Cities and the Environment (CATE)

Volume 5 | Issue 1 Article 12

9-10-2012

The Impact of an Extended Outdoor Residential Workshop on Urban Students' Learning and Appreciation of Biodiversity

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Courses that focus on local flora and fauna are no longer included in biology curricula; therefore most K-12 teachers lack the expertise to teach their students about local biodiversity. When teachers are unable to recognize the plants and animals in their own surroundings, threats to the environment and biodiversity will inevitably remain abstractions to students. In the summer of 2011, a five-day plant and insect biodiversity workshop engaging thirteen pre-service and in-service urban public school teachers and five undergraduate biology teaching assistants was held at a forest field station outside of New York City. The goals were to develop an appreciation of local plant and insect diversity amongst practicing and pre-service teachers, and prepare them to use outdoor experiences to teach urban students. Results from pre- and post-tests and surveys indicate that teachers made significant gains in their understanding of biodiversity, with the largest gains made on plant identification skills. Post-surveys, distributed six months following workshop completion, indicate that half of the in-service teachers used these resources in their classrooms. Responses also highlighted important intangible benefits of the workshop, and indicated that some participants used their new plant identification skills to identify or observe the street trees they pass as part of their daily routine.

Keywords
Environmental Education, Biodiversity Learning, Science Teacher Education, Science Education

Acknowledgements
We would like to thank G. Borman and J. Fassbender for their help in designing, organizing, and teaching the 2011 summer workshop at Black Rock Forest. We would also like to thank the Black Rock Forest Executive Director, W. Schuster, and Black Rock Forest staff, including J. Brady, M. Munson, J. Caldwell, and B. Brady for ensuring that our stay at Black Rock was both productive and complication free. Finally, we would like to thank all of the teachers and undergraduate students who participated in the workshop for their openness and enthusiasm for the outdoor experience. This work was funded by the "City Seeds" grant program of the City College of New York part of the City University of New York.

INTRODUCTION

In the summer of 2011, a five-day plant and insect biodiversity workshop for thirteen pre-service and in-service urban public school teachers and five undergraduate teaching assistants was held at Black Rock Forest, an almost 4,000 acre scientific and educational research forest field station, located in the Hudson Highlands approximately 50 miles north of New York City. The forest was chosen as the workshop site for its varied terrain and forest habitat, its green educational and sleeping facilities, and because the organization allowed participants to collect tree and insect specimens for learning purposes.

The goal for the workshop was twofold:

1. To prepare in-service and pre-service teachers to use outdoors experiences to teach urban students about local plant and insect biodiversity
2. To develop appreciation amongst teacher and undergraduate workshop participants of local plant and insect diversity.

The course focused on collecting, identifying, and preparing specimens of tree and leaf litter diversity from both highland and lowland sites, and included simple data analyses. It also suggested activities to use with urban public school students to familiarize them with the flora and fauna of their neighborhoods and homes.

Outdoor Learning

Outdoor learning has consistently been shown to positively impact attitudes and behaviors towards the environment and to increase learning of science of K-12 students, undergraduates, and teachers, as shown by participant performance on written assessments and through interview and attitude survey responses (Huntoon et al. 2000; SEER 2000; Lindemann-Matthies 2005; Dillon et al. 2006; Hashimoto-Martell et al. 2011). Nevertheless, major barriers still hinder teachers from using the outdoors with their students. Lack of experience leaves many teachers feeling unqualified to teach outdoors, and curricular mandates limit the inclusion of outdoor education in the formal school environment (Plevyak 1997; Dillon et al. 2006). This problem is exacerbated in cities where access is limited; both by the urban landscape and by the perception that outdoor education in urban settings is less valuable than in more "natural" environments (Young and Simmons 1992; Simmons 1998). Extended experiences in "natural" areas outside the urban environment make immersion in the outdoors simple and gratifying, but can cause students to become less concerned about their own urban environments because it encourages them to view cities as places that lack "nature" (Haluza-Delay 2001).

