



## **SEEDS Field Trip Report**

**Oak Ridge National Laboratory and Great Smoky Mountains National Park  
November 14-17, 2002 • East Tennessee**

### **1) Field Trip Overview**

Student field trips, one component of the Strategies for Ecology Education, Development and Sustainability (SEEDS) program, foster greater student identification with ecology and with the SEEDS program through field experiences with fellow students. The SEEDS Program supported a student field trip to the Oak Ridge National Laboratory and the Great Smoky Mountains National Park for sixteen students from thirteen schools, three SEEDS faculty, and three Ecological Society of America (ESA) staff. See Appendix A for a list of participants. The primary goals of the field trip were to provide students with an overview of Oak Ridge National Laboratory and the Smoky Mountains; expose students to the practical application of ecology at a research laboratory and national park; and to build student awareness of various ecological internship, degree, and career options.

On Friday, November 15<sup>th</sup>, 2002, participants visited the Oak Ridge National Laboratory with an emphasis on the work of the Environmental Sciences Division. On Saturday, November 16<sup>th</sup>, 2002, participants visited the Great Smoky Mountains National Park which included a presentation of ecological research being conducted in the park and an overview of the park's cultural history and biodiversity. While in the Smoky Mountains, participants stayed in the rustic cabins of the BridgeMont Camp & Outdoor Center. An itinerary of the field trip can be found in Appendix B.

### **2) Oak Ridge National Laboratory (ORNL)**

ORNL is a multiprogram science and technology laboratory managed for the U.S. Department of Energy by UT-Battelle, LLC. Established in 1943 as a part of the secret Manhattan Project to pioneer a method for producing and separating plutonium, ORNL is the Department of Energy's largest science and energy laboratory.

Scientists and engineers at ORNL conduct basic and applied research and development to create scientific knowledge and technological solutions that strengthen the nation's leadership in key areas of science; increase the availability of clean, abundant energy; restore and protect the environment; and contribute to national security. ORNL also performs other work for the

Department of Energy including isotope production, information management, and technical program management, and provides research and technical assistance to other organizations.

For more information about ORNL visit [www.ornl.gov](http://www.ornl.gov).

### **Environmental Sciences Division**

Ms. Jennifer Seiber, Human Resources and Education Coordinator for the Environmental Sciences Division, welcomed the participants and issued badges. Participants then received an overview of the Environmental Sciences Division from Dr. Anthony Palumbo, Applied Environmental Science and Technology Group Leader.

The Environmental Sciences Division (ESD) of ORNL is an interdisciplinary research and development organization with more than thirty years of achievement in local, national, and international environmental research. Scientists in ESD conduct research, develop technology, and perform analyses to understand and assess responses to global and regional change, environmental stress, and resource use. By expanding scientific knowledge and developing technological solutions, the ESD strengthens the nation's leadership in addressing important environmental problems.

ESD conducts research in the environmental sciences integrating strengths in biogeochemistry, environmental biotechnology, environmental chemistry, ecosystem studies, geosciences, hydrology, environmental assessment, economics, and policy analysis; and ESD conducts research in the microbial sciences emphasizing microbial ecology, functional genomics and proteomics, complex biological systems, and biotechnology.

To learn more about the ESD, visit [www.esd.ornl.gov](http://www.esd.ornl.gov).

### **Throughfall Displacement Experiment (TDE)**

Dr. Stan Wullschleger, core project scientist for the TDE, brought participants to the Walker Branch field site to introduce basic issues surrounding global climate change; describe highlights regarding the results of this catchment-scale manipulation; and discuss implications for existing and future forests of the eastern United States. The goal of the TDE is to understand mechanisms of forest ecosystem response to changes in precipitation that may result from a warming global climate. The TDE allows rainfall to be collected on a “dry” plot and passively transferred to a “wet” plot, thus creating soil conditions that mimic both increased and decreased precipitation. This is accomplished by intercepting throughfall in approximately two-thousand subcanopy troughs suspended above the forest floor. Results indicate that seedlings and saplings are the most sensitive to changing precipitation; a forty percent loss in saplings has been observed in the dry plots since the start of the experiment.

