

# The University Senate of Michigan Technological University

## Proposal 8-10

(Voting Units: Academic)

### “Ph.D. PROGRAM IN ENVIRONMENTAL AND ENERGY POLICY”

#### 1. General description and characteristics of program

The Environmental and Energy Policy (EEP) Ph.D. program will be administered in the Department of Social Sciences of Michigan Technological University. This program builds on the department’s existing M.S. program in Environmental Policy.

This interdisciplinary program will prepare students to conduct research in support of societal decisions regarding environmental- and energy-policy goals, strategies, and programs. Students will use the tools and approaches of multiple disciplines, including sociology, geography, anthropology, political science, economics, history, sustainability science, ecology, and hydrology in support of research involving an integrated assessment of environmental & energy-related policy choices.

#### 2. Rationale

Michigan Tech’s strategic plan calls for the university to establish “world-class research, scholarship, and innovation in science, engineering, and technology that promotes sustainable economic development.” In support of this goal, a doctoral program that focuses on policy-related research supporting societal decisions and choices toward a sustainable society is vital. Efforts to achieve sustainable interactions with Earth systems—in a socially just and economically efficient manner—involve more than simply developing new technologies or a better understanding of natural environmental systems. It also involves reaching consensus on the goals that society hopes to achieve, assessing the different strategies associated with achieving those goals, and determining whether progress toward those goals is being made. For example, understanding the limits of corn-based ethanol as a transportation fuel, and the need for a second generation of non-food based biofuels, requires understanding of the life cycle greenhouse gas emissions, water and land use requirements, and effects on soils, but also the long-term economic costs and implications for food security. Thus, in investigations related to sustainability, research in the natural sciences and engineering should be tightly coupled with research into societal choices and policy tools.

Establishing a Ph.D. program in Environmental and Energy Policy (EEP) would:

- Improve Michigan Tech’s competitiveness in securing sustainability-related research funds.
- Improve Michigan Tech’s ability to attract promising scholars and quality graduate students.
- Complement existing strengths in sustainability-related research in engineering and the natural sciences, including programs currently coordinated by centers of research such as the Center of Energy Excellence, Power and Energy Research Center, the Center for Water and Society, and the Sustainable Futures Institute.
- Represent the logical extension of the Masters Degree in Environmental Policy currently administered by the Department of Social Sciences.

Such a new PhD program was strongly recommended by the Department of Social Sciences’ Periodic External Review in 2002. Scholars with expertise in ecological economics, sustainability science,

computational social science, environmental & natural resource sociology, environmental geography, environmental anthropology, and environmental history are already in place and would form the core of the faculty needed to implement the Ph.D. program.

The proposed doctoral program faculty already has significant expertise in the field of environmental sustainability, especially with regard to energy policy. They have collaborated extensively across disciplinary and departmental boundaries to pursue energy and environmental sustainability questions, including those related to the development of woody bioenergy forms in the Upper Midwest, the siting of wind farms, waterborne disease-related risk perceptions in Mexico, the regulation of on-site sewage systems in the Great Lakes, payment for ecosystem services in a variety of settings, the political economy and ecology of agricultural and industrial systems, the dynamics of watershed management groups, and brownfield redevelopment. As a group, they also support a range of methodologies, including survey research, ecological and environmental economics, anthropological and historical analysis, spatial analysis, and the modeling of decision-making agents.

The 17 core and affiliated faculty have substantial experience in securing external research support. While in most cases the existing Environmental Policy faculty members have been co-PIs on projects rather than PIs, in a substantial number of cases there has been graduate student funding provided by external agencies, which helps to demonstrate the capacity of the EEP program to support doctoral students. While additional EEP faculty, such as (Alex) Mayer and Storer, have generally not supported Environmental Policy students in the past, they would like to collaborate and be affiliated with this program and would be pleased to help support doctoral students in EEP. The EEP program expects to be competitive in winning future support from the NSF, U.S. EPA, U.S. Department of Energy, U.S. Department of Education, USDA Forest Service, U.S. Agency for International Development, Michigan Department of Environmental Quality, Michigan Department of Education, and the Michigan Economic Development Corp. In some cases the masters program in Environmental Policy has been precluded from playing a larger role, such as was the case in the recent sustainability Integrative Graduate Education and Research Traineeship Program (IGERT, which was NSF funded), which supports doctoral students. Thus a doctoral program in EEP will remove this constraint in such cases, and allow students to be involved in research projects of larger scope and scale. It is expected that 2-4 doctoral students will be supported as RAs through such external funding in the early program years.

