

PINEMAP Year 5 Progress Report 2 December 2015 Aim 5 (Education)

This is the second Aim progress report for year 5 (covering activity from July 1, 2015-November 30, 2015). The information provided in these reports is used to track Aim-level outputs and outcomes over the course of the project and to fulfill NIFA reporting requirements.

The purpose of this report is to gather information on progress since the previous progress report in July 2015.

To streamline this process, information reported in July 2015 is provided below, so you will simply need to review and update each section as necessary.

Please return the completed report to Grace no later than December 1st.

PROGRESS SUMMARY:

Please provide 1-3 paragraph summary of key areas of progress since June 30, 2015. You might consider writing this section after completing the remaining sections.

Using feedback from the summative evaluation, workshop participants, and Project Learning Tree (PLT) coordinators and facilitators, the PLT/PINEMAP secondary module, *Southeastern Forests and Climate Change*, was revised and reprinted in October 2015. PLT coordinators from the southern states, as well as coordinators from 10 states outside the region, preordered a total of 2,600 books and expect to use these books in future workshops. Using funds from mini-grants distributed through National PLT or external funding, more than 700 educators received training or information about the module through workshops or presentations from October 1, 2014 to October 1, 2015. Some of those participants have also registered on the module website. In addition, the module website is reaching new audiences—interested individuals who can gain access to the module activities and training materials without attending an in-person event. Currently, more than 375 individuals are registered on the module website. An online survey is being conducted to assess the effectiveness of the module. Website users, workshop participants, and all individuals who received a module by mail are being asked to complete the survey. The summative evaluation with 32 teachers from 10 states in the region was completed in June. Data from more than 1,200 students was collected and is being analyzed regarding changes in student knowledge, hope, and systems thinking skills. Additional research activities in systems thinking and a literature review of climate change education are in progress.

The undergraduate fellowship program during summer 2015 included 14 mentor researchers and 15 undergraduate students from across the eastern United States, California, and Quebec. Eleven of these undergraduates are currently participating in the distance education course and began delivering presentations to public secondary school students and groups in October. Three undergraduates will participate in another offering of the distance education course during spring 2016 to complete their fellowships. The number of presentations is estimated at a similar level as the last cohort of 12 undergraduates, who gave 81 presentations and reached a total of 1,518

students. Research and evaluation on this program is in progress, with a research plan approved and data collection documents in development.

OUTCOMES/IMPACTS

Outcomes and **Impacts** are tangible results for stakeholders and society that the project has produced to advance on the societal challenge (e.g., *changes in knowledge, actions, or conditions* that result from project activities). Outcomes and impacts are similar, but impacts are typically longer-term; outcomes are used as a nearer-term proxy for impacts.

Describe how Aim-level activities, results, findings, techniques, or products contribute to project-level outcomes and impacts (e.g., changes in knowledge, actions, or conditions resulting from activities).

*A narrative has been drafted below. Please **modify or update** as necessary.*

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 Undergraduate Fellowship Program's fourth year began in May 2015 and had 14 undergraduates participating in research at 8 institutions. To date, the PINEMAP Undergraduate Fellowship Program included 44 undergraduates, 24 graduate and post-doctoral researcher mentors, 63 public secondary schools or clubs, 101 individual secondary school teachers, and 5,207 secondary school students. The 2014 cohort in PINEMAP undergraduate course titled Effective Communication Skills delivered 81 presentations on forest resources at 24 secondary schools in the southeastern US and reached a total of 1,518 students. This course is currently offered a fourth time in fall 2015. Ten undergraduate fellows who finished their summer internships are on track to complete the course in December, and the remaining four fellows from the 2015 cohort will take the course during spring 2016.

The Project Learning Tree/PINEMAP secondary module, *Southeastern Forests and Climate Change*, was completed in 2014, with input from more than 140 people who helped with the module development through writing and reviewing activities, or participating in the advisory committee, expert content review, or pilot test. Using PLT's network of state coordinators, facilitators, and educators in the Southeast, a total of 94 people were trained at three regional workshops held in North Carolina, Arkansas, and Florida. These "train-the-trainer" workshops introduced the module to 12 state coordinators, 46 facilitators, and 36 educators. More than 2,700 books were distributed to PLT state coordinators, workshop facilitators, and educators throughout the Southeast. The module website, which provides online access to all the activities and supplemental materials, currently has more than 375 registered website users. Mini-grants provided to 11 states through National PLT have helped state coordinators train educators at workshops, create facilitator kits with workshop supplies, and correlate the module to state learning standards. More than 700 educators have received the module through workshops or presentations held in their state. A summative evaluation with 32 teachers from 10 states was recently completed. Data from more than 1,200 students are being analyzed regarding changes in knowledge, hope, and systems thinking skills. The module was revised using feedback from the summative evaluation participants, workshop participants, and state PLT coordinators and facilitators. The 2nd edition of the module is now complete, and we have distributed 2,600 books to fill requests from PLT coordinators across the nation. An online survey for all individuals who

have received a module is underway. The survey is being distributed in three phases (October 2015, January 2016, and May 2016), dependent upon when people received the module.

OUTPUTS

Outputs are activities, events, services, and products that reach people.

Products

Products include published or in press peer-reviewed publications; other written materials such as white papers, research summaries, fact sheets, or popular press articles; audio or video products; etc.

The lists below summarize products reported in the July 2015 Progress Report (March 1, 2015-June 30, 2015)

Please update as necessary (including in press publications that are now published) and highlight in yellow any new products added to the list for the December 2015 Progress Report.

Peer-reviewed publications

Monroe, M.C., R.R. Plate, L. Colley. 2015. Assessing an Introduction to Systems Thinking. *Natural Sciences Education*, 44(1): 11-17.

