Supplemental Proposal for Schoolyard LTER program to NSF DEB-9211776 for FY2001

The Niwot Ridge Long Term Ecological Research Program 1998-20004: Control on the Structure, Function and Interactions of Alpine and Subalpine Ecosystems of the Colorado Front Range

Introduction

The NWTLTER has carried out a K-12 outreach program from1998 through 2000 by collaborating with existing programs for children in the Denver/Boulder area and by working specifically with the Boulder Valley School District. The conceptual theme of the outreach is the connection between the alpine systems in the mountains and the communities of the Rocky Mountain Front Range. These communities are located at the intersection of the Great Plains and the Rocky Mountains, and have been expanding in population and development. We have found that in elementary and middle school years, children are particularly receptive to environmental education that emphasizes discovery, exploration and empathy with their local environment. As discussed by D. Sobel in his text “Beyond Ecophobia”, a locally based approach to environmental education is more effective in both conveying ecological concepts and developing empathy than are approaches emphasizing more distant and abstract environmental crises, such as destruction of rain forests. We have used these approaches as the educational basis for our outreach program.

Here, we propose to continue involving teachers from the Boulder/Denver area in our current K-12 NWTLTER outreach program by building on the program we have implemented over the past three years.

Current K-12 Outreach Program

The NWTLTER has an outreach program to elementary and middle school students in the Boulder/Denver area through a collaborative effort with Science Discovery (1998-2000) a local program based at the University of Colorado, Bixby School (1999-2000) in Boulder, and Wild Bear Science School (1999-2000) in Nederland, a mountain town located near the Mountain Research Station (MRS). The age range of the children is 5-12 years and the group size is 12-18 children, with 4-6 scientists and student teachers as leaders. In the summer 2001 we will expand our program to include a group of middle school students from Longmont, a city north and east of Boulder. Each of these programs and schools serves children with different backgrounds and interests. Science Discovery offers a wide range of summer science programs for children, including one-day programs, one week classes based in Boulder and one-week field trips within the Rocky Mountains. The program with Science Discovery offered two Saturday field classes in conjunction with our NWTLTER program, one for elementary and one for middle school children. Bixby School is a private elementary school that uses an experiential theme for all their classes during the academic year and the students attending Bixby School in the summer have been in an informal experiential learning environment. Bixby teachers integrate the students’ experiences from the field trips to the MRS into subsequent activities during the school year. The Wild Bear Science School has a two-week session for elementary students on an ecological theme, and a one-week session for middle school students. These students are primarily from the mountain communities. The field trip to the MRS is integrated into the middle of the program for each week of these classes, as a component that emphasizes observations and recording by sketches and note taking. The program in Longmont is targeted for “at-risk” middle school students who can benefit from learning through formats outside a typical classroom.

All of these field trips are coordinated with a MRS summer course- "Elementary Education in Alpine Ecology". 5-15 students have taken this course each year, with about half of the students being in-service teachers. The course is taught by NWTLTER scientists (e.g. Diane McKnight, Susan Sherrod and Hector Galbraith) and by Dr. Jane Larson, an expert in science education from the College of Education at the University of Colorado. In July 2001, Hector Galbraith, Diane McKnight and Jane Larson will teach the class. As the service learning aspect of the summer course, the undergraduate and graduate students, along with the course instructors, lead the field trips described above. In some cases, the instructors from the school programs participate as well. Prior to leading the field trips, the undergraduate students lead “practice” field trips with children of friends and colleagues at the University of Colorado

Field Trip for K-12 children to the Tundra Laboratory- Although all of the school programs involve a field trip with the children to the MRS, including a hike with activities to the Tundra Laboratory and the snow fence experiment at 11,500 ft., each trip is tailored to match with the background and interests of the particular group of children. A common feature of all the field trips are chance encounters with NWTLTER and other scientists in the field on the way up and back down from the Tundra lab. IN these encounters the scientists explain to the children what they are doing in their measurements and experiments. The basic elements of the field trip are described below. The duration of the field trip is about 6 hours from time of departure from the Marr Laboratory at the MRS. The distance of the hike is about 1.5 miles one way. We have found that some energetic 4-5 year olds can easily complete the trip, but some children unaccustomed to high elevation can become tired towards the end of the trip. We are diligent about having the students drink fluids and take rest stops, and with a 4-6 leaders of the trip can adjust as necessary. This basic trip has also been used with teacher groups visiting the MRS, and can be adapted for high school students:

