PINEMAP Year 5 Progress Report 1
July 2015
Aim 4 (Economics & Policy)

This is the first Aim progress report for year 5 (covering activity from March 1, 2015- June 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 via the annual continuation proposals and REEport progress report.

The purpose of this report is to gather information on progress since the previous progress report in April 2015, and **to prepare for submission of our no cost extension (NCE) in July.**

To streamline this process, information reported in September 2014 and April 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 July 15.

NO COST EXTENSION EXCEPTIONAL CIRCUMSTANCES:

The NCE process requires us to list **work completed** and **work remaining to be completed under the one-year no-cost extension** period (from the original objectives). This should be covered in the narrative below, but please try to be specific about what has been completed to date, what you project will be completed before 2/29/16, and what would be occurring during the 1 year NCE.

- 3PG lob. linked with WaSSI and associated economic scenario analysis.
- Trade-based stand-level model of disturbance risk from invasive species
- Stand-level Water-C tradeoff simulator

Formatted: Font: (Default) Times New Roman
Formatted: List Paragraph, Bulleted + Level: 1 + Aligned at: 0.25" + Indent at: 0.5"
Formatted: Font: (Default) Times New Roman
Formatted: Font: (Default) Times New Roman

We must draft a narrative including the **exceptional circumstances** that contribute to the need for the requested no-cost extension. The justification should be compelling such that it demonstrates a bona fide need to convince program staff and the Awards Management Division that the no-cost extension is warranted for successful completion of the award. **Please list your compelling reasons for the work projected to occur during the 1 year NCE, both reasons for delay and improvements in originally planned outputs that will be possible with extra time.**

- Delay in the development of 3PG lob; new, finer-scale WaSSI output that was not available until recently
- New transportation and pestid data that will become available later this year, and used to inform the trade-based stand-level disturbance risk model for invasive species
- Recent availability of new data that are critical to the stand-level water-C tradeoff simulations (M. Cohen et al. field trials from another study are being used to inform the model)

Formatted: Font: Not Bold
Formatted: List Paragraph, Bulleted + Level: 1 + Aligned at: 0.25" + Indent at: 0.5"
Formatted: Font: (Default) Times New Roman

A key part of our justification will be that in a number of important areas, we need additional time to complete tasks and deliverables, and that the additional time taken will enable us to do a much better job or have a better outcome than we had initially anticipated. **Please consider your aim tasks and those of associated integration platforms, and identify a small number of major tasks or deliverables that fit this model, and write a brief description.** We will use this information in the preparation of our extension application, so **please spend some time discussing this with your colleagues.**

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 4 activities contribute to project-level outcomes and impacts by providing the economic analysis that will underpin land manager decision-making in future management and climatic conditions. From the stand- to the regional-scale, economic impacts of disturbance, climate, management, and policy alternatives must form the basis of any viable and sustainable management change. Policy analysis will enable PINEMAP stakeholders to better assess management responses to future policy changes. Quantification of different ecosystem services will lead to a better understanding of tradeoffs among carbon, timber, and biodiversity. Finally, the life cycle assessment (LCA) carried out in this Aim will provide the framework necessary to analyze the stand to regional carbon sequestration implications of changes in management regimes. No update was provided in April 2015

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 September 2014 and April 2015 Progress Reports (March 1, 2014-February 28, 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 July 2015 Progress Report.

Peer-reviewed publications

Cademus, R.; Escobedo, F.J.; McLaughlin, D.; Abd-Elrahman, A. 2014. Analyzing trade-offs, synergies, and drivers among timber production, carbon sequestration, and water yield in Pinus elliotii forests in southeastern USA. Forests, 5:1409-1431.

Daystar, J., Gonzalez, R., Reeb, C., Venditti, R., Treasure, T., Abt, R., and Kelley, S. (2014). "Economics, environmental impacts, and supply chain analysis of cellulosic biomass for biofuels in the southern US: Pine, eucalyptus, unmanaged hardwoods, forest residues, switchgrass, and sweet sorghum," BioRes. 9(1), 393-444.

Dwivedi P, Khanna M (2014) Wood-based bioenergy products – land or energy efficient? Canadian Journal of Forest Research. 44:1187-1195.

Dwivedi P, Khanna M (2013) Abatement cost of GHG emissions for wood-based electricity and ethanol at production and consumption levels. Plos One. 9(6):e100030 (14 pp).

Dwivedi P, Khanna M (2014) Abatement cost of wood-based energy products at the production level on afforested and reforested lands. Global Change Biology Bioenergy. (available online, doi: 10.1111/gcbb.12199).

Gan, J. (Guest Editor). 2015. Special Issue of *Forests*: Climate change and forest fires. http://www.mdpi.com/journal/forests/special_issues/forest_fire.

Gan, J., A. Jarrett, and C. Johnson Gaither. 2015. Landowner response to wildfire risk: Adaptation, mitigation or doing nothing. Journal of Environmental Management 159: 186-191.

Gan, J., A. Jarrett, and C. Johnson Gaither. 2014. Wildfire risk adaptation: Propensity of forestland owners to purchase wildfire insurance in the southern U.S. Canadian Journal of Forest Research 44: 1376-1382.

Grebner, D.L., R.K. Grala, O. Joshi, and G. Perez-Verdin. (In Press). Physical and economic aspects of assessing woody biomass availability for bioenergy production. In: Handbook of Bioenergy. Eds. Sandra Eskogilu. Revised and resubmitted on October 3, 2014.

Joshi, O. Grebner, D.L., and P. N. Khanal. 2015. Status of urban wood waste and their potential use for bioenergy in Mississippi. *Resources, Conservation & Recycling*, 102(2015): 20-26.

Joshi, O., Grebner, D.L., Henderson, J.E., and S.R. Gruchy. 2015. Landowners, bioenergy, and extension strategies. *Journal of Extension, 53(2).* Available online at: http://www.joe.org/joe/2015april/a3.php.

Joshi, O., Grebner, D.L., Munn, I.A., and R.K. Grala. 2015. *Issues Concerning Landowner Management Plan Adoption Decisions: A Recursive Bivariate Probit Approach. International Journal of Forestry Research, vol. 2015, Article ID 926303, 8 pages,* http://dx.doi.org/10.1155/2015/926303.

Joshi, O., Grebner, D.L., Munn, I.A., Grado, S.C., Grala, R.K., and A. Hussain. 2014. Factors influencing utilization of woody biomass from wood processing facilities in Mississippi. *Forest Products Journal*, 64(1/2): 64-71.

Joshi, O., Grebner, D.L., Munn, I.A., and R.K. Grala. (In Press). Issues Concerning Landowner Management Plan Adoption Decisions: A Recursive Bivariate Probit Approach. Submitted to *International Journal of Forestry Research* on August 26, 2014. Accepted on January 12, 2015.

Joshi, O., Grebner, D.L., Henderson, J.E., and S.R. Gruchy. (In Press). Landowners, bioenergy, and extension strategies. Submitted to *Journal of Extension* on February 20, 2014. Resubmitted on October 15, 2014. Accepted on October 20, 2014. Published on April 27, 2015.

Kabli, M., J. Gan, and L. Ntaimo. 2015. A stochastic programming model for fuel treatment management. *Forests 6*(6): 2148-2162; doi:10.3390/f6062148.

Kreye, M.M., Adams, D.C., Escobedo, F.J. 2014. The value of forest conservation for water quality protection. Forests, 5:862-884.

Miner, Reid A. Robert C. Abt, Jim L. Bowyer, Marilyn Buford, Robert W. Malmsheimer, Jay O'Laughlin, Elaine E. Oneil, Roger A. Sedjo, Kenneth E. Skog. (2014) Forest Carbon Accounting Considerations in US Bioenergy Policy. Journal of Forestry. http://dx.doi.org/10.5849/jof.14-009

Skog, Kenneth, Robert Abt, and Karen Abt. (2014). Wood Energy and Competing Wood Markets. Chapter 6. In Wood Energy in Developed Countries. Franciso Aguilar Editor. Routledge. 338pp.

Susaeta, A., Carter, D.R., Adams, D.C. 2014. Impacts of climate change on economics of forestry and adaptation strategies in the Southern United States. Journal of Agricultural and Applied Economics 46(2): 257-272.

Susaeta, A., Carter, D.R., Adams, D.C. 2014. Sustainability of forest management under changing climatic conditions in the southern United States: Adaptation strategies, economic rents and carbon sequestration. Journal of Environmental Management 139: 80-87.

Wear, D.N. E. Dixon, R.C. Abt, N. Singh. 2013. Projecting potential adoption of genetically modified Eucalyptus plantations. 52pp. Submitted to USDA Animal and Plant Health Inspection Service (APHIS) in response to Aborgen request for certification. (manuscript submitted to Forest Science 2014).

Theses/Dissertations

Joshi, O. 2013. Woody biomass and bioenergy opportunities in Mississippi. Doctor of Philosophy Dissertation. Mississippi State University. 118 p.

Kreye, M. 2014. Public Preferences and Willingness to Pay for Forest Conservation Programs that Protect Water Quality. Doctor of Philosophy Dissertation. University of Florida. 212 p.

Other publications

Abt, R. 2013. Contributor to "Biomass Boom: Threat or Opportunity for Southern Forests". BIOENERGY Connections Vol. 2.3, UC Berkeley, Energy Biosciences Institute, Chris Woolston Lead Author.

Abt, R.C., C.S. Galik, R.W. Gonzalez. 2013. An Initial Assessment of Economics, Carbon Scores, and Market Impacts of Selected Woody Biomass Feedstock Biomass Systems. 22p. Electric Power Research Institute.

Jose Soto, Francisco J. Escobedo, Damian C. Adams. 2014. An Overview of Carbon Markets for Florida Forest Landowners. FOR319. Gainesville: EDIS/University of Florida Institute of Food and Agricultural Sciences. http://edis.ifas.ufl.edu/FR387

Jose Soto, Damian C. Adams, Francisco J. Escobedo. 2014. Florida Forest Landowner Preferences for Carbon Offset Program Characteristics. Gainesville: EDIS/University of Florida Institute of Food and Agricultural Sciences. In Press.

Grebner, D.L. and P. Khanal. 2014. Non-industrial private forest landowners' willingness to sequester forest carbon in the Southern United States. In: Pine Integrated Network: Education, Mitigation, and Adaptation Project (Pinemap) Year 3 Annual Report, March 2013-February 2014: 32-22.

Khanal, P. and D.L. Grebner. 2015. Nonindustrial private forest (NIPF) landowner attitudes toward climate change and forest carbon sequestration in the Southern United States. In: Book of Extended Abstracts, International Scientific Conference: Forestry a bridge to the future and 90 years of higher forestry education in Bulgaria. Sofia, Bulgaria, May 6-9, 2015.

Khanal, P. and D.L. Grebner. 2015. What characteristics affect non-industrial private forest (NIPF) landowner attitudes towards climate change and forest carbon sequestration in the United States South. In: Book of Abstracts, International Union of Forestry Research Organizations (IUFRO) Symposium Cross-sectoral policy impacts on managerial economics and accounting in forestry, Joint Units 4.05.00 and 9.05.03. Sarajevo, Bosnia-Herzegovina, May 4-6, 2015.

Khanal, P. N., T.J. Dean, S.D. Roberts, and D.L. Grebner. 2015. Evaluating First-Year Pine Seedling Survival Plateau in Louisiana. In: Proceedings, 18th Biennial Southern Silvicultural Research Conference, Knoxville, Tennessee March 2-5, 2015.

Khanal, P.N. and D.L. Grebner. 2014. Factors Affecting NIPF Willingness to Defer Final Harvest for Forest Carbon Sequestration in the Southern U.S. In: Proceedings, 2008 International Society of Forest Resource Economics Annual Meeting, St. Louis, Missouri, March 17-18, 2014.

Audio/video products

No new reported in Sept 2014 report (April-September 2014) or April 2015 report.

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 the September 2014 and April 2015 Progress Reports (March 1, 2014-February 28, 2015)
Please update as necessary and highlight in yellow any new products added to the list for the July 2015 Progress Report.

Presentations

Author(s)/Presenter(s)	Title	Type	Date	Venue/Location
Abt, K.L., R.C. Abt, C.S. Galik, K.E. Skog, and A.L. Stephenson	Effect of policies on wood pellet production and forests	Presentation	July 28, 2014	Annual Meeting of the Southern Forest Resource Assessment Consortium, Durham, NC
Adams, D.C., A. Susaeta, and D.R. Carter	Economics of Forest Management with Climate Change Risks.	Presentation	April 21, 2015	Growing Pines in Changing Times, Tifton, GA
Adams, D.	PINEMAP Outcome Themes: Public Policy and Economy	Presentation	May 14, 2014	PINEMAP Annual Meeting, Athens, GA
An, H., J. Gan, and K. Clifton	Impact of Climate Conditions and Adaptation on Southern Pine Beetle Infestations	Poster Presentation	May 14-16, 2014	PINEMAP Annual Meeting, Athens, GA
Francisco J Escobedo	Using regional forest inventory data to analyze ecosystem service tradeoffs and synergies	Presentation	August 26, 2014	8th Forest Vegetation Management IUFRO meeting, Halmstad Sweden
An, H., J. Gan, and S.J. Cho	Assessing climate change impacts on wildfire risk in the United States	Poster Presentation	June 3-4, 2015	PINEMAP Annual Meeting, Athens, GA
Gan, J., H. An, K. Clifton	Climate change impact on southern pine beetle infestations	Presentation (Conference)	October 11, 2014	2014 SAF Convention, Salt Lake City, UT
Gan, J., A. Jarrett, C. Johnson Gaither	Propensity of landowners to purchase wildfire insurance: Implications for adaptation to wildfire risk under climate variability	Presentation (Conference)	May 28, 2014	International Conference on Social Sciences, Honolulu, HI
Gan, J.	Why should we buy US made forest products: economic and environmental perspectives	Presentation (Meeting)	April 9, 2014	Texas Society of American Foresters Annual Meeting, Athens, Texas
Gan, J.	Transnational leakage of forest conservation: Implications for REDD and offshore outsourcing	Presentation (Keynote, Conference)	July 16, 2014	IUFRO Second Global Forum on Ecological Economics in Forestry, Nanjing, China

Author(s)/Presenter(s)	Title	Type	Date	Venue/Location
Grebner, D.L., Grala, R.K., Henderson, J.E., and O. Joshi	An approach and framework for assessing the use of woody biomass as a bioenergy feedstock in the United States West Gulf Coast Region.	Presentation (Conference)	May 19-23, 2014	International Symposium of International Union of Forestry Research Organizations (IUFRO), Joint Units 4.05.00 and 3.08.00. Sopron, Hungary
Grebner, D.L., Grala, R.K., and O. Joshi	Current status of woody biomass research in the United States Mid-South	Presentation (Conference)	October 6-9, 2013	Forest Biomass Conference in Mierzęcin, Poland.
Grebner, D.L., Grala, R.K., and O. Joshi	Current status of woody biomass research in the United States Mid-South	Presentation (Conference)	January 29, 2014	Seminar Series, Northern Arizona University, Flagstaff, AZ
Grebner, D.L.	Research update	Presentation (Conference)	November 12, 2014	MSU Department of Forestry Annual Advisory Committee Meeting, Mississippi State University
Grebner, D.L., Henderson, J.E., Grala, R.K., and D.G.Hodges	The role of bioenergy as an ecosystem service.	Presentation (Conference)	October 5-11, 2014.	IUFRO World Forestry Congress, Salt Lake City, Utah
Henderson, J., J. Gordon, S. Dicke, G. Hughes, J. Kushla, B. Self, C. Siegert, D. Grebner, and P. Khanal	Climate Change Related Extreme Weather Events and Risk Management Options for Family Forests.	Presentation (Conference)	July 20-24, 2014	99th Annual Meeting and Professional Improvement Conference of the National Association of County Agricultural Agents, Mobile, AL
Henderson, J., J. Gordon, S. Dicke, G. Hughes, J. Kushla, B. Self, C. Siegert, D. Grebner, and P. Khanal.	Climate change related extreme weather events and risk management options for family forests.	Presentation	October 8-11, 2014	Society of American Foresters National Convention, Salt Lake City, Utah
Khanal, P. and D.L. Grebner	Factors Affecting Non-industrial Private Forest Landowner Decision to Manage Forest for Carbon Sequestration.	Presentation (Conference)	June 13-18, 2015	21st International Symposium on Society and Resource Management, Charleston, South Carolina
Khanal, P. and D.L. Grebner	Nonindustrial private forest (NIPF) landowner attitudes toward climate change and forest carbon sequestration in the Southern United States.	Presentation (Conference)	May 6-9, 2015	International Scientific Conference: Forestry a bridge to the future and 90 years of higher forestry education in Bulgaria. Sofia, Bulgaria
Khanal, P. and D.L. Grebner	What characteristics affect non-industrial private forest (NIPF) landowner attitudes towards climate change and forest carbon sequestration in the United States South?	Presentation (Conference)	May 4-6, 2015	International Union of Forestry Research Organizations (IUFRO) Symposium Cross-sectoral policy impacts on managerial economics and accounting in forestry, Joint Units 4.05.00 and 9.05.03. Sarajevo, Bosnia-Herzegovina

Author(s)/Presenter(s)	Title	Type	Date	Venue/Location
Khanal, P. and D.L. Grebner.	Characterizing nonindustrial private forest landowner attitudes toward climate change and carbon sequestration in the Southern US	Presentation (Conference)	November 14, 2014	PINEMAP Webinar
Khanal, P.N. and D.L. Grebner.	NIPF willingness to sequester forest carbon in the southern United States	Presentation (Conference)	October 8-11, 2014	Society of American Foresters National Convention, Salt Lake City, Utah
Khanal, P. and D.L. Grebner.	Characterizing NIPF attitudes toward climate change and carbon sequestration in the southern United States	Presentation (Conference)	October 5-11, 2014	IUFRO World Forestry Congress, Salt Lake City, Utah
Khanal, P.N., Abdollahi, K., Legiandenyi, T., and D.L. Grebner.	Identifying urban forest status and obstacles to earn offset credits under California carbon trading in Baton Rouge, Louisiana.	Poster Presentation	October 8-11, 2014	Society of American Foresters National Convention, Salt Lake City, Utah,
Khanal, P.N. and D.L. Grebner.	Identifying nonindustrial private forest landowners obstacles to manage forests for carbon sequestration in the Southern U.S.	Poster Presentation	October 8-11, 2014	Society of American Foresters National Convention, Salt Lake City, Utah,
Khanal, P. and D.L. Grebner	Factors affecting NIPF willingness to sequester forest carbon in the South	Presentation (Conference)	March 7, 2014	International Society of Forest Resource Economics Annual Meeting, St. Louis, MO
Khanal, P. and D.L. Grebner	Non-industrial private forest landowner obstacles to forest carbon sequestration in the Southern United States	Presentation (Conference)	March 16-18, 2014	Southeastern Natural Resources Graduate Student Research Symposium, Mississippi State University, MS
Khanal, P. and D.L. Grebner	Non-Industrial Private Forest Landowner obstacles to Forest Carbon Sequestration in the Southern United States	Poster Presentation	May 14-16, 2014	PINEMAP Annual Meeting, Athens, GA
Prestemon, J.P (presenter), U. Shankar, A. Xiu, K. Talgo, D. Yang, E. Dixon IV, and K.L. Abt.	Human and Lightning Wildfire Projections for the Southeastern U.S.: 2015-2060.	Presentation (Conference)	March 17, 2014.	International Society for Forest Resource Economics. St. Louis, MO.
Susaeta, A., Carter, D.C., Adams, D.	Sustainability of slash pine forest stands in the southern United States with climate change	Presentation (Conference)	October 10, 2014	IUFRO World Congress

Trainings, workshops, and courses

No new reported in Sept 2014 report (April-September 2014) or April 2015 report.

Andres Susaeta attended the course *Economics of Forest Resource Management*, Faculty of Forest Sciences, Swedish University of Agricultural Sciences, March 9-20, 2015, Umea, Sweden.

Formatted: Font: Times, Highlight
Formatted: Font: Times, Italic, Highlight
Formatted: Font: Times, Highlight
Formatted: Font: Times

Experiments, surveys, and data collection

No new reported in Sept 2014 report (April-September 2014) or April 2015 report.

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 September 2014 and April 2015 Progress Reports (March 1, 2014-February 28, 2015) 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.

Assess policies and programs that may affect C mitigation in planted pine forests (Goal date?)

No progress reported in Sept 2014 report (April-September 2014) or April 2015 report.

We are completing one manuscript assessing the attitudes and willingness to accept compensation for carbon offset production in Florida. Our goal is to submit to the Journal of Agricultural and Applied Economics by August 2015. The results from this study will also be used for a subsequent publication that compares two survey choice elicitation models (Best Worst Choice and Discrete Choice Experimentation), which produce similar estimates of willingness to accept payments for ecosystem services using different choice tasks. This comparison study will be useful to scientists interested in stated preference survey methods, particularly the use of the relatively new tool called Best Worst Choice. Our goal is to finish this latter publication by November 2015.

Formatted: Highlight
Formatted: Highlight
Formatted: Highlight

NPV analysis and regional market impacts of adaptation strategies (Goal date?)

No progress reported in Sept 2014 report (April-September 2014)or April 2015 report.

Document landowner adoption of mitigation and adaptation strategies (Goal date?)

No progress reported in Sept 2014 report (April-September 2014) or April 2015 report.

We are currently analyzing the data collected from our regional survey of non-industrial private forest landowners across the southern United States. We have submitted on article entitled "Characterizing non-industrial private forest landowner attitudes toward climate change and carbon sequestration in the Southern United States" to the Journal of Forestry. We are currently working on revisions. Within this study Nonindustrial Private Forest (NIPF) landowners are segmented in the southern US on the basis of their attitudes toward climate change and carbon sequestration. A k-means cluster analysis was used to segment their climate change and carbon sequestration attitudes into three broad clusters: skeptic, supportive, and undecided landowners.

Formatted: Font: Times

The results indicated that a majority of the southern landowners (40%) held undecided attitudes while the proportion of supportive and skeptical clusters was 33% and 27%, respectively. These attitude clusters differ with respect to landowner income and education as well as their land ownership and management characteristics. In terms of future impact of climate change, 38.9% of landowners in the supportive cluster expected timber yield to fluctuate more than 5% on average but only 12.9% in skeptic cluster expected it while 28.5% of landowners in undecided cluster anticipated the same impact. Results of this study provide insights on current attitudes of NIPF landowners toward climate change and carbon sequestration as well as strategies for effectively communicating climate change and carbon sequestration information to them. Other manuscripts are in development.

Life cycle assessment of wood products within forest and various management strategies (Goal date?)

No progress reported in Sept 2014 report (April-September 2014) or April 2015 report.

NPV and regional market impacts of altered disturbance risks (Goal date?)

We have completed two publications in which we assessed the impacts of climate change on the economics of loblolly pine and slash pine. Both articles have been accepted for publications by the Journal of Agricultural and Applied Economics and Journal of Environmental Management.

Wildfire forecasts under varying climate and socio-economic scenarios have been developed. Using county level wildfire, socioeconomic and downscaled climate, we estimated a model using a three-stage heckman to account for the irregular missing observations. Forecasts were then generated on an annual basis for 9 climate/socio scenarios. A monte carlo analysis will be used to develop an uncertainty profile for each year's forecast for each ecoregion. The mean, median and confidence interval data will be available for use in a DSS or stand level NPV calcuations. The analysis accounts for uncertainty in both wildfire recording and in climate forecasts.

We are building a GAMS-based bioeconomic model of invasive beetle impacts for southern loblolly pine forests. The model will link climate change-related factors to stand-level optimal rotations and regional markets for wood products.
or April 2015 report.

We are in the process of completing one publication assessing the distributional effects of socio-economic and ecological determinants of forest carbon stocks in Florida. Our results provide evidence of heterogeneity in the effects of important determinants, which highlights the limitations of conventional mean based regression results, and the advantage of using quantile regression analysis. Our goal is to submit this article for publication to the journal Environmental Science and Policy by the end of July 2015.

Formatted: Highlight

Bioeconomic modeling of nontimber market ecosystem services (Goal date?)

Using FIA data, we are employing data envelopment analysis to determine the efficiency of forest plots in the provision of ecosystem services. We are considering forest plots in Florida as a decision making units with inputs (for example, number of trees per ha, stand development, and site productivity) and outputs (timber production, species richness and carbon sequestration). This nonparametric approach would compare the efficiency of each forest plot with the most

efficient plot given the existing conditions. Furthermore, the performance of each plot would be evaluated assuming changes in precipitation, temperatures and forest productivity.

We have completed a publication in which we determined the efficiency of loblolly pine forest plots in the provision of timber, carbon sequestration and species richness under climate change. This manuscript is under second revision in the Journal of Environmental Management. We have also completed draft manuscript in which we assess the profits foregone due to inefficiency in loblolly pine forest management with increased level of temperatures and precipitation using a non-parametric economic optimization approach. This manuscript is under collegial review and will be sent for a special issue of Forest Policy Economics.

Formatted: Highlight

~~We have completed a publication in which we determined the efficiency of loblolly pine forest plots in the provision of timber, carbon sequestration and species richness under climate change. This manuscript is under revision in the Journal of Environmental Management. We are completing a draft manuscript in which we assess the profits foregone due to inefficiency in loblolly pine forest management with increased level of temperatures and precipitation using a non-parametric economic optimization approach.~~

Daniel Taylor-Rodriguez and Salvador A. Gezan (working with Co-PI Escobedo) completed "Ecosystem Service Interaction Analysis and Management-Ecological Driver Predictive Models using objective Bayes Procedures". This statistical analysis developed predictive models based on several FIA-based management and ecological factors that contains 2-way ecosystem service interactions among these variables. Interactions between aboveground carbon, herbaceous richness, net timber volume and saw timber volume were analyzed. Factors or drivers influencing these interactions were predicted and identified.
or April 2015 report.

Assess tradeoffs between regional C sequestration, forest products, & maintenance of ecosystem services (Goal date?)

We are finalizing an analysis on the effect of drivers on ecosystem service interactions in subtropical forests using a genetic algorithm. The manuscript used FIA plot-level data from Florida to develop an automated method that spatially identify pine-dominated stands that provide optimal level of ecosystem services and tests what climate change proxies (e.g. forest management activities, ecological/anthropogenic disturbance) significantly affect diversity, timber production, and carbon stores.

An "Ecosystem Service Interaction Analysis and Management-Ecological Driver Predictive Models using objective Bayes Procedures" manuscript (Daniel Taylor-Rodriguez, Salvador A. Gezan, Francisco J. Escobedo, Wendell Cropper, Tim Martin is in preparation.. This statistical analysis developed predictive models based on several FIA-based management and ecological factors that analyzes 2-way ecosystem service trade-offs and interactions among these variables. Interactions and trade-offs between aboveground carbon, herbaceous richness, net timber volume and saw timber volume were analyzed. Factors or drivers influencing these interactions were also predicted and identified.
No additions/ changes from April 2015 report.

We are developing an economic forest stand level model in which we will determine the impacts of increased temperatures and precipitations on the optimal forest management for southern pines using the 3-PG model. We will apply this model in different locations throughout the U.S.

Formatted: Highlight

South to as ascertain the economic rents, optimal rotation age and C sequestration in situ. Our goal is to have preliminary results by October-November 2015.

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.

None to report at this point. No change in April 2015 report.

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 from the Sept 2014 progress report are highlighted in blue and additions from the April 2015 progress report are highlighted in green.
Please update as necessary and highlight in yellow any updates made for this progress report.

Last name	First name	Position	University	Role
An	Hyunjin	Ph.D. Student	TAMU	Assessing climate change impact on southern pine beetle infestations and associated economic and carbon consequences.
Dwivedi	Puneet	Postdoc	University of Illinois-Urbana Champaign	Working with Dr. Gan to assess impacts of climate change on southern pine beetle infestation and exploring life cycle impacts of different wood products produced using southern pines.
Khanal	Puskar	Ph.D. Student	MSU	Research focus: Evaluating forest management practices that enhance carbon sequestration in stands and developing a survey instrument to determine small forest landowner's willingness to implement these practices and identify potential incentives that increase carbon sequestration at the stand level.
Kreye	Melissa	Ph.D. Student	UF	Completed a literature review on the economic value of forest-based changes in water quality; conducted a meta-analysis of forest-based water quality values; and specified an econometric model that predicts willingness to pay for forest-based water quality. Using a benefit transfer method, she has applied the model to two representative sites.
Soto	Jose	Postdoc; formerly PINEMAP Ph.D. Student (graduated 2013)	UF	Postdoc research focus: ~~Modeling the impacts of invasive pine beetles and ecosystem service values as a function of changing climatic conditions, management, and policy.~~ 1) modeling the impacts of invasive pine beetles and ecosystem service values as a function of changing climatic conditions, management, and policy; and 2) implementing a survey of Florida household residents, Master Gardeners, and public officials, which aims at assessing the value of ecosystem services of Florida's urban forests. PhD research focus: Assessing and summarizing competing programs and policies that incentivize carbon sequestration at the local, state, national, and international level. He has also developed, pre-tested, and implemented a survey of non-industrial private forest landowners to determine their willingness to accept payments for carbon offsets based on offset program characteristics. Results of this work will be used to predict participation rates in programs that incentivize changes in land use that increase carbon sequestration and will be integrated in a bioeconomic model of non-market ecosystem services produced under competing approaches for climate change adaptation and mitigation.
Soto	Justin	Undergraduate Intern	UF	2012 Undergraduate Fellow; assisted Melissa Kreye at University of Florida with assessment of the economic value of forest-based ecosystem services under alternative management and policy regimes.

Formatted: None, Space Before: 0 pt, Line spacing: single, Don't keep with next, Don't keep lines together

Last name	First name	Position	University	Role
Susaeta	Andres	Postdoc	UF	Primarily involved in developing a forest stand-level model to assess expected economic rents for forest landowners under hurricane risks associated with future climate change conditions. He has also played a key role in developing an economic model to analyze carbon sequestration in loblolly pine plantations under various carbon subsidies and tax rates in the context of climate change. Working on FIA plot data to analyze the efficiency in the provision of ecosystem services (C sequestration, timber production and biodiversity values) under changing climatic conditions in the U.S. South. He is currently determining optimal forest management of southern pines under climate and economic uncertainty using 3-PG model. ~~He is currently determining optimal forest management of southern pines under climate and economic uncertainty.~~
Timilsina	Nilesh	Postdoc	UF	Working on assessing the interactions between different ecosystem services in pine flatwoods and optimizing modeling to maximize a particular ecosystem service and asses the tradeoff of the others.
Traboulsi	Mohamad		UF	Working on integrating FIA plot data with hydrologic unit watersheds and subwatersheds in Florida. Watershed-level WASSI water yield outputs will then be integrated with FIA C, Timber and diversity data to identify watersheds with optimal provision levels and use/non-use values for water yield, C, timber and understory diversity.
Tucker	Joanna	Postdoc	UF	Assisting with analysis and manuscript preparation for a project involving the use of available USDA Forest Service FIA forest inventory data to estimate understory species richness (i.e. biodiversity).