Thus, even though research reliably shows the value of immersing students in "natural" environments for fostering student appreciation and understanding of biological systems, these outdoor experiences tend to promote the perception of cities as "unnatural," degraded environments. Yet recent research shows that living in dense cities is in many ways more sustainable than living in areas with easier access to nature. Carbon footprint calculations of people living in rural, suburban, and urban areas show that people living in urban areas consume considerably less carbon than people living outside of cities (Glaeser and Kahn 2008). Urban density contributes to this reduced carbon footprint and also leads to significantly less space used by urban residents per capita than by people living in less dense areas. Significantly, if all of the

world's almost 7 billion people lived at the density of New York City residents, then the world's population would fit into the State of Texas (DeChant 2011; not including the land required to support people). Outdoor experiences for urban students should therefore validate the sustainability of city living, while nurturing appreciation and understanding of "natural" systems.

Urban Biodiversity

One way to validate urban outdoor experiences is to focus on the biodiversity, the variety of life, that is readily apparent in the urban environment. Even small city apartments harbor a surprising number of different insect orders that can, with proper attention, be identified, and city sidewalks and parks are planted with a diverse array of trees that show varied flower, fruit, and leaf structure (Volk 1995; http://www.nycgovparks.org/trees/species-list). Because walking is still a fundamental way of life in many cities, residents can observe this plant diversity during their daily routines. The slow pace of walking makes it easy to stop to observe street trees, and ubiquitous smart phones make it simple to record observations. Teaching students to see the unseen—plants outdoors and insects at home—may be a way to excite students about the living world, while at the same time validating their urban experience.

This focus on plant and insect identification could also address the disappearance of these subjects in the modern biology secondary school curriculum (Sheppard and Robbins 2007). One hundred years ago botany and zoology were core components of high school biology curriculum, but as new biological discoveries emerged, they were dropped in favor of a greater human focus (Rosenthal and Bybee 1988; Sheppard and Robbins 2007). Even today, the number of pages in biology textbooks devoted to plants continues to diminish (Hershey 2002) At the same time that children are learning less about the natural history of local plants and animals in schools, fewer children are venturing outside to discover nature on their own (Louv 2005). Video games, changing mores on child safety, and overscheduling are reducing or even eliminating the time children spend on their own exploring "natural" surroundings (Louv 2005). Plant blindness, the tendency to not even notice surrounding plants, is a persistent problem (Wandersee and Schussler 1999, 2001; Frisch et al. 2010). In short, people are becoming progressively more disconnected from most of the planet's non-human life, at the same time that we are becoming more aware of our outsized impact on the world. Bringing education about local plant and animals back to the classroom is a positive way to raise student awareness of the living world. Interacting with the living things in our midst can transform urban environmental education from negative (how humans damage the natural world) to the very empowering process of discovery (Sobel 1996).

METHODOLOGY

Workshop Demographics, Resources, Logistics, and Activities

Demographics

A diverse group of pre and in-service teachers (N=13) and undergraduate teaching assistants affiliated with the City College of New York, a commuter college located in upper Manhattan, (TAs; N=5) participated in this workshop. Four teachers self-identified as white, four as African

American, four as Asian, and one as Latina. Eight of the teachers were female and five were male. Teachers were recruited from all grade levels, since outdoor learning has been documented to be valuable for all grade levels (Lindermann-Matthies 2005: Hashimoto-Martell et al. 2011). As such, three teachers were currently teaching high school, three were teaching middle school, two were teaching elementary school, and five were pre-service middle and high school teachers. The undergraduate TAs were biology majors selected because they had performed well in botany and/or insect ecology courses with one of the authors. Four of the undergraduates were female and one was male. Two self-identified as Asian, one as Latina, one as African-American, and one as other.

