

Annual Report for Period:03/2005 - 03/2006

Submitted on: 03/20/2006

Principal Investigator: Yanai, Ruth D.

Award ID: 0235650

Organization: SUNY Col Env Sci&Forestry

Title:

Biotic Control of Calcium Supply: Distinguishing Sources to Regrowing Forests

Project Participants

Senior Personnel

Name: Yanai, Ruth

Worked for more than 160 Hours: Yes

Contribution to Project:

Ruth Yanai is responsible for the overall coordination of the project. She is responsible, together with Byung Bae Park, a graduate student, for the analysis of roots collected from soil pits. She is the major professor for Farrah Fatemi, who is responsible for designing and implementing sampling and analysis for allometric equations.

Name: Fisk, Melany

Worked for more than 160 Hours: Yes

Contribution to Project:

Melany Fisk and a graduate student are characterizing soil fungal communities. They are using molecular genetic approaches to quantify the relative frequency of different dominant fungal species throughout an intensively sampled site. This work is paired with quantification and identification of the fungi colonizing mineral baits in the lower B horizon soils. Work is in progress to identify which members of the soil fungal community are attracted to the baits. This work is funded by the US Forest Service.

Name: Blum, Joel

Worked for more than 160 Hours: Yes

Contribution to Project:

Professor Joel Blum is the geochemist on the project. He is responsible for the sequential leaching and chemical analysis of soil and vegetation, which includes major and trace element analyses by ICP-OES and ICP-MS as well as high precision measurement of Sr isotope ratios by TIMS. He is assisted in the laboratory by Dr. Andrea Klaue (senior research associate), Carmen Nezat (Doctoral student) and Kate Keller (Doctoral Student).

Name: Hamburg, Steve

Worked for more than 160 Hours: Yes

Contribution to Project:

Steve Hamburg led the field effort to locate sites and sample soils. He also participated in the design of the tree analysis required for allometric equations. He had four undergraduates participate in the project during the summer of 2004; two were funded from Brown University funds designed to give undergraduates research experience, one was funded off of this grant, and one was supported with the REU funding to the Hubbard Brook LTER.

Name: Arthur, Mary

Worked for more than 160 Hours: Yes

Contribution to Project:

Mary Arthur is the graduate supervisor of Marty Acker who is responsible for characterizing litter fall and coarse woody debris at our study sites. She is also involved in vegetation analysis.

Post-doc

Name: Hane, Elizabeth

Worked for more than 160 Hours: Yes

Contribution to Project:

Elizabeth Hane was primarily responsible for understory vegetation and regeneration and played a role in analysis of overstory vegetation. She was supported by the Rochester Institute of Technology.

Graduate Student**Name:** Lilly, Paul**Worked for more than 160 Hours:** Yes**Contribution to Project:**

Paul Lilly undertook a study of soil acidity funded by the Sussman Foundation. He assisted in our field work in exchange for getting help with his field work in the summer of 2003.

Name: Ritchie, Karen**Worked for more than 160 Hours:** Yes**Contribution to Project:**

Karen Ritchie is working on a Master's thesis on microbial communities in soil funded by the US Forest Service.

Name: Nezat, Carmen**Worked for more than 160 Hours:** Yes**Contribution to Project:**

Carmen Nezat is writing a dissertation on weathering rates of minerals in soil in 2004.

Name: Acker, Marty**Worked for more than 160 Hours:** Yes**Contribution to Project:**

MARty Acker is writing a Master's thesis on litterfall and coarse woody debris. He coordinated field efforts for these collections during the summer of 2004.

Name: Ash, Amanda**Worked for more than 160 Hours:** Yes**Contribution to Project:**

Amanda Ash collected tree cores for a graduate thesis on translocation of calcium and strontium in wood during the summer of 2004.

Name: Boley, Jeremy**Worked for more than 160 Hours:** Yes**Contribution to Project:**

Jeremy Boley worked for us in 2003.

Name: Fatemi, Farrah**Worked for more than 160 Hours:** Yes**Contribution to Project:**

Farrah's Master's thesis will focus on allometric equations for biomass and nutrient content.

Name: Fanelli, Rosemary**Worked for more than 160 Hours:** No**Contribution to Project:**

Rosemary, a graduate student from ESF, processed roots collected from quantitative pits during the summer of 2004.

