United States Department of Agriculture

Final Report

Title:	Change of Forest Composition and its Impact on Forest Biomass in the Eastern U.S.

Sponsoring Agency	NIFA	**Project Status**	COMPLETE
Funding Source	Mcintire Stennis	**Reporting Frequency**	Final
Accession No.	228077	**Project No.**	IND011531MS
Project Start Date	10/01/2011	**Project End Date**	09/30/2016
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Submitted By	Julie Estrada	**Date Submitted to NIFA**	02/20/2017

Project Director

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Performing Department

Forestry & Natural Resources

Non-Technical Summary

Forests comprise the largest C pool of all terrestrial ecosystems; the sum of carbon in living terrestrial biomass and soils is approximately three times greater than the CO2 in the atmosphere. The ability of forest to sequester C is constrained by general factors such as climate, soil, disturbance, and succession. Any processes leading to changes in the quantity and properties of forests will in turn affect the productivity and C dynamics of forests. One change that has been widely observed in the forest ecosystems in eastern North America is the species composition shift. It is well known that forest tree species vary greatly in properties that drive the C cycle, such as different growth patterns over time, specific achievable stand density, different rooting depths and patterns, different effects on soil C pool, specific wood densities, different life spans, and different vulnerabilities to disturbance. However, investigations into the large-scale impact of species composition change on C stock variability in forest biomass have received little attention. Evaluating the magnitude, rate, and large-scale spatial variability of biomass change caused by species composition change will significantly advance understanding of forest ecosystem functioning in relation to the global C cycle. The shift in species composition in forest ecosystems will have serious economic, ecological, and environmental effects. For example, significant decline in heliophytic species, such as oak and hickory, will lead to the collapse of many wildlife populations, and eventually, affect overall ecosystem stability. Because different tree species have different levels of C sequestration capacity, change in species composition will affect the overall level of C sequestration by the eastern forests, which in turn will influence the global C dynamics. The proposed research will contribute in-depth understanding of the species composition change phenomenon by quantifying the change rates and overall direction and estimating its region-wide impact on biomass accumulation. This contribution is significant, because it will provide a quantitative basis for future studies such as large-scale nutrient dynamic and ecosystem restoration and conservation and add a new dimension to biomass alteration estimation. This research will quantify the impacts introduced by species composition, allowing for more accurate DGVMs and climate models. The proposed research is also expected to improve forest C management to mitigate climatic change. Findings of this research will allow policy makers to better guide regional practices in forest resource protection and utilization as well as land use planning and regulation.

Accomplishments

Major goals of the project

The goal of this research is to understand large-scale species distribution patterns and processes and their ecological and environmental impacts. The specific objectives of this proposed project are: 1) to estimate the rate and geographic pattern of abundance change for the top 100 most prevalent tree species in the eastern forests and synthesize the overall trend of the species composition shift at the ecoprovince level for all 14 ecoprovinces in the eastern U.S. and 2)to quantify the impact of species composition change in above-ground forest biomass accumulation at the ecoprovince level.

What was accomplished under these goals?

Objective 1 has been accomplished. A manuscript has been developed and submitted.
Objective 2 has also been accomplished. We are developing a manuscript.

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What opportunities for training and professional development has the project provided?

Training for one graduate student and one postdoc

How have the results been disseminated to communities of interest?

We disseminate our findings primarily through publishing research articles.

What do you plan to do during the next reporting period to accomplish the goals?

{Nothing to report}

Participants

Actual FTE's for this Reporting Period

Role	Non-Students or faculty	Students with Staffing Roles			Computed Total by Role
		Undergraduate	Graduate	Post-Doctorate	
Scientist	0.5	0	0	0	0.5
Professional	1	0	0.5	1	2.5
Technical	0	0	0	0	0
Administrative	0	0	0	0	0
Other	0	0	0	0	0
Computed Total	1.5	0	0.5	1	3.0

Student Count by Classification of Instructional Programs (CIP) Code

Undergraduate	Graduate	Post-Doctorate	CIP Code
	1	1	03.01 Natural Resources Conservation and Research.

Target Audience

Natural resource managers, policy makers, and paractitioners

Products

Type	Status	Year Published	NIFA Support Acknowledged
Journal Articles	Submitted	2016	YES

Citation

Fei, S. et al. Divergent species responses to climate change.

Other Products

{Nothing to report}

Changes/Problems

{Nothing to report}