

**COVER SHEET FOR PROPOSAL TO THE NATIONAL SCIENCE FOUNDATION**

PROGRAM ANNOUNCEMENT/SOLICITATION NO./CLOSING DATE/if not in response to a program announcement/solicitation enter NSF 04-2					<b>FOR NSF USE ONLY</b>	
FOR CONSIDERATION BY NSF ORGANIZATION UNIT(S) (Indicate the most specific unit known, i.e. program, division, etc.)					<b>NSF PROPOSAL NUMBER</b>	
<b>DEB - Ecosystem Studies</b>					<b>0422766</b>	
DATE RECEIVED	NUMBER OF COPIES	DIVISION ASSIGNED	FUND CODE	DUNS# (Data Universal Numbering System)	FILE LOCATION	
01/30/2004	1	08010000 DEB	1181	020657151	03/06/2013 4:08pm S	
EMPLOYER IDENTIFICATION NUMBER (EIN) OR TAXPAYER IDENTIFICATION NUMBER (TIN)		SHOW PREVIOUS AWARD NO. IF THIS IS <input type="checkbox"/> A RENEWAL <input type="checkbox"/> AN ACCOMPLISHMENT-BASED RENEWAL		IS THIS PROPOSAL BEING SUBMITTED TO ANOTHER FEDERAL AGENCY? YES <input type="checkbox"/> NO <input type="checkbox"/> IF YES, LIST ACRONYM(S)		
		0235650				
NAME OF ORGANIZATION TO WHICH AWARD SHOULD BE MADE <b>SUNY College of Environmental Science and Forestry</b>			ADDRESS OF AWARDEE ORGANIZATION, INCLUDING 9 DIGIT ZIP CODE <b>SUNY College of Environmental Science and Forestry PO Box 9 Albany, NY. 122010009</b>			
AWARDEE ORGANIZATION CODE (IF KNOWN) <b>0028514000</b>						
NAME OF PERFORMING ORGANIZATION, IF DIFFERENT FROM ABOVE			ADDRESS OF PERFORMING ORGANIZATION, IF DIFFERENT, INCLUDING 9 DIGIT ZIP CODE			
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IS AWARDEE ORGANIZATION (Check All That Apply) (See GPG II.C For Definitions)		<input type="checkbox"/> SMALL BUSINESS <input type="checkbox"/> FOR-PROFIT ORGANIZATION		<input type="checkbox"/> MINORITY BUSINESS <input type="checkbox"/> WOMAN-OWNED BUSINESS		<input type="checkbox"/> IF THIS IS A PRELIMINARY PROPOSAL THEN CHECK HERE
TITLE OF PROPOSED PROJECT <b>Biotic Control of Calcium Supply: Distinguishing Sources to Regrowing Forests</b>						
REQUESTED AMOUNT \$ <b>12,000</b>	PROPOSED DURATION (1-60 MONTHS) <b>0</b> months	REQUESTED STARTING DATE	SHOW RELATED PRELIMINARY PROPOSAL NO. IF APPLICABLE			
CHECK APPROPRIATE BOX(ES) IF THIS PROPOSAL INCLUDES ANY OF THE ITEMS LISTED BELOW						
<input type="checkbox"/> BEGINNING INVESTIGATOR (GPG I.A)			<input type="checkbox"/> HUMAN SUBJECTS (GPG II.D.6) Exemption Subsection _____ or IRB App. Date _____			
<input type="checkbox"/> DISCLOSURE OF LOBBYING ACTIVITIES (GPG II.C)			<input type="checkbox"/> INTERNATIONAL COOPERATIVE ACTIVITIES: COUNTRY/COUNTRIES INVOLVED (GPG II.C.2.g.(iv).(c))			
<input type="checkbox"/> PROPRIETARY & PRIVILEGED INFORMATION (GPG I.B, II.C.1.d)						
<input type="checkbox"/> HISTORIC PLACES (GPG II.C.2.j)						
<input type="checkbox"/> SMALL GRANT FOR EXPLOR. RESEARCH (SGER) (GPG II.D.1)						
<input type="checkbox"/> VERTEBRATE ANIMALS (GPG II.D.5) IACUC App. Date _____			<input type="checkbox"/> HIGH RESOLUTION GRAPHICS/OTHER GRAPHICS WHERE EXACT COLOR REPRESENTATION IS REQUIRED FOR PROPER INTERPRETATION (GPG I.E.1)			
PI/PD DEPARTMENT <b>Forest and Natural Resources Management</b>		PI/PD POSTAL ADDRESS <b>1 Forestry Drive 210 Marshall Hall Syracuse, NY 13210 United States</b>				
PI/PD FAX NUMBER <b>315-470-6954</b>						
NAMES (TYPED)	High Degree	Yr of Degree	Telephone Number	Electronic Mail Address		
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## **Summary of Proposed Work**

We propose to involve one or two additional undergraduate students in our research on sources of Ca to forests of different ages. The project is well suited to undergraduate participation because we will have a team of researchers (undergraduates, graduate students, and professors) working together at the Bartlett Experimental Forest in New Hampshire. There are many possible research questions that can be asked in the context of our project, and the considerable information already collected will provide the necessary background to interpreting new results.

