A Survey of University-Based Sustainability Science Programs

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Sarah Banas
Center for Science, Technology, and Sustainable Development
American Association for the Advancement of Science
1200 New York Ave, NW
Washington, DC 20005
(202)326-6492
sbanas@aaas.org

AAAS
ADVANCING SCIENCE, SERVING SOCIETY

Introduction

Policy makers at all levels of governance increasingly look to scientists and engineers to provide guidance in creating sustainable societies. In response, the science and engineering communities are undertaking practical, place-based research to provide decision-support for addressing sustainability challenges. Within academia, this research is increasingly emerging as its own field of study: Science and Technology for Sustainability, or Sustainability Science. There seems to be, however, little coherence in the development of this field across institutions and international borders. Whether a program is well established and funded or just being conceived, all of these sustainability science programs have faced, or are facing, challenges and barriers to success. Sharing experiences with these barriers and possible approaches for overcoming them is a critical prerequisite for large-scale development of this field.

To help encourage this dialogue, the American Association for the Advancement of Science (AAAS) called on its international, multidisciplinary network of scientists and engineers who are engaged in sustainability science at the university-level. After gathering empirical data about the nature of these programs, AAAS is hosting a roundtable discussion at the 2007 AAAS Annual Meeting to provide a forum for sharing experiences, aimed at stimulating a dialogue on how university based programs might develop and interact, not only in the U.S., but globally. AAAS intends this discussion to be just one piece of a larger effort within the Association to develop a broad community of researchers addressing critical questions that are at the nexus of environment, development and societal interactions.[1]

Results

Forty-nine sustainability science program directors responded to the invitation to participate in this project,[2] submitting information about their research or academic program via an online questionnaire (see Appendix A). The results presented here should not be viewed as a comprehensive survey of all sustainability science programs nor as representative of the vast majority, as there are many programs that did not participate. However, this survey does provide a good snapshot of a wide range of programs from across the globe that are approaching sustainability from the perspective of science, and exposes these programs' structures, goals, and their respective challenges and successes.

Following is a summary of the responses, including not only the characteristics of the programs themselves, but some of the issues that they are currently tackling or have already overcome. The complete questionnaire from each program is available in Appendix B.

[1] More information about the activities of the AAAS Center for Science, Technology, and Sustainable Development can be found at http://www.aaas.org/programs/centers/sd/.

[2] An announcement of the project was sent to all network members of the Forum on Science and Innovation for Sustainable Development (http://sustainabilityscience.org), higher-ed sustainability listservs, and via email to program directors at numerous universities.

Summary of Responses

Program Characteristics

Figure 1 below provides basic program characteristics of the participating programs. Of the 49 programs that responded to the questionnaire, 65% were based at universities in North America, with the remainder largely from Europe and Australia. There was one respondent each from Africa and Asia. Just under half of the programs were aimed at graduate-level education, with undergraduate and post-graduate programs accounting for roughly 20% each. Those classified as "other" tended to be university-wide initiatives or research centers without an academic component. Sixty percent of the programs included a mixture of research, teaching, or service. Of the remainder, the majority were research-focused programs.

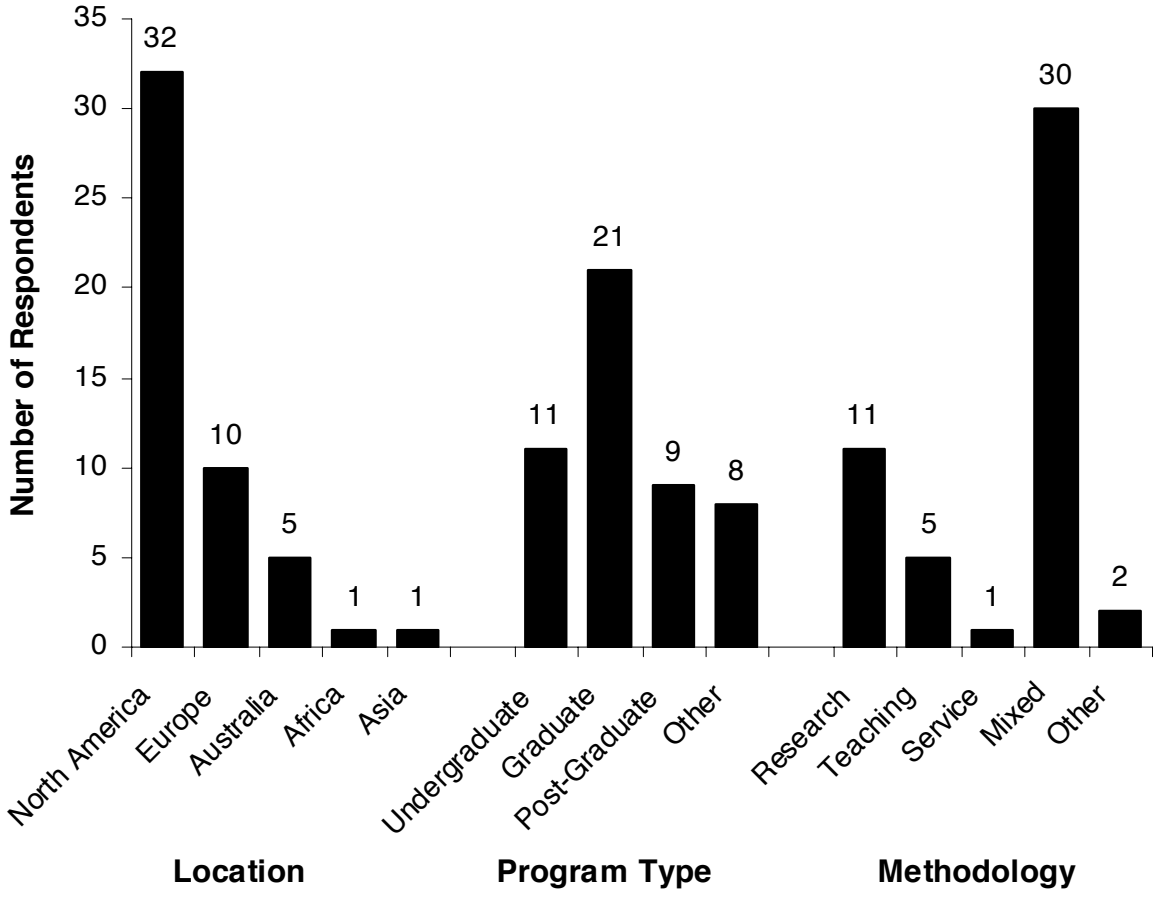

Figure 1 Basic Program Characteristics

Program Enrollment

Figure 2 provides enrollment information of the respondents. The current enrollment of the 34 programs that provided enrollment information is 4,718 students. Eighty-six percent (4,056 students) are currently enrolled in undergraduate-level programs. 458 of the current students are in graduate-level programs. An additional 188 are in sustainability science programs at the post-graduate level. Since their inception, the participating programs have enrolled 14,452 students.

Figure 2 Program Enrollment

	Current Enrollment	Cumulative Enrollment
Undergraduate	4,055	11,632
Graduate	458	776
Post-graduate	188	1,057
Other	17	978
Total	**4,718**	**14,452**

Statistics on program size are provided in Figure 3. There is great variation in the size of programs, with enrollments ranging from 3 to 3,600 participants each year. Undergraduate programs tend to be the largest, with a median of 40.5 participants. Graduate programs, on the other hand, tend to be the smallest, with a median enrollment of 20.

Figure 3 Program Size

	Median Enrollment	Average Enrollment	Min	Max
Undergraduate	40.5	405.5	3	3600
Graduate	20.0	26.9	3	72
Post-graduate	30.0	37.6	7	100
Overall	25.0	143.0	3	3600

Program Funding Sources

Figure 4 on the right shows the most common funding sources for the participating universities. The vast majority of the programs attain funding from multiple sources and so may be represented on the table more than once.

The respondent sustainability science programs, especially those at the undergraduate level or those that are university-wide initiatives, are most commonly funded by the host university. A quarter of the programs receive at least a portion of their funding through research contracts.

Figure 4 Funding Sources

Funding Source	# of Programs
University	16
Research contracts	12
NSF / federal research bodies	8
Unspecified "private" source	8
Government (USA)	7
Private foundation grant	5
Student fees	5
Government (Europe)	5
Corporate	4
Government (non-USA/Europe)	3

Participating University Schools or Departments

The vast majority of sustainability science programs that participated in this project collaborated with a number of schools and departments within their university. Figure 5 shows those departments that were most commonly mentioned as collaborators. Over 25% of the programs work with engineering faculty. 20% of the programs involve the economics, political science, biology, and business or management departments.

Figure 5 Collaborating Departments

School / Department	# of Programs
Engineering	14
Economics	12
Political Science	11
Biology	10
Business / Management	10
Arts & Sciences (general)	8
Architecture	7
Agriculture / Nat Resources	6
Environmental Science	6
Humanities	6
Law	6
Anthropology	5
Chemistry	5
Geography	4
Physics	4
Urban Planning	4
Geology	3
Public Affairs	3
Education	3
Health / Medicine	3
International Development	2
Mathematics	2
Sociology	2

Relationship to Existing Disciplines

In addition to there being great variety in which departments are included in program collaborations, there are also differences in how these programs think about this field of research in relation to those participating disciplines. Figure 6 provides a count of their use of the terms inter-, multi-, trans-, and cross-disciplinary when referring to the field of sustainability science.

Figure 6 Disciplinary Distinction

	# of Programs
Inter-disciplinary	18
Multi-disciplinary	9
Trans-disciplinary	4
Cross-disciplinary	2

Program Focus or Goals

In reading through the program descriptions and academic goals for the 49 programs, there is a great deal of variation in how they describe their work. Figure 7 lists some of the most frequently mentioned themes. About a quarter of the programs explicitly state that their research revolves around human-nature (also society-environment) interactions. Also common among respondents was conducting policy-relevant research, engaging the community in their research, or the importance enlisting systems thinking to solve problems.

Figure 7 Program Focus

Topic	# of Programs
Human-Nature Interactions	12
Policy / Decision-Making Relevance	11
Community Engagement / Communication	10
Systems Thinking	8
Sustainability as 3-Pronged (ecological, enviro, social)	8
Students as change agents	5

Challenges Programs Face

Despite differences in the structure and aims of the responding sustainability science programs, they nevertheless seemed to be facing many of the same challenges. Figure 8 is a comprehensive listing of the challenges that were cited. Overcoming interdisciplinary challenges—working across academic units, and integrating natural and social science research—and finding continued funding topped the list.

Figure 8 Program Challenges

Challenge	# of Programs
Integrating natural and social science research / working across academic units	18
Funding: researcher funding & student scholarships	15
Curriculum design: which content/courses to teach, at which levels	9
Maintaining academic rigor (balance of applied and basic research)	7
Creating public-private partnerships/collaborations	4
Rewarding faculty for interdisciplinary work	4
Marketing / attracting students	4
Determining what methods should be taught & used	3
Institutional structure (types of degree programs / number of electives allowed)	2
Quality / Quantity of researchers	2
Career tracks in sustainability science	1
Creating practical real-life projects for students	1
Scales (global vs. local)	1
Ensuring diversity within the learning environment	1
Student Retention	1

Desired Collaborations

Figure 9 shows what type of additional partners the respondent programs would like to engage. Over half of the programs hope to expand within their host university, collaborating with additional departments. Many are also hoping to work with other universities both domestically (38%) and internationally (25%).

Figure 9 Desired Partners

Partner Type	# of Programs
Additional university departments	25
Other universities (domestic)	19
Local/State/Federal agencies	14
Other universities (international)	12
Domestic (general)	12
International (general)	12
Industry	6

Appendix A – Questionnaire

CONTACT INFORMATION
Please enter primary contact information into the below fields. We will use this information to correspond with you about your submission. Those fields marked with a red asterik are required.

1. Title
2. First Name*
3. Last Name*
4. Department
5. University
6. Mailing Address
7. Phone
8. Email*

PROGRAM INFORMATION
The below section seeks to gather key information on the scope and breadth of University based programs in existence. Note that even small programs are encouraged to submit information and indications of programmatic size are for reference purposes only.

9. Program Title
10. Program Type
11. Duration
12. Program URL #1
13. Program URL #2
14. Program URL #3
15. Students Enrolled Since Inception
16. Students Currently Enrolled
17. Methodology

DETAILS
The below text boxes are designed to accept formatted text and hyperlinks from Web pages and word processors documents. Please feel free to copy and paste any existing programmatic information into these boxes as appropriate.

18. General Description
What is the standard description of this program?

19. University
For collaborative programs, what is the primary host University?

20. Department
What is the primary Department or Departments that oversee this program?

21. Other Departments
What other Departments (if any) are involved?

22. Description of Academic Goals
What academic goals does this program seek to meet? Are these goals specific to the University, drawn from broader guidelines (for example the Millennium Development Goals), or some combination?

23. Description of Funding Sources
In general terms, is this program funded by private funds or government grants? Has funding been adequate, a struggle, or somewhere in between?

24. Description of Challenges
What are the primary challenges of this program? Methodological? Financial? Other?

25. Description of Successes
What are some of the greatest successes of the program thus far? Has it contributed to significant improvements in sustainability, either from a policy or research perspective?

26. Description of Collaborations
What are some of the primary collaborations at work within this program? Are these collaborations within the institution or with other institutions? Is the collaboration primarily domestic or international?

27. Near-term goal
Is there a near-term (five years, one year, other?) goal for this effort? If so, what is the goal?

28. Wished-for Partners
Are their certain collaborations, other than with funders, that could perhaps greatly increase the effectiveness of the program?

Appendix B – Questionnaire Responses

North America

Center for International Earth Science Information Network (CIESIN)

Columbia University, *Palisades, NY, USA*
http://www.ciesin.columbia.edu

CIESIN, the Center for International Earth Science Information Network, is a center within The Earth Institute at Columbia University. CIESIN works at the intersection of the social, natural, and information sciences, and specializes in on-line data and information management, spatial data integration and training, and interdisciplinary research related to human interactions in the environment.

Program Stats

Methodology: Research-based

Home Department: CIESIN

Students Enrolled Since Inception: 0
Students Currently Enrolled: 0

For more information, contact:
Dr. Robert Chen
CIESIN, Columbia
Email: ciesin.info@ciesin.columbia.edu
Phone: 845-365-8988

Academic Goals

CIESIN is not a degree-granting center within Columbia University, and thus does not have academic goals per se, but generally CIESIN's data and research activities focus on themes of environmental sustainability, human wellbeing, poverty alleviation, and human interactions in the environment. For example, CIESIN served as the geospatial data and mapping arm of the UN Millennium Project under Prof. Jeffrey Sachs, and its Environmental Sustainability Index (ESI), produced with Yale University and the World Economic Forum, is a widely cited effort to put the sustainability transition on firmer empirical footings.

Description of Collaborations

We have a variety of domestic and international collaborations. Principal collaborators include U.S. government agencies (NASA, NOAA, EPA, Department of State), multilateral agencies (World Bank, UNDP, UNEP, UNFPA, UNCSD), the private sector (ISciences LLP, IONIC Enterprise, Pitney Bowes), national and international organizations (IHDP, IUSSP, AAG, INECE, CODATA), other universities (Yale, University of New Hampshire, Johns Hopkins), and other departments of Columbia University and The Earth Institute.

Funding Sources

CIESIN's largest single grant is the NASA-funded Socioeconomic Data and Applications Center (SEDAC). CIESIN has also received funds from foundations and multilateral development agencies. Funding has generally been adequate.

Challenges

CIESIN's greatest challenge has been to develop data and tools that facilitate data integration in support of sustainability research and decision making. It is a core challenge of our work and one in which we have had some success, but there remain more challenges ahead.

Successes

CIESIN's greatest successes have been in the area of Internet-based data and information services. CIESIN's Gridded Population of the World (GPW) is widely used for research on human-environment interactions. CIESIN's Environmental Treaties and Resources Indicators (ENTRI) service was the first to provide online treaty status information and the complete texts of a wide number of agreements. CIESIN's Thematic Guides were the first online resources to cover core topics in the area of human dimensions of global environmental change, and continue to be widely cited.

Five Year Goal

To improve data, information, and tools in support of sustainability research and decision making.

Desired Partners

CIESIN is always interested in collaborations with partners on specific research or data development activities.

Center for Resilience

The Ohio State University, *Columbus, OH, USA*
www.resilience.osu.edu

The Center for Resilience is an interdisciplinary research center dedicated to improving the resilience of industrial systems. Our broad scope includes the Manufacturing, Transportation, Energy, Construction, Agribusiness, and Retail industries. In a nutshell, we believe that short-term risk management and long-term sustainability are two ends of the enterprise resilience continuum.

Program Stats

Graduate Program
Methodology: Research-based

Home Department: Integrated Systems Engineering
Other Departments: School of Architecture, College of Business, School of Environment and Natural Resources, School of Public Policy

Students Enrolled Since Inception: 12
Students Currently Enrolled: 10

For more information, contact:
Joseph Fiksel
Integrated Systems Engineering,
The Ohio State University
Email: fiksel.2@osu.edu
Phone: 614-688-8155

Academic Goals

The broad goal is to develop a unifying framework for understanding and modeling resilience in dynamic systems, including environmental, economic, and social systems.

Description of Collaborations

Within institution: Collaboration with OSU Medical Center as well as Facility Operations on Sustainable Architecture.

External: Collaboration with Solid Waste Authority of Central Ohio on innovative resource transformation.

Funding Sources

- Government-funded research develops a fundamental understanding of thermodynamics, biocomplexity, and resilient systems.
- Resilience application projects, conducted in partnership with industrial sponsors, focus on critical issues such as safety, business continuity, resource productivity, and ecological integrity.
- Contract research consists of sponsor-initiated projects with specific deliverables, and full confidentiality protection.

Challenges

The primary challenges is achieving meaningful collaboration across a broad range of disciplines.

Successes

- Major grants from NSF, EPA, and other sponsors.
- Establishment of an industrial consortium with senior executive representation.
- Hosting of annual symposia on cutting-edge resilience-related topics.
- Development of Partnership for Industrial Ecology in Central Ohio.

Center for Sustainability and the Global Environment (SAGE)

University of Wisconsin-Madison, *Madison, WI, USA*
www.sage.wisc.edu

The Center for Sustainability and the Global Environment (SAGE) examines linkages between natural resources, human health and security, and changes in the global environment. Our staff and students conduct cutting-edge research on these critical problems, and disseminate that knowledge through innovative teaching and outreach at the University of Wisconsin-Madison.

Program Stats

Graduate Program
Methodology: Research-based

Home Department: Center for Sustainability and the Global Environment (SAGE)

Students Enrolled Since Inception: 40
Students Currently Enrolled: 20

For more information, contact:
Dr. Jonathan Foley
Center for Sustainability and the Global Environment (SAGE)
University of Wisconsin-Madison
Email: jfoley@wisc.edu
Phone: 608.265.9119

Academic Goals

Research-based Ph.D. programs, plus postdoctoral training.

Description of Collaborations

SAGE is a central "focal point" for sustainability science research and education at the University of Wisconsin, with collaborators across the entire university, specifically in areas of ecology and environmental science, medicine and public health, engineering, and policy issues.

Funding Sources

Mixture of federal funding and private funding.

Successes

Significantly growing program, with ~5 full-time faculty / research faculty, ~20 graduate students, and ~$2 million per year in external funding. Now launching new graduate certificate program (funded by NSF IGERT program): Certificate in Humans and the Global Environment (CHANGE).

Five Year Goal

SAGE is moving ahead with continued plans to expand, especially in the links between global environmental systems, natural resources and human well-being. We are also building a new graduate and postdoctoral leadership program in Global Environmental Solutions.

Desired Partners

Other university, NGO and government-based groups that are focused on sustainability science issues.

Center for Sustainable Development

The University of Texas at Austin, *Austin, TX, USA*
www.utcsd.org

To facilitate the study and practice of sustainable design, planning and development in Texas, the nation and the world through complementary programs of research, education and community engagement.

Description of Collaborations
We collaborate with other departments within the school, and we are currently planning a major research and implementation project that would involve two other major universities in Texas.

Funding Sources
Sponsored research and implementation projects

Successes
Galveston Bay Long Range Planning Project
Solar Decathlon Project
East Austin Housing Project

Program Stats

Graduate Program
Methodology: Mixture of Research, Teaching, or Service

Home Department: Architecture
Other Departments: Architectural Engineering, Public Affairs, Business

For more information, contact:
Michael Mastrangelo
Architecture
The University of Texas at Austin
mike.mastrangelo@mail.utexas.edu
Phone: 512-475-7995

Desired Partners
Collaboration with other schools, disciplines, government agencies, NGOs, and private businesses and associations would greatly increase the effectiveness of the program

Center for Systems Integration & Sustainability

Michigan Statue University, *East Lansing, MI, USA*
www.csis.msu.edu

Achieving sustainability is one of the most important challenges facing society. Addressing complex issues related to sustainability requires innovative systems integration (i.e., integration of multiple disciplines including both social and natural sciences). Our mission is to develop and maintain a center of excellence that integrates ecology with socioeconomics, demography, and other disciplines for ecological sustainability from local, national, to global scales.

Program Stats

Post-graduate Program
Methodology: Research-based

Home Department: Center for Systems Integration and Sustainability
Other Departments: Environmental Science and Policy Program; Plant Biology; Educational Psychology and Special Education; Forestry

Students Enrolled Since Inception: 10
Students Currently Enrolled: 12

For more information, contact:
Dr. William McConnell
Center for Systems Integration and Sustainability, Michigan State University
Email: mcconn64@msu.edu
Phone: 517-432-7108

Academic Goals

Conduct cutting-edge research on emerging issues related to ecological sustainability.

Train new generations of leading scholars for interdisciplinary research.

Disseminate research findings across the globe.

Description of Collaborations

We collaborate with numerous partners here in the US (both at MSU and at other universities) and internationally (e.g., in China, Sweden, New Zealand, Madagascar...)

Funding Sources

Primarily through government grants. The short funding terms of federal grants makes proposal writing a continual activity

Consortium for Environmental Stewardship and Sustainability

Kansas State University, *Manhattan, KS, USA*
www.engg.ksu.edu/CHSR/

In 2006, steps have been taken to start a new effort to develop teaching, research and service activities.

Academic Goals
The main goal is to develop modern programs that allow students to receive a good education in sustainability science, sustainable development, and related fields with opportunities for research and community engagement.

Description of Collaborations
There are efforts to collaborate within the university and with other organizations and institutions.

Funding Sources
This is a new program funded through Kansas State University and gifts to the KSU Foundation.

Program Stats

Graduate Program
Methodology: Mixture of Research, Teaching, or Service

Home Department: Chemical Engineering
Other Departments: The Colleges of Agriculture, Arts and Sciences and Engineering have participating units.

For more information, contact:
Dr. Larry Erickson
Chemical Engineering
Kansas State University
Email: lerick@ksu.edu
Phone: 785-532-4313

Five Year Goal
One goal is to advance the quality of life for all who participate.

Desired Partners
There are opportunities to collaborate with Kansas State University faculty, staff, and students. Please contact the Center for Hazardous Substance Research, 104 Ward Hall, Kansas State University, Manhattan, KS 66506. E-mail: chsr@ksu.edu

Ecological Economics, Values and Policy

Rensselaer Polytechnic Institute, *Troy, NY, USA*
www.rpi.edu/dept/sts/eevp

The Departments of Science and Technology Studies and Economics jointly offer the Program in Ecological Economics, Values and Policy (EEVP), which offers both bachelor's and master's of science degrees. EEVP combines the best of both departments - economic analysis and a broader humanities and social science analysis that combines the roles science and technology play in today's global economy and culture.

