

# Science Education Programs with the ATBI

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## Introduction

THE ALL TAXA BIODIVERSITY INVENTORY (ATBI) in Great Smoky Mountains National Park has been, since its inception in 1998, a compelling and exciting project to benefit science, stewardship, and education. Discover Life in America (DLIA), the non-profit coordinator of the ATBI, has an active education committee composed of park staff and a variety of partners who support not only the work of scientists but also train and support the efforts of community volunteers, teachers, and students who are fascinated by this endeavor. As critical as reserve protection and scientific information are, without effective education and public involvement, few broad conservation goals will be achieved. In order for our national parks to gain from the growing knowledge generated by the project, an array of people from varied backgrounds must work together. For the ATBI to be successful, it is just as necessary to observe and cultivate these human interactions as it is to survey and document the other life forms of the Smokies.

A large array of educational opportunities is being explored with the ATBI, ranging from formal environmental education programs (e.g., NPS's "Parks as Classrooms"), to individuals in home-schooling programs who collect and sort samples. At one end of the spectrum are young children, who can learn and be inspired by the project, while at the other end are retired specialists, such as entomologists, who can help tremendously with the science. Additionally, adult volunteers have been tremendously helpful with ATBI activities, and the response from the local community has been overwhelming. Scientific results are made available to the public to promote enthusiasm for and understanding of biodiversity and to encourage and support con-

servation of biodiversity in parks and elsewhere. The fascination that people have with the discovery of diversity, and with the intricate, colorful world of hidden organisms, has also attracted the arts, with photographers, artists, and even musicians becoming involved.

## ATBI education and outreach programs

The DLIA education committee has been involved with disseminating research results to the general public, among other activities. The goals of this committee are as follows:

- Educate people (students, teachers, park visitors, community, scientists, volunteers) about science, taxonomy,

and biodiversity through the activities of the ATBI.

- Develop, implement, evaluate, and export innovative models for science education.
- Inspire, mentor, and develop future scientists and naturalists.
- Use the scientific findings of the ATBI for improved decision-making that fosters stewardship and resource conservation.
- Identify and garner human and financial resources; evaluate and document our effectiveness; disseminate information.

Much of this information is included in the park's public education programs, which aim to educate, promote awareness and stewardship, and inspire visitors to the park and interested groups outside of its boundary. These programs include classroom presentations, educational products, field trips into the park, and teacher workshops, among others. All of these efforts have shown positive results through student interest, involvement, and requests for return programs. The more formal programs include Parks as Classrooms (a program initiated prior to the ATBI, which now includes specific sections related to the project), and Junior Ranger programs (specific programs are oriented towards finding and identifying various invertebrate groups that are being studied through the ATBI).

Educational products related to the ATBI are being developed by the DLIA education committee to help bring examples of current issues and science topics into the classroom. Many teachers may be interested in the scientific findings, but are unsure of the best way to bring that information back to the classroom. The educa-

tional activities that are described on the DLIA website and at teacher workshops help to promote interest and provide teachers with what they need to conduct ATBI-related activities in their classrooms. Some schools have even developed their own "schoolyard ATBI." Biodiversity trunks filled with materials that can be used in the classroom have been developed, as well as videos, web pages, and exhibits.

The general community oftentimes does not know about the ATBI, nor do they know of the smaller creatures that they depend on every day. Until recently, much of the focus in educational programs has been on the megafauna, with less emphasis on the microfauna. Since the ATBI encompasses all life forms, related educational programs can now take advantage of the new things we are learning about many lesser-known groups. Programs about the ATBI inform the general community that every creature is important to the overall health of the ecosystem and highlights the need to protect not only the organisms but their habitat as well. When conducting youth education programs involving insects, there is usually at least one child who doesn't want to participate because they are repulsed, but by the end of the program, that same child is usually very interested in catching insects and in learning how they move, eat, and live their lives. This newfound appreciation is very rewarding to educators; now this child knows how important all of these creatures are, and perhaps will not think twice about helping protect places for these creatures to live.

One of the most important educational aspects of the ATBI is the connection between real science and the schools, teachers, and general public. Often, when given the opportunity to interact with real scien-



Snowy Cascade on Injun Creek, Great Smoky Mountains National Park. For some species, seasonality is an important consideration in evaluating their status. Photo courtesy of Charles Wilder / DLIA.

tists and actually conduct field work and collect data, students who initially do not seem very enthusiastic can become very participatory. One of the ATBI participating scientists, Mark Wetzel, observed that students who were initially quite reserved during an aquatic outing with a local high school quickly became enthusiastic and inquisitive about what they were finding under rocks in the stream and in the riparian vegetation, such as salamanders and aquatic insects. The teacher of that group later commented that his students talked regularly over the following couple of weeks about their experiences and discoveries, implying that at least some significant impressions were made on these students, which hopefully has increased their aware-

ness of the fauna and flora in streams in their own area.

