LIKING LICHENS:

Exploring Lichen Ecology and the Environment

External Evaluation Report
Cassandra Drennon & Associates, Inc.

Submitted to:
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College of Education
University of Georgia
Athens, Georgia
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EXECUTIVE SUMMARY

The *Liking Lichens* Project is funded by Georgia’s Teacher Quality Higher Education Program Grant and is administered by the Adult Education Program at the University of Georgia’s Department of Lifelong Education, Administration, and Policy. The primary goals for Teacher Quality Higher Education Program Grants, which are an outgrowth of the federal No Child Left Behind Act, are 1) to strengthen and deepen content knowledge in science, mathematics, language arts, and social science for teachers of grades PreK-12; 2) to improve teaching practices and student learning in grades PreK-12; and 3) to identify and disseminate successful PD projects and models. The specific goals for the *Liking Lichens* project are:

- To enhance educators’ understanding of lichen biology, ecology, natural history, identification, and uses in the classroom, laboratory, and field studies
- To develop geospatial knowledge and mapping skills
- To assist in building a lichen bio-monitoring network in Georgia

The project began with a 5-day teacher workshop held July 9-13, 2006 at the Charlie Elliot Wildlife Center in Mansfield, Georgia. Conducting the workshop was a team of expert educators and researchers, led by Dr. Robert Hill, Dr. Tommy Jordan, and Mr. Sean Beeching. The 18 attendees were 10 public school teachers, (5 elementary, 4 middle school, and 1 high school), 5 environmental science specialists, a botanist with the Georgia Department of Natural Resources, a college lab instructor, and a science education doctoral student from the University of Georgia. Three follow up meetings were scheduled to support the educators during the 2006-2007 school year, as they incorporate the workshop content into their instruction, and to build the lichen bio-monitoring network.

Project administrators contracted with Cassandra Drennon & Associates, Inc. (CD&A), an educational research and evaluation firm in Athens, Georgia, to conduct an external evaluation of the 2006 *Liking Lichens* workshop. In brief, nine findings emerged from participant evaluations and focus groups held during the final day of the workshop.

**Key Findings**

- Hands-on experiences promoted learning and increased interest in lichens.
- The workshop presented the familiar in new ways.
- Lecture-style presentations were challenging.
- The need for classroom application was not met.
• Participants wanted more opportunity to process their learning.
• Instructors communicated directions clearly to participants.
• Group communication opportunities were inadequate.
• Participants were well-satisfied with the workshop location.
• Workshop activities needed more structure.

Participants learned. A comparison of pretest and posttest scores revealed knowledge gains in each of the areas covered during the workshop. All participants moved up at least one proficiency level between the pretest and posttest as indicated by the following mean scores:

<table>
<thead>
<tr>
<th>Objective</th>
<th>Pretest</th>
<th>Posttest</th>
</tr>
</thead>
<tbody>
<tr>
<td>Objective 1: Participants will demonstrate knowledge of lichen natural history.</td>
<td>1.27</td>
<td>2.36</td>
</tr>
<tr>
<td></td>
<td>Emerging</td>
<td>Proficient</td>
</tr>
<tr>
<td>Objective 2: Participants will demonstrate knowledge of lichen ecology.</td>
<td>.50</td>
<td>1.62</td>
</tr>
<tr>
<td></td>
<td>No Knowledge</td>
<td>Emerging</td>
</tr>
<tr>
<td>Objective 3: Participants will demonstrate knowledge of lichen uses.</td>
<td>1.28</td>
<td>2.58</td>
</tr>
<tr>
<td></td>
<td>Emerging</td>
<td>Proficient</td>
</tr>
<tr>
<td>Objective 4: Participants will demonstrate knowledge of GPS units.</td>
<td>1.56</td>
<td>2.19</td>
</tr>
<tr>
<td></td>
<td>Emerging</td>
<td>Proficient</td>
</tr>
</tbody>
</table>

**Key Recommendations**

Guided by thoughtful input from the participants and other data collected at the workshop, we formulated these overarching recommendations to improve future teacher workshops:

• To increase the opportunity for teachers to apply the scientific content presented in the workshop to their teaching practices, broaden the expert facilitation team to include a practicing PreK-12 teacher; a professional development specialist from a local education agency, or a faculty member from the University of Georgia who specializes in preparing PreK-12 teachers.
• Create an advisory group of previous attendees to help plan future workshops.
• Actively recruit more PreK-12 teachers to participate in the workshop, particularly from schools targeted for improvement under No Child Left Behind.
• Allow more structured opportunities during the workshop for teachers to develop materials or classroom activities that incorporate lichen content. Or, devote follow-up sessions to this purpose.
• Build more group learning experiences into the workshop.
• Hold daily debriefing sessions and adjust plans when appropriate to respond to participant concerns.
• Communicate workshop logistical details to participants well in advance of the session.
• Develop a protocol for field experiences to maximize learning.
EVALUATION DESIGN

The purpose of this external evaluation was to measure participant learning and satisfaction from the summer 2006 Liking Lichens workshop experience. The four learning objectives of the workshop were:

- Participants will demonstrate knowledge of lichen natural history.
- Participants will demonstrate knowledge of lichen ecology.
- Participants will demonstrate knowledge of lichen uses.
- Participants will demonstrate knowledge of GPS units.

