and gives us clues as to where the river otter has been and what its been up to. Scat is irregular, sometimes short, rounded segments, sometimes flattened masses, containing fish bones, scales, or crayfish parts; when fresh, often greenish and slimy. Scat most often found on banks of stream or pond, on logs, or on rocks in water.
2. Scent mounds: Scent marking in river otters is not a territorial behavior as it is with most other carnivores, such as cats, fox, and coyotes. Scenting in otters indicates their presence rather than a territorial boundary they defend. small scent markers, often just a small pile of grass and leaves with a small squirt of feces and urine. They put them on the trails they commonly use and seem to maintain these message boards, so to speak, year after year.
3. Slide Trails: The most obvious and best-known evidence of otters. Most often lead to their dens or latrines (toilet). About 8 inches wide and can be found on the slopes leading away/around water source.

Refer to my North American River Otter research paper (from Environmental Interpretation course).

Young, Jon., Haas, Ellen., McGown, Evan. *Coyote's Guide to Connecting with Nature*. Second Edition. 2010.

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(Latrines to Landscapes: Effects of Spatial and Temporal Variation in Nutrient Transport by Coastal river Otters on Terrestrial Communities) <http://www.uwyo.edu/wygisc/our_research/past_research/national_research/from_latrines_to_landscapes_effects_of_spatial_and_temporal_variation_in_nutrient_transport_by_costal_river_otters_on_terrestrial_communities.html>

"Leave No Trace"

Original lesson by Freya Fradenburgh

Facilitator: Freya Fradenburgh
Subject: ecology/sustainability/outdoor recreation/ethics
Duration: 60-90 minutes
Location: Lawson point, adaptable to anywhere
Group size: 9; any

Objectives:
Students will be able to:

- Name and explain the seven principles of Leave No Trace (LNT)
- Discuss intrinsic vs extrinsic value of nature and the spectrum of human relationships with the natural world
- Demonstrate LNT principles in a relay activity

Content Standards Addressed:
This lesson satisfies the Washington State Integrated Environmental and Sustainability Education learning standards:

Students develop knowledge of the interconnections and interdependency of ecological, social, and economic systems. They demonstrate understanding of how the health of these systems determines the sustainability of natural and human communities at local, regional, national, and global levels

Students engage in inquiry and systems thinking and use information gained through learning experiences in, about, and for the environment to understand the structure, components, and processes of natural and human-built environments.

Students develop and apply the knowledge, perspective, vision, skills, and habits of mind necessary to make personal and collective decisions and take actions that promote sustainability.

Methods:

- Students will begin by naming/elaborating on as many LNT principles as they can. Instructor will introduce any remaining principles.

- Students will then discuss the principles and apply them to different situations, considering diverse perspectives and value judgments associated with them.
- Lesson concludes with a relay race activity.

Materials:
- Sticks, pinecones
- Hand sanitizer
- Markers for start line and finish line for relay

Procedure:
:00 Intro discussion: Ask students what rules they follow when in nature (if any)

:05 Introduce Leave No Trace if the students don't bring it up

:10 Ask students about what LNT principles they are familiar with

:15 Possible discussion questions:
- Why is LNT important? (each piece)
- Why don't we don't apply this same ethic to
  a) places close to human settlement or in human use
  b) resource extraction areas from which we derive many products that make everyday life much easier, healthier and more comfortable that it would be otherwise… allude to the discrepancy in our attitudes toward different 'types' of nature
- Does LNT exist on a spectrum? How might a logger/miner feel about LNT? An environmentalist? What values are these perspectives based on?
- When have you ignored LNT? Why? Should humans/would you ignore LNT in survival situations?
- What is the potential impact of foraging/harvesting?
- Are animals conscious of their impact on the environment? Ask for examples
- What separates human from animal (if anything?) (ruled by instinct? Morals? Thoughts?)
- Introduce intrinsic vs extrinsic value - does LNT assume that nature has intrinsic value or does LNT simply preserve nature for further human use?

1:00 Game/Activity: leave no trace relay
a) Find a portion of resilient forest and divide students into groups of 3.
b) line students up behind the "start" line with a first runner, second runner, and third runner.
c) begin! *first person* has to find a stick and go 15-20 feet from the start line, dig a 6 inch hole at the other end of the field, and return to start line; *second person* (after being tagged by the first person) walks on knees or crawls with a pinecone held between legs to the hole, deposits it, uses sanitizer, and walked back on knees and tags third person. *Third person* fills hole with dirt, leaves, and/or moss, and covers the hole with leaves to hide it, and returns to start line.

Conclusion:
1:30 Debrief; thoughts; where is it ok to play? What impact did our activity have on the area?

Assessment: Students will write a journal response to the following scenario:

You are a recreational hiker traveling by yourself in the Mt. Baker wilderness. While enjoying a scenic hike on a maintained trail next to a creek far below, you spy a rocky path leading into the underbrush to your right--it looks like it might lead to the stream but judging from the vegetation and fallen logs, it might just be a wildlife trail. You would have to do a good amount of bushwhacking to get through. Do you choose to see where the path leads or do you continue on the maintained trail? Why? Would your answer change if you were out of water and needed to get to the stream? What if you were with another hiker, would their opinion influence your choice?

Extensions: Let the discussion develop. Introduce new situations and new perspectives into the discussion, play devil's advocate. Let students investigate the area for traces of human presence. Ask students where they have seen responsible and irresponsible LNT actions. What about fire suppression or controlled burning?

Backup plan: In the case of rain, discussion can be held in group shelters. This is also a good opportunity to have them evaluate shelters and state parks in the scope of LNT.

Risk management: First aid kit will be on hand. Students will be expected to respect diverse views and be conscious of emotional sensitivity. Leader will be available after the discussion to address any issues.

Background:

Leave No Trace

1. Plan ahead and prepare (know before you go)
    - Know the regulations and special concerns for the area you'll visit.
    - Prepare for extreme weather, hazards, and emergencies.
    - Schedule your trip to avoid times of high use.
    - Visit in small groups when possible. Consider splitting larger groups into smaller groups.
    - Repackage food to minimize waste.
    - Use a map and compass to eliminate the use of marking paint, rock cairns or flagging.
2. Travel and camp on durable surfaces (choose the right path)
    - Durable surfaces include established trails and campsites, rock, gravel, dry grasses or snow.
    - Protect riparian areas by camping at least 200 feet from lakes and streams.
    - Good campsites are found, not made. Altering a site is not necessary.
        - In popular areas:
            - Concentrate use on existing trails and campsites.
            - Walk single file in the middle of the trail, even when wet or muddy.
            - Keep campsites small. Focus activity in areas where vegetation is absent.
            - In pristine areas:
            - Disperse use to prevent the creation of campsites and trails.
            - Avoid places where impacts are just beginning.
3. Dispose of waste properly (pack it in, pack it out; leave nothing but footprints)
    - Pack it in, pack it out. Inspect your campsite and rest areas for trash or spilled foods. Pack out all trash, leftover food and litter.
    - Deposit solid human waste in catholes dug 6 to 8 inches deep, at least 200 feet from water, camp and trails. Cover and disguise the cathole when finished.
    - Pack out toilet paper and hygiene products.

- To wash yourself or your dishes, carry water 200 feet away from streams or lakes and use small amounts of biodegradable soap. Scatter strained dishwater.

4. Leave what you find
   - Preserve the past: examine, but do not touch cultural or historic structures and artifacts.
   - Leave rocks, plants and other natural objects as you find them.
   - Avoid introducing or transporting non-native species.
   - Do not build structures, furniture, or dig trenches.
5. Minimize campfire impacts
   - Campfires can cause lasting impacts to the backcountry. Use a lightweight stove for cooking and enjoy a candle lantern for light.
   - Where fires are permitted, use established fire rings, fire pans, or mound fires.
   - Keep fires small. Only use sticks from the ground that can be broken by hand.
   - Burn all wood and coals to ash, put out campfires completely, then scatter cool ashes.
6. Respect wildlife
   - Observe wildlife from a distance. Do not follow or approach them.
   - Never feed animals. Feeding wildlife damages their health, alters natural behaviors, and exposes them to predators and other dangers.
   - Protect wildlife and your food by storing rations and trash securely.
   - Control pets at all times, or leave them at home.
   - Avoid wildlife during sensitive times: mating, nesting, raising young, or winter.
7. Be considerate of other visitors
   - Respect other visitors and protect the quality of their experience.
   - Be courteous. Yield to other users on the trail.
   - Step to the downhill side of the trail when encountering pack stock.
   - Take breaks and camp away from trails and other visitors.
   - Let nature's sounds prevail. Avoid loud voices and noises.

Edible and Medicinal Plants of Sucia

Original Lesson by Demi Fair; medicinal plant portion adapted from Maya Edgerly's original medicinal plant lesson

Facilitators: Demi Fair and Freya Fradenburgh
Subject: Ethnobotany, human ecology, environmental stewardship.
Duration: 30 minutes; to be referred to throughout the remainder of the trip
Location: Sucia Island
Group Size: 19

Objectives

Students will be able to:

- Identify some of the edible and medicinal plants found on Sucia Island
- Safely and sustainably forage edible and medicinal plants
- Demonstrate their knowledge of the medicinal plant given to them on a card by introducing their plant during the correct scenario

Materials

- Pictures of edible plants on Sucia
- 19 individual note cards with information and pictures of medicinal plants
- Knives, gloves, and bags for harvesting
- Camas bulbs
- Turkish towel and ingredients for chocolate sea pudding
- Whiteboard and markers

Preparation

- Assign individual spring block students to have a certain illness that they will act out somewhere along the trail (based on where the various plants are growing).
- Write sustainable foraging guidelines on whiteboard

Procedure

:00 The Coast Salish were some of the first people who occupied the coastal lands of the Salish Sea. They lived in permanent villages during the winter, and used the summer months traveling around the San Juan Islands to hunt, and collect plants and shellfish. Sucia Island was used as one of these harvesting grounds.