For more information about the TDE visit  
<http://www.esd.ornl.gov/programs/WBW/TDEAAAAA.HTM>

### **Free-air Carbon Dioxide (CO<sub>2</sub>) Enrichment (FACE) Study**

Mr. Nelson Edwards, a researcher in the FACE study, brought participants to the site to describe the study design and to summarize its findings. Investigators at the FACE site seek to better

understand how a closed-canopy forest, both above and below ground, will respond to long-term CO<sub>2</sub> enrichment. The facility, comprising five twenty-five meter plots, was constructed in a deciduous forest, a study site of sweetgum (*Liquidambar styraciflua*) monoculture planted in 1988. The environment in the experimental plots is modified to realistically simulate future elevated concentrations of atmospheric CO<sub>2</sub>. In the experimental plots, CO<sub>2</sub> levels are maintained at 600 parts per million (ppm), 200 ppm above normal ambient air. To achieve this, the design uses a CO<sub>2</sub> tank, vaporizers, a high-volume blower, a plenum or wide ring-shaped pipe for air distribution, vertical standing vent pipes for emitting CO<sub>2</sub> into the exposure area, sensors to measure wind speed, wind direction, and CO<sub>2</sub> concentration, and a computer-control system to regulate and monitor CO<sub>2</sub> releases. The study has found that trees in the elevated CO<sub>2</sub> rings are maintaining a five to ten percent greater diameter growth rate than control trees. The photosynthetic rate is also higher in the experimental rings and those trees exhibit more fine root growth than the control trees. Information from FACE research on how crop, forest, and other ecosystems will react can help anticipate the impacts (both positive and negative) of future global change.

For more information on the FACE study visit <http://www.esd.ornl.gov/facilities/ORNL-FACE/>

### **Panel Discussion**

Dr. Frank Harris, Director of the Biological and Environmental Sciences Directorate, welcomed SEEDS participants and gave a brief introduction to ORNL.

Mr. David Milan, Management Systems Integration Manager, ran the panel discussion. He earned his Bachelor's degree from the University of Tennessee Martin and his Master's degree in Public Health from the University of Tennessee. He worked as a corporate safety and health director prior to coming to ORNL to work as an industrial hygienist. The positive influences in his career path have included his mentors and his mother. He advised the participants to treat people how you want to be treated.

Dr. Washington-Allen received his undergraduate degree in Zoology specializing in honeybee behavior from Ohio State University. After graduation, he taught math for three years in Lusutu with the U.S. Peace Corps. He continued his work in Lusutu with the U.S. Agency for International Development (USAID) as a university lecturer in agricultural resource management. He went on to receive his Master's degree in Range Ecology at Utah State University and recently finished his Ph.D. At ORNL he uses remote sensing to assess environmental impact. The positive influences in his career have included his 8<sup>th</sup> grade teacher, his mother, and the scientist characters in comic books.

Dr. Rebecca Efroymsen received her Bachelor's degree from LaSalle University in Biology and English. As an undergrad she worked in a marine research summer program at the University of Delaware. She received her Master's and Doctorate degree from Cornell University in environmental toxicology. She received a fellowship from USAID where she traveled internationally to do ecological risk assessment before coming to ORNL. Dr. Efroymsen shared her advice about graduate school and careers. She told students that there are many things to consider when choosing a field and graduate program: Do you like field work, lab work, or computers?, Do you like to work alone or with others?, What kind of advisor do you want? She

also told students not to pay for their graduate education and not to assume that they can't switch fields between degrees. Finally, she advised students to seek out a job that they want because ninety percent of all jobs are not advertised.

Dr. Art Stewart received his Bachelor's degree at a "lower-end school" because it was cheap and close to home. He didn't know exactly what he wanted to do but he knew he really liked biology and so he took every biology class that he could. He also received his Master's degree at Northern Arizona University in Aquatic Ecology and then worked in Ghana for two years teaching tropical biology with the U.S. Peace Corps. He found the best aquatic ecologist and wrote a letter to him, asking to work with him. This paid off and he went to Michigan State University to receive his Ph.D. in Limnology. He went to ORNL for post-doctoral work and then taught at the University of Oklahoma for several years. He returned to ORNL and has been there for seventeen years.

Ms. Yvonne Horton received her B.S. in chemistry. After her third year as an undergraduate she interned at ORNL and returned there after receiving her degree. She worked for seven years in research with carcinogenic and mutagenic studies. While working full-time she earned her M.S. in Public Health. She currently works as an Occupational Safety and Health Administration industrial hygienist at ORNL. She advised students that to do their best they need to set goals and work toward them; once goals are achieved, set new ones.