To accomplish this evaluation, we collected data in three ways. First, we administered a 10-item pretest, developed by the workshop faculty, to all participants at the outset of the workshop. The test covered content in four areas represented by the learning objectives. We administered the same instrument on the last day of the workshop in the form of a posttest to measure increases in participants’ knowledge. Dr. Hill and Mr. Beeching independently assessed each participant’s knowledge on the first three sections of their pretest and posttest, using the following performance-based scoring rubric: 0 points = No Knowledge, 1 point = Emerging Knowledge, 2 points = Proficient Knowledge, and 3 points = Exemplary Knowledge. They then compared their independent ratings and negotiated or averaged the differences (which were minor) to arrive at the final scores. Dr. Jordan scored the GPS section separately, using the same scoring rubric.

Second, we administered a written evaluation to measure participant satisfaction on the workshop’s final day. The survey consisted of 23 positive statements about the workshop experience and it asked participants to indicate how strongly they agreed with each, using a 5 point scale: 1 = Strongly Disagree, 2 = Somewhat Disagree, 3 = Neutral, 4 = Somewhat Agree, and 5 = Strongly Agree. The survey was designed to capture participant levels of satisfaction in three areas – the Learning Experience, Communication, and Structure & Organization. Finally, we held focus groups, also on the workshop’s final day, to gather participant perceptions of the program's strengths and weaknesses. We divided the participants equally into two focus groups, which we held simultaneously for approximately one hour. A CD&A moderator in each group used a semi-structured interview guide to lead the discussion. Instruments used to collect and measure the data are included in the appendices at the end of this report.
FINDINGS

The *Liking Lichens* workshop overall was successful in accomplishing the project’s first two goals. In pre-and posttesting, participants demonstrated that (1) they had increased their understanding of lichen biology, ecology, natural history, and identification; and (2) they had developed adequate geospatial knowledge and mapping skills. In the focus groups, however, participants reported that they were less than confident about their ability to apply this knowledge in their educational settings.

The third goal, however, to assist in building a lichen bio-monitoring network in Georgia, did not resonate well with this group of educators, who were concerned primarily with using the lichen-study in their teaching. Aware of the instructors’ interest in the statewide plan, a participant in one focus group said, “The GPS is low on my agenda but high on theirs. We need to know how to use this in the classroom with students.” In the other focus group, someone made a similar observation, “This workshop was geared toward a long-term lichen research effort more than a classroom application.”

Participants found the workshop a very positive experience, nevertheless, and they were energized by their learning of content and technology. “In my wildest dreams, I don’t think I could have dreamed what would happen here,” declared one teacher. They found experts were always on hand when they needed them to help with identification and answer questions. Participants were also highly satisfied with the facilities at the Charlie Elliott Wildlife Center. Their primary dissatisfaction with the workshop related to the lack of time spent adapting the scientific content to the classroom, and many felt that some of the presentation material was over their heads and/or inappropriate for classroom use.

The following discussion of the findings is organized into two major sections, Workshop Experiences and Knowledge Gains.

**Workshop Experiences**

Findings about participants’ workshop experiences are based on the written Participant Evaluation survey and the focus groups. They are organized according to three broad topics: The Learning Experience, Communication, and Structure & Organization. Each of these discussions concludes with a chart showing mean scores for the section of the survey that specifically addressed the topic, and a list of participant recommendations related to the topic that came from the focus groups. This section begins with a display of the aggregate responses for each
statement in the Participant Evaluation survey by percentage (Table 1). All 18 participants answered the entire survey with the exception of one participant, who skipped three items (noted by asterisk) that did not apply to her practice.

### Aggregate Responses to Participant Evaluation Survey

N=18 except where noted (*)