:02 Hold up pictures of edible plants. Ask students if they can identify them. Tell students that many of these plants are available for us to harvest on the island while we are here.

- lady fern
- nettles
- salmonberry
- sorrel
- camas *cannot harvest
- horsetail
- chocolate lily *cannot harvest
- miner's lettuce
- pacific silverweed
- thimbleberry
- soapberry
- bunchberry
- gooseberry
- salal berry
- dandelion
- seaweeds: turkish towel, bullwhip kelp, sea lettuce, nori, red laver

:12 Introduce camas by passing around camas bulbs. Discuss the importance of camas bulbs to the Coast Salish, including how they were managed, harvested, and cooked. *Background information below*

:17 Explain that we will be keep our eyes out for these plants when hiking around the island. We have the opportunity to harvest plants to eat while we are here, but it's extremely important to follow sustainable harvesting methods. Discuss the following questions: Why must we follow these methods? What if everyone took as many plants as they wanted? If we remove too much of a native population, what is effected? Why should we care? Hold up board with the following guidelines:

- **Sustain native wild populations**. Wild plants face many challenges, including loss of habitat due to development and introduced species. Use the "1-in-20 Rule". This means you should never harvest more than 5% of a particular plant or population of plants. Take a good look around the area you intend to harvest. If there are not at least 20 plants of the species you're after, don't take any whole plants. Use your best judgment in deciding to pick more or less.

- **Tread lightly**. Be careful on land and intertidal shores to prevent negative impacts when you harvest. Don't trample other species or disturb animals. Spread out your harvesting over a large area by moving about carefully as you pick. A site where foraging has occurred should look natural – as if you've never been there.

- **Waste nothing.** Take only what you need and can process (dry, can, freeze or otherwise use). If you don't need the whole plant, don't take the entire thing. Learn how to remove plant parts without damaging roots, reproductive parts, or growth patterns.

- **Harvest from healthy populations and sites**. Harvest leaves, flowers, seeds and fruits from healthy, vibrant plants, and avoid diseased or insect-eaten ones. Also gather from healthy and unpolluted sites. Don't harvest too close to roads, industrial sites, power lines, railroads, fields and lawns unless you know their maintenance history.

- **Pause and offer your gratitude before you pick.** There's a beautiful indigenous tradition that involves telling the plant or animal what you will use your harvest for and then leaving a gift. Foraging is a relationship of give and take. Consider your intentions and offer a few words of thanks for this wild food.

:22 Remind students that we must MEET before we EAT. Never harvest a plant you can't positively identify. If in doubt, leave it to sprout! Because of the risk involved, plants must be checked with an Explorations or Spring Block instructors.

:23 Introduce students to the medicinal plants we will be looking for on the island. The Coast Salish used numerous plants to heal a wide variety of ailments. We will be on the lookout for some of these plants while we are hiking around the island.

- Fringecup: the Skagit pound the whole plant, boil it, and drink the tea for any kind of sickness. It especially restores appetite. **located in central valley*
- Stinging nettle: used widely in many different forms by the Coast Salish to treat rheumatism, paralysis, stiffness/soreness, colds, headaches, and nosebleeds.
- Yarrow: leaves are often made into tea. The Cowlitz used it as hairwash, the Makah used it to ease childbirth, the Klallam used it for colds, the Quinault used it as an eyewash and to treat tuberculosis, the Chehalis, Skagit, and Snohomish used it as a diarrhea remedy. Yarrow juice is anti-inflammatory. Yarrow flower tea relieves body aches. **found at lawson point*
- Licorice fern: stalks/leaves grow up individually from a root network (rhizome) rather than clumped together. The Quinault and Makah roast the rhizome or eat it raw to treat coughs. The Cowlitz mix the rhizome with fir needles and boil it for measles.
- Lady fern: The Cowlitz boil the root to make tea to ease body pains. The Makah pound and boil rhizomes to make tea that eases labor.
- Salal: The Klallam and Quileute chew the leaves and put them on burns and sore. The Swinomish and Samish use the leaves for tea to cure coughs and tuberculosis. The Quinault chew the leaves or use tea to treat digestive problems or the flu. Salal leaf tea is astringent and anti-inflammatory.
- Oregon grape: roots can be boiled into a tea that treats coughs and stomach disorders (berberine is a natural laxative). Infusion of boiled bark are used to wash sores on the skin and in the mouth.
- Miner's lettuce: The leaves are gently laxative. Can be taken as an invigorating spring tonic and effective diuretic. A poultice of the mashed plants has been applied to rheumatic joints. Often used as a hair wash.
- Pacific silverweed: The Snohomish, Quinault, and Quileute use a poultice of the leaves to treat blisters, sores, or cuts.
- Salmonberry: The bark and leaves are astringent; the Quileute use a chewed poultice of either on burns. The Makah pound the bark and lay it on aching teeth or infected wounds as a painkiller. The Quinault boil the bark in seawater and drink the tea.
- Madrona: Several tribes boil the leaves to make tea, which is then used to treat colds and sore throats. Because this tree is sacred to the Coast Salish people, it is rarely harvested.
- Ocean spray: The Makah peel the bark and boil it, using the tea for convalescence and athletes. The Lummi strip the blossoms as a cure for diarrhea, and soak the inner bark as an eyewash. They also put the leaves on sore lips and feet. The Chehalis boil dried up bunches of seeds and drink the infusion to stop smallpox, black measles, chicken pox, or other contagious diseases.
- Bunchberry: Antibiotic, antiseptic, and anti-inflammatory; it was used to treat coughs, fevers, and stomach infections. Excessive ingestion of the berries produces a laxative effect. Burned leaves were used to treat topical sores, scrapes, burns, and insect bites.

- Thimbleberry: The Makah collect leaves in the fall, boil them, and drink the tea for anemia. The Cowlitz powder the dried leaves and apply them to burns to avoid scarring. The Skagit burn the leaves and mix the ashes with great to put on swellings.
- Horsetail: The Cowlitz break up the stalks, boil them, and use this as a lice wash. The Quinault press the juice out of the roots and mix it with breastmilk as a wash for sore eyes. The Makah eat the heads of the reproductive shoot raw as a cure for diarrhea.
- Rockweed (fucus): Fucus is high in iodine and thus can stimulate the thyroid. Fucus has antifungal and antibacterial properties. A mixture of two tablespoons dried fucus with one cup water can be a beneficial wash for eczema, sunburn, or wounds.
- Western Red Cedar: Buds can be chewed for toothache, swallowed, or boiled and gargled for sore throat or lungs. The Quinault make an infusion of the bark for kidney trouble. A tea of seeds and buds can help break a fever. The Klallam boil cedar limbs for a tuberculosis medicine. The Cowlitz boil the tips with other plants as a cure for colds.
- Douglas fir: An antiseptic resin is obtained from the trunk. It is used as poultice to treat cuts, burns, wounds and other skin ailments. The resin is used in the treatment of coughs and can be chewed as a treatment for sore throats. An infusion of the young sprouts has been used in the treatment of colds. A mouthwash is made by soaking the shoots in cold water.

:28 Hand out individual note cards with a picture of and information about of one of the medicinal plants and what they were used for. Let students know that they will need to become a spokesperson for the particular plant they have received on the notecard. “Knowledge of the medicinal use of this plant might be helpful along our trip!”

Conclusion

- Along the hike, nearby a plant that we are learning about, a pre-chosen spring blocker will collapse with a dramatic medical need, exclaiming their symptoms and ask for help with their ailment. The students will have to figure out what plant can help them. The student who discovers it is his or her plant will introduce the plant to the rest of the group. (*Don’t let the students know of this plan!*) The following symptoms will be acted out:
    - Sore throat/cough (licorice fern, madrona, salal, douglas fir)
    - Diarrhea (yarrow, ocean spray, horsetail)
    - Loss of appetite (fringecup)
    - Nosebleed (stinging nettle)
    - Flu symptoms (salal)
    - Constipation (oregon grape, miner’s lettuce)
    - Toothache (salmonberry, western red cedar)
    - Blister (pacific silverweed)
    - Chicken pox (ocean spray)
    - Body aches (lady fern)

    - Burns (thimbleberry)
    - Eye irritation (horsetail)
    - Wounds (fucus, douglas fir)
- On Tuesday evening, the facilitator will make chocolate sea pudding with turkish towel already collected. Before serving the pudding, show students examples of products with carrageenan in it, asking them if they can identify this ingredient. Does it appear to be an artificial ingredient? Explain that turkish towel has carrageenan in it, which is what makes the pudding so thick!

Assessment
By the end of the trip, students will successfully identify edible and medicinal plants and demonstrate sustainable foraging techniques. Students may also take part in making chocolate seaweed pudding on Tuesday evening.

Extensions
- Students can create an entire meal out of harvested plants. This meal could include: seaweed salad, dandelion root tea, nettle tea, licorice root tea, dandelion syrup, sauteed nettles, sauteed fiddleheads, berries when in season, and a salad made with dandelion greens, miner's lettuce, nettle, and sorrel.
- Students can create tinctures or salves with medicinal plants.

Glitch Plan
If we cannot find some of the plants we are looking for, we will use pictures to show the plants.

Risk Management
Students must check with facilitators or other staff before harvesting and consuming a plant they are not 100% positive about. There are 4 spring block students who are certified Wilderness First Responders in case there is an accident.