This faculty group also has 13 years of experience administering and graduating students in the existing and highly successful Masters in Environmental Policy. This program has graduated around 40 students who have gone on to pursue PhDs, law degrees, and careers in industry, non-profits, consulting firms, government agencies, and academia. The gender ratio of students in the masters program in environmental policy has been 55% female and 45% male and 36% international, with a 50-50 gender split anticipated in the proposed doctoral program. The new PhD program would expect to place graduates in a similar mix of areas, with about 60% ending up in academic and research positions, and 40% finding employment in government agencies, non-profits, industry, and consulting firms. National trends and studies by the National Research Council, American Association for the Advancement of Science, and other prestigious groups have shown environmental and energy policy to be strong growth areas for employment.

### **3. Discussion of related programs within Michigan Tech and at other universities**

There are no programs at Michigan Tech similar to this doctoral degree proposal. In the North Central states there are four such similar programs: at Indiana University, University of Michigan, Michigan State University (MSU), Southern Illinois University at Carbondale (SIU).

Each program in the region is organized somewhat uniquely, and is different from the one proposed here, although all such doctoral programs are united by the need to develop and implement practical solutions to environmental problems. Indiana University, which is consistently ranked in the top two or three graduate programs in environmental policy nationwide, offers a Ph.D. in public affairs with a focus on environmental policy, and a Ph.D. in public policy that is jointly administered by the School of Public and Environmental Affairs (SPEA) and the Department of Political Science. Environmental policy students are

also strongly encouraged to take courses in environmental sciences in SPEA. At the University of Michigan a Ph.D. is offered in the School of Natural Resources and Environment with a focus on resource policy and behavior. In contrast, at MSU students may seek a Ph.D. specialization in environmental science and policy, but since there is no home department that offers this degree the student must pursue it through one of many existing doctoral programs. Another related doctoral program is at Southern Illinois University (SIU) in Environmental Resources and Policy. It is designed similarly to MSU's program, and currently has three co-directors from three different departments.

There are also several environmental policy programs that are embedded in programs in environmental science and schools of forestry (e.g., Yale, Duke, UC Santa Barbara, etc.). Of the other doctoral programs in environmental policy four deserve special mention. The University of California at Berkeley has a department of environmental science, policy and management within a College of Natural Resources, with a large doctoral program that covers issues ranging from ecosystem science to environmental history, environmental policy, and international forest management. Three other such programs have a stronger emphasis on energy: the University of Delaware through its Center for Energy and Environmental Policy, Georgia Tech through its School of Public Policy, and a small doctoral program in Energy, Resources and Environment at the School of Advanced International Studies of the Johns Hopkins University. The program at SIU also offers a concentration in energy.

The intellectual foundation for this proposal is the belief that there is a significantly growing need for innovative and interdisciplinary solutions to the growing problems of sustainable energy development and mitigation of global climate change, which requires in-depth study and analysis beyond a 2-year masters degree. The proposed program at Michigan Tech will expand upon our master's level curriculum and uniquely combine interdisciplinarity in support of the Michigan Tech and national goal of sustainable development, with a strong focus on energy as well as environmental policy. Such a doctoral program is lacking in the State of Michigan and few exist nationwide. This requires the addition of a few courses that focus on energy resources, energy efficiency, and energy and sustainability policy. It would take advantage of our strong skills in working across social, natural and applied sciences in the pursuit of research and teaching on environmental sustainability. Moreover, housing the central administration in the Department of Social Sciences will help to give the program a clear home, identity, and center of authority and responsibility. However, if other units at Michigan Tech, especially the School of Business and Economics, add new faculty with specialties that complement this proposal, it is envisioned that the proposal may be modified so that other academic units can play an even larger role. Our major focus on energy is reflected in the research publications and projects of EEP program faculty, many of whom are currently actively engaged in interdisciplinary bioenergy-related research projects and teaching. This is expected to be a distinct advantage as there are very few doctoral programs in the U.S. in energy policy.

**4. Projected enrollment.** We project an enrollment of between 5-10 students at any given time. While some students will enter the Ph.D. program following completion of an M.S. in environmental policy at Michigan Tech, eventually most students are expected to be new entrants to Michigan Tech from other states and nations.

