PINEMAP Year 2 Interim Report 2
November 2012
Aim 5—Education

Outcomes/Impacts

Describe how Aim-level activities, results, findings, techniques, or products contribute to project-level outcomes and impacts.

Aim 5 activities contribute to project-level outcomes and impacts through educating graduate and undergraduate students, along with high school teachers and students, on climate science, forestry, and interdisciplinary research. The PINEMAP distance graduate course, *Climate and Forests*, was offered for the first time during the spring 2012 semester (January-May). The course also provides a platform for faculty to interact and better understand the variety of interdisciplinary research, education, and outreach elements within the PINEMAP project. The PINEMAP Undergraduate Internship Program was launched in May as undergraduate interns began working with paired PINEMAP graduate students at host institutions. This internship experience will be used in fall 2012 to educate public secondary school students about forest resources and climate change. Undergraduates deliver at least 10 presentations to local secondary school classes or scouting groups totaling greater than 50 presentations for fall 2012. Additionally, some teachers displayed interest in a continued partnership with the internship program for such activities. Ten activities for the Project Learning Tree/PINEMAP secondary module have been developed and reviewed by the Education Advisory Committee; three additional activities are being developed. In addition, we are developing background information for teachers and additional resources for the module, and planning a pilot educator workshop for March 2013. An online needs assessment of secondary teachers in the Southeast was completed in May, with a total of 732 respondents.

Outputs

List ***Products*** developed/completed January 2012-current (including published, in press, or in review peer-reviewed publications; other written materials such as white papers, research summaries, fact sheets, or popular press articles; audio or video products; etc.).

Aim 5 Peer-reviewed publications (January-November 2012)

Monroe, M.C. In press. Enhancing both Cooperative Extension and national environmental education resources. *Journal of Extension*.

Monroe, M.C., A. Oxarart, and R. Plate. In press. A Role for Environmental Education in Climate Change for Secondary Science Educators. *Applied Environmental Education and Communication*, Climate Change Special Edition.

Aim 5 Other publications (January-November 2012)

Monroe, M.C., A. Oxarart, and R. Plate. 2012. Understanding Southeastern Science Teachers' Interest in Climate Change Education. PINEMAP Research Summary.

Summarize ***Events/Activities*** (January 2012-current) as follows:

→ Provide a bulleted list of presentations (oral and poster) given at meetings or conferences. The format for citing presentations is as follows: Presenter(s)/Author(s). Date. Name/title of meeting/conference, location.

- Kidd, J.B., J.R. Seiler, M.C. Monroe, and S. Sriharan. 2012. The PINEMAP Intern Program: Integrating undergraduates into forest resource and climate change research and education. PINEMAP Annual Conference, May 14-16, Atlanta, GA. [Poster].
- Kidd, J.B., J.R. Seiler, M.C. Monroe, and S. Sriharan. 2012. The PINEMAP Intern Program: Integrating undergraduates into forest resource and climate change research and education. Biennial Conference on Undergraduate Education in Natural Resources, March 23-24, Fort Collins, CO. [Oral].
- Kidd, J.B., J.R. Seiler, M.C. Monroe, and S. Sriharan. 2012. The PINEMAP Intern Program: Integrating undergraduates into forest resource and climate change research and education. Ecological Society of America Annual Meeting, August 5-10, Portland, OR. [Poster].
- Fowler, S., J. Munsell and J. Seiler. 2012. High school science teachers and forestry education: How are they connected? 9th Biennial Conference in University Education in Natural Resources, March 23-24, Fort Collins, CO. [Oral].
- Fowler, S., J. Munsell, and J. Seiler. 2011. High school science teachers and forestry education: How are they connected? SAF National Convention, Nov. 2-6, Honolulu, HI. [Oral].
- Hall, S. and M. C. Monroe. 2012. Climate change education for secondary students. PINEMAP Annual Conference, May 14-16, Atlanta, GA. [Poster].
- Hall, S. and M. C. Monroe. 2012. Climate Change Education for Secondary Students. North American Association of Environmental Education (NAAEE) Research Symposium, October 9, Oakland, CA. [Poster].
- Monroe, M. C., A. Stenstrup, S. Hall, J. Li, and A. Oxarart. 2012. Climate Change and Southeastern Forests: A New PLT Secondary Module. North American Association of Environmental Education (NAAEE) Conference, October 11, Oakland, CA. [Oral].
- Oxarart, A., M. C. Monroe, S. Hall, J. Li, and A. Stenstrup. 2012. Project Learning Tree Secondary Module: Southern Forests and Climate Change. PINEMAP Annual Conference, May 14-16, Atlanta, GA. [Poster].
- Seiler, J.R., J.B. Kidd, M.C. Monroe, and S. Hall. 2012. Internship Successes and Education Research: PINEMAP's Integrating Education Projects. PINEMAP Internal Webinar Series, September 21. [Oral].