Background Information
- Farming has been a way of life in the San Juan Islands for a long time: perhaps as long as 2,500 years! Like peasant communities in Europe, native Coast Salish peoples of the islands not only fished, but also raised crops and livestock. Camas (Camassia leichtlinii and Camassia quamash), a member of the Liliaceae or Lily family, was the staple of Coast Salish agriculture. Camas fields were weeded aggressively to remove competing grasses and poisonous bulbs of "death camas" (Zigadenus venenosus); and were burned every few years to suppress shrubs and recycle nutrients—light burns do not damage the deeply buried camas bulbs. Like Jersualem artichokes, camas bulbs store energy as inulin, a polysaccharide that breaks down into fructose ("fruit sugar") when sufficiently cooked, traditionally for a couple of days in a pit with heated rocks and wet packing. Mildly sweet, cooked camas can be enjoyed at once, or dried into cakes and used later. Coast Salish peoples grew camas in wetlands, on small islets, and on soft bluffs overlooking the sea. (Settlers also targeted wetlands, and the rich soils formed by

years of camas cultivation, for farming here, so most of the evidence of camas in our wetlands has been lost.) Camas gardens were located near good summer salmon fishing sites, so that fishing and farming activities could be carried out simultaneously. Deer were probably also hunted when they tried to browse in camas fields: venison for a camas-sweetened stew!

-From Kiwaht: Center for the Historical Ecology of the Salish Sea

Sustainable Foraging Guidelines from *Pacific Feast* by Jennifer Hahn

Tuesday Campfire

Procedure

0:00 Skits (30 mins)

0:30 Riley's Bonding Game (1 hr)

Students will be asked a series of questions and move and discuss how comfortable they are with that subject. Questions will range from silly to serious.

1:30 Sharing a nature moment from the past two days and sharing something they are hoping to see or learn about in the next days (30 mins)

Slugs and Garry Oak Lesson

Slugs Adapted from Ben Packard
Under Advisement from Gene Myers

Facilitator(s): Katlynne Schaumberg, Skye from Explorations
Subject: Invasive/Native Slug & Garry Oak Discussion
Duration: 90 minutes
Location: Sucia Island – Central Valley Lowland Forest, Garry Oak area
Group Size: 19 students broken into groups of 4

Objectives

Students will be able to:

- Make written observations about slug's and their habitat
- Build empathy for an individual slug
- Talk about invasive species and the role people should play in determining which species survive

- Consider the controversy and issues regarding Gary Oak reintroduction and preservation on Sucia Island
- Explore different ethical perspectives regarding ladder topics
- Consider how humans fit into nature

Content Standards Addressed:

- 9-11 LS2A
  Matter cycles and energy flows through living and nonliving components in ecosystems. The transfer of matter and energy is important for maintaining the health and sustainability of an ecosystem.

Methods

After introducing the lesson, students will search for slugs on the forest floor of the Central Valley of Sucia Island. Students will be asked to make several observations about slugs and their habitat. They can use this space for directed creative expression. Solo time will be followed by a critical discussion focused on invasive and native slug species, and the role people play in determining which species survive. Students will gain a deeper understanding of the invasive species debate. Students will be introduced to the reintroduction and preservation of Garry Oaks on Sucia Island and relate this matters to the border lense of human's place in the natural world through yet another critical discussion.

Materials

- Journals
- Pencils
- Whiteboard & markers
- Anatomical picture of a slug.
- Native banana slug
- English black slug
- Hatchet
- For extension:glass plates, or small sheets of glass or plastic. Bandanas, twine or cord.

Preparation

- Find some slugs (at least one banana slug and one English black slug) ahead of time to help maintain student's interest during the lesson instead of spending the entire time searching. Putting out "slug traps," such as slices of banana, the night before could make slug sightings easier.

Procedure

00:00-00:15 Have everyone assemble in a circle. "For the next half hour, we will be searching for an organism with a unique sexual adaptation: its penis is longer than its body. This makes the sex lives of banana slugs complicated. Usually, these hermaphroditic slugs get stuck. In order to get unstuck to lay eggs, one slug gets its penis bitten off." Pause.
As we walk from work service area ask students to make some observations about forest floor habitat and to look along the trail for slugs. Give students the following choice in terms of what

to do in their journals for the next 10 minutes: ask them to take field notes, or do some creative exploration.
For field notes, have them make a few written observations about slugs and slug habitat in their journals. Specifically, tell them to look under four different species of plants, under one log, and in one hole. Frame their written observations as field notes. Give them the following suggestions: How the areas look, the typical colors they see, the relative temperature, the amount of light, the relative dampness, how they smell, the types of organisms they see.
For the creative exploration, encourage them to lie down and use all of their senses by doing so yourself! Lie down on the ground! If they find a slug, ask them to quietly observe the slug. Ask them to do some creative exploration during their observation: write, draw, or create a song.
If they decide to touch the slug ask them to wet their hands first so as not to harm the slug. Remind them not to lick any slug, because of the presence of e. coli.
Have the third group stay with you for a brief five minute lecture and question/answer session. Ideally, have a slug to show the students, but a picture with the parts of the slugs anatomy would work as well. Tell students various interesting facts about slug's (anatomy, slug copulation and explain what hermaphrodites. Answer any questions they might have about slugs.

00:15-00:20 Have everyone sit in a circle. Ask if a few people want to share their observations, writing or drawings... Ideally, two species of slugs will have been found, the Banana Slug (Ariolimax columbianus) and the European Black Slug (Arion ater). Give some cool slug factoids. Explain that the Banana Slug is native to the North West, and the European Black Slug is an invasive species accidentally introduced by white settlers. Have a whiteboard in front of the class, and ask a student to write a few words to generalize people's ideas.

- What does invasive mean? Is the species native since it is here now?

00:20- 00:35 Bring the two slugs into the circle and place them in front of you. Explain that this species is invasive and competing with the less aggressive and native banana slug. Explain that it is normal for different species to eat one another, especially young slugs. Raise a hatchet up in the air, pause briefly and then say: "Imagine that, with one swing of this hatchet, I could kill all the black European slugs on this Island. Should I kill them?" Emphasize that there are no right or wrong answers. This is simply a discussion of people's subjective values.

- Do we have a responsibility to eliminate the European black slug, since people brought the species to the Island in the first place?
- Should we kill one slug species in order to benefit another? Why, or why not?
- Consider the tension between individual animals' lives and how we weigh them versus the values of an ecosystem.
- What could be done feasibly about a dispersed, prolific and reclusive animal like the slug; should humans intervene even more in nature to make it right, or is that itself bad too (related: is 'doing nothing' a possible strategy of ecosystem management?)
- Does the European black slug have a right to be here?
- Are humans the ultimate invasive species, and if so what different things might that mean for our actions regarding other species we've transported?

00:35-00:50 Switch to Garry Oak Discussion. Allow Skye 15 minutes to introduce Sucia Island's reintroduction and preservation of the Garry Oak.

00:50-01:10 Relate Garry Oak to the slug/invasive species dilemma, then broaden the issue wider. Break students into color teams for discussion.

- What should our role be in this ecosystem?
- Should we have any role in this ecosystem, or should we leave it entirely alone?
- Are we part or separate from this ecosystem? How are we a part of this ecosystem? How are we separate?
- Consider the reluctance to be the one killing an animal, or to have humans deliberately kill one or more vs a natural process doing it. Question of intentionality in moral psychology.
- What if we transfer our feelings (negative or supportive) toward human immigrants onto invasive animals – is that appropriate or not and why?
- Should emotion or reason be predominant in ecosystem management?

Conclusion

1:10-1:30 Have students journal about their thoughts on the discussion and consider where humans fit in the natural world.

Assessment

Students will journal about their observations of slugs, some students will share their observations with the class. Verbal participation during discussion will reveal changes in perspectives between initial discussion and later discussion regarding invasive and native species management. Concluding journal question will show how students have taken concepts discussed in this lesson and applied it to their lives and life philosophies.

Extensions

01:30-01:45 Place slugs that have been found on the sheet of glass. Hold the glass up in the air, and look at the slugs as they move. Watch the slug use its foot to move along the glass. Ask students, "Can you move with only one foot?"

Have students split into groups of 4. Tell students to mimic the way slug's move by lying down on the ground and "freezing" their feet together. An option is to use twine, cord, or bandanas to tie students ankles together. Give them the goal of moving forward one body length, or roughly six feet. Have each group designate a timekeeper. Make sure everyone who wants to try has the chance. See who gets the best time. Do not emphasize competition.

1:45- 02:00 Have students answer the following two questions in their small groups:
What would have made moving easier?
How has the slug dealt with this challenge?

Glitch Plan

If it rains we will briefly go to the Gary Oaks to see them, but proceed back to camp for the rest of the lesson (under cover).

Risk Management
There will be a certified (4 in our group) WFR with a first aid kit during the lesson. We will instruct students not to lick any slug because of the presence of e. coli. We will discuss how to keep the slugs safe by wetting their hands first. Remind them not to lick any slug, because of the presence of e. coli.

Background Information
Field Guide to the Slug and The Banana Slug: A Close Look at a Giant Forest Slug of Western North America.

Banana Slugs are Pacific Northwest natives. Unlike many of the slugs we find munching on our garden plants, such as the European black slug, banana slugs are natives who help indigenous flora by ingesting only the seedlings of competing non-native tree and plant seedlings. They also help ecosystems by spreading fungi spores and nutrient-rich excrement and mucus in the soil.
They recycle. Eating 30 to 40 times their weight a day, they munch on the detritus of our Pacific Northwest forest and garden grounds, eating decaying plant matter, scat, lichen, mushrooms, and, yes, sometimes our beloved strawberries and hosta. But they excrete nitrogen-rich fertilizer vital to the nutrient cycle.

Banana slugs mating
They are hermaphrodites. Yep, they each have a vagina and a penis. When they mate, it can take up to 12 hours, with vigorous hijinks involved, including licking, biting, and locking mantles, coiled together each with its penis inserted into the other's vaginal opening. Sometimes a banana slug may have to chew off its own penis if it gets stuck. Luckily it usually grows back.
Information from: http://www.insidebainbridge.com/tag/pacific-northwest-native-slug/

Did you know...

- Only 5% of the slug population is above ground at any one time. The other 95% is underground digesting your seedlings, laying eggs, and feeding on roots and seed sprouts.
- A slug's blood is green.
- Slug eggs can lay dormant in the soil for years and then hatch when conditions are right.