**5. Scheduling plans (Extension, Evening, Regular).** All courses will be taught during regular daytime hours.

## **6. Curriculum design**

Admitted students will have a B.S. or, preferably, an M.S. degree in one or more fields related to social sciences, public policy, or the environment. Assuming an M.S. degree in environmental policy or the social dimensions of environmental issues, the student coursework requirement would take 2 years. If students do not have an M.S. degree in this field they would be expected to take 3 years of courses. These would include courses in research methods, research design, policy theory, advanced environmental policy analysis, and three courses in a specialty area preparing them for their dissertation focus. All students must meet the prerequisite of at least one microeconomics and one statistics course. The program plans to

add additional graduate-level courses in economics and environmental economics as additional faculty are added to the School of Business and Economics and these courses are added to their graduate curriculum.

Once admitted to the Ph.D. program, students must:

- Complete 60 credits of coursework past their B.S. undergraduate degree. Thirty credits may come from their Masters degree work.
- Pass a comprehensive oral and written exam of their knowledge in areas related to their dissertation. This exam will be administered by a committee of 4 faculty members, at least one of who will be from outside the Department of Social Sciences.
- Conduct significant research supporting some aspect of a societal or organizational choice related to an environmentally related policy or program.
- Write and defend a dissertation as a final product.

The required coursework must satisfy the following (**Bold = new course**):

A) Core courses (12 credits)

All students will be required to take the following:

**SS 5550 Global Environmental History (3 credits) – will replace SS5100**

SS 5300 Environmental Policy and Politics (3 credits) – will be re-titled Environmental and Energy Policy

SS 5400 Sociology of the Environment (3 credits)

**SS5310 Ecological Economics** or EC 5650 Environmental Economics (3 credits)

B) Research Design and Methods courses (10-11 credits)

Students will be required to take the following two courses (additional methods courses can be taken to fit each student's research needs):

**SS 6002 Research Design (3 credits)**

**SS 5001 Advanced Social Science Methods (4 credits)**

In addition, all students will be required to take one of the following statistics courses:

EC 4200 Econometrics (3 credits)

PSY5220 Advanced Statistical Analysis and Research Design II (4 credits)

MA 5701 Statistical Methods (3 credits)

C) Additional policy area courses (9 credits)

Students must choose at least three courses from one policy area: a) Energy Policy; b) Environmental and Natural Resources Policy; and c) Sustainable Development. A fourth concentration emphasizing economics and the environment is a potential future development, contingent upon the availability of faculty expertise in the School of Business and Economics.

*a. Energy Policy*

EC 5620 Energy Economics

**SS 6100 Advanced Seminar in Energy Policy**

MEEM 4200 Principles of Energy Conversion

MEEM 5990 Fuel Cell Technology

MET 4900 Alternative Energy Systems  
EE 5200 Advanced Methods in Power Systems  
EE 5260 Wind Power

*b. Environmental and Natural Resources Policy*

FW 4380 Landscape Ecology (will be renumbered as a SS 5000 level course)

**SS/FW 5111 Advanced Natural Resource Policy**

SS 5635 Environmental Diplomacy and Law

SS 4200 Environmental Anthropology

EC 5640 Natural Resource Economics

EC 5650 Environmental Economics

FW5180 Philosophy and Ethics of Conservation and Ecology

FW 5510 Advanced Forest Health

*c. Sustainable Development*

**SS 5313 Sustainability Science, Policy and Assessment**

ENG/SS 5510 Sustainable Futures I

ENG/SS 5520 Sustainable Futures II

ENG/SS 5530 Graduate Colloquium in Sustainability

BA 4790 Ecological Sustainability and Organizations

BA 5760 Corporate Social Responsibility & Business Ethics

**UN 5100 Water Resource Colloquium**

D) Unspecified credits (28-29 credits)

These credits include reading courses, research credits (between 12-18 credits), and any courses related to the student's research interests.

**7. New course descriptions**

We will accommodate the teaching of new courses (some of which will replace existing courses) through moving existing graduate courses to every other year and through the addition of four EEP faculty hired to start between Spring 2009 & Fall 2010 (Mayer, Rouleau, Sinha & Mincyte).

**SS 5550 Global Environmental History.** Earth systems are now so entangled with human activity that it is difficult to understand one without considering the other. This course is a history of the interaction of the two. It links major developments in world history and environment change with important changes in how humans have interacted with and perceived their relationship to the rest of nature. Of particular interest are changes, debates, and choices that place the challenge of sustainability in historical perspective.

