

# An Environmental Education Partnership for Utah Secondary Schools

## *A Plant Species Inventory for the Box Death Hollow Wilderness Area*

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**M**OTIVATION for active student involvement in science learning should flow naturally from real-world contexts and problems that interest students. Students need to acquire a level of scientific literacy and critical thinking skills that will enable them to make informed decisions about the myriad science-related problems they will face as adults; such as, weighing the benefits of various medical treatments, deciding on the safety of pesticides or food additives, or reconciling economic and ecological needs when voting on whether to preserve local wetlands or build a new highway through them (Raizen & Michelsohn 1994). Field settings, particularly those in which a service component may be introduced, provide excellent opportunities to engage students in activities that enable them to see the usefulness and connectedness of knowledge.

Over the past several years, many studies have attempted to measure and determine the effects of field education on young people. Urie et al. (1971), the University of Pittsburgh (1975), Usher (1977), and Beister et al. (1978) all found that field education contributed to improved self-concept, and, as Robinson (1975) noted in particular, an improved self-concept for females. A consistent finding of researchers has been that although students' vocational interests are usually formed by the ninth or tenth grade, they tend to have naive or unrealistic expectations about specific careers in which they are interested (Williams 1990). Students may not have considered the training necessary, the personal abilities required to do the work, or the nature of the work itself. This is the kind of information that can be acquired through field experience.

"Service learning" has been used for years in the social sciences to integrate curriculum with volunteer service to some part of the school's surrounding community (Palmer 1987). It attempts to show stu-

dents that what is learned in school may be used to improve the quality of life for people with whom they live. As students learn in settings where they experience the relevance and social value of their studies, particularly when they are working alongside their teachers, their peers, and other professionals, science becomes important to them. Science knowledge, favorable attitudes toward science, and the confident use of science process skills become firmly rooted in their lives.

### **The Program**

Beginning in the Fall of 1991 an environmental education partnership was formed with representatives from Brigham Young University, secondary school science specialists, and government agencies (the U.S. Forest Service, the Bureau of Land Management, the Division of Wildlife Resources, and others). The goal of the partnership was to set aside permanent environmental study sites within Utah for Utah students to use for educational purposes. With the cooperation of the government agency with jurisdiction over each site, these "environmental preserves" have become outdoor laboratories where meaningful, service-oriented environmental research is now being conducted by secondary school students and their teachers.

Schools also approached local business and community leaders to assist in funding research and educational activities, and consequently, each participating school entered the program with at least \$1000 of community support. This support, plus additional funding from the Science Research Group at BYU and in-kind support from the U. S. Forest Service, has facilitated research such as the plant species inventory which is the focus of this discussion.

If partnerships between educational institutions, government agencies and the community are to be successful, the program must be integrated into the mission and goals of the schools, the agencies, and the community where it is based. Without clear expectations, continuing negotiations, and respect for the differing goals and needs of each of the parties,

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programs eventually lose the support of the multiple parties whose full participation is necessary for continuation (Kendall 1990). Also, while it is very desirable to help students learn through some type of service experience, the service experience alone does not assure that either significant learning or effective service will occur.

The objective of our program has been to observe and document the effects of field education on young people as they contribute to real science knowledge facilitated by an education - government - community partnership. A secondary purpose has been to describe the aspects of the partnership which contributed to the more positive outcomes.

## The Project

### The Site

Although the environmental education partnership has involved several schools, we will discuss the joint project involving Brigham Young University, Provo High School, and the Escalante District of the Dixie National Forest (U.S. Forest Service). The Escalante Ranger District had been asked, as part of a Department of the Interior Threatened and Endangered Species initiative, to do a plant species inventory of the Box Death Hollow Wilderness Area located in Garfield County on the Aquarius Plateau in southern Utah. Provo High School in Provo, Utah, through the environmental stewardship partnership, agreed to assume responsibility for preparing a plant species inventory for the Box section of the wilderness area. The "Box" is an eight-mile long narrow box canyon with an approximate 1000-ft. vertical drop and steep rock walls on either side. Once the students entered the box canyon, they were committed to hike to the other end, or exit the way they had come. Although scaling the steep side walls may have been a rock-climbing adventure considered by several of the students, it was quickly discouraged by the older, less physically agile adults! Hiking from top to bottom, the students passed through three ecozones with distinct species complexes:

1. High alpine spruce-fir
2. Mid alpine aspen-ponderosa pine
3. Desert juniper-sagebrush.

The overall goal of the project was to produce a comprehensive plant species list for plants occurring within approximately 100 feet on either side of the small stream flowing through the floor of the canyon. Particular attention was being paid to any threatened or endangered species the students might encounter during the survey.