- Gastropods form the second largest class in the animal kingdom, the largest being the insects.
- Slugs are hermaphrodite, having both male and female reproductive organs.
- In favourable conditions a slug can live for up to 6 years.
- A slug is basically a muscular foot, and the name ‘gastropod’ literally means stomach foot.
- Unlike snails that hibernate during winter, slugs are active whenever the temperature is above 5°C.
- A slug is essentially a snail without a shell.
- One individual field slug has the potential to produce about 90,000 grandchildren.
- It’s been estimated that an acre of farmland may support over 250,000 slugs.
- A cubic metre of garden will on average contain up to 200 slugs.
- A slug’s slime enables it to glide without difficulty over glass shards, or even the edge of a razor blade.
- Slugs have the capability to reproduce by themselves, although a mate is preferred.
- When picked up or touched, the Black Slug will contract into a hemispherical shape and begin to rock from side to side. This behaviour confuses predators.
- Slugs leave their own individual scent trail so they can find their way home.
- A slug’s slime absorbs water, which is why it’s nearly impossible to wash it off your hands.
- A slug’s slime contains fibres which prevents it from sliding down vertical surfaces.
- A slug smells with its body..
- A slug can stretch out to 20 times its normal length, enabling it to squeeze through the smallest of openings.
- A slug has approximately 27,000 teeth – that’s more teeth than a shark.
- Like sharks, slugs routinely lose and replace their teeth.
- When a slug loses one of its sensory tentacles it grows another, usually within a few months.
- Vinegar is a good ingredient for slug sprays, and for removing slug slime.

Information from: http://www.slugoff.co.uk/slug-facts/facts

Map and Compass Lesson

Lesson by Anna Dudley under advisement of Gene Myers

Facilitator: Anna Dudley
Subject: Compass reading and mapping
Duration: 1 1/2 hours, flexible shift for more or less time
Location: North Shallow
Group Size: 10 students broken into 5 or more groups

Objectives

Students will be able to:

1) Understand how to find true north and the difference between magnetic north
2) How to take their bearing
3) How to construct an “accurate” map

Materials

Journals/graph paper
Pencils
Compass(es)
Meter or other measuring stick/tape
Protractor
Big graph paper
Example map
Whiteboard and marker

Method

Students will apply their understanding of how to use a compass to create their own map of an area.

Preparation

In the shelter needs to be hung the whiteboard and the paper needed for the large map

Procedure

0:00 The students have been stranded on this island with no power source. Not only that but a storm came in and we have lost all our maps! We still have food and shelter, so what we need to do next is make a new map in order to be able to navigate safely around the island. In order to gain an accurate island perspective.
Lecture on how to read a compass (use declination, azimuth, etc). Pass out compasses to pairs of students. Pairs will be made of ones student who has had some experience with compasses with one that has had none. The student who has less experience will be in charge of the compass and the experience one will be the person to notate. (15 mins)

0:15 Shorter lecture on how maps are made (taking bearings, triangulation). Explanation of how to write their trail on their graph paper. (10 mins)

0:25 Roll of a meter tape for 100 feet. Have students walk along either side of it to figure out how many paces it takes for them to walk 100 feet. Make sure to have them walk normally, but consistent with how they will be walking along the trails. (10 mins)

0:35 Send students in pairs down different paths where they will be getting their bearings, walking until the north arrow moves, then stopping and writing down how many paces they took. Students will map their trail as they walk. They will keep following their trail for 20 mins before coming back to camp to create a group map. (Instructors tag along with groups to make sure

they are understand how to read their compass). Call everyone back to camp with an animal call. (25 mins)

1:00 There will be a large piece of paper at the point of reference they were told to keep in where they will compile their measurements to create a larger map. This can be done by cutting and pasting their trail onto the bigger paper to make a full map (15 mins)

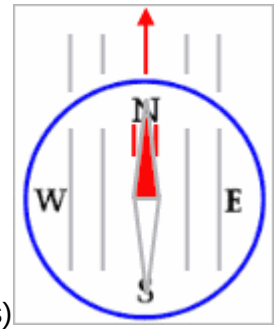
Assessment/Evaluation
If understood by the students, an accurate and large map will be created.

Glitch Plan
If it is raining and everything is wet, we just practice getting to points instead of creating map

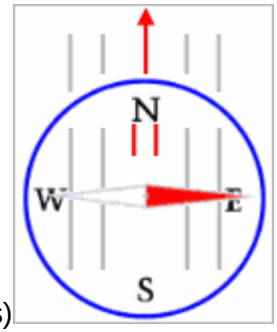
Risk Management
Students will be with a Spring Blocker or other staff member at all times

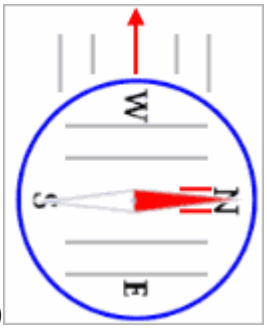
Background
From compassdude.com
Basic Compass Reading
No matter the compass, one end of the needle always points North. On our mountaineering compasses, it is *almost always* the RED end, but its a good idea to test your compass before starting to use it.
If you are north of the equator, stand facing the sun around lunchtime. Whichever end of the needle points towards the sun is South and the end that points at you is North.
If you're 'down under' the North end points towards the sun and the South end points at you.
To read your compass,

- Hold your compass steadily in your hand so the baseplate is level and the direction-of-travel arrow is pointing straight away from you.
- Hold it about halfway between your face and waist in a comfortable arm position with your elbow bent and compass held close to your stomach.
- Look down at the compass and see where the needle points.

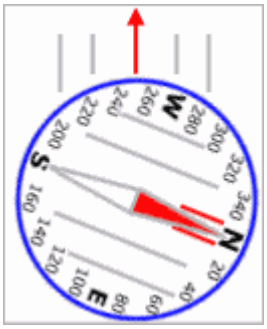


- This compass is pointing due North (also 0 degrees)
- Turn your body while keeping the compass right in front of you.
- Notice that as the compass rotates, the needle stays pointing the same direction.
- Keep turning until the needle points East like the picture below, keeping the direction-of-travel arrow and North mark facing straight in front of you.

- This compass is pointing East (90 degrees) 

- Important: This is a very common mistake! The compass needle is pointing towards East so I must be pointing East, right? No!
- To find my direction, I must turn the compass dial until the North mark and the "Orienting Arrow" are lined up with the North end of the needle. Then I can read the heading that is at the Index Pointer spot (the butt of the direction-of-travel arrow).
- Since the Orienting Arrow is usually two parallel lines on the floor of the compass housing, a good thing to memorize is:
- RED IN THE SHED
- Now we know we are really heading West (270 degrees) 

Take a Bearing

By simply moving your compass with your body and using the N-E-S-W markings, you can get a good idea which way you are going. This is often all you need from your compass. But, you've probably noticed on your compass, there are also numbers and tiny lines. These represent the 360 degrees in a circle that surrounds you no matter where you are. 

When you need to find your way from one particular place to another, you need to use these numbers to find out the bearing to that remote place. The direction you are going is called your heading. Heading and Bearing are pretty much the same thing. The image above is a heading of about 250 degrees.

Wednesday Campfire

Materials

Paper scraps
Writing utensils

Procedure

0:00 Telepictionary (1 hr)
Break into our small groups. Each person has paper, they write a sentence then pass. Person who receives puts that paper to the back of the pile then draws what they think that would look like then passes it. The receiver then writes a sentence of describing the picture. This continues until all paper is used and is returned to the person who wrote the first sentence. MAKE GUIDELINES FOR WHAT IS APPROPRIATE

1:00 Rose, Bud, Thorn (45 mins)
Something good from today, something you hope for tomorrow, something that brought you down for the day

Sucia Island Geology

Adapted from Kendra Krantz and Wendy Walker's curriculum

Facilitator: Haley Rutherford
Subject: Geology of Sucia Island- Chuckanut and Nanaimo
Duration: 1/2 hour
Location: Echo Bay Beach (or Fossil Bay area)
Group Size: 10 students

Objectives

Students will be able to:

- Recognize the two main rock formations on the Island: Chuckanut and Nanaimo
- Explain, draw, and write about the processes that formed the island

Content Standards Addressed:

This is a microcosm of larger geologic processes.

- 9-11 ES3B
  Geologic time can be estimated by several methods (e.g., counting tree rings, observing rock sequences, using fossils to correlate sequences at various locations, and using the known decay rates of radioactive isotopes present in rocks to measure the time since the rock was formed)

Materials

- Rice krispy treats cut into 1/2-1 inch thick about 3”x5”; enough for each pair of students (at least 20 pieces)
- Larger rice krispy treats (2); same thickness and basic size but rounded on opposite sides (oval/circle)
- Scissors
- Frosting or peanut butter and a knife (or two of each)
- Poster-sized map of Sucia Island
- Option: Copies of Sucia geology brochure
- Option: Fossils to pass around, collected from Fossil Bay

Preparation

- Set out krispies and pb/frosting

Procedure

:00 Explain where the rock formations come from:

Nanaimo- deposited 70-75 MY ago. Show fossils if possible. Point to EV Henry and Fox point on map to show where this formation is.

Chuckanut- most common formation in Whatcom county, deposited 50-55 MY ago.

:05 Have students get into pairs and acquire their rice krispies. Have them spread the frosting/pb on one side of each of the treats.

:10 Demonstrate with model (instructing students in how to manipulate it themselves) how the Chuckanut Formation was thrust over the Nanaimo Formation by sliding the two sticky sides of the treats together, showing the pressure put on them from both sides.

:15 Demonstrate how the two units were then folded into a syncline after the fault shoved them together. Show map of Sucia for horseshoe shape and trace “U” outline. Fold model into syncline and hold up in plunging position. Have students do the same. Explain that this happened because they were squished from both sides- demonstrate with a sleeve or blanket, showing that things fold different ways when pushed.

