

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 10-1					FOR NSF USE ONLY	
FOR CONSIDERATION BY NSF ORGANIZATION UNIT(S) (Indicate the most specific unit known, i.e. program, division, etc.)					NSF PROPOSAL NUMBER	
DEB - Ecosystem Studies					1112743	
DATE RECEIVED	NUMBER OF COPIES	DIVISION ASSIGNED	FUND CODE	DUNS# (Data Universal Numbering System)	FILE LOCATION	
12/01/2010	1	08010000 DEB	1181	152606125	03/07/2013 4:27pm 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)		
		0949324				
NAME OF ORGANIZATION TO WHICH AWARD SHOULD BE MADE SUNY College of Environmental Science and Forestry			ADDRESS OF AWARDEE ORGANIZATION, INCLUDING 9 DIGIT ZIP CODE SUNY College of Environmental Science and Forestry PO Box 9 Albany, NY. 122010009			
AWARDEE ORGANIZATION CODE (IF KNOWN) 0028514000						
NAME OF PERFORMING ORGANIZATION, IF DIFFERENT FROM ABOVE			ADDRESS OF PERFORMING ORGANIZATION, IF DIFFERENT, INCLUDING 9 DIGIT ZIP CODE			
PERFORMING ORGANIZATION CODE (IF KNOWN)						
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 Collaborative Research: Nutrient co-limitation in young and mature northern hardwood forests						
REQUESTED AMOUNT \$ 7,500	PROPOSED DURATION (1-60 MONTHS) 0 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.G.2)		<input type="checkbox"/> HUMAN SUBJECTS (GPG II.D.7) Human Subjects Assurance Number _____ Exemption Subsection _____ or IRB App. Date _____				
<input type="checkbox"/> DISCLOSURE OF LOBBYING ACTIVITIES (GPG II.C.1.e)		<input type="checkbox"/> INTERNATIONAL COOPERATIVE ACTIVITIES: COUNTRY/COUNTRIES INVOLVED (GPG II.C.2.j)				
<input type="checkbox"/> PROPRIETARY & PRIVILEGED INFORMATION (GPG I.D, II.C.1.d)		_____				
<input type="checkbox"/> HISTORIC PLACES (GPG II.C.2.j)		<input type="checkbox"/> HIGH RESOLUTION GRAPHICS/OTHER GRAPHICS WHERE EXACT COLOR REPRESENTATION IS REQUIRED FOR PROPER INTERPRETATION (GPG I.G.1)				
<input type="checkbox"/> EAGER* (GPG II.D.2) <input type="checkbox"/> RAPID** (GPG II.D.1)		_____				
<input type="checkbox"/> VERTEBRATE ANIMALS (GPG II.D.6) IACUC App. Date _____ PHS Animal Welfare Assurance Number _____		_____				
PI/PD DEPARTMENT Forest and Natural Resources Management		PI/PD POSTAL ADDRESS 1 Forestry Drive 210 Marshall Hall Syracuse, NY 13210 United States				
PI/PD FAX NUMBER 315-470-6954						
NAMES (TYPED)	High Degree	Yr of Degree	Telephone Number	Electronic Mail Address		
PI/PD NAME Ruth D Yanai	PhD	1990	315-470-6955	rdyanai@syr.edu		
CO-PI/PD						
CO-PI/PD						
CO-PI/PD						
CO-PI/PD						

We are requesting a supplement for Research Experience for Undergraduates to support two REU students.

The project on Multiple Element Limitation in Northern Hardwood Ecosystems (MELNHE) provides excellent opportunities for exposure to scientific research because it involves so many researchers and so many topic areas, with work centered in an attractive geographic location that promotes interaction. In addition to the nine stands of three ages at Bartlett originally funded by NSF, we are working in young and mature stands at Jeffers Brook and Hubbard Brook, which provide a gradient in site fertility. There were five PIs initially funded on collaborative proposals, and four more have written other proposals to fund their work in our sites. There are five graduate students currently funded on the main project and more are being recruited. There are undergraduates on the field crew, each with responsibility for a project area, and there is a constant flow of visiting scientists, foreign exchange students, and visitors from other projects. The center of activity is the White House at Bartlett, with the nearby dorm and lab. Sharing housing, meals, and cooking responsibilities contributes to the chances for interactions with scientists at all levels of development.