Undergraduate Student**Name:** Phillips, Erick**Worked for more than 160 Hours:** Yes**Contribution to Project:**

Erick provided field work support during the summer of 2003.

Name: Ross, Noam**Worked for more than 160 Hours:** Yes**Contribution to Project:**

Noam, an undergrad from Brown University, provided support in our field work in 2003 and lab work in 2004.

Name: Just, Allan

Worked for more than 160 Hours: Yes

Contribution to Project:

Allan provided support for our field work over the summer of 2003.

Name: Clark, Heather

Worked for more than 160 Hours: Yes

Contribution to Project:

Heather provided support during the summer of 2003 for our field work.

Name: O'Donnell, Emily

Worked for more than 160 Hours: Yes

Contribution to Project:

Emily, an undergrad from the University of Michigan, began as summer field help, and has continued to assist us with the lab work in 2004.

Name: Coria, Alexandria

Worked for more than 160 Hours: Yes

Contribution to Project:

Alexandria supported the project in the summer of 2003 by assisting with field work.

Name: Averbek, Robin

Worked for more than 160 Hours: Yes

Contribution to Project:

Robin, an undergrad from Brown University, helped with field work over the summer of 2004.

Name: Blodgett, Corrie

Worked for more than 160 Hours: Yes

Contribution to Project:

Corrie helped with field work over the summer of 2004. She was funded by the Rochester Institute of Technology.

Name: Deringer, Molly

Worked for more than 160 Hours: Yes

Contribution to Project:

Molly, an undergrad from Brown University, helped with field work over the summer of 2004

Name: Matsuzaki, Asuka

Worked for more than 160 Hours: Yes

Contribution to Project:

Asuka, an undergrad from ESF, helped with field work and also processed roots collected from quantitative pits during the summer of 2004.

Name: Miftari, Shefije

Worked for more than 160 Hours: Yes

Contribution to Project:

Shefije, an undergrad from ESF, helped with field work over the summer of 2004.

Name: Shapiro, Nicole

Worked for more than 160 Hours: Yes

Contribution to Project:

Nicole, an undergrad from Brown University, helped with field work over the summer of 2004.

Name: Tucker, Dan

Worked for more than 160 Hours: Yes

Contribution to Project:

Dan, an undergrad from Brown University, helped with field work over the summer of 2004.

Name: Weeks, Brian

Worked for more than 160 Hours: Yes

Contribution to Project:

Brian, an undergrad from Brown University, helped with field work over the summer of 2004.

Name: Glenday, Julia

Worked for more than 160 Hours: Yes

Contribution to Project:

Julia, an undergrad from Brown University, helped with lab work over the summer of 2004.

Name: He, Judy

Worked for more than 160 Hours: Yes

Contribution to Project:

Judy He, an undergrad from Brown University, helped with lab work over the summer of 2004.

Name: Kernan, Gwen

Worked for more than 160 Hours: Yes

Contribution to Project:

Gwen Kernan, an undergrad from ESF, processed roots collected from quantitative pits during the summer of 2004.

Name: Khatana, Sameed

Worked for more than 160 Hours: Yes

Contribution to Project:

Sameed, an undergrad from Brown University, helped with lab work over the summer of 2004.

Name: Nishii, Mutsumi

Worked for more than 160 Hours: Yes

Contribution to Project:

Mutsumi Nishii, an undergrad from ESF, processed roots collected from quantitative pits during the summer of 2004.

Name: Smith, Grant

Worked for more than 160 Hours: Yes

Contribution to Project:

Grant, an undergrad from Brown University, helped with lab work over the summer of 2004.

Name: Wu, Eva

Worked for more than 160 Hours: Yes

Contribution to Project:

Eva, an undergrad from Brown University, helped with lab work over the summer of 2004.