Given the strong interdisciplinary background acquired in EEVP, graduates can play leading roles in resolving the critical environmental and social problems of the 21st century. The United Nations reports that the demand forEEVP-type program graduates exceeds the supply. According to the UN, it is crucial that we educate people who understand that "sustainable development does not merely deal with the conservation of nature or the management of ecosystems, but more broadly and fundamental aims at new models of societal development and social transformation."

Program Stats

Graduate Program
Methodology: Mixture of Research, Teaching, or Service

Home Department: Science and Technology Studies
Other Departments: Economics

Students Enrolled Since Inception: 22
Students Currently Enrolled: 3

For more information, contact:
Dr. David Hess
Science and Technology Studies,
Rensselaer Polytechnic Institute
Email: hessd@rpi.edu

Energy & Environmental Policy Program

The University of Delaware, *Newark, DE, USA*
http://ceep.udel.edu/academics/masters/meep.htm
http://ceep.udel.edu/academics/phd/enep.htm
http://ceep.udel.edu/academics/phd/tes.htm

CEEP supports four graduate programs in the energy and environmental policy field: a Master of Environmental and Energy Policy (MEEP); a Ph.D. in Environmental and Energy Policy (Ph.D./ENEP); a Master of Arts, with a concentration in Energy, Environment and Equity (M.A.E3); and a Ph.D., with a specialization in Technology, Environment and Society (Ph.D./TES).

The MEEP and Ph.D./ENEP are administered directly by CEEP. The M.A./E3 and the Ph.D./TES Graduate are sponsored by CEEP and administered by the Urban Affairs and Public Policy Program Faculty of the School of Urban Affairs and Public Policy. Both degrees offer concentrations in: Political Economy of Energy and Environment; Sustainable Development; Disasters and Public Policy; Energy Policy; Environmental Policy.

The 36-credit Master of Environmental and Energy Policy (MEEP) has a 21 credit core curriculum and 15 elective credits. The Ph.D. in Environmental and Energy Policy (Ph.D./ENEP) has three components: a 21 credit core curriculum, the development of a research area and the dissertation proposal involving at least 24 credit hours; and the writing of the dissertation.

Program Stats

Graduate Program
Methodology: Mixture of Research, Teaching, or Service

Home Department: Center for Energy & Environmental Policy
Other Departments: For the Energy and Environmental Policy (ENEP) graduate programs directly administered by CEEP, 5 colleges co-offer coursework and research. These are: the College of Agriculture and Natural Resources; The College of Arts and Science; The College of Engineering; The College of Marine and Earth Studies; The College of Human Services, Education and Public Policy (where CEEP is housed).

Students Enrolled Since Inception: 400
Students Currently Enrolled: 72

For more information, contact:
Dr. John Byrne
Center for Energy & Environmental Policy, University of Delaware
Email: jbbyrne@udel.edu
Phone: 302-831-8405

The ENEP degrees are directly administered by CEEP with the support of five colleges at the University: Agriculture and Natural Resources, Arts and Science, Engineering, Marine Studies and Human Services, Education and Public Policy (where CEEP is housed). The degrees are intended for individuals who wish to focus their graduate programs on interdisciplinary study of the field of energy and environmental policy. A three-credit science, engineering and public policy proficiency is required in the ENEP degrees.

The M.A.E3 includes 36 credit hours of graduate work, of which 15 are in the core curriculum and 21 are in the area of concentration. The Ph.D. specialization in Technology, Environment and Society (Ph.D./TES) has three components: a 15 credit core curriculum, the development of

a research area and the dissertation proposal involving at least 27 credit hours; and the writing of the dissertation. Areas of specialization in both degrees include: Comparative Energy and Environmental Policy; Sustainable Development; Political Economy of Energy, Environment and Development; Environmental Justice; Conservation and Renewable Energy Policy; Integrated Resource Planning; Technology, Environment and Society

Both programs of study lead to degrees in urban affairs and public policy and are intended for individuals who wish to study in the general area of public policy with a focus on energy and environmental issues.

Academic Goals

CEEP's academic philosophy is an interdisciplinary, non-dualistic strategy that seeks to describe the dynamic ways in which, on the one hand, political and economic power can shape ecological futures and, on the other, how ecologies can shape political and economic possibilities. This philosophy frequently takes political economy's interest in the expression and influence of state and corporate power on environmental politics and combines this with insights derived from understanding and analyzing environmental influences on social activity. CEEP's programs are aimed at extending theoretical inquiry beyond the insights of the conventional social and natural sciences by engaging the philosophy and values of ecological justice and building a basis of analysis that can facilitate social change in oder to meet sustainability objectives.

The master's offerings in CEEP seek to ready graduates to enter fields of policy research and advocacy with an interdisciplinary approach to problems. Graduates join governmental and non-governmental organizations, research institutes, and consulting firms focused on energy, environment and sustainability questions.

The PhD offerings prepare graduates to enter universities, research institutes and the public and private sectors with the ability to offer innovative thinking and research approaches to the central energy, environmental and sustainability challenges of contemporary society.

Description of Collaborations

CEEP collaborates on research and exchange with partners around the world. Signed agreements exist with many of the following organizations and projects have been conducted jointly with others:
Australia Conservation Foundation (Australia); Environment and Planning, Royal Melbourne Institute of Technology (Australia); Center for Technology and Society, University of Toronto (Canada); Institute of Policy and Management, Chinese Academy of Science (China); Center for Environmental Science, Beijing University (China); Center for Renewable Energy Development, Energy Research Institute (China); Prayas (environmental NGO, India); The Energy and Resources Institute (environmental and energy NGO, India); Tata Institute of Social Sciences (India); India Renewable Energy Development Agency (India); Citizens Nuclear Information Center (Japan); Korea Energy Economics Institute (Korea); Research Institute for Energy, Environment and Economy, Kyungpook National University (Korea); Environmental Planning Institute, Seoul National University (Korea); Citizens Movement for Environmental Justice (Environmental NGO, Korea); Korean Federation for Environmental Movement (Environmental NGO, Korea); Center for Asia-Pacific Area Studies, Academia Sinica (Taiwan); Institute for

National Policy Research (Taiwan); Department of Land Economics, National Chengchi University (Taiwan); Taiwan Environmental Protection Union (Taiwan); Center for Energy Research and Development, Obafemi Awolowo University (Nigeria); Helsinki University of Technology (Finland); Lappeenranta University of Technology (Finland)

Funding Sources

In addition to institutional support from the University of Delaware, CEEP and its academic programs are supported by endowments, research grants and project support typically from a mix of the following sponsors: Blue Moon Fund; United Nations Development Program (UNDP); United Nations Environment Program (UNEP); United Nations University; World Bank; Asia Foundation; Institute of International Education; Center for Renewable Energy Development, Energy Research Institute (China); Ministry of Agriculture, People's Republic of China; Chinese Academy of Science, Institute of Policy and Management; Ministry of Environment, and Ministry of Trade, Industry and Energy, Republic of Korea; Ministry of Environment, Republic of Korea; Korea Energy Economics Institute; Department of Environment, United Kingdom; U.S. Department of Energy; Environmental Protection Agency (U.S.); National Renewable Energy Laboratory (U.S.); Lawrence Berkeley Laboratory (U.S.); Environmental and Consumer Advocacy Organizations

Challenges

CEEP's graduate programs are intended to the bridge the gulf between policy & science and technology discourses on the energy, environmental and sustainability challenges of our era. Too often, explanations of society-nature relations have been fragmented along disciplinary lines and plagued by dualistic thinking that analytically isolates physical and social phenomena. Through its research and academic programs, CEEP offers opportunities to examine the barriers to and possibilities for sustainable futures in political, economic, scientific, cultural and ecological dimensions.

Successes

1. JOINT INSTITUTE FOR A SUSTAINABLE ENERGY AND ENVIRONMENTAL FUTURE: CEEP created this institute with several Korean universities, government research centers and non-governmental organizations in a collaborative venture to develop sustainable energy and environmental scenarios for East Asia. In its first project, a 37-member team identified the energy efficiency potential in South Korea and found it sufficient to justify a nuclear power moratorium for the country (the government currently plans to construct 17 new nuclear power plants by 2020). Its findings were used by the country's Presidential Commission for Sustainable Development to open a policy discussion on non-nuclear alternatives to meet the country's growing energy demand.

2. BIOENERGY FOR SUSTAINABLE RURAL DEVELOPMENT: In collaboration with China's Energy Research Institute, a project team evaluated strategies featuring bio-gasification and anaerobic digester technology on a small scale to meet local rural energy needs in a sustainable manner. Economic, environmental and health effects of these systems for rural livelihoods were quantified. The Ministry of Agriculture has used this work to scale up use of the technology and approach designed by CEEP for small farm use.

3. SUSTAINABLE ENERGY UTILITY (SEU): With a Blue Ribbon Task Force created by the Delaware Legislature (co-chaired by CEEP's director), the project is creating a Sustainable Energy Utility that will provide energy efficiency and renewable energy services to all energy end-users in the State. Energy suppliers are highly organized and effective at delivering their products, while energy users who are interested in improving energy efficiency and/or applying renewable energy face a fragmented array of technologies, companies, and financing mechanisms. The SEU is conceived as the point-of-contact for energy efficiency and on-site renewable energy services in the same way that a utility is the point-of-contact for conventional energy supply. An SEU can help reduce electricity customer's utility bills, avert energy price volatility, and encourage increased local investment in customer-sited renewable energy technologies, while shifting energy systems toward environmentally and socially sustainable foundations.

4. EQUITY ANALYSES OF UN CLIMATE CHANGE NEGOTIATIONS: CEEP has participated as an observer organization since 1992 in the UN-sponsored process for negotiation and implementation of climate change response policies. Throughout more than 10 years of its participation in this process, CEEP has been guided by an equity- and sustainability-based approach that would require substantial domestic reductions in greenhouse gas emissions by Northern countries over the next 50 years.

5. INTERNATIONAL SOLAR CITIES INITIATIVE (ISCI): International Solar Cities Initiative (ISCI) is a commitment by cities to achieve sustainable development and climate protection through the application of renewable energy and the efficient usage of energy. CEEP is a co-founder and co-organizer of ISCI.

Our greatest success rests with our graduates. CEEP alumni are located in over 25 countries and throughout the US.

Environmental Communication

Northern Arizona University, *Flagstaff, AZ, USA*
www.nau.edu/soc/ecrc/

The Environmental Communication program educates students about communication channels and procedures for communicating environmental sustainability and science issues to a wide variety of audiences. The program teaches about environmental issues impacting the world and about environmental sustainability. The program is also research intensive and offers opportunities for service learning.

Program Stats

Undergraduate Program
Methodology: Mixture of Research, Teaching, or Service

Home Department: School of Communication
Other Departments: The Environmental Sciences Department in the College of Engineering and Natural Sciences

Students Enrolled Since Inception: 1200
Students Currently Enrolled: 60

For more information, contact:
Mrs. Lea Parker
School of Communication
Northern Arizona University
Email: Lea.Parker@nau.edu
Phone: (928) 523-4661

Academic Goals

The Environmental Communication program at Northern Arizona University is offered as an emphasis area for the bachelor of science degree in two areas: journalism and environmental sciences. Courses in this program are also core courses for the environmental studies bachelor of science degree. This program supports the university's sustainiability initiative.

Description of Collaborations

Students in this program often include members of the student environmental club on campus, The Society of Environmental Communicators. They work together to promote sustainability on this campus. Also, these students have worked with the city of Flagstaff and have won awards from Flagstaff's Clean and Green division.

Funding Sources

This program is part of the university curriculum and does not need outside funding.

Challenges

Currently, there is one faculty member who developed and teaches all courses in this program and has written the books for the courses. However, one new faculty member has just been hired who will develop a new course to be added to the curriculum.

Successes

One course, titled Environmental Communication, has a service based component for writing public awareness/action campaigns about specific environmental issues. Several of these campaigns have resulted in actual positive changes in the communities for which they were developed. Examples include the establishment of recycling bins at apartment complexes, and reduction of pollution, water and energy waste on campus.

Five Year Goal

The goal is to educate and empower future citizens of this world with the knowledge, skills and determination necessary for moving communities to become more environmentally sustainable.

Desired Partners

We would love to have the funds for a webmaster. Our current website, an electronic location called the Environmental Communication Resource Center, is way out of date, and currently there is no funding to support this valuable resource.

Environmental Science

Clark University, *Worcester, MA, USA*
www.clarku.edu/departments/ES

This is an undergraduate major in Environmental Science with three tracks sharing a set of common core courses. The tracks are: Earth Systems Science, Environmental and Conservation Biology, and Environmental Science and Policy. The major began in 2006, by combining some former programs with new directions.

Program Stats

Undergraduate Program
Methodology: Teaching-Based

Home Department: Environmental Science Program
Other Departments: Economics; Government; Chemistry; Philosophy; Management; Physics

Students Enrolled Since Inception: 30
Students Currently Enrolled: 30

For more information, contact:
Dr. Frederick Greenaway
Environmental Science Program
Clark University
Email: fgreenaway@clarku.edu
Phone: 508-793-7182

Academic Goals

Enhance and build up the environmental programs at Clark and provide a focused but multidisciplinary approach to environmental study by establishing a multi-department undergraduate program that has a strong component of participation in research projects.

Coordinate with other environmentally based activities on campus (including student-led clubs and activities, university sustainability efforts, and research).

Strengthening the sciences at Clark; help bridge the divide between the social sciences and physical and biologial sciences, while placing understanding the human-environmental relationship as a core objective of the program.

Description of Collaborations

Multiple collaborations within the institution involving faculty (and students) from many departments.

Funding Sources

funded by Clark University

Challenges

Primary challenge is to get faculty from many different departments working closely and efficiently with one another.

Five Year Goal

Develop a strong, well enrolled major in environmental science. Engage undergraduates in faculty and graduate student initiatives in the environmental sciences and sustainability efforts.

Desired Partners

We have yet to establish many internship opportunities with local NGOs and industries.

Environmental Science

University of California, Los Angeles, *Los Angeles, CA, USA*
http://www.ioe.ucla.edu/major.html

Environmental science is the study of the natural processes that occur in the environment and how humans affect them. Rapid increases in human populations and economic development intensify the stresses we place on the planet. Environmental science is centrally important as humankind strives to develop a more sustainable relationship with the Earth and its natural resources.

UCLA's Institute of the Environment, together with the Departments of Atmospheric and Oceanic Sciences, Civil and Environmental Engineering, Earth and Space Sciences, Ecology and Evolutionary Biology, Environmental Health Sciences and Geography, is pleased to announce the inauguration of an innovative dual-component degree program in Environmental Science.

The first component, the Environmental Science Major, provides students with disciplinary breadth in areas important to environmental science. The second component, a Minor/Concentration in one of eight environmental science areas, provides students with focused, disciplinary depth in an area of their choosing. Both components of the program must be completed to receive the degree.

Program Stats

Undergraduate Program
Methodology: Teaching-Based

Home Department: Institute of the Environment
Other Departments: The following departments collaborate with the Institute of the Environment to offer the interdisciplinary degree program: Atmospheric and Oceanic Sciences, Civil and Environmental Engineering, Earth and Space Sciences, Ecology and Evolutionary Biology, Environmental Health Sciences and Geography.

Students Enrolled Since Inception: 20
Students Currently Enrolled: 20

For more information, contact:
Dr. Cully Nordby
Institute of the Environment
University of California, Los Angeles
Email: nordby@ucla.edu
Phone: (310) 267-5607

Academic Goals

Graduates of this program will be fully prepared to enter a career in environmental science or to continue their education in a graduate degree program.

Funding Sources

Funding comes from UCLA College of Letters and Science. Has been more than adequate so far.

Challenges

The main challenge has been working with multiple departments to create and oversee the program. Seven academic units oversee the program which includes courses from 17 different departments.

Five Year Goal

To build the enrollment to ~65 students/year.

Environmental Science and Policy

Clark University, *Worcester, MA, USA*
http://www.clarku.edu/departments/idce/academicsGradESP.cfm

Clark's innovative Environmental Science and Policy (ES&P) graduate program offers a master's degree that develops students' abilities to integrate natural and social sciences to address global and local environmental priorities. Following a tradition of integrated environmental analysis, (in the early 1970s, Clark University started one of the first environmental programs in the country to explore the relationship between science, technology and society) the current ES&P graduate program focuses on the interfaces among environment, technology, society, and development.

Clark's ES&P Graduate Program encourages students to deepen their understanding of environmental issues, and to expand their capacity to respond to those issues. It does this by engagement with a wide spectrum of perspectives and approaches, by stimulating in-depth inquiry, by engendering a healthy skepticism about conventional approaches, and by promoting a learning environment where students are encouraged to develop creative and innovative solutions to pressing environment and development problems. We believe that respect for a variety of opinions, cultures and types of knowledge underpins the success of our work, and that ideological, rigid, and overly narrow approaches represent barriers to solving environmental problems in a sustainable way. We are known for raising and addressing the hard questions – not blindly accepting "conventional wisdom" without proof and validation. The ES&P Program performs appropriate and sound analysis, working on problems that people care about, with transparency in what we do, sharing of data, and we cultivate good communication with colleagues both inside and outside the University.

Program Stats

Graduate Program
Methodology: Mixture of Research, Teaching, or Service

Home Department: Environmental Science and Policy Program. Department of International Development, Community and Environment
Other Departments: Graduate students in Clark's Environmental Science and Policy Graduate Program benefit from many other faculty, students and research initiatives at Clark in the areas of environment and sustainability in the departments of Geography, Biology, the Graduate School of Management, Math and Computer Science and the Marsh Institute.

Students Enrolled Since Inception: 250
Students Currently Enrolled: 30

For more information, contact:
Dr. Jennie Stephens
Environmental Science and Policy Program. Department of International Development, Community and Environment, Clark University
Email: jstephens@clarku.edu
Phone: 508 793-8846

As a member of a closely knit family of graduate programs including International Development & Social Change, Community Development & Planning, and Geographic Information Science for Development & Environment, our ES&P Program is unique. Students are exposed to multiple perspectives and creative, integrated thinking in the classroom and research.

Clark's ES&P program currently has three signature topic areas:

1. Environment and Human Health – understanding and responding to local and global environmental health challenges. This includes: the use of risk and vulnerability assessment; health policy analysis; participatory methods, health GIS, environmental justice, dimensions of social justice and poverty.

2. Climate, Energy and Sustainability - understanding and responding to climate change at the local and global scale, energy and sustainable development challenges. This includes: climate change impact assessment and mitigation; climate and energy policy analysis; energy technology innovation; energy efficiency measures; renewable energy, and other clean energy technologies; campus sustainability.

3. Environmental Management and Policy – understanding the role of science and technology in environmental policy making. This includes how to manage natural resources and pollution, stakeholder engagement, uncertainty in decision-making, the role of regulation, the role of technological innovation, the roles of institutions, social learning, capacity building and policy analysis.

Academic Goals

ES&P graduate students, through coursework and research, are able to gain five critical abilities which are highly sought after by employers in the private and public sectors (ECO, 2004):

1) Creative, critical thinking and problem solving;
2) Scientific and technical literacy
3) Quantitative and qualitative analytical skills;
4) GIS capability; and
5) Knowledge of what it takes to bring together and collaborate with multiple stakeholders.

Our mission is: to educate students to become leaders of, and contributors to, the rapidly evolving field of environmental science and policy; and to undertake innovative research at the intersection of environment, technology, society, and development. Our niche is our intellectual position at the interface of: theory and practice, multiple academic disciplines, and multiple social actors. We teach students to synthesize knowledge and methods from the natural and social sciences, including how to apply appropriate quantitative and qualitative analytical tools like GIS, air, water and soil quality sampling, computer modeling, surveys and focus groups. We also equip them to work with a wide array of stakeholders – communities, industries, governmental agencies, NGOs, researchers and donors – in ways that are sensitive to cultural, institutional, socio-political, and economic contexts. Our graduates are able to recognize, frame, characterize and address problems creatively at the intersection of environment, technology, society, and development.

Some of the many questions that our teaching and research ask include: What role can technology play in reducing the environmental impacts of economic growth, in alleviating poverty, and enhancing community development? How can we manage the double-edged sword of technology that promises great progress but may foster unanticipated environmental consequences and require increasing societal diligence and control? How can we measure

vulnerability to environmental health effects? How can we mitigate climate change impacts while cognizant of inherent uncertainties? How can we make good decisions in situations characterized by high uncertainty and potentially catastrophic consequences? How can stakeholders with different interests work more effectively together to realize more environmentally sustainable and socially just development? How can the needs of industries, communities and individuals be addressed in current and future environmental management processes? What are the existing capacities of national and global institutions to promote a sustainable environment, equitable development and poverty reduction, and how can they be strengthened or new ones created? How can developed and developing countries collaborate on global challenges like climate change, water scarcity and health? How can GIS be applied to environmental science and policy?

Description of Collaborations

Our students and faculty have a broad range of collaborators. We collaborate internally within the Environmental Science and Policy program, as well as with other researchers at Clark University, as well as with external institutions, including academic and non-academic institutions. Our collaborations are both domestic and international.

Funding Sources

Funding for Clark's Environmental Science and Policy graduate program is largely tuition-based within the university structure within the Department of International Development, Community, and Environment, but faculty and student research efforts have been supported by both private funds and government grants. For the most part, it has been a struggle all along to fund top applicants and to fund student research. The university puts most of its research resources into doctoral programs.

Challenges

The primary challenges to the program are financial. We are working on increasing external funding to provide more research experiences to our students.

Successes

Students who complete our master's program have gone on to professions in many organizations related to sustainability. Our students find appropriate jobs within a short time after graduation and move upward in their respective organizations.

The results of our research serve a diversity of audiences from fellow scholars to governmental agencies, private companies, and community groups, especially those who are partners on that research.

Five Year Goal

Clark's ES&P graduate program has identified three strategic objectives to achieve within the next five years: 1) to raise its profile as a top-flight, internationally recognized program in the environmental field; 2) to attract and recruit high quality students from the USA and internationally who identify with our signature areas; and 3) to undertake innovative research that continues to break new ground at the vanguard and intersection of environment, technology, society, and development. Over the next five years ES&P faculty – through the George Perkins

Marsh Research Institute - will enhance our program in the following ways: expand our innovative interdisciplinary research domestically and internationally with a broad array of partners; increase our publication record in both top academic journals as well as influential reports and reviews; and support an increasing number of graduate student researchers through external funding.

Desired Partners

Greater engagement with professionals in the field, through teaching and internships would be very helpful to our students. To do so we need more human and financial resources to maintain the network of affiliated professionals, to fund courses and organize/identify internships.

Environmental Science and Policy Program

Michigan State University, *East Lansing, MI, USA*
http://www.environment.msu.edu/
http://www.environment.msu.edu/specialization/index.html

The Environmental Science and Policy Program (ESPP) is an integration of Michigan State University's environmental work in many fields. One hundred sixty faculty members from 40 departments are affiliated with the program, which began three years ago. ESPP facilitates its interdisciplinary environmental work via a list-serv, website, grants program, coursework and events. ESPP offers a doctoral specialization (equivalent of a minor) bringing together students from multiple departments (40 are engaged to date) for an interdisciplinary complement to their disciplinary work. (The specialization offers four courses; 20 students are enrolled in all four and 50 have taken at least one.) Masters' specializations are being developed.