1) Marr Laboratory- Introductions, rest stop, looking at maps and discussion of rules of conduct for hike.
2) 4-Wheel Drive trip from Marr Laboratory to the Cable Gate site.
3) Departure on hike from Cable Gate, checking for backpacks, jackets, lunch/dinner, water bottles, sunscreen, etc. and review of rules of conduct.
4) Rest stop #1 at the Kiwi Van- Discussion of sub-alpine forest, needs of trees and plants, discussion of small huts used by scientists for their equipment.
5) Rest stop #2 at sub-alpine snowbank- Discussion of snowmelt, children collect snow in small bottles and put in their pockets. Next part of hike is actually on the snowfield covering the trail.
6) Rest and snack stop #3 near top of snow field- Discussion of treeline and the changing shapes of the trees, looking down to observe the Green Lakes and Silver Lake.
7) Rest stop #4 at T-Van- Activity with the wind (stretching up to feel the wind blowing them down, huddling on hands and knees on the ground to feel the warmth and the shelter from the wind), and activity looking at the equipment where the air samples are collected (excitement is to see all the flies and bugs fly out when the door is opened).
8) Arrival at the Tundra Laboratory- Eat lunch/dinner, discuss the trip, explore the Tundra Laboratory. Hydrology activity: look at their melted snow samples and compare to samples of tap water from Boulder brought by student teacher; Alpine plants activity: children in groups of 3 set down a rope tied in a circle (about 2 ft across), examine all the different alpine plants in their circle, draw pictures, invent names for the plants (e.g. “Blue Moon plant”), choose plant(s) for their Polaroid photo to keep (taken by instructor), learn actual name if interested, discuss how the small plants are sheltered from the wind. For older children, walk behind Tundra lab to the snow fence experiment to see how the snow depth is measured, and to see the alpine enclosure experiments. In our first trip, some children looked at the enclosures and immediately observed that it must be warmer for the plants in the enclosures.
9) Hike back down to Cable Gate- review rules of conduct, including rule not to get ahead of the lead instructor, enjoy sliding in the snowfield with brief stop at treeline.
10) Cable Gate- Reassemble and drive to Marr Laboratory.
11) Marr Laboratory- Rest stop, meet as a group to share sketches of plants and pictures, to ask more questions, and eat a snack.

Virtual Field Trip to Niwot Ridge- The NWTLTER has developed a virtual field trip to Niwot Ridge with support from the University of Colorado. The prototype of this field trip is now posted on the web site at http://culter.Colorado.EDU:1030/Field_trip. The virtual field trip provides background information, and then 3 field trips that emphasize the mammals, plants and the effect of nitrogen on biodiversity. The trip is structured with pictures of the animals and plants that can be enlarged. The virtual field trip complements the experiential field trips in many ways: providing a back up should inclement weather limit the trip, providing access for children in a group who may have a handicap limiting the possibility for a hike, providing follow-up and refresher material for students after the trip which they can access at school or at home; providing material that the students could use in later classroom activities and projects in later grades.

Children’s book: “My Water Comes from Silver Lake”- Another accomplishment of the NWTLTER K-12 program has been the completion of a text and pictures for a children’s book describing the ecology of the Green Lakes valley and the hydrologic cycle which supplies water from the valley to the City of Boulder. A former student from the MRS summer course prepared the text and the pictures are brilliant water colors painted by students in her third grade class. This material has been submitted to several potential publishers. The City of Boulder Water Department will support the publication of the initial edition.

Outreach to Elementary Teachers

A major use of the funds provided by this supplemental proposal has been and will continue to be for stipends to support the participation of current elementary school teachers in this program. We are now enrolling teachers for the coming summer program (July 2001) and will use funds to enroll teachers for the summer program in the subsequent year (July 2002). We will support the teachers for a month while they take the MRS class. We propose to use the supplemental funds to offer stipends to seven teachers. We have found that providing stipends greatly encourages participation by teachers. We expect that the interest in the outreach program in future years will also be sustained by word of mouth based on the experience of the teachers who have participated in the course. The other use of funds is for van rental for transporting the students in the class from Boulder to the MRS, and for van rental for the teachers who have taken the MRS course to bring their own classes to the MRS either in the early fall or late spring. The provision of resources for transportation to the MRS greatly helps the teachers plan for the field trip.

With funds provided by an additional previous supplement we are also providing computers to the teachers who have participated in the class. This allows the teachers to access the NWTLTER database and use other materials with which they became familiar during their classes during the school year. For example, the teachers can access the images from the Tundracam, a camera located at the top of the Tundra lab that provides continuous images of the surrounding alpine area and can be steered by remote access over the web.

Outreach to Middle School Students and Teachers

We have conducted an additional outreach activity that more directly reaches middle school students. For the past two years INSTAAR has held an event in which 400-500 middle school students come to INSTAAR for a half-day of lab tours and a science lecture. As part of the INSTAAR event in the fall 1999 and 2000, NWTLTER scientists conducted 5 sessions of an activity for the students at Boulder Creek (located two blocks from INSTAAR) in which we demonstrated methods for stream flow measurement, water quality sampling and measurement, and collection of aquatic biota, and discussed the connections between Boulder Creek as it travels through the city and its origins in Green Lakes Valley. The activity is completed in about 45 minutes, with stops at 3 stations along the creek. The activity at the creek is followed by a tour of the limnology laboratory at INSTAAR, including looking at algae in a microscope. Some of the students who took the middle school Science Discovery class had participated in the field activity at INSTAAR. From this activity, one middle school student conducted a science fair project with a NWTLTER graduate student, and she won an award at the state competition. We plan to continue this activity in the Spring 2001.

Summary

During the summer and fall of 2000, the involvement of elementary and middle school students in NWTLTER outreach activities was as follows:

Summer field trips to the MRS: 12 groups, about 180 children
Field trips by teachers with their classes: 4 classes, about 120 children
Field sampling exercise in Boulder Creek at INSTAAR for middle school students: about 300 students

Because we provide teacher training and computer resources, all of these activities involve some continuing opportunities for in-class involvement by the teachers and the students. The resources requested in this supplement will sustain this program. The approach has applications to other communities in the Rocky Mountain Region.