<table>
<thead>
<tr>
<th>The Learning Experience</th>
<th>Strongly Disagree</th>
<th>Somewhat Disagree</th>
<th>Neutral</th>
<th>Somewhat Agree</th>
<th>Strongly Agree</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Presentations by instructors increased my interest in lichens.</td>
<td>6% (1)</td>
<td>11% (2)</td>
<td>83%</td>
<td></td>
<td></td>
</tr>
<tr>
<td>2. Field experiences with instructors increased my interest in lichens.</td>
<td></td>
<td></td>
<td></td>
<td>100% (18)</td>
<td></td>
</tr>
<tr>
<td>3. Experiences with GPS units increased my interest in using technology in future instruction related to lichens.</td>
<td></td>
<td>6% (1*)</td>
<td>12% (2*)</td>
<td>82% (14*)</td>
<td></td>
</tr>
<tr>
<td>4. Experiences with microscopes increased my interest in using technology in future instruction related to lichens.</td>
<td></td>
<td></td>
<td>12% (2*)</td>
<td>88% (15*)</td>
<td></td>
</tr>
<tr>
<td>5. Learning about GIS will be helpful to me.</td>
<td>11% (2)</td>
<td>6% (1)</td>
<td>11% (2)</td>
<td>72% (13)</td>
<td></td>
</tr>
<tr>
<td>6. The workshop provided ample resources to support my understanding of the content.</td>
<td></td>
<td></td>
<td></td>
<td>11% (2)</td>
<td>89% (16)</td>
</tr>
<tr>
<td>7. The workshop provided ample resources to assist with my instructional needs.</td>
<td>11% (2)</td>
<td></td>
<td></td>
<td>33% (6)</td>
<td>56% (10)</td>
</tr>
<tr>
<td>8. Adequate time was provided during the workshop for us to discuss how the material could be applied.</td>
<td>17% (3)</td>
<td>6% (1)</td>
<td>22% (4)</td>
<td>56% (10)</td>
<td></td>
</tr>
<tr>
<td>9. Opportunities to conduct lichen identification were adequate.</td>
<td></td>
<td></td>
<td></td>
<td>11% (2)</td>
<td>89% (16)</td>
</tr>
<tr>
<td>10. Sufficient time was allocated to learn how to use and apply the GPS unit for exercises during the workshop</td>
<td>6% (1)</td>
<td></td>
<td>17% (3)</td>
<td>78% (14)</td>
<td></td>
</tr>
</tbody>
</table>
Table 1

The Learning Experience

Finding 1: Hands-on experiences promoted learning and increased interest in lichens.

The most positive learning experiences occurred during fieldwork with instructors and in the opportunities given participants to conduct lichen identification. They said they learned best during hands-on activities, building confidence by struggling to identify samples and then being able to defend their decisions. Instructors worked alongside the learners, modeling identification procedure as they went, and participants found their enthusiasm contagious. Participants felt good after being left out in the field during the night hike to navigate their way back, using their
GPS units. All 18 participants strongly agreed that field experiences increased their interest in lichens (Figure 1).

**Finding 2: The workshop presented the familiar in new ways.**

To be cast in the learning role was eye-opening for many of the participants, who are accustomed to teaching others. One teacher said this reminded her of “what it feels like when you don’t know something…As an adult I feel some pride that I know something I didn’t know before. I know that I can go back and take certain things and work them out.” One scientist said, “I work with microscopes all the time but it’s still extremely engaging here,” and another participant commented, “We were seeing things that were always there but seeing them in a new way.” An environment education specialist said she became completely engaged when she discovered a wetlands area similar to her science center and sat down to look around. “For the first time I was able to see what I’ve always seen and know what it was,” she marveled. “I will have a good working knowledge now and will be able to share this with the kids who come to the Nature Center and use it.”

The workshop provided ample resources to support understanding of the content – 88.9% strongly agreed with this survey statement (Figure 1) – despite an initial shortage of microscopes. Participants appreciated the high quality of the resources and tools they were given and the thought that had gone into outfitting them so thoroughly for a return to their work environments.

**Finding 3: Lecture was challenging.**

In contrast to the fieldwork, participants had a difficult time with the instructional format of the first two days, when a lot of scientific information was delivered through concentrated lecture. “If I could make one suggestion, it would be less talk on the first day and more examination of lichen,” commented one participant and others agreed. Some information was over their heads; a botanist, who probably knew the material better than most, described the first day as “overwhelming.” Without visual aids, participants found themselves unable to take notes during the lectures because they didn’t know how to spell the scientific terms. Only 27.8% strongly agreed that the presentations were pitched at their level.

**Finding 4: The need for classroom application was not met.**

Teachers were concerned about whether they would be able to adapt workshop content to their classrooms and to the learning levels of their students. In both focus groups the consensus of teachers and nature center directors alike was that some workshop time should have been used to develop curriculum and lab activities for classroom use. According to one teacher:
If I start using these terms with my students they’re going to be scared to death. The only drawback that concerns me is I wish we had more time to talk about how we’re going to use this with our students. I’m real concerned that I can go back and use this. I need some things that are very concrete. I don’t want to overwhelm my middle school students.

Reflecting this concern, survey results were lowest for the following statement: “Instructors helped me connect scientific information in the workshop with the K-12 classroom or science center work.” Only 35.3% agreed strongly, while 17.6% somewhat disagreed. Along these same lines, teachers said that the level of GPS instruction was much more detailed than they needed for classroom use.

Finding 5: Participants wanted more opportunity to process their learning.

As they could have improved their own learning experiences, participants suggested that taking more time for reflection, for journaling, and for debriefing in small groups, as well as for diversion and relaxation would have helped. They found little time during the day for this; teachers in particular mentioned that they would have needed guidance or “permission” to opt out of planned activities in order to create this personal time, explaining that their normal workday is very structured and they are unaccustomed to such freedom. In retrospect, some also wished that they had done more advance preparation, such as reading ahead and studying the lab descriptions in workshop material.