Resources

In preparation for the workshop, participants were provided with a packing list, transportation instructions, a written orientation to the forest, and a site map. They also received curriculum materials including instructions for making plant collections, an e-Quick-Guide to common trees of the forest, an e-Quick-Guide to common litter arthropod orders, and a Quick-Guide to data analysis. Laminated copies of the Quick-Guides and traditional field guides were also provided at the site. Additionally, teachers left the workshop with their collections of at least ten pressed, mounted, and labeled plant specimens, their boxed collections of pinned and labeled arthropod specimens, their science notebooks, magnifying loops and litter sifters, and many new ideas. They were subsequently provided with an e-Quick-Guide to NYC street trees that they could print to use with students.

Logistics

Participants reached the site using either private transportation, or a combination of train and taxi. The dormitory building had two wings, each room including 3 or 4 bunk beds, closets, and a desk. Each wing had two bathrooms (with self-composting toilets) and showers. Between the sleeping wings there was a fully functional kitchen, a common dining and meeting area, and a large terrace. Because the workshop schedule was ambitious, box lunches (to take into the field) and dinners were catered. There was a second building with laboratories and classrooms. WiFi was available throughout the facility.

Main activities

The main focus of the workshop was to compare biodiversity (of tree species and leaf litter arthropods) along two transects: one followed a higher altitude ridge-top, the second was along a lower, wetter trail. Specimen collections were made on two consecutive days. The teachers worked in two groups, each with the assistance of an instructor and the same two or three undergraduate TAs. Each group spent one field session measuring, and identifying trees and collecting their leaf specimens, and one field session collecting leaf-litter arthropods. Prior to the leaf-litter collections, teachers constructed their own litter sifters by cutting windows in the bottoms of heavy-duty reusable shopping bags and attaching mesh (either wire or fabric) with duct tape. They were encouraged to formulate their own experimental protocols.

Back in the lab, plant samples were pressed and dried for one or two nights and then mounted on herbarium stock. Field identifications were checked using field guides or electronic resources, and labels were applied to the mounted specimens. Arthropod specimens were dry-mounted, photographed through a microscope, and identified to order; labels were then applied to the dry-mounted specimens. After specimens had been sorted, mounted, and identified, teachers were introduced to simple quantitative tools for analyzing biodiversity data. These included importance values (to document dominant species); Simpson's Diversity Index and species accumulation curves (for measuring the diversity of species in a community); and Jaccard Similarity Values (for comparing the degree of similarity or difference among samples or sites).

Time was allotted for teachers to discuss their findings and to discuss how best to bring what they learned into the classroom without collecting plants and insects from City parks. On the final morning they made informal presentations. In some cases the presentations were based on data analysis (mostly focusing on plants, which were easier to identify). Other groups decided to give presentations based on their ideas about how the workshop methods could be integrated into their own curricula.

Supplemental activities

In addition to the collecting projects, there were supplemental activities including a facilities tour, an orientation to working outdoors, an introductory scavenger hunt, black-lighting for nocturnal insects, aquatic sampling, two night hikes, and an *ad hoc* birthday party.

Surveys and Assessments

Pre- and post workshop assessments (11 questions) and surveys (20 questions) were distributed to learn whether the course learning goals were met (see appendix 1 and 2). These included: 1. Preparing in-service and pre-service teachers to teach local plant and insect biodiversity outdoors to urban students. 2. Developing appreciation amongst teacher and undergraduate participants of local plant and insect diversity. Pre-post assessments were used to measure teacher learning of plants and insects and pre and post-workshop surveys were used to measure growth in teacher willingness to go outside with their students, confidence in their learning of outdoor plant and insect biodiversity, and to assess the most and least useful workshop components for teaching. We followed up with teachers and undergraduate biology students six months after the course to determine if and how the teachers used course content in their classes, and what participants most remembered from the course. We also conducted more in depth follow-up interviews with three teacher participants.

RESULTS

Teacher Biodiversity Learning

Results from teacher completion of the pre and post assessments indicate that teachers made significant gains in their of learning of plant and insect biodiversity (Table 1). Breakdown of

teacher responses to the plant and insect identification skill questions shows that teachers made the largest gains in plant identification.