→ Provide a short narrative describing any workshops, courses, and/or trainings conducted.

Undergraduate Communication Course

A distance delivered undergraduate course, *Effective Communication Skills,* was begun in the fall 2012 semester. The course was required of interns who participated in the

past summer as PINEMAP Undergraduate Fellows and worked on a research project with graduate mentors. The course has the following objectives: learn principles of oral communication and inquiry-based education, create effective inquiry-based educational lessons regarding the role of southern pine management in climate change mitigation, present educational lessons to multiple local secondary school classrooms, learn to effectively use power point as a communication tool, and learn principles of scientific communication in the form of a poster presentation. The "heart" of the course is the delivery of ten presentations by each student to public schools and groups near their home institution.

Five of the six PINEMAP Undergraduate Fellows participated in the course. Students registered for 3 credits of independent study at their home institution. Through the semester students watched material on practical effective communication skills, listened to live lectures, and practiced their presentation to each other and the instructors. The class will be evaluated using a course evaluation tool, and students were surveyed before and after the class on speaking anxiety.

Distance Graduate Course

A distance graduate course, *Climate and Forests*, was launched in the spring of 2012. The course goals were to 1) prepare graduate students to address climate change mitigation and adaptation issues in southern pine forests; 2) facilitate greater levels of integration by encouraging students to engage in processes designed to enhance communication, cooperation, and collaboration among disciplines and across research, education, and Extension functions; and 3) build interdisciplinary research, education, and outreach capacity. Twenty-two students (16 Ph.D. and 6 M.S.) from 8 southeastern universities participated in the course, and an interdisciplinary team of 15 PINEMAP faculty members assisted with course instruction.

Students registered for 2 credits of independent study or special topics at their home institution. All course materials (readings, archived webinars, online discussion threads, and additional resources) were hosted on a course web site, the PINEMAP Education Portal. Throughout the semester, students participated in live webinars and reviewed narrated PowerPoint presentations covering topics including impact of climate change on forest ecosystems, climate model projections in the southern U.S., southern forest futures, carbon scoring and policy, Extension programming, challenges to communicating about climate, decision support system, and interdisciplinary research. In addition, students completed readings related to each topic and participated in online discussion.

Students completed two group assignments during the course. For the research assignment, students in each PINEMAP Aim group worked with a faculty member to understand their research foundations and questions. In working with fellow students and faculty in their disciplines, students learned about existing disciplinary knowledge, why research is proposed, and what questions the research is designed to answer. Student groups developed presentations to explain their Aim research to the other

students. All students reviewed other groups' presentations and answered questions during a live webinar. For the interdisciplinary outreach assignment, students worked in groups to develop an extension product (fact sheet, web site, presentation, or action plan) for a target audience (limited resource landowner, private landowner, industrial/corporate landowner, or state forest agency) on the topic of southern pine forest vulnerability to climate change or management practices to enhance forest resilience. Groups created an evaluation form, sent their product to a team of reviewers, synthesized evaluation comments, and presented a brief report on their product and what they learned from this experience.

At the conclusion of the course, students completed an online survey evaluation and offered feedback on a webinar. Twenty students completed the survey which included 14 questions (3 closed-ended and 11 open-ended). Furthermore, a discussion activity regarding the course was conducted at the 2012 annual meeting to garner additional feedback from graduate students, faculty, postdocs, and staff.

Quantitative survey responses indicate that the course did a fairly good job at facilitating learning about climate change in the Southeast and climate change mitigation and adaptation in southern pine forests. Respondents also indicated that the course did a fairly good job at instilling a better understanding of integration among the PINEMAP Aims. Students indicated that the course aided them in better understanding PINEMAP objectives and strategies, and the majority of students felt that the course content was well organized. In addition, respondents indicated that the assignments were effective mechanisms for learning about Aim research goals and about Extension product development.

Qualitative responses gathered from the survey and the annual meeting activity indicate that students enjoyed interacting, collaborating, communicating with, and getting to know other graduate students and found that the course provided a great deal of useful information. Students thoroughly enjoyed the presentations, and felt that they were very informative and that the speakers were very knowledgeable. The course could do better at promoting discussion both online prior to the webinars and also during live webinars.

Students also indicated that the workload may have been too much for a 2-credit course and that some readings could be designated as supplemental. Students and faculty indicated that there needs to be more uniformity in grading—all students should receive a letter grade and there should be a standardized system for assigning grades. Students thought the assignments were useful, but also consistently noted that distance group work is difficult and tedious; students also indicated that more detail and direction for assignment 2 would be helpful and make the assignment more useful.