### The Students

Since the trail down the narrow box canyon is somewhat difficult with the need to cross the stream


over 40 times between top and bottom, students were carefully selected to participate in the species inventory. These students are a cross-section of the ecology and botany students at a local high school (ninth through twelfth grades) who have been willing to undergo special apprentice-mode training in plant classification and preservation, who are physically fit, and who have agreed to maintain acceptable scholarship throughout all their classes.

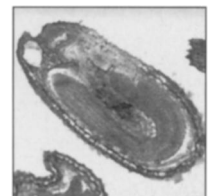
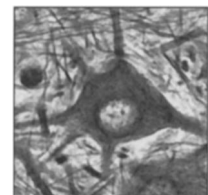
Because of the nature the "Box," it hasn't been feasible to take very large groups down the box canyon itself. Students from the ecology and botany classes, as well as students from other science, art and English classes, have camped at nearby Escalante State Park where, in addition to providing background for the plant species inventory, they have studied desert ecology, plant and animal fossils, and prehistoric Anasazi culture.

Even though only a relatively small number of students (14) actually hiked the box canyon collecting plant specimens, many others participated in the plant species inventory project. Classroom discussion prior to the field experience dealt in-depth with the issue of threatened and endangered species, particularly plants. Threatened and/or endangered plants are often overlooked in favor of more well-known or publicly touted animals such as the desert tortoise or the

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snow leopard. Students studied manuals distributed by the U.S. Forest Service describing threatened and/or endangered plant species they might see. Although the students didn't find any of these species, they were prepared to call attention to any they found, photograph them, and leave them in place.

Students studied the basics of plant anatomy and plant taxonomy in preparation for identifying the plant species they would collect. Many students, both during class and before and after school, spent hours mounting, preserving, and attempting to identify their field collections. Students who had collected in the field were quick to share their experiences and knowledge of the plants' habitat with other classmates who did not make the trip. Generous displays of photos and "war stories" helped others to integrate the field experience with classroom activities.

### The Survey

Teams of students under the direction of Jan Cooper, science teacher at Provo High School; and Renee Van Buren, Kimball Harper and Eileen Bunderson, botanists from Brigham Young University, made multiple trips down the "Box" during the 1993–1994 seasons. Between three and four hundred species of plants were collected, including plants never before recorded from Garfield County. So far, no threatened or endangered species have been sighted. Specimens from many plant families have been collected and pressed in the field. Trips during 1995 will continue to look for ephemerals, isolated and infrequent species, and cacti. Although cacti are abundant and easily spotted in the "Box," students have put off collecting them until last. Cacti present some unique challenges for collectors, some of which leave painful (!) reminders of the plant's taxonomic peculiarities, but the students are determined to add them to their inventory. Preservation of the plants has been done by the students under the supervision of Kaye Thorne, Assistant Curator of the Monte L. Bean Museum. Preparation of voucher specimens and verification of the collection has been done by plant taxonomists Kimball Harper and Kaye Thorne. Plants have been collected in triplicate; one collection will remain with the Museum, one will go to the Forest Service, and one will remain with Provo High School as a reference for future projects and a reminder of their adventure in "real time" science.

### Project Management

Managing this project has involved much creativity on the part of the supervising biology teacher. The students need to travel about five hours each way to reach the "Box". This involves getting released time from other classes in order to spend at least one full day in the canyon. Provo High School administrators and parents have been very cooperative in allowing

students the necessary time to participate. The students usually travel to the study site Thursday afternoon, stay the night in a Forest Service campground, then spend the following day collecting. Occasionally they have spent two nights in the campground and two days in the canyon. Sometimes the students have volunteered their services to the Forest Service to do campground maintenance and other service either before or after work on the plant inventory. After hiking the "Box" carrying heavy plant presses, and many additional hours of physically demanding service, students and teachers haven't been too excited about the five-hour drive home. However, the excitement of the project has kept enthusiasm high and interest keen.