ACCEPTED: Bowers, A. W., M. C. Monroe, and D. C. Adams. Finding the common ground of climate change, *Environmental Communication*. RENC-2015-0114.R1.

In review: Monroe, M.C., S. Hall, C. J. Li. Can climate change enhance biology lesson? A quasi-experiment. *Applied Environmental Education and Communication*.

In press: Munsell, J.F., McCabe, S. and J.R. Seiler. Forestry Education in US Southern Piedmont High School Science Classes. *Journal of Forestry*.

Theses/Dissertations

None reported for March – June 2015

Other publications

None reported for March – June 2015

Tseng, Y-C, Li, C.J., Monroe, M.C. When forests encounter climate change: An introduction of PINEMAP project and Southeastern Forests and Climate Change module. *Taiwan Forestry Journal*, 41(5), 3-9.

Kunkle, K. and Monroe, M.C. 2015. Cultural Cognition and Educator Engagement in Climate Change. PINEMAP Research Summary.

Monroe, M. C., & Oxarart, A. (Eds.). (2015). Southeastern forests and climate change: A Project Learning Tree secondary environmental education module (2nd ed.). Gainesville, FL: University of Florida and American Forest Foundation.

In production: Monroe, M.C. and C. J. Li. 2016. Evaluation techniques that improve programs, in Monroe, M.C. and M. E. Krasny. *Across the Spectrum: Resources for Environmental*

Educators. Washington DC: North American Association for Environmental Education.
<http://naaee.net/publications/acrossthespectrum>

Audio/video products

None reported for March – June 2015

Barron, S. (Producer). 2015. A PINEMAP Production: Video 1: Trees and People. Video from the PINEMAP Undergraduate Fellowship Course: Effective Communication Skills.

<https://youtu.be/bO5EpQZqoKY>.

Events/Activities

Events/activities include presentations (oral and poster) given at meetings or conferences; workshops/trainings/courses conducted; and experiments/surveys/data collection conducted.

The table(s) below summarize products reported in July 2015 Progress Report (March 1, 2015- June 30, 2015)

Please update as necessary and highlight in yellow any new products added to the list for the December 2015 Progress Report.

Presentations

Author(s)/Presenter(s)	Title	Type	Date	Venue/Location
Monroe, M. Ardoin, N	Measuring Our Impact: Environmental and Sustainable Literacy	Presentation	Feb 6, 2015	Green Building Coalition Meeting to establish goals to measure impact, Washington DC
Bryce Forrester, Lori Haynes	Introduction to Southeastern Forests and Climate Change	Presentation	March 21, 2015	League of Environmental Educators in Florida 2015 Conference, Venus, Florida
Ritchie, T. and M. Monroe	Methods for Measuring Systems Thinking in High School Students	Poster	April 10, 2015	SFRC Graduate Student Symposium University of Florida Gainesville, FL
Li, J. and M. Monroe	Understanding, Measuring and Cultivating Hope about Climate Change	Oral Presentation	April 10, 2015	SFRC Graduate Student Symposium University of Florida Gainesville, FL
Kunkle, K. and M. Monroe	Cultural Cognition and Climate Change Education: Why Consensus is Not Enough	Oral Presentation	April 10, 2015	SFRC Graduate Student Symposium University of Florida Gainesville, FL
Oxarart, Monroe, Ritchie, Li, Kunkle	Linking Educators and Students to Forests in a Changing Climate	Poster	June 3, 2015	PINEMAP Annual Meeting, Athens GA
Ritchie, T. and M. Monroe	Methods for Measuring Systems Thinking Skills of High School Students	Poster	June 3-4, 2015	PINEMAP Annual Meeting Athens, GA
Li, J. and M. Monroe	Understanding, Measuring and Cultivating Hope about Climate Change among High School Students	Poster	June 3-4, 2015	PINEMAP Annual Meeting Athens, GA
Kunkle, K. and M. Monroe	Cultural Cognition and Climate Change Education: Why Consensus is Not Enough	Poster	June 3-4, 2015	PINEMAP Annual Meeting Athens, GA

Author(s)/Presenter(s)	Title	Type	Date	Venue/Location
Monroe, M and Stallard, J	How PLT Supports STEM Instruction and Systems Thinking	Presentation	June 11, 2015	Project Learning Tree Annual Conference, Saratoga Springs NY
Monroe, M., Oxarart, A., Ritchie, T., Li, J., Kunkle, K.	Using Climate Change Curriculum to Improve Systems Thinking and Hope	Poster	July 2, 2015	World Environmental Education Congress, Gothenberg Sweden
Monroe, M.	Framing Science-based Issues for Community Discussions	Presentation	July 15, 2015	Kettering Foundation, Dayton OH
Nancy Peterson	Southeastern Forests and Climate Change	Presentation	May 29, 2015	FL PLT Facilitator Meeting Thonotosassa, FL
Lisa Deaton	Southeastern Forests and Climate Change (follow-up to presentation in previous year)	Presentation	May 29, 2015	Spring Meeting for Virginia Science Education Leadership Association - Natural Bridge, VA
Boby, L., Lin, W., Kidd, J., McElligott, K., Ritchie, T., and Russell, E.	Panel Discussion on Graduate School	Panel Presentation	August 21, 2015	PINEMAP Undergraduate Fellowship Program Meeting, Blacksburg, VA
Nancy Peterson	Southeastern Forests and Climate Change	Presentation	September 23, 2015	Florida PLT Steering Committee Meeting, FL
Martha Monroe	What's Important to Measure? 2015 Connecting Kids to Nature – Disney's Next Steps	Presentation	September 28, 2015	Disney, Orlando FL
Kunkle, K. and M. Monroe	Integrating Motivated Reasoning into Climate Change Education	Poster	October 13, 2015	NAAEE Research Symposium, San Diego CA
Li, J. and M. Monroe	Effective Climate Change Education: Making Hope Happen	Poster	October 13, 2015	NAAEE Research Symposium, San Diego CA
Ritchie, T. and M. Monroe	Measuring Systems Thinking Skills	Poster	October 13, 2015	NAAEE Research Symposium, San Diego CA
Monroe, M., Ritchie, T., Tseng, Yu-Chi	Teaching Systems Thinking Skills	Presentation	October 17, 2015	NAAEE Conference, San Diego CA
Monroe, Martha	Encouraging conservation behavior with well-designed programs	Presentation	October 19, 2015	Informal Learning Symposium, San Diego Zoo Global
Monroe, M., and Li, C.	Measuring hope: Make a difference in climate change programs and evaluate it!	Webinar	November 5, 2015	ANREP Climate Science Initiative Webinar
Tseng, Y-C., Li, C. & Monroe, M.	An introduction of PINEMAP and Southeastern Forests and Climate Change Module in U.S.	Presentation	November 14, 2015	International Conference and Eastern Asia Forum for Environmental Education, Hualien, Taiwan
Monroe, M. C.	Communicating Science During Controversy	Webinar	December 18, 2015	Livestock and Poultry Environmental Learning Center