Name: Beem-Miller, Jeffery

Worked for more than 160 Hours: Yes

Contribution to Project:

Name: Dejong, Hans

Worked for more than 160 Hours: Yes

Contribution to Project:

Name: Drum, Bochay

Worked for more than 160 Hours: Yes

Contribution to Project:

Name: George, Valerie

Worked for more than 160 Hours: Yes

Contribution to Project:

Name: Gonzalez, Elena

Worked for more than 160 Hours: Yes

Contribution to Project:

Name: Hagamen, Lindsay

Worked for more than 160 Hours: Yes

Contribution to Project:

Name: Molinar, Marissa

Worked for more than 160 Hours: Yes

Contribution to Project:

Name: Mubita, Lynn

Worked for more than 160 Hours: Yes

Contribution to Project:

Name: Skeldon, Monica

Worked for more than 160 Hours: Yes

Contribution to Project:

Technician, Programmer

Name: Vadeboncoeur, Matthew

Worked for more than 160 Hours: Yes

Contribution to Project:

Matt Vadeboncoeur is the full-time technician on this project. During the field season, he was responsible for organizing the field crew and their efforts. He is also responsible for sample management and data coordination.

Name: Andronokova, Irina

Worked for more than 160 Hours: No

Contribution to Project:

Name: Klaue, Andrea

Worked for more than 160 Hours: Yes

Contribution to Project:

Name: Knowlden, Amber

Worked for more than 160 Hours: Yes

Contribution to Project:

Other Participant

Name: Fuss, Colin

Worked for more than 160 Hours: Yes

Contribution to Project:

Colin helped with field work over the summer and through the fall of 2004, he also continued to help us in the lab with sample preparation.

Name: Garrett, Brendon

Worked for more than 160 Hours: No

Contribution to Project:

Brendon helped with field work during the fall of 2004.

Research Experience for Undergraduates**Organizational Partners**

USFS Northeast Forest Experiment Station

USFS White Mountain National Forest

Other Collaborators or Contacts**Activities and Findings****Research and Education Activities:**

We collected soil samples in Maine (International Paper), New York (Finch-Pruyn and IP), and Pennsylvania (public lands) and analyzed them to determine the importance of apatite in the parent materials. We also collected soils and surveyed vegetation in six stands of different ages in New Hampshire. We have engaged 6 graduate students and 6 undergraduate students in these research activities.

In the second year of the project, we began work on 'intensive' study sites at the Bartlett Experimental Forest. We identified three replicate stands of each of three ages. Each stand has three plots 50m x 50m (some of the younger sites may have smaller buffers) with a 30m x 30m core area in which all trees >10cm have been measured and tagged. Subplots were established for measurement of smaller trees and saplings. One soil pit (to a minimum of 25cm below the B-C transition, one was to 50cm into the C) was dug in each of the three plots of six of the sites (2 of each of three ages). The third 'block' of sites remains to be sampled in the third year of the project. We sampled trees in four of the younger sites for allometric analysis, including nutrient contents; we will need to collect additional trees for analysis this summer. We are writing proposals for future experiments involving fertilization of 2 of the plots in each stand.

In the third year of the project we completed field-based data collections (summer 2005), data entry and laboratory analysis of vegetation and soil samples collected during the first two field seasons. We collected tree cores, bark samples, and canopy leaf samples from mature trees to better estimate nutrient stocks in mature stands. We validated vegetation inventory data in plots where we suspected errors, and improved the permanent plot markers at some sites. We measured coarse woody debris and litterfall at our extensive research sites and litterfall at our intensive sites. We collected fresh litter repeatedly at our intensive sites, in order to analyze any bias in litter chemical composition that may result from the traditional litter basket methodology. Chemical analyses of litterfall and soil samples taken in 2004 are nearly complete and analyses of 2005 samples are underway. As part of the ROA project, we visited three forested sites that had been formerly limed and collected vegetation data, soil samples and tree cores. Incubations and collections to examine soil nitrogen processes were also done at these sites.

Findings:

We are preparing manuscripts describing our work in the first year of the study (extensive sites). We found that patterns of regeneration in the chronosequence show that yellow birch sapling density is increasing in the youngest stands but declining in others, sugar maple is increasing in middle-aged stands and declining in the others, and beech is increasing in the oldest stands and changing little in other stands. These changes may reflect a sequence of microsuccession as outlined in Forcier (1975). We have analyzed roots from the soil pits excavated in 2003 and are preparing a manuscript describing the distribution of roots. The title is 'The distribution of roots with soil depth and distance to trees in young and old northern hardwood stands.' The samples from the second year of field work are still undergoing analysis.