There are clear opportunities for students to develop their own projects; several are immediately obvious to us, but students will be responsible for designing their own research objectives and implementation plans. We will be sampling soils and collecting roots in stands of different ages. Information on soil depth, horizonation, and the depth distribution of roots would be available for analysis during time frame of a summer REU, in contrast to information on soil or tissue chemistry, which must await sample processing and analysis. Information on species composition and forest structure, similarly, could be studied immediately, and the patterns revealed would be helpful to the overall project. In addition to the replicate blocks of stands of three ages, which are the focus of our efforts this year, we have at least one collaborator interested in some additional sites that were once limed; the response of various components of the vegetation to liming could be interpreted in the context of changes in Ca cycling with stand age revealed by last year's chronosequence study. Questions that depend on chemical analysis could be taken on by a student planning to continue with a thesis or independent study in the fall.

Without dictating the choice of student projects, we can anticipate some of the training benefits they will receive. They will be involved in additional field measurements to those of their own study, as the field teams visit the various sites to lay out plots, measure vegetation, and sample soils. The excavation of quantitative soil pits will give them first-hand experience with the physical properties of forest soils and their variation across the various sites in the project. They will also learn about the morphology and distribution of the tree roots of various species in soil horizons. They will become familiar with the trees of the northern hardwood forest and with the methods of forest inventory and sample collection. If a student is interested in laboratory or greenhouse experience, there are other projects ongoing that could make use of short-term help, just to provide exposure and a change of pace. Perhaps most importantly, the student will learn about research planning, time management, project coordination, and the scientific method, though shared exploration and problem solving with the many other members of the team.

## **Project supervision and coordination**

The student will benefit from close cooperation with four P.I.s from four institutions, two additional senior personnel from two additional institutions, graduate students from various programs, and half a dozen undergraduates, most of them undertaking honors theses. Students will be housed during the field season in facilities at the Bartlett Experimental Forest, where they will interact with established and developing scientists from many disciplines and institutions. They will attend the annual cooperators meeting of the Hubbard Brook Ecosystem Study, further expanding their connections; we have housing there, as well, and some opportunities to see that forest, collecting snails. Students will also have the opportunity to visit other sites in the region, most notably in upstate New York.

Ruth Yanai has supervised fifteen undergraduate students enrolled in various independent study projects over the years at SUNY-ESF, as well as having undergraduate students employed as research aides in the office, field, and lab. Steve Hamburg has supervised countless honors thesis projects at Brown University. We hope that students will produce not only honors theses but peer-reviewed publications. Guidance in preparing results for publication is available in a seminar taught by Ruth Yanai: FOR 694 Publishing in Scientific Journals.

### **Broader Implications of the Proposed Study**

Four of the six senior scientists conducting this project are women. It is important for male as well as female students to learn from women scientists, and we will consider both; the opportunities to work with female faculty at SUNY-ESF are few (less than 10% of the faculty are women), and both female and male students benefit from the different skills and perspectives that women provide. Yanai is active in the ESF Women's Caucus, which is available to undergraduate women as a source of support as they pursue scientific training in a male-dominated establishment.

### **Previous REU Supplement support**

An earlier award, DEB-0087263, supported three REUs over three years. In 2001, Dan McLean was supported on an REU supplement. He was extremely competent in the field, including dendrology and root excavation, and was a great help in reconnaissance. He learned new skills in the laboratory, and took the lead in setting up the system for scanning roots and analyzing their geometry.

In 2002, the REU supplement supported Sarah Kulpa's research for her Honors Thesis. She analyzed samples and data from our previous experiments on nutrient efflux from intact roots of mature trees, interpreted the results, designed her own experiment, and implemented it. She enrolled in my graduate seminar preparing a manuscript for publication, and her paper is now in review. Sarah was an extremely capable student,

and I was fortunate to be able to employ her as a technician for six months before she started graduate school.

In 2003, DEB-0087263 supported an REU for Oscar Abeillera, who worked on nutrient uptake experiments in the laboratory, in cooperation with a graduate student. He took the lead in developing the methodology to measure root respiration simultaneously with nutrient uptake. These experiments have been valuable to the graduate student, who has continued to develop this approach.

In 2003, this project supported an REU student, Erick Phillips, who divided his time between field work in New Hampshire and lab work in Syracuse. Erick took responsibility for analyzing changes in the depth of the forest floor in thirteen stands of different ages, which had been sampled two or three times previously. He was also involved in collecting and processing roots from soil pits. Erick remained involved as a Research Aide in the fall, so that he could process and weigh the samples he had helped to collect. He learned the statistical techniques necessary to analyze the data, and concluded that the depth and mass of the forest floor had not increased over time, in contrast to a recent regional study.

## **Participant selection**

We will select students based on academic and career interests, previous academic course work and field experience, and aptitude for research. We have contact with many potential students through our teaching and research projects; where we don't have first-hand knowledge of student ability and interest, we will interview their referees, rather than relying solely on written references. The Honors Program is a good source of students with exceptional preparation and motivation.