Ten of the 23 statements on the Participant Evaluation Form administered on the final day of the workshop related to The Learning Experience. We determined the mean score for each statement, based on the 5 point scale then ranked them according to how strongly participants agreed with each. Figure 1 shows that participants were highly satisfied with the fieldwork and the ample opportunities provided to learn about lichens. It also highlights the area where participants’ were least satisfied. The statement, “The workshop provided ample resources to assist with my instructional needs,” received the lowest scores (a mean of 4.1), just below the statement, “Adequate time was provided to discuss how the material could be applied” (4.2).
**Figure 1**

**Participants Recommend:**

- Begin the lecture session with major concepts, supported by PowerPoint or overheads, use of the whiteboard, and vocabulary handouts.
- Share samples kit and matrix early in the process.
- Build in time for reflection, for diversion, for debriefing in small groups.
- Encourage participants to work together.
- Provide more opportunities to adapt learning to the classroom and to various grade levels, to create curriculum and lab activities and present them to the group.
- Provide the Georgia performance standards to guide the inclusion of lichen content into classroom curriculum.
- Emphasize GPS instruction that is appropriate for PreK-12 students.
- Provide enough microscopes for everyone
Communication

**Finding 6: Instructors communicated clearly with participants.**
In general, participants agreed that workshop information had been clearly communicated to them. They well-understood the goals and objectives of the workshop (88.9% strongly agreed) and the purpose of the three follow up meetings was also clear. Instructions given prior to the activities were clear (77.8% strongly agreed). They found facilitators patient and willing to repeat information no matter how often a question was asked, but they only agreed somewhat with the statement that difficult material was well-explained. This may have been due in part to the challenging nature of the lectures, as discussed previously.

**Finding 7: Group Communication Opportunities Were Inadequate**
Participants felt that many of their workshop concerns, for instance their need to talk about classroom application and some confusion about field work, could have been resolved through daily debriefing sessions. As one teacher commented, "If we had just sat down in small groups at least once a day and talked through this – the way we’re doing now – it would have made a big difference."

Five statements on the Participant Evaluation Form related to issues of communication. By ranking the mean scores for each statement according to participant agreement with them, (Figure 2) we determined that workshop leaders communicated the goals and objectives of the workshop and instructions for activities clearly, but participants sometimes considered lectures to be over their heads and they did not feel that faculty helped them sufficiently apply the content to their work.
PARTICIPANT SURVEY RESULTS: COMMUNICATION

Statements Ranked by Mean Score
N=18 (except where noted)

<table>
<thead>
<tr>
<th>Statement</th>
<th>Mean Score</th>
</tr>
</thead>
<tbody>
<tr>
<td>Instructors helped me connect scientific info in the workshop with classroom or science center work</td>
<td>3.5</td>
</tr>
<tr>
<td>Presentations by instructors were pitched at my level</td>
<td>4.3</td>
</tr>
<tr>
<td>Instructors did a good job of explaining difficult material</td>
<td>4.2</td>
</tr>
<tr>
<td>Goals &amp; objectives of workshop were clear (N=17)</td>
<td>4.6</td>
</tr>
<tr>
<td>Instructions given for activities were always clear</td>
<td>5.0</td>
</tr>
</tbody>
</table>

Figure 2

Participants Recommend:
Provide clear guidance to prepare participants for field work.
Check in with learners more frequently through daily debriefings.

Structure & Organization

Finding 8: Participants were well-satisfied with the workshop setting.
The workshop facilities, housing, and arrangements for meal breaks were considered very satisfactory (see Figure 4), and everyone praised the food. “They are very sensitive to people’s needs and need for comfort,” and “[Luanne] went way above and beyond the call to see that our needs were met,” were representative comments. They liked the classroom space, where they could leave their materials out overnight. The only concern about the facility was not having a communal gathering place where people could relax and talk about their learning in a casual setting (someone recommended rocking chairs for the veranda). After-hours time spent in the work room, participants found, invariably led them back to their microscopes rather than to
A related concern was that the chairs and tables were not supportive to leaning over the equipment for long periods of time.

**Finding 9: Workshop activities needed more structure**

Participants raised the theme of intentionality versus happenstance repeatedly, indicating the need for more structure in some areas. Some of their learning experiences, they said, would have been more effective had they been intentionally planned. Group learning, for instance, was highly valued but difficult to enact. “There were so many types of people here that you get a good balance of information from different people,” commented a participant. Nevertheless, one of the teachers, who had been using a lichen curriculum in her classroom for two years, found little opportunity to share what she had learned with others. There was no mechanism in place to share information such as the matrix that evolved during the week or to encourage participants to work in small groups or pairs.

Fieldwork was somewhat disorganized as well. “All the instructors were showing [us] things at the same time,” said a participant. “I didn’t know where to be.” The botanist in the group would have welcomed more direction on how to collect specimens before they went out into the field. “Bob would tell you if you asked him, or if you were right there,” she explained. “But it would have been better if there was a little more intentionality about it.” Several teachers said they needed more detailed information about the physical reality of fieldwork (such as clothing and hygiene), as they had no previous experience to draw on. The experience caught many off guard: “The first day we collected and came back – that day we felt, ‘I’m done. I’ve just got to stop.’ Everyone was so tired! We were doing something we had never done before for hours and hours.” By the second day they were more acclimated and better able to take care of themselves.