In the third year, We submitted three manuscripts describing roots and stands of different ages. One is in press, one is accepted pending revision and one is still in review. Many more papers are in preparation. We have not yet completed the many chemical analyses necessary to fully understand questions related to soil chemistry, although some intriguing patterns seem to be emerging.

Training and Development:

A very large number of undergraduate students have been involved in the project, four of whom have used their work on this project as a basis for undergraduate honors theses. Two graduate students, one from U of Kentucky and one from ESF, have used this project to provide the focus of their Master's theses. In addition two doctoral students at the University of Michigan have utilized this project as part of their dissertation research. Additional graduate students from Appalachian State University, and SUNY ESF have taken on projects that are ancillary to their thesis research.

In addition to the training mentioned above, many professional presentations were made having to do with the data collected from this project.

Steve Hamburg gave a talk at the Ecosystem Center at MBL in March 2004. The title was Calcium Biogeochemistry in the northern hardwood forest; trace minerals, land-use history and acid rain. The co-authors were Ruth Yanai, Mary Arthur and Joel Blum. He also presented 'The Future of New England's Forests: Climate Change, Land-use History, Acid Rain and Mining' at the RI Natural History Survey in November 2004.

Finally, at the Hubbard Brook Cooperators' Meeting in July 2004, Steve Hamburg presented 'Looking Deeper into Soil Nutrients.' The co-authors of this presentation were Joel Blum, Ruth Yanai, Mary Arthur and Elizabeth Hane. Elizabeth Hane gave a presentation titled 'Stand Dynamics Along a Chronosequence.' Ruth Yanai presented 'Chasing the calcium source: Current and future studies, Bartlett field sites and methods.' Emily O'Donnell presented 'Chemical weathering of various soil size fractions at Bartlett Experimental Forest' and Marty Acker presented 'Calcium and leaf and woody litter along a chronosequence.'

Outreach Activities:

We have been involved in outreach projects focused on a new teacher education initiative as well as a regular lecture series that exposes the larger community around our study region to the ideas we and our colleagues are working on. These lectures are organized by one of the co-PIs. The Hubbard Brook Ecosystem Study, of which this project is part, has active programs in outreach and education described at <http://www.hubbardbrook.org>.

Journal Publications

R.D. Yanai, J.D. Blum, S.P. Hamburg, M.A. Arthur, C.A. Nezat, and T. Siccama, "New insights into calcium depletion in northeastern forests.", *Journal of Forestry*, p. NA, vol. 103, (2005). Accepted

S.P. Hamburg, R.D. Yanai, M.A. Arthur, J.D. Blum, and T.G. Siccama, "Biotic control of Ca cycling in northern hardwood forests: acid rain and aging forests.", *Ecosystems*, p. 399, vol. 6, (2003). Published

Ruth D. Yanai, Byung B. Park, and Steven P. Hamburg, "Root distribution with depth in young and old northern hardwood stands measured using quantitative soil pits.", NA, p. NA, vol. NA, (2005). will be submitted in 2005

Ruth D. Yanai, Steven Hamburg, Byung B. Park, and Elizabeth J. Schwartz, "The effects of stand age on land gastropod dynamics in northern New England", NA, p. NA, vol. NA, (2005). will be submitted in 2005

Byung B. Park, Ruth D. Yanai, and Steven P. Hamburg, "Fine and coarse root biomass distribution as stand age with comparing coring method with quantitative soil pits. (Likely to change).", NA, p. NA, vol. NA, (2006). will be submitted in 2006

Byung B. Park, Ruth D. Yanai, and Steven P. Hamburg, "Verifying multivariate factors influencing fine and coarse root biomass in northern hardwoods. (Likely to change).", NA, p. NA, vol. NA, (2006). will be submitted in 2006

Hamburg, Smith, Arthur et al., "Northern hardwood forest productivity: influence of air pollution, land use history and climate change", NA, p. NA, vol. NA, (2006). will be submitted in 2006

Steve Hamburg, Matthew Vadeboncoeur, Joel Blum et al., "Sampling forest soils: a critical look at the quantitative pit method", NA, p. NA, vol. NA, (2006). will be submitted in 2006