Trainings, workshops, and courses

Marcia Bisnett	Southeastern Forests and Climate Change	Educator Workshop	October 11, 2014	Miami, Florida
Maria McDaniel	Southeastern Forests and Climate Change	Educator Workshop	January 27, 2015	A Time for Science Grifton, North Carolina
Jan Forrest Kent, Lauren Johnson	Southeastern Forests and Climate Change	Educator Workshop	February 5, 2015	Georgia Science Teachers Conference, Macon, GA
Karen Hargrove, Bonnie	Southeastern Forests and	Educator Workshop	March 14, 2015	Nashville, Tennessee

Ervin, Cindi Smith-Walters, Dave Walters	Climate Change			
Jan Forrest Kent, Lauren Johnson	Southeastern Forests and Climate Change	Educator Workshop	March 21, 2015	Environmental Education Alliance of Georgia Conference Eatonton, GA
Lori Nicholson	Southeastern Forests and Climate Change	Educator Workshop	April 11, 2015	St. Marks National Wildlife Refuge St. Marks, Florida
John Guyton, Harold Anderson	Southeastern Forests and Climate Change	Educator Workshop	April 16, 2015	Delta State University, Cleveland, Mississippi
Ellen Powell and Bill Worrell	Southeastern Forests and Climate Change	Educator Workshop	April 16, 2015	2015 VA Forestry Summit, Charlottesville, Virginia
Jennifer Hubbard-Sanchez, William Bennett, Henriette Sheffel	Southeastern Forests and Climate Change	Educator Workshop	April 24, 2015	Buckley Wildlife Sanctuary, Frankfort, Kentucky
Hannah Thompson-Welch	Southeastern Forests and Climate Change	Educator Workshop	May 11, 2015	Granville County Expo and Convention Center, Oxford NC
Jennifer Hubbard-Sanchez and Laura Duffey	Southeastern Forests and Climate Change: PLT Secondary EE Module Overview and Adaptations for Other Regions	Educator Workshop	June 16, 2015	2015 Summer Institute for Climate Change Education Apple Valley, Minnesota
Bonnie Ervin	Educator Workshop	Educator Workshop	June 18, 2015	Teacher's Forest Conservation Workshop, Knoxville, Tennessee
Martha Monroe	Teaching about Climate Change	Educator Workshop	July 21, 2015	Teacher Summer Science Institute, Center for Precollegiate Education and Training, University of Florida
Kim Garret, Alisa Wickliff	Southeastern Forests and Climate Change	Educator Workshop	November 20, 2015	Reedy Creek Park and Nature Preserve Charlotte, NC
Carla Rapp, Deb Breedlove	Facilitator Training	Educator Workshop	March 5, 2015	Gwinnett Environmental and Heritage Center Buford, GA
Gail Westcot, Sarah Donnell	Southeastern Forests and Climate Change	Educator Workshop	March 7, 2015	Savannah National Wildlife Refuge Hardeeville, SC
Gail Westcot	Southeastern Forests and Climate Change	Educator Workshop	April 25, 2015	Mary Kahrs Warnell Forest Education Center Guyton, GA
Stephanie Kolok, Russell Hubright, Matt, Schnabel	SC PLT Facilitator Reunion and Refresher	Facilitator Workshop	May 29, 2015	Columbia, SC
Meachem Harlow and Baxter Rowley	South Teachers Conservation Workshop	Educator Workshop	June 12, 2015	Jones County Jr. College Ellisville, MS
Harold Anderson	Pre-service Weeklong Training	Educator Workshop	June 17, 2015	William Carey University / Hattiesburg, MS
Ashley Hoffman	KY PLT Facilitator Retreat	Facilitator Workshop	June 22, 2015	Falls of Rough, KY
Jennifer Hubbard-Sanchez, Moris Painter	Southeastern Forests and Climate Change	Educator Workshop	June 23, 2015	Jamestown, KY
Harold Anderson	Teachers Conservation Workshop	Educator Workshop	June 26, 2015	Booneville, MS