Students and faculty alike overwhelmingly agree that the course should be conducted in subsequent years of the project. We will utilize the evaluation results to guide revisions to the course structure and format for a two-credit graded course; revise assignments to

provide better detail and instructions, as well as more opportunity for feedback; and review assigned readings. In addition, we will work closely with course instructors to clearly explain their role in and responsibilities with the course. We will ask instructors to be engaged in online discussion during their topic week and to develop specific points/questions to guide student discussion and input.

A draft syllabus for the second offering has been developed and faculty speakers have been secured for each week of the course. The course will be required of new PINEMAP graduate students and open to other interested students working with PINEMAP co-PIs.

PLT Activities with the Center for Precollegiate Education and Training, University of Florida

- We conducted a half-day program with 48 high school students in two Science Quest programs, a week-long residential science camp program at UF. Students explored the carbon cycle and measured carbon stored in trees at the Austin Cary Memorial Forest. This activity enabled us to pilot test two PLT activities. (July 11 and July 18, 2012)
- We worked with 90 high school students to provide basic information about climate change and to help them understand why people have different perceptions on the issue in two sessions, July 16 and 20. This enabled us to pilot test one PLT activity.

→ Provide a short narrative describing experiments or surveys conducted and/or analyzed.

Internship Survey

John Kidd and John Seiler leveraged the opportunity to survey undergraduate interns to examine intern attitudes toward research before and after a 12 week internship in PINEMAP-related research. Interns were asked to complete a pre-internship survey on their attitudes toward research. Pre-internship results will be compared with those from a post-internship survey as an attempt to detect changes in attitudes. This study will be conducted over the length of the Undergraduate Internship Program, and has a potential maximum sample size of 50 interns. To date, five of six interns voluntarily completed either pre- or post-internship surveys, and three students completed both surveys. Open-ended items from the post-test indicate that these particular students greatly value the research internship experience and gained a greater knowledge of the research process. Some respondents clarified their expected post-graduate career decisions.

High School Educators: Forest Management Survey

A web-based survey of high school science teachers in the 5 state southern Piedmont region of the United States was conducted to study their knowledge, attitudes and teaching practices with regard to forest management. A total of 1024 surveys were successfully delivered with 324 returned for an adjusted response rate of 32%. Results indicate that most teachers (82%) agree forestry should be taught in high schools and most frequently present forestry concepts in the context of ecosystem services, followed by concepts related to physical and physiological characteristics of trees. Concepts related to products,

uses, and management are taught least frequently. Variables that predict teaching frequencies for each of these three concept groups include classes taught in the last five years, environmental education program training, and childhood location in addition to attitudes toward and knowledge of forest management. Also, it was found that over half (57%) of the teachers surveyed do not take field trips to forests and less than 25% do so multiple times per year. Variables that predict whether or not teachers take forest field trips include confidence to teach forestry concepts, involvement in school natural resources related extra-curricular activities such as 4-H and Envirothon, and the presence of a forest within walking distance of the school. The most widely reported constraints to teaching forestry concepts and taking field trips to forests are mandated standards or curriculum (60%), money (40%), time (32%), mandated testing (19%), and training, interest, and infrastructure (19%).

Educator Needs Assessment

A needs assessment survey was distributed throughout the region in May 2012 to enable secondary science teachers to provide input to the PLT module. Because we asked people to forward the survey link to their lists, it is not possible to report on non-response bias. A total of 746 surveys were received; 675 of those were completed. Most respondents teach 11^{th} and 12^{th} grades (61% each); 57% teach 10^{th} graders and 48% teach 9^{th} graders. We heard from fewer middle school teachers; 16%, 21%, and 21% teach 6^{th}, 7^{th}, or 8^{th} grades, respectively.

Most respondents (77%) already cover climate change in their secondary science courses. Teachers report being most likely to teach about climate change in environmental science, earth science, biology, environmental studies, or agriculture courses. In agriculture, chemistry, and physical science courses the largest percentage of respondents do so with informal discussions. Planned lessons lasting one week or less are used by the largest percentage of respondents teaching biology, AP biology, earth science, integrated science, and marine science. Teachers use planned lessons lasting more than a week in ecology, environmental issues, environmental science, and AP environmental science classes. A large majority (82%) of the respondents are interested in continuing to cover climate change in future courses.

Many teachers believe they have a moderate understanding of the issue (46%); 24% have a detailed understanding and 28% have a basic understanding. Because some students and parents may disagree with climate change science, only 37% of the respondents are very comfortable teaching about climate change; 35% are somewhat comfortable, and 15% are neutral.