Because of the large number of researchers involved, REU participants will have the opportunity to learn about and contribute to a wide variety of measurements at these sites, including tree inventory, herb and seedling inventory, root biomass, root imaging, soil sampling, soil respiration, nitrogen mineralization, leaf area, collecting litterfall, and shooting fresh foliage. There are opportunities for laboratory experiments, for example on nitrogen mineralization and microbial respiration, as well as field experiments. They will also have access to reams of data collected during the previous funding cycle at Bartlett (<http://macmillan.brown.edu/research/calcium/>) and collected over decades at the Hubbard Brook Experimental Forest (http://www.hubbardbrook.org/data/dataset_search.php).

We hope to have additional REU students on our team at Bartlett, supported on the HBR LTER or by the REU Site at Plymouth State University, if renewed. Regardless of how they are funded, we treat all our team members as researchers, not just as grunt labor, and we give them the support they need to learn about experimental design, research planning, time management, project coordination, data analysis, and the scientific communication of results. The integration of efforts across a range of backgrounds and experiences, from REU, to RET, to visiting professors, provides everyone an opportunity to better understand the process of scientific research, and everyone gains exposure to a wide range of subjects within the fields of forest ecology and ecosystem nutrient cycling.

Possible projects

Participants in this year's field operations will develop focused research projects in the context of the overall experimental design. Some possible projects are listed here.

- Impact of fertilization on soil nitrogen transformations using laboratory incubations: The student can examine questions relating to changes in decomposition rates and in nitrogen mineralization and nitrification rates resulting from N and P fertilization. We have pre-treatment results as well as results from similar factorial experiments where nutrients were added in the lab, and the student can compare their results to this previous work.

- Filming minirhizotrons can tell us the effect of nutrient treatments on root production. Calculations of root turnover can make use of root biomass measured in 2009 in power-cored samples at depths > 30 cm and soil cores for shallow root biomass (0-30 cm). Root biomass and production can thus be compared by soil depth, forest age, and across sites.
- Heterotrophic respiration: In 2009, we trenched plots in five stands to exclude roots. This year, a comparison of soil respiration in the trenched plots and outside the plots permits an estimate of autotrophic and heterotrophic respiration. The four plots in each stand should be compared to see if there is already a response to nutrient additions in young and old stand in two contrasting sites.
- The development of leaf area could be monitored using an LAI-2000. We will be monitoring sap flow in some of our stands to test for an increased in transpiration in response to nutrient additions, as observed in the whole-watershed Ca addition at Hubbard Brook. Differences in leaf area development with treatment could be important to explaining changes in transpiration following nutrient additions.
- Northern red oak is an infrequent associate of northern hardwood species in our permanent plots. In a warming climate, we expect this species range to expand. Monitoring oak regeneration could give us an early signal of response to climate change. We have regeneration data from the 1990s to which to compare current data.
- Forest productivity: We will inventory trees on all our plots this year, the first year of treatment. We need to test whether growth differs already by treatment compared to earlier inventories, or whether these data can be used as a baseline to detect future changes in productivity. This project would include field work (with a large crew), data entry, documentation of methods and data, and statistical analysis.
- Forest composition: The results of stand inventory can also be used to describe forest community structures through non-parametric multivariate analysis such as Canonical Correspondence Analysis or Non-Metric Multidimensional Scaling. We have data on environmental variables such as soil chemistry, soil depth, aspect, slope and elevation that could be used in the multivariate analysis to explore causes of the variation in forest structure.

Other program elements

We have developed a culture for mentoring students and developing skills essential to the conduct of scientific research and a spirit of cooperation in the field crew. Some of the program elements are outlined below. New this year will be a weekly seminar series, based on the successful Science Night tradition at Hubbard Brook.

- Proposals for each research project will be developed by the leading student and reviewed by the team. Approved proposals will be posted on our web site prior to initiation of the work. Formal review of proposals can prevent many misunderstandings and errors in implementation.
- Each REU will be mentored by a graduate student. They will be mentored in several areas relating to their individual research, including proposal preparation, data collection, organization, and documentation, and statistical analysis.

- Each REU will give an oral presentation at the annual Hubbard Brook Cooperators meeting in July. Many of our undergraduates have made presentations at this meeting, including three last year.
- We take turns posting photos, results, and stories during the course of the summer. Last year's blog is available at <http://shoestringproject.wordpress.com/>.
- An important component of the summer experience is the shared living experience, including cooking (in teams of two), eating together, and household chores. We have a wide variety of experience and cultural backgrounds represented on the team, and we learn from each other in professional, social, and personal arenas.
- Thursday night discussion series: Herb Bormann and Tony Federer have already agreed to give presentations; many other prominent researchers work at Bartlett who are not associated with our project (Scott Ollinger, Andrew Richardson, Dave Hollinger, Bill Leak), and we will schedule them to give presentations on their work in conjunction with their travel to Bartlett. In alternation with these presentations, we will discuss reading of common interest, including topics such as the impacts of scientific research on society.