Academic Goals

Philosophy of the doctoral specialization: In the 21st century, environmental professionals will need both interdisciplinary breadth and disciplinary depth. This is the model that some have called the "T-shaped" graduate student. Disciplinary depth is the pillar of the "T" that provides command of a literature in detail and the meticulous skills required to conduct sound research. Interdisciplinary breadth is the crossbar of the "T", providing language and conceptual frameworks that allow communication across disciplines. Together, these develop professionals who understand the context of their research and can work effectively in multidisciplinary teams. Doctoral students pursue a Ph.D. in one

Program Stats

Graduate Program
Methodology: Mixture of Research, Teaching, or Service

Home Department: Environmental Science and Policy Program
Other Departments: Faculty from these departments are involved: Advertising, Public Relations & Retailing; Agricultural Economics; Animal Science; Anthropology; Biochemistry and Molecular Biology; Biosystems Engineering; Chemical Engineering & Materials Science; Chemistry; Civil and Environmental Engineering; Community, Agriculture, Recreation & Resource Studies; Computer Science and Engineering; Construction Management Program; Criminal Justice; Crop and Soil Sciences; Economics; Entomology; Family and Child Ecology; Fisheries & Wildlife; Forestry; Geography; Geological Sciences; History; Horticulture; Journalism; Kellogg Biological Station; College of Law; Microbiology & Molecular Genetics; Packaging; Pathobiology and Diagnostic Investigation; Pediatrics & Human Development; Pharmacology and Toxicology; Philosophy; Plant Biology; Plant Pathology; Political Science; Psychology; Sociology; Urban & Regional Planning; Writing, Rhetoric and American Cultures; Zoology

Students Enrolled Since Inception: 70
Students Currently Enrolled: 70

For more information, contact:
Dr. Tom Dietz
Environmental Science and Policy Program
Michigan State University
Email: espp@msu.edu
Phone: 517-492-8296

of MSU's many existing doctoral programs that have an environmental focus. In addition, they complete the coursework for the Specialization in Environmental Science and Policy. The Specialization provides students with an understanding of the diverse disciplines brought to bear on contemporary environmental problems. Each course is designed to provide an understanding of how various disciplines conceptualize environmental issues and how scientific information can be brought to bear on environmental decision-making and environmental policy.

Description of Collaborations
The program itself represents a major collaboration between five MSU colleges, and the Environmental Research Initiative represents faculty-level collaboration. A result of these collaborations includes work research ventures that have developed across institutions both domestically and internationally.

Funding Sources
The program is funded by the university: specifically, the five deans on the board, the Vice President for Research and Graduate Studies, the Provost, and the Michigan Agricultural Experiment Station. Part of the program's mandate is to assist faculty in accessing grant money.

Challenges
Challenges are essentially those connected with interdisciplinary work: how best to bring together people from different backgrounds and support their interactions, given conceptual and logistical barriers (e.g., time constraints).

Successes
MSU faculty are already geared toward interdisciplinary work. ESPP's Environmental Research Initiative provided additional resources for such collaboration, funding 13 interdisciplinary groups on diverse issues. Faculty members have also designed the four courses of the doctoral specialization to provide a base for interdisciplinary understanding.

Five Year Goal
The program is a way to (a) showcase strong existing MSU work in this area and (b) enhance it further.

Desired Partners
ESPP is interested in connections with external entities engaged in environmental activities – business, government, media, the non-profit sector. ESPP and associated faculty engage with these groups in multiple ways (for example: through a memorandum of understanding with the Department of Environmental Quality, and membership in the local Sustainable Business Forum). These connections are essential for ensuring that academic and other sectors share knowledge in addressing critical issues.

Global Environmental Studies

Clark University, *Worcester, MA, USA*
www.clarku.edu/ges

Global Environmental Studies focuses on the economic, cultural, and political forces that produce environmental transformation. Students will learn what kinds of economies and livelihoods lead toward sustainability, economic and social justice; and what remedies there are for restoring degraded ecologies. Students will also learn the geographies of difference and choice regarding development desires and nature-society relationships.

Through this major you will gain knowledge from a wide range of disciplines here at Clark University. Administered through Clark's world renowned School of Geography, you will have a chance to take classes from the following departments and programs:
Geography, Environmental Science and Policy, Visual and Performing Arts, International Development and Social Change, Biology, Economics, Government, History, Management, Philosophy, Sociology and Women's Studies.

Program Stats

Undergraduate Program
Methodology: Mixture of Research, Teaching, or Service

Home Department: Geography
Other Departments: Visual and Performing Arts, International Development, Community and Environment, Biology, Economics, Philosophy, Government, Communication and Culture, English

Students Enrolled Since Inception: 20
Students Currently Enrolled: 16

For more information, contact:
Dr. Jacque (Jody) Emel
Geography, Clark University
Email: jemel@clarku.edu

Academic Goals

The goals of this program are to understand the economic, political and cultural structures and processes that produce environmental transformation and degradation. Clear understanding of the bases of undesirable transformation may produce "solutions" that will actually achieve "sustainability" of some sort. Communicating the nature and implications of these transformative processes is necessary to sustainably altering them, and thus communication through writing, art, and speaking is another primary goal of the program. Student research and learning abroad is yet another goal because comparative work suggests new ways of thinking about environmental issues.

Description of Collaborations

The program is interdisciplinary within the institution -- nearly all departments are involved. The program also has strong ties to other universities with environmental science/studies programs, such as Murdoch University in Australia and Worcester Polytechnic Institute locally in Worcester. The plan is to continue to build this international and local network.

Funding Sources
This program is funded by the university. Funding for "hands on" learning in the community and abroad is desirable.

Challenges
the primary challenges of the program are financial and organizational (because it is an interdisciplinary program).

Successes
The Global Environmental Studies program produces undergraduate majors. There is a direct link to significant improvements in campus sustainability. There are, in addition, many more people going on to graduate school, teaching jobs, etc. with a much better understanding of how sustainability might be achieved through political, economic and cultural change.

Five Year Goal
The goal is to have at least 8 related universities (in other countries) with environmental science/studies programs working with us by 2010.

Desired Partners
In addition to international academic partners, we would like to have a number of non-governmental organizations involved with our program. Greenpeace offers a semester of organizing for students and we would like to have other ngos to which we can send interested students. Social movements are an important piece of the move toward "sustainability".

Global Institute of Sustainability

Arizona State University, *Tempe, AZ, USA*
www.asusustainability.asu.edu
http://sustainable.asu.edu
http://schoolofsustainability.asu.edu

The Global Institute of Sustainability (GIOS) serves as an umbrella organization under which all sustainability related activities in the University are organized. GIOS encompasses 4 broad areas across the University: Education/Curriculum, Research, Solutions/Outreach/Engagement, and Campus Sustainability (Operations). Brief descriptions of these areas are as follows:

Education/Curriculum: Includes PhDs and Masters (with undergraduate degrees being developed for the near future) offered through the School of Sustainability, in addition to certificates/concentrations/minors offered or under development in all departments.

Research: Basic and applied research investigating the most critical issues facing our region and the world and focusing on issues of urbanization such as: water, energy, health and well-being, policy and decision-making, community development, and earth systems. We use our region and campus as a living laboratory with the intention of transferring what we learn to other regions through partnerships and collaborative research.

Solutions/Outreach/Engagement: Bridges to the community at large in the form of K-12 education outreach, service learning, visualization tools (such as the Decision Theater - http://dt.asu.edu/), and programs designed to connect researchers with the users. Also includes fellowships, faculty/staff exchanges, and meeting spaces.

Program Stats

Methodology: Mixture of Research, Teaching, or Service

Home Department: President's Office of Sustainability Initiatives
Other Departments: We have 550 faculty and practitioners working in areas of sustainability representing every department in the University – collaboration between the expertise across the University is critical. The Global Institute of Sustainability (GIOS) serves as an organizing mechanism linking and organizing programs in multiple departments around a specific problem or goal. Some of the departments include: Architecture & Landscape Architecture; Civil and Environmental Engineering; Economics; Geographical Sciences; Earth and Space Exploration; Global Studies; Human Evolution & Social Change; Justice & Social Inquiry; Law; Life Sciences; Planning; Public Affairs

Students Enrolled Since Inception:
GIOS' IGERT program - 34+
Students Currently Enrolled:
GIOS' IGERT – 28+
School of Sustainability – 7+

For more information, contact:
Ms. Bonny Bentzin
President's Office of Sustainability Initiatives, Arizona State University
Email: Bonny.bentzin@asu.edu
Phone: 480-727-8651

Campus Sustainability (Operations):
Encompasses all aspects of the campus operations, in addition to practitioner training programs, and the development of campus research and learning studio courses.

We believe that bundling these different areas under one entity will foster free collaboration across the departments and capture cross-cutting learning and research opportunities that may otherwise be difficult to realize.

The School of Sustainability builds upon the extensive research portfolio of the Global Institute of Sustainability. The School is educating a new generation of leaders through collaborative learning, transdisciplinary approaches, and problem-oriented training to address the environmental, economic, and social challenges of the 21st Century. These challenges include:

- Adaptive Solutions for our Urbanizing World
- Sustainable Energy and Materials
- Water Quality and Scarcity
- Economic Development and Social Transformation
- Loss of Biodiversity
- Socioecological Resilience

Academic Goals

Combination - The goal of the university-wide, interdisciplinary approach is to create a collaborative, flexible system that enables academic entities to adapt and change as we learn from the process and as the study of sustainability evolves.

Description of Collaborations

Due to the interdisciplinary nature and broad scope in the study of sustainability collaborations and partnerships both internal and external to the University are the norm, rather than the exception. A short list of examples include:

Internal:

Certificate in Sustainable Technology and Management; School of Sustainability faculty - creating a balance of 20% full time faculty, 80% joint-hires with other departments.

Regional:

Arizona Water Institute (Partnership between the Governors Office and the three State Universities in Arizona);Central Arizona-Phoenix Long Term Ecological Research project;Ecology Explorers (K-12 outreach)

National:

Southwest Consortium for Environmental Research and Policy (SCERP - Multiple U.S. Partners; EPA National Center for Excellence for SMART Innovations for Urban Climate + Energy; Decision Center for Desert Cities

International:

Joint Center for Urban Sustainability (in partnership with the Chinese Academy of Sciences); Urban Environmental Monitoring Project (Multiple International Partners)

Funding Sources

Combination - Private funding, public research grants, partnerships. ASU is currently in the early phases of a large fund-raising push; it is too early to answer the funding questions completely.

The interdisciplinary nature of our program has drawn a lot of private interest. The Global Institute of Sustainability has a history of successfully garnering and managing interdisciplinary research projects funded by public funding entities.

Challenges

- Keeping the program collaborative across internal units – preventing it from evolving into its own silo.
- Developing the support structure required for students and research while ensuring flexibility and allowing the process to evolve as this area of study evolves
- Balancing the need for basic research with the critical need for applied research.

Successes

2001 - Integrative Graduate Education and Research Training (IGERT) in Urban Ecology
2006 - The School of Sustainability, the first U.S. school to award degrees in sustainability, was approved by the Arizona Board of Regents.

Five Year Goal

- To expand the offerings of the School of Sustainability with more courses, concentrations, faculty, exchanges, and fellowships. Expand the academic offerings to every department in the university.
- To expand all research areas – basic and applied, as well as improving mechanisms transferring research outcomes and innovations to the community at large

Desired Partners

Collaborations (Regional, National, and International) in the study of issues related to urbanization.

GLOBES (Global Linkages of Biology, Environment, and Society)

University of Notre Dame, *Notre Dame, IN, USA*
http://globes.nd.edu

GLOBES is a new, interdisciplinary Ph.D. program at the University of Notre Dame studying Global Linkages of Biology, the Environment, and Society. Launched by funding from an IGERT (Integrated Graduate Education, Research and Traineeship) grant from the National Science Foundation, GLOBES is directed to finding innovative solutions to pressing world environmental problems in human and global health.

Through GLOBES, teams of student scholars and faculty from across the University's College of Science, College of Arts and Letters, and Law School work together on the interrelated problems of infectious disease, invasive species, and environmental degradation that threaten the well-being of humanity and the planet.

Field research projects organize students and faculty into interdisciplinary teams that explore topics including invasive species (U.S. and China), malaria (West Africa), macaque-human interactions (Bali), sudden oak death (U.S.) schistomiasis (China), and AIDS and filariasis (Haiti).

This new graduate training program offers generous fellowships to outstanding students, provides team-based teaching and research experiences, and prepares students for careers as the leaders and problem-solvers of the future.GLOBES courses, seminars, modules, and research projects are also open to undergraduates providing new educational experiences and opening a myriad of career opportunities for all Notre Dame students, while exposing them to the challenges of addressing critical environmental and health problems.

Program Stats

Graduate Program
Methodology: Mixture of Research, Teaching, or Service

Home Department: Biological Sciences
Other Departments: Participating Notre Dame departments include Biological Sciences, Mathematics, Physics, Chemistry and Biochemistry, Economics and Econometrics, History, Philosophy, History and Philosophy of Science, and Theology. The Department of Anthropology is also an active participant but does not have a Ph.D. program. Anthropology students can enroll in the Department of Biological Sciences and be co-advised by faculty from both Biology and Anthropology.

Students Enrolled Since Inception: 8
Students Currently Enrolled: 8

For more information, contact:
Dr. Jeffrey Feder
Biological Sciences, Notre Dame
Email: feder.2@nd.edu
Phone: 574-631-4159

Academic Goals

The objective of GLOBES is to provide the next generation of Notre Dame graduate students with the knowledge, technical tools, and research experience needed to combat world challenges in socially responsible and ethically sound ways. GLOBES seeks to integrate Notre Dame's graduate programs in the biological sciences, social sciences, and law with research, service activities and partnerships with the University's resource centers and institutes dedicated to

environmental stewardship and justice. Students develop the independent disciplinary expertise they need to contribute to their chosen professions by fulfilling the Ph.D. requirements of their home department. Through the GLOBES core curriculum, symposiums and modules, they study and work in interdisciplinary, faculty-mentored teams focused on real-world problem solving.

Description of Collaborations

GLOBES was conceived as a broad-based collaboration within the university between the College of Science, College of Arts and Letters and Law School. As teams of faculty from different disciplines work together, their efforts will spawn new collaborations (internal and external) to be explored and developed. This fall (2006) GLOBES partnered with the Center for Aquatic Conservation and the Graduate School's Office of Research to sponsor the 5th annual NDEER (Notre Dame Environmental Education and Research) Symposium which brought together students and faculty from multiple disciplines to engage in a day-long conference with outside experts on the theme of "Forging Integrative Solutions: Challenges in Disease, Water Quality and Pollution." Planning for the 2007 NDEER has already begun as a joint effort with the newly formed Notre Dame Energy Center.

The team research aspect of GLOBES will involve both domestic and international topics and partnerships.

Funding Sources

The University of Notre Dame received IGERT grant funding in October, 2005, and awarded its first cohort of 8 fellowships in April of 2006. Grant funding will take the program through its first five years of training, awarding a minimum of 20 fellowships. The University is also seeking long-term support for GLOBES through its fund-raising programs in order to establish GLOBES as a permanently endowed program. Success of external fund-raising will dictate how adequate resources are in years to come.

Challenges

Problems are both internal and external to the University. We face internal difficulties with certain groups (especially civil engineers) in forming a single unified effort on campus involving all relevant contributors necessary to solving the challenges of human and global health dilemmas. There is also some difficulty in meshing cultural differences among various academic fields in the Arts and Letters and Sciences. However, flexibility in the GLOBES program in course requirements and the granting of Ph.D. degrees in home departments alleviates many of these difficulties.

An external problem faced in the future will be to attract benefactors to endow the program and continue the interdisciplinary gains made in the first five years of the GLOBES program at the end of the NSF granting period.

Successes

It is early to evaluate the successes of the GLOBES program. However, the program has been successful in bringing together diverse students and faculty with common goals. Proposed student projects show great potential. Realization of the potential will first become evident within a three-year timeframe.

Five Year Goal

The five-year goal is to graduate a minimum of 20 GLOBES Ph.D. scholars armed with the biological, social, moral and legal training they will need to combat pressing problems in human and global health. A second goal is to engage faculty in new, interdisciplinary research efforts that bear on solving world environmental problems; a third goal is to coordinate education and research activities on the environment and human health into a cohesive program.

Desired Partners

The GLOBES program could be more effective if it integrated an engineering component together with its strong partnership among biologists, social scientists and legal scholars.

Graduate Program in Sustainable Agriculture

Iowa State University, *Ames, Iowa, USA*
http://www.sust.ag.iastate.edu/gpsa/

The GPSA seeks to provide students with the skills necessary to confront the challenges of future agriculture. The key competency we strive to instill and develop is the ability to apply systems thinking in natural resource management. This includes the aptitude to both identify and define system components and processes, and to recognize system boundaries, hierarchies of organization and emergent properties. Individuals with the aforementioned capacities should be able to consciously match appropriate methods of inquiry with the variety of strategies that humans apply to multiple-purpose management of natural resources, within the context of systems that humans neither fully understand nor fully control.

Program Stats

Graduate Program
Methodology: Research-based

Home Department: Graduate Program in Sustainable Agriculture
Other Departments: Participating departments include: Agricultural & Biosystems Engineering; Agricultural Education & Studies; Animal Science; Anthropology; Community & Regional Planning; Ecology, Evolution & Organismal Biology; Economics; Entomology; Food Science & Human Nutrition; Horticulture; Landscape Architecture; Natural Resource Ecology & Management; Philosophy & Religious Studies; Plant Pathology; Political Science

Students Enrolled Since Inception: 75
Students Currently Enrolled: 40

For more information, contact:
Mr. Charles Sauer
Graduate Program in Sustainable Agriculture, Iowa State University
Email: gpsa@iastate.edu
Phone: 515.294.6518

Academic Goals

As a result of their training in the GPSA, graduates are expected to:

- be able to frame problems and ask critical questions concerning agricultural sustainability,
- have knowledge of biophysical as well as socioeconomic aspects of agricultural sustainability,
- acquire expertise in sustainable agriculture that transcends disciplinary boundaries,
- attain an appreciation of the intellectual history of efforts to improve agricultural sustainability,
- become professionals who work interdependently and collaboratively,
- address complex agricultural problems by using systems thinking and other approaches
- be able to critique different problem-solving methods and approaches, and
- recognize and display visionary leadership with moral and ethical integrity.

Description of Collaborations

USDA-SARE, USDA Forest Service, USDA-NRI, USDA-CSREES, Leopold Center for Sustainable Agriculture (ISU), Practical Farmers of Iowa, Center for Sustainable Rural Livelihoods (ISU, international), The Land Institute

Funding Sources
The program receives operational and assistantship funds from the ISU Graduate College and the Wallace Chair for Sustainable Agriculture. It receives assistantship funds from the ISU College of Agriculture and the Leopold Center for Sustainable Agriculture. Additional funds are brought in through individual faculty and student efforts to obtain research grants. The program has been traditionally underfunded relative to the number of applicants and interest expressed in it.

Challenges
ongoing evolution and development of curriculum, faculty engagement (currently the promotion & tenure structure at ISU does not recognize faculty contributions to interdepartmental programs such as the GPSA), funding

Successes
The program has produced 26 MS and PhD graduates to date, the vast majority of whom have taken up careers in agriculture or pursued additional higher education in agriculture-related fields. Faculty and students are currently engaged in over 76 different sustainable-ag-related research projects, involving over $10 million in research funding. This research is contributing to the body of science that underpins sustainable ag practices. The program also collaborates with several agricultural NGOs and numerous Iowa farmers to apply sustainable ag methods in the field.

Five Year Goal
expand enrollments, expand extramural research funding

Institute for Research and Innovation in Sustainability (IRIS)

York University, *Toronto, ON, Canada*

The York Institute for Research and Innovation in Sustainability (IRIS) was established by York University in 2004 to create an interdisciplinary university-wide research institute that is a focal point for the sustainability-related activities of all eleven faculties at York. York has identified sustainability as one of its four overarching strategic priorities for research, along with health, international studies and culture and entertainment. IRIS supports the sustainability-related research of York faculty and brings academics together, encouraging interdisciplinary collaboration. www.iris.yorku.ca

Program Stats

Methodology: Research-based

Home Department: Institute for Research and Innovation in Sustainability (IRIS)

For more information, contact:
Dr. Dawn Bazely
Institute for Research and Innovation in Sustainability (IRIS), York University
Email: irisinfo@yorku.ca
Phone: (416) 736-5784

Academic Goals

IRIS seeks to include research opportunities for undergraduate and graduate students in the grants in which it participates.

Description of Collaborations

Current projects include international collaborations with scientists in Norway, Sweden and Mongolia; regional work on Great Lakes pollution, and deer overgrazing; and institutional efforts in practicing sustainability by promoting carbon offsets.

Funding Sources

Individual projects are funded from a wide variety of governmental granting agencies, as well as national and international business organisations and quasi-governmental agencies.

Challenges

Interdisciplinary collaborations often face financial challenges, as the programs we envision often do not fit easily into a granting agency's categories.

Institute for Sustainability Science in Latin America and the Caribbean

Florida International University, *Miami, FL, USA*
http://lacc.fiu.edu/centers_institutes/
http://globalwaters.net/glows/AboutGlows/

Program Stats

Graduate Program
Methodology: Research-based

Home Department: Department of Environmental Studies

Students Enrolled Since Inception: 0
Students Currently Enrolled: 0

For more information, contact:
Dr. David Bray
Department of Environmental Studies, Florida International University
Email: brayd@fiu.edu
Phone: 305-348-6236

The Institute for Sustainability Science in Latin America and the Caribbean (ISSLAC), a program of the Latin American and Caribbean Center (LACC) at Florida International University (FIU), studies the patterns of interactions between nature and society in this region of the world. It combines new methodological approaches and problem-driven, interdisciplinary research to gain a more complete understanding of these interactions.

The need for this kind of applied research is especially urgent in developing countries, which are most vulnerable to the stresses produced by rapid social and environmental change. The institute has as its goal the implementation of integrative, place-based research that combines the physical, natural and social sciences in the pursuit of rigorous scientific research that also contributes to solutions to local, regional and global environmental problems.

ISSLAC's research brings together faculty from the Latin American and Caribbean Center and FIU's Department of Environmental Studies, as well as experts from many other disciplines. Some of the core issues they address include exploring the ways community-water interactions in the Andean Amazon and community-forest interactions in the Yucatán Peninsula of Mexico may contribute to sustainable landscapes. In these and other cases to be developed, the institute works to identify the factors that determine the vulnerability or resilience of these interactions in particular settings.

Just as important as the identification of these problem areas is the development of new models for Latin America and the Caribbean, including incentives to promote sustainable development and the creation of integrated systems for adaptive management and social education programs. In support of these goals, ISSLAC engages in faculty exchange programs and joint projects with institutions in Latin America and the Caribbean. In addition to producing original research, ISSLAC also co-sponsors LACC events and publications relating to issues of sustainable development. ISLACC two major projects current are GLOWS and community forest management in Mexico.

Academic Goals
The institute has as its goal the implementation of integrative, place-based research that combines the physical, natural and social sciences in the pursuit of rigorous scientific research that also contributes to solutions to local, regional and global environmental problems. ISSLAC's research brings together faculty from the Latin American and Caribbean Center and FIU's Department of Environmental Studies, as well as experts from many other disciplines. Some of the core issues they address include exploring the ways communities and water interact in several watersheds globally and community-forest interactions in the Yucatán Peninsula of Mexico and how these interactions may contribute to sustainable landscapes. In these and other cases to be developed, the institute works to identify the factors that determine the vulnerability or resilience of these interactions in particular settings.

