Western Washington University and Klondike Gold Rush National Historical Park

Earth Science Curriculum for Skagway, Alaska

Dyea Long Term Monitoring Plot Project

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Introduction

Skagway, Alaska is located in the deep Skagway valley, with massive mountains rising directly out of the Lynn Canal. It is home to a small community of eight hundred residents. The town is famous for its Gold Rush era authentic historic district dating back to the late 1890s, ancient trails that people used to deliver goods from the Alaskan coast to the interior of the Yukon, and for its unique narrow gauge railroad. During the summer the community thrives on this cultural history and comes to life mimicking the Wild West town that it once was. The town serves and entertains nearly one million visitors arriving via RV, car and aboard cruise ships. Skagway is a bustling tourist destination and it can be easily forgotten that is also a small Alaskan town, where natural resources are also abundant. In contrast Dyea, Alaska, which sits in a neighboring valley 10 miles away from Skagway, is a broad, open tidal flat where tourists and local alike go to enjoy views of snow capped peaks, bears feeding upon salmon and to visit the remains of a ghost town from the gold rush era.

Klondike Gold Rush National Historical Park (NHP) manages units within both the Skagway Historic District and in Dyea. Klondike Gold Rush NHP was designated in 1976 to recognize and honor the tremendous adventure of the Klondike Gold Rush that took place between the years of 1897-1900. The National Park Service manages several units within the historical park and its mission is to preserve and protect the natural and cultural resources.

Due to the historic nature of the park the primary focus is often placed upon the cultural resources; however each division of the National Park also aims to help preserve and protect the area's natural resources. By the year 2009 the Klondike Gold Rush Education Program had developed curriculum materials for 4^{th}-6^{th} grade students and Junior Rangers materials that primarily focused on the cultural resources of the park. Only a handful of informal natural resource oriented environmental education program and activities had been developed and presented during summer programs.

As the park expanded its education programs and began to reach out to youth and the local school district it became clear that curriculum regarding the park had not yet addressed its unique natural resources. While the teachers had adequate education materials about the history of the Klondike Gold Rush, the park had yet to supply a comprehensive Place Based earth science curriculum. This gap in Klondike Gold Rush National Historical Park's education program inspired the creation of long term monitoring plots, in which students make observations and conduct field investigations. The development of earth science curriculum to accompany the long term monitoring plots, program planning and curriculum implementation are the goals of this field project.

This project offers a number of challenges and learning opportunities, and allows the park to develop stronger partnerships with the local school district and community, as well as inspires deeper connections among students to both the park's natural and cultural resources. Challenges included working around school testing schedules, accommodating Skagway School District's unique arrangement of mixed classrooms and developing an alternating curriculum. While the challenges are still present, teachers and park staff have gone above and beyond what was expected to support the new curriculum. This support made the pilot phase of the curriculum and introduction of the Dyea monitoring plots an overall success. Students are demonstrating a greater appreciation and ownership

towards Dyea, Alaska and communications between the school and the National Park Service are continuing to strengthen.

Although this curriculum and pilot program are being presented in this document as a short-term field project the curriculum and monitoring plot investigations will continue well beyond this project's scope. The curriculum is fluid and ever evolving. Klondike Gold Rush National Historical Park will continue to pilot new units of the curriculum in the upcoming 2010/2011 school year.

As with any curriculum, the materials created will change and be adapted by new teachers and education specialists that enter into the program. The future of the program is not likely to look like the program that was piloted in the 2009/2010 school year. This fluidity demonstrates the curriculum's application of Inquiry and Place Based learning models which inspire active community involvement and student directed learning. This dynamism of the curriculum will help meet the overall goals of the new program which is to ensure that Skagway youth develop a strong connection to their home and the amazing resources, natural and cultural, that it offers to the world.

Project Goals and Overview

In 2008 Klondike Gold Rush NHP was awarded Parks as Classroom funding to create curriculum and education materials for the Skagway School District. The park purchased Vernier Lab Quest field testing computers with science curriculum and probes for grades K-12 in response to a request made by the local teachers to help better meet science and technology standards. The National Park Service desired to merge the materials purchased with an Environmental Education Curriculum. After discussion among the Park Biologist (Dave Schirokauer), Education specialist (myself) and local teachers (Mary Thole and Vivian Meyer) it was decided to create long term monitoring plots in which students would be able to conduct field investigations and monitor the landscape over time using the Vernier Lab Quest equipment to conduct field tests and analyze data. It was also determined that the establishment of long term monitoring plots would require a tailored curriculum that would meet state learning standards and fit into the school district's set curriculum. Teachers and park staff agreed that to best meet the goals of both organizations and produce the highest level of appreciation and understanding among students the curriculum would utilize both Place Based and Inquiry Based Learning methods.

A number of locations were discussed to establish long term monitoring plots, however the tidal flats in Dyea were chosen because of the area's abundant natural resources, its community significance as a place for outdoor recreation, and its current management issues. Dyea is a large river valley that is experiencing several natural changes. The glacial fed Taiya River frequently changes its course, and the valley is undergoing glacial rebound that causes the land to rise nearly ¾" annually. This rise in land has exposed land that was once underwater and is now in the process of biological succession. The fluctuations of tides, dynamic watershed and rapid geological rebound make Dyea an ideal location to monitor changes on a landscape.

Dyea also holds significance within the Skagway Community as a get-a-way. It a place where locals like to fish, camp, hike, ride all terrain vehicles, cross-country ski, view wildlife, and other outdoor recreation activities. Additionally, it is a living museum littered with artifacts and archaeology sites from the when Dyea was a gold rush town populated by more than 8,000 people. The old Dyea town site is protected within Klondike Gold Rush NHP, while the flats are managed by the Municipality of Skagway, and some of the surrounding forests are on State land. This mixture of natural and cultural resources and management agencies make it an ideal location for students to learn about civic processes, public land management, and natural resource management. The learning opportunities in Dyea are infinite and provide an outdoor classroom where students can use inquiry and investigation skills to study a rapidly landscape due to glacial rebound and plant succession. Student's can then apply this knowledge to consider local issues and public land management decisions.

Curriculum Description

Due to the Skagway School District's remote location of Southeast Alaska the school operation is unique. In the elementary school grade levels are combined. This curriculum recognizes this challenge and offers a rotating curriculum to ensure students are receiving a full scope and sequence of knowledge and not repeating concepts and themes. To accommodate the school's classroom arrangement eight earth science concepts were selected that meet state learning standards, are already integrated into the

school district's curriculum and allow students to begin the curriculum at either the first or second year curriculum. The selected concepts to be covered in the curriculum are listed below.

First Year Topics for Field Based Inquiry

3rd Grade/ 4th Grade: Habitat and Communities

5th Grade/ 6th Grade: Soil Study and Plant Succession

Second Year Topics for Field Based Inquiry

3rd Grade/ 4th Grade: Watershed and Water Cycle

5th Grade/ 6th Grade: Biodiversity and Conservation

Each unit consists of five lesson plans: One pre-field trip lesson to be facilitated by a teacher, one pre-field lesson to be conducted by a National Park Service Ranger, one field investigation day in Dyea, one post-field trip lesson facilitated by a ranger that allows time to analyze data and a final lesson for student presentations of field investigation findings. This series of activities will take place twice a year once in the fall and once in the spring.

The program was piloted with 3-6 grade students in the fall of 2009. A formative assessment revealed that more time was needed to complete the activities. In response to this the number of lesson plans increased from 3 to the current 5 lesson plans per unit. Additionally, the lessons have been simplified as result of teacher comments on too much content and grade level appropriateness. Also the time for the field investigation was not adequate. Students were rushed during the field study section of the program; therefore logistics have been modified to allow for more observation and investigation time. The changes in the curriculum noted above were implemented during the second phase of piloting, which took place in the Spring of 2010.

The goal of the evaluation completed during the two piloting phases was to determine if the program is meeting the goals set by the National Park Service and meeting the needs of the Skagway School District. The evaluation completed was both formative and summative. The formative aspect helps park staff and teachers improve the curriculum for future students. The summative evaluations aid park managers in requesting additional funds for the park's education program.

Program Goals

During the development of the curriculum the following program goals were selected reflecting the desired outcomes and goals of both the Skagway School District and Klondike Gold Rush National Historical Park.

1. Foster a long term partnership between the National Park Service, the Skagway School District, and the Skagway community to further develop appreciation of Skagway historical and natural significance.

2. Develop and use skills of inquiry, observation and investigation to gain an understanding of scientific processes used by field researchers and resource managers.

3. Create a long term data set that can be used by future students, public land managers, and other park education programs to evaluate and better understand the changes occurring in Dyea, Alaska.

4. Develop an understanding of the interaction between people and their physical environment as it changes overtime.

5. Create awareness to the fragility and resilience of ecosystem and cultural sites.

6. Meet Alaskan State Grade Level Expectations in Science and Alaska State History Performance Standards through hands-on field study.

7. Provide students with a sense of ownership of their public lands encouraging stewardship and providing the knowledge needed to help them make informed decisions about public lands in the future.

These program goals will be measured and evaluated using formative assessments that will be completed during the piloting phases and throughout the program's continuation to ensure that program goals and desired outcomes are updated as the needs of students, teachers, and the National Park Service.

Dyea Earth Science Monitoring Plots Literature Review

This literature review serves to outline the benefits and challenges of the educational learning theories and methods employed in the Dyea Earth Science Monitoring Plot Program. Additionally, the review will examine the best methods used to evaluate program outcomes and assess student learning.

The primary educational theory and methods used to develop the Dyea Monitoring Plot program curriculum were Place Based Education and Inquiry Based Learning. Both of these methods have shown to be beneficial in meeting the goals of Environmental Education (EE). EE has two founding documents that communicate its goals. The Belgrade Charter of 1976 defined the broad mission statement of environmental education (NAAEE, 2004);

> *The goal of environmental education is to develop a world population that is aware of and concerned about, the environment and its associated problems, and which has the knowledge, skills, attitudes, motivations, and commitment to work individually and collectively toward solutions of current problems and the prevention of new ones.*

Place Based Education and Environmental Based Education

Place Based Education (PBE) is a method of teaching in which learning is grounded in the local environment and aims to improve education outcomes and works to achieve a sustainable society by developing a sense of connectedness to where students live (Meichtry & Smith, 2007). The goals of PBE according to Promise of Place.org include; Boosting student achievement by providing a sense of personal efficacy as stewards of their local environment and community; Increasing community, social, and economic vitality by forging strong ties between local studies and environment organizations, schools and communities; and Creating ecological Integrity by allowing students to make tangible contributions to resolving local environmental issues and conserving local environmental quality (Engagment, 2010). The basic driving principles of PBE include; Learning takes place on site in the school and/or local community; Learning focuses on local themes, systems and content; Learning is personally relevant; Learning experience contributes to community vitality, environmental quality and supports the community's role in fostering global environmental quality; Learning is sponsored by strong and varied partnerships; Learning is interdisciplinary; Learning is tailored to the local audience; Learning is grounded in and supports the development of a love for one's place; Learning is a foundation for understanding and participating in regional and global issues (Engagment, 2010).

Engagement of students in local environments and emphasizing relevance of lessons to students lives have been shown to yield several benefits to teachers and students. For example in a recent study titled "*An Evaluation of Four Place Based Education Programs,"* author Amy Powers (2004)reports that K-12 schools using PBE methods have shown increased student engagement, more meaningful learning, improved test scores, increased student enthusiasm for learning, greater pride in accomplishments, and greater teacher job satisfaction.

Another teaching model that is similar to PBE is Environment Based Education (EBE). The North American Association for Environmental Education (NAAEE) produced a report in 2001 stating that using

the environment as a tool helps teachers meet broader education goals and utilizes a number of teaching techniques including: problem or issue based learning, interdisciplinary education, team teaching, learner centered instruction, constructivist approaches and self-directed learning. NAAEE (2004) reviewed a number of EE programs to demonstrate that EBE is effective in creating future workers, problem solvers, thoughtful community leaders, and people who care about people, creatures, and the places around them.

Involving the community and focusing learning in a specific place does present challenges. The challenges of PBE were identified by Powers (2004) in her review of four different Place Based Programs. The study found external challenges to include a lack of time to implement and limited support staff. The internal challenges include limited teacher guidance in curriculum planning and training.

Inquiry Based Learning

Inquiry Based Learning (IBL) is learner centered and directed. It is structured on the process of questioning, observation and investigation. The principles of IBL include; flexibility, collaborative learning, building a framework and focus for student questioning, and applying constructivist approaches (Education Broadcasting Coorporations, 2004). IBL has been widely recognized in formal education and in 1996 was incorporated into the National Science Education Standards. The scientific method and inquiry skills are now listed in most state science standards. Inquiry, prediction, investigation and the scientific method are all included into Alaska State Standards (Alaska Deparment of Education and Early Development, 2010).

Inquiry Based Learning is often seen as more challenging by teachers due to their own lack of knowledge and comfort with science and inquiry skills ((Bencze, 2010). John Larence Bencze, author of "*Promoting Student Led Science and Technology Projects in Elementary Teacher Education,"* states that students rarely get to do science because teachers are not comfortable doing science themselves and teacher training in science is inadequate (2010). Students are taught theories and laws, and instructed about the results of others and not encouraged to generate their own desirable products (Bencze, 2010). Bencze claims that without hands-on science students are not likely to construct their own knowledge and or develop comprehensive science literacy (2010).

The integration of IBL into curriculum has been proven to empower students, develop skills in decision making, problem solving, and critical thinking. Overall, IBL has been shown to enrich student learning by involving students in real world problems, allowing class discussions to become learner centered, and engage them in hands-on, invetigative science (Thadani, Cook, Griffis, Wise, & Blakey, 2010; Bencze, 2010; Khalid, 2010).

Challenges with implementation are similar to PBE in that curriculum development and implementation are more time consuming than traditional methods. Additionally, in a study on the effects of Inquiry Based Education concerning education equality it was found that teachers often did not follow out Inquiry curriculum to its fullest and reverted back to providing answers, thus not allowing students to guide their own learning (Thadani et al, 2010).

Monitoring Projects

The majority of monitoring projects reviewed were curriculum based Inquiry science programs allowing students to problem solve, develop skills in the scientific method, and engage in real world issues. Long term monitoring projects have been shown to be effective in meeting Inquiry standards nationwide.

A major component of monitoring plot programs is student field investigations of their local environment. Research indicates that field investigations stimulate student's senses and therefore help facilitate better understanding of ideas and concepts. For example according, to C.E. Knapp in the 1992 article, "*Lasting lessons: A teacher's guide to reflecting on experience,*" (as sited in Cachelin, Paisley, & Blandar, 2009) the brain absorbs both central and peripheral sensory information. When students are outdoors peripheral sensory is enriched, which allows for the brain to store information differently using spatial memory. Spatial memory allows for better understanding of information and increased chances of remembering information (Cachelin, Paisley, & Blandar, 2009). Other positive impacts of monitoring include; better student comprehension of concepts, activities are hands-on and engaging, maintains student curiosity, and engages learners in inquiry activities (Haley & Overholt, 2005). One review of 15 schools from around the Unites States conducting stream investigations found that monitoring gave students a reason to learn, helped students better understand interdisciplinary concepts, and made science come alive (Haley & Overholt, 2005). The same study reported that the majority (91%) of participating teachers believe the program provided an opportunity for the students to share their investigation with their community.

A wide variety of monitoring programs exist. Many local schools and districts have become active in monitoring their watershed and local streams. Many monitoring or inventorying programs are on done on a local level, while other programs work to create national and/or international databases, such as Global Learning and Observation to Benefit the Environment (GLOBE). GLOBE is a unique program that involves elementary and secondary schools around the world. Students collect data concerning their local environment and share the data on the internet. GLOBE gives students and teachers access to 20 different data collection protocols, teacher training and curriculum. The program has completed extensive program evaluations for last ten years. The evaluations have shown the program to continually improved science skills among students, allowed students to spend more time in groups, found students are more likely to assist other students in learning, and improved performance in earth science assessments (SRI International, 1997). Student surveys indicated they enjoyed entering data on the computer the most, while others said that they enjoyed collecting data and making observations (SRI International, 1997).

Green is one program of several stewardship curriculums offered by Earth Force. In the Green program students conduct a stream inventory and monitoring stream quality; they identify a problem and work with community partners to create a solution. The 2007-2008 program evaluation indicated that 90% of participants felt they had a better understanding of environmental issues.