Results from previous REU Supplements

This is our first request on the current grant. The previous grant for work on this project (DEB-0235650) supported several REU students. Their projects included an analysis of change in forest floor depth, using long-term remeasurement; analysis of roots collected from quantitative soil pits, contributing to a publication; and a satellite project exploring the long-term effect of liming on N mineralization and P availability. Most of these students made presentations at the annual Cooperators' Meeting of the Hubbard Brook Ecosystem Study, and several used their research projects as the basis for Senior Theses.

Diversity

The crew leader at our field site is a woman, Corrie Blodgett (a veteran of our 2004 field crew, when she was an undergraduate). The majority of our current graduate students (4 out of 5) are women. Half of the 6 PIs are women, including two in leadership positions. Thus the male and female students on the crew will be exposed to both female and male role models. This is important for students from institutions such as ESF, which still has only 23% women on the faculty. We also benefit from broad cultural diversity, with students hailing from Puerto Rico, China, and Korea, as well as the mainland US.

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 teaching and academic year lab employment; where we don't have first-hand knowledge of student ability and interests, we will interview their referees, rather than relying solely on written references.

JUSTIFICATION FOR SUPPLEMENTAL FUNDING

We propose to involve two additional undergraduate students in our research of nutrient co-limitation in hardwood forests of different ages. The project is well suited to undergraduate participation because we will have a team of researchers (undergraduate and graduate students, professors, and Forest Service scientists and others) working together at the Bartlett Experimental Forest in New Hampshire.

SUMMARY PROPOSAL BUDGET

YEAR 2

ORGANIZATION SUNY College of Environmental Science and Forestry				FOR NSF USE ONLY			
				PROPOSAL NO.	DURATION (months)		
PRINCIPAL INVESTIGATOR / PROJECT DIRECTOR Ruth Yanai				AWARD NO.	Proposed	Granted	
A. SENIOR PERSONNEL: PI/PP, Co-PI's, Faculty and Other Senior Associates (List each separately with title, A.7. show number in brackets)				NSF Funded Person-months		Funds Requested By proposer	Funds granted by NSF (if different)
				CAL	ACAD	SUMR	
1. Ruth D Yanai - Principal Investigator				0.00	0.00	0.00	0
2.							
3.							
4.							
5.							
6. (0) OTHERS (LIST INDIVIDUALLY ON BUDGET JUSTIFICATION PAGE)				0.00	0.00	0.00	0
7. (1) TOTAL SENIOR PERSONNEL (1 - 6)				0.00	0.00	0.00	0
B. OTHER PERSONNEL (SHOW NUMBERS IN BRACKETS)							
1. (0) POST DOCTORAL SCHOLARS				0.00	0.00	0.00	0
2. (0) OTHER PROFESSIONALS (TECHNICIAN, PROGRAMMER, ETC.)				0.00	0.00	0.00	0
3. (0) GRADUATE STUDENTS							0
4. (0) UNDERGRADUATE STUDENTS							0
5. (0) SECRETARIAL - CLERICAL (IF CHARGED DIRECTLY)							0
6. (0) OTHER							0
TOTAL SALARIES AND WAGES (A + B)							0
C. FRINGE BENEFITS (IF CHARGED AS DIRECT COSTS)							0
TOTAL SALARIES, WAGES AND FRINGE BENEFITS (A + B + C)							0
D. EQUIPMENT (LIST ITEM AND DOLLAR AMOUNT FOR EACH ITEM EXCEEDING \$5,000.)							
TOTAL EQUIPMENT							0
E. TRAVEL 1. DOMESTIC (INCL. CANADA, MEXICO AND U.S. POSSESSIONS)							0
2. FOREIGN							0
F. PARTICIPANT SUPPORT COSTS							
1. STIPENDS \$ <u> 4,000</u>							
2. TRAVEL <u> 2,500</u>							
3. SUBSISTENCE <u> 0</u>							
4. OTHER <u> 0</u>							
TOTAL NUMBER OF PARTICIPANTS (1)				TOTAL PARTICIPANT COSTS		6,500	
G. OTHER DIRECT COSTS							
1. MATERIALS AND SUPPLIES							0
2. PUBLICATION COSTS/DOCUMENTATION/DISSEMINATION							0
3. CONSULTANT SERVICES							0
4. COMPUTER SERVICES							0
5. SUBAWARDS							0
6. OTHER							0
TOTAL OTHER DIRECT COSTS							0
H. TOTAL DIRECT COSTS (A THROUGH G)							6,500
I. INDIRECT COSTS (F&A)(SPECIFY RATE AND BASE) F1 (Rate: 25.0000, Base: 4000)							
TOTAL INDIRECT COSTS (F&A)							1,000
J. TOTAL DIRECT AND INDIRECT COSTS (H + I)							7,500
K. RESIDUAL FUNDS							0
L. AMOUNT OF THIS REQUEST (J) OR (J MINUS K)							7,500
M. COST SHARING PROPOSED LEVEL \$ 0				AGREED LEVEL IF DIFFERENT \$			
PI/PP NAME Ruth Yanai				FOR NSF USE ONLY			
ORG. REP. NAME* William nicholson				INDIRECT COST RATE VERIFICATION			
				Date Checked	Date Of Rate Sheet	Initials - ORG	