Description of Collaborations
Collaborations are both domestic and International. The GLOWS Consortium is lead by Florida International University and includes the World Wildlife Fund (WWF), World Vision, Lake Net, and Amizade. Together the partners possess skills in the advanced theory and analytical techniques of IWRM, innovative mechanisms for sustainable resource management linked to biodiversity conservation, community-based programs to alleviate poverty through improved sanitation and potable water supply, networking of local NGO's to achieve IWRM, and international volunteer opportunities for Americans with special skills.

The community forestry in mexico program, as noted above, is collaborating with a variety of Mexican and US universities.

Funding Sources
Government and private, but mostly government (USAID). Funding adequate for now.

Challenges
Integrating multiple disciplines into a research project

Successes
The community forestry in Mexico program has won global attention, with presentations before high-level Chinese forestry officials in September, 2006 and the World Bank in November, 2006. The GLOWS project is developing highly integrated multidisciplinary projects in Kenya, India, and Ethiopia.

Five Year Goal
We have not had a specific goal-setting exercise like this

Desired Partners
For the most part, we have the collaborators we need right now.

Leaders in Sustainability

UCLA, *Los Angeles, CA, USA*
www.anderson.ucla.edu/leadersinsustainability.xml

"Sustainability" (loosely defined as the simultaneous consideration of economic, environmental and social factors) has become a key element in decision making in many areas of business and public policy. By definition, sustainability requires a multi-disciplinary perspective. Currently, students in each of the graduate schools at UCLA have interests in this area, but few opportunities to experience or practice interdisciplinary thinking. "Leaders in Sustainability" aims, first, to provide a mechanism for students in these schools to pursue their interests in sustainability, and second, to attract top-caliber students with these interests to UCLA's graduate schools.

Program Stats

Graduate Program
Methodology: Mixture of Research, Teaching, or Service

Home Department: UCLA Anderson School of Management
Other Departments: Most graduate schools at UCLA.

Students Enrolled Since Inception: 15
Students Currently Enrolled: 15

For more information, contact:
Dr. Charles Corbett
UCLA Anderson School of Management
charles.corbett@anderson.ucla.edu
Phone: 310-825-1651

Intended audience

The emphasis is aimed at graduate students who will become decision-makers in various types of organizations (businesses, non-profits, governmental, etc) and who will have to address the three dimensions of sustainability. The emphasis is open to all graduate students at UCLA; we have received significant interest from students at the Anderson School of Management, the School of Law, the School of Public Affairs, the School of Public Health, the Henry Samueli School of Engineering and Applied Science, Geography, Economics, and others. With an average of 3-5 students per school per year, the emphasis could attract 15-50 students per year. For 2006-2007, the emphasis will be in test mode; students participating in the emphasis in 2006-2007 should expect to be actively involved in designing and managing the emphasis.

Structure

The program is intended as an "emphasis" within the existing graduate school programs. No separate degree program is proposed, although an official certificate of completion of the emphasis requirements will be provided by the UCLA Institute of the Environment. The emphasis requirements for 2006-2007 are:

- All students must take at least 4 quarter courses (at least 16 units, or the equivalent in semester units) on topics closely related to sustainability. At least 2 of these courses must be outside their "home" department. Each student will submit a study plan for approval to the Coordinator of the emphasis. Ideally these courses will be graduate courses and apply towards students' graduation requirements; however, relevant courses (such as certain undergraduate courses) may be applied towards the emphasis even if they do not count towards a student's graduation requirements.

- All students will participate in a new course on sustainability offered by the Institute of the Environment during Winter 2007. This course is currently being planned; if it is indeed offered, this course will count as one of the 4 courses required for the emphasis.
- All students will participate actively in relevant events organized by the Institute of the Environment, including seminars, conferences, etc.
- All students will work on a project related to sustainability in teams that include students from at least 2 different departments. These projects will ideally be part of the students' regular graduation requirements. The faculty will try to identify suitable projects but teams may also identify their own projects, subject to the Coordinator's approval.

Academic Goals
Fostering cross-disciplinary thinking among graduate students with interest in sustainability.

Description of Collaborations
Currently mostly across graduate schools at UCLA, aim to broaden scope to other UC campuses and possibly beyond.

Funding Sources
Search for funding will begin this year.

Challenges
Unknown: this program is starting this year.

Successes
Feedback from institutions and individuals on campus and off campus has been overwhelmingly positive; program will officially start January 1, 2007, so too early to know about real successes.

Five Year Goal
Facilitating interaction between graduate students with interests in sustainability; making UCLA a premier university for students who wish to combine a rigorous degree in a traditional discipline with an interdisciplinary emphasis on sustainability, without enrolling in a full dual-degree program.

Desired Partners
As yet unknown.

Mascaro Sustainability Initiative

University of Pittsburgh, *Pittsburgh, PA, USA*
www.engr.pitt.edu/msi

The Mascaro Sustainability Initiative (MSI) was created in 2003, through funding from the Heinz Endowments and generous alumni, to serve as a cross-disciplinary research center focusing on the design of more sustainable community infrastructure. MSI has funded a series of seed grants for faculty teams at the University of Pittsburgh and our partners at Penn State University and Carnegie-Mellon University that examine the development of next generation technical solutions to problems in sustainable development. MSI also funds a summer research program for undergraduates, educational and outreach programs, and a biannual conference on technical developments in sustainable community infrastructure. Through an IGERT training grant from the NSF, plus a GAANN program supported by the Department of Education, MSI also supports a number of PhD students in the school of engineering at the University of Pittsburgh.

Program Stats

Graduate Program
Methodology: Mixture of Research, Teaching, or Service

Home Department: Chemical Engineering
Other Departments:
www.engr.pitt.edu/msi

Students Enrolled Since Inception: 45
Students Currently Enrolled: 7

For more information, contact:
Dr. Eric Beckman
Chemical Engineering
University of Pittsburgh
Email: beckman@engr.pitt.edu
Phone: 412-624-4828

Academic Goals

To educate all engineering students on the importance of including sustainability as part of their designs.

Description of Collaborations

www.engr.pitt.edu/msi has all of these details.

Funding Sources

Funding has come from private and public sources. Funding is a constant struggle because generally, the federal government is not interested in sustainability. Foundations are interested in sustainability, but are generally not interested in hard science and engineering, only policy and education. Hence, a constant struggle.

Challenges

1. Financial, as described above.
2. Academics tend to live in disciplinary silos, where federal funding reinforces these silos. breaking down the barriers to communication between disciplines is a struggle, but one that needs to be pursued if innovations are to occur.
3. The perception by industry, and many academics, is that sustainable products are more expensive and less functional than conventional analogs.

Successes

- Design of mold-resistant surface coatings.
- Design of superhydrophobic surfaces.
- Completion of a study that shows how moving to a green building impacts productivity and health care costs.

Five Year Goal

Sustainable funding.

Desired Partners

Yes, with NGO's and with a university in Europe, given that the EU is ahead of the US in this area.

Master of Science in Sustainable Systems

Slippery Rock University, *Slippery Rock, PA, USA*

The Master of Science in Sustainable Systems program located in the Parks and Recreation / Environmental Education Dept. at Slippery Rock University is a 30 credit hour graduate program with courses covering sustainable design, sustainable agriculture, and sustainable resource management. Students can choose either thesis or internship options as part of their degree requirement. The internship option requires the completion of two professional papers. The Robert A. Macoskey Center for Sustainable Systems Education and Research on campus is a hands-on facility where students and community members alike can come and participate in educational or research oriented activities to get a first hand look at sustainable systems in development. Graduate assistants, work study students, interns and others are responsible for carrying out activities at the center while graduate students use the center and site for practice and research. Many of the MS3 alumni are working in the Pittsburgh region and elsewhere in jobs on the cutting edge of sustainability in the non-profit sector, corporate sector, farm sector, and as entrepreneurs. Please contact us if you are interested.

Program Stats

Graduate Program
Methodology: Mixture of Research, Teaching, or Service

Home Department: Parks and Rec./ Environmental Ed

Students Enrolled Since Inception: 150
Students Currently Enrolled: 25

For more information, contact:
Mr. Chris Leininger
Parks and Rec./ Environmental Ed,
Slippery Rock University
Email: chris.leininger@sru.edu
Phone: 724-738-2622

Academic Goals

This program undergoes a five year review to help the department maintain assessment and accreditation requirements.

Description of Collaborations

The primary collaboration is between the MS3 program and the PREE Dept. and the Macoskey Center. The connections to the groups in Pittsburgh and elsewhere is less formal, usually through internships or post graduate careers. Some research and joint projects are done with small growers, energy producers or non-profits. One alum has started up Steel City BioFuels.

Funding Sources

The curriculum in this program is funded by Slippery Rock University as is the operations on the Macoskey Center. Grants are used to augment programs and continue development of the site. Funding is never adequate and is sometimes a challenge to get or to administer.

Challenges

One of the biggest challenges of this program is fitting into the state university system. It is an innovative program that is a broad or general curriculum that is nonetheless a graduate program. There are not many standards or programs to compare to or from which to learn.

Successes

The fruit from this program has been the alumni network and the great jobs they have found working as change agents with groups that are fostering the transition to sustainability. In Pittsburgh groups like the Green Building Alliance, Conservation Consultants, Construction Junction, the Greater Pittsburgh Community Food bank, Western Pennsylvania Conservancy, the Pittsburgh Parks Conservancy and others have employed and been further developed by MS3 alumni. There are dozens of theses published and research papers presented on all sorts of topics from greywater treatment to sustainable design on campus. It is this generation of change agents in a common social network that is having the greatest impact.

Five Year Goal

The near term goal is to strengthen the numbers and environment in the program while building on the connections and student opportunities for our current crop of excellent students. Identify and build more relationships with other like minded programs.

Desired Partners

We are actively looking to partner with undergrad programs to explore the idea of a three plus two or four plus one kind of program where someone in five years can start as a freshman and finish with an MS3 degree.

Resilience and Adaptation Program

University of Alaska Fairbanks, *Fairbanks, AK, USA*
http://www.rap.uaf.edu/

The University of Alaska Fairbanks offers graduate training in the Resilience and Adaptation program (RAP) to train scholars, policy-makers, and managers to address issues of regional sustainability. The program integrates the tools and approaches of ecology, economics, anthropology, political science, and community and regional development in a systems framework to understand the functioning of regional systems. Our underlying assumptions are: The major problems facing the world must be addressed in an integrated fashion, and no solution will last unless it is ecologically, economically, and culturally sustainable. The program emphasizes high-latitude ecosystems but is equally relevant for addressing issues of sustainability in all parts of the world.

Program Stats

Graduate Program
Methodology: Mixture of Research, Teaching, or Service

Home Department: Institute of Arctic Biology
Other Departments: Anthropology, Biology and Wildlife, Economics, Geology and Geophysics, Natural Resource Management, Political Science

Students Enrolled Since Inception: 51
Students Currently Enrolled: 40

For more information, contact:
Dr. Stuart Chapin
Institute of Arctic Biology
University of Alaska Fairbanks
Email: terry.chapin@uaf.edu
Phone: 907-474-7922

The Resilience and Adaptation Program (RAP) provides training at the PhD and Masters levels to graduate students at the University of Alaska, as well as to graduate students at other universities who wish to enroll for one year of intensive course work in the RAP program at the University of Alaska. We provide course work and a seminar program that integrates ecology, economics, political science, and anthropology in a systems framework. We also provide faculty mentorship and internships in areas outside each student's parent discipline. The RAP program is associated with numerous research programs at the University of Alaska and in state and federal agencies, which provide interdisciplinary research opportunities for RAP students. The program emphasizes cross-cultural communication through heavy involvement with the Alaskan Native American community and with managers, businesses, and conservati on groups.

We offer NSF-funded fellowships to PhD candidates entering the program. Additional funding is available to both PhD and Masters students through participating departments. A detailed description of the program and application forms are available at http://www.rap.uaf.edu/ or by contacting Terry Chapin (terry.chapin@uaf.edu) at the Institute of Arctic Biology, University of Alaska, Fairbanks, AK 99775. February 1 is the target date for reviewing applications to the RAP program, although applications received after that date will also be considered.

We strongly encourage applications from ethnic minorities and other under-represented groups.

Academic Goals

The academic goals are specific to this program. Our goal is to train scholars, policy-makers, and managers to address issues of regional sustainability. The program integrates the tools and approaches of ecology, economics, anthropology, political science, and community and regional development in a systems framework to understand the functioning of regional systems. Our underlying assumptions are: The major problems facing the world must be addressed in an integrated fashion, and no solution will last unless it is ecologically, economically, and culturally sustainable.

Description of Collaborations

The major collaborations of the program are among departments within the university, especially with the College of Rural and Community Development, which plays a major role in educating Alaska Natives in rural Alaska, and with a wide range of state, federal, and tribal organizations that manage resources and engage in community development in Alaska.

Funding Sources

The first five years of the program was funded primarily by the National Science Foundation IGERT (Integrative Graduate Education and Research Training) program, and we have just submitted a renewal proposal. The University of Alaska Fairbanks has provided additional fellowship and in-kind support. This funding has been adequate to develop an excellent program.

Challenges

The primary challenges have been intellectual. When we initiated the program, there were no other programs in sustainability science. We had to design the curriculum from scratch and develop much of the underlying intellectual framework. We are now writing a textbook in sustainable resource management to make this information available to a broader audience.

Other challenges were institutional: establishing an interdisciplinary graduate program that integrated the efforts of multiple departments in the natural and social sciences. These challenges have been largely overcome.

Successes

The program has had substantial impact on sustainability science in Alaska. The State of Alaska has adopted the mission of our program as the central focus of the Research and Development Plan for the state: “sustainability is one of the key issues, and most urgent challenges for resource management in Alaska… The nature of coupled natural and human systems in the contexts of resource management, sustainability, and resiliency has to be a focal theme for an Alaskan R & D plan, if the state is to expand its economy while preserving those human and natural values that make the state so attractive. Sustainability has become a formal mission of the University of Alaska Fairbanks, and a degree program in sustainability science has been established.

Students in the program have been active in changing policies in the state, for example by rewriting the coastal zone management plan for the state of Alaska, writing the congressionally mandated evaluation of the Tongass Wilderness Plan for the U.S. Forest Service, evaluating motivations of businesses that have joined an Alaskan green certification program, synthesizing

data on contaminants in Alaskan marine mammals as input to decisions on the safety of subsistence foods, and managing water quality assessment for the Yukon River Drainage (the second largest watershed in North America.

Five Year Goal

Our major near-term goals are to (1) increase the proportion of Alaska Native graduates of the program, (2) play an active international role in the International Polar Year, and (3) solidify the funding base for fellowship support after our current (and hopefully renewed) NSF support ends.

Desired Partners

We seek collaborations with other universities and tribal entities that seek to promote education and implementation of sustainability science, both internationally among northern countries and nationally

Social Policy and Social Research Doctoral Program, sub-specialty in International Sustainable Development and Justice

Loma Linda University, *Loma Linda, CA, USA*
http://www.llu.edu/llu/grad/socialwork/phdmain.html
http://resweb.llu.edu/rford/SPOL/
http://resweb.llu.edu/rford/EESS/

This program is designed to provide students with a unique interdisciplinary curriculum in social science, social ethics, research methods, statistics, information technology, and specialized social policy areas.

Program Stats

Graduate Program
Methodology: Mixture of Research, Teaching, or Service

Home Department: Social Work and Social Ecology
Other Departments: Department of Earth and Biological Sciences, School of Science and Technology, and the School of Public Health, Geoinformatics programs and Resource Center

Students Enrolled Since Inception: 18
Students Currently Enrolled: 15

For more information, contact:
Dr. Robert Ford
Social Work and Social Ecology, Loma Linda University
Email: rford@llu.edu
Phone: 909-558-7507

Academic Goals

Key purpose: This is a graduate-level sub-specialty within the Social Policy and Social Research doctoral program that is designed to introduce the student in an integrative manner to the exciting field of Sustainable Development Policy and related fields, e.g. Science and Technology for Sustainability. The course first explores the historical development of "sustainability" as a concept and then looks at how sustainability has influenced real-world practice in various development sectors: health, knowledge management, agriculture, natural resource management, poverty reduction, and so on.

Description of Collaborations

We work jointly with several universities and NGOs in the US as well as other partners internationally:

US and Global Partners include: Redlands Institute (University of Redlands); CEEMaST (CSU-Pomona); USAID FRAMEweb; SERVIR-Cathalac (Panama); ESRI Inc (GIS for Sustainable Development - Environment)

International NGOs and Universities include: Spanish Bay Conservation & Research Center (Belize); USAID-MIRA Project (Honduras); FUCSA; UNAH; CURLA; REDHES; FUPNAPIB; SERNA; AFE-COHDEFOR; Honduran Tourism Institute

Funding Sources

Private funds plus some grants and contracts for research projects abroad, e.g. see recent Projects in Mesoamerica.

Challenges

- Financial - finding scholarship resources to help developing country students get funding to attend.
- Field course teaching costs - since we want students to learn by doing in the real world, costs can be high for travel, etc.
- Equipment (Information technology) lab support, e.g. keeping up with needed software and hardware.
- Marketing - getting out the word on the program - many people don't know where to find it because it is buried within a larger program within a department of social work, where many don't think to look.

Successes

We've had a significant input to major sustainability research and planning (focused on biodiversity) within Honduras via a contract we did with others for USAID'as MIRA Project - see Integrated Watershed Management is financed by USAIDand will be working in Honduras for 4 years (2005-2008)

Five Year Goal

Within the next 1-3 years we hope to be teaching many of our course via a Mesoamerican Studies Center based in Honduras.

Desired Partners

We would welcome joint research collaborations as well as organizations that would take students for field research and policy analysis experience. We want students to learn-by-doing" in real-world settings.

Sustainability Science Program at Harvard University's Center for International Development

Harvard University, *Cambridge, MA, USA*
http://www.cid.harvard.edu/sustsci/
http://www.cid.harvard.edu/sed

The Sustainability Science Program at Harvard's Center for International Development seeks to advance basic understanding of the dynamics of human-environment systems; to facilitate the design, implementation, and evaluation of practical interventions that promote sustainability in particular places and contexts; and to improve linkages between relevant research and innovation communities on the one hand, and relevant policy and management communities on the other.

"Sustainable development" -- reconciling society's developmental goals with the planet's environmental limits over the long term -- has emerged as one of the central challenges facing humanity at the dawn of the 21st century. Today's development trajectories are increasingly recognized to be neither adequate for meeting human needs nor environmentally sustainable over the long run. For example, rapid industrialization powered by fossil fuels is producing waste streams that far exceed nature's absorptive capacities, resulting in transformation of the global climate and deterioration of air and water quality in many parts of the world. The world's ecosystems on which more than a billion people directly depend for their livelihoods and all of us indirectly depend for a variety of essential services are likewise subject to accelerating degradation. To recognize these threats to the sustainability of development is not to counsel despair or to oppose economic growth. It is to argue for the transcendent importance of identifying and promoting development paths that embody a transition toward sustainability -- that advance human well-being in ways that nurture and restore the earth's essential life support systems.

Program Stats

Methodology: Mixture of Research, Teaching, or Service

Home Department: Center for International Development
Other Departments: The Center for International Development is a university-wide research center that draws upon faculty, staff, and researchers from the Kennedy School of Government, the Faculty of Arts and Sciences, the School of Public Health, the Medical School, the Graduate School of Education, the Graduate School of Design, the Law School, and the Business School.

Students Enrolled Since Inception: 17
Students Currently Enrolled: 17

For more information, contact:
Dr. William Clark
Center for International Development, Harvard University
Email: william_clark@harvard.edu
Phone: 617-496-3981

Ms. Nancy Dickson
Center for International Development, Harvard University
Email: nancy_dickson@harvard.edu
Phone: 617-496-9469

"Sustainability science" is the emerging field of research addressing the challenges of sustainable development. From a focus on use-inspired basic research on the interactions between social and

natural systems, the field reaches out to embrace relevant scholarship both on the fundamental character of interactions among humans, their technologies, and the environment, and on the utilization of that knowledge to address urgent problems of economic development and environmental conservation. Sustainability science, began to emerge as a field in its own right during the mid-1990s. Today it has become embedded in the ongoing research agendas of both academies of science and international development institutions, supports its own journals, and is increasingly the focus of academic programs, institutes, and even schools around the world.

Program Activities:
To achieve its goals, the Sustainability Science Program at Harvard's Center for International Development currently promotes and supports three broad streams of activity:

Globalization and sustainable development: At the strategic level, we build on Harvard's position as a leading international university to explore how broad trends of globalization are reshaping the challenges of -- and opportunities for -- sustainable development. We seek to improve understanding of the nature and consequences for sustainable development of globalization in priority areas of trade and finance, democratization and human rights, population and habitation, environmental change, and information and communication.

Linking knowledge with action: At the tactical level, the Program draws on the practice-oriented traditions of Harvard's professional schools to explore issues of what works, under what conditions, for better linking knowledge with action in support of sustainable development. Our work includes evaluations of the efficacy of alternative policies and institutions, identification of best practices, and efforts to promote systematic learning from comparisons of experience across sectors and places. Current work is underway in regions around the world, with sectoral foci on water, energy, health, and the nexus of agriculture and ecosystems.

Capacity building: The Program also supports a diverse set of capacity-building, training and education activities, all carried out in close collaboration with our research and policy efforts. The core of these activities is our Fellows Program, which brings together students from throughout the greater Cambridge university community plus visiting doctoral students, post-doctoral researchers, and practitioners from around the world. Our university-wide seminar speaker series on "Frontiers in Sustainable Development" brings to Harvard leading scholars and practitioners of sustainable development. Finally, we are developing and disseminating a range of information and curricular materials designed to support existing teaching at Harvard as well as new executive Programs for advanced professionals working in sustainable development.

The Program Network:
The Sustainability Science Program seeks to serve as a common forum and facilitator for work on science, innovation and sustainable development by members of the entire Harvard community, and to promote collaboration between members of the Harvard community and the extended international network of scholars and practitioners engaged in sustainability science. Close working relations are therefore maintained with other relevant Harvard efforts, especially those of the Environment and Development initiatives of the Harvard University Center for the Environment, the Science, Technology and Public Policy Program of the Belfer Center for Science and International Affairs, and the Growth Lab at the Center for International

Development. The Program's external network involves collaborators from scientific academies and professional institutions, development organizations, research centers and other universities around the world. Especially active are links with the sustainability science and technology programs of the US National Academy of Sciences and the Academy of Sciences for the Developing World. Harvard's Sustainability Science Program also maintains a close working relationship with the Center for Science, Innovation and Sustainability at the American Association for the Advancement of Science. Through that relationship, the Program continues to play a central role in shaping the international virtual network it established as the Forum on Science and Innovation for Sustainable Development.

Program Sponsorship:
The Sustainability Science Program's core support is provided by Harvard's Center for International Development plus a generous gift from the Italian Ministry for the Environment and Territory. Additional project-specific funding comes from a variety of federal agencies, private foundations, and Harvard sources. The Program uses these resources to run a competition for grants to Harvard faculty interested in initiating research and training projects in sustainability science, and an international fellows competition that brings doctoral and post-doctoral students as well as practicing professionals to Harvard for extended periods.