**SS 6002 Research Design.** The objective of this course is to explore the fundamentals of research design and analysis, particularly as these are applied to identifying, initiating, carrying out, and completing a thesis or dissertation research in Environmental and Energy Policy. The course would examine the concepts and structure of scientific inquiry such as inductive and deductive reasoning, ethical issues in research, and the nature of research design. During the course, the students would learn how to formulate appropriate research questions, and how to turn these into valid assessments of the real world. The course will briefly review various qualitative, quantitative and mixed methods used in social science research, and students would learn to understand the nature of variables, as well as how to collect and analyze. The course would also consider the use of primary historical and secondary sources of data.

**SS 5001 Advanced Social Science Methods.** This course provides a graduate-level introduction to social science methodology and highlights its role in research design, data construction, and data analysis. It exposes students to a variety of social science methods, emphasizing quantitative or mixed-methods approaches such as survey research. The course uses practical examples to highlight key concepts and techniques including: sample design, sampling error, data collection, hypothesis testing, linear and non-linear regression analysis, and advanced statistical or computational methods (i.e., GIS or computer simulation for experimentation). The course also underscores the importance of sampling frames, context and wording of survey questions, non-response data, interviewer/interviewee relations, sample estimation and error, and alternative research designs. The goal is to provide proficiency and encourage critical thinking for students preparing to engage in quantitative research in the social sciences.

**SS 5310 Ecological Economics.** This course will survey the emerging transdisciplinary field of ecological economics, which combines theories and methods from neoclassical economics, systems ecology, and other fields. Ecological economics starts with the preanalytical vision that the economy is a sub-system of the Earth's ecological systems, not vice versa. Foundational issues include examination of the optimal scale of the human economy, efficient allocation of resources, and the equitable distribution of resource flows among populations and between humans and other species. Major applications of ecological economics, such as to energy and climate change problems, will also be reviewed.

**SS 5313 Sustainability Science, Policy and Assessment.** This course will cover foundational scientific concepts, such as dynamic systems and catastrophe theory, as applied to socioecological systems, and the use of indicators and their aggregation into quantitative indices to track the progress of these systems towards sustainability targets and goals. The course will also review policies that have been implemented at the local, national, and global scale to guide the sustainable development of socioecological systems.

**SS/FW 5111 Advanced Natural Resource Policy.** This course surveys basic important federal policies related to water, land, forest, mineral, and wildlife and fisheries management. It uses policy analysis tools to understand the theory and study of policy development and implementation.

**SS 6100 Advanced Seminar in Energy Policy.** This course will examine current issues in energy policy, both domestically and internationally. Emphasis will be placed on policy instruments and treaties to develop renewable and sustainable energy sources and energy efficiency technologies, in the context of international efforts to reduce greenhouse gas emissions and growing scarcity of fossil fuels.

**UN 5100 Water Resource Colloquium.** This seminar will cover current topics in water resources. Objectives: (1) build towards a common literacy on water resources issues; (2) identify areas of common interest among students and faculty in water resources topics.

## **8. Additional resources required**

Most of the resources required to construct this Ph.D. program are already in place serving the existing M.S. Program in Environmental Policy (EP). As of Fall 2010, the program will have 11 core and 6 affiliated faculty, 11 of whom have their primary appointments within the Department (Appendix A). If the School of Business and Economics hires additional faculty in the environmental and energy fields, it is envisioned that additional economics faculty members may be added to this list.

The M.S. program is built around four core courses that are taught yearly. The faculty members who deliver these courses generally teach one graduate course per year, with the remainder of their teaching effort devoted to undergraduate students. The graduate courses taught as part of the M.S. program serve not only EP students, but graduate students across campus as well.

The proposed Ph.D. program will make several additional graduate courses—not all of which will need to be taught yearly—available to EP students and graduate students across campus. These will be met through making new and existing graduate courses offered on an every other year basis and through the

participation of new faculty who have already been hired (two of whom are replacement hires and two of who are SFHI hires).

Given that the existing core faculty and the new required positions are also expected to support undergraduate departmental programs and the university's general education program new PhD teaching assistantship lines are needed. Increasing the capacity of the core faculty to focus on funded research projects would require four graduate teaching assistantship (GTAs) positions to free up faculty resources now devoted to general education courses. Thus, some of the new PhD students will be expected to teach some of the department's general education courses when the students have sufficient qualifications in the social sciences. These GTA lines would also provide a baseline of financial assistance for students in the program; beyond that baseline, students would be funded through extramural support associated with faculty research projects.

**9. Library and other learning resources.** The existing library hard copy and electronic journal, report, and book resources as augmented through occasional interlibrary loans are sufficient to support ongoing and future environmental and energy-related social science research.