Although the survey indicated that participants were reasonably satisfied with the length of the sessions, we heard numerous complaints about the days being very long, lasting into the night, with few breaks for independent activity. Although the evening sessions were listed as optional, new material emerged there, and teachers did not feel that they could “skip class.” Scheduling time during the day specifically for teachers to work on curriculum development would have been helpful, they said. “It’s very important that different people work together on the lesson plans.” explained one teacher. She went on:

> There’s no way that I could use some of what we did here with my kids because they’re young. I can adapt that, but some people aren’t so good with adapting. More structure and more direction during the retreat would be beneficial. People who are good at this could work with those who aren’t as good with it.
“Trying to do that at 8:00 at night is not the way to do it,” added another teacher. They need to schedule it as an activity for the teachers.”

A final issue about the workshop’s structure and organization was that details were not formalized far enough in advance for participants to plan adequately (less than half strongly agreed that the information was timely). Participants received some basic information, such as exact time and location only a week before the workshop, and, according to one participant, some details in emails were erroneous.

The final six statements on the Participant Evaluation Form related to Structure & Organization. We determined the mean score for each of these statements, based on the 5 point scale, then ranked them according to how strongly participants agreed with each. Figure 3 reflects participants’ strong satisfaction with the facilities (a mean score of 4.8 for both location and housing) but lower levels of agreement with statements about provision of workshop information.

![PARTICIPANT SURVEY RESULTS: STRUCTURE & ORGANIZATION](image)

**Figure 3**
Participants Recommend:

- Shorten the workday; build in diversions and optional activities.
- Do field work early in the morning when weather is cool.
- Create a communal gathering space away from the work area.
- Provide appropriate furniture for long hours over the microscope.
- Send workshop information out at least two weeks in advance.
- Allow time at the three scheduled follow-up meetings for teachers to share their post-workshop experiences and to bring samples of new lichen curriculum they have developed.
- During the third follow-up session, have teachers help plan next year’s workshop.

Knowledge Gains

Findings about knowledge gained during the workshop were measured by pretesting and posttesting that was conducted at the beginning and end of the workshop. These knowledge gains were measured according to the four learning objectives – that participants would demonstrate their knowledge of (1) lichen natural history, (2) lichen ecology, (3) lichen uses, and (4) GPS units. Tables 1-4 compare pre- and posttest scores for each objective, indicating the percentage of participants scoring at each of the four levels of knowledge (1=No Knowledge, 2=Emerging, 3=Proficient, 4=Exemplary).

All 18 participants moved up at least one knowledge level in virtually every area tested (Tables 2-5). The most impressive gains occurred for Objective 2, knowledge about lichen uses. In this area 56% of the participants began with little or no knowledge, and the entire group moved up to the proficient or exemplary level by the end of the workshop. The smallest gain was for Objective 3, lichen ecology, which seemed to be the most difficult topic for participants to grasp. Only 11% got to proficiency level and none reached exemplary; and this was also the least understood area for participants prior to the workshop, considering that 89% entered with no knowledge at all. For Objectives 1 and 4 the majority of participants began the workshop with an emerging level of knowledge and ended at the proficient level.

Another way of looking at the pre- and posttest results for each learning objective was to compare mean scores for each of the 10 test questions (Figures 4-7). These comparisons emphasize the jump in knowledge that occurred in certain areas, notably lichen identification (Figure 5) and how lichens reproduce (Figure 4).
KNOWLEDGE GAINS: Percentages of participants pretesting and posttesting in each category

<table>
<thead>
<tr>
<th>% Pretested in this category</th>
<th>Objective 1: Participants will demonstrate knowledge of lichen natural history</th>
<th>% Posttested in this category</th>
</tr>
</thead>
<tbody>
<tr>
<td>17%</td>
<td>No Knowledge: The participant does not answer the question or his or her answer is wholly incorrect</td>
<td>0%</td>
</tr>
<tr>
<td>78%</td>
<td>Emerging: The participant demonstrates minimal knowledge. His/her response is partially right. It reflects, at best, a superficial understanding of the topic.</td>
<td>11%</td>
</tr>
<tr>
<td>5%</td>
<td>Proficient: The participant demonstrates satisfactory knowledge. His/her response is true/correct. Supporting details, if provided, are right for the most part. The response reflects a good basic understanding.</td>
<td>78%</td>
</tr>
<tr>
<td>0%</td>
<td>Exemplary: The participant demonstrates extensive knowledge. His/her response is correct and supporting details are extensive and accurate. The response shows an unusual depth of understanding.</td>
<td>11%</td>
</tr>
</tbody>
</table>