Program People:
The Program is directed by William C. Clark (Harvey Brooks Professor of International Science, Policy and Human Development at the Kennedy School) and Nancy Dickson (Senior Research Associate at the Center for International Development). The directors are supported by a steering group of Harvard faculty, and an Advisory Committee chaired by CID Director Ricardo Hausmann. Membership in the Program is open to Harvard faculty, researchers and students upon application to the directors, and to collaborators from other institutions by invitation. Members are eligible for Program grants, and to host Program fellows.

Academic Goals
The primary goal of the Sustainability Science Program is to have reframed and populated a vibrant intellectual debate among scholars and practitioners on the design of institutions that can more effectively create and apply useful knowledge for development.

Our principal research goal for this first year of the Sustainability Science Program is to shape a global consensus of leading researchers on the core research challenges of sustainability science. (As described by the US National Academy of Sciences, "sustainability science" is the emerging field of use-inspired research encompassing studies of the interactions between human and environmental systems as well as the sustainability challenges relating to agriculture, biodiversity, cities, energy and materials, health and water.) To achieve this goal, we have begun working with colleagues at the AAAS, the US National Academy of Sciences, and the Academy of Sciences of the Developing World to review the priorities for basic research needed to support a transition toward sustainability.

Our capacity building goal is strengthen the international network capacity in the field of sustainable development. We have launched the Sustainability Science Fellows program, an international competition to bring younger professionals, including in particular senior doctoral

and post-doctoral students, to Harvard's Center for International Development as well as a practitioner fellowships for individuals in governmental, non-governmental or private organizations with at least five years of professional experience doing work involved in linking science and practice for sustainable development.

The goal of our outreach and community building activities is to advance to international recognition the field of sustainability science. We will measure success in terms of: secured/created high profile venues for publication; framed the research agenda for sustainability science; and entrained a tradition of periodic/ annual conferences bringing scholars and practitioners of the sustainability science field together.

Description of Collaborations

The Sustainability Science Program seeks to serve as a common forum and facilitator for work on science, innovation and sustainable development by members of the entire Harvard community, and to promote collaboration between members of the Harvard community and the extended international network of scholars and practitioners engaged in sustainability science.

Harvard network:
Harvard University Center for the Environment Environment and Development Initiative
Science, Technology and Public Policy Program of the Belfer Center for Science and International Affairs
Growth Lab at the Center for International Development
David Rockefeller Center for Latin American Studies
Science, Environment and Development Group at the Center for International Development

Beyond Harvard network:
The Program's external network involves collaborators from scientific academies and professional institutions, development organizations, research centers and other universities around the world, including:

In the United States:
American Association for the Advancement of Science, Center for Science, Innovation, and Sustainability
Arizona State University, Consortium for Science, Policy & Outcomes
Clark University, School of Geography
Forum on Science and Innovation for Sustainable Development
Green Chemistry Institute
Heinz Center for Science, Economics and the Environment
National Academies' Roundtable on Science and Technology for Sustainability
Stanford University, Center for Environmental Science and Policy
University of California at Berkeley, Center for International and Development Economics Research

Abroad:
Academy of Sciences for the Developing World (TWAS), Italy
Alternatives to Slash-and-Burn Programme (ASB), Consultative Group on International

Agriculture Research, Kenya
Chiang Mai University, Unit for Social and Environmental Research, Thailand
Economic Commission for Latin America and the Caribbean, Sustainable Development and Human Settlements Division, Chile
International Livestock Research Institute, Kenya and Ethiopia
Initiative on Science and Technology for Sustainability
Potsdam Institute for Climate Impact Research, Germany
Sustainable Europe Research Institute, Austria
Tyndall Center for Climate Change Research, UK
Venice International University, Thematic Environmental Networks Center, Italy
World Agroforestry Centre (ICRAF), Southeast Asia Programme, Indonesia
World Conservation Union (IUCN)

Funding Sources

The Sustainability Science Program's core support is provided by Harvard's Center for International Development and a generous gift from a foreign government ministry. Additional project-specific funding comes from a variety of federal agencies, private foundations, and Harvard sources.

Challenges

A central challenge in developing this Program is to communicate to academics and practitioners what sustainability science is. As described by the US National Academy of Sciences, "sustainability science" is the emerging field of use-inspired research encompassing studies of the interactions between human and environmental systems as well as the sustainability challenges relating to agriculture, biodiversity, cities, energy and materials, health and water. The field spans the range from a quest for fundamental understanding of interacting human-environment systems to the very case- and place-specific application of knowledge to foster actions on challenges as diverse as agroforestry and low carbon energy. Sustainability science as practiced is centered in Stokes idea of "use-inspired basic research" (aka "Pasteur's Quadrant") and reaches out from there to do both building of better fundamental understanding and building of better technologies and policies. The essence of the field as a dynamic entity is that by spanning this range, basic understanding informs practice, and practice (including the tacit knowledge of practice) informs fundamental understanding.

Career tracks in sustainability science: Identifying career paths that allow people to get hired and promoted is a central challenge.

Teaching sustainability science: A central challenge is figuring out what courses should be taught at what level. Should we provide certificates tacked onto known disciplines or full programs?

Methods: The Program does not promote any single method. Methods tend to be regional and place-based, integrating approaches from such fields as experimental economics, ecology, participatory methods, institutional analysis, environmental systems analysis, geographical information systems, and comparative case analysis; as well as results-based management approaches such as outcome mapping.

Funding: The field of sustainability science has emerged without a single central source of funding. The Packard Foundation and NOAA provided early funding of the field.

Collaboration: There is much talk of the challenges of collaboration. The central issue is not the details of how (which will differ from place to place, country to country) but rather that partnerships of academia with actors more attached to action are necessary. The interesting questions – being explored, for example, by the NAS Roundtable on Science and Technology for Sustainability through its summer study on "Partnerships for a sustainability transition" – are how partnerships can be facilitated and learned from between universities, private sector (like BP), NGOs (like WWF) and government funded research institutions involved in public good production (eg. US National Labs, CGIAR centers, etc). I would like to see AAAS help to map the range of experiences and perhaps sketch something of a model.

Successes

The Sustainability Science Program has launched a successful fellowship program offering doctoral, post-doctoral and practitioner fellowships in Sustainability Science, see http://www.cid.harvard.edu/sustsci/grants/fellows/07_fellows_RFP.htm The Program is also playing a central role in promoting the emerging field of "sustainability science."

Five Year Goal

The primary goal of Program is to have reframed and populated a vibrant intellectual debate among scholars and practitioners on the design of institutions that can more effectively create and apply useful knowledge for development. We will judge success in standard academic terms of peer reviewed publications, but also in terms of influence on "Gold Standard" documents and discourse in the policy arena, including those of the World Bank, the Consultative Group on International Agricultural Research, and the World Health Organization.

The primary goal of our outreach and community building activities is to advance to international recognition the field of sustainability science. We will measure success in terms of: secured/created high profile venues for publication; framed the research agenda for sustainability science; and entrained a tradition of periodic/annual conferences bringing scholars and practitioners of the sustainability science field together.

Desired Partners

We collaborate with an extended network of academic institutions, research labs, and policy groups around the world. Our current priority is to forge greater links with private-sector organizations seeking to foster sustainable development.

Sustainability: Science and Policy

Clarion University of Pennsylvania, *Clarion, PA, USA*
http://www.clarion.edu/departments/phys/sustainability/

Program Stats

Undergraduate Program
Methodology: Mixture of Research, Teaching, or Service

Home Department: Physics
Other Departments: Biology, Chemistry, Mathematics, Communications, AGES (Anthropology, Geology, Earth Science), Economics, and Philosophy.

For more information, contact:
Dr. Joshua Pearce
Physics
Clarion University of Pennsylvania
Email: profpearce@gmail.com
Phone: 814-393-2713

The minor in Sustainability: Science and Policy will provide students already enrolled in Clarion University the opportunity to add a vital skill set and knowledge base to their baccalaureate degree. This program will also give students added incentive to pursue undergraduate research by providing them with opportunities to work with cutting edge technology in an applied science and an opportunity to affect the real world in contemporary policy implementation. This minor compliments established environmental programs because of the focus on students performing interdisciplinary research to find solutions to environmental problems, which are quantified in existing courses. The 19 credit Sustainability: Science and Policy minor is built around an existing set of environmental focused courses offered at and consists of five parts:

i. An introductory course in Physics of Energy and the Environment
ii. Two elective courses in Sustainable Science
iii. Two elective courses in Sustainable Policy
iv. At least one credit of Research in either Sustainable Science or Policy
v. A capstone seminar on Environment and Society in senior year.

Academic Goals

The minor will allow graduates to synthesize the analytical skills of scientific disciplines with the policy skills necessary to navigate the real world of politics, which often trump the hard facts delivered by science. Minoring in Sustainable Science and Policy will enhance the graduates' chances of obtaining jobs not only in Pennsylvania's businesses, which are taking an active role in 'greening' their production to save money and enhance their public image, but also for positions in the Pennsylvania government and many non-profit organizations.

Description of Collaborations

The Sustainability Science and Policy Minor also compliments the work of the Pennsylvania Consortium For Interdisciplinary Environmental Policy, an organization comprised of environmental policy makers and universities and colleges devoted to improving environmental policy and understanding through government and academic cooperation that encourages interdisciplinary analysis and discourse.

Funding Sources
Pennsylvania State System of Higher Education.

Challenges
Encouraging University to offer more elective courses.

Successes
The proposed minor is a first step by the Clarion University in 'branding' itself as the premier school in the PA State System of Higher Education for applied environmental studies in both science and policy. The Sustainability Science and Policy minor will be housed in the new Science and Technology Center, which will be LEED (Leadership in Energy and Environmental Design) certified. It is planned to be constructed using integrated sustainable design and thus be the first "green" building at Clarion's campus. This building will be the flagship of a new era in both technically and environmentally superior buildings for Clarion University and the Commonwealth Hopefully, this minor will serve as a model for sister institutions seeking to encourage their students to learn advanced skills for science research and policy implementation.

Recently the Physics Department won a Energy Harvest grant to integrate solar photovoltaic panels on the roof of the new building.

In addition, the Clarion administration has committed to having the new Biotechnology Business Center & Incubator building silver LEED certified.

Five Year Goal
Increase enrollment and expand sustainability-focused course offerings.

Desired Partners
National Science Foundation.

Sustainable Business

Aquinas College, *Grand Rapids, MI, USA*
www.aquinas.edu/sb
www.centerforsustainability.org

Sustainable Business practices restore environmental quality, promote stable and healthy communities, and increase long-term profitability. The Aquinas Sustainable Business Degree (B.Sc., Sustainable Business) program fosters ecological and social intelligence in all business decisions and is the only undergraduate program of its kind in Michigan and possibly the United States. This four-year Bachelor of Science Degree is an interdisciplinary major with course work in business, science, environmental studies, and sustainable business. Its graduates emerge with a clear understanding of environmental processes, business principles and transformative sustainable business strategies that will increase corporate profitability, eliminate adverse environmental impacts and build social capital. Through the programming of the Center for Sustainability at Aquinas College, students also have opportunities to put sustainable business theory into practice on campus, in business and in the community. For details on current curriculum and faculty, see Aquinas College Sustainable Business Program.

Program Stats

Undergraduate Program
Methodology: Mixture of Research, Teaching, or Service

Home Department: Sustainable Business Department
Other Departments: Business Administration, Accounting, Economics, Biology, Chemistry, and Physics are also partners in our efforts. The Center for Sustainability at Aquinas College (Center for Sustainability at Aquinas College) offers a linkage between our academic program and the business community, as well as our broader campus sustainability initiative.

Students Enrolled Since Inception: 65
Students Currently Enrolled: 51

For more information, contact:
Dr. Deborah Steketee
Sustainable Business Department, Aquinas College
Email: stekedeb@aquinas.edu
Phone: 616.632-2930

Academic Goals

The academic goal of the program is to provide graduates who are able to participate fully in fostering the "next industrial revolution" through their critical understanding of sustainable business strategy and practices.

Description of Collaborations

We have been fortunate to have the expertise and involvement of some of the country's leading businesses devoted to moving toward sustainability. These have included companies such as Steelcase, Herman Miller, Interface and others who have contributed to the success of our program through their service on our External Advisory Committee. Noted visionaries in the field such as Janine Benyus, William McDonough and others have also contributed to our program's development through on-campus and field experiences. Aquinas College is also part of a Community Sustainability Partnership including other academic institutions with the express purpose of developing a regional awareness and involvement in the movement toward sustainability in our community. Various projects are developing through the participation of the

Sustainable Business Department and various domestic and international businesses such as sustainably manufactured wind turbines, closed-loop urban composting, and others.

Funding Sources

The Sustainable Business program has been honored to have received the generous support of the Steelcase Foundation, the Wege Foundation, and at its start, a visionary anonymous donor.

Challenges

There are numerous challenges in launching a interdisciplinary and transdisciplinary program on the cutting edge of business education. Institutional challenges have involved the development of effective communication channels across disciplinary boundaries. Also, sustainable business theory is currently developing and the availability of educational materials is very limited. The complexity of this transformative approach to business--and the attempt by some to distill this complexity--also poses challenges to curriculum development and integration. Sustainable business can not be taught in "ten easy steps." One of our biggest challenges to develop students who can discern truly sustainable business practices from those which pretend to pursue sustainability.

Successes

We feel we are succeeding based upon the numbers of students who are choosing to enroll in this rigorous program. We have exceeded our projected 2009-2010 enrollment as of this fall and anticipate a growing interest in our program as others become more familiar with the restorative power of a sustainable business approach. Through our graduates, we view possibilities for sustainable business practices to spread through their influence as they enter the workplace. Many of our graduates are now employed in professional positions where they are returning to Aquinas to involve our students through internships and other projects that are making a difference.

Five Year Goal

Our immediate goal is to further pursue excellence in our sustainable business program through the constant redesign of our curriculum to adapt to changing business, environmental and social challenges and circumstances. Over the next year, we are developing new and refining our existing practice-based opportunities for our program's students that can make positive and lasting contributions to our local and global community.

Desired Partners

We continue to seek partners in business who interested in incorporating sustainable business practices into their workplace and wish to embark on their own journey toward sustainability.

Sustainable Cities Graduate Certificate Program

University of Southern California, *Los Angeles, CA, USA*
http://www.usc.edu/dept/geography/ESPE/graduatecertificate.html
http://www.usc.edu/dept/geography/ESPE/index.html

The Sustainable Cities Graduate Certificate Program requires 16 units of graduate work: Sustainable Cities, Natural Spaces in Urban Places, Methods for Assessment and Protection of Environmental Quality, Applied Air Quality Management, Water Quality Management and Practice, Sustainability in the Environment: Infrastructure, Operative Landscapes, and Buildings, Smart Growth and Urban Sprawl: Policy Debates and Planning Solutions, Transportation and Environment, Directed Research from an approved academic unit focused on area of specialized interest

Each academic unit, department or program will determine the number of units completed that may be applied to the student's master's or doctoral degree.

Program Stats

Graduate Program
Methodology: Mixture of Research, Teaching, or Service

Home Department: Geography
Other Departments: The Center for Sustainable Cities, which offers the Graduate Certificate program, has affiliated faculty from the natural and social sciences, policy and planning, architecture, and engineering.

Students Enrolled Since Inception: 40
Students Currently Enrolled: 3

For more information, contact:
Dr. Jennifer Wolch
Geography
University of Southern California
Email: wolch@usc.edu
Phone: (213) 821-1325

Academic Goals

The goal of the Program is to produce superior scholars prepared for leadership positions in a wide variety of domains: academia, private sector firms, nongovernmental bodies, and public agencies. The Program produces scholars capable of top-quality research and professional practice, who as a result of their training experience can think more flexibly and set different sorts of goals for their careers. They will make their contributions not only within the confines of the research laboratory and peer-reviewed journals, but in the complex professional world of environmental and urban problem solving.

Description of Collaborations

The academic program itself does not have collaborations, except with participating faculty and academic units. However, the Center for Sustainable Cities has a wide array of collaborations linked to research, executive education, public policy outreach.

Funding Sources

The program was initially funded by an NSF IGERT award, and was restricted to doctoral students. It is currently supported by the university, and is open to masters students as well as doctoral students.

Challenges
Working across academic units is challenging, as is developing a funding base to offer scholarships to students to support their participation in the program.

Successes
The Sustainable Cities Graduate Certificate Program has broadened the education and training of a sizable cadre of capable students, and in many cases changed the exact nature of the career opportunities and chosen path. It has also had a mutually beneficial relationship with the Center for Sustainability in terms of research and policy outreach activities.

Five Year Goal
The Certificate was recently revised to allow masters students to participate. New students need to be recruited - hence the low official numbers - but this is happening. A new one-year masters program is also in development ("Energy and Sustainability Science") which should attract a broad array of students, including mid-career professionals.

Desired Partners
It would be extremely useful to have formal linkages with the Sustainability Science section of the AAAS, beyond a website listing, and to participate in an active network of university-based programs to raise the profile and opportunities for sustainability science education.

Sustainable Development Service Learning Internship

Arizona State University, *Phoenix, AZ, USA*
http://uc.asu.edu/servicelearning/descriptions.php?cd=uni484c

UNI 484 Sustainable Development Service Learning Internship (3 credits)

Interns will help small groups of 7th graders at Southwest School to learn about sustainable development issues. Focus will be on water, energy and materials used at their school and in the City of Phoenix. Interns will assist the 7th graders in conducting service projects designed to reduce resource use. No exams. A full background-check and fingerprinting is required. Fee ($20, applies to transportation costs).

Program Stats

Undergraduate Program
Methodology: Service-Based

Home Department: University College
Other Departments: School of Life Sciences and Global Institute of Sustainability

Students Enrolled Since Inception: 17
Students Currently Enrolled: 3

For more information, contact:
Dr. Nancy Crocker
University College, Arizona State
Email: Nancy.Crocker@asu.edu
Phone: 602-496-1260

Academic Goals

Goals are to introduce university students to issues in sustainable development and involve them in a service project.

Description of Collaborations

Arizona Department of Water Resources
Global Institute for Sustainability, ASU
U.S. Bureau of Reclamation
Phoenix Preparatory Academy, Phoenix Elementary School District
U. S. Partnership for the UN Decade of Sustainable Development
Maricopa Cooperative Extension (University of Arizona)
Girl Scouts – Arizona Cactus-Pine Council, Inc.
National Science Foundation
School of Life Sciences, ASU

Funding Sources

Funding is provided by Arizona State University and the National Science Foundation.

Challenges

Involving greater numbers of university students. Greater enrollment will enable us to reach larger numbers of middle school students and teachers.

Successes

Has been well-received by University students, middle school students, teachers and parents. Probably the greatest success is simply that we are being effective in breaking out of the circle of the university and reaching community members with no previous affiliation with the university. We are introducing children early to issues regarding sustainability and through them to their parents and families members who might not have paid attention otherwise. Children are

excellent community educators and advocates. To reach the non-university community, it is especially effective to invite parents and family members to children's presentations. Parents and other adult family members will attend and listen carefully to their own children when they would not pay attention to similar issues otherwise.

Five Year Goal

Arizona State University students and 7th graders are working with the Arizona Department of Water Resources to develop a patch program on water conservation and related science issues. The program will be available to youth throughout Arizona. The activities will also be proposed as a water conservation Girl Scout patch. Interns will videotape activities and the documentation will eventually be available as technical training to teachers and Girl Scout troop leaders.

Sustainable Universities Initiative

University of South Carolina, *Columbia, SC, USA*
www.sc.edu/sustainableu
www.environ.sc.edu
www.sc.edu/EAC

The Sustainable Universities Initiative is a statewide network of faculty, staff and students who share an interest in integrating environmental considerations into their work. While all the SUI schools collaborate and share information, each individual school focuses on the aspects of sustainability that best fit the institution.

Programs include sustainability modules taught in classes ranging from engineering to English, operational changes, green building initiatives, and student projects. There have been significant collaborations with state and community organizations.

Program Stats

Methodology: Mixture of Research, Teaching, or Service

Home Department: Office of Sustainability
Other Departments: School of Engineering, Law School, Arts and Sciences, Public Health, Business, as well as operational units such as Housing, Facilities Management, Construction and Planning.

For more information, contact:
Ms. Patricia Jerman
Office of Sustainability
University of South Carolina
Email: jerman@sc.edu
Phone: 803-777-7760

- **Academic Goals**
  The primary focus of our efforts is to "change our product" — to help students understand how to meet fundamental human needs without destroying the planet's ability to support us. We do this by working with faculty to expand their teaching and research portfolios and by working with administrators and operations managers to ensure that our institutions are practicing what faculty preach. SUI serves as a catalyst for activities that will make the state's three research universities, other educational institutions, and ultimately, the state as a whole, more sustainable. (from SUI website.)
- Individual faculty develop their own focus, based on personal interest, discipline, and opportunities.
- Within the School of the Environment, a new focus on rivers is beginning this year; while the details of the research initiative are not yet firm, we expect the initiative will be closely related to state sustainability efforts.

Description of Collaborations

The Sustainable Universities Initiative began as a collaboration among the state's three research universities, later expanding to include 13 other colleges around the state.

Funding Sources

The statewide Sustainable Universities Initiative (SUI) was funded with a private foundation grant. The University of South Carolina subsequently provided internal funding for a USC-specific Office of Sustainability, as have several other SUI schools.

Challenges

A significant challenge continues to be the difficulty of rewarding faculty for interdisciplinary work, and for work which may be seen by some as too "applied" (such as working with students on campus facilities issues.) On the operations side, inertia, funding challenges, and reluctance to have unknown "outsiders" making suggestions all pose challenges.

Successes

Individual faculty members have embarked on research that significantly advances sustainability. For example, USC hosts the NSF University Industry Cooperative Center for Fuel Cells, researchers initially funded by SUI are exploring CO2 as an alternative cleaning/sterilizing agent in medical applications.

Our most enduring success is probably in the area of green building. The University of South Carolina and Clemson, both SUI schools, have US Green Building Council LEED certified buildings, and both have a number of registered buildings which will be certified as they are completed. The University of South Carolina's West Quad, a 500 bed residence hall, is the largest LEED certified residence hall in the country, and has been used as an effective teaching tool for resident and non-resident students alike. When students live in, or take courses in, a green building they leave the university with ideas that can be replicated in their businesses and homes, magnifying the value of the buildings. Details about successes in the early years of the program are available on the SUI website, www.sc.edu/sustainableu

Five Year Goal

We're in a period of transition between the statewide organization and a number of internally-focused university sustainability efforts. Our near-term goal is to make the transition gracefully!

The New Jersey Sustainable State Institute

Rutgers University and the New Jersey Institute of Technology, *New Brunswick, NJ, USA*
www.njssi.org

NJSSI is an independent agency based at Rutgers that works with government, public interest groups, business leaders, scientists, and citizens from all walks of life, to answer the question: "Where are we, and where do we need to be, in order to preserve our quality of life and become a sustainable state?"

NJSSI convenes multi-stakeholder processes that integrate science and politics to identify goals, indicators and targets for the future of New Jersey. We cover economic, social and environmental issues that:

- Are critical to the future well-being of New Jersey;
- Manifest over a long time period;
- Are difficult for most citizens to follow without indicators to track progress.

Program Stats

Post-graduate Program
Methodology: Mixture of Research, Teaching, or Service

Home Department: New Jersey Sustainable State Institute/Planning and Public Policy

For more information, contact:
Mr. Randall Solomon
New Jersey Sustainable State Institute/Planning and Public Policy, Rutgers University & the New Jersey Institute of Technology
Email: randalls@eden.rutgers.edu
Phone: 732.932.5475x695

The current goals and indicators can be found in our most recent report, Living With the Future in Mind: Goals and Indicators for New Jersey's Quality of Life.