Formal Evaluations of monitoring projects, including: GLOBE Program, Earth Force, and the Haley and Overholt study, revealed that monitoring does have implementation challenges and considerations such

as acquisition of funding, training, equipment (Earth Force, 2008; The Globe Program, 2010; Haley & Overholt, 2005). Additionally, teachers fascilitating stream monitoring said that major considerations in program desgin and implementation are; safety, class management, application of aoncepts, and building communities (Haley & Overholt, 2005). Teachers listed safety as a priority and helped solve classroom management problems by assigning students specific tasks during the project. Teachers participating in the GLOBE program identified the challenges of the monitoring projects as a lack of infrastructure in the education system, limited time to complete the projects, and diffiuclty collecting data on weekends and vacations.

It is notable to mention that each of the reviewed monitoring programs integrate principles and goals of Place Based Edcuation, Inquiry Based Learning, and Environmental Education. The literature reviewed indicates that none of the these teaching methods or activities stand alone, and the varitey of reviewed education programs demonstarted an integration of the teaching and learning strategies discussed above. Additionally, many of the EE programs and monitoring plot programs followed a similar structure of lessons. Each of the reviewed monitoring projects include pre- and post-field investigation activities to set guidelines, introduce broad concepts, and help student reflection.

Methods of Evaluation and Assessment for Place Based, Inquiry Based learning and Monitoring Programs

A variety of methods are used to evaluate EE, PBE, IBL and monitoring programs, including; post program surveys, student pre and post assessments, site visits, interviews, review of standardized test scores and student GPA, comparison of control and treatment groups, focus groups, development of logic models and observations. The goals and evaluation questions of the assessments reviewed here varied with most aiming to measure the impacts of the program on students and teachers. The tool used most frequently by all programs reviewed included teacher and student post program surveys to gather quantitative data. Powers (2004) recommends documenting success early and recommends more qualitative data when conducting EE program evaluations.

The need for more qualitative data is echoed in another study entitled " *The Significant Life Experience Framework to Inform Porgram Evaluation: The Nature Conservancy's Wings and Water Wetlands Education Program*" The study's purpose was to describe evaluation techniques that measure qualitative and quantitative to reveal whether or not PBE and EE are effective in fostering a pro-environmental behavior (Cachelin, Paisley, Blandar, 2009). Recent studies evaluating the impacts of EE have shown that knowledge alone does not change behavior or provide a sense of environmental stewardship. These concepts and behavior changes can be difficult to prove and measure. The authors of this study state that in order to measure whether goals, such as creating environmental stewardship behaviors, are being met evaluations must focus more on collecting both qualitative and quantitative data to demonstrate changes in student attitudes and behaviors. The evaluation completed on the Nature Conservancy Wetland EE program (Cachelin, Paisley, Blandar, 2009) used both quantitative and qualitative assessment measures. Quantitative data was gathered by having students complete pre and post concept maps demonstrating an understanding of ecosystem connections. For the qualitative evaluation students were led in a guided imagery activity and asked open ended questions about how

they felt about their experience. The answers were coded and evaluated and indicated that a conservation sentiment was only apparent in students that participated in an outdoor investigation. The program evaluators had a number of recommendations for future evaluations including providing less structure in the cognitive qualitative portion of the assessment, eliminating the use of guided imagery and using a more random sampling of students that attended the field trip at different times.

Conclusion

The review of articles concerning Placed Based Education, Inquiry Based Learning, and monitoring projects highlight the benefits of utilizing these methods in Environment Education Curriculum. Overall, the methods blend well together and will help create better informed, engaged, and curious learners that are more involved within their community and produce the outcomes of the program goals.

Additionally, researching how various PBE, IBL and monitoring programs are assessed and evaluated revealed the need for more research to be done on how to effectively measure the development of pro-environmental attitude and sentiment for stewardship.

Methods, Implementation, and Program Evaluation

The creation of Long term Monitoring Plots in Dyea, Alaska and accompanying curriculum included three major components: Curriculum development, program implementation, program evaluation. The methods and processes used to complete these components are discussed below.

Curriculum Development

The curriculum development process was completed using the *Understanding by Design* model. The model is often referred to as *Backward Design.* Like many curriculum guides, the process outlines the objectives and goals at the beginning; however, it also focuses on developing assessments and evaluation before lessons are created. This is done to better define learner outcomes and skills acquired. The Backward Design model was not initially used to development curriculum for this project but the model was used to edit and re-develop the curriculum before the first pilot phase occurred in September of 2009. Additionally, the curriculum development was guided by the research of Alaska State Science Learning Standards, Skagway School District Curriculum, teacher input, and research gathered from the literature review.

The curriculum was first outlined in the spring of 2009. This preliminary outline addressed the topics that would be covered and determined the scope and sequence of the overall rotating year curriculum. From this outline Alaska State Learning Standards were researched and the appropriate learning skills to be meeting were selected. Once the overarching concepts and learning skills were determined, principles of EE, PBE, and IBL were considered in creating the curriculum goals and desired outcomes.

The curriculum developed aimed to blend the methods of IBL, PBE and EE together into one standard based curriculum to maximize the impacts of the program on students, teachers and the local community. The focus on public land in Dyea fostered the use of PBE and EE methods and helped to engage students in the public lands and involve them in the community to help them become informed citizens, recreationists, and future decision makers concerning a location near their home. IBL methods were incorporated into the curriculum by inviting students to create their own observation questions, hyptohesis and experiments. Additionally, the program lab packet will foucs on providing a framework for questioning.

Curriculum was developed with assistance by Klondike Gold Rush NHP volunteer Sarah Betcher during the summer of 2009. Additional review and assistance was provided by seasonal park ranger Stephanie Steinhorst during the spring of 2010.

Program Implementation

The program was implemented in cooperation with the Skagway School District. It was determined that the program would be piloted in the 2009/2010 school year with two field trips being planned to go to Dyea, once in during the early fall and again in the late spring. The first field investigations took place September 15-16, 2009. The second phase of piloting took place in April 28-29, 2010.

The organization of the field trip required gathering field investigating supplies, establishing safety procedures, organizing transportation, sending a letter and permission slip home to parents, determining data collection protocols, and organizing the field investigation schedule . Transportation was provided by the local community transit organization SMART bus and school vans. Field supplies such as, hand lenses, backpacks, binoculars were provided by the Klondike Gold Rush NHP. Student safety guidelines were established in the curriculum and reviewed with students in the field prior to starting the field investigations. Additional rangers were also present to provide additional safety measure during peak bear season in the fall and provide more adult supervision and student assistance.

The program will be continued in the 2010/2011 school year. The units taught during the fall and spring sessions will not be used, instead the curriculum will rotate ensuring that students do not repeat the same curriculum.

Overall the program implementation was successful due to strong support from the Skagway School District and Klondike Gold Rush NHP, and hard work and commitment from the teachers, Mary Thole and Vivian Meyer.

Program Evaluation

Program evaluation and assessment is essential to ensure that the program is sustainable and meeting the desired goals of both the National Park Service and the Skagway School District. The primary goal of the program evaluation was to conduct formative assessments between piloting phases allowing for improvements and program adjustments to be implemented between fall and spring units. During the initial phase of piloting an observation protocol was used to solicit feedback from the teachers. Additionally, teachers communicated program suggestions via informal emails. These emails were not structured with formal interview questions since the program served only two classrooms and two teachers this form of communication allowed for fluid program development and flexibility. No quantitative or qualitative data was gathered from students during this initial evaluation phase.

During the winter of 2010 a formal program evaluation plan was developed that included creating a logic model, outlining assessment goals, establishing which assessment tools would be necessary and the development of the tools. The formative evaluation included the use of; observation protocols to be completed by outside observers or assisting rangers, teacher interviews, student surveys, and student presentations of the field investigations completed. Most data collected from this formal evaluation plan is also qualitative, and not quantitative.

The feedback from the teachers during the initial pilot was used to improve the curriculum and logistics for the second session in April. The second, more formal formative assessment results will also be used to improve the curriculum. Additionally, the formal evaluation offers insight into whether the program is meeting desired outcomes, particularly in regards to the development of ownership and stewardship behaviors in students. The proceeding table outlines the formal evaluation plan used during the second pilot phase of the curriculum.

Evaluation Questions	Indicators	Information Sources	Tools	Design and Sampling
Does the curriculum meet Alaska State Standards and is it grade level appropriate?	Teachers include into their teaching plan	Teachers, Literature Review of curriculum	Observation Protocol Teacher Interview	Participating teacher Teacher Ranger Teacher
Do lesson plans, activities, and the field investigation lab follow appropriate scope and sequence?	Students follow lessons with ease Time allowed is adequate for lesson	Student and teachers	Teacher Interview Observation Protocol Student Quantitative and Qualitative Assessment	Participating teachers Teacher Ranger Teacher
Are lesson plans effective in meeting curriculum essential questions and enduring meanings?	Students can communicate big ideas of the units they participated in	Students and teachers	Teacher Interview Student Quantitative and Qualitative Assessment	All students Pre/post
Do students feel a greater sense of ownership and stewardship toward public lands?	Student's narrative presentation reflects these concepts in final presentation	Students and teachers	Final Student Presentation Student Quantitative and Qualitative Assessment Teacher Interview	All students pre/post
Have students gained skills in inquiry, investigation, and observation?	Lab packet completed successfully Student Presentations of investigations	Student and teachers	Student Quantitative and Qualitative Assessment Teacher Interview Observation Protocol	All Students
Do students have a greater appreciation for the natural and cultural history of Alaska?	Demonstrate appreciation during final student assessment presentations	Students and teachers	Student Quantitative and Qualitative Assessment	All students Pre/post

Dyea Long Term Monitoring Plots Curriculum

Dyea Long Term Monitoring Plots Earth Science Curriculum

3-6 Grades

Klondike Gold Rush National Historic Park
Skagway, Alaska

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Introduction

Klondike Gold Rush National Historical Park and its surrounding region with public, state, and municipality lands, share a unique history, both natural and cultural. The region offers glaciers, expansive tidal flats, meandering glacial rivers, artifacts from what is often coined as *America's Last Great Adventure* and a rich history of characters and cultural diversity. Klondike Gold Rush NHP and bordering lands are an ideal place to learn about how natural and cultural histories shape a landscape.

Klondike Gold Rush National Historical Park was designated in 1976 to recognize and honor the tremendous adventure of the Klondike Gold Rush that took place between the years of 1897-1900. The National Park Service manages several units within the historical park and its mission is to preserve and protect the natural and cultural resources within these units. The Historic Dyea town site is one area managed by the National Park Service. The town site is surrounded by public, private, state and municipal lands. The tidal flats surrounding Dyea will provide the outdoor classroom for this curriculum.

The place-based field study curriculum presented here is intended to help Skagway students engage in a hands-on study of the significance and importance of the place in which they live, recognize the fascinating cultural and natural changes taking place, and come to see themselves as the future land owners, managers, and stewards of public lands, like Dyea, Alaska.

Place Based and Field Study Approach

Dyea, Alaska is a system of tidal flats located 10 miles from Skagway, AK and is one of a limited number of places left of its kind. Dyea contains a ghost town, a relic from the past. It is also being molded, shaped, and recreated everyday by natural processes. The learning opportunities in Dyea are infinite and provide an outdoor classroom where students can use inquiry and investigation skills to study the dynamic landscape. The focus of this curriculum is a field study of Dyea, where students will collect samples to be tested, make observations, and monitor the quality of Dyea's habitat, water, biodiversity, and succession progression. Pre- and post- classroom activities are also included to enhance the field study.

The field study as well as the classroom based learning opportunities will meet Alaskan State Learning Standards in science and math, providing an interdisciplinary perspective of Dyea, AK.

Rotating Curriculum Designed for Skagway School District Operations

Skagway School District is situated in a remote location of Southeast Alaska; therefore the school operation is unique. In the elementary school grade levels are combined. This curriculum recognizes this challenge and offers a rotating curriculum to ensure students are receiving a full scope and sequence of knowledge and not repeating lessons.

<u>First Year Topics for Field Based Inquiry</u>

3rd Grade/ 4th Grade: Habitat and Communities

5th Grade/ 6th Grade: Soil Study and Plant Succession

Second Year Topics for Field Based Inquiry

3rd Grade/ 4th Grade: Watershed and Water Cycle

5th Grade/ 6th Grade: Biodiversity and Plant Succession

Each of these units consists of five lessons: One pre-lesson to be facilitated by the teacher, one pre field study classroom visit by a National Park Service Ranger, one field study day in Dyea, and one post field study ranger-led lesson to analyze data and culminating lesson in which students will present presentation of field investigation. This series of activities will take place twice a year, once in the fall and once in the spring.

Program Goals

1. Foster a long term partnership between the National Park Service, the Skagway School District, and the Skagway community to further develop appreciation of Skagway's historical and natural significance.

2. Develop and use skills of inquiry, observation and investigation to gain an understanding of scientific processes used by field researchers and resource managers.

3. Create a long term data set that can be used by future students, public land managers, and other park education programs to evaluate and better understand the changes occurring in Dyea, Alaska.

4. Develop an understanding of the interaction between people and their physical environment as it changes overtime.

5. Create awareness of the fragility and resilience of ecosystem and cultural sites.

6. Meet Alaskan State Grade Level Expectations in Science and Alaska State History Performance Standards through hands-on field study.

7. Provide students with a sense of ownership of their public lands encouraging stewardship and providing the knowledge needed to help them make informed decisions about public lands in the future.

Essential Questions:

- ✓ What do public lands mean to a community?
- ✓ What can be learned about natural and human caused change from observing and monitoring a landscape?
- ✓ What can people do to protect and enjoy public lands?

Enduring Meanings

- ✓ Public lands serve a number of purposes for citizens, scientists, and communities.
- ✓ Long term monitoring, observation, and research reveals secrets about a landscape, its changes and how people and wildlife adapt overtime.

Concepts and Topics

Habitat and Community

- Space, Food, Water, Shelter, Sun
- Signs of Wildlife
- Temperature
- Adaptation
- Food Chain
- Interconnectivity

Soil Study and Plant Succession

- Qualities of Soil: Moisture, pH, Salinity
- Soil Types and Classification
- Collecting Samples
- Stages of Plant Succession
- Causes of Disturbances
- Plant Families
- Glacial Rebound

Watershed/ Water Cycle

- Sun as Energy
- Water Quality
- Maps of Local Watersheds
- Physical Properties of Water
- Stream Qualities: Turbidity, Dissolved Oxygen
- Pollutants

Biodiversity and Conservation

- Invasive Species
- Stewardship
- Endangered Species
- Energy transfer
- Nutrients Cycles
- Habitat Loss

Scientific Processes

- Scientific Method
- Investigation and Inquiry Skills
- Observation and Monitoring Skills
- Analyzing Results

Public Land use

- Monitoring
- Recreation
- Land Management
- Land Ownership
- Civic Involvement

Background Information

Dyea Estuary and Taiya Flood Plain

The Dyea flats are a broad river delta that was formed by sediments deposited by the Taiya River, a major glacial river basin. The area is composed of uplifted estuary that continues up the Taiya river valley with a series of glacial outwash terraces. Numerous ecosystem types appear on the flats including; temperate rainforest, intertidal rocky beaches, coastal dunes, early forests, coastal meadows, creeks, slough and more.

Disturbance and change are common occurrences in Dyea's natural history. Glaciers carved out the valley, deposited unsorted moraine materials and are the source for the meandering Taiya River. After the ice moved in and retreated back the area was a desolate outwash area. It is possible that the area has been ice free for many thousands of years now. The exact date of when glaciers left Dyea is still disputed by geologists. Despite the debate the vegetation in Dyea tells ecologists that the area experienced primary stages of glacial succession some time ago. Tall stands of Sitka Spruce trees and Western Hemlock exist up through the lower part of the Taiya River Valley.

Glaciers are not the only disturbance the area has had to respond to. Floods from an overflowing river, high tides, and storm surges all have affected the area. Finally, the area is also experiencing uplift due to glacial rebound. When the glaciers were in Dyea the immense weight forced the earth's crust to depress. As the ice melted away the land was relieved of the weight and is now bouncing back. In the last one hundred years the land has risen approximately 10-12 feet in elevation. This has provided for nearly one quarter to one half mile of new tidal marsh and coastal meadow lands. This new land is changing from rocky shoreline, to coastal dune, to meadow and eventually on to become forested lands. These changes offer numerous opportunities to observe transitional zones and provide for a unique biodiversity of plant and animal life in Dyea.