Ms. Kim McMahan works as an external dosimetrist for ORNL where she measures radiation levels to determine the dose of exposure in ORNL employees. She received her B.S. and M.S. from the Georgia Institute of Technology in health physics. When trying to pick a school, she was not sure exactly what she wanted to do but she knew that she liked math. She majored in nuclear engineering and her professor, a health physicist, introduced her to the field of health physics which was first named during the Manhattan Project era.

## **Laboratory Protection Division and Operational Safety Services Division Facility Tours**

### **Laboratory Shift Superintendent (LSS)**

Mr. Steve Abercrombie, Laboratory Shift Superintendent, gave an overview of the Laboratory Systems Attendants Office. The office is responsible for monitoring and controlling all systems and activities twenty-four hours a day, seven days a week. These responsibilities include weather, emergencies, and the one nuclear reactor on site. They also run security drills and are responsible for submitting reports to regulatory agencies.

### **Emergency Operations Center (EOC)**

Mr. Richard Rodriguez, EOC Coordinator, gave an overview of the Office of Emergency Preparedness. If an emergency were to arise, it would be categorized as: (1) operational (not further classified), (2) alert-team called, (3) site area emergency, or (4) general emergency (off-site). If an emergency arises, a cadre is paged. There are many positions in the cadre but the Crisis Manager and the Department of Energy Operations Manager are the ultimate decision-makers. They receive information including plume models and may make a decision for protective action: shelter-in-place or evacuate. The information

is also given to the LSS and the Tennessee Emergency Management Agency so they can act accordingly.

### **Bioassay Lab**

The bioassay lab is involved in monitoring both short and long-term effects of occupational activities on worker health. In particular, the lab tests urine and sometimes fecal samples of ORNL employees to determine whether employees have been exposed to radioactive elements. Dr. Myint Thein and Dr. Govind Rao led us through the testing process and the counting lab, where alpha spectrometers count isotopes in samples.

After the tours participants reconvened to hear about education programs for students and faculty at ORNL. ORNL has hosted undergraduates, graduate students, postgraduates and faculty since 1946. In 2001, the lab hosted nearly 550 participants. Linda Holmes presented information on what can be done at ORNL, the unique experience the lab can provide, the benefits, and how to apply for these opportunities.

## **3) Great Smoky Mountains National Park**

### **Clingman's Dome**

Participants met Dr. Robert Keller in the parking lot of Clingman's Dome. At an elevation of 6,643 feet, Clingman's Dome is the highest point in the park. Dr. Keller explained that areas around parking lots and grassy medians between highways may actually be rich habitat as they are often undisturbed areas. He and his colleagues had set Sherman live traps in the area around the parking lot prior to our arrival. The students helped to collect the traps each of which had been baited with sunflower hearts and cotton batting to provide protection. Several species were collected including the white-footed mouse (*Peromyscus leucopus*), the red-backed vole (*Clethrionomys gapperi*), and the North American short-tailed shrew (*Blarina brevicauda*). Dr. Keller explained the particulars of the collected species. Dr. Keller also explained his work with the All Taxa Biodiversity Inventory (ATBI). This research effort represents a comprehensive inventory of all life forms in the Great Smoky Mountains National Park. For more information on ATBI visit [www.discoverlife.org](http://www.discoverlife.org).

Dr. Robert Keller is a professor at the University of Tennessee at Chattanooga. He has conducted research in the Smoky Mountains for over seven years and did his dissertation work on the affects of the European wild boar on the park's plant and animal population. His current projects include examining the effects of artificial habitat maintenance on the small mammal communities inhabiting the grassy balds of the Great Smoky Mountains National Park; examining the effects of the European Wild Boar (*Sus scrofa*) on the small mammal community and the vegetational structure of the Oak-Hickory forests of the Great Smoky Mountains National Park; and examining the effects of recreational rock climbing on Sunset Rock in the Chickamauga and Chattanooga National Military Park.

### **Sugarlands Visitor Center and Hike to Cataract Falls**

At Sugarlands Visitor Center participants met with Rangers Pam Rogers and Bahia Mar. They explained that the Great Smoky Mountains National Park is the most visited of the all the

national parks with over ten million visitors each year. The national park, in the states of North Carolina and Tennessee, encompasses eight-hundred square miles of which ninety-five percent are forested. World renowned for the diversity of its plant and animal resources, the beauty of its ancient mountains, the quality of its remnants of Southern Appalachian mountain culture, and the depth and integrity of the wilderness sanctuary within its boundaries, it is one of the largest protected areas in the east.