Table 1. Teacher Pre- and Post-workshop Scores on Plant and Insect Identification Assessment Items (N=13)

	Overall Plant and Insect Identification	Insect Order Identification	Insect Name	Plant Name	Plant Fact
Pre Workshop Mean Percent Correct	31.4	23.1	19.3	36.5	23.1
Post Workshop Mean Percent Correct	52.1	46.2	34.6	69.2	50
Δ Mean Pre to Post Percent Correct	+ 20.7*	+ 23.1*	+15.3	+32.7*	+26.9*

** Significant at $p \leq 0.05$ through pairwise one tailed t-tests.*

Teacher responses to survey items also show that teachers thought the course increased their understanding of plant and insect identification (Table 2). Additional questions asking teachers to rate the usefulness of the workshop for teaching showed that teachers ranked this workshop as very useful to their teaching (Table 3).

Table 2. Teacher Ratings of their Understanding of Plant and Insect Identification Skills

The Course increased my understanding of:	Average Score
Plant identification	4.769
Plant Collection	4.692
Plant Specimen Preparation	4.615
Insect Identification	4.538
Insect Collection	4.769
Insect Specimen Preparation	4.615

Likert Scale was from 1-5, with 1 considered to be strongly disagree, 3 considered to be neutral, and 5 considered to be strongly agree

Table 3. Teacher Ratings of Workshop Usefulness to Teaching

Category	Average Score
This course was useful for my teaching.	4.692
It provided activities to use in my class.	4.615
It provided content to use in my class.	4.384
It increased my confidence in my knowledge of the material covered.	4.384
The specimens that I collected and prepared will be useful in my teaching	4.307

Likert Scale was from 1-5, with 1 considered to be strongly disagree, 3 considered to be neutral, and 5 considered to be strongly agree

One teacher elaborated on her ratings about the usefulness of the workshop:

> My goal for this course was to learn how to help students learn about and connect with their natural environment, and through plant/insect collecting and preparation I feel I learned just that. I also experienced the joy and frustrations of collecting, identifying, and preparing specimens.

Most Valuable Workshop Components

To gain feedback on the design of the outdoor workshop, teachers were asked about the most and least valuable components of the course. Teacher responses in the post-workshop survey indicated that more than 75% of the teachers found both plant and insect collection and identification to be the most valuable portion of the course (Table 4), although 3 teachers specifically identified insect collection as the least valuable part of the course. Nine teachers did not identify any aspect of the course as least valuable. Analysis of six-month follow-up responses to questions asking teachers about their most valuable, memorable, and useful lessons indicated that teachers placed a higher value on plant collection and identification than they did on the insect collection and identification. There were almost twice as many teachers who identified plant identification as useful or memorable as there were teachers who identified insect learning as important.

Table 4. Teacher open-ended identification of the most valuable, memorable, and useful lessons (N=13)

	Plant and Insect Identification and Collection	Plant Identification and Collection	Insect Identification and Collection	Other Responses Like: Preservation of Life; Deeper Content Knowledge; Collaborative Work; Classification
Most Valuable Lessons (post-workshop survey)	9	1	0	3
Items mentioned as memorable or useful in 6 month follow-up survey	5	6	1	1 (Classification)

Follow-up: Applications, Intangible Benefits, Strengths and Challenges

Going Outdoors

Teacher responses to a pre-test question indicated that all except for one were likely to bring their urban students outside. The one teacher who stated that she was not likely to bring her students outside clarified her response by citing behavioral and student-teacher ratio issues. Following the workshop, all teachers said they were likely to bring their students outside. Interestingly, in their post workshop responses some teachers described barriers to going outside that they had not previously mentioned, such as the difficulty of finding appropriate sites in an urban setting. However, three teachers, including the teacher who originally stated that she would not bring her students outside, indicated that they would probably bring students outside due to the close proximity of their schools to local parks.