Immense diversity exists in Dyea, AK due to its location at the end of the Lynn Canal. The northern Lynn Canal is a transitional landscape between wet coastal environments and drier interior environments. Skagway receives only 26.5 inches of precipitation annually including snow fall. Compared to other Southeast Alaska locations this is anywhere from one half to one third below average rainfall. Conversely, in comparison to the Yukon and interior regions of Alaska this amount of rainfall is 2-3 times above normal precipitation levels.

Below is a description of four of the ecosystems that will be explored during the Dyea Earth Science Curriculum.

Coastal Dune:

Upon first glance there does not appear to be a coastal dune ecosystem on the tidal flats in Dyea, Alaska. As one approaches the high tide line evidence of rolling mounds become apparent. These represent a coastal dune ecosystem that is fairly stable and well developed, yet still in constant change from a number of factors. South winds from the Lynn Canal whip through the flats causing the sandy soil to move and alter the shape of the landscape.

Additionally, the Taiya River is a glacial river that is still altering its course as the land experiences glacial rebound and numerous forks branch out. The combination of wind and water constantly erode and re-deposit the dunes.

Dune communities are often broken down into four parts;

- Beach
- Fore Dune
- Back Dune
- New Ecosystem

A beach is considered the intertidal area that sits in front of the dune ecosystem. This area experiences times of high and low tide and is often wet or dry depending on tides. The area just above high tide stays dry throughout the day. As sand accumulates on the dry section, a combination of wind and weather start the dune construction process by blowing the sand further inland.

This accumulating sand collects naturally around topographical features or objects such as stumps. In some cases human placed objects acquire sand as well. This formation of sand is called the Fore Dune and acts as defense against storms. In Dyea these dunes are small possibly due to our extreme tides and winds. Fore Dune communities often face hardship. The ocean's salty waters make it impossible for most plants to grow and the area is exposed to high winds. The exposed sand is subject to rapid temperature changes, and has low capacity to hold water. Plants adapt to this by going through stages of dormancy, deep root systems to reach cool soil, waxy coats to deflect salt, and can withstand being buried by drifting sand.

Behind the Fore Dune is the Back Dune. The plot in the study is on a back dune site. This area has more vegetation as it is better protected and more stable. Perennial grasses, small wildflowers, mosses and lichens grow in this area. Dyea, AK is fortunate to still have Beach Wild Rye Grass or American Dune Grass (*Leymus mollis or Elymus mollis)* still dominating the back dune ecosystem. Along the western coast of the United States this native grass has been replaced by a non-native species from Europe to stabilize dunes. Both grasses help stabilize dunes systems; however European dune grasses overly effective at stabilizing the dune system and therefore allow for less flexibility and adaptability for survival of the ecosystem. Along the storm ridden pacific coast many dunes systems with the non-native grass have lost their number one adaptation to help them survive; the ability to be fluid and change rapidly with the storms. The tall perennial Dune grass provides a home for voles, numerous insect species, and provides great habitat and shelter to many other species. Back dunes often give way to the primary ecosystem or other transitional zone. This can vary from marsh, lagoon, coastal meadows, or forest. In Dyea the back dune becomes a broad coastal meadow that will soon become a forested area.

Southeast Alaska's coastlines offer unique dune systems. The cool, temperate summers that lack a dry season allow for more vegetation. This increased biomass takes place particularly in the slacks between the dunes. Southeast Alaska is also a geologic hot spot where mountains

are experiencing uplift and glacial rebound. This adds complexity to the coastal dune systems often removing them from intertidal zones, such as on the large tidal flats in Dyea, AK.

Common Plants:

- Silverweed
- Goose Tongue
- Beach Pea
- Sea-beach Sandwort
- Dune Grass
- Yarrow

Coastal Meadow and Early Succession Forest

Most of Dyea is considered to be a tidal marsh. These are maritime communities that support lush meadow vegetation. The estuarine habitat of a tidal marsh is thought to be one the most productive ecosystems. Daily tides bring in nutrients to support the landscape. This land is extremely dynamic and experiences constant disturbance and change. The extreme tides of Southeast Alaska and the rising land cause tidal and freshwater floods frequently. Additionally, the newly exposed land rising out of the ocean is rapidly developing from beach shoreline to forest. The large marsh occupies the bulk of this transition. Marshes help to recharge ground water supply, mitigate floods on a flood plain, and filter pollutants helping to purify watersheds.

Marshes are typically divided into two distinct zones, upper and lower. This upper marsh offers a wide diversity of grasses, sedges, wildflowers, shrubs, and other meadow vegetation and is now showing signs of an early forest. As the land gains elevation and rises above the water table it develops more nutrient rich soils and thus heartier plants such as shrubs and saplings of larger trees begin to grow. This area shows immense diversity. Plants and animals from the meadow and dune community are present; however the development of soil and process of plant succession have permitted the beginnings of a forest to appear.

Overall the site is an exceptional place to view and understand ecological succession. Moving from the north, where some glaciers still linger in the mountains, to the south one can view signs of primary succession that has occurred. From south to north uplift succession is clearly visible.

Common Plants:

- Dune Grass
- Moss
- Lupine
- Wild Iris
- Paint Brush
- Yarrow
- Alder
- Birch
- Willow

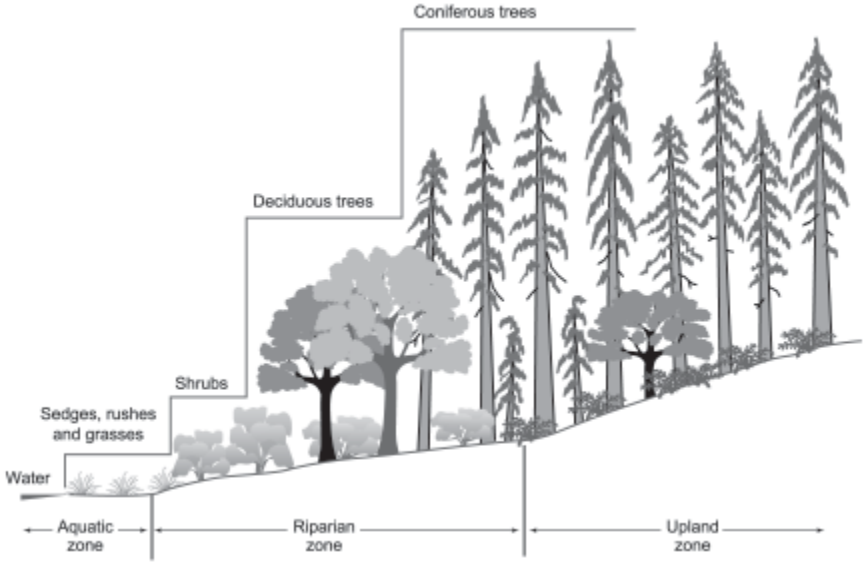
- Shore Pine
- Sitka Spruce
- Lichen
- Fireweed

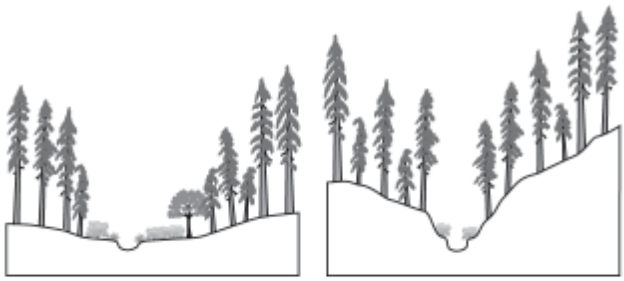
Riparian Habitats

A Riparian zone is the interface between land and lake, river, stream, slough, or other water habitat. Plant communities in these areas, such as stream banks and river beds, are referred to as riparian vegetation. Riparian areas aid in soil conservation, increase biodiversity, and filter freshwater sources. Additionally, riparian zones are vital for many species of birds, insects, and mammals as sources of food, water, and shelter. A healthy riparian zone is an indicator of a healthy environment.

To better understand the concept, Riparian Zone, definitions and diagrams from an US Forest Service Ecology report are provided:

> *Riparian areas are three-dimensional ecotones of interaction that include terrestrial and aquatic ecosystems, that extend down into the groundwater, up above the canopy, outward across the flood plain, up the near slopes that drain to the water, laterally into the terrestrial ecosystem, and along the water course at a variable width.*





	A. Broad, open area	B. Narrow, entrenched area
Local slopes:	30%	60%, often 80%
Location:	Well developed flood plains. Also includes lakes, wetlands, (marshes, bogs, ponds, wet meadows).	Poorly developed flood plains. Also includes small glacial or landslide lakes, small wetlands around springs or seeps.
Dominant process:	Deposition.	Active erosion and transport.
Soils:	Deep and often fine textured.	Often shallow and coarse textured.
Sunlight:	Year-round.	Often partially blocked during winter months or long periods of the day.
Winds:	Relatively open to disturbance.	Relatively sheltered.
Vegetation and structure:	Localized variations in soil type, moisture, and disturbance often create high diversity.	Often limited.

Nelson Creek

Primarily run-off or surface water is the source of the creek on the Dyea flats. This small tributary enters the Dyea estuary near the mouth of West Branch Creek.

Nelson creek is an important habitat in the Dyea flats. The creek has a short alluvial fan segment that offers shallow, poorly confined cobble bed channel that is utilized by chum and pink salmon that are spawning and provides limited salmoniod rearing habitat. Along the banks of the creek are a variety of riparian vegetation from grasses, small forbes and shrubs such as willow and alders. These riparian plants help keep the creek bed in place limit muddy sediment rich waters.

The creek offers a wildlife corridor, fishing grounds for brown bears, breeding grounds for western toads, dragon flies, and salmon.

Nelson Slough

On the west coast of the United States and Canada, a slough is a secondary channel of a river delta or a narrow channel in a shallow salt-water marsh, usually flushed by the tide. The channels are slow moving, almost stagnant, and often have trees, shrubs, and other aquatic plants growing throughout the habitat. The plants growing in sloughs are very water tolerant. The source of the Nelson Slough is unique from the creek. The sloughs source is a shallow aquifer rather than surface water. This habitat is important for invertebrates that feed salmon and birds. The slow moving less oxygenated water, similar to a pond, offers excellent nutrients and is a great place for the eggs and larva stages of many invertebrates.

Unit 1: Have to Have Habitat (Grades 3 &4)

Essential Questions and Enduring Meanings:

Fall Session:

- ✓ Is Dyea part of your Habitat?

  Animals and humans both require healthy habitats to survive and thrive.

  Animals and humans often share the same spaces of habitat.

Spring Session:

- ✓ How am I connected to Dyea's ecosystem?

  Plants, animals and nonliving parts of an ecosystem are all interconnected.

  Indicator Species are important species that scientist study to monitor an area or region.

Fall Session: What is Habitat?

Lesson 1: What is a habitat?
Teacher Led Pre Activity

LESSON PLAN HIGHLIGHTS

Purpose: Introduce the concept and elements of habitats.

Duration:
40 minutes

Setting:
Classroom

Activities
Defining and compare Habitats with pictures and drawings.

Materials Needed:
1. Habitat photos
2. Crayons and colored pencils
3. Lab packet

Alaska State GLE:
SC1.2 (3rd): Describing how some traits of living organisms have helped them survive as a species.
SA 3.1 (4th): Identifying the local limiting factors that determine which plants and/or animals survive.

Objectives

1. Students will be able to define the term habitat and be able identify the elements of habitat that all livings things need to survive.

2. Students will compare their own habitat needs to an animal's habitat needs.

Introduction:

Habitat loss is one of the most serious problems that our environment is facing today. As cities, neighborhoods, agriculture, and industry continue to expand natural wildlife habitat is being lost. According to U.S. Fish and Wildlife Service, most western states have destroyed one-third of to one-half of their wetlands during the past 100 years and more than 75% of riparian woodlands have been destroyed and caused several species, particularly birds, to be placed on the endangered species list.

As Alaskan residents, students of Skagway have the privilege of growing up in a place where large expanses of intact habitats still exist, such as Dyea, Alaska. Although the Klondike Gold Rush that helped establish Skagway and Dyea is considered to have opened up Alaska as the "Last Great Frontier," this vast country still has wild and natural areas. These remaining natural areas provide animals and native plants with a home, or habitat. While wolves, bears, marbled murrelets, dune grass and other species are disappearing in the lower 48 states, Dyea, Alaska offers these species a place to live and thrive.

A habitat is more than just an animal's home; it includes the food, water, shelter and space that an animal needs to survive. Without these features, animals, including humans, cannot survive. For example, a bear often relies on downed trees or a willow thicket for shelter. Bears also need healthy food sources such as plants and prey to survive. The elements of habitat are interrelated to a larger ecosystem. Dyea offers more than just a habitat for wildlife. Dyea also serves as an important part of the Skagway community by providing

recreation, economic opportunities, subsistence and solitude and for its human habitants.

Pre-Assessment Activity:

1. The teacher will present the students with two photos, one of a house and one of a bird's nest. Students will be given a few minutes to write down similarities and differences between the two photos. The goal is evaluate if the students identify both as a home and assess their attitudes about the idea of home.

2. Next ask students to make a drawing of their own homes and instruct them to include everything they believe they need to survive.

Activity Outline:

1. Write the elements or requirements of habitat on the board: Water, Shelter, Space and Food.

2. Have students say each word out loud as a class. Ask student questions to help them define the four words. Explain that animals need these elements to survive and that they make up their habitat.

3. Have the students choose an animal and draw the animal's habitat on the back side of the drawing of their home. Students should label the four elements.

4. Have students share their drawings with the class. The teacher as the facilitator should use questions to expand on the concept of habitat. The goal is to have students begin to consider where animals get the things they need to survive. Using the animals chosen by the students ask questions like:

- How much space to the animals need? Compare the animals that the students have drawn and discuss the similarities and differences in survival needs.
- How are habitats of humans and wildlife the same? Different?
- Do worms and bugs need habitat?
- Do animals adapt to live in some habitats? Can a grizzly bear live in a smaller habitat?
- How do elements of habitat present in place change what animals can live in that place?

5. Next ask the class if plants also have a habitat? Spend time discussing the difference between plant and animal habitats. Both need the elements but plants can't move. How do they deal with weather, temperature, sunlight, limited space, etc. Discuss that plants have to adapt.

6. Now expand the concept of plants and habitat even further with your students. Discuss how plants have a habitat but are also a part of a habitat for other animals providing food or shelter, such as the eagle building its nest in a tree. Have students draw in the plants that the animal would need in its habitat.

Evaluation:

Have student write two sentences on their paper about habitat comparing what animals, plants and people need to survive.

Lesson 2: How do Scientist Study Habitat?
Ranger Led Pre Activity

LESSON PLAN HIGHLIGHTS

Purpose: Students will identify different habitat types in Dyea, Alaska and understand how animals adapt to live there.

Duration:
60 minutes

Setting:
Classroom

Activity:
Creating a habitat map

Materials Needed:
1. Photos of Dyea habitats
2. Science Journals
3. Crayons or colored pencils

Alaska State GLE:
(3)(4)SA1.1 :

Asking questions, predicting, describing, measuring, classifying, making generalizations, inferring and communicating.

Objectives:
1. Students will be able to identify the different habitat types of habitat in Dyea, Alaska.

2. Student will make hypotheses about which animals use these habitat types.

3. Students will be able to list habitat requirements of at least two animals they predict to be in Dyea.

Introduction:
Scientists study habitats to better understand the value of different places by learning about what plants and animals need and how they utilize different habitats and elements in them.

Establishing long-term monitoring plots is an effective way to evaluate habitat, biodiversity, soil and water quality and pollutants. Monitoring plots allow scientists to gather baseline data that will help them compare measurements collected in the future to determine if change has occurred.

Monitoring plots are also a great way for students to learn observation and investigation skills. Completing field investigations converts the outdoors into a living laboratory and students learn about scientific processes and developing hypothesis, making predictions, and collecting and analyzing data.

Pre-Assessment Activity:
1. Using a map of Alaska have students point out where is Dyea, Alaska.