Table 2

<table>
<thead>
<tr>
<th>% Pretested in this category</th>
<th>Objective 2: Participants will demonstrate knowledge of lichen ecology</th>
<th>% Posttested in this category</th>
</tr>
</thead>
<tbody>
<tr>
<td>89%</td>
<td>No Knowledge: The participant does not answer the question of his or her answer is wholly incorrect</td>
<td>0</td>
</tr>
<tr>
<td>11%</td>
<td>Emerging: The participant demonstrates minimal knowledge. His/her response is partially right. It reflects, at best, a superficial understanding of the topic.</td>
<td>72%</td>
</tr>
<tr>
<td>0%</td>
<td>Proficient: The participant demonstrates satisfactory knowledge. His/her response is true/correct. Supporting details, if provided, are right for the most part. The response reflects a good basic understanding.</td>
<td>28%</td>
</tr>
<tr>
<td>0%</td>
<td>Exemplary: The participant demonstrates extensive knowledge. His/her response is correct and supporting details are extensive and accurate. The response shows an unusual depth of understanding.</td>
<td>0</td>
</tr>
</tbody>
</table>

Table 3

<table>
<thead>
<tr>
<th>% Pretested in this category</th>
<th>Objective 3: Participants will demonstrate knowledge of lichen uses</th>
<th>% Posttested in this category</th>
</tr>
</thead>
<tbody>
<tr>
<td>28%</td>
<td>No Knowledge: The participant does not answer the question of his or her answer is wholly incorrect</td>
<td>0%</td>
</tr>
<tr>
<td>28%</td>
<td>Emerging: The participant demonstrates minimal knowledge. His/her response is partially right. It reflects, at best, a superficial understanding of the topic.</td>
<td>0%</td>
</tr>
<tr>
<td>% Pretested in this category</td>
<td>Objective 4: Participants will demonstrate knowledge of GPS units</td>
<td>% Posttested in this category</td>
</tr>
<tr>
<td>------------------------------</td>
<td>---------------------------------------------------------------</td>
<td>-------------------------------</td>
</tr>
<tr>
<td>5%</td>
<td>No Knowledge: The participant does not answer the question of his or her answer is wholly incorrect</td>
<td>0%</td>
</tr>
<tr>
<td>67%</td>
<td>Emerging: The participant demonstrates minimal knowledge. His/her response is partially right. It reflects, at best, a superficial understanding of the topic.</td>
<td>33%</td>
</tr>
<tr>
<td>28%</td>
<td>Proficient: The participant demonstrates satisfactory knowledge. His/her response is true/correct. Supporting details, if provided, are right for the most part. The response reflects a good basic understanding.</td>
<td>56%</td>
</tr>
<tr>
<td>0%</td>
<td>Exemplary: The participant demonstrates extensive knowledge. His/her response is correct and supporting details are extensive and accurate. The response shows an unusual depth of understanding.</td>
<td>11%</td>
</tr>
</tbody>
</table>

Table 4

Table 5
Objective 1: Participants will demonstrate knowledge of lichen natural history

<table>
<thead>
<tr>
<th>Question</th>
<th>Pretest</th>
<th>Posttest</th>
</tr>
</thead>
<tbody>
<tr>
<td>What are lichens?</td>
<td>1.61</td>
<td>2.14</td>
</tr>
<tr>
<td>Where do lichens occur?</td>
<td>1.67</td>
<td>2.56</td>
</tr>
<tr>
<td>How do lichens reproduce?</td>
<td>0.53</td>
<td>0.53</td>
</tr>
</tbody>
</table>

Mean Scores

Objective 2: Participants will demonstrate knowledge of lichen ecology

<table>
<thead>
<tr>
<th>Question</th>
<th>Pretest</th>
<th>Posttest</th>
</tr>
</thead>
<tbody>
<tr>
<td>What ecological roles do lichens play in the environment?</td>
<td>0.53</td>
<td>0.47</td>
</tr>
<tr>
<td>What lichens can you identify and name in the field?</td>
<td>0.02</td>
<td>2.31</td>
</tr>
</tbody>
</table>

Mean Scores

Figure 4

Figure 5
Objective 3: Participants will demonstrate knowledge of lichen uses

Describe some ways that lichens are used by humans and wildlife.

Figure 6

Objective 4: Participants will demonstrate knowledge of GPS units

What is a GPS unit? How do GPS units function? What are coordinates? For what purposes are coordinates used?

Figure 7
RECOMMENDATIONS

From the perspective of their educational backgrounds, workshop participants offered a cogent list of recommendations for upcoming lichen workshops. These appear in the various sections of the findings. Based on their input and data collected from the workshop, we have assembled a group of key recommendations intended to address our own and participant concerns, and to offer improvements for other such educator enhancement workshops in the future.

Key Recommendations

• To increase the opportunity for teachers to apply the scientific content presented in the workshop to their teaching practices, broaden the expert facilitation team to include a practicing PreK-12 teacher; a professional development specialist from a local education agency, or a faculty member from the University of Georgia who specializes in preparing PreK-12 teachers.