:20 Demonstrate the tipping of the syncline- creating a plunging syncline. Point the end of the model down, tilting it 45 degrees. Explain that this happened also because of the force on both sides, it was concentrated on one side which forced the other down into the crust.

:25 Demonstrate how erosion by glaciers cut off the top of the plunging syncline and eroded the softer layers into valleys and then water submerged most of the valleys by cutting off the curved portion of the demonstration model. Explain that this is why the island is in a horseshoe shape and that the frosting/pb in between is an example of the valleys the ice carved out and filled with water.

:30 End lesson by letting students eat their models.

Assessment
My assessment will be on observing the students models.

Extension
Have students go around Ev Henry Point to look for fossils. Discuss how there are 70 million year old clam shells next to present-day clam shells.

Glitch Plan
If someone eats the treats, I will use a blanket or piece of paper instead.

Risk Management
There will be a certified WFR with a first aid kit during the lesson. Review proper butter knife skills.

Background Information
* Information pamphlet attached in back of curriculum

Honeycomb Weathering with Luigi

Lesson by: Luigi (Riley Wilmot)

Facilitator: Riley Wilmot
Subject: Honeycomb Weathering
Duration: 30 minutes
Location: Echo bay
Group Size: 10

Objectives: Through this lesson students will be able to identify the different ingredients that go into making honeycomb weathering and understand the different life stages that this form of weathering goes through. Students will be able to think critically about this process and be able to identify the missing ingredient to the secret family recipe of Tafoni. The students will be taking observations of honeycomb weathering throughout its 4 stages and be sketching them in their notebook. The students will have to think critically about each of the stages and take well-rounded observations in order to solve the puzzle. The students will be able to infer, discuss, and raise thought provoking questions about honeycomb weathering. The lesson will be experiential in nature while we physically explore the many honeycomb weathering formations, and intellectually challenging through the discussions that will take place.

Content Standards Addressed:

- ESE3.1
  Understands the physical characteristics, cultural characteristics, and location of places, regions, and spatial patterns on the Earth's surface.

- ESE3.1.2
  Understands the physical characteristics of places in the community
- ESE3.2
  Understands human interaction with the environment.

Materials

- Journals and pens/pencils
- Hand lens (optional)
- Costume

Preparation

The students will need to have their journals out to record observations. The facilitator will need to have a site that has all of the stages of Tafoni nearby.
The facilitator for this lesson will be taking the role of an Italian cook named Luigi that has lost his great Grandmother's famous family recipe for making Tafoni. Luigi will need the student's help to assist him in re-creating the recipe.

Procedure

00: Have another facilitator guide the students to a good example of honeycomb weathering, where Luigi will be waiting for them pretending to cry. Luigi will start to explain that he has lost his family recipe. Have the other facilitator lead Luigi with Questions such as:

.

What's wrong?

Luigi- Oh
I've lost my grandmother's recipe! I am one sad a-meat-a-ball-a…

.

Can we help?

Luigi- Oh
that would be wonderful! ...

.

Well what are some ingredients that you do remember?

Luigi-

Dissolved salt… Grandma always said that you needed to have salt that was dissolved in water, like ocean water, so that the salt would have a way to get into the tiny cracks in the rocks surface.

Porous Rock face… Grandma always said that a harder rock just wouldn't do. Because then the salty water would just run right off! No, she said that you needed a rock like a sandstone that had some little spaces in-between it so the salt water could creep in.

Evaporation… Grandma-ma-mi-ah always told me that the secret was evaporation, so that the water could be separated from the salt. You needed this process, she said, so that the salt crystals could form, thus pushing the spaces in the

rock farther apart which creates erosion and leads the the wearing down of the rock surface

And I could swear that there was one more ingredient that I just can't remember…

It sounds to me like you have it all planned out, what's the problem?

Luigi-

the problem is that I've figured out how to make the erosion process start but for the life of me I can't be that classic honeycomb shape like grandma used to! The rock face just disappears! I can't figure out how to build up those smooth walls and those deep holes.

.

How do you think that we can best help you find the missing ingredient?

Luigi-

Maybe I could tell you about the different life-stages of Tafoni and then you could go find me a good example of it to study? The first life stage is when the Tafoni is just starting to form, it's making little cracks in the rocks surface and little honey combs and you can tell that it's only going to get deeper. Stage two, is when the honeycombs are growing larger and larger, this is the stage that I can't seem to get a handle on. The 3rd stage is when the honeycombs are getting so big that they are

starting to grow into each other! I am so very jealous, I could never make honeycomb THAT big. And the final stage it's when the rock gets so eroded that it returns to its original state so that the process can start again.

:8 Send the students in 4 different groups to focus on one life stage and draw a picture of it in their notebook using their pencil as a size marker in all of their pictures. Ask them to think about all aspects of the stage that they are looking at including the color, size, shape, etc… and tell them that they will be expected to share with the class and more importantly, Luigi what they have found.

:15 Everyone will come back with their findings and start to brainstorm what the secret ingredient is. Some guiding questions will be:

.

What did you find in each of your drawings?

.

Are there any patterns you noticed as you watched the Tafoni mature?

.

What about the color difference between the walls and the center?

.

What could be making the change in color?·

How might that change the rate
of erosion over an extended period of time?

:30 Luigi will end with a talk on the two different theories why lichen helps to create his grandmother's secret recipe. The raincoat theory: which states that the lichen acts as a protective biofilm barrier between the salt water and the rock, which prevents the rock from being eroded as quickly. The "wet blanket" theory which states that the lichen protects the walls of the Tafoni by impeding the evaporation process, thus slowing the erosion process.

Conclusion
The students will be able to appreciate in more detail the wonder that is Tafoni, and all of the hard work that it takes to create it. Hopefully they will also be more inclined to protect it because they feel like they have now helped to solve the mystery and are personally invested in the process.

Assessment
The evaluation will be based on the students drawings and critical thinking skills applied to solving the mystery.

Extensions
Have the students spend some more time looking at the Tafoni and making observations. the students can also spend some more time with their journals sketching their stage of the life cycle.

Glitch Plan
If rain is present, the students could skip the drawing section and just spend some time "observing" their life stages. In this case Luigi can instead of giving them all the answers to the two different theories, they can discuss them as a group.

Risk Management
Since this lesson will be operating in an area where there is potential for falling. We will ask students to remain a body length away from the edge where they are not accessing the tidal area. In order to insure safe travel from the grass down to the observation area we will model and require students to use a three points of contact technique as well as a spotter below the access area. All students will be required to have on close-toed shoes that have sufficient tread. An instructor will head down to the observation area first to make sure the surface is not too slick. All students will be required to remain within the designated boundary during exploration time and to stay away from slick surfaces. There will be two Wilderness First Responders on hand, as well as a first aid kit to ensure immediate response to any injury that may occur.

Background Information

Honeycomb weathering is found in many rock types, including granite and rhyolite, as well as sandstone. It occurs in humid and desert environments, cold and hot. Honeycomb weathering produces intricate and highly photogenic structures in seaside exposures of Chuckanut Formation sandstone. George Mustoe, at Western Washington University's geology department, did his masters thesis research on the development of honeycomb weathering, which he published in 1982. This was the first serious attempt to explain how honeycomb weathering forms. George used chemical analyses to find that in the Chuckanut, and probably by extension in similar coastal locales, honeycomb results from disaggregation of mineral grains by evaporation of salt water splashing on the rock; algae living within the rock surface protect the walls separating the cavities (septa) from further evaporative erosion.

Tide Pool Mapping

Original Lesson by Anna Dudley

Facilitator: Anna Dudley
Subject: Intertidal marine life, tide pools, mapping
Duration: 1 1/2 hours, flexible shift for more or less time
Location: Tidepools at Ewing Cove
Group Size: 10 students broken into 5 or more groups

Objectives

Students will be able to come away with a greater understanding of:

1.) How tide pools form
2.) How they work as ecosystems
3.) What lives in tidepools

Content Standards Addressed

- 9-11 LS2D
  Scientists represent ecosystems in the natural world using mathematical models.
- 9-11 LS2E
  Interrelationships of organisms may generate ecosystems that are stable for hundreds or thousands of years. Biodiversity refers to the different kinds of organisms in specific ecosystems or on the planet as a whole.
- 9-11 LS3E
  Biological classifications are based on how organisms are related, reflecting their evolutionary history. Scientists infer relationships from physiological traits, genetic information, and the ability of two organisms to produce fertile offspring.

Materials:

Journals
Pencils (color if wanted)

Compass(es)
Hand lense(s)
Density grid/dohmeyer frame(s)
Meter or other measuring stick/tape
Gradient Sticks

Method

Students will create their own visual maps of tidepools, illustrating the changes in water and the ecosystem of a tidepool. Students will be able to identify special characteristics of tidepools through observance. They will look at how the beach environment changes between tides, what their general makeup is, and what animals live within the pools.

Preparations

Scope out the safest way to travel to and from tidepools and have all gear ready

Procedure

0:00 Begin lesson with going over tide pool etiquette. It is very important to remind students that where they will be walking is covered in life. While barnacles and seaweed can withstand tromping through, it is always best to minimize potential impact. Not only should you tell students to be careful where they walk, but to also be aware of what they handle. Anemones, seastars, and crabs can handle some touching but your hands should be wet and generally underwater at all times. Fish should be not be touched or handled (handled only by teachers or others who understand the potential risks involved for the animal, like heat, oil from skin and lack of oxygen). (5 mins)

(Walk to pools with time from 1 & 2)

0:05 Go over goals for their time at the tide pools. Tide pools are generally fun and always interesting but they are there to glean knowledge through observance. (5 mins)

0:10 Students will be allowed to find a tide pool that appeals to them. No more than 4 students to a tide pool where they will be for the remainder of lesson time. (5 mins)

0:15 Students will work through the work sheet (see last page). They can choose to do so as a group or individually. If they work as a group they can produce one or two maps but they must be more detailed than maps made without a group. Everyone else should be taking notes and helping the illustrator find the information he or she needs to complete the map. Students can choose to spend a lot of time drawing their pool or just make a simplistic drawing. All will have the same written details/coordinates. (50 mins)

1:10 Instructors will move from pool to pool helping to guide students through their observations. Instructors will try their best to not directly answer questions but instead ask another question to help them come to their own answers. In order for this lesson to reach its full potential, it is important that students work through their own observations to come to answers to questions of the lesson and questions of their own.