2. As a class, ask students if they can tell from the map what sorts of habitats might be present in Dyea.

Activity Outline:
1. Introduce NPS and the role of rangers in public lands conservation and protection. Ranger will also prepare students to be scientists and inform them that they will be engaging in a field project to investigate habitats in Dyea, and collect data for a long-term science study.

2. Ranger will explain that scientists must first look at the big picture before they begin a study. To study habitats scientist will first learn more about the area in which they are investigating. The first step of the investigation will be to identify the different habitat types in Dyea.

3. Define the term habitat type. Show the students pictures of different habitats such forest, lake, stream, grassland. Ask students what is different about the pictures and discuss the concept of habitat types.

> Habitat Type: an environment or ecological area in which particular plants and animals are found defined by a prevailing climate.

3. Using the satellite maps of Dyea in the lab packets have students work in 3 groups to list the different types of habitats they can find from looking at the map. Explain those students are making guesses and that during the field investigation they will have the opportunity to "ground truth" or verify their guesses.

4. Compare the habitats found in the groups and agree as a class on 3-5 habitat types.

5. Have students assign a color to the different habitat types. Have students make a key to the map; writing the habitat type next to a sample of the color. Students will use the appropriate color to circle the different habitat types on their map.

6. Explain to students that the next step in the scientific process is to ask questions and make predictions what they will find. Student will work in their lab packets (See appendix) to make predictions and hypotheses. Each group will be assigned one of the monitoring plots with the exception of the Dune Community Plot. All groups will be guided by the ranger in making predictions for the Dune plot as an example. Students will make predictions of their assigned plots within their groups.

7. Explain to students that from our knowledge of habitats, habitats types and Dyea we can make educated guesses about what will find there. For example, on the Dyea map students can't see animals; however they can identify a forest habitat type. What type of animals could live in a forest? What animals could be found in a stream? Have students consider what they are not seeing in the aerial photo. Alaska Department of Fish and Game offers an extensive curriculum and website to aid teachers and rangers in learning about flora and fauna of Alaska.

http://www.wc.adfg.state.ak.us/index.cfm?adfg=education.main

8. End by preparing students for their upcoming field investigation reminding them that their job as scientist will be to collect baseline data for other scientist to use and to test the hypothesis they have created.

Evaluation:

Teachers can evaluate the questions, predictions and hypotheses, and maps created to assess student comprehension.

Lesson 3: Investigations of Habitat Types in Dyea
Ranger Led Activity in the Field

LESSON PLAN HIGHLIGHTS

Purpose: Students will gain firsthand knowledge of what is required to collect data that can be used for long-term analysis.

Duration:
Full Day Field Trip

Setting:
Dyea Flats

Activity:
Habitat Plot investigations

Materials Needed:
1. 5 Vernier gadgets
2. 5 GPS probes, 5 temperature probes
3. 5 bingo sheets
4. Waterproof recording paper
5. 2 PVC Quadrats
6. Raingear and boots
7. Lunch
8. Testing containers
9. Binoculars
10. Measuring tapes
11. String
12. Distilled water

Alaska State GLE:
(3) SA1.2 Observing and describing their world to answer simple questions.

(4) SA1.2 Observing, measuring, and collecting data from explorations and using this information to classify, predict and communicate.

Objectives:
1. Observe and record: Weather conditions, wildlife and signs of wildlife, plants types, and soil conditions.

2. Complete field investigations to test hypothesis.

3. Student will have time in the field to reflect on Dyea and the place they live, Southeast, AK.

Introduction:
Today Students will collect scientific data that will be analyzed by the Skagway elementary classrooms and will be shared with the community of Skagway. Observations and data collected will be added to each year to a local database. This will allow for future students and researchers to compare and observe changes over time. As the years progress, students will become more skilled as field scientists and will complete more advanced investigations.

The 2009 Skagway Elementary students are the pioneers of this project. The success of this earth science curriculum and the investigations in Dyea will determine the future of the program. Safety and respect to other people and wildlife will be emphasized. Additionally, the program will strive to preserve and protect Dyea, AK and help promote the unique biodiversity in Skagway's backyard.

Activity Outline: Habitat Investigations

Part 1: Field Investigation Preparation

1. Students, teachers and rangers will meet at the school and prepare for the field trip to Dyea. Rangers and teachers should check to make sure that all students have lunches, rain gear, and warm clothing. Upon arrival to Dyea, students, teachers and rangers will be dropped off as far south in the Dyea Flats as safe for the vehicle and passengers.

2. Upon arrival in the flats, the ranger will review Bear Safety and play *Black Bear* to remind to students to freeze if a bear is seen. Students will be instructed to

freeze, look for the nearest adult, and listen for instructions if a bear is seen.

Instructions for Black Bear:
Explain that students will have to strike a pose each time one of four specific poses is called out by "the caller." Each pose requires a different number of people. If students can't find the required number of people or does not freeze, they are out. The four poses are:

- *BLACK BEAR: (1 person) Student should freeze in a bear pose*
- *HORSE AND RIDER: (2 people) One person stands, while the second person kneels next to them. NO ONE RIDES ANYONE!*
- *TOURIST: (3 people) Two people pose together while the third person pretends to take their picture.*
- *GROUP HUG: (4 People) All four people huddle together.*

3. Students will find their lab groups from the classroom session and receive lab pack.

4. Ranger will set rules and expectation for traveling between plots and explain the day's activities:
Morning: Introduction, Snack, First Plot investigation of Dune Community. For safety and review the first plot site will be completed as a whole group.
Lunch: Sack Lunch at NPS Picnic Area, Temporary Shelter available in case of rain
Afternoon: Visit and complete Creek, Slough, and Early Forest plot Investigations. Each plot will be investigated by a different group after a quick tour of the plots. (2 adults will accompanying each group)

5. Ranger will offer an introduction to the field investigation. The ranger will review the habitat types located on the map and have students review their predictions. Students will be reminded of their investigation questions and their role as scientists in "ground truthing" what they observed in the aerial photos. Students also have a role in collecting baseline data that can be compared to data collected in the past, present and future. Student will be asked about the importance of things like soil type, temperature, wildlife signs, etc. before observing and measuring.

Part 2: Field Investigations
These instructions will be followed at each investigation area, Coastal Dune, Early Succession Forest, Creek, and Slough.

1. Ranger or teacher will introduce students to each habitat site by reading the habitat and ecosystem description.
2. Students will review their own predictions and hypothesis that their group made during the pre-activities.
3. Students will follow detailed Field Investigation Protocol (See Appenidx). Each student will have an assignment. For example, one student will work on the lab quest, one will manage equipment, another will read the Field Investigation Protocol, and the fourth student will be the scribe. All students will participate in making observations and

investigations. Once lab investigations are completed, students will do a sweep of the area checking for equipment and gear before moving on the next site.

Lesson 4: What does the data mean?
Ranger facilitated classroom visit

LESSON PLAN HIGHLIGHTS

Purpose: Students will analyze data from field investigations and understand what that information indicates about the area studied.

Duration:
2 class periods
1.5 hour- 2 hrs

Setting:
Classroom or Lab

Materials Needed:
1. Lab Quests and probes
2. Overhead projector of computer screen
3. Lab sheets
4. Poster boards
5. Large table

Alaska State GLE:
Science as Inquiry
(SA1.1)
Math
S&P-1
Data Display: Designing an investigation and collecting, recording and organizing data.
S&P-2
Tables, Graphs and Charts
MEA-2
Comparing and ordering objects according

Objectives:
1. Students will create a table of the data collected during the field investigation.

2. Students will analyze to make conclusions about their observations and investigations.

3. Students will work within their group to plan a presentation poster to present the community (classmate, park rangers, other classes, etc.)

Introduction:
Scientists complete their field work outside conducting studies. Being a scientist also requires plenty of work in the lab analyzing and reviewing the data collected in the field. This part of science is often the most difficult. Not only do scientists have to organize and compare the data, but they also have to determine what all the numbers mean. Often numbers do not mean anything without repeated studies, consequently monitoring programs are helpful in understanding and comparing data.

Students will analyze data to determine if their predictions and hypotheses were correct. Students will also be asked to consider if Dyea is part of their own habitat? What does Dyea provide for them? And for Skagway?

Activity Outline:

Part 1: Looking at our data
1. The ranger will explain why organizing information is important to be able to compare data and use it in the future. Students will move between 3 data analysis stations to complete their lab packets and organize data.

Data Analysis Stations

Database: Student will enter their information in the Dyea Monitoring Data Base.

Vernier Lab Quest: Students will be uploading their data from the Vernier lab quest and analyzing the graphs created.

Student Reflection: Students will be asked to answer the questions below anonymously

- What is one question that the field trip to Dyea made you think of?
- How did you feel after the trip?
- Do you want to go back to Dyea? Why or Why not?
- What did you learn on the trip?

Part 2: Making Conclusions

1. Students will get together with their groups and finish the last stages of the scientific process. Students will discuss their findings and conclusions.

2. Groups will be given a poster board to create a presentation of their findings from the field investigation. All students will be asked to present their findings and answer the question: *Is Dyea part of your Habitat?*

Lesson 5: Is Dyea part of your Habitat?

Ranger and teachers are present for student presentations

LESSON PLAN HIGHLIGHTS

Purpose: Students will effectively communicate the findings of the field investigation during class presentations and answer how Dyea, AK is part of Human Habitat.

Duration:
60 minutes or 1 class period

Setting:
Classroom or NPS auditorium

Materials Needed:
1. Vernier gadgets and probes
2. Overhead projector of computer screen
3. Lab sheets
4. Poster boards

Alaska State GLE:
Science as Inquiry
(SA2.1) Supporting their ideas with observations and peer review.

Objectives:

1. Students will present the findings of the field investigation.

2. Students will evaluate how Dyea, AK is a habitat for humans like themselves and how this connects them to Dyea.

Introduction:

"Clear communication is an essential part of doing science. It enables scientists to inform others about their work, expose their ideas to criticism by other scientists and stay informed about scientific discoveries around the world. Scientific discussion includes explanation of findings to others, and actively listens to suggestions for possible interpretations and ideas…..Scientists review and ask questions about the other scientists' work."

-Skagway School District 4th Grade Science Curriculum

Science is an evolving process that starts by asking questions and usually ends with more questions. This lesson offers students the opportunity to share their findings and review the findings of other groups.

This is also a great time to share the work of the students with the community. Place Based Education standards encourage student to inform the community of their findings because it helps make the learning more relevant and meaningful. Other classes, park departments, and community organizations can be invited to visit the school for this class period. The National Park Service also offers it auditorium for the presentations.

Activity Outline:

1. Student work groups will present their field investigations and answer the final question, "Is Dyea part of you Habitat?"

2. Time should be allotted for the audience to ask questions.

3. After presentations are completed and guests have

left students will complete a final assessment activity.

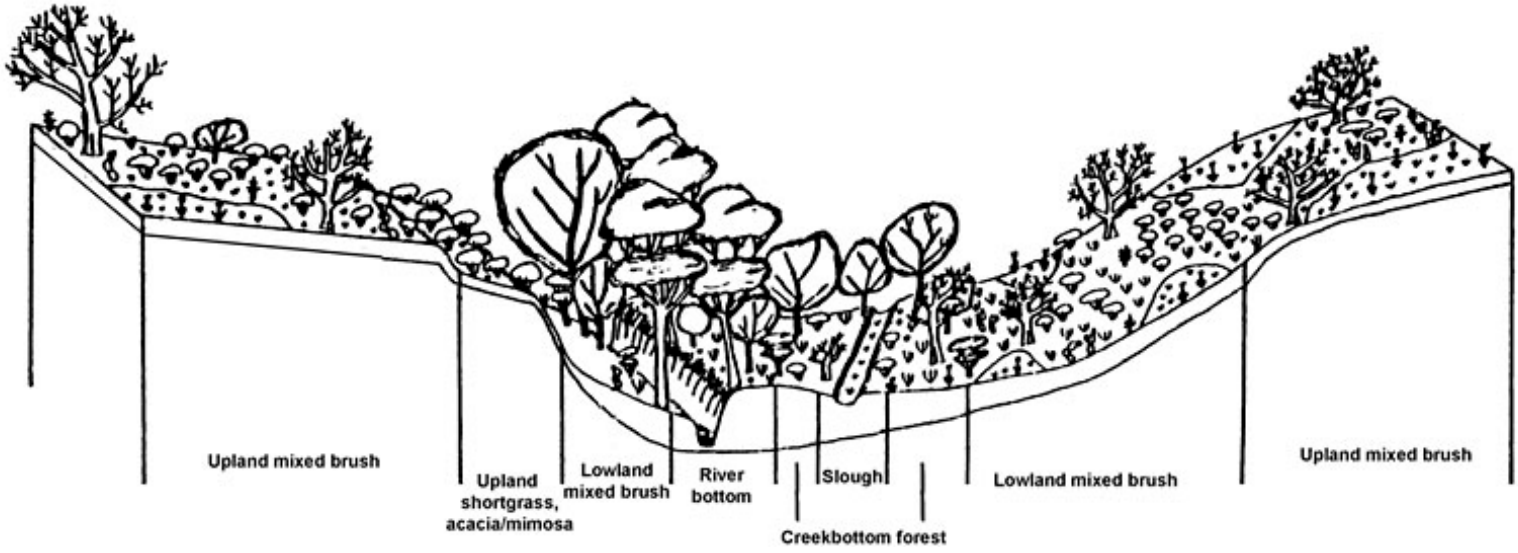
HAVE TO HAVE HABITAT

Fall Unit Post Assessment Activity

Students will be asked to once again draw their own habitat as they did during the first class. This time students will be asked to consider the entire community as their habitat. Student will be asked to label the four elements and include:

- Where they go to play?
- Where they see a lot of other people?
- Where they go to get food?
- Where does your water come from?
- What is your shelter made of?

Spring Session: Plant Communities



Lesson 1: How are living things connected in an ecosystem?
Teacher Led Activity

LESSON PLAN HIGHLIGHTS

Purpose: Students will create maps of their community and the Dyea habitat to help them better understand how organism are linked together to create ecosystems.

Duration:
60 minutes or class period

Setting:
Classroom

Materials Needed:
1. Dry erase of chalk board
2. Lab packets with maps of Skagway and Dyea
3. Pencil and crayons
4. Photos of local plants and animals

Alaska State GLE:
(3) SC2.1 Sorting animals and plants into groups based on appearance and behaviors.

(3)(4) SC3.1
Identifying and sorting examples of living and non living things in the local environment and the relationship between them

(3) SC3.2
Organizing a simple food chain of familiar plants and animals

Objectives:
1. Students will be able to define the word ecosystem.

2. Student will understand the different roles nonliving and living organisms play in a community such as producer, consumer, decomposer, and scavenger.

3. Student will be able to show how living organisms are connected through food chains.

Introduction:
Habitats are more than simply places to live. Habitats, and all of the elements needed for healthy habitats are part of the larger picture of an Ecosystem. An ecosystem, as defined by Project Wet, is a natural unit that includes living and nonliving parts interacting to produce a stable system in which the exchange of materials between the living and nonliving parts follows a closed path. Each part, living or nonliving has its own role or niche in the ecosystem. Student will explore the different jobs that exist in an ecosystem and compare them to important jobs that people do in their community to keep it working properly.

Pre Assessment Activity:
Ask the students to express in writing or with a drawing how they are connected to grass. Give students a chance to share. After students have shared, explain that throughout the next two learning sessions they will learn about how they and other animals are connected to plants.

Activity Outline:
1. Write the words Community and Ecosystem on the board. As a class create definitions for these words.

Community

- As defined by Project Wet: Is a group of plants and animals living and interacting with one another in a specific region under similar environmental conditions.

- As Defined by Merriam-Webster Online Dictionary: **1 :** a unified body of individuals: as a : STATE, COMMONWEALTH b : the people with common interests living in a particular area; *broadly* : the area itself <the problems of a large community> c : an interacting population of various kinds of individuals (as species) in a common location d : a group of people with a common characteristic or interest living together within a larger society
  http://www.merriam-webster.com/dictionary/community

Ecosystem

- As Defined by Project Wet: Is a natural unit that includes living and nonliving parts interacting to produce a stable system in which the exchange of materials between the living nonliving parts follows a closed path.
- As Defined by Merriam-Webster Online Dictionary: the complex of a community of organisms and its environment functioning as an ecological unit
  http://www.merriam-webster.com/dictionary/ecosystem

2. Ask student to compare the two definitions. One concept of importance is that an ecosystem includes living and nonliving items, such as water, nutrients, and sunlight. Ask students if humans have both a community and an ecosystem? Ask students to think about how they would describe the Skagway community.