Most respondents thought the variety of teaching strategies listed on the survey were appropriate to use for teaching about climate change. The widest diversity of respondents thought presenting all perspectives as valid, even though most scientist disagree to be the most inappropriate option (36% very inappropriate and inappropriate; 41% appropriate and very appropriate). Over 85% of the respondents believe it is appropriate or very appropriate to: explain scientific uncertainty, present the rationale for how people interpret climate

change differently; discuss advantages and disadvantages of climate related policies, and discuss the history of climate change science. Just over 50% of the respondents are most interested in covering climate change impacts related to their local area (50.5%), their state (54%), and the nation (50%). Most, however, would like to cover climate change as it relates to the world (81%).

The majority of respondents (57%) prefer to incorporate a secondary module through lessons that can be inserted into several units throughout their course. Only 8% would use it as a unit lasting more than two weeks, but 30% would teach the module as a unit lasting one week or less, and 34% in a unit lasting from one to two weeks.

All of the supplemental resources will be very useful to the largest percentage of respondents with hands-on student activities (80%) and lab exercises (76%) collecting the most votes. Background information, data sets to analyze, short videos of scientists, and photographs were also very useful.

It is very important to the largest percentage of respondents for the module to help them meet the following goals:

Connecting science to students' everyday lives	80%
Emphasizing critical thinking	79%
Developing data analysis skills	65%
Emphasizing choices that affect sustainability	55%
Emphasizing systems thinking	53%
Enabling students to use technology	46%

It is fairly important to the largest percentage of respondents for the module to help them meet the following goals:

Connecting science issues with policy	46%
Building skills for working in groups	43%
Exploring career options	43%
Implementing action projects	42%
Teaching about technology	42%

Climate Change Education Strategies

Data on climate change education strategies were collected at two summer science programs, Science Quest and Student Science Training Program (SSTP). Climate change education research is needed to develop better climate change lessons so that the next generation will have the skills and knowledge to tackle this global issue. One difficulty that teachers face is the controversial nature of the issue and the different opinions people hold about the issue. The following research questions were investigated for this study:

1. Does connecting carbon lessons to climate change increase student interest and knowledge gain?
2. To what extent are student attitudes about climate change influenced by their perception of their parents' opinions of climate change?

3. Is a role play or discussion more effective at encouraging students to discuss a variety of opinions about climate change in a respectful manner?

Science Quest

Participants were rising sophomores in a summer science program. The program consisted of two different one-week sessions. All students were asked about their knowledge of carbon, attitudes about climate change, perceptions of their parents' attitudes about climate change, and demographic questions. Students were split into two treatment groups. Both groups participated in the same activities but the activities during Week 1 were nested within the context of climate change while the activities in Week 2 were not (Table 1).

Table 1.

Week 1- Activities in the Context of Climate Change (n=23)	**Week2- Activities <u>not</u> in the context of climate change (n=24)**
-Pre-test on carbon knowledge -Activities • Students move through the carbon cycle as an atom and discuss human changes to the carbon cycle • Students measure carbon in a tree, calculate their state's sequestration rate, and compare to emissions rate -Post-test -Interviews	-Pre-test on carbon knowledge -Activities • Students move through the carbon cycle as a carbon atom • Students measure carbon in a tree and calculate carbon in the forest -Post-test -Human changes to carbon cycle, state's sequestration rate compared to emissions rate -Interviews

A t-test ($p<0.05$) of the carbon knowledge questions found that there was no significant difference between the two pretests, suggesting the two treatment groups had similar initial knowledge. Among these high-achieving, science-minded students, 25% believe that climate is not currently changing and 17% believe that any change is due to mostly or all natural causes.

<u>Carbon Knowledge</u>

A t-test ($p< 0.05$) found that students in Week 1 scored significantly higher on the climate change knowledge questions on the posttest than students in Week 2, confirming that the two treatments were different. There was a significant difference between the Week 1 pretest and posttest and no significant difference between the Week 2 pretest and posttest. There was no significant difference between the posttests.

<u>Interest in Climate Change</u>

All the students except for three indicated that they felt that knowing that carbon is an important part of climate change made the activities more interesting. Of the students who

found the connection interesting many preferred the connection throughout the activities but a few students preferred the connection at the end.

Themes in Student Responses

Student responses varied on why they found the connection to climate change interesting or not; some of the themes include:

- It made the activities more relevant/personal
- It gave a better understanding of an issue that they often hear about
- It made carbon seem more important and gave meaning to the activities
- It made it more interesting because they got to find answers about climate change themselves
- It was more interesting because climate change is controversial
- More interesting because solving the problem is dependent on understanding the causes
- Not interesting because it's not relevant

Conclusion

Linking carbon activities with climate change appears to help students learn about carbon, perhaps because the content becomes more interesting, relevant, and meaningful, even for students who are less concerned about climate change. A majority of students felt that the connection to climate change should be throughout the activities.