**10. Computing access fee.** Same as for other graduate students in the Department of Social Sciences (currently at \$285 per student per academic year).

**11. Description of available/needed equipment.** Laboratory and office computers, same as for other graduate students in the department.

**12. Program costs, years 1 through 3.** \$300,000. The major costs to the university will be the requested support for 4 additional Ph.D. GTAs based on fall plus spring term stipend of \$11,769 (soon to rise) and tuition and fees of \$13,134 per student, for a total of approximately \$100,000 per year, or \$300,000 total for years 1 through 3 (which assumes some annual increase. Note the EP Masters program currently has 5 GTAs). We would expect the Ph.D. students to teach some of the Department's share of UN courses when they have sufficient qualifications and skills.

A second need is for space for several additional students beyond that associated with the current M.S. program. We anticipate that the new doctoral students will be housed in the existing Environmental Policy graduate student office, where space is limited. The Department will work with the Dean of Sciences and Arts to resolve space issues as they arise.

**13. Policies, regulations and rules.** No additional policies, regulations, or rules beyond those mandated by the Graduate School.

**14. Accreditation requirements.** Accreditation is not necessary for this program.

### **15. Internal status of the proposal.**

Department of Social Sciences, September 23, 2009, Date Approved October 19, 2009

Dean, College of Sciences & Arts, October 20, 2009, Date Approved November 10, 2009

Graduate Faculty Council, December 1, 2009, Date Approved December 1, 2009

Provost, November 10, 2009, Date Approved January 29, 2010

Deans Council, November 13, 2009, Date Approved January 29, 2010

University Senate, January 29, 2010, Date Approved \_\_\_\_\_

Academic Affairs Officers, \_\_\_\_\_, 2009, Date Approved \_\_\_\_\_

Board of Control, \_\_\_\_\_, 2009, Date Approved \_\_\_\_\_

## **16. Planned implementation date.** Fall 2010

### **APPENDIX A: Affiliated Faculty Specialty Areas & Faculty Resumes (\* designates core faculty).**

Curriculum vitae are available at: <http://www.social.mtu.edu/EP/faculty.html>

#### **Bradley Baltensperger\*, Geography (CLS)**

Dr. Baltensperger is a geographer with particular interests in agriculture, ethnicity, natural hazards, and global environmental systems. His recent work has focused on improvement of geoscience, geography, environmental and history education in K12 schools through programs that enhance teachers' content knowledge and ability to improve student learning. He has advised 21 master's students and has served on over 35 other masters and doctoral committees at Michigan Tech.

#### **William Breffle, Environmental Economics (SBE)**

Dr. Breffle is an applied microeconomist specializing in environmental and natural resource economics. His areas of expertise include non-market valuation, discrete choice modeling, benefit-cost analysis, restoration program planning, and health economics for over ten years. Prior to joining Michigan Tech, he conducted and managed economic research primarily for testimony for large Natural Resource Damage Assessments (typically at Superfund sites) involving mining injuries, petroleum spills, health advisories, groundwater contamination, and other injuries. He has done work in 13 states for a variety of Federal, state, local, and tribal clients. He has supervised 1 masters student at Michigan Tech.

#### **Gary Campbell\*, Mineral Economics (SBE)**

Dr. Campbell is the Director of the M.S. Program in Applied Natural Resource Economics in the School of Business and Economics at Michigan Tech. He has experience in China, Ethiopia, Mongolia, and South Africa. Metal markets and mining sustainability are areas of current research interest. He has supervised 10 masters students and served on 40 other masters and doctorate committees. He has also been the external examiner on 5 doctorate theses for the University of Witwatersrand, South Africa.

#### **Mary Durfee, Political Science (SS)**

Dr. Durfee publishes on the Great Lakes of North America and international environmental law. Her research interests are in two areas. First is third-party intervention before international courts and duties *erga omnes* in public international law. Second is information transparency in the development of treaties. She currently serves as an appointed member of the EPA Science Advisory Board's Homeland Security Advisory Committee. She was a Fulbright Scholar to Malta in 2007-08 where she taught international law and international relations as well as various speaking and environmental education events at the request of the U.S. Embassy.

#### **Louise Nelson Dyble, History and the Built Environment (SS)**

Dr. Dyble specializes in the history of technology, infrastructure and the built environment, and metropolitan government and governance. Her book, *Paying the Toll: Local Power, Regional Politics, and the Golden Gate Bridge* (2009), traces the history of the bridge in the context of regional politics, development and planning. Her ongoing research includes a study of road and highway financing in the United States with a focus on turnpike authorities and the changing politics of public enterprise and privatization. She is also engaged with study of business/government relations and the development of California agriculture.