As we walked to Cataract Falls, Ranger Rogers talked about the cultural history of the park. The park was originally inhabited by the Cherokee Indians who called the mountains Shaconage, meaning “blue, like smoke.” The Cherokee were forcibly removed in the 1830s as white settlements became established. Around 1900, logging was introduced and during the next thirty years, sixty-seven percent of the future park was clear-cut. In the early 1920s the movement to establish the park began. Many people lived on the land that was to become the park and while some accepted cash for their land, one resident’s fight went to the State's Supreme Court where a compromise allowed the residents to remain on the land with a life-time lease. Others supported the cause and raised money to buy the private lands to donate to the federal government. The park was officially established in 1934 and was among the first national parks assembled from private lands.

Ranger Rogers also addressed some of the environmental concerns of the park. Introduced species are a major concern including the balsam woolly adelgid, a small wax-covered insect that attacks Fraser fir trees. Other pests and diseases affecting park ecosystems include chestnut blight, southern pine beetle, and dogwood anthracnose. Air and water quality are further concerns due to the park’s proximity to several major metropolitan areas. Acidic deposition, combined with the Smokies' acidic bedrock, threatens aquatic ecosystems.

Ranger Mar narrated a slide show presentation which focused on the species diversity of the park. She discussed some of the reintroduced species including the elk and the river otter. Ranger Mar also discussed the All Taxa Biodiversity Inventory. By some estimates, the park possesses more than 100,000 species of only which a small percentage have been identified.

In the afternoon, some participants watched the video on the natural history of the park at the Sugarlands Visitor Center while others went for a hike on the Elkmont Nature Trail.

For more information on the park visit [www.nps.gov/grsm](http://www.nps.gov/grsm)

#### **4) Field Trip Evaluation Comments**

Overall, the field trip was described as “great, unforgettable, educational, memorable, exciting, entertaining, knowledgeable, informative, stimulating, enjoyable, and a great opportunity.”

Participants were asked to rate each aspect of the field trip on a scale from 1 (lowest) to 5 (highest). No event received an average rating lower than a 4. The most highly rated component was the lunch panel discussion at the Oak Ridge National Laboratory followed by the Oak Ridge National Laboratory Field Site Tours, the presentation at the Great Smoky Mountains National

Park by Rangers Rogers and Mar, Dr. Keller's presentation at Clingman's Dome, the welcome and orientation, the meals and accommodations, and the Oak Ridge National Laboratory Protection Division Tours.

When asked what accomplishments were achieved, responses included: motivation to continue with educational and professional goals; learning about funding opportunities; seeing ecologists and specialists at work; exposure to both field and lab aspects of ecology; deepening a love of ecology and research; learning about the variety of degrees related to ecology; allowing for more informed decisions about education and career; reconnecting with nature and self; deciding future career paths; determination to apply to graduate school; meeting a lot of interesting people with similar interests; networking; learning about internships; learning about the biodiversity of the Smoky Mountains; and, overcoming fears of hiking and mountains.

Suggestions for improvement included: scheduling less activities so that the days are less hectic; having more social activities during down time; extending the length of the field trip experience overall; planning it for a warmer time of year; allowing more time in the field; including a visit to a university; and, better directions for the drivers.

Many people contributed to the success of the field trip and the wealth of ecology opportunities packed into the two days. The field trip fulfilled its goals: participants received an overview of the Oak Ridge National Laboratory and the Smoky Mountains, two interesting and ecologically important sites; participants saw the practical application of ecology in both a laboratory and field setting; and, participants increased their knowledge of ecology and the opportunities available within the field. Participants also initiated their own opportunities including hikes to the peak at Clingman's Dome and the Elkmont Nature Trail in the park and a shopping excursion to Pigeon Forge, Tennessee.

