

Woods Undergraduate Interdisciplinary Research Program (Woods UIR)

Program's Goals:

Woods Institute for the Environment (Woods) actively catalyzes interdisciplinary research groups that primarily focus on addressing urgent environmental problems we face today. Woods Undergraduate Interdisciplinary Research (Woods UIR) Program will be used specifically to help undergraduates join some of these groups, which will provide paths of inquiry, analysis and discovery for the students through interdisciplinary research. A total of 145 faculty across the university (from all seven schools) are actively involved at Woods, from which 17 or so will provide direct mentoring to about 13 students in 2009-2010.

Woods UIR Program has five primary goals. First, provide students a “hands-on” interdisciplinary research experience with mentors who will show how large real-world problems can be scientifically investigated. Second, provide a working and learning environment in which students build the self-confidence needed for future independent research activities. Third, provide an opportunity for each student to feel a part of their mentor’s research group, thereby watching and participating in collaborative interdisciplinary work. Fourth, getting students from around the campus to know a new cohort of like-thinking peers, from whom they can both learn and teach. Fifth, provide the faculty valuable help for their research projects and “new eyes” through which to view various problems.

Basic Organizational Structure:

Stanford environmental faculty, including 145 Woods affiliated faculty who come from all seven schools, will be asked to submit applications for undergraduate interdisciplinary research opportunities for spring and/or summer terms in the 2009-10 academic year. Five students will be accepted for spring term, and eight for summer. Students wishing to initiate a project will need to approach a faculty member who is willing to apply on the student’s behalf. Faculty applications will describe the interdisciplinary research planned, the names of the various experts involved in the project with whom the student could interact, the tasks the undergraduate will perform, what the student will glean from the work, and the qualifications needed by the student. Faculty are encouraged to nominate an undergraduate. If they cannot, Woods will assist them in identifying several possible applicants and the faculty mentor will make a selection.

Woods will provide some summer grants at \$5.6K, and to spread funding further during the economic downturn, we will continue the funding practice we established in the pilot year, when Woods encouraged faculty mentors to cost-share where possible. Woods will negotiate with faculty to cost share on some grants with a Woods/faculty split of \$4K /\$1.6 for full-time research in the summer.

During the academic year quarterly research awards will not exceed \$1,500. Offering part-time funding commitments will allow additional students to participate in undergraduate interdisciplinary research during the academic year.

Students will be paid by stipend if their research involves traveling with faculty off campus. If students are based on campus they will be paid \$14/hour up to the grant allocation.

Students who participate in research projects in either the spring or summer are required to participate in a new spring course, taught by Professor Terry Root, on “interdisciplinary research survival skills”. Students who participate in research projects on campus in the summer are required to attend a weekly

seminar, managed and funded jointly by the School of Earth Sciences and Woods Institute for the Environment.

We have strong support from the Woods Institute for the Environment which will provide faculty leadership from Woods Senior Fellow Terry Root and staff support from Leigh Johnson, Program Manager, for administrative help, and Kern King, Operations and Business Manager, for accounting oversight. Additionally Woods will provide \$5,600, one student equivalent, to support the program. Woods faculty will cost share up to \$8,000 (five faculty providing \$1.6 in matching funds each).

Recruitment Plans and Selection Criteria for Faculty Mentors:

After funding approval from VPUE, a request for proposals from faculty will be issued on the Woods' website and by email to 145 Stanford environmental faculty and department chairs across campus, including the professional schools.

Proposals will be selected based on strong interdisciplinary collaborative research opportunities for undergraduates; strong mentorship throughout the spring and/or summer quarters; the scope of work and responsibility for the student; faculty commitment to integrate the student with colleagues; and Academic Council affiliation. Additionally, Woods will seek research projects from across the University's five environmental focal areas: climate and energy, land use and conservation, oceans and estuaries, freshwater, and the sustainable built environment.

Examples of Specific Previous Project Objectives and Student Responsibilities:

Evaluating the Sustainability of Multiple-Use Water Services in Developing Countries...

According to Jenna Davis, Civil and Environmental Engineering faculty mentor:

"The research project was designed to explore how the use of domestic water in rural villages can reduce poverty, enhance the financial sustainability of water services, and advance important social goals such as gender equality."