To determine how the teachers used the materials with their students, follow-up responses were solicited from teachers six months after the workshop. These responses indicate that half the teachers currently working with students (N= 4 out of 8) used workshop components in their classrooms. Additionally, two pre-service teachers also reported using workshop components, including one pre-service teacher who took an urban youth group outside to explore and identify local park trees. Most teachers described how the resources helped them with plant identification and classification, but a number of teachers also mentioned the usefulness of the workshop for helping with data collection, developing closer observation skills, and for emphasizing the utility and individuality of science notebooks.

We also applied what we learned while preparing for, conducting, and analyzing data from the residential field workshop to our urban on-campus courses. Based on our findings, we chose to focus an undergraduate life science course for pre-service elementary school teachers on local insects and street and park tree diversity. The aim of this generalized life science course became more specifically geared towards helping undergraduate elementary education majors get to know the trees that they pass on a daily basis, in the hope that they will bring their future students outside to experience the urban biodiversity that may otherwise go unnoticed. The workshop also led to the addition of new projects to an undergraduate course in botany for science majors; they were oriented towards observing urban tree diversity through analysis of percent green cover and the phenology of street trees.

New Experiences

Six months after workshop completion, teachers and undergraduates were surveyed about what they had seen or experienced during the forest workshop that they had never seen or experienced before. Their responses indicate some of the affective benefits of this outdoor experience. Besides being the first time many participants collected or identified plants and insects, this trip provided many outdoor firsts for the participants, including "almost stepping on a rattlesnake," spotting many salamanders in the forest, and seeing "so many beautifully colored" fungi (Table 5). Three participants mentioned that they had never hiked before and two cited the experience of eating on a rock with a view of the New York City skyline in the distance.

One participant summed up her new experiences:

> I had never seen the Big Dipper before. I never knew what to look for, so that was very cool. I had never seen a rattlesnake before and I saw it for the first time on one of the night hikes. I also had never been hiking before. It was awesome. I had a lot of fun, even though I was scared to death about ticks trying to give me Lyme Disease.

Another described:

> Using moonlight to walk though nature without using any kind of man-made tools; encountering a rattlesnake; many of the reptiles and fungi we came across; working together, enjoying the company, and sharing the same sleeping quarters with a group of strangers for a week.

Table 5. New experiences described by course participants (N=18)

New Experience	Times Mentioned
Collecting/Identifying Plants or Insects	9
Salamanders in the wild	8
Big Dipper	6
Rattlesnake	6
Fungi; Glowing fungi; So many varieties of mushrooms; So many beautifully colored mushrooms	4
Hiking; Climbing a mini-mountain	3
Lunch on top of a rock with the skyline in the distance	2
Green building features (geothermic cooling; composting toilets)	1
Attacking hornets	1
Blueberry bushes	1
Moonlight walk	1
Overnight with strangers	1
Strange Spiders	1

Responses indicate that urban participants can reap substantial unforeseen benefits from this type of multi-day outdoor residential program. Many of the participants had never seen the Big Dipper—easy for some to take for granted— and some had never participated in a group overnight experience. Four of the six participants who had never seen the Big Dipper were present undergraduate or recent graduates of the City College of New York, an urban commuter college. To assess whether this finding was representative of other undergraduate commuter students, 12 current undergraduate botany students were surveyed and 75% had never seen the Big Dipper. Students (N=25) in a science course for undergraduate elementary education majors were surveyed and nearly 70% of them had never seen the Big Dipper.

The Value of Plant Identification

Analyses of teacher and undergraduate student responses six months after workshop completion show that participants developed a greater connection with and appreciation for biodiversity and the outdoors.

One undergraduate student emphasized how she connected to nature outside of the City setting:

> It was an experience I will never forget, and I know so many (people) do not get the freedom to experience nature to that capacity in their day to day lives. It was so much fun, and opened my eyes to seeing all I can do with a biology degree.

Yet, the most striking responses are the teacher and undergraduate student responses that describe the empowerment they feel in having learned how to recognize, name, and even think about the local biodiversity in their urban environment.