NJSSI is currenty developing targets of sustainable development for New Jersey that are assocated with each indicator starting in the field of energy.

NJSSI is also working municipalities to develop sustainable community plans that:

- Have goals, indicators, targets, strategies and actions;
- Link local sustainability to regional and global sustainability imperatives;
- Provide guidance specifically targeted to government, individuals, businesses, homeowners associations, schools, civic organizations.

Academic Goals

NJSSI convened actors in NJ to develop a set of sustainability goals to serve as a focal point for future efforts. The goals are availabel at NJSSI.org. NJSSI also provides learning opportunites for graduate and undergraduate students as well as research and publication opportunities for faculty and staff.

Description of Collaborations

We serially collaborate with state agencies and other NJ university based research centers on indicator and target setting activities for different sectors and issues of concern. NJSSI convenes process, brings political actors to the table, and marshals topical expertise from other entities.

Funding Sources
A combination of government (state, local, and federal), foundation, and corporate grants. Funding has been a challenge, though better of late as we have become more established.

Challenges
It is difficult to raise money for a program that collects, prioritizes, and disseminates serial data. We try to convene scientifically informed deliberative dialogues with experts and stakeholders to identify indicators and targets (priorities). However, making a relatively novel effort politically salient is a challenge.

Successes
- Producing three volumes of our core Goals and Indicators report.
- Building a Board of Governors that has serving state government cabinet officers as well as business and NGO leaders.
- Many successful events and conferences.

Five Year Goal
To have the results of our work become politically salient, and widely known, within NJ.

UCSD Environment and Sustainability Initiative

University of California - San Diego, *La Jolla, CA, USA*
http://esi.ucsd.edu

The ESI is a campus-wide initiative to focus the educational and research capabilities of UCSD on sustainability solutions. The mission of the ESI is to:

- Develop practical solutions to local, regional, and global problems;
- Create innovative partnerships with industries, governments, and international organizations;
- Generate new research and teaching specifically aimed at sustainability challenges;
- Collaborate with partners in industry, government, and civil society to ask the right questions and create the best solutions.

Program Stats

Methodology: Mixture of Research, Teaching, or Service

Home Department: Scripps Institution of Oceanography

For more information, contact:
Dr. Lisa Shaffer
Scripps Institution of Oceanography, UCSD
Email: lshaffer@ucsd.edu
Phone: 858.822.2489

Academic Goals

This is not an educational program per se, but a broad initiative to encourage the inclusion of sustainability in existing curricula and to develop new academic offerings, as well as research initiatives. The educational efforts are informed by AASHE as well as other sources.

Funding Sources

Start-up funding has been provided by private donors. Government funding is expected for specific research projects that are being developed. Funding is always a challenge.

Challenges

Challenges to date are primarily institutional - how to structure an initiative that is inclusive, produces tangible results, involves partnerships across academic units and beyond the walls of academia; how to provide incentives for innovative teaching and research endeavors; how to fund the needed non-academic staff and other support infrastructure in advance of substantial programmatic funding.

Successes

We have only just begun ... our successes so far have been in creating opportunities for faculty from different departments to meet and get to know each other, and from that interaction, to begin developing ideas for collaborations around sustainability challenges.

Five Year Goal

Our vision is to make UCSD a world leader in addressing the challenges of sustainable coastal cities. Coasts are home to an increasing share of the world's human populations, and embody some of the most complex aspects of sustainability. Our focus on coastal cities allows us to integrate the extensive expertise within the UC San Diego academic community, including

Scripps Institution of Oceanography, and work with partners in our own coastal community, across the border with Mexico, around the Pacific Rim, and on a global scale. Among the research and educational activities at UC San Diego relevant to this vision are development of carbon neutral energy solutions, mitigation and adaptation to the impacts of climate change, the relationship between environmental conditions and public health, “green chemistry” solutions to create environmentally benign industrial processes, and the development and use of wireless sensor networks and advanced information technologies to provide continuous monitoring and analysis to support decision-making.

Environmental Quality and Sustainable Development

University of Zaragoza, *Zaragoza, Spain*
http://wzar.unizar.es/servicios/epropios/oferta/194.html
http://ingmecanica.unizar.es/calidad_ambiental/

The present Postgraduate Course on Environmental Quality and Sustainable Development is proposed with the aim of covering the urgent need of preparing professionals able of building and creating a sustainable world. At the same time it covers an educational gap of the University of Zaragoza in this multidisciplinary field.

The programme has a clear emphasis on the physical / natural / technological dimensions of Sustainable Development. It is mostly oriented to an audience with a scientific and technological background, however it is also open to graduates and professionals with formation in humanities. Therefore this course can be attractive for engineers, scientists, managers, educators, people from government and administration, NGO and people who are eager to learn about Sustainable Development in depth.

It includes instrution in the following topics: Introduction to Sustainable Development; Systems thinking; Tools for evaluating the degree of sustainability of human activities; Natural resources. Fundamentals;Energy and its eco-efficient utilization; Eco-efficient use of materials;Eco-efficient use and management of water; Development and socio-economic organization; Poverty: Causes, consequences and alleviation; and a Postgraduate project

Program Stats

Post-graduate Program
Methodology: Mixture of Research, Teaching, or Service

Home Department: Dept. of Mechanical Engineering
Other Departments: Dept. of Chemical Eng. and Environmental Technologies, Department of Applied Physics, Department of Economy, Department of Public Law
Other institutions participating in the programme: LEAD Europe (UK), UNESCO Chair on Environmental Education (UNED, Spain), Polytechnic University of Catalonia (Spain) , University of Vic (Spain), Environment Dept. of the Zaragoza's city council (Spain), Environment Dept. of Government of Aragon (Spain), Fundación Ecología y Desarrollo (Spain), Federación Aragonesa de Solidaridad (Spain)

For more information, contact:
Dr. Luis M. Serra
Dept. of Mechanical Engineering, University of Zaragoza
Email: serra@unizar.es
Phone: + 34 976 761913

Academic Goals

The main aim of this postgraduate course is to provide the required knowledge, tools and skills for evaluating the consequences of human activities in respect to the environment and the society with a global and holistic perspective.
This kind of knowledge is in most of cases not provided by classical studies of higher education institutions, particularly in the degree level, presenting a clear focus towards the specialization in specific fields. This is also the case of the University of Zaragoza, which is a big university with about 40,000 students and with a broad educational offer in sciences, engineering, humanities and health sciences (http://www.unizar.es). In this context the proposed postgraduate course

intends to broaden the perspective of the students as well as to widen their capabilities and abilities for envisaging the challenging task of building a sustainable world.

In order to fulfil this general objective the next specific objectives have to be reached. In the context of building a sustainable world the required professionals should be able to:

- Understand how their work interacts with society and the environment, locally and globally, in order to identify potential challenges, risks and impacts.
- Understand the contribution of their work in different cultural, social and political contexts and take those differences into account.
- Work in multidisciplinary teams, in order to adapt current technology to the demands imposed by sustainable lifestyles, resource efficiency, pollution prevention and waste management.
- Apply a holistic and systemic approach to solving problems and the ability to move beyond the tradition of breaking reality down into disconnected parts.
- Participate actively in the discussion and definition of economic, social and technological policies, to help redirect society towards more sustainable development.
- Apply professional knowledge according to universal values and ethics.
- Listen closely the demands of citizens and other stakeholders and let them have a say in the development of new technologies and infrastructures.
- Develop a consistent and feasible vision about how a sustainable society could be and how it could be built, that is a society fully integrated in harmony within the biosphere and with an equitable socio-economic development for all human beings.

Description of Collaborations

- The most important part of lecturers come from different departments of the University of Zaragoza. It was an objective of the programme to use as much as possible “local resources”. Nevertheless, there is a significant participation of lecturers from other Spanish institutions and universities.
- We would like to remark the importance of the participation of Lead, which is a really global non profit organization. Lead participates in the systems thinking module, presenting their dynamics and approach. Lead dynamics and approach is that one that we would like to apply to the different modules of the programme.
- Finally, the participation of companies is very much needed. The students should develop their project in a company or institution different than the University of Zaragoza. At present it is being established the conditions of participation of several companies that have shown interest in this programme.

Funding Sources

The University of Zaragoza provides the installations, services and its infrastructure for developing the programme. The main source of funding comes from the fee paid by the students.

Challenges

It is highly multidisciplinary, with the participation of experts and lecturers form very different disciplines, including scientific, technological and social. The effort of coordination is very high. Further, the course requires a high involvement and participation of the students, as well as some of the lecturers. The analysis tools presented in the first module should be applied in the rest of

modules, in order to promote the participation, cooperation and reflection of the participants. In other words, an important objective is the creation of a reflection and creative space for the participants allowing them to think about how to address in their environment the challenge of creating and promoting a more sustainable behaviour.

Another important challenge is to communicate the importance of the programme and present a clear and attractive offer. There are many postgraduate programmes offered by the University of Zaragoza. Further, several students approaching this programme consider that it is very interesting, but they do not think that it could help them to find an employment.

Should be mentioned also, the challenge of attracting companies willing to collaborate with this programme.

A final challenge is the need of additional funding, but we do not consider it the most important.

Successes

The programme has not been launched yet. However, there is already an important success, which is the organization of a programme with this approach in the University of Zaragoza. Up to now, it was not a similar educational offer in this university, and this fact represents itself a success.

It has been really rewarding the good acceptance of the programme among the lecturers and institutions invited to participate in it.

Five Year Goal

The near term goal is very simple. Just to launch the programme and learn about it the first year.

The mid term goal is to extend the length of the programme in order to go in deep in the different modules.

The long term goal, is that this programme could be the starting point for a process oriented to greening the curricula of the different studies offered in the University of Zaragoza. We would like that as much departments as possible of the University of Zaragoza were involved in this programme. The long term goal, would be that this programme were not necessary, because the Sustainable Development thinking and approach were implemented in all departments, studies and different levels of the university life of the University of Zaragoza.

Desired Partners

It would be interesting to open this programme to some other universities and to organize an inter-university programme. This could be done at Spanish level or at international level in the EU. In this respect we are exploring possibilities of cooperation and collaboration with some other universities as for instance UPEACE (UN) in Costa Rica, which has some programmes in Europe. In Spain, the Polytechnical University of Catalonia has very interesting programmes on Sustainable Development. But we consider that this type of collaboration should be established once the programme had been launched and experienced in the University of Zaragoza.

ESRC Centre for Social, Technological and Environmental Pathways to Sustainability (STEPS)

University of Sussex, *Brighton, UK*

Program Stats

Continuing-Education Program

Home Department: Institute of Development Studies

For more information, contact:
Dr. Melissa Leach
Institute of Development Studies,
University of Sussex
Email: m.leach@ids.ac.uk
Phone: +44 (0)1273 678685

STEPS is a new Centre at Sussex that provides a global hub for interdisciplinary research and policy engagement to meet these challenges. Funded by the Economic and Social Research Council (ESRC), its first phase formally started on 1st October 2006 and runs for five years.

The Centre brings together researchers in the KNOTS team at IDS with those at SPRU (Science and Technology Policy Research), enabling a new and valuable integration of work in environment and development studies, and science, technology and innovation studies. Hosted administratively at IDS, the centre is directed by Melissa Leach with co-direction from Ian Scoones (IDS) and Andy Stirling (SPRU).

STEPS will explore the pathways through which technologies, ecologies and social systems interact in development and how these can contribute to processes and outcomes that are more resilient, sustainable, socially just and favourable for the poor. The Centre will develop a 'pathways approach' which recognises rapid change in Social systems; Technologies and their spread, and Environmental conditions. These interact in complex, uncertain and non-linear ways creating multiple Pathways - some threatening poor people's livelihoods and health, but others creating opportunities for Sustainability.

The STEPS Centre will develop, test and apply this approach through interdisciplinary, interactive research. It will build new, integrative theory, drawing together work on dynamic ecology, complex systems, grounded ethnography, science and technology studies, critical political ecology, ecological economics, and the social and political dimensions of institutions and governance. It will link theory with the design of methods and tools to understand actual and potential pathways, and to engage policy actors and poor people themselves in shaping sustainable futures. To do this, the Centre's research programme will link projects in three domains: A) food and agriculture; B) health and disease, and C) water and sanitation, with work around three themes:

Dynamics: the interlinked processes of social, technological and environmental change in different settings, and how these create possibilities for alternative pathways to sustainability.

Governance: the institutional, political and policy processes across global and local scales that enable or constrain different pathways to sustainability in favour of poorer and marginalised people.

Designs: decision-making procedures, appraisal methods and analytical tools which enhance citizen engagement and the capacity for negotiating pathways to sustainability under uncertainty.

Through cross-cutting, interdisciplinary analysis; through a highly interactive style of research involving close collaboration with scientists, policy-makers and civil and private sector partners in global and local settings, and STEPS will connect the development of new theory with practical approaches that create opportunities for the poor. As a Centre, STEPS aims to become a focus for debate, a source of critical, informed policy advice, and a locus for convening researchers and users and training the next generation of social scientists, equipped with analytical tools and practical concepts relevant to the 21st century challenges of rapid social, technological and environmental change.

Academic Goals

- To develop and apply a new 'pathways' approach and thus achieve theoretical breakthrough in understanding the interactions between social, technological and environmental dynamics, and their implications for sustainability and social justice, in contemporary developing country contexts;
- To advance a new set of interdisciplinary concepts and methodologies for a contemporary environment and development agenda, by drawing together science and technology studies, development studies, and a variety of social and natural science approaches;
- To develop a new set of institutional designs, decision-making procedures, appraisal methods and analytical tools which enhance citizen engagement and the capacity for negotiating pathways to sustainability in uncertain environments, together with a critical understanding of appropriate contexts for their application;
- To advance policy debates around promoting environmental sustainability and making science and technology work for the poor, through collaborative work with users around project issues in the food and agriculture, health and disease, and water and sanitation domains, and by promoting new dialogue and insights across these domains;
- To establish a new national and international hub for interactive, interdisciplinary social science around science, technology, environment and development issues, with associated networks that link social scientists, natural scientists, and users across diverse local, national and international settings;
- To train and build the capacity of new cohorts of junior researchers, Masters' students, PhD students and postdoctoral fellows in concepts, methods and approaches associated with the STEPS Centre's work;
- To build capacity for critical reflection and productive engagement with social dimensions of contemporary science, technology, environment and development issues amongst natural scientists, international organisations, policy-makers, donors, government and NGO staff.

Description of Collaborations

1. STEPS involves many forms of collaboration, both domestic and international. These include:
2. Collaboration between IDS and SPRU, as premier UK-based institutions in development studies and science and innovation studies respectively;

3. Collaboration with other institutions on the Sussex campus, including its Life Sciences department and Medical School;
4. The establishment of international networks of researchers across the social and natural sciences, and policy makers and practitioners, associated with each of the Centre's agriculture, health and water domains;
5. Partnerships with research and policy institutions in developing countries associated with particular research projects - to be decided.

Funding Sources

The Centre is funded by the UK Economic and Social Research Council (ESRC) as one of its major investments in research centres. Securing this funding involved an intensely competitive process. As a reuslt of success, generous funding is now in place for 5-10 years. this will be supplemented by the seeking of co-funding for specific projects.

Challenges

The primary challenges for STEPS Centre are also its main goals: developing new interdisciplinary conceptual frameworks and methodologies, and drawing together research and practical, policy concerns. To meet these, the Centre's 'pathways approach' will be guided by several distinctive features:

- An explicitly interdisciplinary, problem-focused framework that highlights dynamic system properties in relation to sustainability;
- An approach to sustainability that recognises that social, technological and environmental dynamics are intertwined and mutually co-constituting, requiring place-specific, ethnographic understanding informed by an exploration of political and cultural context;
- A broader understanding of uncertainty and the ways diverse perspectives and interests shape options and priorities for pathways to sustainability in different institutional settings.
- An approach to practical policy analysis which transcends reductionist forms of 'evidence-based' policy-making and appraisal, while also avoiding the pitfall of relativist 'anything goes' positions. Instead, we will elaborate an 'evidence-bound' framework that highlights how scientific data and other forms of salient knowledge constrain the set of actions that might be considered rational and legitimate, yet, within this, allows for contingent aspects of sustainability, and the need for negotiation amongst contested perspectives and priorities.
- An interactive research approach that engages with diverse actors, including poor people themselves, in helping to shape future outcomes that are resilient and sustainable. This will be based on the development of a suite of methods and tools that reflexively link theory and practice, in which concepts, methods and tools are both critically examined as part of existing governance processes, and considered as potential routes to address sustainability and poverty reduction more effectively.

Successes

The Centre is currently in its inception phase so there are few findings to report as yet. By the end of March 2007, it should be able to report initial advances in understanding sustainability in conceptual terms, and cross-sectorally - ie linking debates in health, agriculture and water domains.

Five Year Goal
See overall description

Desired Partners
The STEPS Centre is seeking to expand its existing collaborative networks through interaction with other institutions worldwide that share similar goals, or that are exploring connections between sustainability science, technology and innovation.

Exploring a Sustainable World

Utrecht University, *Utrecht, The Netherlands*
http://www.copernicus.uu.nl

The Copernicus Institute for Sustainable Development and Innovation seeks to contribute to the development of knowledge and techniques as well as methods and instruments in the field of sustainable development, taking note of related social debates and policy processes. The specific character of the Institute is the combination of developing solid scientific knowledge and experience in the field of specific technical and scientific issues as well as in the field of processes of change and innovation. It is the ambition of the institute to make a difference – in science and education and in society at large – in the exploration of a sustainable world.

Program Stats

Continuing-Education Program Methodology: Research-based

Home Department: Copernicus Institute for Sustainable Development and Innovation

For more information, contact:
Dr. Margien Bootsma
Copernicus Institute for Sustainable Development and Innovation
Utrecht University
Email: m.bootsma@geo.uu.nl

Within the Copernicus Institute sustainable development is broadly defined, in line with e.g. the report of the World Commission of Environment and Development (Brundtland report, 1987), the outcome of the United Nations Conference on Environment and Development (Rio de Janeiro, 1992), and the World Summit on Sustainable Development (Johannesburg, 2002). The concept of sustainable development primarily refers to a development of our economy and society that can be maintained. The issue is not so much finding final situations in which sustainability is realised, as there is no fixed final situation. Striving for economic prosperity is as legitimate as striving to protect nature and the environment and striving for social justice, both across generations and within them. For each dimension of the issue of sustainable development – economic, social and ecological – there are questions about which values, goals, and principles are to be used, as well as about the effectiveness, efficiency, and justice of developing and applying options. Exploring sustainable development means investigating these questions in connection to each other. Starting point of the institute's research programme is the cause and effect chain, which links economic activities and ecological qualities.

Within this context the mission of the institute is formulated as follows:

The Copernicus Institute develops knowledge, methods and instruments directed towards sustainable development, with specific attention for:
- demand, supply and use of energy and materials;
- land use, the environment and biodiversity;
- governance and innovation.

Description of Collaborations

There is collaboration with many other groups within of close to Utrecht University (e.g. Utrecht Centre of Energy research, Utrecht Centre of Geosciences), with other university groups within the Netherlands and worldwide.

International Centre for Integrated Assessment and Sustainable Development

Maastricht University, *Maastricht, Netherlands*
http://www.governance.unimaas.nl/masters/mpp/programme_details.html
www.icis.unimaas.nl

The main objective of the Sustainable Development programme is to give students insights in the principles of governance, sustainable development, and sustainability science by understanding the challenges, constraints and interactions of its academic definitions, decision-making tools and practices. The track will build on an understanding of governance and sustainable development as a co-evolutionary, adaptive process that needs to permeate both human societies and the natural environment. The emphasis will be on explaining and using the generic, complex and, by definition, flexible terms of sustainable development with the help of specific tools and methods.

Program Stats

Graduate Program
Methodology: Mixture of Research, Teaching, or Service

Home Department: International Centre for Integrated Assessment and Sustainable Development

Students Enrolled Since Inception: 50
Students Currently Enrolled: 20

For more information, contact:
Dr. Pim Martens
International Centre for Integrated Assessment and Sustainable Development, Maastricht University
Email: p.martens@icis.unimaas.nl
Phone: +31-43-3883555

Academic Goals

By the end of the programme students will:

- have an understanding of relevant contemporary social, economic and environmental theories and concepts related to sustainability;
- be able to perform a quantitative analysis of 'sustainable development issues' by using a set of 'Integrated Assessment' methods and tools;
- have grasped the ethical, legal, socio-economic, political and environmental fundamentals of the concept of sustainable development;
- appreciate the contested meaning of governance and sustainable development from a variety of perspectives;
- be able to translate these general concepts to a wide range of sectoral and spatial contexts;
- understand and be able to apply a number of selected management approaches and governance concepts for implementing and measuring sustainable development;
- be able to work as a team member on the practical implementation of governance and sustainable development strategies both in governments and the industry.

Description of Collaborations

Primarily domestic

Funding Sources
Government grants - with the notation 'somewhere in between'.

Challenges
Lack of interdisciplinarity incentives at the university

Successes
A steadily increase of # students.

LUMES

Lund University, *Lund, Sweeden*
www.lumes.lu.se

The mission of LUMES is to provide a unique, inter-disciplinary atmosphere for learning about global issues surrounding sustainability. LUMES should maintain a forum where a community spirit can be developed year after year by ambitious, dynamic individuals with a diversity of educational and cultural backgrounds. The result should be a truly global network of compassionate and well-educated critical thinkers working within a variety of sectors and striving to uphold the vision of LUMES.

The LUMES programme aims at preparing the students to contribute to a long-term sustainable development through a critical and system thinking approach. It is designed to build on the knowledge, skills and experiences the students already possess with the intention of producing graduates having the capacity to become leading actors, locally as well as globally. Graduates should leave feeling prepared and inspired to contribute to the sustainability of natural, societal and human resources

Program Stats

Graduate Program
Methodology: Mixture of Research, Teaching, or Service

Home Department: LUCSUS
Other Departments: Several departments from different faculties participate. Each course is taught by a multi-disciplinary team of lecturers. Most important departments are: Political science, Economic history, Environment and Energy systems, Architecture, Design, Chemical engineering, Geography, Sociology of law,

Students Enrolled Since Inception: 350
Students Currently Enrolled: 35

For more information, contact:
Dr. Lennart Olsson
LUCSUS, Lund University
Email: lennart.olsson@lucsus.lu.se
Phone: 46462220511

Academic Goals

After completion of the programme, the students should:

- possess knowledge concerning environmental and resource handling issues: causes, problem boundary identification, interrelations, feedbacks, and possible solutions, especially in relation to the different dimensions of sustainable development;
- have developed a holistic outlook and an understanding for perspectives coming from disciplines other than their own;
- have developed communication skills and the ability to think critically;
- be able to analyse and formulate solutions to complex problems within the environmental field; be able to work in a trans-disciplinary setting, especially through a systems analysis approach, and in a multi-cultural international environment to prepare and implement long-term sustainable solutions to environmental and developmental related issues.

Funding Sources

Funded by the government as part of the Lund University. Several student from transition countries and developing countries receive scholarships for living expenses.

Masters in Strategic Leadership Towards Sustainability

Blekinge Institute of Technology, *Karlskrona, Sweeden*
http://www.bth.se/msls
http://www.bth.se/tmslm

The MSLS Programme revolves around an intellectually-strict model for making systematic progress towards an attractive and sustainable society. Built on a total systems perspective and a scientifically relevant world-view, the programme uses a framework for strategic sustainable development, an internationally-recognised methodology for guiding strategy towards sustainability (widely know amongst business and political leaders as The Natural Step framework). It is a generic and therefore widely applicable approach to sustainable development at multiple scales (e.g. global, national, business, corporate, community and individual), allowing for a systematic approach to: analyze current practices, envision solutions, find strategic paths to a sustainable outcome, and select and design cohesive and complimentary tools to support strategic planning for sustainability.