1:05 Make sure to give the students 5 and 1 minute warning so that they can wrap up their final thoughts and observations before the instructors will be coming around to ask questions.

Conclusion
1:10 Instructors will then move from each tide pool to hear from the student groups. Each group will present their tide pool to the instructors. What makes their tide pool unique? What did they discover about their pool? Presentations should be kept to 3 mins per pool. Students can spend more time at their tide pools or see others. (~15 mins)

Assessment/Evaluation
If completed and understood, students will have a detailed map/drawing of their tidepool with written observations and notes about the characteristics, which the instructor can assess.

Extension
If you find yourself with more time, give the students more time at the tide pools, either at step 4 or after to see each others maps and tide pools.

Glitch Plan
If it is heavily raining the lesson will need to be shorter but otherwise proceed as normal

Risk Management
There will be a certified (4 in our group) WFR with a first aid kit during the lesson. Instructors will move students carefully over slippery rocks.

Background
Marine & intertidal ecology - basic terms and dimensions
(From Deb Donovan, Biology, WWU)

I. Some definitions
- A. Benthic - on the bottom
  - 1. Supralittoral - zone immediately above the high water mark
  - 2. Littoral or intertidal - region between the high water mark and low water mark
  - 3. Sublittoral or subtidal - all bottom regions between low-water mark and edge of continental shelf, to depth of 100 fathoms
- B. Pelagic - in the water
  - 1. Neritic zone - water above the continental shelf
    - a. Nektonic - organisms which control speed and direction of movement
    - b. Plankton - organisms which depend on water movement for locomotion
      - i. Zooplankton - animal species
      - ii. Phytoplankton - plant species
- C. Photic, and aphotic - light, and absence of light. Light intensity decreases at increasing depth.

II. Seawater

A. Composition
    1. Major elements
    2. dissolved organic matter (sugars, amino acids
    3. dissolved gases in equilibrium with air (O2 CO2 N2)
B. Temperature
    1. varies with time, latitude and depth
    2. amount of fluctuation depends on geographic region. Shallow tropics don't have much change; temperate intertidal has lots
        a) worldwide range for coastal water -3C to +44C
        b) polar intertidal - night water low tides associated with freezing temperatures
        c) Tropical intertidal - day lows associated with high temps
        d) temperate (ie, here), we get both since our winter lows occur at night and our summer lows occur during the day
    3. Daily fluctuation not as great as terrestrial envt
    4. easily measured so lots of information about it
    5. Temp. affects many rates of organisms - metabolism, activity, pumping, feeding
    6. Can also look at lethal temps for different animals
C. Salinity
    1. Expressed as parts per thousand water (‰)
    2. average is 35‰
    3. ranges from 155‰ in tropical shore ponds to <1‰ in estuaries after heavy rain
    4. osmoconformers - organisms whose tissues have same ionic concentration as envt, due to loss or gain or water and ions.
    5. osmoregulators - organisms that use biochemical, physiological, and behavior mechanisms to regulate internal environment over an environmental range of a given variable (may conform on others, and at envt.'l extremes)
D. Oxygen
    1. Levels can vary significantly
    2. solubility decreases with increasing temp
    3. solubility decreases with increasing salinity
    4. organic matter uses oxygen
E. Light
    1. Changes almost continuously in quality and intensity
        a) Rhythmic change - daily and seasonal
        b) Arrhythmic change - eg. cloud cover
    2. penetration depends on amount of radiation immediately over the water surface, determined by the angle of incidence of the radiation, and the surface reflectivity.
        a) Radiation decreases with depth due to scattering and absorption. In areas with lots of kelp and plankton, not much penetration.
    3. UV radiation causes harmful genetic changes especially during larval stages
    4. behavioral responses to light

F. Pressure

1. Increases 1 atmosphere for every 10 meters depth
2. some organisms stay in one narrow range - stenobathic
3. others migrate up and down the water column - eurybathic

III. Wave action

A. Waves caused by pressure and friction of wind passing over water. Open ocean waves that continue after wind has decreased are called swell

B. Waves breaking on shore influence individuals, populations and communities of organisms. Must be strongly attached to withstand forces.

1. Drag is force in direction of water movement and depends on surface area of the organism.
2. Lift is the force that tends to pull organisms off the substrate and is proportional to the surface area and shape.
3. Acceleration force is due to the presence of the organism's mass in a flow and is proportional to volume (bigger animals have relatively larger acceleration force).

C. Many organisms live in the boundary layer, a region of low flow next to the bottom or a surface, due to friction of the sea floor.

D. Waves also bring food, oxygenate the water and disperse gametes and larvae.

Factors influencing zonation: An invitation to discovery

Intertidal zonation refers to different groupings of species that occur at different depths along a marine shoreline. Zonation is a result of the fact that organisms are exposed to different amounts of several critical factors, including:
Tides - period of water coverage vs exposure
Temperature - drying and freezing
Wave action - physical force & splash
Salinity - decr. due to seepage, rain, runoff; increase due to evap.
Light - different wavelengths penetrate to different depths; exposure to UV can cause bleaching.

These stresses have resulted in the evolution of mechanisms and structures that allow organisms to maintain critical equilibria despite the stresses.

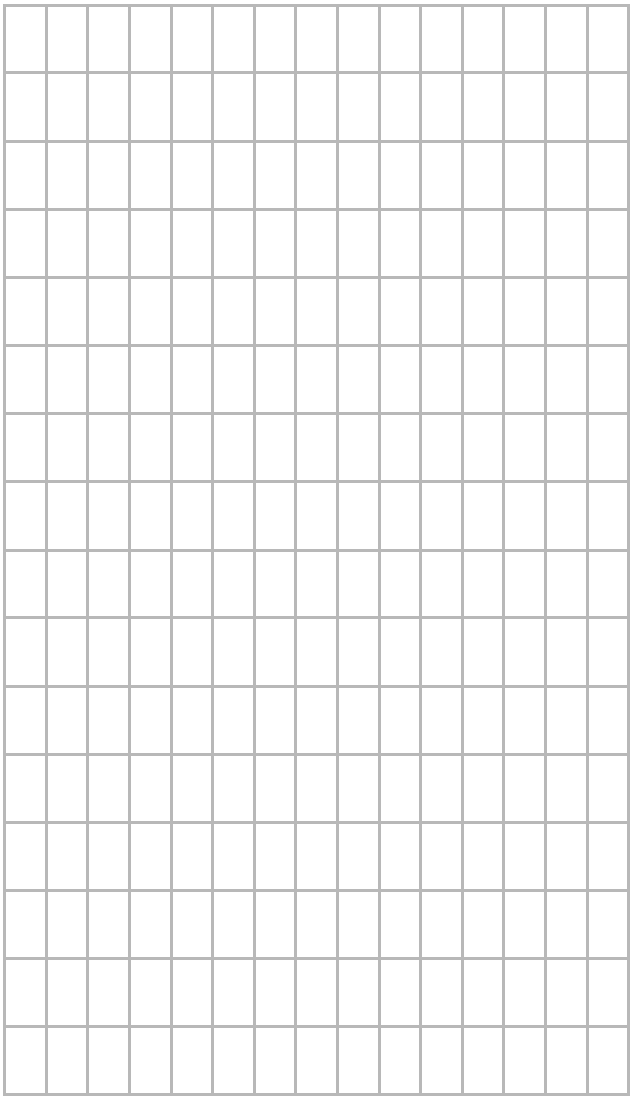
Some of the adaptations that allow maintenance of equilibria despite these inter-tidal variables include ways to:
Resist water loss
Maintain heat balance
Withstand mechanical stress
Respire (breathe) during submersion or exposure
Feed or absorb nutrients
Move (or for some plants and animals, stay put in an optimal place)
Withstand salinity variation

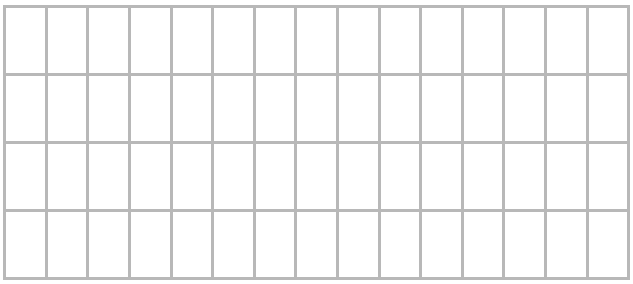
Reproductive adaptations, especially lifecycle stages that require certain substrates to successfully attach.

In addition, communities of organisms interact among themselves, for example in food webs (primary producers, herbivores, carnivores, detritivores), in competition, parasitism, and symbiosis. These interactions add other stresses to which organisms develop adaptations. Some of these interactions and adaptations can be discovered by keen observation and detective work.

When examining an organism in different zones you can make intelligent inferences about what stresses the organism is subject to, and how the observable features of the organism reveal solutions to these problems. Careful observation, asking questions, and thinking logically about fairly simple but interacting factors can lead to discovery of ecological concepts.

Tidepool Map





Cardinal Directions:

Map Scale:

Approximate Distance from tide:
Low tide at 11:57am

Guiding Questions to answer and observe:
Only a couple(if any) of these are one sentence answers. Please answering these questions with thoughtful observance (write as much as you possibly can about one question!) Try to answer at least 5 of these questions during your hour of observance (you can divide up the questions and try to get more of answers that way!).