Lisa Deaton and Kari Abbott	VA PLT Facilitator Meeting	Facilitator Workshop	July 15, 2015	Providence Forge, VA
Harold Anderson	Southeastern Forests and Climate Change	Educator Workshop	July 25, 2015	Crosby Arboretum Picayune, MS
Lisa Deaton and Kari Abbott	Biology II / Ecology Institute	Educator Workshop	July 29, 2015	Providence Forge, VA
Lauren Johnson, Jan Kent	Southeastern Forests and Climate Change	Educator Workshop	August 11, 2015	GA
Robert Raze	Eco Teacher Training Camp	Educator Workshop	July 27, 2015	Brooker Creek Nature Preserve, Tarpon Springs FL
Brian Elkins	Southeastern Forests and Climate Change	Educator Workshop	August 10, 2015	Solid Waste Authority Education Center, West Palm Beach FL
Carla Rapp	Southeastern Forests and Climate Change	Educator Workshop	August 28, 2015	GA
Ellen Powell	Southeastern Forests and Climate Change	Educator Workshop	August 30, 2015	Virginia Master Naturalist Conference – Eastern, Wakefield, VA
Jennifer Hubbard-Sanchez and William Bennett	Southeastern Forests and Climate Change	Educator Workshop	September 11, 2015	KY Association for EE Annual Conference, Prestonsburg, VA
Jennifer Hubbard-Sanchez, William Bennett, Ashley Hoffman	Southeastern Forests and Climate Change	Educator Workshop	September 27, 2015	TEEA/SEEA Annual Conference, Burns, TN
Martha Monroe	Introduction to Environmental Communication	Online Lecture	Recorded October 2015 for delivery Spring 2016	Global Online Environmental Education Course, Cornell University
Martha Monroe	Adaptive Management and Collaborative Adaptive Management	Online Lecture	Recorded October 2015 for delivery Spring 2016	Global Online Environmental Education Course, Cornell University

Experiments, surveys, and data collection

Please limit summaries to one **brief paragraph for each item. I have color coded entries from **March – June 2015 blue** and preserved older entries (though color coded grey)

Undergraduate Fellowship Program Attitudes Survey

The objective of this survey research is to identify changes in undergraduate student attitudes toward research as a result of participating in a full time summer research internship. Three cohorts of students (n = 30) have come through the PINEMAP Undergraduate Fellowship Program from 2012-2014. The survey was presented in a pre- and post-experience format, and it consisted of 24 Likert-type items (1 represented “strongly disagree” and 5 represented “strongly agree”) that integrated 17 items from the “Attitudes Toward Research” (ATR) Scale and 7 scientific-method oriented items. Responses for both surveys were completed by 21 students. From these 21 respondents, 14% were upcoming sophomores, 29% were juniors, 48% were seniors, and 9% were returning seniors. Females (52%) were the majority of respondents. Minorities comprised 34% of the sample with 10% of respondents not reporting a racial background and 56% identifying as White or Caucasian. Approximately 62% of respondents had no previous undergraduate research experience. A Wilcoxon signed-rank analysis of data from 2012-2014 cohorts identified no significant differences for each factor (research use, negative attributes of research, positive attributes of research, and research understanding).

Undergraduate Personal Report on Public Speaking Anxiety

As a metric of evaluating the process of developing and presenting lessons during undergraduates' participation in the PINEMAP undergraduate course, *Effective Communication Skills*, we implemented a 34 item survey on public speaking anxiety in a pretest-posttest format. Twenty seven fellows have participated in the course during years 2012-2014. Of these, 18 students completed both pretest and posttest. A paired t-test of anxiety scores indicated that student anxiety significantly decreased by an average 14.6 points ($t(17) = -4.204, p < 0.001$). Data from the current, fourth cohort will be incorporated into the final report.

Formative Evaluation

To test the usefulness and effectiveness of the secondary module, Southeastern Forests and Climate Change, the team conducted a formative evaluation during fall 2013 to answer questions about how teachers perceive the module and how the activities can be improved. From the 123 applicants, 64 teachers were accepted to represent regional and grade-level diversity. Twenty-eight teachers (46.4% high schools and 53.6% middle school) agreed to use two activities and complete the online teacher evaluation form. Thirty-six high school teachers agreed to use four activities, complete the online teacher evaluation form, and involve their students in pre- and post-activity surveys. Forty-four pilot testers completed their evaluation forms by January 24, 2014, and about half (53%) of the teachers used the activities in environmental science and advanced placement (AP) environmental science classes. Participating teachers were from Florida (45%), Kentucky (16%), Virginia (14%), Arkansas (11%), North Carolina (9%), and Georgia (5%). The team obtained excellent and useful feedback from these teachers and their students which enabled us to make systematic revisions to the module (e.g., adding modifications for younger students) and editing the activities to increase clarity. We also added systems thinking connections to each activity to increase visibility for this important skill. Experts reviewed all changes to the materials to assure that no misconceptions were introduced in the revision process.

Hope Research

We developed a 14-item hope scale and administered the pre- and post- survey between September 2013 and January 2014. High school students ($n=872$) from 18 schools completed survey before and after their teachers conducted a package of four activities from *Southeastern Forests and Climate Change* (SFCC). Students were equally divided by gender (50% male); about 65% were 11th and 12th graders and 35% were 9th and 10th graders. Dependent t-tests were employed to understand whether or not feelings of hopefulness change after exposure to four activities from SFCC. Preliminary results suggest that engaging in the activities significantly increased students' hope about resolving climate change. In addition, we conducted a factor analysis and a path analysis to empirically explore the determinants of hope. We revised the scale based on the preliminary analysis and pilot tested with about 50 high school students in January 2015. The revised hope scale was sent out to 45 summative evaluation teachers. Nine hundred and seventy seven high school students provided parents' consent forms and completed pre- and post- surveys before and after they participated a package of five activities from SFCC between January and June 2015. Data collected from summative evaluation enabled us to further test the reliability and validity of the scale. We calculated Cronbach's alpha (.835) and conducted exploratory factor analysis (EFA) and confirmatory factor analysis (CFA) to assess the internal consistency of the hope survey. Three dominant factors delineated based on the covariance analysis. Paired t-tests were used ($n=977$) to compare the differences between students' pretest and posttest mean. Results suggest that hopefulness significantly increased among all packages.

