

PINEMAP Quarterly Report
Year 1, Quarter 3 (September 1-November 30, 2011)

SECTION I: PROGRESS ON TASKS/DELIVERABLES/MILESTONES

Aim 1	
Task	Progress
Initial regional C and nutrient baselines from Tier 1 data.	Potential Tier 1 sites have been identified by the individual cooperative programs participating in PINEMAP. A list of these sites has been compiled and the protocol for transferring the existing data to PINEMAP is being developed by the PINEMAP data manager.
Measure Tier 2 sites for C, nutrients, and soil respiration.	A list of Tier 2 sites is being developed where measurements will begin in the 2011-2012 dormant season. Leaf area was measured on a group of Tier 2 sites in August 2011 to capture peak leaf area and compare a variety of measures including LAI 2000, ceptometer, and hemispheric photography. A subset of the Tier 2 sites will be identified where more intensive ecophysiology measurements will be made throughout the PINEMAP project.
Install Tier 3 sites.	Sites for the Tier 3 Rainfall Exclusion Study that meet the established criteria have been identified in Virginia, Georgia, Florida and Oklahoma. A design for the rainfall exclusion structures has been agreed upon that utilizes clear plastic to remove throughfall from the plots. The impact of the plastic on radiation has been tested. A prototype of the throughfall exclusion structures was constructed on site to evaluate materials and design. Installation of the Tier 3 sites has started and will be completed as targeted for the end of the 1 st quarter 2012.
Measure Tier 3 sites.	Initial inventory of Tier 3 sites is underway to collect baseline data.
Regional C, H ₂ O baseline data with responses to field manipulation.	Tier 2 sites are being identified where impact of silvicultural treatments on C, H ₂ O will be measured.
Regional C, H ₂ O, baseline with Tier 2 data.	Tier 2 sites are being identified so that regional C, H ₂ O baseline data will be available in Year 3 of the project.
$\delta^{18}\text{O}$ and $\delta^{13}\text{C}$ from Tier 2 wood samples.	Tier 2 sites are being identified where impact of wood samples will be collected.
Quantification of regional variation in soil respiration.	A regional database on soil respiration based on previous measurements in the region is being compiled. A new protocol for separating heterotrophic and autotrophic soil respiration is being developed and tested.

Initial regional quantification cross-region fertility rating and stomatal response functions.	Data from Tier 1 and Tier 2 sites is being compiled to develop an improved fertility rating.
TerraC training.	A data manager for PINEMAP has been hired.
Deliverable	Progress
Standardize methods for C, N, N ₂ O, H ₂ O foot prints.	Protocols for the following sampling methods have been developed: Sampling stand parameters; ecosystem C and N; ¹⁵ N fertilizer uptake and fate; NH ₃ volatilization and N ₂ O loss following N fertilization; soil chemical and physical properties; soil CO ₂ efflux measurements including separation of heterotrophic and autotrophic components of soil respiration; leaf level gas exchange from photosynthesis, respiration, and transpiration rates based on sap flow; water use efficiency based on C isotope analysis of wood samples.
Milestone	Progress
Finalize standardized measurement protocols.	See above.
Aim 2	
Task	Progress
Preliminary assessment/case study of management effects on loblolly pine C budget over a rotation cycle.	Teskey and colleagues have completed this assessment using 3PG. A manuscript on this topic is in preparation and nearing completion.
Preliminary assessment/case study of climate change factors on loblolly pine carbon and water exchange.	Teskey and colleagues have also completed this assessment using 3PG with the manuscript reporting on this work also in preparation and nearing completion. Sun et al., in a regional watershed-scale study using a different approach, found that regional mean watershed-based GEP and NEE are likely to increase for 3 of the 4 GCMs climate scenarios due to a warming trend. However, one hot and dry scenario may cause too much soil water stress and reduce GEP and NEE.
Assessment of the resolution of alternative methods for quantifying forest water use.	Domec et al. have a paper that has been accepted with minor revisions in <i>Forest Science</i> related to the assessment of the resolution of alternative methods for quantifying forest water use: J.C. Domec, G Sun, A. Noormets, M. Gavazzi, E. Treasure, E. Cohen, J.J. Swenson, S. McNulty, J. King, "A comparison of three methods to estimate evapotranspiration in two contrasting loblolly pine plantations: age-related changes in water use and drought sensitivity of evapotranspiration components." <i>Forest Science</i> .

Modeling team coordinates with Aim Leaders on field measurements.

Domec et al. organized a sap-flow workshop where 15 people from Georgia, NC, OK, FL attended. The aim was to standardize the sap flow technique (heat dissipation method) that will be used at the Tier 3 sites to measure tree water use and finalize methods for future data analysis.