SUMMARY PROPOSAL BUDGET Cumulative

ORGANIZATION SUNY College of Environmental Science and Forestry				FOR NSF USE ONLY			
				PROPOSAL NO.	DURATION (months)		
PRINCIPAL INVESTIGATOR / PROJECT DIRECTOR Ruth Yanai							
				AWARD NO.		Proposed	Granted
A. SENIOR PERSONNEL: PI/PD, Co-PI's, Faculty and Other Senior Associates (List each separately with title, A.7. show number in brackets)				NSF Funded Person-months		Funds Requested By proposer	Funds granted by NSF (if different)
				CAL	ACAD	SUMR	
1. Ruth D Yanai - Principal Investigator				0.00	0.00	0.00	0
2.							
3.							
4.							
5.							
6. () OTHERS (LIST INDIVIDUALLY ON BUDGET JUSTIFICATION PAGE)				0.00	0.00	0.00	0
7. (1) TOTAL SENIOR PERSONNEL (1 - 6)				0.00	0.00	0.00	0
B. OTHER PERSONNEL (SHOW NUMBERS IN BRACKETS)							
1. (0) POST DOCTORAL SCHOLARS				0.00	0.00	0.00	0
2. (0) OTHER PROFESSIONALS (TECHNICIAN, PROGRAMMER, ETC.)				0.00	0.00	0.00	0
3. (0) GRADUATE STUDENTS							0
4. (0) UNDERGRADUATE STUDENTS							0
5. (0) SECRETARIAL - CLERICAL (IF CHARGED DIRECTLY)							0
6. (0) OTHER							0
TOTAL SALARIES AND WAGES (A + B)							0
C. FRINGE BENEFITS (IF CHARGED AS DIRECT COSTS)							0
TOTAL SALARIES, WAGES AND FRINGE BENEFITS (A + B + C)							0
D. EQUIPMENT (LIST ITEM AND DOLLAR AMOUNT FOR EACH ITEM EXCEEDING \$5,000.)							
TOTAL EQUIPMENT							0
E. TRAVEL							
1. DOMESTIC (INCL. CANADA, MEXICO AND U.S. POSSESSIONS)							0
2. FOREIGN							0
F. PARTICIPANT SUPPORT COSTS							
1. STIPENDS \$ <u> 4,000</u>							
2. TRAVEL <u> 2,500</u>							
3. SUBSISTENCE <u> 0</u>							
4. OTHER <u> 0</u>							
TOTAL NUMBER OF PARTICIPANTS (1)				TOTAL PARTICIPANT COSTS			6,500
G. OTHER DIRECT COSTS							
1. MATERIALS AND SUPPLIES							0
2. PUBLICATION COSTS/DOCUMENTATION/DISSEMINATION							0
3. CONSULTANT SERVICES							0
4. COMPUTER SERVICES							0
5. SUBAWARDS							0
6. OTHER							0
TOTAL OTHER DIRECT COSTS							0
H. TOTAL DIRECT COSTS (A THROUGH G)							6,500
I. INDIRECT COSTS (F&A)(SPECIFY RATE AND BASE)							
TOTAL INDIRECT COSTS (F&A)							1,000
J. TOTAL DIRECT AND INDIRECT COSTS (H + I)							7,500
K. RESIDUAL FUNDS							0
L. AMOUNT OF THIS REQUEST (J) OR (J MINUS K)							7,500
M. COST SHARING PROPOSED LEVEL \$ 0				AGREED LEVEL IF DIFFERENT \$			
PI/PD NAME Ruth Yanai				FOR NSF USE ONLY			
ORG. REP. NAME* William nicholson				INDIRECT COST RATE VERIFICATION			
		Date Checked		Date Of Rate Sheet		Initials - ORG	

C *ELECTRONIC SIGNATURES REQUIRED FOR REVISED BUDGET

Budget Justification Page

The impact of this budget revision is a reduction in scope from two students to one.