We used independent t-tests to compare the difference between groups and data revealed that the change in hopefulness was not a function of course, grade level, gender, or ethnicity.

Summative Evaluation

To determine the value of the final product of the secondary module, *Southeastern Forests and Climate Change*, the team conducted a summative evaluation during spring 2015. A total of 32 teachers from 10 states completed the evaluation process. The activities were grouped into three packages of five activities each based on thematic subject area content. Package 1 consisted of activities for biology classes related to carbon. Package 2 was designed for agriculture education courses and had content on forest management. Package 3 consisted of the systems-based activities and was best suited for environmental science courses. Pre and post content surveys for each package were used to measure student knowledge. Teachers submitted online surveys for each activity to provide feedback on how the activities worked with their students and offered suggestions, tips and edits that were incorporated into module website and reprint of the book (October 2015), and an overall survey that evaluated their experience with the module. Teachers submitted their survey responses and student data by the end of June 2015. Students (n=992) in each of the three packages demonstrated a significant gain in knowledge, with no difference associated with gender.

Systems Research

The module emphasizes systems thinking skills to help students better understand large scale systems such as forests and climate and to increase understanding of complex environmental issues such as climate change. Each activity has a systems thinking connection section that highlights the skills, tools, and vocabulary utilized in that activity as well as systems-based discussion questions. There are also nine supplemental systems enrichment exercises available online that reinforce systems thinking skills. These activities are not directly related to the content, but offer opportunities for students to practice using different systems thinking tools such as behavior over time graphs, stock and flow diagrams, causal loop diagrams, and computer simulations. The evaluation team developed multiple choice questions to assess the basics of system dynamics which were included on the Package 3 pre and post content surveys. In addition, each student in Package 3 completed a pre and post systems survey. This tool included three open ended questions that explored how students perceived relationships among variables in complex systems. In order to ascertain a deeper understanding of how the students were thinking about systems after completing the activities, 21 students were selected to participate in in-person interviews. The interviews asked students to explain their thought process when answering questions about systems and they also constructed a systems diagram. The interviews have been transcribed and will be analyzed to determine the level of systems complexity used as well as proper systems terminology. The data from all three survey types (content test, systems survey, and in-person interviews) will be used to develop an assessment tool to measure systems thinking skills in students as well as help determine strategies for effectively incorporating systems-based instruction into science lessons to help students better understand the complexity of large-scale environmental issues. Preliminary findings show that students were not comfortable with proper terminology. While they might have been able to explain a feedback loop in the systems survey or interview, they often did not use that vocabulary. Further analysis is needed to determine if there was consistency across classes and states of terminology used.

Cultural Cognition and Climate Change

Previous studies have shown that science educators vary in their willingness to address climate change and their self-reported knowledge of the topic. To understand if and how personal or

political values play a role in their professional opinions about climate change education and willingness to use instructional materials, we developed and administered an online survey to formal and non-formal science educators in five states (Florida, North Carolina, Arkansas, Pennsylvania, and Virginia). The survey included quantitative and qualitative measures and was used to evaluate respondents' intentions to support climate change education, assess if and how those respondents' intentions and desired curriculum content vary according to their self-identified worldview, and explore the barriers and advantages of integrating climate change education into meaningful cultural narratives. Among the 251 completed surveys, the largest number of respondents identified as formal educators (55%), who teach in public schools (51%) and teach biology (41%). The results of the study suggest that worldview values and personal beliefs about climate change have a significant influence on respondents' intentions to support climate change education. These variables also exhibited a significant influence science educators' preferred curriculum content, as respondents indicated higher intentions to support lessons that reflect their personal beliefs about climate change. Respondents of diverse perspectives agreed that climate change education can provide valuable opportunities to engage students in current issues, but formal educators perceive limited ability to provide these opportunities given the time and curriculum constraints of the education system. The processes and results of this research can be adapted and applied to diverse audiences or scenarios that require targeted and effective climate change communication strategies.

Teacher Efficacy

At each facilitator and educator workshop, pre and post surveys were distributed to participants. We developed and pilot tested the educator self-efficacy survey with 15 educators in summer 2014. The reliability of the self-efficacy survey was confirmed with Cronbach alpha at .94. Paired t-tests suggest that all three workshops significantly increased participants' self-efficacy in teaching about climate change. In addition, participants (n=85) indicated that it is very likely that they will use this educational resource in their future work, recommend this educational resource to their colleagues, and expand the coverage on climate change in their work. Several participants provided open-ended comments that indicated their satisfaction with the materials and the workshop. The survey is being used by facilitators at their workshops throughout the Southeast throughout the summative evaluation period. We are in the process of analyzing teacher efficacy survey across the settings and workshops.

How Does Education Enhance Community Resilience for Climate Change?

As part of our literature review for and research with the secondary module and from our work with Aim 6 program development and evaluation, we have developed a useful perspective on the way educators can approach the highly politicized issue of climate change with audiences that may or may not agree with foundational assumptions. We have been asked by the North American Association for Environmental Education to join their national Anecdotes to Evidence initiative (March 2015) and have launched a process to conduct a systematic review of the literature as it relates to education and outreach and community climate resilience (June 2015). We are in the process of conducting a systematic review of the English-language, peer-reviewed, scholarly literature regarding the outcomes of climate change education.