3. Discuss the terms jobs and roles with students. Ask student what would happen if there were not teachers, trash men, train conductors, grocers, etc in Skagway? How would the community survive?

4. Provide each student with a map of Skagway. Have students mark what they believe are the important jobs in their community. Allow students time to share what they have put on the map. The teacher should write all the jobs down on the board.

5. Now ask students if they believe there are jobs in a natural ecosystem or community?
If yes? What kinds of jobs?

6. Write the following ecological terms on the board: Producer, Consumer, Decomposer, Scavenger, Carnivore, Herbivore, and Omnivore. Explain that these are the major jobs in an ecosystem. As a class define the seven terms. Relate the terms back to the jobs discussed in the community of Skagway. Provide an example of each and use the visual aids provided:

Definitions Provided by Project Wild:

Producer: A green plant or bacterium that uses photosynthesis (Plant that makes its own food from water, nutrients, and sunlight). They represent the first trophic level in the food chain (i.e. Grass, Iris, etc.) Producers rely heavily on nonliving elements to make food.
Compare producers to the Grocer, Farmer, and Baker (they provide and make the food)

Consumer: The first part of an ecosystem is the nonliving substance; the second part consists of those organisms that are called producers or food makers; the third part is called consumer because it uses the producer for its food; it may be in turn be used as food by a secondary consumer.
Compare the consumers to buyers at the grocery store, farm or bakery. We buy the food and eat it. We are consumers! What type?

Carnivore: A meat eater (i.e. wolf)

Omnivore: Eats both plants and meat (i.e. humans and bears)

Herbivore: A plant eater (i.e. rabbit)

Decomposer: Those organisms (i.e. bacteria, fungi) that convert dead organic material into inorganic materials. *Compare this job to the community compost and recycling, where things are broken down to be reused again.*

Scavenger: An organism that habitually feeds on refuse or carrion. (i.e. coyotes and eagles) *Compare this to the garbage men/women who help keep the city clean.*

6. Provide each student with a map of Dyea. Have student draw plants and animals in the appropriate habitat and label each one with its "job" or role in the community.

Evaluation:

Ask students again how they are connected to grass. Have students connect the animals and plants on their maps of Dyea, creating a food chain to show the relationships of different organisms. Have students include humans on their Dyea, Map and demonstrate their connection to plants or grass.

Lesson 2: What species are vital to Dyea's Ecosystem?

Ranger Led Pre-Activity

LESSON PLAN HIGHLIGHTS

Purpose: Students will make predictions about connections and relationships in the Dyea ecosystem and hypothesize the presence of Indicator Species.

Duration:
60 minutes or one class period

Setting:
Classroom

Materials Needed:
1. Dry erase or chalk board
2. Lab packets with maps of Skagway and Dyea
3. Pencil and crayons
4. Photos of Dune Grass habitat
5. String
6. 3 Sets of ecosystem memory cards

Alaska State GLE:
(4) SC3.1 Identifying a simple food chain and diagramming how energy flows through it and describing the effects of removing one link.

(4) SA3.1 Indentifying the local limiting factors that determine which plants and/or animals survive.

(3) (4) SA 1.1 Asking questions, predicting, observing, describing and measuring, classifying, making generalizations, inferring and communicating

Objectives:

1. Students will be able to define Indicator Species.

2. Students will understand why scientists study relationships in an ecosystem.

3. Students will make predictions and hypothesis about vital species in Dyea, AK.

Introduction:

Ideally, scientists would study every species in a region, however time and resources do not allow for this. How do scientists choose which species to study? Scientists try to select species that indicate the health of an ecosystem.

The roles of some organisms are so vital to an ecosystem that without its presence the ecosystem may experience a dramatic shift or collapse completely. Some species define traits of an ecosystem because there is so much of it a habitat or ecoregion. Other species are sensitive to changes in climate, environmental conditions, and disease outbreaks. The presence of Indicator Species can suggest how healthy an ecosystem is and demonstrate important relationships in an ecosystem.

Indicator Species are great tools in long term monitoring. By tracking the presence, increase or decrease of an Indicator Species population scientist can ask important questions about ecosystem interdependence and compare data over the years to answer those questions.

Student will explore the concept of Indicator Species and predict and hypothesize what species are vital to Dyea. Student will also continue to collect baseline data on the monitoring plots.

Monitoring plots are also a great way for students to learn observation and investigation skills. Completing field investigations converts the outdoors into a living laboratory and students learn about scientific processes and developing hypothesis, making predictions, and collecting and analyzing data.

Activity Outline:

1. Ranger and NPS introduction. The ranger will also remind students that this activity is to prepare for the field investigation that they will be completing as scientists.

2. As review students will play Ecosystem Memory. Students will have to match terms with their definition or picture. Students should do this in their field investigation groups. Divide class in 3 groups.

3. The Memory game will have one new term that students do not know. Use the new card to explain and define the term Indicator Species. Write the term on the board and explain the term to students.

Indicator Species: As defined by Wikipedia based of article published in *Conservation Biology:*

An indicator species is any biological species that defines a trait or characteristic of the environment. For example, a species may delineate an ecoregion or indicate an environmental condition such as a disease outbreak, pollution, species competition or climate change. Indicator species can be among the most sensitive species in a region, and sometimes act as an early warning to monitoring biologists.

Lindenmayer *et al.* (article as cited on Wikipedia.com) suggest 7 alternative definitions of indicator species:

1. a species whose presence indicates the presence of a set of other species and whose absence indicates the lack of that entire set of species;
2. a keystone species, which is a species whose addition to or loss from an ecosystem leads to major changes in abundance or occurrence of at least one other species
3. a species whose presence indicates human-created abiotic conditions such as air or water pollution (often called a pollution indicator species)
4. a dominant species that provides much of the biomass or number of individuals in an area
5. a species that indicates particular environmental conditions such as certain soil or rock types
6. a species thought to be sensitive to and therefore to serve as an early warning indicator of environmental changes such as global warming or modified fire regimes (sometimes called a bioindicator species)
7. a management indicator species, which is a species that reflects the effects of a disturbance regime or the efficacy of efforts to mitigate disturbance effects.

Type 1, 2, and 4 has been proposed as indicators of biological diversity and types 3, 5, 6, and 7 as indicators of abiotic conditions and/or changes in ecological processes.

http://en.wikipedia.org/wiki/Indicator_species

3. Introduce students to Dune Grass, showing the students pictures of the grass and telling its story of how only a limited number of Dune communities still have the native grass. Discuss the roles or jobs that it plays in the Dyea dune system and how it has adapted to live in such rough conditions. Describe the grass as an Indicator Species for Coastal Dune Communities because it is the dominant species and its presence indicates a healthy dune community.

4. Demonstrate the importance of Dune grass in maintaining the Dune community by creating a web of life with the students. Assign one student the role of Dune grass and using string create a web showing how all other parts of the Dune Community are connected by the grass. Eliminate the dune grass and ask the student what they believe will happen.

5. Assign each group one of the other 3 plots beside the dune community. Have students make predictions and hypothesize what Indicator Species may exist within their assigned plot. Explain to students that this type of work, the scientific method, is how scientists develop study questions, experiments and prepare for a field investigation.

6. End by preparing students for their upcoming field investigation reminding them that their job as scientist will be to collect baseline data for other scientist to use and to test the hypothesis they have created.

Evaluation:

Have students create a food web based upon their predictions of their assigned plot.

Lesson 3: Investigations of Habitat Types in Dyea

Ranger Led Activity in the Field

LESSON PLAN HIGHLIGHTS

Purpose: Students will gain firsthand knowledge of what is required to collect data that can be used for long-term analysis.

Duration:
Full Day Field Trip

Setting:
Dyea Flats

Activity:
Habitat Plot investigations

Materials Needed:
1. 5 Vernier gadgets
2. 5 GPS probes, 5 temperature probes
3. 5 bingo sheets
4. Waterproof recording paper
5. 2 PVC Quadrats
6. Raingear and boots
7. Lunch
8. Testing containers
9. Binoculars
10. Measuring tapes
11. String
12. Distilled water

Alaska State GLE:
(3) SA1.2 Observing and describing their world to answer simple questions.

(4) SA1.2 Observing, measuring, and collecting data from explorations and using this information to classify,

Objectives:
1. Observe and record: Weather conditions, wildlife and signs of wildlife, plants types, and soil conditions.

2. Complete field investigations to test hypotheses.

3. Student will have time in the field to reflect on Dyea and the place they live, Southeast, AK.

Introduction:
Today Students will collect scientific data that will be analyzed by the Skagway elementary classrooms and will be shared with the community of Skagway. Observations and data collected will be added to each year to a local database. This will allow for future students and researchers to compare and observe changes over time. As the years progress, students will become more skilled as field scientists and will complete more advanced investigations.

The 2009 Skagway Elementary students are the pioneers of this project. The success of this earth science curriculum and the investigations in Dyea will determine the future of the program. Safety and respect to other people and wildlife will be emphasized. Additionally, the program will strive to preserve and protect Dyea, AK and help promote the unique biodiversity in Skagway's backyard.

Activity Outline: Habitat Investigations

Part 1: Field Investigation Preparation
1. Students, teachers and rangers will meet at the school and prepare for the field trip to Dyea. Rangers and teachers should check to make sure that all students have lunches, rain gear, and warm clothing. Upon arrival to Dyea, students, teachers and rangers will be dropped off as far south in the Dyea Flats as safe for the vehicle and passengers.

2. Upon arrival in the flats, the ranger will review Bear Safety and play *Black Bear* to remind to students to freeze if a bear is seen. Students will be instructed to

freeze, look for the nearest adult, and listen for instructions if a bear is seen.

Instructions for Black Bear:
Explain that students will have to strike a pose each time one of four specific poses is called out by "the caller." Each pose requires a different number of people. If students can't find the required number of people or does not freeze, they are out. The four poses are:

- *BLACK BEAR: (1 person) Student should freeze in a bear pose*
- *HORSE AND RIDER: (2 people) One person stands, while the second person kneels next to them. NO ONE RIDES ANYONE!*
- *TOURIST: (3 people) Two people pose together while the third person pretends to take their picture.*
- *GROUP HUG: (4 People) All four people huddle together.*

3. Students will find their lab groups from the classroom session and receive lab pack.

4. Ranger will set rules and expectations for traveling between plots and explain the day's activities:
Morning: Introduction, Snack, First Plot investigation of Dune Community. For safety and review the first plot site will be completed as a whole group.
Lunch: Sack Lunch at NPS Picnic Area, Temporary Shelter available in case of rain
Afternoon: Visit and complete Creek, Slough, and Early Forest plot Investigations. Each plot will be investigated by a different group after a quick tour of the plots. (2 adults will accompanying each group)

5. Ranger will offer an introduction to the field investigation. The ranger will review the habitat types located on the map and have students review their predictions. Students will be reminded of their investigation questions and their role as scientists to test their hypothesis regarding Indicator Species. Students also have a role in collecting baseline data that can be compared to data collected in the past, present and future. Student will be asked about the importance of things like soil type, temperature, wildlife signs, etc. before observing and measuring.

Part 2: Field Investigations

These instructions will be followed at each investigation area, Coastal Dune, Early Succession Forest, Creek, and Slough.

1. Ranger or teacher will introduce students to each habitat site by reading the habitat and ecosystem description.
2. Students will review their own predictions and hypothesis that their group made during the pre activities.
3. Students will follow detailed Field Investigation Protocol (See appendix). Each student will have an assignment. For example, one student will work on the lab quest, one will manage equipment, another will read the Field Investigation Protocol, and the fourth student will be the scribe. All students will participate in making observations and investigations. Once lab investigations are completed, students will do a sweep of the area checking for equipment and gear before moving on the next site.

Lesson 4: What does the data mean?

Ranger facilitated classroom visit

LESSON PLAN HIGHLIGHTS

Purpose: Students will analyze data from field investigations and understand what that information indicates about the area studied.

Duration:
2 class periods
1.5 hour- 2 hrs

Setting:
Classroom or Lab

Materials Needed:
1. Lab Quests and probes
2. Overhead projector of computer screen
3. Lab sheets
4. Poster boards
5. Large table

Alaska State GLE:
Science as Inquiry
(SA1.1)
Math
S&P-1
Data Display: Designing an investigation and collecting, recording and organizing data.
S&P-2
Tables, Graphs and Charts
MEA-2
Comparing and ordering objects according

Objectives:

1. Students will create a table of the data collected during the field investigation.

2. Students will analyze to make conclusions about their observations and investigations.

3. Students will work within their group to plan a presentation poster to present the community (classmates, park rangers, other classes, etc.)

Introduction:

Scientists complete their field work outside conducting studies. Being a scientist also requires plenty of work in the lab analyzing and reviewing their data collected in the field. This part of science is often the most difficult. Not only do scientists have to organize and compare the data, but they also have to determine what all the numbers mean. Often numbers do not mean anything without repeated studies, consequently monitoring programs are helpful in understanding and comparing data.

Students will analyze data to determine if their predictions and hypotheses were correct. Students will also be asked to consider how grass and other plants in Dyea impact their lives in Skagway.

Activity Outline:

Part 1: Looking at our data

1. The ranger will explain why organizing information is important to be able to compare data and use it in the future. Students will move between 3 data analysis stations to complete their lab packets and organize data.

Data Analysis Stations

Database: Student will enter their information in the Dyea Monitoring Data Base

Vernier Lab Quest: Students will be uploading their data from the Vernier lab quest and analyzing the graphs created.

Student Reflection: Students will be asked to answer the questions below anonymously

- What is one question that the field trip to Dyea made you think of?
- How did you feel after the trip?
- Do you want to go back to Dyea? Why or Why not?
- What did you learn on the trip?

Part 2: Making Conclusions

1. Students will group together with their groups and finish the last stages of the scientific process. Students will discuss their findings and conclusions.

2. Groups will be given a poster board to create a presentation of their findings from the field investigation. All students will be asked to present their findings and answer the question: *How are you connected to Dyea?*

Lesson 5: How are you connected to Dyea?
Ranger and teachers are present for student presentations

LESSON PLAN HIGHLIGHTS

Purpose: Students will effectively communicate the findings of the field investigation during class presentations and answer how Dyea, AK is part of Human Habitat.

Duration:
60 minutes or 1 class period

Setting:
Classroom or NPS auditorium

Materials Needed:
1. Vernier gadgets and probes
2. Overhead projector of computer screen
3. Lab sheets
4. Poster boards

Alaska State GLE:
Science as Inquiry
(SA2.1) Supporting their ideas with observations and peer review.

Objectives:
1. Students will present the findings of the field investigation.

2. Students will evaluate how Dyea, AK is a habitat for humans like themselves and how this connects them to Dyea.

Introduction:
"Clear communication is an essential part of doing science. It enables scientists to inform others about their work, expose their ideas to criticism by other scientist and stay informed about scientific discoveries around the world. Scientific discussion includes explanation of findings to others, and actively listens to suggestions for possible interpretations and ideas…..Scientists review and ask questions about the other scientists' work."

-Skagway School District 4th Grade Science Curriculum

Science is an evolving process that starts by asking questions and usually ends with more questions. This lesson offers students the opportunity to share their findings and review the findings of other groups.

This is also a great time to share the work of the students with the community. Place Based Education standards encourage student to inform the community of their findings because it helps make the learning more relevant and meaningful. Other classes, park departments, and community organizations can be invited to visit the school for this class period. The National Park Service also offers it auditorium for the presentations.

Activity Outline:
1. Student work groups will present their field investigations and answer the final question, "How are you connected to Dyea?"

2. Time should be allotted for the audience to ask questions.

3. After presentations are completed and guests have

left students will complete a final assessment activity.

HAVE TO HAVE HABITAT

Spring Unit Post Assessment Activity

Students will again be asked to write about or draw how they are connected to grass. The growth seen between the answer provided during the first lesson and the last lesson will be used to measure if students have grasped the ecosystem concepts discussed. Student can also be asked to describe:

- The benefits or “jobs” of grass in an ecosystem
- Describe why Dune Grass in an Indicator Species
- Describe what would have happen if there was no Dune Grass in Dyea

Unit 1 References and Resources

Alaska Department of Fish and Game
http://www.wc.adfg.state.ak.us/index.cfm?adfg=education.main

Alaska Sea Grant
http://seagrant.uaf.edu/marine-ed/index.html

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Lindenmayer, David B.; C.R. Margules, D.B. Botkin (2000). "Indicators of Biodiversity for Ecologically Sustainable Forest Management." *Conservation Biology* **14** (4): 941–950.