Wynne in concert with Noormets, Teskey, Thomas, Blinn and other Aim 2 members drafted an in situ LAI protocol for Tier 2 and 3 sites.

Aim 2 has continued to participate in soil heterotrophic measurement protocol discussions.

Compile regional satellite, meteorological (including climate scenarios), and soils data needed for model runs.

Landsat WRS-2 scenes 17/39, 16/37, 21, 37, and 16/34 have been selected for the compilation of LAI using Landsat Thematic Mapper scenes from 1984 to present. This work is being carried out using a variant of the MODIS Land Team LAI/fPAR algorithm by Nemani and colleagues at NASA Ames Research Center. Gopalakrishnan (Ph.D. student under Wynne and Thomas, VT) is compiling all needed NARCCAP data that will be served for Aim 1 sites through Terra-C, for Aims 2 and 4 modeling through ArcGIS Server, and for high-performance computing needs through the NASA Earth Exchange (NEX).

NEX user accounts have been requested for both the VT and Florida scientists. Gopalakrishnan, in concert with Blinn (VT) and Thomas (VT) is also compiling the gridded SSURGO data needed for Landsat-resolution model runs. This is being done in cooperation with soil scientist John Galbraith (VT).

Develop and assess management alternatives with Tier 1 data and existing models of C sequestration.

The Tier 1 data set is being assembled. With leadership from Burkhart (VT, FMRC), example data sets from the cooperatives have been submitted in order so the project data base management team can develop appropriate protocols for uploading the data to TerraC and coordinating the forest plot measurement data with climatic information. Until the full Tier 1 data base is formulated, plot measurement information from the Forest Modeling Research Cooperative continues to be used for exploratory modeling.

Predict C pool dynamics at varying scales for alternative land use, management, and climate scenarios.

Maggie Wang (Ph.D. student under Teskey) will be working on a portion of this topic area (at the stand level). She is planning to link 3-PG and Century to examine forest ecosystem carbon sequestration. Her research proposal is currently in preparation.

Refinement of forest management modules for integration into DSS.

Rebecca Musy, working with Wynne and Teskey, has two Fortran 2003 versions of 3PG in the late stages of development, one based on Peter Sands' Excel spreadsheet-based program '3PG-pjs', and one based on Robert Teskey's Visual Basic graphical user interface (GUI) program, '3PG+'. The Fortran version of this program will be used in more computationally expensive geoprocessing, supercomputing, region-wide simulations, sensitivity analyses, and Monte-Carlo style analyses. The Fortran version will be able to be based on a UNIX server, or through a web-based interface, accessible to remote users with no need for installation. Future changes to the algorithms will be made to the centrally located software, preventing versioning discrepancies between users. The graphical user interface created for 3PG+ will be adapted to make it easier for users to generate text files for input into the Fortran program.

The Fortran version of 3PG-pjs is ready for beta testing by end users. Preliminary comparisons of outputs from 3PG-pjs and the Fortran equivalent indicate that the Fortran product is functional. In comparing the outputs of these two programs, some discrepancies initially occurred. The timing of silvicultural events was not happening concurrently in the two programs because stand age is stored as a real (floating) point number. With help from Intel programmers, the code for both programs was changed to improve internal consistency, resulting in the Excel and Fortran versions now being in agreement with each other.

The Fortran version of 3PG+ is also very close to being ready for beta testing. Early comparisons of outputs from 3PG+ and the Fortran version show small differences in the outputs, which accumulate in some variables over time and become significant. These differences could be due to differences in precision between the Visual Basic 3PG+ and the Fortran version. Minor changes to the code are being made and further testing is in progress. These two versions will also need to be altered due to the floating point errors described above so that silvicultural events and some stand age-dependent variables are occurring at the same ages in both programs.

Aim 3

Task	Progress
<p>Develop uniform response functions with provenance trial data and version 1 of genetic deployment tool.</p>	<p>Texas A&M University: 1. Latitude and longitude for the progeny tests and county centroids for the family origins determined. 2. Conducted preliminary ASReml analyses.</p> <p>North Carolina State University: Latitude and longitude for the progeny tests and county centroids for the family origins determined.</p> <p>University of Florida: Latitude and longitude for the progeny tests and county centroids for the family origins determined.</p>
<p>Determine appropriate genome reduction methods for genotyping by sequencing.</p>	<p>Texas A&M University: 1. Established a bioinformatics server dedicated to the genetic study and analysis of nucleotide data generated by the project; installed Agilent Genomics Workbench 6.5 for Agilent Sure Select Target Gene Enrichment System. 2. Obtained 35,550 unigene sequences and partitioned for probe design. 3. Germinated seed and captured megagametophytes for genomic DNA isolation.</p> <p>North Carolina State University: Conducting pilot scale experiment to test Genotyping-By-Sequencing (Elshire et al, PLoS One 6(5): e19379, 2011).</p> <p>Virginia Tech: Germinating seed to begin testing RAD-seq for reduction of genome complexity.</p> <p>University of Florida: Obtaining appropriate material for DNA extraction and exploring complementary novel method for genome reduction and genotyping by sequencing.</p>