• Create an advisory group of previous attendees to help plan future workshops.

• Actively recruit more PreK-12 teachers to participate in the workshop, particularly from schools targeted for improvement under No Child Left Behind.

• Allow more structured opportunities during the workshop for teachers to develop materials or classroom activities that incorporate lichen content. Or, devote follow-up sessions to this purpose.

• Build more group learning experiences into the workshop.

• Hold daily debriefing sessions and adjust plans when appropriate to respond to participant concerns.

• Communicate workshop logistical details to participants well in advance of the session.

• Develop a protocol for field experiences to maximize learning.

Promotion of Future Workshops

Participants suggested a number of ways to promote and expand the reach of future lichen workshops to additional educators. One concern was that minorities, particularly African American educators, were not represented. “It could be cultural,” suggested one science center director who works in an urban area, adding, “Inner city kids and teachers are just not as used to being outside… I wonder if, maybe you could show – or give a teaser – on how you could apply this. You can find lichens anywhere, even in the city.” This led to a recommendation to contact
Piedmont Park in Atlanta and coordinate with its Saturday programming for parents, teachers, and children. The educators also recommended the following promotional strategies.

- Conduct workshops, pre-conference sessions, booth, presentations at Georgia Science Teachers Association (GSTA) and Georgia Science for Youth Teachers Conference (GSYTC), in Athens next year
- Use the Environmental Educators Association network
- Post information at Nature Centers across the state.
- Attend the Outdoor Classroom Symposium in October
- Distribute workshop information through RESAs
- Use Direct Mail – Send information directly to Science Coordinator or Science Department chair at each school, rather than to school district.
- Ask previous workshop participants to spread the word.
APPENDICES

1. Focus Group Questions
2. Assessment of General Knowledge – Pre-session
3. Assessment of General Knowledge – Post-session
4. Participant Evaluation Form
5. Scoring Rubric
Liking Lichens
Focus Group Questions

CD&A is participating as an external evaluator for this workshop. Our purpose in being here with you today is to gain insights into the experience you’ve had this week and, from that, to learn how to improve the workshop for the future. To guide our report-writing, we’ll be reviewing this conversation along with the paper evaluation form you filled out this morning. For the sake of accuracy, we’d like to audiotape our conversation today. Your remarks, however, will be kept confidential (we won’t use any names) and the tapes will be destroyed once we’ve completed the evaluation report. Does anyone have any questions/concerns?

We have just a few questions, and they’re intended to encourage a conversation about your learning experience this week:

1. What was the most engaging moment of the week for you? (At what moment did you feel most involved with what was happening?)

2. What was the most distancing moment of the week for you? (At what moment did you feel least involved with what was happening?)

3. We’d like you to think for a moment about yourself as a learner this week. What could you have done differently that would have improved your learning experience?
   
   Probes:
   
   a. Did anything get in the way of your ability to learn?
   b. What could the project staff have done differently to support your learning?

4. In the future, what is the best way to reach other teachers who might be interested in this opportunity?
Assessment of General Knowledge

Liking Lichens Workshop - Summer 2006 – Pre Session

Welcome to the “Liking Lichens” workshop! Thanks for participating!
Below is a four-part assessment designed to provide the workshop facilitators with baseline information regarding participants’ general knowledge in two areas: lichens and Geographic Positioning System (GPS) units. Participants are not expected to familiar with these two areas. Please be as thorough in your responses as you can. You may use additional paper to answer the questions. Please do not provide your name or comments that could lead to personal identification.

1. Lichen Natural History
What are lichens?

Where do lichens occur?

How do lichens reproduce?

2. Lichen Ecology
What ecological roles do lichens play in the environment?

What lichens can you identify and name in the field?

3. Lichen Uses
Describe some ways that lichens are used by humans and wildlife

4. Geographic Positioning System (GPS) units
What is a GPS unit?

How do GPS units function?

What are coordinates?
For what purposes are coordinates used?

Please use other side to continue your responses.
Assessment of General Knowledge  
Liking Lichens Workshop - Summer 2006 – Post Session

Thanks for participating in the “Liking Lichens” workshop!

On the first day of the workshop, you completed this four-part assessment which was designed to provide us with base-line information regarding your general knowledge in two areas: lichens and Geographic Positioning System (GPS) units. We are asking you to resubmit this questionnaire. Please be as thorough in your responses as you can. You may use additional paper to answer the questions. Please do not provide your name or comments that could lead to personal identification.

1. Lichen Natural History
What are lichens?

Where do lichens occur?

How do lichens reproduce?

2. Lichen Ecology
What ecological roles do lichens play in the environment?

What lichens can you identify and name in the field?

3. Lichen Uses
Describe some ways that lichens are used by humans and wildlife

4. Geographic Positioning System (GPS) units
What is a GPS unit?

How do GPS units function?

What are coordinates?

For what purposes are coordinates used?

Please use this side to continue your responses.
Thank you for your participation in the workshop! We hope that this week’s experience was beneficial to you. To help us improve future workshops, please take a few moments to respond to the following questions.