O' Clair, Rita M, Armstrong, Robert H, and Carstensen, Richard. *The Nature of Southeast Alaska.* Alaska Northwest Books, Anchorage an Portland, 2003

Pojar, Jim and Mackinnon, Andy. *Plants of the Pacific Northwest Coast.* Lone Pine Publishing, Canada. 1994.

USFS, *Klondike Gold Rush National Historical Park Ecological Reconnaissance Inventor.* March 1994. USDI National Park Service, Alaska Regional Office, USDA Forest Service, Tongass National Forest, Chatham Area. Sitka, AK.

US EPA Wetlands page
http://www.epa.gov/owow/wetlands/types/marsh.html

Unit 2: Successful Dyea (Grades 5 & 6)

Essential Questions and Enduring Meanings:

Fall Session: Soil Study

- ✓ What does the soil in Dyea provide our ecosystem?

  Soils are living systems that support all life.

  The properties of soil differ from place to place and affect what type of plants and animals can thrive in a region.

Spring Session: Plant Succession

- ✓ How are Dyea's plant communities changing over time?

  Past and present geological and other natural events cause landscapes to change overtime.

Fall Session: Soil Study

Lesson 1: What is the difference between dirt and soil?

Teacher Led Pre-Activity

LESSON PLAN HIGHLIGHTS

Purpose:

Introduce students to the concepts of Soil Study and why scientist study soils.

Duration:

60 minutes

Setting:

Classroom visit by a Teacher

Activities:

1. Soil Safari
and/ or Create Soil Critter Trading Cards
2. Learn Soil Forming Factors

Materials Needed:

1. Computer with internet connection for Soil Safari
2. Example of items derived from soil: medicine, art, etc.
3. Copies of Soil Critter Trading cards
4. Vocabulary Cards

Alaska State GLE:

Science:

(5) SD2.1: Describing how wind and water tear down and build up the earth's surface resulting in new land formations

Objectives:

1. Student will be able to describe what soil is and its main components.
2. Student will be able to name 3 or more organisms that live in soil.
3. Student will be able to list the 5 soil forming factors

Introduction:

Soil is one of earth most scarce resources. It comprises only 10% of the Earths' surface and it vital to all terrestrial life. Soil holds nutrients and water for plants, filters and cleans water, produces and stores gasses, provides a home to plants and animals, and provides a snapshot of geological, climatic, biological and human history. Soil is composed of four main components: minerals, organic materials, water, and air.

In this lesson students will learn about these components and how they come together to form soil. Students will learn the five soil forming factors; Parent Material, Climate, Organisms, Topography, and Time. Student will also have an opportunity to go on a soil safari to identify the living organisms and material within the soil.

Pre-Assessment Activity:

1. Ask students fold a piece of paper in half. On one side have students write the definition or describe what soil is in one or two sentences. On the other half have students make a list of why soils are important in their own lives.

2. Have students put this piece of paper aside.

Activity Outline:

1. Ask Students what they believe the difference is between soil and dirt.
Answer: Soil is Alive!
Dirt is under your nails, soil is under your feet.

> **"**Think of soil as a thin living skin that covers the land. It goes down into the ground just a short way. Even the most fertile topsoil is only a foot or so deep. Soil is more than rock particles. It includes all the living things and the materials they make or change."
>
> **The Dirt on Soil**
> http://school.discoveryeducation.com/schooladventures/soil/recipe_soil.html

1. Next have students make a list of what they believe soil is used for and its function on Earth. As this list is being created the teacher should have example of items in which soil is used to make the product or support life.
Examples Include (pictures of items will work):
    - Art and tools: Pottery, Kitchenware, sand painting
    - Medicine: diarrhea medicine, antibacterial gel or cream, facial masks)
    - Building Materials: Bricks, adobe
    - Make Up: Blush, foundation
    - Plant
    - Filter and bottled water (filters water)
    - Sponge (holds water)
    - Photo of oxygen or diagram of atmosphere (affects amount and types of gases in the air)
    - Thermometer (hold heat and effects air temperature)
    - Photo of fossil (tell stories of the past)

2. Ask Students what they believe Soil is made of. Write the answers on the board and organize the student answers in the four component categories.
    - Minerals of different particle sizes (Put up Vocabulary words as they come up)
    - Organic Materials from the remains of dead plants and Animals
    - Water that fills open pore spaces
    - Air that fills open pore spaces

4. Ask students if they believe soil is the same all around the world? How is it the same or different? What factors make it different? Explain that soil scientists use five factors to describe how soil was formed. Write the five forming factors on the board. Discuss each factor and allow students to ask questions.

    - Parent Material is the material from which the soil is formed. This could be bedrock that has been weathered, organic material that has been decomposed overtime, construction materials, loose soil deposited by wind, water, glacier,

volcanoes, or moved down a slope. The parent material will be broken and made into nutrients by physical weathering, chemical reactions, and decomposition by microorganisms.

- Climate: Heat, rain ice, snow, wind, water, and other environmental forces break down parent material. The climate also determines what type of plants and animals can survive in the area affecting what organic matter goes into the soil.
- Organisms: Soil is home to many plants and animals. These living things shape the physical and chemical properties of the soil with their movement (growing roots, animals burrowing homes), their rate of decomposition, help exchange gasses between soil and the atmosphere. They also help soil filter water.
- Topography: The location of soil on a landscape also affects its form and characteristics. For example soils at the bottom of a hill will collect more water and be wetter. Steep slopes will not have much soil because gravity will the particles away, soils on the south facing slope will get more sun and will be drier, etc.
- Time: The amount of time that the other 4 factors have been interacting with each other will determine the properties of the soil. Some things like moisture and temperature can change quickly other such as the mineral make up or how much organic material is present take years and sometimes even hundreds of years to change.

5. Soil Safari: Two Options (A. Internet Option or B. Classroom Stations)
   A. Internet Option:
      1. Have students navigate to http://school.discoveryeducation.com/schooladventures/soil/soil_safari.html
      2. Students will do the soil safari and complete the Soil Critter Trading Cards sheet in their packet as they explore soil at different magnifications.
   B. Classroom Stations
      1. Divide students into 4 groups.
      2. Set up for stations. Each will represent the 4 magnification levels of studying the soil.
      3. Groups will rotate through the stations and complete the Soil Critter Trading Cards for the organisms they find.

Post Assessment

Student will return to their original sheet. Students should use the reverse side of the paper to create a concept map showing how they are connected to soil (Similar to a food web). Students will be asked to create new definition of soil and write a small paragraph on the role soil plays on our Earth.

Lesson 2: Why do Scientists study soil?
Ranger Led Pre-Activity

LESSON PLAN HIGHLIGHTS

Purpose:

Students will learn about the different soil properties and make predictions about what characterizations of soil will be found in Dyea.

Duration:

60 Hours

Setting:

Classroom visit by a Ranger

Activities:

Create a Soil Profile

Predict soil types. texture, color, pH, salinity and moisture levels of soil in Dyea.

Materials Needed:
1. Lab Packets
2. Pictures of soil profiles
3. Soil Samples and Grain size scales
4. Soil Properties and Characterization Descriptions

Alaska State GLE:
Science:
(6) SD2.1:Describing the formation and composition of soils.

(5) SA1.2
Using qualitative or quantitative observations to create their own inferences and predictions.

Objectives:
1. Students will be able to identify 3 or more soil properties.

2. Students will be able to describe how different soil properties make layer in the soil.

3. Students will use the scientific method to make hypothesize about the soil in Dyea.

Introduction
Scientists study the soil for a variety of reasons. Data collected from soils help determine the land potential for plant growth, and other land uses. Additionally, by investigating soils scientist can learn more about how the soil formed gaining history from the past about climate and geology.

Dyea, Alaska is located in a transition zone between coastal and interior climates and ecosystems. There are steep mountains, large flood plains, and glacial deposits. This unique landscape offers a wide variety of soil types and profiles.

During this lesson students will learn about the properties of soil, soil profiles and how scientists study them. This will help students prepare for the soil study that they will conduct in Dyea, AK.

Pre-Assessment

1. One layer at a time the ranger will place a horizon or layer of soil on the white board starting from bedrock. Students will be asked to discuss which of the five forming factors affect the horizon, soil properties, and components.

2. Students will also be asked to indicate which micro-organisms live in the different horizons.

Activity Outline

1. Ranger will explain that what the class has just created is a soil profile and will explain what a soil profile is and how scientists use the profile to examine soil properties.

2. Ranger will split class into three groups. These will be the same groups in which students will conduct their field study in Dyea, AK.

3. Students will move through 4 stations to learn about different soil properties.

4. After the students visit each station the ranger will then present the "Soil Story of Dyea."

5. Based on what was learned in the stations and the Dyea Soil Story students will make predictions of what soil characteristics and properties the soils in Dyea will have by creating a sketch what they believe that soil profile of Dyea would look like. Students will also use the soil characterization chart to predict what the soil will be like on their assigned monitoring plot.

6. Ranger will remind students of what is needed for the field investigation in Dyea.

Evaluation

Soil Profile created and Predictions will help teacher evaluate if students have grasped the larger concepts of soil study.

Lesson 3: Investigations of Soil in Dyea
Ranger Led Activity in the Field

LESSON PLAN HIGHLIGHTS

Purpose: Students will gain firsthand knowledge of what is required to collect data that can be used for long-term analysis.

Duration:
Full Day Field Trip

Setting:
Dyea Flats

Activity:
Habitat Plot investigations

Materials Needed:
1. 5 Lab Quests
2. 5 GPS probes, 5 temperature probes
3. 5 bingo sheets
4. Waterproof recording paper
5. 2 PVC Quadrats
6. Raingear and boots
7. Lunch
8. Testing containers
9. Binoculars
10. Measuring tapes
11. String
12. Distilled water

Alaska State GLE:
(5) (6) SA1.1
Asking questions, predicting, observing, describing, classifying, making generalizations, inferring and communicating

Objectives:
1. Observe and record: Weather conditions, wildlife and signs of wildlife, plants types, and soil conditions.

2. Complete field investigations to test hypotheses.

3. Student will have time in the field to reflect on Dyea and the place they live, Southeast, AK.

Introduction:
Today Students will collect scientific data that will be analyzed by the Skagway elementary classrooms and will be shared with the community of Skagway. Observations and data collected will be added each year to a local database. This will allow for future students and researchers to compare and observe changes over time. As the years progress, students will become more skilled as field scientists and will complete more advanced investigations.

The 2009 Skagway Elementary students are the pioneers of this project. The success of this earth science curriculum and the investigations in Dyea will determine the future of the program. Safety and respect to other people and wildlife will be emphasized. Additionally, the program will strive to preserve and protect Dyea, AK and help promote the unique biodiversity in Skagway's backyard.

Activity Outline: Habitat Investigations

Part 1: Field Investigation Preparation
1. Students, teachers and rangers will meet at the school and prepare for the field trip to Dyea. Rangers and teachers should check to make sure that all students have lunches, rain gear, and warm clothing. Upon arrival at Dyea, students, teachers and rangers will be dropped off as far south in the Dyea Flats as safe for the vehicle and passengers.

2. Upon arrival in the flats, the ranger will review Bear Safety and play *Black Bear* to remind to students to freeze if a bear is seen. Students will be instructed to

freeze, look for the nearest adult, and listen for instructions if a bear is seen.

Instructions for Black Bear:
Explain that students will have to strike a pose each time one of four specific poses is called out by "the caller." Each pose requires a different number of people. If students can't find the required number of people or do not freeze, they are out. The four poses are:

- *BLACK BEAR: (1 person) Student should freeze in a bear pose*
- *HORSE AND RIDER: (2 people) One person stands, while the second person kneels next to them. NO ONE RIDES ANYONE!*
- *TOURIST: (3 people) Two people pose together while the third person pretends to take their picture.*
- *GROUP HUG: (4 People) All four people huddle together.*

5. Students will find their lab groups from the classroom session and receive lab pack.

6. Ranger will set rules and expectations for traveling between plots and explain the day's activities:
Morning: Introduction, Snack, First Plot investigation of Dune Community. For safety and review the first plot site will be completed as a group.
Lunch: Sack Lunch at NPS Picnic Area, Temporary Shelter available in case of rain
Afternoon: Visit and complete Creek, Slough, and Early Forest plot Investigations. Each plot will be investigated by a different group after a quick tour of the plots. (2 adults will accompanying each group)

5. Ranger will offer an introduction to the field investigation. The ranger will review the characteristics and properties of soil and remind students of how they affect what grows and lives within the plot. The students also have a role in collecting baseline data that can be compared to data collected in the past, present and future. Student will be asked about the importance of things like soil type, temperature, wildlife signs, etc. before observing and measuring.

Part 2: Field Investigations

These instructions will be followed at each investigation area, Coastal Dune, Early Succession Forest, Creek, and Slough.

4. Ranger or teacher will introduce students to each habitat site by reading the habitat and ecosystem description.
5. Students will review their own predictions and hypothesis that their group made during the pre activities.
6. Students will follow detailed Field Investigation Protocol (See appendix). Each student will have an assignment. For example, one student will work on the lab quest, one will manage equipment, another will read the Field Investigation Protocol, and the fourth student will be the scribe. All students will participate in making observations and investigations. Once lab investigations are completed, students will do a sweep of the area checking for equipment and gear before moving on the next site.

Lesson 4: What does the data mean?

Ranger facilitated classroom visit

Objectives:

1. Students will create a table of the data collected during the field investigation.

LESSON PLAN HIGHLIGHTS

Purpose: Students will analyze data from field investigations and understand what that information indicates about the area studied.

Duration:
2 class periods
1.5 hour- 2 hrs

Setting:
Classroom or Lab

Materials Needed:
1. Lab Quest and probes
2. Overhead projector of computer screen
3. Lab sheets
4. Poster boards
5. Large table

Alaska State GLE:
(6) SA 3.1 Gathering data to build a knowledge base that contributes to the development of questions about the local environment

(5) SA 2.1 Supporting their statements with facts from a variety of resources and by identifying their sources.

2. Students will analyze to make conclusions about their observations and investigations.

3. Students will work within their group to plan a presentation poster to present the community (classmate, park rangers, other classes, etc.)

Introduction:

Scientists complete their field work outside conducting studies. Being a scientist also requires plenty of work in the lab analyzing and reviewing their data collected in the field. This part of science is often the most difficult. Not only do scientists have to organize and compare the data, but they also have to determine what all the numbers mean. Often numbers do not mean anything without repeated studies, consequently monitoring programs are helpful in understanding and comparing data.

Students will analyze data to determine if their predictions and hypotheses were correct. Students will also be asked to consider how the changing soils in Dyea will affect their own lives.

Activity Outline:

Part 1: Complete Lab Tests Lab Quest

1. Students will measure soil pH, moisture, and salinity tests using the samples collected in the field.

Part 2: Looking at our data

1. The ranger will explain why organizing information is important to be able to compare data and use it in the future. Students will move between 3 data analysis stations to complete their lab packets and organize data.

Data Analysis Stations
Database: Student will enter their information in the Dyea Monitoring Data Base

Table: Student will enter their information in a table to comparing plot data

Vernier Lab Quest: Students will be uploading their data from the Vernier lab quest and analyzing the graphs created.

Student Reflection: Students will be asked to answer the questions below anonymously

What is one question that the field trip to Dyea made you think of?

How did you feel after the trip?

Do you want to go back to Dyea? Why or Why not?

What did you learn on the trip?

Part 3: Making Conclusions
1. Students will group together with their groups and finish the last stages of the scientific process. Students will discuss their findings and conclusions.

2. Groups will be given a poster board to create a presentation of their findings from the field investigation. All students will be asked to present their findings and answer the question: *How do the changing soils in Dyea affect your life?*

Lesson 5: How are you connected to Dyea?

Ranger and teachers are present for student presentations

LESSON PLAN HIGHLIGHTS

Purpose: Students will effectively communicate the findings of the field investigation during class presentations and answer how Dyea, AK is part of Human Habitat.