Aim 4

Task	Progress
Assessment of policies and programs that may affect C mitigation in planted pine forests.	A literature review has been conducted to identify and compile existing policies and incentive programs that may have implications for carbon sequestration in southern pine plantations. The review includes details of non-governmental programs (e.g., Climate Action Reserve) and will be expanded in the coming months to include regional markets (e.g., Western Climate Initiative) and federal and state programs (e.g., Conservation Reserve Program).
Regional market impacts modeled based on business-as-usual assumptions.	The Sub-regional Timber Supply Model was employed to assess the regional economic impacts under business-as-usual assumptions. A manuscript based on the model simulation results was submitted to <i>Forest Science</i> and is currently in revision.
NPV analysis and regional market impacts of adaptive management impacts.	We have developed a stand-level model to quantify net expected economic rents for landowners under the risk of catastrophic disturbances associated with future climate change such as increased hurricane, fire, or pest occurrences. The model has been applied to evaluating the impact of hurricanes and a related manuscript has been submitted to <i>Forest Science</i> . Along with this model, we are developing a generalized version of the Faustmann model that includes payments/penalties for carbon sequestration/emissions for plantations with varying cutting cycles under different climate change scenarios.
Assessment of landowners' mitigation and adaptation strategies.	We have conducted a literature review on landowners' mitigation and adaptation strategies, which will lead to designing a landowner survey. Additionally, a survey instrument has been developed and pretested to estimate family forestland owners' willingness-to-accept carbon offsets contracts using conjoint choice and best-worst valuation methods. It is ready for distribution to survey participants in Florida.
Life cycle inventory for key physiographic regions.	We have assessed carbon emissions from various silvicultural activities using a detailed life cycle assessment approach. We have calculated the overall global warming impact (GWI) from managing a hectare of intensively managed slash pine plantation and found that fertilization contributed most to GWI. We have also incorporated carbon payments/penalties to evaluate economic returns from slash pine plantations in the southern U.S. This work has led to the development of a manuscript.

Economic losses from altered disturbance risks.

The relationships between southern pine beetle (SPB) outbreaks and climate variables were identified. We are expecting the data on the project-wide climate change scenarios from Aim 2 to design our simulation scenarios for assessing regional economic impacts via the Sub-regional Timber Supply Model. Additional data collection and modeling efforts are underway to evaluate the impacts of adaptation on alleviating the damage of SPB outbreaks. Collaboration with the U.S. Forest Service has been arranged to collect and compile regional fire data for modeling.

Aim 5

Task

Progress

PLT Secondary Module: Draft scope and sequence; revise with input.

We created a scope and sequence, revised it with input from Al Stenstrup in the PLT office, used it in the Environmental Education Program Development class at the University of Florida, and shared it with Aim 5 team members in October 2011. We plan to share it with the Aim 5 Advisory Committee and revise it with their input.

PLT Secondary Module: Assess existing activities and provide to undergrads and advisory committee.

We have explored climate change activities available on CLEANet.org and critiqued the following websites as a part of the Environmental Education Program Development course: Your Climate, Your Future: World Wildlife Fund; Facing the Future; CSI: Climate Status Investigations; Windows to the Universe: Our Changing Planet; GLOBE; and Keeping Watch on Coral Reefs.

PLT Secondary Module: Begin designing activities to fill gaps and provide to undergrads.

We have begun to design activities. They are:

1. Climate Controversy – understanding multiple perspectives
2. Carbon in the Ecosystem – comparing forests to grasslands
3. Climate Variability and Forests – understanding how climate can impact forests in the context of environment, economics, and society
4. Life Cycle Analysis of Lawn Furniture – a play in three acts
5. What makes a product environmentally friendly? – debate on common products

Students in the Environmental Education Program Development class will be pilot testing these activities in November 2011 and reporting their findings on December 7. We will develop additional activities in 2012 to meet all of the objectives in the scope and sequence.

Undergrad Intern Program: Create application and selection process; market programs; select graduate students.

Application forms have been drafted and are expected to be finalized by late-November to early-December. Postings for internships and calls for proposals will be distributed as soon as applications are completed and available (expected November 30). Graduate student selection will be next quarter (see Section II, 6).

Undergrad Intern Program: Create and maintain web site for program.

Internship program pages have been created and are being uploaded to the PINEMAP site as of November 1. Application forms will be uploaded to the site by November 30. Intern program pages are maintained and updated as needed by the program coordinator.