- What factors lead to the tide pool being shaped?
- How and where does the water come in and out? What happens when the tide reaches and leaves the pool?
- How deep and wide is it?
- What is the animal and plant density factor of this tide pool? Is it high or low? Why do you think it is that way compared to other tide pools?
- Make a list of animals and tally how many you find. If you do not know what the animal is called you can ask an instructor, or you can simply label it by its characteristics. What animal was most common?
- Where do different type of animal like to hide? Do any of them use or benefit from each other? Do others compete?
- What appears to make a good tide pool?
- Why would an animal want to live in a tidepool?
- Does something about your tide pool limit the density of marine life?
- What is the weather like today? Yesterday? Do you think it has any affect on how many animals you are finding in your tidepool?
- Draw a smaller section of your tidepool using a tangible square to frame it. Then indicate which section(s) of the tidepool you have zoomed in. This could be just one square on your map or multiple.

Life in the Pools of the Tide

Original Lesson by Haley Rutherford

Facilitator: Haley Rutherford
Subject: Tide Pool interconnections of Sucia
Duration: 1 1/4 - 1 1/2 hours
Location: Ewing Point tide pools
Group size: 10 students

Objectives

Students will be able to:

- Identify factors that limit population growth in tide pools
- Infer interdependencies and interrelationships among the organisms in tide pools
- Explain the factors that their own organism is influenced by with within the tide pool community as well how their organism influences its surroundings.

Content standards addressed:

- 9-11 LS2C
  Population growth is limited by the availability of matter and energy found in resources, the size of the environment, and the presence of competing and/or predatory organisms.
- 9-11 LS2E
  Interrelationships of organisms may generate ecosystems that are stable for hundreds or thousands of years. Biodiversity refers to the different kinds of organisms in specific ecosystems or on the planet as a whole.

Methods

- Discussion on adaptations of tide pool organisms
- Observations of tide pool organisms
- Solo writing/drawing activity
- Discussion with group about individual organism

Materials

Journals and writing utensils
Whiteboard and marker
Materials to make makeshift white boards for every student
Containers (to collect tide pool critters, if possible)
Field guide(s) for identifying intertidal plants and animals

Preparation

- Collect organisms to show as examples for adaptations, if possible
- Retrieve materials

Procedure

:00 Talk about tide pool etiquette: (if not previously explained by Anna- may ask them what they remember and remind them of tips they don't remember)

- Watch where you step. Be careful not to step on too many barnacles and mussels. There is also seaweed that is very slick.
- Look closely; observe before doing anything.
- Touch gently. Wet your hands before you touch any animal, warm dry hands will cause damage to their delicate surfaces. Leave them in their pool- do not try to take them out, they need to stay in the water. Do not try to pry animals off the rocks, most will die. If you move a rock to look underneath, return in to how you found it.
- Use all your senses! Listen and smell!

:05 Now we will be looking micro-scale at tide pools!
Talk about adaptations

- What are some of the adaptations you think these organisms have? Think about what helped the organism survived and how other animals adapt and interact with each other and their surroundings.
- These organisms have adapted to withstand periods of different water temperatures, water salinity, and even no water at all.
- Factors needing to adapt to:
    - Resist water loss
    - Maintain heat balance
    - Withstand mechanical stress
    - Respire (breathe) during submersion or exposure
    - Feed or absorb nutrients
    - Move (or for some plants and animals, stay put in an optimal place)
    - Withstand salinity variation
    - Reproductive adaptations, especially lifecycle stages that require certain substrates to successfully attach.
    - Examples:
    - Limpets suction tighter to rock when the tide goes out to hold water in
    - Gunnels can hide under rocks and stay still to retain water

:15 Discuss: Even though these critters have all these adaptations, they still all have predators. Tide pools have thrived for thousands of years, why hasn't one species taken control over the whole tide pool? What keeps every population in check to maintain biodiversity?

:20 Pass around/display organisms collected in containers (if possible) or find a large tide pool to crowd around and point out various organisms. Specify that they should not touch, but for the sake of the lesson I have captured a few for the time being and I will return them promptly.

- What are some things you notice about these organisms? What are some adaptations you notice and why you think they have them?
- Point out a few cool adaptations for them to ponder. (Also, what they eat, how they eat, something that helps them survive, etc.)

:30 Tell students that they will have about a half hour to create their own organisms that lives in the intertidal zone! Let them pick a tide pool that they can sit at quietly to creatively express the critter they designed. They will need to detail their organism for a short activity afterwards.

- Need to have a carefully detailed explanation of their organism. Can be a labeled drawing or list of every attribute.
- Must have predator and prey/energy source
- Need to write down in their journal how their creature lives in this harsh (to us) environment and what kind of adaptations it has to live here.
- Describe how else it can interact with the other organisms besides the predator/prey relationships
- Write a story, a poem, draw a picture, etc. showing/depicting the tide pool they chose with their organism involved. Label or detail the environmental factors interacting with you organism. Have students pick a perspective to look "through the eyes" of whatever organism they choose:
    - Ex: write a story through the eyes of the organism you designed or another critters observation of the new addition to the neighborhood; draw a picture of you organism interacting with at least one other critter, or within the whole tide pool

:50 Have students get into their color groups to talk about the critter they designed

Conclusion

:65 Have students figure out within their group how their individual organisms interact with *each other*. Write down in their journals all the interactions (predator/prey, symbiosis, etc.) and whose creature it involved.

Assessment

My evaluation will be the discussion on adaptations and on how their designed creatures interact with the environment.

Extension

Get together as a big group to talk about individual organisms and how they interact with each other/where they live in relation to other groups.

Glitch Plan

If it is raining, we will have instructors stationed at safe tide pools to visit so less rock-slipping occurs. We will do the journaling in a short period of time, jotting down ideas they have with personal whiteboards. Later, we will give them time to draw or write.

Risk Management

There will be a certified WFR with a first aid kit during the lesson. Give clear restrictions to where the students can venture for their sit-spot and make sure they can still see someone where they are sitting. Remind them of slippery surfaces.

Background Information:
Some of the adaptations that allow maintenance of equilibria despite these inter-tidal variables include ways to:
- Resist water loss
- Maintain heat balance
- Withstand mechanical stress
- Respire (breathe) during submersion or exposure
- Feed or absorb nutrients
- Move (or for some plants and animals, stay put in an optimal place)
- Withstand salinity variation
- Reproductive adaptations, especially lifecycle stages that require certain substrates to successfully attach.

In addition, communities of organisms interact among themselves, for example in food webs (primary producers, herbivores, carnivores, detritivores), in competition, parasitism, and symbioses. These interactions add other stresses to which organisms develop adaptations. Some of these interactions and adaptations can be discovered by keen observation and detective work.
When examining an organism in different zones you can make intelligent inferences about what stresses the organism is subject to, and how the observable features of the organism reveal solutions to these problems. Careful observation, asking questions, and thinking logically about fairly simple but interacting factors can lead to discovery of ecological concepts.

From: Deb Donovan, Biology, WWU

Discovering the Story
(Thursday Campfire)

Adapted from Carson Yach's original lesson

Facilitator: Jordan Westerholm
Duration: extended lesson, lasts from Monday to Thursday
Location: first phase on Snow Goose, second phase at camp before dinner on Thursday
Group Size: 19 high school age

Goals: To foster a relationship between students and native birds.

Objectives: That the students will be able to recognize and identify various birds by hearing their calls, identifying and illustrating them in the wild, and observing and recording their characteristics. Students will demonstrate a sense of connection to wildlife by creating original stories.

Content Standards Addressed

- ESE2
  Students engage in inquiry and systems thinking and use information gained through learning experiences in, about, and for the environment to understand the structure, components, and processes of natural and human-built environments.

Methods: Students will be responsible for observing nature on their own.

Materials:

-binoculars
-field guide(s)
-observation sheets
-journals
-colored pencils and pens
-recording device documenting native bird calls

Preparation: Begin this lesson right after doing the Crow Tails lesson on the Snow Goose. Crow Tails provides the example of creative storytelling that students will need to understand how important stories are for connecting with the landscape. On the Snow Goose, just plan on framing and introducing the lesson; telling the kids what they'll be doing in the next few days, because this lesson will be extending until Thursday evening's campfire.

Procedure:

Monday, Snow Goose

0:00-0:20 Tell students, "Right now, I'm going to prep you for an upcoming lesson. The story that I told about Crow and Raven is an example of what's often called a 'how and why' story. These types of stories explain how and why things are the way they are." Explain that storytelling has been used for centuries by people to describe the way thing work, significant events in life, and reasons for why different creatures act certain ways. Also bring up that storytelling is often a sacred way of honoring beliefs and ancestors, and are meant to show compassion and understanding for the way things are. "Something you're going to get the opportunity to do is to create your own 'how and why' stories about birds that you observe on the island. On Thursday from 3:30 to 4:30 you'll have some time to craft your stories, and then you'll have the opportunity to share them during Thursday's campfire. In order to do this, you're going to want to get to know the birds on Sucia as well as you can before tomorrow evening. It's not a hard thing to do; you just have to be observant. There's a lot of birds on the island (robins, pileated woodpeckers, bald eagles, crows, ravens, hummingbirds, chickadees, buffleheads, harlequin ducks, cormorants)." Recommend that when the students see a bird that interests them, they get a closer look with binoculars, sketch it in their journals, and record behavior and characteristics of the bird. Hand out observation sheets to model how to record information in their journals. Tell the students they should eventually pick a bird that interests them enough that they would want to create a story about it. The more birds they observe, the more they'll have to choose from. Let them know that it's up to them to find time to observe birds, but instructors will be periodically checking in with them to see that they're making progress. We'll also prompt them when good opportunities for bird-watching arise. Inform them

that they can use instructors as resources of information (I have a few field guides, binoculars, recorded bird calls). Leave them with the question: How does this relate to our perspectives theme?