Duration:
60 minutes or 1 class period

Setting:
Classroom or NPS auditorium

Materials Needed:
1. Vernier Lab Quest and probes
2. Overhead projector of computer screen
3. Lab sheets
4. Poster boards

Alaska State GLE:
Science as Inquiry

(5)SG 2.1 Reviewing and recording results of investigation of the natural world

Objectives:

1. Students will present the findings of the field investigation.

2. Students will evaluate how Dyea, AK is a habitat for humans like themselves and how this connects them to Dyea.

Introduction:

"Clear communication is an essential part of doing science. It enables scientists to inform others about their work, expose their ideas to criticism by other scientist and stay informed about scientific discoveries around the world. Scientific discussion includes explanation of findings to others, and actively listens to suggestions for possible interpretations and ideas…..Scientists review and ask questions about the other scientists' work."

-Skagway School District 4th Grade Science Curriculum

Science is an evolving process that starts by asking questions and usually ends with more questions. This lesson offers students the opportunity to share their findings and review the findings of other groups.

This is also a great time to share the work of the students with the community. Place Based Education standards encourage student to inform the community of their findings because it helps make the learning more relevant and meaningful. Other classes, park departments, and community organizations can be invited to visit the school for this class period. The National Park Service also offers it auditorium for the presentations.

Activity Outline:

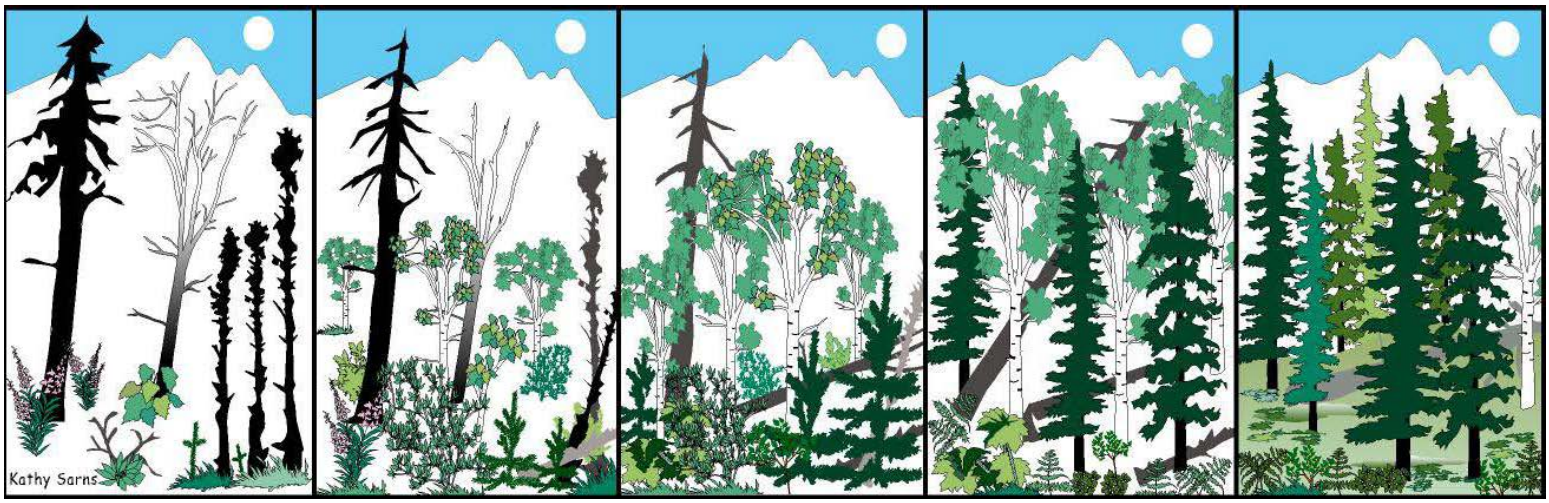
1. Student work groups will present their field investigations and answer the final question, "*How do the changing soils in Dyea affect your life?*

2. Time should be allotted for the audience to ask questions.

3. After presentations are completed and guests have left students will complete a final assessment activity.

Spring Session

Plant Succession



Lesson 1: How does a meadow become a forest?
Teacher Led facilitated classroom visit

LESSON PLAN HIGHLIGHTS

Purpose:

Introduce students to the concepts of succession and other basic processes that help to create ecosystems, like Dyea, AK.

Duration:

60 minutes

Setting:

Classroom lesson led by the teacher

Activities:

Define Succession
Building a forest

Materials Needed:

1. Succession Vocabulary Matching Cards
2. Succession Photos
3. Supplies to make a forest

Alaska State GLE:

Science: (5) SC2.1: Identifying and sorting animals into groups using basic external and internal features.

Objectives:

1. Students will be able to define succession.

2. Students will be able to determine the causes of primary and secondary plant succession.

3. Students will learn the stages of succession for a boreal forest.

Introduction:

Natural disasters and geologic process such as tornadoes, volcanic eruptions, earthquakes, floods, glaciers, fires, etc. are frequent occurrences on our planet and the ecosystems that inhabit the earth have found ways to adapt and regenerate themselves after these disturbances. This slow process of rebuilding an ecosystem is called biological succession. This process includes different stages of soil development and plant communities until an ecosystem reaches its climax.

In this lesson students will learn about the different stages of biological succession that occur in Southeast Alaska following, fire, glacial advancements, and glacial rebound.

Pre- Assessment Activity

1. The teacher will show students pictures of places where succession has occurred like, Glacier Bay, the Sawtooth's, Yellowstone after fires, etc.

2. The teacher will ask students what they think happened in these areas.

3. This discussion will prompt students to begin thinking about how plants and entire ecosystems grow back after glaciers, fires, glacial rebound etc…

Activity Outline:

1. The teacher will give each student 1-2 cards. Each card will either have a definition or term on it. Students will have to work together to match the definitions with the terms based upon the introduction discussion. Student should record the definitions in their lab packets. The terms will help students understand the different stages in which plants grow back.

2. Make your own forest! From beach to forest. Teacher should pass out the supplies to students so that they can make their own developing forest as the facilitator describes the process of ecological succession to the students. Discuss how the ever changing river, human impact and glacial rebound have complicated the story at Dyea.

Pioneers: Dog Lichen, Dwarf Fireweed, moss, wolf spiders, hover flies, Dolly Varden, dusky shrews, and wolverines

Homesteaders: willow, black cottonwood, Sitka alder, birch

Forest: Sitka Spruce, Shore Pine, Hemlock

The supplies will include: rocks, gravel, soil, and plant samples of pioneer, homesteader and forest species.

Post Assessment

1. Students will be able to write the definitions of both primary and secondary succession.

Lesson 2: How has biological succession affected Dyea?

Ranger Led Activity

LESSON PLAN HIGHLIGHTS

Purpose:

Student will make predictions and hypothesis about the field investigations concerning the stages of plant succession that will be found in Dyea.

Duration:

60 minutes

Setting:

Classroom lesson led by the Ranger

Activities:

Natural History Timeline
Pre-Field Trip preparation

Materials Needed:

1. Succession Vocabulary Matching Cards
2. Succession Photos
3. Supplies to make a forest

Alaska State GLE:

Science:

Concepts of Earth Science

(SD1.1), (SD2.1)

Objectives

1. Students will be able to describe and draw the different stages of plant succession in Dyea, AK.

2. Student will be make hypothesis about the stages of plant succession that they will find in Dyea.

Introduction

Signs of glaciations dominate the landscape throughout Southeast Alaska. Dyea, Alaska is no exception. The Taiya valley is a broad river valley that was once filled with ice. Debate still occurs over when the last time the valley was glaciated, however there is no doubt that ice was well over a 1,000 feet thick at one time.

When this ice disappeared from the valley it left behind a scarred landscape, full of rock piles called moraines, and minimal life existed. Looking around Dyea today, green with tall grasses and trees this can be hard to imagine. The process of going from bare rock to evergreen forest is called ecological succession. Over time the addition of nutrients and new species will arrive to a disturbed landscape and it will completely rebuild itself.

In places where glaciers have carved the land a unique factor, called glacial rebound, adds complexity to ecological succession. Not only is life bouncing back, but so is the land itself. The weight of the ice depressed the earth's crust, now with the weight gone the land is rising at a rate of nearly ¾ of an inch every year. In tidal flats regions like Dyea, this is very apparent. A rise of only 1-15 feet in elevation over 100 years can result in acres of new landscape. This can be observed in the coastal meadow of Dyea. The new land rising from the ocean also experience it own process of succession.

In less than a decade, residents of Skagway and Dyea notice changes in their landscape. This is one of the reasons that make Dyea so special and such a fascinating place to conduct studies. It is also the

perfect place to discuss and learn about plant succession.

Pre-Assessment Activity

1. The ranger will explain that Dyea has an amazing natural history, in which the landscape has been transformed a number of times. Each student will receive a photo depicting one of the stages in Dyea's history. Have students line up in the order they believe the pictures should go.

SE Alaska Formation- Rock Cycle
Glacier Surge
U-Shaped Valley Created
Earth's crusted depressed
Melting
Erosion
Human Impact and settlement
Glacial Rebound
River outwash/ bare and rocky
Meadow/ Dunes
Early Successional Forest
Mature Forest

2. Ranger will tell the story of Dyea, Alaska and students will be asked to re-organize their timeline based upon the story.

Activity Outline

1. Ranger will pass out lab packets and have student open their lab packets to the page that has the stages of plant succession listed.

2. Students will draw the different stages of succession that are happening in Dyea and describe the plants and soils at each stage.

3. The ranger will then split the group into their plot study groups. Each group will be assigned a plot. As a group, students will make predictions and hypotheses about which stage of succession their plot is in, or if the area has been disturbed? Is this a result of primary succession or secondary succession? Maybe the site has not experienced recent disturbance, etc. Ranger will also explain why scientists make predictions before they conduct field investigations.

4. Ranger will prepare for the upcoming field trip to conduct field investigations.

Lesson 3: Investigations of Plant Succession in Dyea

Ranger Led Activity in the Field

LESSON PLAN HIGHLIGHTS

Purpose: Students will gain firsthand knowledge of what is required to collect data that can be used for long-term analysis.

Duration:
Full Day Field Trip

Setting:
Dyea Flats

Activity:
Habitat Plot investigations

Materials Needed:
1. 5 Vernier gadgets
2. 5 GPS probes, 5 temperature probes
3. 5 bingo sheets
4. Waterproof recording paper
5. 2 PVC Quadrats
6. Raingear and boots
7. Lunch
8. Testing containers
9. Binoculars
10. Measuring tapes
11. String
12. Distilled water

Alaska State GLE:
(5) (6) SA1.1: Observing, predicting, asking questions, making generalizations, inferring and communicating

Objectives:

1. Observe and record: Weather conditions, wildlife and signs of wildlife, plants types, and soil conditions.

2. Complete field investigations to test hypotheses.

3. Student will have time in the field to reflect on Dyea and the place they live, Southeast, AK.

Introduction:

Today students will collect scientific data that will be analyzed by the Skagway elementary classrooms and will be shared with the community of Skagway. Observations and data collected will be added to each year to a local database. This will allow for future students and researchers to compare and observe changes over time. As the years progress, students will become more skilled as a field scientists and will complete more advanced investigations.

The 2009 Skagway Elementary students are the pioneers of this project. The success of this earth science curriculum and the investigations in Dyea will determine the future of the program. Safety and respect to other people and wildlife will be emphasized. Additionally, the program will strive to preserve and protect Dyea, AK and help promote the unique biodiversity in Skagway's backyard.

Activity Outline: Habitat Investigations

Part 1: Field Investigation Preparation

1. Students, teachers and rangers will meet at the school and prepare for the field trip to Dyea. Rangers and teachers should check to make sure that all students have lunches, rain gear, and warm clothing. Upon arrival to Dyea, students, teachers and rangers will be dropped off as far south in the Dyea Flats as safe for the vehicle and passengers.

2. Upon arrival in the flats, the ranger will review Bear Safety and play *Black Bear* to remind to students to freeze if a bear is seen. Students will be instructed to

freeze, look for the nearest adult, and listen for instructions if a bear is seen.

Instructions for Black Bear:
Explain that students will have to strike a pose each time one of four specific poses is called out by "the caller." Each pose requires a different number of people. If students can't find the required number of people or does not freeze, they are out. The four poses are:

- *BLACK BEAR: (1 person) Student should freeze in a bear pose*
- *HORSE AND RIDER: (2 people) One person stands, while the second person kneels next to them. NO ONE RIDES ANYONE!*
- *TOURIST: (3 people) Two people pose together while the third person pretends to take their picture.*
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7. Students will find their lab groups from the classroom session and receive lab pack.

8. Ranger will set rules and expectations for traveling between plots and explain the day's activities:
Morning: Introduction, Snack, First Plot investigation of Dune Community. For safety and review the first plot site will be completed as a group.
Lunch: Sack Lunch at NPS Picnic Area, Temporary Shelter available in case of rain
Afternoon: Visit and complete Creek, Slough, and Early Forest plot Investigations. Each plot will be investigated by a different group after a quick tour of the plots. (2 adults will accompanying each group)

9. Ranger will offer an introduction to the field investigation. The ranger will invite students to look around and observe the changes of Dyea's landscape. These changes demonstrate the ecological succession that is taking place in Dyea. The ranger will remind students to consider the past and future of the plot they are on, and consider which stage of succession the plot is experiencing. Students also have a role in collecting baseline data that can be compared to data collected in the past, present and future. Student will be asked about the importance of things like soil type, temperature, wildlife signs, etc. before observing and measuring.

Part 2: Field Investigations

These instructions will be followed at each investigation area, Coastal Dune, Early Succession Forest, Creek, and Slough.

7. Ranger or teacher will introduce students to each habitat site by reading the habitat and ecosystem description.
8. Students will review their own predictions and hypothesis that their group made during the pre activities.
9. Students will follow detailed Field Investigation protocols (See Appendix). Each student will have an assignment. For example, one student will work on the lab quest, one will manage equipment, another will read the Field Investigation protocols, and the fourth student will be the scribe. All students will participate in making observations and investigations. Once lab investigations are completed, students will do a sweep of the area checking for equipment and gear before moving on the next site.

Lesson 4: What does the data mean?
Ranger facilitated classroom visit

LESSON PLAN HIGHLIGHTS

Purpose: Students will analyze data from field investigations and understand what that information indicates about the area studied.

Duration:
2 class periods
1.5 hour- 2 hrs

Setting:
Classroom or Lab

Materials Needed:
1. Lab Quests and probes
2. Overhead projector of computer screen
3. Lab sheets
4. Poster boards
5. Large table

Alaska State GLE:
(5) SG 2.1: Reviewing and recording results of investigating into the natural world

Objectives:
1. Students will create a table of the data collected during the field investigation.

2. Students will analyze to make conclusions about their observations and investigations.

3. Students will work within their group to plan a presentation poster to present the community (classmate, park rangers, other classes, etc.)

Introduction:
Scientists complete their field work outside conducting studies. Being a scientist also requires plenty of work in the lab analyzing and reviewing their data collected in the field. This part of science is often the most difficult. Not only do scientists have to organize and compare the data, but they also have to determine what all the numbers mean. Often numbers do not mean anything without repeated studies, consequently monitoring programs are helpful in understanding and comparing data.

Students will analyze data to determine if their predictions and hypotheses were correct. Students will also be asked to consider how the changing landscapes Dyea will affect their own lives.

Activity Outline:

Part 1: Complete Lab Tests with Vernier Equipment

1. Students will measure soil pH, moisture, and salinity tests using the samples collected in the field.

Part 2: Looking at our data
1. The ranger will explain why organizing information is important to be able to compare data and use it in the future. Students will move between 3 data analysis stations to complete their lab packets and organize data.

Data Analysis Stations
Database: Student will enter their information in the Dyea Monitoring Data Base

Table: Student will enter their information in a table to comparing plot data

Vernier Lab Quest: Student will be uploading their data from the Vernier lab quest and analyzing the graphs created.

Student Reflection: Students will be asked to answer the questions below anonymously

What is one question that the field trip to Dyea made you think of?

How did you feel after the trip?

Do you want to go back to Dyea? Why or Why not?

What did you learn on the trip?

Part 3: Making Conclusions

1. Students will group together with their groups and finish the last stages of the scientific process. Students will discuss their findings and conclusions.