Undergrad Intern Program: Develop distance course on education.

Syllabus for the undergraduate distance course is being drafted as of October 15. The course will be directed by faculty at Virginia Tech. We expect the class to meet in the evening twice per week during the fall 2012 semester.

Graduate Distance Course: Distance class on climate change education and interdisciplinary research project (training of graduate and postdocs in multi-disciplinary research).

We developed a syllabus for the PINEMAP distance graduate course and the Executive Committee approved it. We assigned components of the class to Co-PIs to organize. The course is scheduled for the Spring 2012 semester.

Deliverable

Progress

PLT Secondary Module: Conduct audience assessment on climate and LCA and southern pine (teachers, Extension specialists, landowners).

We have begun the process of interviewing teachers to ask how they teach about climate. Their responses will be used to craft an online survey for educators.

A survey sent to 1024 high school (346 responded) teachers to determine the extent to which high school science teachers in the Southern Piedmont region of the United States are presenting forestry related concepts in their classes (including climate change and carbon sequestration) and to determine which attitudinal, personal, educational, and demographic variables best predict the frequency that teachers present forestry related concepts.

Milestone

Progress

PLT Secondary Module: Education advisory council meets.

We met with the Southeastern PLT Coordinators on August 5, 2011 by conference call. In discussions with PLT – National and other Aim 5 and 6 members, we decided to establish an advisory committee for the PLT project only, not for the entire Aim.

Aim 6

Task	Progress
Assess audience needs.	<p>A survey was developed and delivered to Extension faculty in the 1890 and 1862 institutions in GA, AL, FL, NC, VA, TX, and MS. to assess attitudes, beliefs, practices and interest in climate change programs and programming. We have received 2,275 completed surveys (achieving between 62-79% response rate). The data are now being processed and a summary report is being developed for the project leadership. Analysis of North Carolina responses is being addressed by NC partners. A number of articles are planned for regional and state data.</p> <p>We have begun the process of understanding forest landowner perceptions of climate change and have informal focus groups scheduled for November and December in Leon and Madison counties in Florida.</p>
Create state teams for deployment of outreach materials and programs.	<p>A program Extension Associate was hired at the Southern Regional Extension Forestry Office in October to begin developing a plan whereby state teams will be developed, trained, and provided opportunity to give feedback to the project. The plan will be to engage Extension as the lead in each of the states in the PINEMAP region. These leads will be organized into a regional PINEMAP Extension Advisory Team. This Team will advise on the structure and makeup of the state teams (industry, NGO, academic, etc. membership). To date, several Extension specialists in the Southern region have been notified of the project and are willing to assist with the deployment of materials and the provision of feedback.</p>
Develop Extension products for region.	<p>Fact sheets are being developed to complement the first and second internal webinars on the following topics: 1) weather vs. climate (Dinon); 2) climate oscillations and impacts to forestry (Dinon); and 3) drought impacts on forest systems (Vuola/Megalos/Boyles). The Extension Team is also completing the first draft of <i>Minimizing Forest Insect/ Disease Risk; A Practical Landowner Guide</i> (anticipated review date December, 2011). Finally, the Extension Team is beginning a draft of an invasives fact sheet (Temple/Megalos).</p>
DSS development: develop user interface to DSS and pilot test.	<p>We are in the initial stages of planning for the DSS, and have been talking to folks in the other aim groups as well as partners in the Southeast Climate Consortium to determine the best design and implementation scheme. Most of the effort for this will be dedicated during years 2-5 of the project.</p>

eXtension modules.	The Extension Team is beginning discussion with the National Leadership of eXtension as well as the current Climate Science and Forests Interaction Community of Practice (CoP). This CoP looks to be the most promising avenue at this junction and is currently lacking in Southern forest climate science materials and information.
Assess impacts of outreach.	Evaluation plans are being formulated and will be placed into action following the delivery of various outreach activities.
Deliverable	Progress
Open source DSS design based on audience needs.	See above—most of this work will be completed in years 2-5.
Milestone	Progress
Develop and launch project web site.	The Extension Team’s IT specialist created the project-wide website: http://www.pinemap.org . This website will include both internet and intranet access and materials. The website will include teaching, research and Extension/Outreach materials including documents, reports, photos, and research DSS modules.
Implement and strengthen forestry Extension/climatologist partnership.	We have had several email conversations with state climatologist partners. We’ve also had the opportunity to meet with several of them during the American Association of State Climatologists (AASC) Annual Meeting in July 2011. During this meeting, we introduced the southern state climatologists to PINEMAP and provided them with a one-page handout containing more details about their specific role in the project. To build on this, we are setting up conference calls which will virtually introduce state climatologists to Aim 6 team members in their particular state. These conference calls will involve two to three states per call, and discussion will revolve around next steps for building Extension/state climatologists partnerships.