Establishing Trust Among Audiences

As PINEMAP engages in opportunities to share research findings with stakeholders and the public, Aim 5 is providing assistance to our colleagues by helping to explore strategies that build trust in the messenger and the message. To this end we enlisted the assistance of Andrew

Hoffman who gave a webinar to PINEMAP faculty, staff and students (October 21, 2015) and collected data from forest landowners attending the Forest Insight conference in Valdosta GA (October 2015). We plan to continue this effort by listening to audiences in Arkansas and Illinois, and sharing our findings with PINEMAP in May and Extension colleagues developing a climate course in Minnesota.

PROGRESS NARRATIVE

Provide a brief summary of progress on each deliverable/task/input/output listed below. Please provide a *brief* summary of progress on each deliverable/task/input/output listed below. In many cases, a one sentence summary may suffice. If there is no progress update on an item, leave blank. Please do not include any figures or tables, but please do include quantifiable measurements, if available (i.e., # of plots measured, # of samples, # of runs, # of people reached, etc.)

Text below summarizes products reported in the July 2015 Progress Report (March 1, 2015-June 30, 2015) Older entries are grey

Please update as necessary and highlight in yellow any new products added to the list for the July 2015 Progress Report, with approximate month of estimated completion.

PLT Secondary module

Task: Design and test summative evaluation tools (11/30/14)

The student pre and post knowledge survey, systems survey, and hope surveys have been developed, tested, and finalized for both formative and summative evaluations. A workshop pre/post survey was developed, pilot tested, and finalized. The online survey for all individuals who have received a module was finalized and launched in October; two additional rounds of survey invitations will be sent in January and May 2016.

Input: Researchers assist in workshops (11/30/14)

Task: Conduct regional workshops, distribute kits (11/30/14)

Mark Megalos was able to assist with the workshop in Asheboro, North Carolina on September 19. Rod Will and Adam Maggard attended the Little Rock, Arkansas workshop and provided a presentation on Tier 3 research. Grace Crummer attended the Jacksonville workshop, and we invited a few UF graduate students as well, but they were not able to attend. Aim 5 students/researchers attended and presented workshops in NC and FL.

Deliverable: Print Module, revise website (11/30/14)

The module was printed and website is complete. The 2nd edition of the module was completed (August 2015), printed (October 2015), and 2,600 books were distributed to PLT state coordinators within the southeast and nationwide.

Task: Begin summative evaluation process (2/28/15)

An application was distributed across the Southeast in December 2014. Of the 160 applicants, 45 teachers were invited to participate in the evaluation. All materials and instructions have been sent to the participants. Observations and student interviews were conducted in four classrooms in spring 2015. 32 teachers completed the evaluation and received stipends from national PLT.

Deliverable: Complete regional workshops (8/31/15)

Three regional workshops were completed.

- September 19, 2014: 6 hour workshop for educators from NC and facilitators from KY, VA, NC, TN, and GA in Asheboro, NC. 39 participants.
- November 13-15, 2014: Two day workshop for educators from AK and facilitators from AR, MS, NC, OK, GA, TX, TN, and SC in Little Rock, AR. 22 participants.
- January 23-24, 2015: 6 hour workshop for educators and facilitators from FL, AL, MS, TX, GA, and SC in Jacksonville, FL. Facilitators also participated in an extra session the evening of January 23. 37 participants.

Task: launch state grants program (2/28/15)

We worked with National Project Learning Tree staff to develop an application form for state grants to implement workshops that distribute the SFCC module to educators. Applications were received and grants were processed by 2/1/15. We have been tracking progress in each state through quarterly reports, and we are gathering participant data from the workshops when possible. We are meeting needs as requested by state coordinators not in the Southeast (to date, Colorado and Illinois).

NCE Task: (2/1/17)

To better support state PLT coordinators and market the secondary module to more educators, we plan to work with the national community of AP Environmental Science teachers, provide guest speakers to support state workshops, and develop a series of webinars to support educators. How these offerings develop will be based on the results of the online survey and assessment of efficacy of teachers who attended workshops and those who did not. The website will be modified to include background information that is typically offered in workshops. These new tasks will help state PLT programs reach new audiences, as many states have not yet developed a strong secondary program. To better understand how to help teachers gain confidence and competence in conveying systems thinking, a special workshop may be offered in 2016.

Task: analyze data to explore climate change and hopefulness, systems thinking, teacher efficacy, teacher worldviews (5/31/15) (post-PINEMAP/NCE)

Data are being analyzed; papers are being written. An extension will be useful for this task.

Deliverable: Complete summative evaluation (8/31/15)

The summative evaluation with teachers and students throughout the Southeast is complete. We are in the process of finishing data analysis and drafting results.

Task: conduct literature review on climate education for community adaptation (8/31/15) (post-PINEMAP/NCE)

We launched this project in June 2015 and plan to continue through the extension period.

Deliverable: reprint revised module (11/30/15)

Feedback from summative evaluation results, state coordinators and facilitators, and workshop participants was used to revise the module. The 2nd edition is complete.

Task: revise and repeat systems evaluation (11/30/15)

Data from the summative evaluation is being analyzed to help us know how best to revise the research questions and data collection on systems thinking, July 2015.

Deliverable: publications on hope, systems thinking, worldviews (2/29/17) (post-PINEMAP/NCE)

Deliverable: Module and website used to train students and educators (2/28/15)

The module and website are complete and are currently being used by educators with their students.