2. Groups will be given a poster board to create a presentation of their findings from the field investigation. All students will be asked to present their findings and answer the question: *How do the changes occurring in Dyea affect the Skagway Community?*

Lesson 5: How are you connected to Dyea?

Ranger and teachers are present for student presentations

LESSON PLAN HIGHLIGHTS

Purpose: Students will effectively communicate the findings of the field investigation during class presentations and answer how Dyea, AK is part of Human Habitat.

Duration:
60 minutes or 1 class period

Setting:
Classroom or NPS auditorium

Materials Needed:
1. Vernier Lab Quest and probes
2. Overhead projector of computer screen
3. Lab sheets
4. Poster boards

Alaska State GLE:
Science as Inquiry

(5)SG 2.1 Reviewing and recording results of investigation of the natural world

Objectives:

1. Students will present the findings of the field investigation.

2. Students will evaluate how Dyea, AK is a habitat for humans like themselves and how this connects them to Dyea.

Introduction:

"Clear communication is an essential part of doing science. It enables scientists to inform others about their work, expose their ideas to criticism by other scientist and stay informed about scientific discoveries around the world. Scientific discussion includes explanation of findings to others, and actively listens to suggestions for possible interpretations and ideas…..Scientists review and ask questions about the other scientists' work."

-Skagway School District 4th Grade Science Curriculum

Science is an evolving process that starts by asking questions and usually ends with more questions. This lesson offers students the opportunity to share their findings and review the findings of other groups.

This is also a great time to share the work of the students with the community. Place Based Education standards encourage student to inform the community of their findings because it helps make the learning more relevant and meaningful. Other classes, park departments, and community organizations can be invited to visit the school for this class period. The National Park Service also offers it auditorium for the presentations.

Activity Outline:

1. Student work groups will present their field investigations and answer the final question, "*How do the changes occurring in Dyea affect the Skagway Community?"*

2. Time should be allotted for the audience to ask questions.

3. After presentations are completed and guests have left students will complete a final assessment activity.

Unit References and Resources:

Discovery Education. *The Dirt on Soil.* Educational Web Adventures**.** Retrieved May 16, 2010 from: **http://school.discoveryeducation.com/schooladventures/soil/soil_safari.html**

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The Globe Program. (2010). *Soil Study Protocal Guiude* Retrieved March 2010, from The Globe Program: http://www.globe.gov

United States Fish and Wildlife Service: Alaska Region. *Role of Fire in Alaska* http://alaska.fws.gov/fire/role/default.cfm

USFS, *Klondike Gold Rush National Historical Park Ecological Reconnaissance Inventor.* March 1994. USDI National Park Service, Alaska Regional Office, USDA Forest Service, Tongass National Forest, Chatham Area. Sitka, AK.

Results of Formative Evaluation and Suggested Program Improvements

The pilot phase of the Monitoring Plots program proved to be a successful program introduction. Teaching staff showed an interest in continuing the curriculum into a second year and found the program to be a beneficial learning experience for their students. After two sessions of field investigations the students have demonstrated a comprehension of basic earth science concepts. They have also exhibited behaviors indicating the development of a stewardship ethic and a sense of ownership of their public lands.

After the first unit was piloted feedback from two teachers was gathered through an observation protocol that was given to the teachers. While two observation protocols were distributed, only one was received back for review. The other respondent did not complete the protocol, but did communicate via email with comments regarding the field investigation and lessons conducted in the classrooms. The teacher's feedback revealed that the curriculum attempted to cover too much material, and in some cases the material was not grade level appropriate. Additionally, classroom and field investigation activities required more time then estimated by the curriculum. The teachers suggested that for the next piloting phase vocabulary and basic concepts should be introduced to the students before the ranger visit to the classroom. It was also suggested that the field investigation protocols be shortened to provide time for more meaningful investigations. The teachers recommended that each student group would not investigate each plot, as this proved to be time consuming, but instead each group would be responsible for investigating and preparing a group presentation for one assigned plot.

A number of actions were taken to prepare and revise the curriculum in response to the teacher's recommendations before the second unit was piloted in the spring of 2010. These actions included; re-examining Alaska State grade level expectations and the Skagway School District curriculum to better reflect and include the set standards, develop additional lesson plans, and re-organize the logistics and schedule for field investigations.

The original curriculum planned for three lesson plans; a pre visit, a field investigation and a post field trip wrap up. It was recognized that this structure did not allow for the students to grasp either the scientific process or the earth science concepts. As a result, an additional pre-field trip teacher led lesson plan was added. The lesson introduces the earth science concept and vocabulary that is discussed throughout the unit. In the revised curriculum the second lesson plan is a ranger led program which builds upon the earth science concepts introduced by the teachers and prepares students for the field investigations and the scientific process. During this ranger-led lesson students make predictions and learn the definition of hypothesis. Another lesson was added to the curriculum which allowed time for student to present their findings to their peers in a formal presentation.

Additionally, lessons were simplified to focus on one overarching question and central idea, rather than attempting to cover several concepts. The chosen central themes were selected based upon review of Alaskan state learning expectations and the Skagway School District Curriculum.

Field investigations were restructured for the second piloting phase allowing students more time to make observations and follow scientific protocols. Originally it was intended that students would visit

each plot site and complete field investigations in a group. Weather conditions, bear safety and other environmental factors proved that this schedule was not feasible in a one day field trip. During the first field investigation only two of four plot investigations were completed in the five hour field trip. The field investigation schedule was re-evaluated per teacher recommendation for the second phase of piloting. The revised schedule had the entire class to investigate the Dune Community plot as a whole. This provided students with a demonstration of protocols and an opportunity to practice data collection skills, before practicing on their own. During the afternoon portion of the field trip students investigated their assigned plots applying the skills developed at the first plot.

Additional changes for the second pilot phase included the implementation of a formal formative evaluation program plan. The plan included surveying the students and teachers for qualitative data on the program, particularly regarding attitudes and behavior changes regarding conservation and stewardship.

The formal evaluation used during the second piloting phase assessed overall program goals as well as student desired learning and achievement goals. The evaluation program utilized teacher email interviews, observation protocols from other rangers, student qualitative surveys and informal teacher feedback via conversation and email.

One of the two teacher email interviews was received by Mary Thole. Thole's response was positive and concluded that she believed the program was successful in helping students develop a sense of ownership over their natural resources in Dyea.

> They (students) gained an appreciation and ownership for the Dyea Flats as part of their habitat, they discovered that humans and animals do impact habitats which can affect the health of the habitat, and that collecting data to compare over time can show how the health of a habitat is being affected.
>
> Mary Thole- 3rd and 4th Grade Teacher
> Skagway School District

Thole also indicated that the scope and sequence of the revised curriculum was appropriate for her classrooms. Vivian Meyer did not answer the email interview; Although Meyer did provide feedback via informal email and verbally after one of the sessions. She also agreed that the second piloting phase demonstrated positive program growth and showed higher student comprehension than the previous fall sessions. Both teachers also suggested adding an additional lesson to each unit giving the students opportunity to practice with the Lab Quest computers before the plot investigations. This request for additional lessons within the curriculum demonstrates a desire to continue the program and give more time to the earth science portion.

The formal evaluation also included asking observing rangers and guests to complete observation protocols. Four rangers who attended the program as assistants to help students and provide adult supervision were asked to complete the observation protocol. Two additional protocols were distributed to the Park Superintendent and Natural Resource Program manager who were invited to observe portions of the spring session. In total, six observation protocols were given out and four were

received back. One of the four included notes, but was not complete so it was not be included in the data.

All observation protocol respondents were able to clearly identify the key idea of the lesson and indicated that the presenter properly introduced themselves, the lesson and the context of the lesson. Also two of the three respondents stated that the strategies used to assess what students knew at the beginning of the lesson were effective and provided a set of expectations for the students.

All respondents agreed that the presenter used a variety of questioning strategies to engage students. One hundred percent of respondents agreed that open ended questions were used sometimes, and that "yes/no" questions were used sometimes or in one response frequently. Additionally, only one respondent felt that critical thinking questions were used frequently, while two of three respondents felt that students rarely developed their own questions during the field investigation process.

This review of questioning strategies indicates that the curriculum should be adjusted to allow for more student directed inquiry, and rely less upon facilitator guided questioning. Similar results indicated that an increase of IBL methods should be used in the curriculum. Respondents indicated that students were guiding their own activities only sometimes or rarely, while two out of three agreed that the activities were frequently presenter directed.

The results concerning student directed learning and questioning skills highlight the difficulty in developing and presenting quality IBL curriculum. These results were anticipated because of a lack of experience in developing inquiry based curriculum. However in order to better integrate inquiry based methods, the park has hired a seasonal Teacher Ranger Teacher (TRT) to review and improve the curriculum during the 2010 summer season. The TRT was selected based on extensive experience in IBL science curriculum and knowledge of the *Understanding by Design model*. The TRT will revise the current lesson plans already written and develop a framework for the upcoming units to be piloted in the fall of 2010.

While the observations protocols highlighted the need for improvements they also revealed successful aspects of the program as well. All respondents indicated that the lessons included hands-on activities and were either adequately or extremely engaging. Additionally one hundred percent noted that the field investigations were conducted in an extremely safe manner. This is of great importance, as indicated in the literature review that safety is a primary concern for teachers and parents in regards to monitoring programs. All respondents agreed that the materials, logistics, and program schedule were either extremely or adequately, appropriate.

Comments from one observer stated that the Lab Quest units were a distraction. This sentiment was also felt by teachers and me during the first field investigations. The protocols for the field investigation were changed for the second field investigation to use the Lab Quest after initial observations and a quiet drawing activity. This modification allowed students to focus on using their senses for observations of the environment. It has recommended by teachers to continue to research and practice with the Lab Quest units to better incorporate them into the curriculum and not allow them to be a distraction. The Lab Quests are excellent testing equipment, however they do offer challenges in

curriculum development and data collection protocols. More experience and understanding of the software is an added requirement. This will require a strong commitment that must be made by the NPS staff and the teachers of the Skagway School District.

Overall the observation protocols were helpful in providing feedback, although only fifty percent of the protocols were viable for data analysis. In the future it may be helpful for observers to have a better understanding of their role in providing useful feedback and the goal of the program evaluation is.

Another assessment tool utilized during the second piloting session was a student reflection survey, in which students anonymously answered 4 questions:

1. What is one question that Dyea made you think of?
2. Would you like to return to Dyea? Why or Why not?
3. How did you feel after the trip to Dyea
4. What did you learn on the field Trip to Dyea?

The questions were evaluated using a rubric developed to determine the effects of the field investigation trip had on student attitudes towards Dyea particularly in regards to stewardship and appreciation for science, natural and cultural history. Each question was up to two points, for a total score of eight. The rubric and scoring scale is listed below.

	Did not Achieve desired Outcome (0 pt)	**Partially Achieved Desired Outcome (1 pt)**	**Achieved Desired Outcome (2 pt)**
Desired Outcomes			
Do students feel a greater sense of ownership and stewardship toward public lands?	Negative feelings, did not inspire a questions, neutral no desire to return	Showed some interested in returning, inspired yes/no or basic questions, neutral or positive desire to return and feeling about field trip	Enthusiastic desire to return and very positive feelings towards field trip, inspired critical thinking question concerning stewardship
Have students gained skills in inquiry, investigation, and observation?	Student indicates nothing was learned, did not inspire a question	Student list one skill learned, inspires yes/no or basic question, positive desire to return and feelings field trip	Indicated learning numerous skills or knowledge points, inspired critical thinking question, desire to return to learn more
Do students have a greater appreciation for the natural and cultural history of Alaska?	Did not inspire a question, nothing learned, neutral or no desire to return, negative feelings	Student's have positive desire to return and feelings about trip, inspired basic question about natural or cultural resources	Enthusiastic response to return and positive feeling towards the field trip, inspired complex questions concerning natural or cultural resource

Rubric Scores

Program Did Not Achieve Desired Outcomes: 0-2

Program Partially Achieved Desired Outcomes: 3-5

Program Achieved Desired Outcomes: 6-8

A total of 17 students responded to the reflection survey. This included all students in attendance during Lesson 4 of the curriculum units. The results indicated that 52%, or nine students, answered the questions indicating that the program was partially successful in meeting desired program goals. The remaining 48% of student surveys answered the questions indicating that the program had achieved success in meeting program goals. The student oriented program goals are listed below.

- Develop and use skills of inquiry, observation and investigation to gain an understanding of scientific processes used by field researchers and resource managers.
- Develop an understanding of the interaction between people and their physical environment as it changes overtime.
- Create awareness to the fragility and resilience of ecosystem and cultural sites.
- Provide students with a sense of ownership of their public lands encouraging stewardship and providing the knowledge needed to help them make informed decisions about public lands in the future

Most students' comments were positive about how they felt after leaving Dyea. A sample of student comments is provided below.

"Good that I have found data for people in the future to see how it has changed."

"I felt that I learned a lot about what scientist do."

"Awed by nature."

"I felt like I knew more about Dyea."

These positive results coupled with the formal presentations presented by students after the field investigations demonstrated that students are gaining an understanding of the scientific method, recognize the importance of establishing a long term data set, comprehend the earth science concepts that were covered in each unit, and are developing a sense of ownership of Dyea. In presentations, students defined basic concepts about habitat, soils profiles, observation findings, plot comparisons, and implications of pH and soil moisture tests. The presentation offered teachers and park staff a chance to gauge the students' comprehension of concepts and the amount of learning that occurred during the program. These presentations are essential in both program and student evaluation.

In conclusion the formal evaluation completed during the second phase of piloting in the Spring of 2010 showed that the students are gained knowledge and increased their sense of stewardship and that the program was partially or completely successful in meeting the program goals. The results also indicated

that logistics of the curriculum need to be improved to better reflect and accommodate more time for activities and incorporate IBL methods into the curriculum. Overall the program was successful and showed marketable improvement from the initial pilot. The formal evaluation was effective in showing program strengths and weaknesses as outline above.

Conclusion and the Future of the Program

In the 21st century it is evident that our children have become more and more detached from the places that they live and more tuned into their computers, cell phones and televisions (Louv, 2006). Even in small rural Alaskan towns, such as Skagway where natural and cultural resources are abundant, kids are spending less time exploring the natural world. It is often assumed that kids living in Alaska know all about salmon, bears and glaciers; however this was recognized as a falsehood during the first phase of piloting the program when the most memorable part of the day for one child was the story about salmon that the ranger told on the bus ride home. It was assumed the kids knew everything there was to know about salmon, being from Alaska, and yet in the end learning about the fish's basic life cycle inspired one young student. Later that day when a community member asked about the class trip to Dyea, the girl replied she learned all about salmon. This anecdote demonstrates why it is important that the children of small rural communities, just like the kids of urban environments receive positive, engaging place-based environmental education.

The long term monitoring plot program and curriculum has done just that and it has inspired some students to learn more about their natural surroundings and helped to develop a sense of ownership about their local public lands. Although improvements are necessary for the program the initial phase of piloting during the 2009/2010 school was successful and demonstrated meeting outlined program goals and outcomes.

Teachers and park staff are committed to continuing the program and working to improve the curriculum and field investigations. Teachers are even discussing the allowance of two-week session twice a school year for future years. Additionally, brief discussions with teachers in other communities such as Haines and Juneau have shown that expanding the program to other school districts to set up their own long term monitoring plots may be an option. Additionally, future field investigations may work closer with the GLOBE program, as discussed in the literature review. This program could allow the data collected to be used on a global scale and adding another dynamic aspect to the program.

Recently, the future of the program has come into question due to the May 2010 budget cuts and the decision to restructure the arrangement of the Skagway School. It is likely that the classrooms will no longer be 3rd and 4th grades and 5thand 6th grades combined. The re-arrangement of the classrooms may require that the curriculum is re-organized to reflect different grades levels, grades 4-8 rather than grades 3-6. Although this adaption will require a significant amount of work it is believed that teacher and National Park Service support will allow the program to continue.

Overall, the Dyea Earth Monitoring Plot program is off to an excellent start, with positive feedback from park staff, teachers, and students. Students are demonstrating skills and knowledge gained. The program will continue to grow, expand and change as necessary to keep students and teachers interested, inquiring, learning and making deeper connections with their home.

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Appendices

Appendix A: Logic Model

Appendix B: Assessment Tools

Appendix C: Field Investigation Protocol

Appendix D: Examples of Student Lab packets