SECTION II: ADDITIONAL PROGRESS/SUPPLEMENTARY INFORMATION

1. Needs from/linkages to other Aim groups:
 - a. Outline research/data that your Aim group needs from another Aim group.

Aim 1

- Aim 2 needs to review the final measurement protocols developed to ensure that the minimum data needed to drive the models used in PINEMAP will be available.
- Aim 3 needs to review the final measurement protocols developed to ensure that the data needed to correlate molecular markers for specific traits is available.

Aim 2

- The lack of Tier 1 data from the coops is hampering Aim 2 generally. Region-wide modeling, either through refinement of empirical growth and yield models or calibration of mechanistic models, is now behind our original schedule because of this.

Aim 3

- Coordination with Aims 1 and 2 regarding data structure and formats for Tier 1 data sets.
- Climate data for URF analysis.

Aim 4

- Data on predicted temperatures and precipitations under various climate change scenarios for the region to assess economic impacts.
- FORTRAN coded version of the 3PG model to estimate forest productivity at the county level.

Aim 5

- We need subject-matter experts from Aims 1, 2, 3, and 4 to work with us to develop interesting, creative, experiential activities for the PLT secondary module.
- We need specialists from Aims 1, 2, 3, and 4 to assist with reviewing the PLT secondary module activities for accuracy and honesty.

Aim 6

- Eventually, we will need a list of output from the researchers so that we can brainstorm potential decision support tools and educational materials for the DSS.

- b. Outline research results/data that your Aim group has compiled which has value or relevance to another Aim group.

Aim 1

- Tier 1 sites have been identified and the existing data from these sites is being transferred to PINEMAP that will be used by other Aim groups.
- Tier III sites are being installed.
- Preliminary study of soil respiration and the separation of autotrophic and heterotrophic components has been conducted to test methodology.
- Leaf area has been measured in a subset of Tier 2 installations to compare methods of LAI estimations and intercepted radiation that will be used in modeling efforts.
- ¹⁵N fertilization studies were installed in 2011 and fertilizer uptake efficiency data for conventional and enhanced efficiency N fertilizers will be available for modeling efforts.

Aim 2

- The LAI protocol will be useful to Aim 1.
- The NARCCAP data will be useful to Aims 1 and 4 and perhaps the project as a whole.

Aim 4

- We have compiled data on precipitation and temperatures for all counties in the U.S. South.

Aim 5

- We have developed a graduate course for all students to enroll in for spring 2012.

Aim 6

- We have made recommendations to the modeling aim regarding which downscaled climate model projections and scenarios should be utilized within the forest production models.
- The extension perceptions of climate change survey results will be helpful to all Co-PIs who interact with stakeholders.
- The Extension Aim group has also developed several internal webinars that are viewable on demand (archived). These webinars are utilized for professional development for PINEMAP project members.

- c. Outline additional linkages to other Aim groups.

Aim 1

- We are working closely with Aim 2 to determine the minimum data sets needed to drive the models of stand, watershed and regional forest productivity.

Aim 2

- Stand-level mechanistic models (e.g., 3-PG) and empirical growth and yield models will need information on any changes to growth or physiology anticipated through enhanced growing stock.

Aim 4

- We designed and implemented a climate change perception survey in cooperation with Aim 6.
- We are closely working with Aim 2 to define the representative zones to be modeled under different emission scenarios.
-

Aim 5

- In our efforts to understand how to talk and teach about climate change, we are generating ideas that could be useful to Aim 6 and anyone from Aims 1, 2 and 3 who work with industrial coops.

Aim 6

- We have tried to link together all aim groups via the internal webinar series.

2. Describe connections or collaborations with other research groups or projects outside of PINEMAP.

Aim 1

Several PI's from PINEMAP (Tom, Fox, Eric Jokela, Mike Kane, and Jose Stape) are also PI's in the NSF Center for Advanced Forestry Systems (CAFS). The efforts of these two programs are complimentary and close collaboration will benefit both programs.

Aim 2

Strong connections have been made with NASA Ames that will improve the quality of Aim 2 work.

Aim 4

Bob Abt is serving on the EPA Science Advisory Board for biogenic carbon, and is therefore able to link this project's activities to the EPA carbon accounting framework.

Aim 5

We are having discussions with CLiPSE (Climate Literacy Partnership in the Southeast). We have used the Pacific NW research project on forest landowners perceptions of climate change as a template for our forest landowner focus groups planned in Florida. An Undergraduate honors student at the University of Florida will conduct the forest landowners focus group research in Florida.

An Undergraduate/Graduate course taught by Martha Monroe at the University of Florida (Environmental Education Program Development) is currently doing much of the background work for the PLT secondary module as part of class assignments.