Task: recommendations for Extension programs and education materials based on literature review (post-PINEMAP/NCE)

Underway

Undergraduate Fellowship Program

Input: Researchers mentor UG fellows (5/31/15)

Twelve PINEMAP graduate students, post-doctoral researchers or faculty submitted proposals for hosting undergraduate students through the PINEMAP Undergraduate Fellowship. Additionally, two faculty members from non-PINEMAP institutions working on southeastern forest ecophysiology were invited to host additional undergraduate fellows as needed.

Task: Train 4th cohort UG fellows (5/31/15)

Fourteen undergraduate students from 10 North American universities were provided with fellowships to work with 13 graduate student, postdoctoral or faculty mentors at 8 universities. These positions include four of PINEMAP disciplinary aims: silviculture, modeling, education, and extension. One undergraduate terminated his position two months into the summer, and this position was filled with a 15th student that is continuing to work on the same research project.

Task: Analyze program evaluation data (8/31/15)

Preliminary analysis of student intern attitudes toward research has been conducted on all but the current (2015) cohort. Tasks relevant to the PINEMAP fellowship evaluation remaining are: developing the interview protocol and interviewing undergraduate and mentor participants, and examining student feedback on the fall distance education course. Due to an expanded scope of research incorporating other undergraduate research programs in natural resources, protocol development and interviews will be informed by online surveys of participant outcomes that are currently in development. Interviews are now estimated to be conducted early during the extension period.

Deliverable: Enhancing climate education paper (11/30/2015)

This integration paper between the PLT module, graduate student course, and undergraduate fellowship groups is currently being discussed. Writing will depend on the journal, but the focus will be on useful ideas for other projects integrating research and education. More formalized plans are currently in development and will be discussed within the PINEMAP team in January 2016.

Deliverable: Report on program evaluation (2/28/16)

Due to the inclusion of a fourth cohort of undergraduate students that will complete the fellowship in December, 2015, the evaluation report is expected to be pushed beyond a February 2016 timeline. An extension would allow a more thorough and accurate report on the fellowship program's activities, participants, and outcomes. Additionally, research examining other REU programs will be conducted during a potential no-cost time extension that will allow a comparison of the PINEMAP fellowship to other programs within natural resources disciplines.

BROAD IMPACTS

Provide a short narrative describing broad impacts (i.e., far-reaching and possibly unanticipated outcomes resulting from Aim work). Specifically, please highlight leveraged funds and/or partnerships with other projects/external collaborations.

One offshoot of the Education Aim work is the opportunity for John Kidd to pursue dissertation research on the PINEMAP Undergraduate Fellowship Program and similar research experiences for undergraduates. John plans to conduct a meta-analysis of natural resource REUs including the Fellowship Program. This analysis would categorize, define, and describe current summer undergraduate research experiences and/or internships within the natural resource discipline. There may be a possibility for opening up any evaluations of the fellowship program to other natural resources REUs that currently do not have evaluations in place.

We have been able to involve many people representing a variety of expertise areas in our module development process through the advisory committee, expert review, pilot test, and incorporating student projects into undergraduate environmental education courses. These connections have provided opportunities to introduce PINEMAP research and to build relationships that will help us distribute and train educators to use the final module.

We have built a strong relationship with the University of Florida Center for Precollegiate Education and Training. This relationship has allowed us to test activities and evaluation tools, to present about climate change and forest topics, and to co-produce the Climate Change Symposium.

We have strengthened our relationship with Project Learning Tree and between Extension and PLT across the South. State coordinators are working with PINEMAP researchers and Extension faculty to plan and conduct teacher workshops in several states. This effort has also increased educators' likelihood to talk about climate change, as evidenced by workshop comments such as, "I really learned something here." And "This curriculum is an excellent resource and provides educators tools to introduce discussions about climate change or dive into investigations." State Project Learning Tree Coordinators from Colorado, Idaho, Illinois, Indiana, Minnesota, Missouri, New Hampshire, Pennsylvania, Ohio, Wisconsin, and West Virginia have ordered quantities of printed books and planned to offer workshops. Their interest is helping to create a more permanent niche for our materials in the suite of offerings from Project Learning Tree. We will be coordinating a facilitator workshop in Illinois in March 2016.

We have been asked to assist with the national Anecdotes to Evidence initiative by completing a systematic review of the published literature on effective education and outreach strategies for adapting to climate change. These results will be vital to future Extension and education programs and research activities around the world.

The Chinese Environmental Education Society in Taiwan has expressed interest in adapting portions of the PLT module for use in the nature centers in their forest reserves. An article and conference presentation introduced our materials and we are looking forward to assisting them identify the concepts that are most useful to convey, as well as the research findings that are available.

We are using activities from Southeastern Forests and Climate Change in a Women Woodlot Owners workshop in Arkansas in March 2016 to help this audience understand the link between climate and good forest management.

We are working with Nathan Meyer and Hilarie Sorensen to provide a PINEMAP case study for their forestry strand in a state-wide online course for natural resource managers on climate. This course is using national examples with the intent of becoming a template for other states to adapt, with a stockpile of appropriate examples through ANREP.

TRAINING

A CUMULATIVE list of all Aim 1 undergraduate and graduate students, postdocs, and technical/research personnel trained under this project and descriptions of their research focus and/or role in the project is provided below. Additions/ changes made in the July 2015 progress report are highlighted in blue. Please update as necessary and highlight in yellow any updates made for this progress report.

