

DOE Award # DE-SC0008085 Close-Out Report for UIUC Portion of Grant

UIUC portion of grant closed June 14, 2014. Grant remains active at the Smithsonian.

CARBON DYNAMICS OF FOREST RECOVERY UNDER A CHANGING CLIMATE: FORCINGS, FEEDBACKS, AND IMPLICATIONS FOR EARTH SYSTEM MODELING

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Publications

Anderson-Teixeira, KJ, Miller, AD, Mohan, JE, Hudiburg, T, Duval, BD, DeLucia, EH (2013). Altered dynamics of forest recovery under a changing climate. *Global Change Biology*, 19, 2001-2021. DOI: 10.1111/gcb.12194

Miller AD, Dietze M, DeLucia E, Anderson-Teixeira K (in prep) Elevated CO₂ alters successional processes and productivity in simulated forest regeneration. *Global Change Biology*.

Anderson-Teixeira, KJ et al. (in prep) Carbon dynamics of tropical forest recovery from disturbance derived from a global database. *Global Change Biology*.

Presentations

Miller, A.D., Dietz, M., DeLucia, E., Anderson-Teixeira, K.J. (Dec 2013). American Geophysical Union Fall Meeting, San Francisco, CA.

Anderson-Teixeira, K.J., Miller, A.D., Duval, B.D., DeLucia, E.H. (May 2013) Carbon Dynamics of Forest Recovery under a Changing Climate: Forcings, Feedbacks, and Implications for Earth System Modeling. TES/SBR Joint Investigators Meeting, Potomac, MD.

Anderson-Teixeira, K.J., Miller, A.D., Mohan, J.E., Hudiburg, T., Duval, B.D., DeLucia, E.H. (Feb 2013) Altered dynamics of forest recovery under a changing climate. North American Carbon Program Meeting, Albuquerque, NM.

Anderson-Teixeira, K.J., Miller, A.D., McGarvey, J., Dietze, M, LeBauer, D, Duval, B.D., DeLucia, E.H. (May 2014) Carbon Dynamics of Forest Recovery under a Changing Climate: Forcings, Feedbacks, and Implications for Earth System Modeling. TES/SBR Joint Investigators Meeting, Potomac, MD.

Workshops

Adam Miller attended the “ED Dev, User, Trainee Meeting 2013”, at LBNL (Dec. 2013), organized by Ryan Knox, Marcos Longo, Jeff Chambers, and Paul Moorcroft. Trained on model mechanics and usage, including best practices on model initialization, evaluation, data management, and visualization.

Organized Conference Sessions

"Dynamics of global forests under a changing climate"; American Geophysical Union Fall Meeting (Dec. 2013) (Anderson-Teixeira, McMahon, & Detto)

"Forest dynamics under a changing climate and their long-term context"; American Geophysical Union Fall Meeting (Dec. 2012) (Anderson-Teixeira, DeLucia, & Duval)

Database Development

We are developing a comprehensive, publically accessible global database on C cycling in forests recovering from a variety of stand-clearing events, including stand-clearing fires, clear-cut, and agricultural land abandonment. The database under preparation (Forest Carbon Database, ForC-db) is now the largest global forests C database and features thorough treatment of disturbance history. It includes both forests recovering under ambient conditions, as well as those subjected to climate change experiments (CO₂ enrichment, warming, and precipitation manipulation). Response variables include net ecosystem C balance, primary production (and components thereof), respiration (and components thereof), and C stocks in plant, dead wood, and soil pools. As of Nov 2013, the database includes >14,000 measurements made at 875 sites from observational/ chronosequence, warming, and CO₂ enrichment studies. The database is near- complete for the tropics (Anderson-Teixeira et al. in prep). Database development continues under the portion of the grant transferred to the Smithsonian.

Data Synthesis & Analysis

We are currently analyzing C cycle dynamics of forest recovery in the tropics and how these are shaped by climate (focus on precipitation and seasonality thereof) and preparing a manuscript for submission (Anderson-Teixeira et al. in prep). This work continues under the portion of the grant transferred to the Smithsonian.

Modeling

Postdoc Adam Miller is working on modeling forest regeneration under altered CO₂ and climate using the Ecosystem Demography (ED) model. Because C cycling depends heavily on forest age structure and successional patterns, ED was deemed the best choice, as it is the only current forest simulation scheme that tracks C dynamics across size and age classes. Using Duke forest as a model system, we are using ED2 to simulate the dynamics of C cycling during secondary succession and their probable response to elevated CO₂. Adam has parameterized and evaluated the ED2 model performance against both DukeFACE data and chronosequence data and run simulations for forest recovery under elevated CO₂. Results indicate that elevated CO₂ will significantly alter community composition and forest climate feedbacks and that current projections of long-term NEP increases in forests worldwide may overestimate forest C sequestration. We are currently preparing this first modeling manuscript for submission (Miller et al., in prep). Modeling efforts will continue under the portion of the grant transferred to the Smithsonian.