We are working with Florida Climate Institute staff on landowner climate change perception focus groups.

Aim 6

We are initiating collaborations with the Southeast Climate Consortium (SECC) and the Climate Literacy Partnership in the South East (CLiPSE). We are planning on several presentations at the Society of American Foresters national conference, the Association of Natural Resource Extension Professionals (ANREP) national conference, and several other meetings and conferences. In addition, the PINEMAP Extension Team will be working closely with the Integrated Biomass Supply Systems (IBSS), funded at the University of Tennessee. In particular, there is a great interest in working with the Life Cycle Analysis components of both projects.

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

Aim 1

A \$195,000 grant from NSF is supporting the research on nitrogen uptake efficiency and ecosystem N fate in loblolly pine using ¹⁵N labeled fertilizers. Additional resources from the Forest Productivity Coop (\$100,000) are allocated to the ¹⁵N study.

Support from Weyerhaeuser (\$240,000) is being used to support a post doc working on N₂O emissions following N fertilization of loblolly pine.

Aim 5

One month salary for Martha Monroe for each of two years was leveraged to create a graduate assistantship and tuition waiver for Stephanie Hall, a new M.S. student. The final package comes to about \$26,000 per year.

An anonymous donor is providing the food and travel expenses for the forest landowners participating in the focus groups– to the tune of about \$5,000.

Aim 6

NCSU PINEMAP Graduate Assistantships (Vuola/Temple)—leveraged Atlantis (International) Grad stipend and work study Assistantships roughly \$20,000 to double grad student involvement in year one.

4. List any PINEMAP-relevant presentations given during the quarter, including presentations at scientific meetings, meetings with stakeholders, university courses, etc. Please provide the following information for each presentation:
 - Presentation title, date, and location
 - Description of attendees/audience
 - Description of outcome/impact

Aim 1

Presentation:

Title: PINEMAP Overview

Date: October 4, 2011

Location: Virginia Tech, Blacksburg, Virginia.

Audience: Advisory Committee of Forest Productivity Cooperative;

Outcome/Impact: Discussion of data sharing protocols and PINEMAP operating principles. Support from industrial members of this organization for the PINEMAP project was reiterated.

Aim 3

Presentation:

Title: PINEMAP Update (Ross Whetten)

Date: November 10, 2011

Location: Cooperative Tree Improvement Program meeting, North Carolina State University Contact meeting, Macon, GA

Audience: 30 attendees

Aim 4

Posters:

- Title: The Value of Water Quality Protection Programs: A Meta-Analysis (Kreye, M.M., D.C. Adams, T. Borisova, and F. Escobedo)
Date: November 2- 6, 2011
Location: Society of American Foresters National Convention, Honolulu, HI,
Audience: Research, extension, and education professionals; students.
Outcome/impact: Increased awareness of policy design mechanisms and value related to co-generated ecosystem services from carbon programs.
- Title: Valuing nutrient pollution prevention in well-conserved aquatic systems: A meta-analysis (Kreye, M., D.C. Adams, T. Borisova and F.J. Escobedo)
Date: November 1-4, 2011
Location: 38th Natural Areas Conference, Tallahassee, FL
Audience: Research, extension, and education professionals; students.
Outcome/impact: Increased awareness of policy design mechanisms and value related to co-generated ecosystem services from carbon programs.

Aim 5

Posters:

- Title: Unraveling public perceptions of climate change (Martha C. Monroe)
Date: May 16-18, 2011
Location: National Workshop on Climate and Forests, Northern Arizona University, Flagstaff AZ.
Audience: 200 forestry researchers and extension agents attended.
Outcome/Impact: Extension faculty formed a climate change subgroup and have become active in ANREP. This poster was requested by five attendees based on the information it provides. It was submitted to the eXtension Climate and Forests group.
- Title: High School Science Teachers and Forestry Education: How Are They Connected? (S.J. Munsell Fowler, S, J. and J.R. Seiler.
Date: November 2-6, 2011
Location: Society of National Foresters National Convention, Honolulu, HI

Aim 6

Presentations:

- Title: Introduction to Climate, Climate Variability, and Climate Change in the Southern U.S.
Date: September 30, 2011
Location: Forest Biology Research Cooperative Annual Advisory Council Meeting, Gainesville, FL
Audience: members of the Forest Biology Research Cooperative
Outcome/impact: This talk generated a good discussion about needs of the audience in terms of how climate might have an impact on forestry systems. Based on anonymous feedback, it was decided that we need to hold a conference call among internal team members to discuss strategies for message development and integration of forestry information into climate information, and vice versa.