At least two plant specialists from BYU have accompanied the students on each trip, offering suggestions regarding collection strategies, answering questions ranging from requests for immediate plant identification to "why people like us love plants so much," and generally enjoying the stimulating company of the students. The students participate in the costs of the trip by providing most of their own sleeping equipment and food. The Forest Service has waived campground fees and provided good maps and local weather information. Provo High School and BYU have shared transportation and additional food costs. BYU has also provided research quality cameras to assist in recording student activities and site information.

### Project Evaluation

Before starting the plant inventory, an environmental questionnaire was administered to several hundred students at Provo High School and other high schools in the area. Tentative evidence indicates that, compared to baseline data, the environmental awareness of the students participating in the inventory has increased considerably over that of their peers. In addition to a significantly positive shift in attitudes toward the environment, the majority of students who have participated in the plant species inventory have indicated plans to pursue post-secondary science degrees—with three or four wanting to be botanists!

### Project Outcomes

These following aspects of the partnership experience seemed to have been the keys to successful outcomes for the students:

- It was real world science. Students learned from experience that this is what "real" scientists do in the way "real" scientists do it.
- It fulfilled an actual need of the Forest Service. Students knew they were providing a plant species inventory for a previously undocumented

area. They were also making an important contribution to an inventory to determine the status of threatened and endangered plant species on a national scale.

- It made a publishable contribution to the scientific literature. Before the students undertook this project, there had never been a plant species inventory of any kind conducted in this part of the Box Death Hollow Wilderness Area. Now each student's name will be archived with the permanent plant collection sheets.
- Students had fun doing (and learning) science. The project solidified several choices of science as a career and produced some real bonding between students and adults as they enjoyed—and endured (!)—the hike down the canyon.
- The students have been excellent role models for other students in their classes. Although none of the students has exhibited the tendency to show off his/her botanical skills (well-earned, by the way), they have been in demand as tutors, special guests at Boy and Girl Scout meetings, teachers' aides, speakers for local Expanding Your Horizons in Math and Science conferences, and Utah Science Teacher Association meetings, etc. These opportunities have provided excellent positive reinforcement for their new knowledge.
- The project has received very favorable reviews in both the educational and community press. The students have brought recognition to themselves, their school, and the partnership in areas not usually associated with teenagers.
- Members of the partnership were willing to compromise some of their expectations to insure a valuable educational experience for the students. The Forest Service realized that the students would not be able to cover the amount of territory other more professional plant scientists might cover. However, they knew the quality of the survey would be high because of the willingness of the university scientists to commit long hours along with their expertise to the project. Provo High School was flexible in allowing students released time from school during May and October when early and late collections were made. Overall, the partnership produced a credible and much needed plant species inventory of a portion of the Box Death Hollow Wilderness Area.

It is very important that the teaching of biology connect to the larger social context within which students live. Learning basic science skills may be seen as essential in many classrooms, but they are not enough. Students should be able to solve problems creatively, understand their own learning processes, and connect knowledge from different disciplines (Slavin et al. 1994). Students need frequent opportunities to work collabora-

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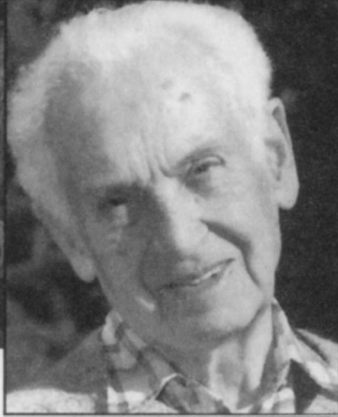


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tively to solve simulated and real-life problems using everything they've learned in class. Science should be relevant to what is important in their lives. The students at Provo High School realize that their plant species inventory of the Box Hollow Wilderness Area has contributed necessary scientific knowledge and may be used in formulating threatened and endangered species policies throughout the western United States. In the words of the students, "That's cool stuff!"

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