Tuesday, Shallow Bay
7:00-8:00 pm: Optional bird watching time. Lead a group of students to the beach or through the forest, facilitate their bird watching.

Wednesday, Shallow Bay
7:00-8:00 pm: Optional bird watching time. Lead a group of students to the beach or through the forest, facilitate their bird watching.

Thursday, North Shallow camp
3:30 to 4:30 pm: Be with the students to answer questions. Tell them a brief, made-up 'how and why' story to inspire creativity. Be sure to clarify that these stories should not be disrespectful to anyone or any beliefs. Explain that developing a story, fictional or nonfictional can help to develop a sense of place and relationship with a landscape. Stories can be in the form of written narratives, oral presentations, poems, or songs.

8:00 to 10:00 pm: Give each student a time limit of 10 minutes to tell their story and briefly explain what bird traits they based their story on. Not everyone has to share if they don't want to.

Conclusion: After students tell their stories, if there is time, lead a discussion about how their stories demonstrate the theme of perspectives. Ask them how they feel about their stories being fact/fiction. Is it right/wrong to be making stories about animals that may draw attention away from the facts?

Assessment: It will be evident that students have or haven't met the lesson objectives based on the stories they tell. Students should also give a brief explanation of why their story is the way it is, e.i. the bird traits they based their stories on.

Extensions: Students could also pair up or group up and do a skit about a bird or about multiple birds.

Glitch Plan: If it rains during the campfire, move under the shelter. If there ends up not being enough free time from 7 to 8 on Tuesday and Wednesday to lead bird-watching, the constant reminders we give the students to look for birds should suffice.

Risk Management: Do not permit students to climb trees or get too close to cliff edges when watching their birds. Too close to cliff edges means three feet from the edge.

Silent Hike

Adapted by Riley Wilmot

Facilitator: Riley Wilmot
Subject: Solo Reflection Time
Duration: 1-2 hours
Location: Ewing Cove
Group Size: 19 Students

Objective:
Through this lesson students will be able to spend some one-on-one time enjoying and observing the natural world. The students will use this time to reflect on their week on Sucia Island and to take a final look on “perspectives”. The goal is to set up an unstructured time for the students to explore their own personal piece of the island.

Content Standards Addressed

- ESE5.3.1
  States own viewpoints and listens to viewpoints of others.
- ESE5.2.1
  Creates and uses research questions that are tied to an essential question to focus inquiry on an idea, issue, or event.
- ESE5.2.1
  Evaluates and revises research questions to refine inquiry on an issue or event.

Materials:

- Poem or reading
- Hand lens (optional)

Preparations:
The students will meet at Ewing cove before they embark. A poem or reading will be read there.

Procedure:
:00 Everyone meets for the poem or reading and goes over logistics.

:05 Line the students up to take them to start the hike

:10 Explain to them that they are free to think about anything that they want to but that you are going to give them a prompt that you would like to have them come back to. The prompt is the perspective of the marine life that lives underwater and how that compares to our atmosphere here on earth. Example: the ground we walk on could be like the bottom of the ocean and the atmosphere could be compared to how the marine life might view the air up above.

:15 The students divide into four groups and head out with 5 minutes between them.

1:10 The students will meet each other gain each other and start to talk about their experiences. Reflection questions will include.

- How was enjoying nature silently different from doing it as a group?
- Did you find that you liked it better or worse? Why?
- What did you think of the prompt that was given to you?
- Did you come up with any thought that you would like to share with the group?

Conclusion:
The students will have the opportunity to reflect on their time on the island and make it their own experience. They will also have the chance to explore a more abstract perspective and let their imaginations create a more personal connection to marine life.

Assessment:
The evaluation will be based on the student's answers and participation in the group discussion at the end.

Glitch Plan
Finding shelter might be necessary in case of rain for the discussion section of the activity. Also, the facilitator might have to be prepared to separate students that are talking during this activity.

Risk Management Plan:
On account of the students getting separated during different parts of the this activity, a head count will have to occur before, during, and at the end of each section in order to assure that no one is missing. There will also need to be a facilitator in the area in case of any emergencies. There will be two Wilderness First Responders on hand, as well as a first aid kit to ensure immediate response to any injury that may occur.

Scavenger Hunt

Created by everyone

Facilitator: All staff
Subject: What the students have learned throughout the week
Duration: Four hours (10am-2pm)
Location: All over Sucia Island (except Ewing)
Group Size: 19 students in 4 groups (4-5 per group)

Objectives
Students will be able to:

- Apply the knowledge and tools/skills accumulated from the week
- Compile their knowledge to work together and find their lunch, then the boat

Materials

- Scavenger hunt cards with clues on them (number dependant on group), color coded
- Back up cards for staff members accompanying groups
- Plastic bags for each clue
- String or tacks to post clues, rocks to hold to ground, etc.
- Costumes for staff
- Bandanas in four colors (green, purple, aqua blue, and orange) enough of each color for every student and staff in each group
  About 7 of each color
- Beacon
- Buckets to hide lunch in (4- one for each group)

Preparation

- Write cards with clues and numbered order, put them in bags
- Staff will post clues throughout the island during free time or day-to-day when in the area
- Stage staff throughout the locations or with the groups
- Write letter to introduce the “adventure” or have someone come up with a story to tell
- Split students equally into four groups, paying attention to hiker strength (for appropriate groups)

Procedure:

:00 Instruct them into their four scavenger hunt groups and briefly introduce that they will completing a mission (scavenger hunt). Hand out bandanas and tell groups to come up with team names.

  - Green (N. Echo) Group
    Facilitators: Katlynne and Riley
  - Purple (Johnson Pt) Group
    Facilitators: Haley and Demi
  - Orange (Fox Cove) Group
    Facilitators: Freya and Lindsey
  - Aqua Blue (Shallow Bay) Group
    Facilitators: Jordan and Anna

00:10 Go over rules, risk management, boundaries, etc..... Tell them they will have one staff member that will be accompanying them but that cannot give hints. There will be people meeting them at some spots.

00:15 Give each group their first clue and let them go!

For Staff:
00:15 This person goes here, this person goes here, etc.....

General outline of each groups route:

Green/N. Echo

- Camp
- N. Echo Shelter (drop off packs)
- Glacier rock on Ewing trail
- Honeycomb on N. Echo Bay
- N. Echo Shelter (lunch and pick up packs)
- Ghost Forest
- Dock

Purple/Johnson Point

- Camp
- Garry Oak grove
- Homestead (drop packs off)
- Johnson Point (lunch)
- Homestead (pick up packs)
- Docks

Orange/Fox Cove

- Camp
- Ghost Forest
- Dock (drop off packs)
- Ev Henry Point (lunch)
- Fox Cove
- Docks

Blue/Shallow Bay

- Camp (leave packs)
- Lawson
- Camp (pick up packs)
- China Caves
- Ghost Forest
- Homestead
- Dock

Conclusion

Once the groups return to the dock we will move to the Fox Cove field to have reflection activities and an appreciation circle.

Assessment

By working through the activity, students will demonstrate their natural history experience and hands-on skills (map/compass) learned throughout the week.
This is a good wrap-up activity for their time on Sucia. It is a good activity for teamwork, group bonding, using their personal strengths, mental and physical challenge, and having fun!

Extension

Go to Johnson Point or Fox Cove field to have students reflect on what they learned, what they remembered, etc; basically moving on to other bonding activities earlier.

Glitch Plan
If we can't get all the cards out on time, we will run out before they leave to make sure they're in place. (waking up earlier)
If a clue is missing from its location, we will have copies with the staff members accompanying students throughout the whole journey to give to the students.
Clues are in plastic so they won't get wet in rain.

Risk Management
There will are four certified WFR's within our group with a first aid kit during the lesson. They will have an explicit location that every staff knows.
A staff member will be with each group at all times, and meeting up with other staff members who will then join the group (or at a later time).
For the China Caves, we will be explicit with a no-climbing rule.

Background information
Places they have been: North Shallow, Echo Bay, Lawson Bluff, Fossil Bay, Ghost Forest, Johnson Point, Ewing Cove Trail, Garry Oak tree area

Skills/tools acquired throughout week: foraging, LNT, compass reading, map reading, plant identification
Topics covered throughout week: Birds, epiphytes, geology of Sucia/honeycomb weathering, river otter, slugs, Garry Oak, tidepools, medicinal plants, Coast Salish plant uses

* Clues will be added at a later time, in the back of the curriculum

Web O' Friendship

Adapted by Riley Wilmot

Facilitator: Riley Wilmot
Subject: Appreciation and Reflection Time
Duration: 30 minutes
Location: Snow Goose
Group Size: 19 Students

Objective:
The students will be able to share and express their appreciation towards one another and also make a bracelet.

Materials:
- Poem or reading

- Large ball of yarn or string
- Scissors

Preparations:

The students will meet at on the snow goose in a circle and the facilitator will need to have all of the materials on hand.

Procedure:

:00 Everyone meets for the poem or reading and goes over how the game is played. The first person will start with the ball of yarn and wrap it several times around their wrist. They will then start to describe something that they really admire about someone in the group that they have witnessed over the course of the week. (the facilitator can suggest that it should be someone who the students don't always compliment, in hopes that the less popular kids will have genuine and well thought out compliments given to them). They will then announce that person's name and throw the ball of yarn to them. That person will wrap their section of the yarn around their wrist several times and then continue passing it to someone else. This continues until everyone has had the yarn thrown to them and it returns to the first person.

:05 The students will start playing the game.

:25 Once it returns to the person that started the game. The facilitator will instruct everyone to cut off their section of the yarn so that the part around their wrist remains. Student will then have the opportunity to make their bracelets.

Conclusion:
The students will have something physical to walk away with from the trip and they can keep it with them and remember that they are appreciated.

Risk Management Plan:
The students will need to be supervised while using the scissors. There will be two Wilderness First Responders on hand, as well as a first aid kit to ensure immediate response to any injury that may occur.