- Title: Understanding the Link between Weather/Climate and the Concomitant Impact to Forests in the Southern US
Date: October 7, 2011
Location: PINEMAP Internal Webinar Series, hosted on Elluminate!
Audience: internal members of PINEMAP
Outcome/impact: This talk also generated a good discussion about how climate might have an impact on forest systems--particularly regarding critical time periods and/or thresholds for vulnerability.
- Title: Southern Drought and Forests
Date: October 21, 2011
Location: PINEMAP Internal Webinar Series, hosted on Elluminate
Audience: internal members of PINEMAP
Outcome/impact: We learned some critical sensitivities: 1) multi-year droughts have more impact than single year events, and 2) dry falls and winters are an issue for planting.
- Title: AFRI PINEMAP climate change grant:
CNR's role in advancing pine plantation management for a changing future
Date: October 24, 2011
Location: North Carolina State University
Audience: 35 graduate Students and Faculty from the Department of Forest And Environmental Resources
Outcome/Impact: Faculty and cooperators were informed of the intent, collaboration and extent of the PINEMAP project and NCSU's unique role in its implementation and deliverables.
Title: AFRI PINEMAP climate change grant:
CNR's role in advancing pine plantation management for a changing future
Date: October 11, 2011
Location: North Carolina State University
Audience: 35 undergraduate Students form the NC Forest 330 course were challenged to see how forest management strategies could be used to mitigate and adapt to anticipate climate variability in the future
Outcome/Impact: Students were informed of their professor's involvement in PINEMAP and NCSU's unique role in facilitating regional collaboration, implementation, and deliverables.

Posters:

- Title: An Overview of Pine Integrated Network: Education, Mitigation, and Adaptation Project (PINEMAP)
Date: November 3, 2011
Location: Southeast Climate Consortium (SECC) 2011 Fall Planning Meeting, Tallahassee, FL
Audience: primarily members and graduate students within the SECC universities but a few attendees were from partner organizations such as NOAA
Outcome/impact: An introduction to the PINEMAP project was provided, and partnerships were initiated.
- Title: PINEMAP Extension Goals and Objectives
Date: May 18, 2011
Location: Flagstaff, AZ (National Workshop on Climate and Forests)

Audience: Extension professionals with natural resources interest. USDA Forest Service researchers and technology transfer experts. Other key partners.

Outcome/Impact: Participants are more aware of the PINEMAP project and its implications. Several partners expressed interest in working with the PINEMAP Extension Team.

- Title: An Integrated Approach to Climate Variability Extension Delivery

Date: November 1, 2011,

Location: Honolulu, HI (Society of American Foresters meeting)

Audience: Forestry and natural resources experts

Outcome/Impact: Participants are more aware of the PINEMAP project and its implications. Several partners expressed interest in working with the PINEMAP Extension Team.

5. List any research papers, journal publications, or extension publications published during the quarter.

Aim 2

Domec, J.C., Sun, G., Noormets, A., Gavazzi, M., Treasure, E., Cohen, E., Swenson, J.J., McNulty, S., & King, J. 2012. A comparison of three methods to estimate evapotranspiration in two contrasting loblolly pine plantations: age-related changes in water use and drought sensitivity of evapotranspiration components. *Forest Science* (in review).

Sun et al. write-up: In a regional watershed-scale study using a different approach, found that regional mean watershed-based GEP and NEE are likely to increase for 3 of the 4 GCMs climate scenarios due to a warming trend. However, one hot and dry scenario may cause too much soil water stress and reduce GEP and NEE.

Aim 4

Abt, K., R.Abt, and C. Galik. Effect of bioenergy demands and supply response on markets, carbon and land use. *Forest Science* (in revision).

Huang, J., Abt., B., Kindermann, G., & Ghosh, S. 2011. Empirical analysis of climate change impact on loblolly pine plantations in the southern United States. *Natural Resource Modeling* 24(4): 445-476. DOI: 10.1111/j.1939-7445.2011.00098.x.

Susaeta, A.I., Carter, D.R., Change, S.J., and Adams, D.C. The impact of hurricane risk on optimal forest management in southern U.S. pine plantations: Application of a generalized Reed model. *Forest Science* (in review).