According to Ana Hernandez-Diaz, undergraduate:

"This research was meaningful to me because, I simply would not have been able to participate in this project otherwise. This grant accounted for more than I even pay for my Stanford tuition each year. The project I participated in really helped me make decisions on where I want to take my professional life...I really loved the interdisciplinary opportunities available with the use of the program, especially in the area of development. I liked most the value placed on interdisciplinary research. My project was not fully a civil engineering project. It was also not anthropology or sociology. It was a combination of several disciplines and skills. I think this is where most research should be headed now."

Ecosystem Services as a New Policy Paradigm...

According to Sabine Bergmann, undergraduate:

"My summer research was inspired by a breakthrough concept known as ecosystem services, science that I felt had huge potential to change human behavior. I was eager to explore national policies that would make the most of such potential. Given my background in natural sciences, Professor Buzz Thompson has expertise in fields still new to me. I am truly privileged to have worked with Professor Thompson, a prominent professor at Stanford's Law School."

According to Professor Buzz Thompson, Stanford Law School

"Sabine worked with me this summer on how the concept of ecosystem services can be integrated into environmental impact studies and assessments. Scientists have increasingly discussed the concept of ecosystem services, but the concept is only beginning to be integrated into policy. One of the most important contexts where the concept can be useful is in evaluating the potential impact of new

governmental projects and actions on ecosystem services. Sabine started her research by evaluating the degree to which current environmental impact statements and assessments employ the concept. She then analyzed ideas for how the concept could be better integrated into statements and assessments. As part of this work, she comprehensively reviewed the existing literature and travelled to Washington, to meet with officials in government and non-governmental organizations. Her work was exceptional and significantly advanced the research in this area. I thoroughly enjoyed working with Sabine."

Student Recruitment and Selection:

Student leaders from across campus will receive a flier about the Undergraduate Interdisciplinary Research RFP to disseminate to their ASSU student groups. Department chairs will also be asked to forward the notice to their communities, and the information will be disseminated in the Woods newsletter and on the Woods website. Faculty will select which student will work with them.

Specific Student Assignments, Deliverables, or Presentation:

Students doing research in either the spring or summer or both are required to take a new 1-credit course Interdisciplinary Research Survival Skills, offered in spring term 2010 and taught by Professor Root. The goal of the course is to provide the students with interdisciplinary research skills and the confidence needed to form the foundation upon which more independent work can be built. Additionally, the course aims to help enhance communications between the students and the members of their research teams

Curriculum will include: understanding differences between multidisciplinary and interdisciplinary research, developing an answerable research question, writing research proposals, giving presentations, providing constructive critical comments, publishing, making the most of a research internship, and facilitating student-faculty interactions. Guest speakers from Stanford groups might include representatives from: Woods interdisciplinary senior faculty; Leopold Leadership Program, an international program managed by Woods, which provides leadership and communications training to mid-career academics; Writing and Rhetoric; Center for Teaching and Learning; School of Education; HAAS; and the VPUE. Additionally, several faculty mentors will tell their stories of how they discovered their research interests and expertise.

We will continue our successful collaboration (piloted last year) with the School of Earth Sciences over the summer quarter, which was based on a program the School of Earth Sciences has run for several years. Students funded for summer term research projects on campus are required to attend a weekly seminar run and funded jointly by the School of Earth Sciences and Woods Institute for the Environment. In addition to lunchtime discussions with other students, faculty mentors from the Earth Sciences and Woods undergraduate research programs will discuss their research. Faculty will be selected from a broad range of environmental topical areas and academic disciplines. An emphasis on interdisciplinary environmental research will be included.

Students will be required to present their research at a Woods Advisory Council meeting, a Symposium of Undergraduate Research in Progress (SURP), or the Woods spring student leaders reception.

Students and faculty will sign an agreement to meet these requirements. This is done in the Earth Sciences program and their experience has proven that the compliance level increases when such an agreement is signed and formalized.

Strategies for Providing Mentorship Including:

Training and Resources Available to New or Inexperienced Mentors...

New or Inexperienced Faculty: At the beginning of the spring quarter, all mentors known at that time will meet for lunch, where goals will be discussed, success stories shared, an overview of the program provided, questions can be answered, and concerns addressed by Professor Root, Leigh Johnson, and a guest speaker from VPUE.

Guidance, Resources, and Feedback Available to Students...

Mentoring addressing specific research activities will be overseen by each student's own mentor. Professor Root will meet individually as necessary with students to counsel on problem solving, and if needed will speak with a mentor about next steps and expectations.