Please indicate the extent to which you agree with each of the following statements.

<table>
<thead>
<tr>
<th>The Learning Experience</th>
<th>Strongly Disagree</th>
<th>Somewhat Disagree</th>
<th>Neutral</th>
<th>Somewhat Agree</th>
<th>Strongly Agree</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Presentations by instructors increased my interest in lichens.</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
</tr>
<tr>
<td>2. Field experiences with instructors increased my interest in lichens.</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
</tr>
<tr>
<td>3. Experiences with GPS units increased my interest in using technology in future instruction related to lichens.</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
</tr>
<tr>
<td>4. Experiences with microscopes increased my interest in using technology in future instruction related to lichens.</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
</tr>
<tr>
<td>5. Learning about GIS will be helpful to me.</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
</tr>
<tr>
<td>6. The workshop provided ample resources to support my understanding of the content.</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
</tr>
<tr>
<td>7. The workshop provided ample resources to assist with my instructional needs.</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
</tr>
<tr>
<td>8. Adequate time was provided during the workshop for us to discuss how the material could be applied.</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
</tr>
<tr>
<td>9. Opportunities to conduct lichen identification were adequate.</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
</tr>
<tr>
<td>10. Sufficient time was allocated to learn how to use and apply the GPS unit for exercises during the workshop.</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
</tr>
</tbody>
</table>
### Communication

<table>
<thead>
<tr>
<th></th>
<th>Strongly Disagree</th>
<th>Somewhat Disagree</th>
<th>Neutral</th>
<th>Somewhat Agree</th>
<th>Strongly Agree</th>
</tr>
</thead>
<tbody>
<tr>
<td>11. The goal(s) and objective(s) of the workshop were clear to me.</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
</tr>
<tr>
<td>12. Instructions prior to any activity were always clear.</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
</tr>
<tr>
<td>13. Presentations by instructors were pitched at my level (neither too simple nor too advanced).</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
</tr>
<tr>
<td>14. Instructors did a good job explaining difficult material.</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
</tr>
<tr>
<td>15. The instructors helped me connect the scientific information in the workshop with the K-12 classroom or science center work.</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
</tr>
<tr>
<td>16. The purpose of the next three meetings over the course of the academic year is clear.</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
</tr>
</tbody>
</table>

### Structure and Organization

<table>
<thead>
<tr>
<th></th>
<th>Strongly Disagree</th>
<th>Somewhat Disagree</th>
<th>Neutral</th>
<th>Somewhat Agree</th>
<th>Strongly Agree</th>
</tr>
</thead>
<tbody>
<tr>
<td>17. The host site (Charles Elliott Wildlife Center) provided an amenable location for a lichen workshop.</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
</tr>
<tr>
<td>18. The environment at the host site was suitable for learning.</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
</tr>
<tr>
<td>19. Housing at the host site was adequate.</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
</tr>
<tr>
<td>20. Information provided to me prior to the workshop was clear.</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
</tr>
<tr>
<td>21. Information provided to me prior to the workshop was timely.</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
</tr>
<tr>
<td>22. Adequate time was provided for the meals and breaks.</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
</tr>
<tr>
<td>23. The length of the sessions each day was about right.</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
</tr>
<tr>
<td>Objectives</td>
<td>Questions</td>
<td>No Knowledge</td>
<td>Emerging</td>
<td>Proficient</td>
<td>Exemplary</td>
</tr>
<tr>
<td>----------------------------------------------------------------------------</td>
<td>-----------------------------------------------------------------------------------------------------</td>
<td>--------------</td>
<td>---------------------------</td>
<td>----------------------------------------------</td>
<td>-----------------------------------------------------------------------------------------------------</td>
</tr>
<tr>
<td>1. Participants will demonstrate knowledge of lichen natural history.</td>
<td>A. What are lichens?</td>
<td>0 Points</td>
<td>1 Point</td>
<td>2 Points</td>
<td>3 Points</td>
</tr>
<tr>
<td></td>
<td>B. Where do lichens occur?</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>C. How do lichens reproduce?</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2. Participants will demonstrate knowledge of lichen ecology</td>
<td>A. What ecological roles do lichens play in the environment?</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>B. What lichens can you identify and name in the field?</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>3. Participants will demonstrate knowledge of lichen uses.</td>
<td>A. Describe some ways that lichens are used by humans and wildlife.</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>4. Participants will demonstrate knowledge of GPS units.</td>
<td>A. What is a GPS unit?</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>B. How do GPS units function?</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>C. What are coordinates?</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>D. For what purposes are coordinates used?</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

OBJECTIVE 1 - AVERAGE = TOTAL EARNED POINTS DIVIDED BY 3:

OBJECTIVE 2 - AVERAGE = TOTAL EARNED POINTS DIVIDED BY 2:

OBJECTIVE 3 - AVERAGE = TOTAL EARNED POINTS

OBJECTIVE 4 – AVERAGE = TOTAL EARNED POINTS DIVIDED BY 4: