

# PINEMAP Year 5 Progress Report 2

## December 2015

### Aim 4 (Economics & Policy)

---

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.

#### 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 July 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 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

Adams, D.C. (Guest Editor). 2015. Special Issue of *Forests: Ecosystem services from forests*. [http://www.mdpi.com/journal/forests/special\\_issues/forests\\_services](http://www.mdpi.com/journal/forests/special_issues/forests_services).

An, H., J. Gan, and S. Cho. 2015. Assessing climate change impacts on wildfire risk in the United States. *Forests* 6:3197-3211.

Gan, J. (Guest Editor). 2015. Special Issue of *Forests: Climate change and forest fires*. [http://www.mdpi.com/journal/forests/special\\_issues/forest\\_fire](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.

Grebner, D.L., R.K. Grala, O. Joshi, and G. Perez-Verdin. 2015. Physical and economic aspects to assessing woody biomass availability for bioenergy production and related supply constraints. In: *Handbook of Bioenergy* (pp. 299-321). Eds. Eskogilu, S. Rebennack, S., and P.M. Pardalos. Springer International Publishing, Switzerland 343 p.

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>.

Formatted: Highlight

Formatted: Indent: Left: 0", Hanging: 0.5",  
Adjust space between Latin and Asian text,  
Adjust space between Asian text and numbers,  
Tab stops: Not at 0"

Formatted: Highlight

Formatted: Highlight

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.

**Theses/Dissertations**

Khanal, P. 2015. Carbon sequestration on nonindustrial private forest lands for climate change mitigation in the southern United States. PhD Dissertation. Mississippi State University. 121 p.

None reported in July 2015 report.

Formatted: Indent: Left: 0", First line: 0"

**Other publications**

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, 18<sup>th</sup> Biennial Southern Silvicultural Research Conference, Knoxville, Tennessee March 2-5, 2015.

**Audio/video products**

No new reported in July 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 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
Adams, D.C., A. Susaeta	Efficiency of Ecosystem Services Production in Loblolly Forests with Climate Change	Presentation	November 6, 2015	SAF National Convention, Baton Rouge, Louisiana
	Efficiency of Ecosystem Services Production in Loblolly Forests with Climate Change		November 6, 2015	SAF National Convention, Baton Rouge, Louisiana
Adams, D.C., M. Kreye	Public Preferences for Conserving Rural Lands	Presentation	November 5, 2015	SAF National Convention, Baton Rouge, Louisiana

Formatted: Highlight

Formatted: Highlight

Formatted: Highlight

Formatted: Highlight

Formatted: Highlight

Formatted: Highlight

Author(s)/Presenter(s)	Title	Type	Date	Venue/Location
Adams, D.C., J. Soto	Pre-Invasion Economic Assessment of Ambrosia Beetle X in Southern US Loblolly Stands	Poster	November 5, 2015	SAF National Convention, Baton Rouge, Louisiana
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
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
Grebner, D.L.	The role of bioenergy as an ecosystem service.	Presentation (Special Seminar)	September 21, 2015	Instituto Politécnico Nacional, Durango, Mexico
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	21 <sup>st</sup> 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

Formatted: Highlight

Formatted: Highlight

### Trainings, workshops, and courses

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 July 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 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.*

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

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 July 2015 report.

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

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 an 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. 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.

Formatted: Font: Times, Highlight

Formatted: Font: Times

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

No progress reported in July 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 calculations. 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.

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

We have completed two publications in which we assessed, respectively, the implications of future climate change-related disturbances on landowners' current harvesting decision, and the economic implications of a pre-invasion of Ambrosia beetle on loblolly pine forests. These articles are currently under revision in Forest Policy and Economics, and Journal of Economic Entomology.

### **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 will be sent for a special issue of Forest Policy and Economics.

Formatted: Highlight

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.

### **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.

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. South to as ascertain the economic rents, optimal rotation age and C sequestration in situ. Our goal is to have preliminary results by February 2016.

Formatted: Highlight

Formatted: Highlight

Formatted: Highlight

We are also developing a regional survey to determine public preferences for ecosystem services associated with southern pines such as water quality, carbon sequestration and biodiversity, to elicit public support to develop a hypothetical forest program to ensure the sustainable provision of forest based ecosystem services in light of climate change. The survey will be passed in January – February 2016 and preliminary results are expected in March 2016.

## **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 reported July 2015.

## 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
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. <b>Has completed his PhD Dissertation. Will graduate December 2015.</b>
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: <del>Modeling the impacts of invasive pine beetles and ecosystem service values as a function of changing climatic conditions, management, and policy.</del> 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).