The students will meet as a cohort in the interdisciplinary research survival skills class. Besides having fun learning from each other, these meetings will provide a supportive venue where learning how to give and take constructive criticism will be possible.

Two formal evaluations will be conducted by Woods at the end of the spring quarter and at the end of the summer. At least one informal evaluation will be done roughly halfway through the spring quarter, allowing mid-course corrections where needed. Additionally students will complete the VPUE survey.

Outcomes of Past Programs and Ideas for Improvement of Student Experiences:

Pilot Year...

During our pilot year, eight students participated during the academic year and six in the summer, with larger grants for summer research. Faculty mentors included senior faculty, many with joint appointments in Woods. Representation from across campus included Biological Sciences (Gretchen Daily, Rodolfo Dirzo, Don Kennedy), Civil and Environmental Engineering (Jenna Davis), Communication (Jon Krosnick), Education (Nicole Ardoin), Environmental Earth Systems Sciences (Chris Field, Steve Gorelick, David Lobell), Law (Buzz Thompson), Political Science (Terry Karl), and the Emmett Interdisciplinary Program in Environment and Resources (Michael Mastrandrea-special permission granted from VPUE).

To spread funding around during the recession, the amount of money given in the summer was \$1,500-\$4,000 rather than \$5,200 per student. During the academic year quarterly stipends did not exceed \$1,500. On campus students tracked their time hourly on AXESS and researchers in the field received stipends to cover their time. Several of the faculty mentors were able to cost-share, which brought several stipends up to or near to \$5,200. Offering smaller funding commitments allowed additional students to participate in undergraduate interdisciplinary research. We did not provide funding for materials or travel in the pilot year. We required that students working overseas purchase emergency evacuation insurance.

Woods is grateful for the extensive advice we received during our pilot year from the VPUE-funded Earth Sciences Undergraduate Research Program. Their program has been well established over a half-dozen years, and collaborating with the leaders, Anne Egger and Simon Klemperer, shortened our learning curve in many ways including: formalizing requirements for both students and faculty to encourage compliance, providing preparatory support to undergraduates to make the most of the research experience, developing a cohort of undergraduate environmental researchers, and providing fundamental research and presentation skills.

We were able to send our students to several sessions of the School of Earth Science’s GeoPhys spring course, and in return Professor Root lectured in the seminar on how to give effective scientific presentations.

In the summer, several of our students were off campus, and the number on campus was low. We then decided to collaborate and cost share with Earth Sciences on their well established lunchtime seminar. We provided several interdisciplinary speakers from the social sciences, funding for two lunches, and a third of a portion for a graduate student stipend. The addition of our students provided critical mass for the program. Again, faculty from both Earth Sciences and Woods faculty mentors gave talks, which significantly broadened what the students would have had in either program otherwise.

Improvements...

We will provide a similar program with the following improvements. Research grants will be concentrated in spring and summer terms to provide critical mass and to align with course offerings in support of the individual research projects. Professor Root will develop an interdisciplinary research survival skills course for spring term and all participants for spring and summer will be required to take the course for credit. We will add a training and success stories session for faculty mentors.

We required students to give presentations at the SURPs this fall, but almost to a person our undergraduates were overseas fall term! Consequently, we are planning to have “last year’s” presentations later in the academic year at the Woods Advisory Council meeting, the spring Woods environmental student leader meeting, or the spring SURP. We will offer additional opportunities for presentations throughout the year for subsequent years.

Cost share...

We have strong support from the Woods Institute for the Environment that will provide faculty leadership from Woods Senior Fellow Terry Root and staff support from Leigh Johnson, Program Manager, for administrative help, and Kern King, Operations and Business Manager, for accounting oversight. Additionally Woods will provide \$5,600, one student equivalent, to support the program. Building upon our funding approach in the pilot year, in 2009-10 Woods will provide some summer grants at the full \$5.6K and negotiate with faculty to cost share on some grants with a Woods/faculty split of \$4K /\$1.6 for full-time research in the summer. So Woods faculty will cost share up to \$8,000 (five faculty at \$1.6). Additionally, some smaller grants will be made in spring for \$1.5K.

Budget

Three Summer Students at \$5,600 each	16,800
Five Summer Cost-Share Students at \$4,000 with VPUE funds and \$1,600 Woods Faculty Matching	20,000
Five Spring Part-time Students at \$1,500 each	7,500
Thirteen Poster Session supplies at \$50 each	650
partial TA (shared with School of Earth Sciences)	1000