SSTP

Participants were 42 rising juniors and seniors in a seven week summer science program. All students were asked about their knowledge of climate change, attitudes about climate change, perceptions of their parents' attitudes about climate change, and demographic questions. All students participated in a lecture on climate change evidence, solutions, and perspectives and then completed a homework assignment to examine how people can reach incorrect conclusions from factual information. Students were then separated into two treatment groups; students in group 1 participated in a role play where they adopted different climate change perspectives to discuss solutions while students in group 2 participated in a discussion about climate change solutions and were given information about different perspectives. Data was collected through pretests, posttests, open-ended surveys, and audio recordings of the role plays and discussions.

On the pretest 26 percent of these students believed that the climate is not currently changing and 15 percent believed that any change is due to mostly or all natural causes. On the posttest 15 percent of these students believed that the climate is not currently changing and 13 percent believed that any change is due to mostly or all natural causes.

Themes in Student Solutions

The most common solutions generated by students focused on:

- Improving recycling
- Lowering emissions from transportation
- Renewable energy, especially solar power

- Government incentives and mandates to decrease emissions

More unique solutions generated by students include:

- Clothes made of photosynthetic cells
- Solar powered windmills
- Tree Expansion and Program for Osmosis Treatment (TEAPOT act)
- Worldwide volunteer-led conferences on climate change

Efficacy of Role Play versus Discussion

The role play and discussion are being evaluated for their ability to encourage students to discuss the diversity of views on climate change in a respectful manner.

Milestones and Work Plan Progress

Provide a short narrative describing progress and accomplishments on the year 2 milestones and work plan tasks listed below. Please also describe any changes to the Aim 5 milestones and/or work plan.

Year 2 Milestones

→ Report of audience assessment for PLT module (November 2012).

We completed a survey of secondary science teachers in the Southeast. The information gleaned is providing justifications for the Project Learning Tree/PINEMAP module and helping us prioritize activities and resources. These results have been shared with the Education Advisory Committee and PINEMAP collaborators through a research summary, PINEMAP newsletter article, and PINEMAP internal webinar. A peer-review publication has been accepted in Applied Environmental Education and Communication's special edition on climate change.

→ Report of teachers' attitudes concerning forest management (November 2012).

A full report of this information is contained in the thesis:
Fowler, S.M. 2012. Forestry Education Attitudes and Teaching Practices Among High School Science Teachers in the Southern Piedmont. M.S.Thesis, Virginia Tech, Blacksburg, VA.

→ Report of research on climate change education strategies (November 2012).

Data were collected in July on climate change education strategies to determine whether connecting carbon lessons to climate change affects student interest and knowledge gain, whether student's attitudes about climate change are influenced by their perception of their parents' opinions of climate change, and whether a discussion or a role play is more effective in getting students to discuss the variety of opinions about climate change. The results will be used in Stephanie Hall's thesis and developed into a journal article.

→ Web-based course in multidisciplinary research for graduate students completed (May 2012, May 2013).

The first offering of the PINEMAP graduate student course occurred spring term 2012 at 8 universities for 22 students.

→ Undergraduate research internships completed (August 2012).

Six interns worked at their mentors' host universities in mid- to late-May. Interns remained at their host university through the 12 week internships. After internships concluded in early August, students returned to their home universities for the fall semester and to participate in the undergraduate *Effective Communication Skills* course.

→ Undergraduate teaching and communication distance course completed (December 2012).

The undergraduate distance-delivered course, *Effective Communication Skills*, is scheduled to be completed the second week in December. The course is on pace to meet this milestone with five of six students earning credit for completion.

Year 2 Work Plan Tasks

Undergraduate Internship Program

→ Announce winners of intern micro-grant program (April 2012).

Graduate student winners of the 6 micro-grants to host interns for summer 2012 were notified in March 2012. Official letters were attached in an email to successful applicants, and they were asked for a confirmatory response within one week.

→ Facilitate undergraduate intern transitions to host universities (April-May 2012).

Mentors and the program coordinator assisted interns with identifying and procuring suitable housing at or near host universities for their summer internship. All interns needing housing finalized arrangements by their starting dates in May.

→ Maintain the intern program web site and update as needed with information for internships and the undergraduate distance course (September-October 2012).

This task is being performed as needed by the intern program coordinator. A Frequently Asked Questions (FAQ) page was uploaded to the intern program section on the PINEMAP internet site.

→ Continue development of undergraduate teaching and communication distance course (May-July2012).

The syllabus for the undergraduate teaching and communication course was completed in June. Other course materials such as assignment handouts and class notes were finalized in August.

→ Weekly monitoring of summer 2012 undergraduate intern program participants (June-August 2012).

This task is being performed on an informal basis by the intern program coordinator. Interns are contacted every other week when timesheets are due and other weeks to schedule online meetings.

→ Monthly online meetings with interns and graduate student mentors (June-August 2012).

We had 2 monthly meeting with program participants. Interns were able to meet each other and describe their current and projected work schedules. The program director provided additional detail about the fall distance course and how the internship fits into that half of the intern program.