The ATBI has demonstrated that there is still much to be discovered by everyone, and people of any age and background can contribute to scientific knowledge. Teachers and students alike can benefit by learning about the actual scientific methods used in collection, and the chance to interact with the scientists and take that experience back to the classroom is very valuable. Additionally, young people may discover a career path or an area of life-long interest they might not have otherwise been aware of or considered.

### **Volunteerism**

The recruitment, training, and support

of our volunteers have been particularly rewarding activities. Volunteers include everyone from high school students who become involved with particular projects, to retired folks who are experts in their field and are sharing their time and talents. Allowing volunteers a chance to see “behind the scenes” aspects of the science that takes place on a regular basis helps them gain a deeper appreciation for national parks and illustrates the important role that parks play in protection of resources and for activities other than leisure or recreation. When people realize the potential discovery of a new species, they get excited and want to help, and once the public appreciates the importance of these discoveries and the incredible biodiversity this park has, they often realize that they can contribute to the overall knowledge about its resources.

Volunteers can provide scientists with both tangible and intangible benefits. The tangible benefits include such practical contributions as collecting samples during the off-season; setting out traps in remote locations, which allows for a more thorough coverage of the park; and participating in long-term projects, such as fern forays. The more intangible benefits are ones that are carried back to the rest of the community from the ATBI experience, such as an understanding of the importance of the scientists’ work and how it will help protect the resources of the Smokies and beyond. The communities around the park benefit whenever citizens get involved in the natural heritage that is in their own backyard. They gain knowledge, skills, and the reward of doing something useful and making a contribution to the park.

Dr. Ed Lickey (left) assists a volunteer with data collection while another volunteer checks his GPS unit during a fern foray at Cataloochee. Photo courtesy of Kemp Davis, Jr. / DLIA.





The 5,000th new discovery in the Smokies ATBI: the velvet leaf blueberry, *Vaccinium myrtilloides*. Photo courtesy of Heather MacCulloch / DLIA.

### Student involvement

Young students can often rekindle in scientists that sense of wonder that children possess, but is often lost with age. They can also make interesting observations that may be profound, and can give scientists and biologists a sense of fulfillment. It is rewarding for them to see people interested and enthusiastic about a topic that they feel passionate about.

There are numerous examples of student activities associated with ATBI data collection, three of which are highlighted here. Students at Cherokee High School, many of them enrolled members of the Eastern Band of the Cherokee Indians, collected springtails in a remote area of the

park that contained a unique soil type, and which therefore was thought to perhaps have unique species of springtails. Rather than ask the specialist to come collect in this area, the students learned the technique and performed the collection, and the samples were forwarded to him. A specimen was discovered in this collection that was different from thousands of others collected elsewhere. Another interesting example involves summer high school interns who were asked to periodically search in the Cataloochee area of the Park for additional specimens of an intriguing “junkyard bug” (green lacewing larva) which is known for carrying up to six different species of snails on its back as camouflage. The third exam-



ple is from Great Smoky Mountains Institute at Tremont (Tennessee), which is an environmental education facility within the park. Since the ATBI began, we have developed a 6-year-long moth trapping project, using a specially designed non-lethal black light trap. Specimen identifications are verified by ATBI lepidopterists when necessary, but for the most part, identifications are done by the students, after which the moths are released. This project has produced records for over 600 moth species, including year-round adult flight phenologies and relative abundances, all from a site where we previously had no moth records. Over 120 species found and identified by students and their teacher-naturalists are new records for the park. The comprehensiveness of this project far surpasses any previous moth work conducted by park staff, university contractors, or other agencies in the history of the park.

By these examples, it is evident that students can easily follow instructions provided by researchers and thus can save the researchers time and money, and can provide them data that would not have otherwise been available. The most formidable challenge is fitting the right group to the right scope of project, as well as providing enough structure to maintain quality science products and life-changing experiences. There may be resistance among some scientists with regard to the quality of data that may be collected. However, scientists we have worked with have been very pleased with the quality of the work and data collection that students, as well as teachers and adult volunteers, have provided. Most are happy to work with students and look forward to the opportunity to do so. At times it can be a challenge to mesh the goals of science and education if the focus

becomes too narrow—if it is trained on only part of the ATBI mission. Training scientists about the goals of education may be just as important as training educators about the goals of science.