Steve Hamburg, Joel Blum, et al., "Nutrients in northern hardwood forest soils: the role of forest age and disturbance history", NA, p. NA, vol. NA, (2006). will be submitted in 2006

Joel Blum and Carmen Nezat, "Variation in long-term chemical weathering rates across the White Mountains Region of New Hampshire", NA, p. NA, vol. NA, (2005). will be submitted in October 2005

Nezat et al., "Sequential leaching of soils as a means of assessing calcium availability and the weathering end-member.", NA, p. NA, vol. NA, (2005). will be submitted in March 2005

Nezat et al., "The importance of soil parent material in assessing calcium availability in soils across the northeastern US", NA, p. NA, vol. NA, (2005). will be submitted in April 2005

Blum et al., "Differences in soil calcium reservoirs available to various northern hardwood tree species.", NA, p. NA, vol. NA, (2005). will be submitted in October 2005

Hane et al., "Stand Dynamics Along a Chronosequence", NA, p. NA, vol. NA, (2005). will be submitted in 2005

Yanai, R.D., B.B. Park, S.P. Hamburg, "The vertical and horizontal distribution of roots in northern hardwood stands of varying age.", Canadian Journal of Forest Research, p. , vol. , (). Accepted

Park, B. B., R. D. Yanai, M. A. Vadeboncoeur, and S. P. Hamburg, "How best to estimate root biomass: pits, cores, or allometric equations?", Soil Science Society of America Journal, p. , vol. , (). In Revision

Vadeboncoeur, M. A., S.P. Hamburg, and R.D. Yanai, "Validation and refinement of allometric equations for roots of northern hardwoods", Ecology, p. , vol. , (). Submitted

Books or Other One-time Publications

George, Valerie and Hane, Elizabeth, "Long-Term Effects of Lime Addition on Forest Understory Biodiversity in New England Forests", (2005). Poster Presentation, Published
Bibliography: Rochester Academy of Sciences poster presentation, November, 2005.

Acker, M.D. and M. A. Arthur., "Mass and nutrient dynamics of coarse and fine woody debris in a chronosequence of northern hardwood forest stands.", (2005). Abstract, Published
Bibliography: Abstracts of the 90th Annual Meeting of the Ecological Society of America, Montreal, Canada. August, 2005.

Fatemi, F.R. and R.D. Yanai, "Aboveground biomass and nutrient content in developing northern hardwood stands.", (2005). Abstract, Published
Bibliography: Abstracts of the 90th Annual Meeting of the Ecological Society of America, Montreal, Canada. August, 2005.

Yanai, R.D., B.B. Park, C.A. Nezat and J.D. Blum, "Apatite as a Calcium Source to Forests", (2005). Abstract, Published
Bibliography: Abstracts of the 90th Annual Meeting of the Ecological Society of America, Montreal, Canada. August, 2005.

Nezat, C.A. and J.D. Blum., "A Sequential Leach Method and Pb Isotope Approach to Studying Apatite Weathering in Granitoid Soils at Hubbard Brook Experimental Forest, NH, USA.", (2005). Poster Presentation, Published
Bibliography: Am Geophys. Union Fall Meeting, San Francisco, December, 2005.

Web/Internet Site

URL(s):

<http://envstudies.brown.edu/research/calcium/>

Description:

Login Information:

username: Acer

password: saccharum

Other Specific Products**Contributions****Contributions within Discipline:**

Our information changes our understanding of Ca sources and Ca supply.

Contributions to Other Disciplines:

Our focus on distinguishing the behavior of young and old stands has implications for interpreting changes in streamwater chemistry over time.

Contributions to Human Resource Development:

See education and development, above.

Contributions to Resources for Research and Education:

Through publications and presentations, as described above.

Contributions Beyond Science and Engineering:

Our research is relevant to environmental policy concerning acid rain and forest harveting, noth of which may cause calcium depletion. For this reason, supporting studies have been funded by both the Agenda 2020 collaboration between the US Forest Service and industry and the New York State Energy Research and Development Authority (NYSERDA) which is the research branch of the electric power industry.

Special Requirements

Special reporting requirements: None

Change in Objectives or Scope: None

Unobligated funds: less than 20 percent of current funds

Animal, Human Subjects, Biohazards: None

Categories for which nothing is reported:

Any Product