Program Stats

Post-graduate Program
Methodology: Mixture of Research, Teaching, or Service

Home Department: Engineering
Other Departments: Engineering, Management, European Spatial Planning

Students Enrolled Since Inception: 125
Students Currently Enrolled: 39

For more information, contact:
Mr. Pong Leung
Engineering, Blekinge Institute of Technology
Email: pong.leung@bth.se
Phone: +46 (0)455 38 55 26

Students also build their personal leadership capabilities through the study of concepts such as organizational learning and transformational change processes. By learning and practicing a combination of the clear and logical structure of the framework for strategic planning for sustainability and a focus on leadership skills, graduates are able to enter the professional arena with an energetic and inspired approach to societal and organizational change. A specialization in technology or leadership and management is possible through choice of projects and electives.

MSLS creates leaders who are empowered to act, who will literally create a better world. Our pioneering students entered the workforce in 2005, and have already delivered a clear message: the graduates of the MSLS programme are a powerful force for positive change.

The programme is taught in English and is transdisciplinary in approach. Students are typically high caliber professionals in early to mid-career and are welcomed from any professional background and any part of the world.

Academic Goals

The overall mission of the MSLS Programme is to educate a global network of leaders who understand strategic sustainable development, and can inspire the human energy necessary to create a sustainable society.

The profile for the university states a focus on: “Applied Information Technology and Sustainable Development of Industry and Society”.

Within this context, the aim is for each graduate to:

- Have a thorough understanding of an intellectually strict, widely applicable framework for strategic sustainable development,
- Be able to apply the framework, in a range of situations, for an analysis of problems as well as creation of solutions,
- Be able to select, design and apply a range of complimentary and cohesive tools and concepts as part of a strategic approach to sustainability,
- Be able to demonstrate an in-depth, sophisticated application of the framework (as part of a group thesis); and
- To develop enhanced leadership capabilities and the ability to inform and empower through an improved awareness of organisational and personal learning as well as improved presentation, facilitation and coaching skills.

By helping students to achieve these goals, the programme will make a substantial contribution to a growing worldwide network of professional practitioners in sustainable development.

Description of Collaborations

- Related research in the field of sustainable product innovation (through the Sustainable Product Innovation Research IniTiative - SPIRIT)
- Support and research collaboration with The Natural Step and Lund University on a major research initiative in the field of strategic sustainable development
- Collaboration with other universities in Sweden and internationally eg Kunming University of Science and Technology (China).
- Specific research projects with Swedish research institutes such as the Knowledge Foundation, in the areas of operational support methods & tools for sustainable product innovation
- Collaboration on master’s thesis projects with various local and international organizations, e.g. local and regional governments, multinational corporations, small businesses, sustainability consultancies and other academic institutions.
- The development of a network of partners in the Statleade Network to support the programme and its goals

Funding Sources

Government funding, grants from Swedish research institutes for related research and support from alumni and our partners in the Statleade Network. Tuition is currently free for all students in Sweden (including foreigners). Should this change in future years student fees would provide a replacement source of funding.

Finding adequate funding is an ongoing issue. Basic funding is in place, but for the programme to continue to develop, additional financial support is needed, primarily for a larger staff, to offer scholarships, and to develop other initiatives that will enhance the overall experience for students and effectiveness for contributing to creating a sustainable society.

Challenges
Managing curriculum load within a short 1 year academic programme; lack of resources for programme delivery and ongoing development; developing teaching methods suitable to programme content and a diversity of adult learning styles; ensuring diversity within the learning environment; creating practical real-life projects for students to gain experience through.

Successes
Graduates demonstrate the overall success of the programme through their endeavours in cutting edge research, as policy makers and leaders in municipalities, multi-nationals and NGO's (refer to the website for more information). Graduates have and will continue to present thesis and ongoing research findings at various conferences in fields such as corporate citizenship, climate change, carbon markets, biofuels etc. Testimonials from graduates indicate that we are heading in the right direction, towards fulfilment of the programme's mission.

Specific Programme Highlights:

- A number of published master-level theses that apply the framework for strategic sustainable development to a broad range of issues.
- Support and research collaboration with The Natural Step in the field of strategic sustainable development
- A very successful public outreach programme to the local community, The Karlskrona Dialogues, bringing internationally acclaimed sustainability leaders to Karlskrona.

Five Year Goal
For the Stratleade Network, to have 50 companies actively engaged in support of the programme by 2009. Specific research goals are outlined in research project proposals.

For the program the near term goal is to increase collaboration with real-world organizations to enhance the learning experience. In addition, the program also wants to identify quality candidates and increase enrollment of students in Sweden and the European Union. The program also hopes to increase the number of graduates who then participate in the university's research programs on sustainable product innovation and further development of the framework for strategic sustainable development.

Desired Partners
Greater collaboration with EU and international agencies (eg United Nations).

Organizations for students to partner with in concrete and real-life projects related to sustainability

Organizations, news groups and list-serves etc to help publicize the programme to potential students.

Social Ecology

Klagenfurt University, Austria, *Vienna, Austria*
http://www.iff.ac.at/socec/index.php

At the Institute of Social Ecology, natural and social scientists from several disciplines cooperate in investigating aspects of society-nature interaction. For example: social metabolism, land use, environmental information and indicator systems and sustainable development.

Program Stats

Post-graduate Program
Methodology: Research-based

Home Department: IFF Social Ecology

Students Enrolled Since Inception: 500
Students Currently Enrolled: 30

For more information, contact:
Dr. Marina Fischer-Kowalski
IFF Social Ecology
Klagenfurt University
marina.fischer-kowalski@uni-klu.ac.at
Phone: +43-1-5224000-415

Academic Goals

Today's environmental problems are the starting point for our work. We take our clients' interests and the requirements of research programmes as a challenge not simply to do research but to contribute to improving society-environment relations through our research work. This is why we strive to present our results also to public debate.

For a long time, the natural sciences alone were active in demonstrating which environmental problems exist and in analysing them. However, problems are not solved by being demonstrated. Approaching a solution means changing societal behaviour with regard to the environment. It is this insight which inspired our work in Social Ecology. In order for societies to change their behaviour, they must develop tools to observe themselves. Most of our research projects in the last ten years have been dedicated to developing and consequently applying such self-observational tools for society's environmental behaviour.

In the meantime, we seek to go one step further. As we better understand how society's environmental relations are engrained in social organisation, we increasingly need to ask social science questions, such as on the relation between economic structure and the dynamics of resource use, Globalisation, trade, transport and climate change, demography, time use and migration.

Description of Collaborations

Sociology and biology of University of Vienna. UAB Barcelona, Lund University, Postdam Institute for Climate Impact Research, and many others.

Funding Sources

Public university funding; Austrian Science Fund; funding from various research programs and the European Union.

Challenges

Epistemological and theoretical: Bridging the social and natural sciences.

Successes
Generation of a social metabolism paradigm that is now being translated into public statistics worldwide.

Five Year Goal
Be able to fund scholarships for doctoral students.

Sustainable Development

Utrecht University, *Utrecht, The Netherlands*
www.geo.uu.nl/mastersd
www.uu.nl/internationalmasters

The main focus of this master's programme is the scientific analysis of the complex processes of change related to the pursuit of a sustainable society. Besides a critical analysis and evaluation of these processes, the programme also deals with the various means by which societal and/or technological changes can be implemented. These issues are viewed from a multidisciplinary perspective. Next, a deep expertise on topics as sustainability, energy and resources, land use and biodiversity and environmental policy and management is provided. The programme comprises elements of the natural and social sciences.

In an intensive programme, the students learn to apply scientific instruments in the areas of analysis, evaluation, and design. In addition, they become familiar with practical strategies for intervention. The programme devotes ample attention to the international dimension of sustainability issues.

Program Stats

Graduate Program
Methodology: Research-based

Home Department: Department of Innovation and Environmental Sciences
Other Departments: Department of Chemistry

Students Enrolled Since Inception: 150
Students Currently Enrolled: 45

For more information, contact:
Dr. Peter Driessen
Department of Innovation and Environmental Sciences
Utrecht University
Email: p.driessen@geo.uu.nl
Phone: 31302535771

The aims of the master's degree program in Sustainable Development are expressed in the following mission statement:
To educate academics who will be able to make a substantial contribution to the transition to a sustainable society through their scientific research and their skills in the area of societal intervention.

The program consists of a general part, in which all students participate, and three tracks, in which students specialize in a particular direction.

The purpose of the general part of the curriculum is to provide each student with the same scientific skills and knowledge they need in each track. In the track part, students are offered a choice among the following three tracks: Energy & Resources (E&R); Land Use, Environment & Biodiversity (LEB); Environmental Policy &Management (EPM)

Two of these tracks – namely Energy & Resources and Land Use, Environment & Biodiversity – are meant for students from the natural sciences. The third one – Environmental Policy & Management – is intended for students from the social sciences. Each track devotes attention to theoretical backgrounds, research methods, a research assignment and intervention strategies

Academic Goals

The goals of the program are specific to the university, although some are related to societal guidelines.

The program aims to:

- provide specialised knowledge, skills and insights within the field of environmental sciences, especially in problems of sustainable development,
- prepare the student for:
- a career as a researcher at a university or at the research department of a company or a research institute and
- a career in policy, business or management on an academic level within a company or public organisation in the field of the practical environmental sciences.

The following general endpoints apply to the program as a whole. The graduates are able to:

- analyse the issue of sustainable development from a natural-science and social-science perspective,
- engage in a scientific debate on the issue of sustainable development,
- set up and carry out scientific research on the issue of sustainable development in a creative and independent way,
- formulate fundamental critique on the scientific work of others,
- communicate natural-science or social-science knowledge on the issue of sustainable development verbally and in writing to a wide audience,
- put the results of a scientific investigation in the form of a scientific article or similar kind of publication.

Description of Collaborations

The program of the master's degree in Sustainable Development focuses on the theoretical background and research methods regarding sustainable development. The program is closely linked to the research program of the Copernicus Research Institute for Sustainable Development and Innovation (http:/www.copernicus.uu.nl). The mission of the institute is formulated as follows:
The Copernicus Institute investigates and develops processes and opportunities for innovative change towards sustainability, with special attention for demand, supply, and use of energy and resources; land use, biodiversity, and ecosystem functioning; governance; and innovation.

The courses are given by members of the teaching staff who actively contribute to the development of scientific knowledge in their area, participate in national and international research programs and have scientific networks in this field.

We try to establish also some international colloboration, especially with universities in Europe, the United States and Canada.

Funding Sources

This program is funded by the government.

Challenges
The challenge of this master's degree program in Sustainable Development is to educate academics who will be able to make a substantial contribution to the transition to a sustainable society through their scientific research and their skills in the area of societal intervention.

Successes
After completing the program graduates can obtain jobs in a broad range of sustainability-related jobs. MSc graduates have a high potential for attaining (inter)national research positions, inside or outside universities.

Five Year Goal
To attract a lot of foreign students to our master's program.

Desired Partners
None

Sustainable Energy Engineering

University of Zagreb, *Zagreb, Croatia*
www.fsb.hr/see

Program Stats

Post-graduate Program
Methodology: Mixture of Research, Teaching, or Service

Home Department: Faculty of Mechanical Engineering and Naval Architecture

Students Enrolled Since Inception: 15

For more information, contact:
Dr. Vlasta Zanki
Faculty of Mechanical Engineering and Naval Architecture, University of Zagreb
Email: see@fsb.hr
Phone: 38516168564

Consisting of introductory general courses followed by two parallel majors with advanced courses, the MSc SEE programme provides a basic and an advanced state-of-the-art education in the fields of power generation and energy utilization in the built environment by means of economically and environmentally sustainable systems and technologies. The programme is focused on the technical and economic aspects of application of both conventional and renewable energy technologies as well as of relevant policies and practices with the final aim of providing and utilizing energy at the least financial, environmental and social costs. Advanced methods are to apply to the practical design and modelling of thermal systems, the construction of relevant devices, as well as to their performance evaluation during operation and the assessment of environmental impact. Through various project work assignments carried out in collaboration with experts from companies, services and enterprises, students will have an opportunity to obtain proficiency in solving real problems. The MSc SEE programme includes a number of study visits to power and refrigeration plants, factories and other facilities relevant to the program objectives in both Croatia and neighbouring countries. Advanced lecturing in terms of distance learning is arranged with the partner universities.

Total duration of the taught courses is 9 months corresponding to 60 ECTS credits (one week of full time studies corresponds to 1.5 ECTS credits) followed by five months reserved for thesis project work accounting for 30 ECTS credits. The programme is offered to applicants from all over the world with a suitable academic background i.e. degrees equivalent to 8 semesters of study, at least. The programme language is English. Successful completion of the programme leads to obtaining the degree of Master of Science with specialization in Sustainable Energy Engineering.

Academic Goals

Sustainable Energy Engineering (MScSEE) is an international Master of Science Degree Programme with two parallel study majors, both having a strong environmental focus: Sustainable Energy Utilization in the Built Environment and Sustainable Power Generation.

Description of Collaborations

The programme is carried out by the Department of Thermodynamics, Thermal and Process Engineering and the Department of Power Engineering, at the Faculty of Mechanical

Engineering and Naval Architecture, University of Zagreb. MSc SEE is established in year 2004 within the Tempus Joint European Project in a close co-operation with the Royal Institute of Technology, Stockholm, Sweden, which has already successfully established the international SEE programme similar to the present one, as well as with other consortium member universities: University of Rijeka, Croatia; University of Split, Croatia and University of Padova, Italy.

Tyndall Centre for Climate Change Research

University of East Anglia, *Norfolk, UK*
www.tyndall.ac.uk

No comparable programme in its initial years has come further, faster or produced more exciting results than the Tyndall Centre' wrote the international panel of leading scientists and business leaders who appraised the first phase of the Tyndall Centre.

The UK's Tyndall Centre brings together scientists, economists, engineers and social scientists, who together are working to develop sustainable responses to climate change through trans-disciplinary research and dialogue on both a national and international level - not just within the research community, but also with business leaders, policy advisors, the media and the public in general.

Our research and communication objective is to further enhance our expertise and functioning to continue to develop sustainable responses to climate change and understand and transfer this knowledge into policy and practical action.

Program Stats

Post-graduate Program
Methodology: Research-based

Home Department: Tyndall Centre for Climate Change Research
Other Departments: University of East Anglia, University of Manchester, University of Cambridge, University of Southampton, University of Oxford, University of Newcastle

For more information, contact:
Mr. Asher Minns
Tyndall Centre for Climate Change Research,
University of East Anglia Norwich
Email: a.minns@uea.ac.uk
Phone: 07880 547843

Our strategy 2006-2009 builds upon our previous work on integrated assessment, energy, adaptation, and coasts and add three new programmes exploring international policy, international development and cities. We give greater focus to research deliverables produced in collaboration with the actual users of our research. By generating insights and delivering outcomes of the highest possible quality and relevance, the Tyndall Centre has and will continue to make a real difference to these evolving scientific and policy agendas during a crucial period of time.

Academic Goals

Vision: To become an internationally recognized source of high quality and integrated climate-change research, and to exert a seminal influence on the design and achievability of the long-term strategic objectives of UK and international climate policy.

Medium-Term Objectives:

- Advancing the science of integration ….. to develop, demonstrate and apply new methodologies for integrating climate-change related knowledge.
- Developing responses ….. to seek, evaluate and facilitate sustainable solutions that will minimise the adverse effects of climate change and stimulate policy for the transition to a more benign energy and mobility regime.

- Motivating society ….. to promote informed and effective dialogue across society about its ability and willingness to choose our future climate.

Description of Collaborations
The Tyndall Centre's collaborations are primarily UK but also coordinates and is involved with a number of EU research endeavors and has significant international collaborations through its International Development research programme, among others.

Funding Sources
The Tyndall Centre is core funded by three of the UK's Research Council's - the Natural Environment Research Council; the Engineering and Physical Sciences Research Council and the Economic and Social Sciences Research Council. External research funding (eg. EU) doubles the annual core budget of £1.9m

Challenges
Doing truly useful climate change research for both policy and practice is a novel experiment in itself and the Tyndall Centre has had few forerunners from which to learn. Research has to be integrated across disciplines and expertises if it is to be truly useful and we have devised methods of interaction, stakeholder engagement and communication. Successful integration and engagement requires significant investment of time, which of course requires financing. A further challenge is appropriate recognition of interdisciplinary research by traditional single-discipline funders. A third challenge is recognition of policy impact and knowledge transfer when traditional research metrics count only published academic papers.

Successes
In the Foreword to a recent Tyndall publication, William C. Clark, Professor of International Studies, Public Policy and Human Development at Harvard University wrote:

The Tyndall Centre for Climate Change Research is a breathtaking experiment. Even from the other side of the Atlantic, it was clear in the opening years of this Millennium that while other countries were talking about new approaches for bringing intelligence to bear on the unprecedented challenge of climate change, the UK was actually doing something about it. Rumours of what was that precise “something”, fuelled by a growing number of working papers and press releases, drifted across the waters during the Centre’s formative years, leaving many of us over here alternately excited, envious and confused. It was therefore with something of the enthusiasm of a zoologist given a chance to examine an exotic new species that I received and accepted the invitation of the UK Research Councils to chair the first external review of the Centre in 2004. What the review team found was a grand experiment indeed that seemed to be grappling with four central questions: How can science and technology communities on the one hand, and stakeholder communities on the other, be brought together for the collaborative production of useful knowledge about climate change? How can purposive efforts to shape such knowledge draw on the best scientists and engineers throughout the UK and beyond? How can the knowledge of multiple disciplines mobilized through such collaborative processes be integrated to provide the robust and powerful insights on possible responses to climate change? How can a new generation of scientists, engineers and integrators be nurtured for careers that pursue the novel approaches being pioneered by the Centre? We concluded then, and I believe

today, that the Centre has created and implemented a unique vision of a solution-driven, virtual institute for climate change systems analysis that is internationally recognized for its innovative character and is increasingly being emulated. It has produced research output of international calibre quality and impressively high quantity. Decision makers at the regional, national, and global scale increasingly seek it out as a source of authoritative and useful knowledge regarding response options. Finally, it has assembled an impressive collection of senior researchers, fellows and doctoral students who are enthusiastic about being members of the Tyndall community, who are learning – even as they help to invent – the Tyndall approach, and who will surely constitute a uniquely valuable resource for the nation and the world in the years to come. The Tyndall Centre is maturing as an extraordinarily ambitious effort to tackle an extraordinarily important problem. Experience suggests that under the best of circumstances it will require a decade or more of active learning-by-doing and capacity building before a venture of this magnitude and difficulty can be reliably judged to have succeeded. But I do not know of any comparable programme that in its initial years has come further, faster, or produced more exciting results. I am therefore particularly pleased for the opportunity to help introduce a wider audience to the evolving but already truly useful Tyndall Centre.

Five Year Goal

Over the next three years we will help to provide specific answers to well defined questions that can be grouped under seven broad topics. Our research on international policy, energy, and adaptation will help us all to prepare now for a sustainable future. Research on international development, coasts, and cities will help the most vulnerable communities and assets respond to the challenges imposed by climate change. Our integrated modeling will deliver and deploy an analytical tool, spanning climate and human systems, which will allow quantitative exploration of policy questions. The Tyndall Centre will be truly useful.

Desired Partners

Over the next three years we plan to increase both our international reach and diversify our funding

Australia: Sustainability and the Environment

School for International Training (SIT), *New South Wales, Australia*
http://www.sit.edu/studyabroad/program_content/contents.cfm?include=asm_index.html&progCode=ssa.asm

SIT's Australia: Sustainability and the Environment program is designed to empower students to make a positive contribution towards making our societies sustainable. To achieve this, the program is designed to address the students' hearts and spirits, as well as their minds. Students are not only given the knowledge needed to make informed judgments about environmental issues; they are inspired to believe that they can make a difference and are motivated to take action to address environmental problems.

Program Stats

Undergraduate Program

Home Department: Study Abroad

Students Enrolled Since Inception: 180
Students Currently Enrolled: 15

For more information, contact:
Dr. Peter Brennan
Study Abroad, School for International Training (SIT)
Email: brennan@nor.com.au
Phone: 61 2 66891993

The program is based on the philosophy that environmental issues are so important in today's world that all students, no matter what their major, should be 'ecologically literate.' Therefore, there are no prerequisites for this program. The program's design caters to students with a range of backgrounds in environmental studies, and in turn the program benefits from the multidisciplinary input of students into formal and informal group discussions.

For example, one of the most successful students on the program was a business major. At the same time, students with strong backgrounds in environmental studies have found the program both inspiring and challenging, while students with a strong biology and ecology background have welcomed the opportunity to broaden their focus to include environmental management issues.

This emphasis on environmental management is what distinguishes this program from other SIT environmental studies programs that emphasize natural ecology. Another distinguishing characteristic of this program is the large amount of travel involved. Field trips to the island of Tasmania off the southeast corner of the continent, the Kimberleys in the northwest, and Fraser Island off the east coast give students an appreciation of the diverse environments of this continent.

This program is also characterized by the use of workshops as a method of teaching. These two-day workshops, run by leading practitioners in the relevant fields, are highly regarded by students because they feel engaged in an active learning process.

The program begins at the personal level by examining the range of environmental philosophies and encouraging each student to reflect on and develop his or her own environmental philosophy and ethics. The Aboriginal Studies component of the program also gives students insights into an entirely different way of looking at the environment and resources, as well as examining the

utility of traditional ecological knowledge in the present day. Workshops, discussions, and field trips also focus on how the changes one makes in one's own life have profound consequences on the sustainability of all societies.

The program then addresses what changes can be made at governmental and industrial levels to promote sustainable development. Students explore how environmental decisions are made, look at innovative planning methods, and evaluate legislation. Field excursions illustrate the environmental impacts and innovative sustainable solutions in a range of industries including agriculture, forestry, mining, energy production, residential development, and tourism. The management of protected areas such as national parks and world heritage sites is also examined during field trips.

Throughout the semester, students are introduced to the natural environment of each region visited and learn about the local climate, geology, geomorphology, soils, and flora and fauna. This helps instill a sense of place in the students and serves as a basis for understanding the varying management issues in each region.

Bachelor of Science in Environmental Science

Griffith University Gold Coast campus, *Queensland, Australia*
http://www17.griffith.edu.au/cis/p_cat/admission.asp?ProgCode=1018&Type=overview

Environmental Science: This major study will provide students with the opportunity to focus on the science of sustainability and indicators of environmental condition. It also provides skills in environmental monitoring and impact assessment procedures. Minors can be selected from the following:
Terrestrial Ecology
Marine Ecology

Program Stats

Undergraduate Program
Methodology: Mixture of Research, Teaching, or Service

Home Department: School of Environmental and Applied Sciences
Other Departments: Almost exclusively this one School.

Students Enrolled Since Inception: 400
Students Currently Enrolled: 60

For more information, contact:
Dr. Clyde Wild
School of Environmental and Applied Sciences, Griffith University Gold Coast campus
Email: Clyde.Wild@Griffith.edu.au
Phone: 61 7 55528669

Academic Goals

To produce graduates well equipped for work in environmental industries with solid practical and strong and current theoretical skills.