→ Finalize undergraduate teaching and communication distance course syllabus (August 2012).

The final version of the undergraduate teaching and communication distance course syllabus was completed in June. The course is titled *Effective Communication Skills*. During the first half of the course, student interns learn public speaking skills in conjunction with some basic principles of science education. Concurrently, students identify learning content standards around which to develop their oral presentations to school students. The second half of the course requires interns to deliver their presentations, write scientific abstracts, and create professional quality scientific poster and oral presentations. These abstracts and presentations focus on work conducted and data collected during the summer internship.

→ Recruit secondary school teachers, 4H and Scout leaders, and introduce undergraduate intern teaching activities (June-October 2012).

More than 342 public secondary school science and agriculture teachers within three hours of interns' universities were contacted. From this group, 32 teachers inquired about how to schedule students for school visits. Teachers are currently scheduling visits with interns.

→ Conduct undergraduate communication and teaching distance course on education (August 2012).

The undergraduate course, *Effective Communication Skills*, operating as part of the internship program began on September 5. Five of six interns have completed the first part of the course that focused on public presentation skills. Students each developed a 50 minute presentation that conveys PINEMAP's goals and focuses on specific work, within the broader context of climate change, each intern conducted over the summer internship. Interns began presenting their lessons to public secondary school students during the second week of November.

→ Promote 2013 summer undergraduate internship program (November 2012-February 2013).

Materials for the 2013 internship program are currently being updated in preparation for promotion in late November. Furthermore, we have decided to change the titles of participating undergraduates from "Undergraduate Interns" to "Undergraduate Fellows." This change better reflects the mission of the internship program to not only train students as undergraduate research assistants, but also to have them communicate the research to a variety of audiences.

→ Deliver inquiry-based educational presentations (October-December 2012).

Interns began site visits to nearby secondary schools and scouting groups during mid-November. Each intern is expected to deliver at least 10 presentations. Currently, 26 biology and agriculture classes and two Boy Scouts groups are scheduled for visits. Students will continue to schedule visits and deliver presentations through the first week in December.

Distance Graduate Course

→ Obtain evaluation input from students and faculty on future graduate student interactions and next course offering (January 2013).

Evaluation data were collected in April and May 2012 and the course was discussed during the annual PINEMAP meeting in Atlanta. A compilation and summary report has been shared with all instructors and the course organizing team for 2013.

→ Compile and review evaluations and student/faculty input; plan for second version of course scheduled for spring 2013 as well as future graduate student activities and interaction within PINEMAP.

An evaluation report for the spring 2012 course was compiled.

We are also exploring opportunities and mechanisms to continue to engage graduate students in interdisciplinary research and outreach activities. Specifically, we are developing a plan and process for graduate students to team up to co-author Extension fact sheets for PINEMAP. The initial plan is for student teams to start planning and discussing before the 2013 annual meeting, and at the annual meeting, we will have an activity where they will share ideas, drafts, etc. and get feedback and assistance from Aim 6 members.

→ Revise course syllabus, structure, themes, and overall goals/objectives based on evaluations and student/faculty input.

The syllabus for the spring 2013 course was developed after consideration of the evaluation feedback from the spring 2012 course.

→ Identify instruction and assignment coordinators/teams; work with instruction and assignment teams to finalize course syllabus, structure, and themes.

Completed Nov 1, 2012.

PLT Secondary Module

→ Develop and revise activities, based on advisory committee feedback (January-December 2012).

We have held 5 conference calls with the Education Advisory Committee to review activity drafts and concepts. The final call is scheduled for December 2012. In addition to the feedback gathering during the call, several committee members have emailed suggestions and comments. Ten activities have been developed and are being revised, based on Advisory Committee feedback. The table on pages 14-15 summarizes activities that will be included in the module and their stages of development.

→ Launch needs assessment with high school science teachers (May 2012).

An online needs assessment survey was launched in April 2012 with 4 email lists of teachers and 9 contacts who forwarded the survey link to their email lists. A total of 746 teachers completed the survey.

→ Identify experts to review activities (June-December 2012).

In progress.

→ Collect data on climate change education strategies (July 2012).

Data were collected in July at two summer science camps hosted by the Center for Precollegiate Education and Training, University of Florida. Both quantitative and qualitative data were collected, including pretests, posttests, interviews, and discussions. Data indicate that connecting carbon lessons to climate change increases student knowledge gain. Based on student interview responses, climate change increases student interest by making the lessons more relevant and important. There is a correlation between students' attitudes about climate change and their perception of their parents' opinions.

→ Develop supplemental resources (videos, web site, etc.) (July 2012-April 2013).

In progress.

→ Needs assessment findings report (November 2012).