## **Appendix A**

### **Field Trip Participants**

#### **Students:**

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## **Appendix B Field Trip Itinerary**

### ***Thursday November 14, 2002***

Afternoon                      Arrival to McGhee-Tyson Airport in Knoxville, Tennessee  
6:00 – 8:00 pm                Pizza Dinner and Orientation Meeting at the hotel Hospitality Room

### ***Friday, November 15<sup>th</sup>, 2002***

7:45 – 8:30 am                Deluxe continental breakfast at the hotel  
8:40 am                        Vans depart for Oak Ridge National Laboratory (ORNL)  
9:00 – 9:30 am                Registration in Environmental Sciences Lobby  
9:30 – 10:00 am               Division Overview by Tony Palumbo, Groupleader  
10:00 – 12:00 pm              Division Tours – Field site tours at Walker Branch Watershed Throughfall  
Displacement Experiment\* (TDE) conducted by Stan Wullschleger and the Free-  
Air CO<sub>2</sub> Enrichment\*\* (FACE) Site conducted by Nelson Edwards  
(tour group to be divided up approximately 12 to a group)

\* The TDE is a large-scale study that is designed to examine the response of a temperate deciduous forest to altered precipitation. The TDE is unique in that the experimental design allows rainfall to be collected on a “dry” plot and passively transferred to a “wet” plot, thus creating soil conditions that mimic both increased and decreased precipitation. As part of the TDE tour, the group will be introduced to basic issues surrounding global climate change and hear highlights regarding the results of this catchment-scale manipulation. Implications for existing and future forest of the eastern United States will be discussed.

\*\* The ORNL FACE study is one of only a handful of studies in the United States examining the growth and physiological response of large trees to elevated CO<sub>2</sub> concentrations. Building upon a rich history of DOE-sponsored CO<sub>2</sub> effects research on seedlings and saplings grown in pots and open-top chambers, investigators working at the FACE site seek to better understand how a closed-canopy forest, both above and below ground, will respond to long-term CO<sub>2</sub> enrichment. While visiting the FACE site, researchers will present a brief history of CO<sub>2</sub> research at ORNL, discuss important global change issues, and summarize findings from the study as it enters its fourth year of exposure.

12:00 – 1:30 pm                Lunch in ORNL DJ Nelson Auditorium  
12:30 pm                        Lunch Panel to Begin

#### **Panel Members**

##### **Environmental Sciences Division**

Art Stewart  
Rebecca Efroymsen  
Robert Washington-Allen

##### **Laboratory Protection Division**

Yvonne Horton  
Kim McMahan  
David Milan

1:30 – 3:30 pm      Tours of various Laboratory Protection Division and Operational Safety Services  
Division facilities  
(tour group to be divided with approximately 12 to a group)

Group A: 1:30 - 2:00 pm      Visit to the Laboratory Shift Superintendent  
2:15 - 2:45 pm      Visit the Emergency Operations Center  
3:00 - 3:30 pm      Visit the Urinalysis Lab

Group B: 1:30 - 2:00 pm      Visit the Emergency Operations Center  
2:15 - 2:45 pm      Visit the Laboratory Shift Superintendent  
3:00 - 3:30 pm      Visit the Urinalysis Lab

3:30 pm      Reconvene in the D. J. Nelson Auditorium for a brief overview of the educational  
opportunities offered at ORNL for students and faculty

3:45 pm      Vans depart for BridgeMont

6:00 pm      Dinner at BridgeMont

***Saturday, November 17<sup>th</sup>, 2002***

7:30 – 8:00 am      Breakfast at BridgeMont.

8:05 am      Vans depart for the Great Smoky Mountains National Park

9:30 – 11:00 am      Meet with Robert Keller, University of Tennessee at Chattanooga, and learn  
about the work of an ecologist who studies the interaction of plants and animals  
in the park. We will check Dr. Keller's small mammal monitoring plots at  
Clingman's Dome and learn about his research methodologies

11:15 am      Vans depart for Sugarlands Visitors Center

12:00 – 1:00 pm      Picnic lunch in the park

1:00 – 3:00 pm      Sugarlands Visitor Center – Meet Rangers Pam Rogers and Bahia Mar to hear  
about the park ecosystems

3:00 – 3:30 pm      Field trip evaluations

3:30 – 5:00 pm      Hike in the park

5:00 pm      Depart park for BridgeMont

6:00 pm      Dinner at BridgeMont

***Sunday, November 18<sup>th</sup>, 2002***

5:45 am      First van will depart for the airport with Akinboyewa, Rizo, and Sedeno

7:00 – 7:30 am      Breakfast at BridgeMont

7:45 am      Three remaining vans will depart for the airport

## **Appendix C**

### **Field Trip Presenters**

#### **Oak Ridge National Laboratory**

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