> Everywhere I go I think I have a greater appreciation for nature. I know I don't pass a tree without thinking: What tree is that? Are the leaves alternate

> or opposite? What kinds of roots does it have? Are they deep? Are they near the surface?
>
> My education has never consisted of such an integration, but this trip has opened my eyes and I rarely walk on the sidewalk without attempting to identify the trees that have been planted.
>
> I would like to be able do this again because I learned. I am really interested in classifying trees. I've looked at trees and I was never able to remember what they were. . . I've always been plagued by not being able to identify anything around me. The trees had more of an impact on me.

STRENGTHS & CHALLENGES

One of the main strengths of the residential workshop was that participants had the opportunity to plan, execute, and analyze data from a research project while they were in a beautiful natural environment, away from the distractions of daily life. We observed, during the presentations, that each group had a different approach to the common material. This suggested to us that teachers would be likely to adapt the workshop material to suit their own needs.

Each TA remained with a particular group of teachers throughout the entire workshop, and a sense of community developed that is seldom observed at our college, where most students commute. (This was evidenced by an *ad hoc* birthday party that materialized for one of the TAs). The diverse research teams included both in-service and pre-service teachers. The teachers benefitted from the expertise of the TAs and the TAs had the opportunity to work with thoughtful and enthusiastic teachers. This experience may encourage some of the TAs to consider science teaching as a career option. Additionally, the pre-service teachers benefit from the teaching experience of engaged in-service teachers, which might lessen some of the anxieties that beginning teachers face.

The success of this workshop in creating a community of learners points to the challenge of maintaining this community after completion of the workshop. Perhaps developing a professional learning community online and a blog to share ideas on the objectives of the workshop—and on science and science teaching in general—would provide long-term growth opportunities for workshop participants.

During the workshop there were some minor conflicts over division of labor but, as might be anticipated, the greatest immediate challenges concerned lack of experience with natural environments. We did not realize until several days into the workshop that some participants didn't know how to use a trail map or follow blazes; these should have been covered during the orientation. The gravest problem arose from our attempts to make sure that participants understood how to protect themselves from potential outdoors hazards. Some became so anxiety stricken about potential mosquito or tick bites that they literally drenched themselves in repellent. The forest caretaker became agitated because, if they then touched salamanders or other amphibians, insect repellent—or even seemingly innocuous substances such as hand cream—would be absorbed through the permeable skin and kill the very animals that the Black

Rock Forest Consortium wants to protect. In the future, it would be preferable to ask participants to pre-treat their field clothing in advance, or simply to check for ticks when showering. We also discovered that, although covering both plants and arthropods made the workshop more diverse and interesting, some felt rushed by the pace. Finally, collecting plants and insect on a large scale is not always feasible in an urban environment, but photographing specimens and collecting insects indoors is a valuable alternative.

CONCLUSIONS

Findings from this study show that plant and insect identification is a promising tool for engaging an urban population in outdoor learning about biodiversity. After devoting five days to collecting, preparing and identifying tree and insect specimens, teacher participants showed substantial gains in their ability to identify tree species and insect orders. Participant comments reveal that this approach, particularly for tree identification, empowered workshop attendees to notice and recognize urban tree diversity. Although learning of local plant and insect diversity has been mostly removed from high school biology curriculum, it is a valuable device for involving urban students with the natural world in a positive manner. Greater emphasis should be placed on studying and appreciating local biodiversity in elementary and middle school classrooms, since teachers of these students may have more flexibility to bring their students outside.

This out-of-city experience was significant for all of the participants, enabling them to engage in outdoor experiences that are difficult to encounter in an urban setting. The participants were able to see the Big Dipper in the night sky, rattlesnakes, salamanders, and colorful fungi alongside trails, and hike forested mountain and valley habitats. These were first time experiences for many, vividly recalled six months after the completion of the workshop.