Two publications have been produced:

1) A white paper research summary that has been shared with the Education Advisory Committee and PINEMAP collaborators.
2) A peer-review publication for Applied Environmental Education and Communication's special edition on climate change (accepted Nov 13, 2013).

→ Research report on climate change education strategies (November 2012).

Stephanie Hall (UF) is analyzing data for her thesis and a journal article – in progress.

→ Begin plans for formative evaluation (December 2012).

In progress. Christine (Jie) Li (UF) is developing a plan for the evaluation as part of a fall course and will finalize the plan with input from the Advisory Committee.

Broad Impacts & External Collaborations

Provide a short narrative describing broad impacts (i.e., far-reaching and possibly unanticipated outcomes resulting from Aim work, including contacts/collaborations with entities outside of PINEMAP).

The needs assessment with high school teachers has generated interest in pilot testing the new climate change activities. We have a list of 29 volunteers who have expressed interest in the materials.

Drafts of PLT secondary module activities have been the focus of two teleconference meetings for a professional development group, the Climate Change Education Professional Learning Community. The team received educator feedback on two activities, and these activities prompted group discussion regarding "What can/should our lessons do to educate about climate change?"

The PINEMAP graduate students have expressed interest in taking additional courses offered at other universities within the project, which could challenge our institutions to allow an "exchange student" option to federally-funded multi-institution students on assistantships. Students have also offered to assist incoming graduate students with course assignments, building a more cohesive network of students.

Dr. Shobha Sriharan of Virginia State University, in collaboration with researchers from Morgan State University and Elizabeth City State University, developed a public school/university lead natural resource field trip to areas near Virginia State University where public school students learned how to use GPS, collect water samples and identified trees and wildlife. This trip was lead by faculty and undergraduate students at VSU. Students learned about geotagging photographs of plant and wildlife species important to ecosystems and in Back Bay Wildlife Refuge and Great Dismal Swamp. Additionally, students were introduced to two geospatial techniques: ground truthing and habitat classification from Landsat imagery.

Training

Please list undergraduate and graduate students, postdocs, and technical personnel trained under this project and include a description of their research focus and/or role in the project.

- Stephanie Hall, M.S. student, University of Florida. Stephanie is helping to develop and pilot test activities for the PLT/PINEMAP Secondary Module and conducting research on how to best introduce potentially divisive and contested concepts in secondary school curricula.
- John Kidd, Undergraduate Intern Program Coordinator, Virginia Tech. John is developing the selection criteria, matching students, awarding proposals, developing the fall course, and working with local teachers to set up school presentations for the Undergraduate Internship Program.
- Annie Oxarart, Environmental Education Program Coordinator, University of Florida. Annie is working on the development of the PLT/PINEMAP Secondary Module, including

assisting with the needs assessment, development and pilot testing of activities, and oversight of the Education Advisory Committee.

- Richard Plate, Postdoctoral Associate, University of Florida. Dr. Plate is assisting with the development and evaluation of activities for the PLT/PINEMAP Secondary Module and analyzing needs assessment data.
- Paul Decker, Undergraduate Intern from Virginia Tech. Paul is working with Stephanie Hall at the University of Florida to investigate how to teach high school students about controversial topics such as climate change.
- Christine Jie Li, Ph.D student, University of Florida. Christine is helping revise and develop activities for the PLT/PINEMAP Secondary Module and will play a large role in the designing and implementing the formative evaluation plan.
- An entire class of 23 UG and G students enrolled in Environmental Education Program Development provided initial ideas for the PLT module activities and needs assessment in Fall 2011.

Collaborations and "integrated" knowledge developed

Provide a short narrative describing new ideas, research questions, or insights that have arisen through work and discussions with colleagues, stakeholders, and others. In addition, explain the extent to which you intend to incorporate this into PINEMAP milestones and/or your Aim work plan.

Stephanie Hall: Challenges to the science education about controversial issues; addressing misconceptions to allow learners to accommodate new information.
Martha Monroe: Engaging environmental educators in climate change education – an area previously held by earth science educators because of a focus on climate science rather than impacts of change.
Christine Li: Assessing interest in climate change based on and hopefulness and relevance of solutions; teacher self-efficacy for teaching about climate; student self-efficacy for participating in climate change solutions.
John Kidd: The influence of the UG Fellows program on career aspirations, speaking confidence, and understanding of science.

Needs from/linkages to other Aim groups

→ Provide a bulleted list outlining research results, data, products, or assistance that your Aim group needs from another Aim group.

- Reviewers of activities (now)
- Designers/developers of activities (past)
- Instructors for graduate course (past)
- Graduate students to apply for interns (now)

→ Provide a bulleted list outlining research results, data, or products that your Aim group has compiled that have value or relevance to another Aim group (and note which Aim group).