With the dearth of taxonomic authorities for an increasing number of groups, efforts are being made at the Smokies to recruit serious students into this area of science. We have had some success in this area, with at least two Ph.D. candidates working on degrees in insect taxonomy. Additionally, several M.S. degrees related to taxonomy have been completed, and several more are in progress. We also have encouraged undergraduates to conduct taxonomic studies in the park. For example, at Warren Wilson College (a small liberal arts college in Asheville, North Carolina, with approximately 600 students in total), interested students have tackled one phylum of life—tardigrades, or “water bears” (microscopic crustaceans)—to work on, park-wide. When they approached ATBI coordinators wanting to participate, one of the few tardigrade experts in the U.S. was contacted to mentor them. We now know of 70 species of tardigrades from the park, whereas our previous knowledge was of only one species. This new number includes the discovery of 14 species new to science and one genus new to science. The students have presented their papers at professional meetings, including international tardigrade symposia, and now the Smokies, along with Poland and sections of Italy, are the best-studied sites in the world for this phylum of life.

### **Research Learning Center and other facilities**

Hubs of science and education are being developed around the park. Although

each facility has a different mixture of science and education, programs at these sites are integrated to further the educational mission of the ATBI and the National Park Service (NPS). These include the Appalachian Highlands Science Learning Center at Purchase Knob (North Carolina), Great Smoky Mountains Institute at Tremont (Tennessee), and the Twin Creeks Science Center (Tennessee).

The Appalachian Highlands Science Learning Center is one of a network of 17 Research Learning Centers throughout the National Park Service as of summer 2006. The mission of the Appalachian Highlands Science Learning Center is to increase the amount and effectiveness of research in the Appalachian Highlands Network of parks. The aim is to meet management needs while increasing public access to, understanding of, and appreciation of these research activities. Learning Center programs include research seed-grants for outside scientists, publications about research in the parks, internet databases for class-

room use, teacher training seminars for elementary classroom teachers through college instructors, logistical support and housing for research needs, and education and citizen science programs for ages middle school to adult (Table 1). Much of the Learning Center's focus is on ATBI-related topics.

One on-going program that has been operated out of the Learning Center involves hiring high school interns from North Carolina to help conduct a variety of ATBI-related projects. Through this program, sponsored by the Burroughs Wellcome Fund, students work with visiting scientists to extend and intensify their projects, while also undertaking their own independent projects. Some of the projects have involved the following taxonomic groups: beetles, grasshoppers, gall-making insects, fruit flies, land snails, salamanders, planthoppers, bees and other pollinators, algae, slime molds, moths, ants, and bacteria. Collectively, they have found new mollusks for the state of North Carolina, collected

Table 1. ATBI program statistics from the Appalachian Highlands Science Learning Center at Purchase Knob, Great Smoky Mountains National Park.

	2005		2006	
	<i>Number of Programs</i>	<i>Number of Participants</i>	<i>Number of Programs</i>	<i>Number of Participants</i>
Teacher workshops	6	201	10	235
College classes	6	121	4	111
Adult programs	2	158	5	230
High School	12	574	8	134
Middle School	17	580	13	265
Totals	43	1,634	43	975

pollinators on rare plants, collected insects new to science, and filled in collection records for many different scientists.

### **Summary**

Teachers, students, and volunteers are a crucial link between Great Smoky Mountains National Park to decision-makers and the public at large. They convey what they have learned about the biodiversity of the Smokies, and why it is important to protect the park. As “hands-on” participants in the ATBI, they are able to give examples of what they have seen and touched while out in the field with the researchers. They have heard directly from park staff and scientists about why we should care about the entire, complex web of life in the Smokies, and they can speak with fellow citizens and with politicians about resource allocation for

research and about being good stewards of even the smallest creatures.

Education related to the ATBI benefits the park by helping people understand that in order to protect the park properly, we must first know what we are protecting. It is vital to have that basic information in order to carry out the mission of the National Park Service. The synergy of DLIA and resource educators depends on communication, goal setting, creativity, and the willingness to continue to create learning opportunities for the public. The science will provide the foundations of knowledge for years to come, and will generate new frontiers in education and resource management. Additionally, seeking that information is an excellent way to involve people in the community, thus creating stronger stewardship links.

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