Description of Collaborations

Gold Coast City Council, State Government Department of EPA, some local environmental consultancies -- mainly domestic collaborations

Funding Sources

Very predominantly the Australian Government as Commonwealth Grants Scheme funds

Challenges

Meeting the costs of delivery when numbers of students enrolled is relatively low.
Maintaining the solid science content in face of pressure form the University to include more social science and his will necessarily require removal of basic sciences

Successes

Placement of graduates in influential, and sometimes high, positions in local and state government where they can effectively pursue the sustainability agenda in their particular context.

Five Year Goal

To introduce a "global change science" strand to our studies, or even a new degree

Bachelor of Science in Sustainable Development

Murdoch, *Perth, Australia*
www.sustainability.murdoch.edu.au

The Bachelor's degree in Sustainable Development provides a broad and interdisciplinary approach to the many crucial issues related to the sustainability debate, such as population growth, resource use, poverty alleviation, technology development, lifestyles, environmental protection, consumerism, inequality, trade and economic growth. At all times the emphasis is on building connections between theory and practice and helping students to learn how they can 'make a difference'. As an example, students are required to undertake STP325 Sustainable Development Project, in which students apply some of the conceptual tools they have learnt to specific problems through data collection and analysis.

Courses Include: Introduction to Sustainable Development, Introduction to Environmental Science, Introduction to Economics, Introduction to Australian Indigenous Studies, Introduction to Politics, Introduction to Community Development, Environmental Biology

Program Stats

Undergraduate Program
Methodology: Teaching-Based

Home Department: Institute for Sustainability and Technology Policy
Other Departments: Many across the university but we teach the majority of the units as we want to make the integration of sustainability mean something.

Students Enrolled Since Inception: 1000
Students Currently Enrolled: 200

For more information, contact:
Dr. Peter Newman
Institute for Sustainability and Technology Policy, Murdoch
Email: p.newman@murdoch.edu.au
Phone: 64 8 93602913

Academic Goals

- To create a new profession of sustainable development.
- To enable people to have a perspective on a range of disciplines but to see that problem solving requires their integration.
- To develop skills in integration through involvement in real world projects.

Description of Collaborations

Collaborations within ISTP drive the program but we are constantly fed by collaboration with practitioners, with other discipline areas, with international partners.

Funding Sources

University funds (government primarily).

Challenges

Constant process of needing to reassess what sustainability means in practice and finding its relevance to the issues of our day. Linking the global and local too.

Successes
We now have a Sustainability Practitioners Association. We now have a State Sustainability Strategy. Our graduates have been part of both and are in positions of power and influence now.

Five Year Goal
To keep growing and influencing.

Desired Partners
More collaboration with innovative industries is a key we are trying to pursue. We have been mostly NGO and government-oriented.

Ecologically Sustainable Development

Murdoch, *Perth, Australia*
www.sustainability.murdoch.edu.au
http://www.murdoch.edu.au/contacts/academic/Institute_for_Sustainability_and_Technology_Policy

The Master of Arts in Ecologically Sustainable Development is designed to explore the policies, issues and processes of ecologically sustainable development (ESD). Students are able to study the current status, the history and the value bases of sustainable development, together with the policy approaches that are emerging for sustainability in the various sectors such as energy, industry, the household, agriculture and fisheries.

The core unit, STP412 Ecologically Sustainable Development, provides a background to the policy, economic and ethical frameworks through which ESD is currently being explored and implemented. These frameworks provide students with the tools for interpreting ESD issues and for applying them in practice.

Courses include: Ecologically Sustainable Development; Global and Regional Sustainability; Policy, Technology and Democracy; Sustainability for Professionals; Environmental Ethics; Cities and Innovation; Social, Educational and Policy Research Methods; Ecology, Society and Human Health; Marine Conservation Policy and Coastal Sustainability; Overseas Aid and International Development

Program Stats

Post-graduate Program
Methodology: Mixture of Research, Teaching, or Service

Home Department: Institute for Sustainability and Technology Policy
Other Departments: Environmantal Science and Economics help a little.

Students Enrolled Since Inception: 400
Students Currently Enrolled: 100

For more information, contact:
Dr. Peter Newman
Institute for Sustainability and Technology Policy, Murdoch
Email: p.newman@murdoch.edu.au
Phone: 61 8 93602913

Academic Goals

Creating a research-oriented sustainability professional
Creating a sustainability professional with broad skills as well as a particular professional niche.

Description of Collaborations

Primarily domestic collaboration but always a context of the international.

Funding Sources

The Masters is fee-based and the PhD has scholarships and has no fees (apart from overseas students).

Challenges

Continuing to be a step ahead of the students or at least to be where we think the next steps are heading as sustainability is rapidly evolving in practice.

Successes
Contributed to the growth of the profession and the development of the State Sustainability Strategy; 50 students from ISTP were involved in the development of this when professor Newman was seconded to the state government to develop the Strategy - the first in the world at state level.

Five Year Goal
Keep growing.

Desired Partners
More collaboration with industry.

Masters in Sustainability Science

University of Southern Queensland, *Queensland, Australia*
http://www.usq.edu.au/handbook/2007/MSSC.html

Modern environment and natural resource management requires the integration of social, environmental and economic research within an interdisciplinary planning and policy framework. It also requires a capacity to handle complexity and uncertainty and the application of different methods of analysis and different approaches to governance and community engagement. This coursework Masters program addresses these needs by providing environmental and resource managers and other professionals with appropriate formal instruction to enhance their skills and knowledge in the emerging discipline of sustainability science.

Program Stats

Post-graduate Program
Methodology: Teaching-Based

Home Department: Faculty of Sciences
Other Departments: Faculty of Business, Faculty of Engineering & Surveying

Students Enrolled Since Inception: 7
Students Currently Enrolled: 7

For more information, contact:
Dr. Andy Le brocque
Faculty of Sciences
University of Southern Queensland
Email: lebrocq@usq.edu.au
Phone: +617 46311529

Academic Goals

On completion of the program graduates will be able to (specific program goals/objectives):

- understand and apply the principles and approaches of sustainability;
- integrate the scientific foundations for sustainable development through environmental, social and economic disciplines;
- critically analyse multi-disciplinary information and data to provide informed decision-making in relation to resource management;
- understand global environmental systems and their influence on sustainable practices;
- critically assess emerging approaches to policy development and institutional arrangements to support sustainability;
- identify and establish strong links between science, effective community engagement and sound policy;
- demonstrate, through the breadth of their studies, an advanced understanding of issues, concepts and applications of sustainability science in environment and natural resource management;
- manage complex decision-making in the face of risk and uncertainty; advance their professional standing by incorporating contemporary scientific approaches to sustainable development.

Description of Collaborations

Australian Centre for Sustainable Catchments (USQ research centre)
Other USQ Faculties

Funding Sources
The full-fee paying program commenced in 2006. Start up costs have been met by internal Faculty funds; however it is expected that the program will be cost neutral within a few years. A substantial part of the program (5 out of 8 courses) is drawn from existing courses from across the University. Three specific courses have been developed within Faculty.

Challenges
Marketing: there has yet to be established a strategic marketing plan for the program (nor have adequate funds been made available for this purpose)

Student retention/completion: potential/current students tend to be employed (full time, often demanding middle to higher-level jobs) and/or have young families. Such students have particular learning/time management isssues and make signficant demands on academic staff.

Further program development: future development of program (including developing more advanced sustainability courses) will be very much dependent on enrolments within current program structure. This program has been developed utilising existing expertise in various disciplines. In the mid- to long- term, truely inter(cross)-discinplinary expertise is required.

Successes
Too ealry to tell (one year). From anecdotal evidence, students appear satisfied with course content, delivery and assessment, although results from formal student surveys will not be available for some months.

Five Year Goal
Subject to demand for current program, a short term goal is to further develop more advanced (specific) sustainability coursework to complement broader aspects of the program.

Desired Partners
Not considered at this time. However, keen to develop such collaborations (at least at operational level).

Engineering

Federal University of Technology, *Minna, Nigeria*

The engineering programme is design to train and produce independent minded, self reliant and competent engineers in Agricultural, chemical, civil, electrical and computer and mechanical fields. It is a four or five years programme depending on the entry qualification of the student. Candidates with five credits in English, Mathematics, Physics, Chemistry and any other science subject are admitted into the five year programme. Candidates with ordinary diploma in addition to the basic five credits mentioned earlier are admitted into four year programme. Only students with cumulative grade point average of 2 on a 5-point scale at the first year can proceed to the engineering programme. Bachelors of Engineering in the various disciplines are awarded to successful students.

Program Stats

Undergraduate Program
Methodology: Teaching-Based

Home Department: Chemical Engineering Department
Other Departments: Generally the foundational sciences and applied sciences courses – general to all the programmes are handled by the School of Science and Science Education and some staff of the School of engineering.

Students Enrolled Since Inception: 8700
Students Currently Enrolled: 3600

For more information, contact:
Prof Joseph Obofoni Odigure
Chemical Engineering Department, Federal University of Technology
Email: josephodigure@yahoo.com
Phone: +234 803378849

Academic Goals

The goals of the engineering and technology programme are based on the vision and mission of the University, which is drawn taking into consideration the Millennium Development Goals. The Vision is to strive to be one of the Nigerian's leading Universities and a centre of excellence, recognized nationally, regionally and internationally for its quality pedagogy and research which is supported by visionary leadership, responsible citizenry, internal and external partnership and a unique value system.

Our specific goals include to develop engineering programme leading to award of first degree which emphasis planning, adaptive, technical, maintenance, development and productive skills with the aim of producing socially matured men and women with capability not only to understand, use and adapt technology but also improve on it and develop new ones.

Description of Collaborations

At the end of the third and fourth year the student are expected to proceed on student work experience programme. The duration of the programme is normally 3 and 6 months respectively. This programme/industrial training is normally in collaboration with the industries and Research Institutes. There are no formal collaborative agreements with them. However they generally accept our students for the programme. The programme is primarily domestic.

Funding Sources

Presently the major source of funding is the government grants. Government maintains that the University should be tuition free. However there is a slight shift with the realization that she can not adequately finance the 27 federally owned Universities. Administration of funds in the University id centrally controlled. The University also generates fund from some students' charges for the engineering programme. This may be by introduction of new or upward review of existing charges. To a large extent this has improved the standard of teaching and learning in the engineering programme. There is a consultancy outfit established in 1991. However the success story is nothing to talk about. Government agencies are reluctant to patronize it because of the inherent corruption in the system. The multinational companies that could have patronized the outfit for revenue generation normally conduct their researches in their home countries.

Challenges

The challenges today are legion. "Can the Faculties/Schools of Engineering and Engineering Technology score itself a pass mark" What are the problems mitigating the progress of the School What are the ways forward The truth is no matter the position once finds oneself – for or against a given school of thought a question like "Could things have been done differently. I will try and look into some of the commonly identified problems in the educational system in my School and of course give my own opinions about them.

First on the list of common problems is funding. I do not wish to spend them on this. We find it very difficult to understand that there are significant improvement. The salary of a University staff has increased by about 600% with the monetization policy. Direct teaching and laboratory cost has been introduced. Educational institutions have introduced various target specific charges to enhance their operations. Funding may not be enough but it has greatly improved.

The second problem is the near lose of focus on the part of the lecturers and Departments. The quality of Lecturers in the system is very unsatisfactory. There is the need to radically do something about it. Majority of us have not seen what we teach and therefore find it very difficult to conceptualize meaningful projects. We need exposure and training. Department do not have the required catalyst for visionary leadership and conceptualization of mind burgling projects.

The next problem is that the system is poorly understood by those it is to serve. The School needs exposure. For too long we have remain and operated as an island. This have made it very difficult for us to understand and to conceptualize far reaching national research and development goals. Consequently, the school has not attracted any meaningful external funding or award.

One dangerous evil in the school is the inability of the staff to partner in developing meaningful projects. Traditional understanding of our individual department has since falling apart in the developed nations. There is the need to develop multidisciplinary programs and Departments. History will not forgive us if we fail to understand global trends in program development in engineering education.

Comparatively it could be said to be up to the micro level; 10-3. In the developed economy R&D now operate at 10-9. Today's researches are driven by reaction mechanism at the nano scale. I quite understand that we do not have the necessary equipment to effectively compete all the time globally. However development of theoretical models should not elude us.

Our proposed methodologies for a better tomorrow include the realization of the following:

- Developing viable and sustainable Institutional public and private partnership. There are serious partners today actively collaborating with our Universities to bridge the digital gap. However they are limited in scope and number. There is the need for more collaborations both with the big multinationals and individuals. There is the need for the Universities to liberalize;
- A paradigm shift in educational concept. Training must be based on national goals and needs. Educational policies must be tailored to suit prevailing national developmental programme. The current national content policy must be domesticated in the educational institutions. While a sincerely appreciates the emphasis on IT (software application) workshop for our schools, we must understand that our hope is not on consumption but in the development of local softwares for every facet of our lives. This is where the revolution will come from;
- Developing fundamental sciences. This will greatly enhance our analytical minds. Mathematical modeling and software development will define the future world psyche. Consequently our education must emphasis fundamental science even within the context of professional courses.

Successes

Presently there is a gradual paradigm shift in the administration of the University system. The administration is becoming more result-oriented. The single tenure Vice Chancellorship system has considerably reduced friction of handing over. We still hope the University bill before the houses will be passed someday. This will clearly structure the running of the system. This development will greatly impact of the engineering programme.

We still have world class result achieving and focused Professors and lecturers in the system. They are our success story Men and women who do not want to leave and are fully committed to the system. The quality of our products are attested to by the compliments we receive locally and internationally. Our success is actually based on the strong theoretical background of our products and the determination to succeed.

Five Year Goal

Our one year goals are to increase the volume and spread of the relevant books and journal, enhance the quality and number of staff. Enhance the Information and Communication technology quality. And work towards the fully accreditation of all the departments by the National University Commission and Council for the Regulation of Engineering in Nigeria.

Desired Partners

The University presently has received a grant to enhance the ICT standing of the School from the Petroleum Development Trust Fund. Their also grant from Education Trust Fund. There are few and insignificant grants from some international bodies like the TWAS etc. The School will welcome International Partners interested in any area of engineering education.

Integrated Research System for Sustainability Science (IR3S)

University of Tokyo, *Japan*
http://www.ir3s.u-tokyo.ac.jp/en/top.html

IR3S aims to create a network-type platform for world-class research and education in the field of sustainability science. The concept of sustainability is the key to any discussion of the science, technology, and economics of the 21st century, the Century of the Environment. Sustainability science is a new, trans-disciplinary discipline destined to play a fundamental role in addressing critical global issues and developing visions that can lead to a sustainable global society.

Currently, there are three flagship projects conducted under the framework of IR3S.

Research Project 1: Sustainable Countermeasures for Global Warming

Designing of sustainable countermeasures for global warming requires a unified approach to prediction, impact assessment, and adaptation measures. Responses from a wide range of academic fields, including science, engineering, agriculture, economics, and political science, is essential to the design. However, conventional research has lacked a comprehensive evaluation because it has addressed the problem from a viewpoint of a particular field. This project, with the best use of research characteristics of the five participating universities, aims to work on researches with a focus on mutual relationship between the various fields, through feedback of results of each study and opinion exchange by researchers in the fields. One topic of the project is development of scenarios for the future in consideration of feedback effects on global warming of countermeasures, which bring developments in technology and changes in energy supply and demand, and of changes in food production, which bring changes in industry, land use, and society. Through such approaches, we will propose multiple designs for society in the 21st century, taking account of uncertainties in prediction of global warming, maladaptation of socioeconomic systems, and uncertainties in technical development and food production.

Program Stats

Graduate Program
Methodology: Mixture of Research, Teaching, or Service

Home Department: Department of Human and Engineered Environmental Studies, Graduate School of Frontier Sciences
Other Departments: Research Centers of the Participating Universities:
Transdisciplinary Initiative for Global Sustainability (TIGS), University of Tokyo
Kyoto Sustainability Initiative (KSI), Kyoto University
Research Institute for Sustainability Science (RISS), Osaka University
Sustainability Governance Project (SGP), Hokkaido University
Institute for Global Change Adaptation Science (ICAS), Ibaraki University
Cooperating Institutions
Toyo University
National Institute for Environmental Studies
Tohoku University
Chiba University

For more information, contact:
Dr. Masaru Yarime
Department of Human and Engineered Environmental Studies, Graduate School of Frontier Sciences, University of Tokyo
Email: yarime@k.u-tokyo.ac.jp
Phone: +81-(0)4-7136-4608

Research Project 2: Development of an Asian Recycling-Oriented Society

The development of a recycling-oriented society must no longer be confined to the domestic issues of the Japanese government, but must become a major theme throughout Asia, including China as one of the hubs of production of the world. When we assume the development of a recycling-oriented society to be in harmony with a system of human activities comprising production and consumption (one axis) and the environment supporting this in terms of material, biology, and land (another axis), it is desirable in sustainability science to incorporate spatiotemporal sustainability as the third axis. The five participating universities constitute an organization in the Asian region, and perform this flagship project with accumulated experience in the technical development of environmental infrastructure (engineering), technical selection and design (environmental system science), institutional design (social sciences such as environmental economics), and research on natural resources.

Research Project 3: The Concept and Development of Global Sustainability: Reform of the Socioeconomic System and the Role of Science and Technology

Dealing with the severe problems facing human society in the 21st century brought about by global environmental problems is no longer simply a matter of environmental protection, but requires an approach to future economic growth and the state of the development of science and technology, as well as the problems of poverty, and a variety of socioeconomic problems including the management of crises affecting the existence of mankind, for example disaster prevention. These approaches are becoming increasingly recognized in Asia, and in other regions, as being linked to the realization of a sustainable world. These mutual and complex interacting difficulties are dealt with head-on, and in order to show the direction for the reform of science and technology and the socioeconomic system, barriers between disciplines should be overcome, and furthermore, an approach in which the cultural and social sciences, for example environmental economics and environmental ethics, and the natural sciences, should cooperate in the development of knowledge. The five participating universities approach these interdisciplinary research topics using the strengths of accumulated breadth and depth of scholarship, and experience in the many fields of the cultural and social sciences and the natural sciences, and promote coordination between related universities both at home and overseas, including Asia.

IR3S also has an educational program: The Integrated Research for Sustainability Science Program.

The five participating universities will collaborate on inaugurating the Integrated Research for Sustainability Science Program, a master's program that nurtures specialists who can make an active contribution to the construction of a sustainable society on the global stage. The universities, providing instruction primarily in English, will develop people who thoroughly understand the diversity, internationality, and interdisciplinarity of the concept of sustainability and who take action in order to promote the realization of sustainability through the practice of public activity. This program should become the benchmark for sustainability education in the world's universities.

In addition to students who major in sustainability science for the purpose of obtaining a master's degree, this program will accept students for whom sustainability science is a minor.

The participating universities will promote credit transfers among themselves and issue joint degrees or joint course completion certificates. A distance-learning framework extending across the universities will be introduced.

Academic Goals

The goal of sustainability science is to establish a trans-disciplinary academic structure that facilitates the fusion of the natural sciences with the humanities and social sciences.

TIGS aims to create a truly transdisciplinary sustainability science by maintaining the following functions: 1)a research function that organizes projects that transcend existing academic disciplines and contribute to solutions to practical problems of importance to society by giving structural form to problems and academic approaches; 2)an education function that promotes new forms of interdisciplinary education; 3)a fundraising function that lays the foundation for autonomous activities by obtaining external funding; and 4)an outreach function that draws upon the intellectual resources of the University to promote collaboration with external organizations.

TIGS aims to develop sustainability science as an academic discipline at the University of Tokyo by building on the University's areas of research specialization and experience. These TIGS research activities and distinctive research conducted at the research centers in other participating universities play mutually complementary roles, and each institution generates cutting-edge research and powerfully promotes the creation of sustainability science.

TIGS conducts research in five fields. It seeks solutions to various problems at the global level, social level, and individual level while simultaneously placing importance on the interrelationships between the three levels.

1. Research to serve as a common foundation: TIGS conducts research that will become the foundation for sustainability science, including satellite-based remote sensing of environmental conditions, geographic information system (GIS) technology, and supercomputer modeling of climate and ecosystems.
2. Research into global warming and energy issues: TIGS conducts research into global warming and closely related environmental problems such as wide-area atmospheric pollution and into the dynamic relationship between resources and energy with a goal of proposing a long-term vision for sustainable growth in society from the perspective of resource and energy utilization.
3. Research into population, water and food supplies: TIGS studies ways to ensure safety and security in people's lives by maintaining sustainable resource usage and food production against a background of explosive population growth and a deteriorating natural environment.
4. Research into the amalgamation of urban and rural areas: TIGS promotes resource recycling and energy conservation in Asia's fast-growing giant metropolises by means of adapting technologies to local conditions with the aim of constructing recycling societies by means of the amalgamation of urban and rural areas and creating excellent urban ecosystems.
5. Research into environmental risk management: TIGS evaluates the impact of environmental risks, such as harmful chemicals, infectious diseases, and wide-area atmospheric pollution, on human health and lifestyles and proposes risk management

solutions in consideration of cultures and lifestyles. It also engages in social science research into international politics and public relations, environmental risks, and health problems.

Description of Collaborations

The Integrated Research System for Sustainability Science will establish and operate research centers for research and education in sustainability science on the basis of strong collaboration among the five participating universities. In addition, cooperating institutions that specialize in important issues in sustainability science that the five participating universities cannot adequately address will participate in the program. As a result of solicitation and rigorous screening conducted in fiscal 2005, four institutions were selected as cooperating institutions: Toyo University, the National Institute for Environmental Studies, Tohoku University, and Chiba University.

The cooperating institutions will contribute to the establishment of sustainability science through collaboration with the Transdisciplinary Initiative for Global Sustainability (TIGS) of the University of Tokyo, which will be responsible for the structuring of sustainability problems and scholarship. The roster of cooperating institutions may be expanded as collaborative research progresses.

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Challenges

The concept of sustainability is the key to any discussion of the science, technology, and economics of the 21st century, the Century of the Environment. Sustainability science is a new, trans-disciplinary discipline destined to play a fundamental role in addressing critical global issues and developing visions that can lead to a sustainable global society.

Repairing Global, Social, and Human systems

Sustainability science concerns itself with global systems comprising resources, energy, and ecosystems that support human life; social systems comprising national economies, governments, industries, and technological structures; and human systems comprising individual lifestyles, health, security and safety, and human values. Given that today's global problems arise from the close interaction among these three systems, it is particularly crucial that Sustainability science focus on the linkages among these systems.

To cite just two examples, global warming is an issue that involves interactions between global and social systems, while establishing a risk management system for environmental problems is an issue that involves interactions between social and human systems. Sustainability science first seeks to understand the mechanisms that damage these global, social, and human systems and the linkages among them, then proposes visions and methods for repairing these systems and linkages.

Novelty of Sustainability Science

The novelty of Sustainability science lies in its academic approach; specifically, it must meet a number of challenges that existing disciplines have not experienced. These include the endeavor to simultaneously understand phenomena and solve problems, uncertainty and the "precautionary principle," the simultaneous advance of knowledge and problems, and trade-offs between global and local problem-solving.

Practitioners of Sustainability science must therefore establish a trans-disciplinary academic framework that brings together the natural sciences, social sciences, and humanities, and define and structure problems and academic inquiries so as to identify indicators and criteria for the sustainable restoration of global, social and human systems and their interactions. Sustainability science must also reach out to society at large. Only by disseminating the results of our research to society and the individuals that compose it can we achieve a sustainable society.