Last name	First name	Position	University	Role
Decker	Paul	Undergraduate Intern	VT	2012 Undergraduate Fellow; worked with Stephanie Hall at University of Florida to investigate how to teach high school students about controversial topics such as climate change. 2016: graduate student at Univ of Florida
Glover	Kristen	Undergraduate Intern; MS student; research staff	UF	2013 Undergraduate Fellow; working with Christine Li at UF. Assisted with development of slide presentations for the web; compiled teacher feedback from summative evaluation for revision of module. 2016: UF Extension agent
Krantz	Shelby	M.S. Student	UF	Produced videos for module website 2016: Southeast Climate Consortium Coordinator
Holmes	Tiara	Undergraduate Intern	VT	Assisted with video production for module website
Hall	Stephanie	M.S. Student	UF	Research focus: conducting research on how to best introduce potentially divisive and contested concepts in secondary school curricula; also helping to develop and pilot test activities for the PLT/PINEMAP Secondary Module. 2016: Outdoor Education coordinator for Girl Scouts in Michigan
Kidd	John	Research Staff	VT	Undergraduate Intern Program Coordinator. 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.
Li	Jie(Christine)	Ph.D. Student	UF	Research focus: 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.
Oxarart	Annie	Research Staff	UF	Environmental Education Program Coordinator. 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.
Plate	Richard	Postdoc	UF	Assisting with the development and evaluation of activities for the PLT/PINEMAP Secondary Module and analyzing needs assessment data; assisting with data analysis for the Extension climate perceptions survey. Assisting with systematic literature review.
Kunkle	Kristen	M.S. Student	UF	Research focus: assessing if and how personal and political beliefs influence science educators' intentions to support climate change education and desired curriculum content. 2016: Environmental Education Specialist, North American Association for Environmental Education
Ritchie	Tracey	Ph.D. Student	UF	Research focus: Conducting summative evaluation of curriculum module and exploring how to successfully develop and measure systems thinking skills in high school students

Clifford	Margaret	M.S. students	UF	Assisting with Extension program evaluation; assessing climate perspectives and program needs
Burja	Kristy	M.S. Student	UF	Assisting with materials development and evaluation
Cheek	Morgan	Undergraduate Intern	NCSU	2014 Undergraduate Fellow assisting with module production, evaluation, and research tasks
White	Ahnaia	Undergraduate Intern	VSU	2014 Undergraduate Fellow assisting with module production, evaluation, and research tasks
Hamill	Alyssa	Undergraduate Intern	VT	2014 Undergraduate Fellow; worked with John Kidd at Virginia Tech on a variety of projects related to undergraduate research experiences and secondary education.
Moreno	Bianca	Undergraduate Intern	UF	2015 Undergraduate Fellow; working with Tracey Ritchie on data organization, entry, tracking, and analysis for the summative evaluation and teacher workshops.
Chaves	Willandia	Doctoral Student Assistant	UF	Assisting with systematic literature review.
Bowers	Alison	Research Staff	UF	Assisted with module development. Assisting with systematic literature review. 2016: Graduate student, Virginia Tech
Berrios	Fatima	Undergraduate Intern	VT	2015 Undergraduate Fellow; worked with Yang Zhang at Texas A&M on root biomass responses to increased fertilization and decreased precipitation.
Eskinder	Brhan	Undergraduate Intern	Spelman College	2015 Undergraduate Fellow; worked with Leslie Boby at UGA on fact sheet development.
Galanopoulos	Christos	Undergraduate Intern	VSU	2015 Undergraduate Fellow; worked with Jinyan Yang at UGS examining soil efflux responses to fertilization and rainfall exclusion treatments.
Henshaw	Connie	Undergraduate Intern	VT	2015 Undergraduate Fellow; worked with Ed Russell at VT on loblolly pine plant water relations during fertilization and rainfall exclusion.
Legendre	Manon	Undergraduate Intern	McGill University	2015 Undergraduate Fellow; worked with Wen Lin at NCSU on root respiration partitioning.
Nation	Marrina	Undergraduate Intern	CSU-East Bay	2015 Undergraduate Fellow; worked with Chris Gough at Virginia Commonwealth University studying carbon sequestration on a restored wetland.
Newton	Emily	Undergraduate Intern	VT	2015 Undergraduate Fellow; worked with Michael Tyree at Indiana University Pennsylvania examining American chestnut hybrid seedling survival on reclaimed mine sites.
Nguyen	Bill	Undergraduate Intern	CSU-East Bay	2015 Undergraduate Fellow; worked with Charles Pell at AU examining longleaf pine leaf level gas exchange.
Parr	Brian	Undergraduate Intern	VT	2015 Undergraduate Fellow; worked with Kristin McElligot at VT on soil efflux and enzyme activity responses to fertilization and drought.
Prehn	Brandon	Undergraduate Intern	TAMU	2015 Undergraduate Fellow; worked with Yang Zhang at TAMU on root biomass responses to fertilization and rainfall exclusion.
SantaMaria	Taylor	Undergraduate Intern	Kenyon College	2015 Undergraduate Fellow; worked with Wen Lin at NCSU on relationships between tree growth and water use efficiency.

Comment [JBK1]: Grace, in the past I think we've let the other Aim # reports include undergraduate fellows that were not in Aim 5. I've included them here just in case for your reference and as a CYA measure for me. Feel free to delete or transfer to other reports as needed.

Word	Clayton	Undergraduate Intern	VT	2015 Undergraduate Fellow; worked with Ben Ahlswede at VT to sample biomass for sensitivity analyses to constrain loblolly pine growth models.
Worrall	Duncan	Undergraduate Intern	George Mason University	2015 Undergraduate Fellow; worked with Allan Bacon at UF examining soil organic matter and carbon content on loblolly pine plantations.
Parker	Benjamin	Undergraduate Intern	Paul Smiths College	2015 Undergraduate Fellow; worked with Ed Russell at VT looking at plant water relations of loblolly pine.