6. List all current graduate students (indicate M.S. or Ph.D.), postdocs, and staff employed by the project.

Aim 1

Research Coordinators

Andy Laviner, Virginia Tech
Madison Akers, University of Georgia
Geoffrey Lokuta, University of Florida

Research Technicians

Elaine Stebler, Oklahoma State
Sam Frye, Virginia Tech (partially supported by PINEMAP)

Graduate Students

Brett Heim, M.S. Virginia Tech
Santosh Subedi, Ph.D., Virginia Tech
Adam Maggard, Ph.D., Oklahoma State
Lu Zhai, Ph.D., Texas A&M University
Joe Clark, M.S., Auburn University
Maxwell Wightman, M.S., University of Florida

Aim 2

Ranjith Gopalakrishnan, Ph.D, Virginia Tech
Nabin Gyawali, Ph.D., Burkhardt, Virginia Tech
C. Wade Ross, Ph.D, Grunwald, University of Florida
Maggie Wang, Ph.D, University of Georgia
Nilesh Timilsina, postdoc, University of Florida

Aim 3

Dr. Tomasz Korlewski, postdoc, Texas A&M University
Mengmeng Lu, Ph.D., Texas A&M University
Alfredo Farjat, Ph.D., North Carolina State University
Benjamin Rusche, Undergraduate, North Carolina State University
Rajesh Bawa, Ph.D., Virginia Tech
Jianxing Zhang, Ph.D., University of Florida

Aim 4

Andres Susaeta, post-doc, University of Florida
Jose Soto, Ph.D., University of Florida (funded by another project)
Puskar Khanal, Ph.D., Mississippi State University (co-sponsored by another project)
Ernest Dixon, M.S., North Carolina State University

Aim 5

Stephanie Hall, M.S., University of Florida

Annie Oxarart, staff, University of Florida

Shelby Krantz, Honors Undergraduate student (not paid by PINEMAP)

Richard Plate, postdoc, University of Florida

John Kidd, Undergraduate Intern Program Coordinator, Virginia Tech

Aim 6

Aaron Vuola, M.S., North Carolina State University

Christina Temple, M.S., North Carolina State University

Heather Dinon, Applied Climatologist, North Carolina State Climate Office

Matthew Bonham, Extension Associate, Texas Agrilife Extension

Leslie Boby, Extension Associate, Southern Regional Extension Forestry

7. Outline any major changes to the Aim 1 year 1-2 work plan.

No changes noted.

8. Finally, briefly describe a forecast of Aim group work planned for and progress expected during the next quarter.

Aim 1

- Measurement protocols will be finalized and tested. Revisions needed based on field experience will be discussed.
- Data from the Tier 1 installations will be transferred to PINEMAP for the modeling work.
- Measurements at Tier 2 sites included in PINEMAP will begin.
- Wood samples for ^{18}O & ^{13}C from Tier 2 will be collected.
- Studies of ^{15}N fertilizer uptake will continue.
- Studies of N_2O emissions will continue.
- Installation of Tier 3 sites will begin.

Aim 2

- NEX system approval is anticipated before Christmas, with a training session scheduled for mid-January at Ames.
- The beta testing of the Fortran version of 3-PG will take place.
- Growth and yield modeling will continue using FMRC and FPC data with inclusion of other co-op data once it has been added to Terra-C.

Aim 3

- All groups: provide Tier I data
- Develop uniform response functions with provenance trial data and version 1 of genetic deployment tool: Texas A&M, NCSU, and UF: obtain and integrate weather/climate data into data sets.
- Determine appropriate genome reduction methods for genotyping by sequencing:
Texas A&M: design probes for 35,550 unigenes for Agilent Sure Select Target Gene Enrichment system, create and sequence enriched libraries
NCSU: carry out the measurements of a wide-range common garden loblolly pine field tests called the Plantation Selection Seed Source Study (PSSSS) and collect foliage samples for genotyping in year 2.
UF: Continue extraction of DNA from CCLONES 1 population; Inventory ADEPT2 field planting; Explore novel methods for genome reduction and genotyping

Aim 4

- We expect to define the representative zones to be modeled via the 3-PG and develop a stand-level carbon sequestration model.
- We also expect to have preliminary results about the effects of climate change on the profitability and optimal management of loblolly pine plantations.
- We will proceed with the implementation of the valuation survey of Florida forestland owners; conduct further literature reviews on policies and programs, and mitigation and adaptation strategies; and continue with data gathering and modeling efforts to assess regional economic impacts of disturbances.

Aim 5

- Graduate distance course will be implemented January–May 2012.
- PLT project: Advisory Board will be established; draft activities will be pilot tested; additional activities will be created
- Intern project: finalize the undergraduate distance course plan; launch the internship program for summer 2012; begin selection of internship and micro-grant winners February 20, 2012, with winners announced mid-March; continually update the website with internship program news and announcements.

Aim 6

- Complete drafts of Forest Insect and Disease Risk publications
- Review draft of Forest Invasives publication.
- Prepare MS thesis draft on NCCES attitudes on climate change and needs and obstacles to implementing a pine plantation climate adaptation curriculum.
- Continue PINEMAP Internal Webinar Series.
- Finalize state Extension and outreach team decision points. Begin to work with states to develop the teams.
- Finalize presentations and workshops for the ANREP conference.
- Begin adding eXtension content.
- Summarize Extension needs assessment survey.
- Begin to develop and implement related needs assessments and surveys.