The new experience that was mentioned most frequently was plant and insect identification, certainly made special by the beauty of the "natural" setting, but also purposefully experienced by the participants in an urban setting after the workshop had concluded. Although large cities may not be an optimal setting for viewing the Big Dipper or off-road hiking, they are well-suited for observing and identifying local plants. Walking, a necessity for most city residents, provides ample opportunity for stopping to notice surrounding trees. For urban students, making plant identification a focal point of outdoor classroom learning moves the emphasis away from the perceived deficits of city living towards positive everyday interactions with the natural world. Plants are actually becoming easier to learn about in many urban environments, due to both local programs (such as Million TreesNYC, http://www.milliontreesnyc.org/html/educate/programs.shtml) and national programs like Rails-to-Trails, an innovative initiative to create a national system of trails along abandoned rail lines (http://www.railstotrails.org/aboutUs/index.html). Our model, in which teachers attend a residential program at a field station to learn about biodiversity in a "natural" environment, and then bring tools to observe urban biodiversity back to their classrooms, could undoubtedly be replicated in many urban settings.

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APPENDIX 1: PRE/POST ASSESSMENT

Multiple Choice

1) What features do all insects have?
    a. 2 legs and 4 body parts
    b. 4 legs and 2 body parts
    c. 6 legs and 3 body parts
    d. 8 legs and 3 body parts

Short Answer

2) Identify the insect specimens using the identification key provided.

    Insect example 1:
    (a) Order_____
    (b) Common name_____
    (c) Role in the habitat_____
    Insect example 2:
    (d) Order_____
    (e) Common name_____
    (f) Role in the habitat_____

3) Identify the plant leaf and state an interesting fact about the plant:

    Plant example 1:
    (a) Name_____
    (b) Interesting fact_____
    Plant example 2:
    (a) Name_____
    (b) Interesting fact_____

4) How likely are you to take your students outside to collect plants, animals, or measure water or soil quality? Why or why not?

APPENDIX 2 FINAL COURSE SURVEY

The Course increased my understanding of:

1. Plant identification
A. Strongly Agree B. Agree C. Neutral D. Disagree E. Strongly Disagree
Comments:

2. Plant Collection
A. Strongly Agree B. Agree C. Neutral D. Disagree E. Strongly Disagree
Comments:

3. Plant Specimen Preparation
A. Strongly Agree B. Agree C. Neutral D. Disagree E. Strongly Disagree
Comments:

4. Insect Identification
A. Strongly Agree B. Agree C. Neutral D. Disagree E. Strongly Disagree
Comments:

5. Insect Collection
A. Strongly Agree B. Agree C. Neutral D. Disagree E. Strongly Disagree
Comments:

6. Insect Specimen Preparation
A. Strongly Agree B. Agree C. Neutral D. Disagree E. Strongly Disagree
Comments:

7. This course was useful for my teaching.
A. Strongly Agree B. Agree C. Neutral D. Disagree E. Strongly Disagree
Comments:

8. It provided activities to use in my class.
A. Strongly Agree B. Agree C. Neutral D. Disagree E. Strongly Disagree
Comments:

9. It provided content to use in my class.
A. Strongly Agree B. Agree C. Neutral D. Disagree E. Strongly Disagree
Comments:

10. It increased my confidence in my knowledge of the material covered.
A. Strongly Agree B. Agree C. Neutral D. Disagree E. Strongly Disagree
Comments:

11. The specimens that I collected and prepared will be useful in my teaching.
A. Strongly Agree B. Agree C. Neutral D. Disagree E. Strongly Disagree
Comments:

12. What do you think was the most valuable thing you learned during this course?

13. What do you think was the least valuable thing you learned during this course?

14. What will you bring back to your classroom from the course?

15. How will you use the specimens you collected and prepared in your teaching?

16. How likely are you to take your students outside to collect plants, animals, or measure water or soil quality? Why or why not?

17. What do you think should be included in future versions of this workshop?

18. Which type of tools do you prefer for plant/animal identification: online web based tools, traditional field guides, or handheld apps? Please explain your answer.

19. How did spending five days in a Black Rock Forest affect your perceptions about nature?