Aim 6 could use information about how we are communicating climate change information to youth leaders.

→ List any additional potential linkages to other Aim groups.

Leveraged funding/additional resources

Describe how PINEMAP funds were leveraged as well as any additional resources obtained. Please list amounts and sources.

Funding for Wendy-Lin to help PINEMAP from McIntyre Stennis (goes in Admin I imagine)
UF CALS Matching Assistantship for Stephanie Hall ($8,000 in 2011 and 2012)
UF CALS Alumni Fellowship for Jie Li ($22,000 per year for 4 years)
Stapp Scholarhip for Stephanie Hall to attend NAAEE conference ($350 in 2012)
Stapp Scholarhip for Christine Li to attend NAAEE conference ($350 in 2012)

PLT-PINEMAP Secondary Module Activities

Section 1: Climate Change and Forests **Projected climate changes will likely affect forest ecosystems.**			
Activity		**Summary**	**Status**
1	Clearing the Air	Students learn about the scientific evidence supporting climate change, use this information to evaluate and improve different climate change conclusions, and participate in a role-play to negotiate solutions. Through this activity, students explore the nature of science and the various perspectives surrounding climate change.	Drafted, Reviewed by Advisory Committee Pilot tested in July Reviewed by Climate Change Education PLC In revision
2	The Changing Forests	In small groups, students learn about research that is exploring climate change impacts on southeastern forests. This information will help forest managers monitor and respond to changes using new tools and management techniques.	Drafted, Reviewed by Advisory Committee
3	Atlas of Change	By using the USFS Climate Change Tree and Bird Atlas, students will explore the effects of climate change on the future distributions of tree and bird species.	Drafted, Reviewed by Advisory Committee Finalizing Part 2 (Bird Atlas)
Section 2: Forest Management and Adaptation **Forests can be managed to thrive in a changing climate.**			
Activity		**Summary**	**Status**
4	Managing Forests for Change	Student teams learn from forest management case studies in the Southeast and then predict and diagram what might happen to each forest given projected climate changes, potential forest disturbances, and management strategies.	Drafted, Reviewed by Advisory Committee In revision
5	Mapping Seed Sources	In Part A of this activity, students will "map" rainfall, growth rates, and fusiform rust outbreaks to discover patterns controlled by genes in two distinct metapopulations of loblolly pine. In part B, students predict how different genotypes would perform (survival and growth rates) at each location, given climate projections.	Concept reviewed by Advisory Committee In revision
Section 3: Carbon Sequestration **Forests can be managed to reduce atmospheric greenhouse gas and to prevent greenhouse gas emissions.**			
Activity		**Summary**	**Status**
6	Carbon on the Move	By becoming a carbon atom, students learn how carbon cycles through biological and physical systems. Group work and class discussions allow students to better understand global carbon pools, quantities, fluxes, and residence time—with an emphasis on how human activities can affect the cycle.	Drafted, Reviewed by Advisory Committee Pilot tested in July

7	Counting the Carbon	Students measure trees in their schoolyard or in a nearby forest and calculate the amount of carbon stored in individual trees. Students then compare carbon sequestration potential for land-use types in their state, and put this in perspective by comparing it to the amount of carbon released by human activities.	Drafted, Reviewed by Advisory Committee Pilot tested in July
Section 4: Life Cycle Assessment **Consumer choices can play a role in reducing and preventing carbon emissions.**			
Activity		**Summary**	**Status**
8	The Real Cost: Shopping for Externalities	Through a simulated shopping activity students will learn about the impact of their consumer choices on the environment. They will explore questions such as: What are the hidden costs of everyday items? What environmental factors could be used to compare products?	Drafted, Reviewed by Advisory Committee
9	Adventures in Life Cycle Assessment	Students investigate the life cycle of three types of outdoor lawn furniture (plastic resin, cast aluminum, and pine) and make conclusions regarding their relative impact on global climate change. The information necessary to perform the assessment is provided in two formats: 1) a three-act stage play and 2) student presentations.	Drafted, Reviewed by Advisory Committee Reviewed by Climate Change Education PLC In revision Part B: Create Your Own Life Cycle Assessment
10	Life Cycle Assessment Debate	After a debate where students compare products, students develop a set of life cycle questions that can be used to guide consumer choices.	Drafted, Reviewed by Advisory Committee
Section 5: Putting it Together			
Activity		**Summary**	**Status**
11	Carbon Storage and Wood Products	Using a group activity, students assess a series of facts to understand how to manage forests to maximize the removal of atmospheric carbon.	In development
12	Planning for the Future of Forests	Student teams review what they have learned in this module by compiling a report on the future of southeastern forests. Students share their knowledge with others by writing a letter to the local newspaper.	In development
13	Action Projects	Students are encouraged to think about ways to put their knowledge to work in their community through a service-learning action project	In development