### **Hugh Gorman\*, Environmental History and Policy (SS)**

Dr. Gorman is a historian trained at the intersection of environmental history and the history of technology. He studies interactions between policy choices, technological innovation, and environmental change--with the goal being to inform efforts to construct policies that reward sustainable practices. He is working on a book that examines how industrial society first learned to bypass ecological limits associated with production of fixed nitrogen and now is learning to manage the consequences. Past work includes a history of how, in the period 1890 to 1990, socio-technological systems for producing, transporting, and refining oil evolved in response to pollution-related concerns and policies aimed at addressing those concerns.

### **Kathleen Halvorsen\*, Sociology of Natural Resources (2/3 SS/1/3 SFRES)**

Dr. Halvorsen is a sociologist of natural resources specializing in water and forest policy processes. Her current emphases are in woody bioenergy, climate change, and water resources policies. Her projects focus in the U.S. and Mexico. She has advised 20 masters and doctoral students and sat on an additional 40 doctoral and masters student committees from across campus during her career at MTU.

### **Carol MacLennan\*, Anthropology (SS)**

Dr. MacLennan is an anthropologist specializing in environmental anthropology and history. Her research on industrialization and environmental policy is both historical and ethnographic and currently located in Hawai'i, and the Western U.S. She studies water histories, landscapes, and toxics in mining and sugar plantation communities. She has supervised nine graduate students in Environmental Policy and Industrial Archaeology and served on over 40 MS and Ph.D. graduate committees.

### **Audrey Mayer\*, Sustainability Science (2/3 SS/1/3 SFRES)**

Dr. Mayer is an ecologist with additional expertise in environmental policy. Her current research is focused on sustainability assessment, sustainable forest management, and biodiversity conservation. She has mentored graduate students while at the U.S. Environmental Protection Agency and at the University of Helsinki, and currently serves as the major advisor to one master's student and one doctoral student, as well as a committee member for several theses and dissertations.

### **Alex Mayer\*, Hydrology (CEE/GMES)**

Dr. Mayer is Professor of Environmental and Geological Engineering and Director of the Center for Water & Society at MTU. His teaching and research focuses on human-biophysical interactions in water systems, water resources management and modeling, and groundwater flow, transport, and remediation and includes computational, field, and laboratory studies. The primary geographic settings for this work are the Laurentian Great Lakes and northwest Mexico. He has supervised 9 PhD and 19 masters committees and has sat on an additional 112 graduate student committees.

### **Diana Mincyte\*, Rural and Environmental Sociology (SS)**

Dr. Mincyte is currently a research fellow at the Rachel Carson Center for Environmental Studies, Ludwig Maximilians University-Munich and will join MTU's Department of Social Sciences in 2010. As an environmental sociologist, she examines how the implementation of sustainable development policies affects land-use and occupational structures in the Global South. Her book project focuses on post-socialist Europe and considers how local farmers and consumers negotiate the EU agro-food reforms and environmental regulations with their daily practices and incomes.

### **Mark Roberts, Natural Resource Economics (SBE)**

Dr. Roberts studies the cycles in mineral and energy prices, especially metals and petroleum. He is currently writing a textbook on energy economics. Dr. Roberts has advised 22 master's students, is currently advising six master's students, and served on an additional 6 doctoral and 35 masters student committees from across campus during his career at Michigan Tech.

### **Fredric L. Quivik, Environmental History (SS)**

Dr. Quivik is an historian of technology who has worked for fifteen years as an expert witness in Superfund and related environmental litigation. He has also worked for more than three decades documenting, preserving, and interpreting historic sites that have an industrial or engineering character. He studies the history of industrial systems, industrial landscapes, and energy history.

### **Mark Rouleau\*, Political Science (SS)**

Dr. Rouleau specializes in the application of advanced computational methods to complex international problems and processes. He has used Agent-Based Modeling to explore many environmental topics, such as land-use decision-making, the development of water-quality markets, international environmental policy-making, and the interplay of environmental factors and civil violence.

### **Deb Ranjan Sinha\*, Geography (SS)**

Dr. Sinha specializes in environment and development policy issues. His research uses the political ecology framework, and incorporates environmental history and GIS analysis. His past research include implementation of community forestry in Nepal, land use/land cover change in response to market liberalization in India, and impact of legacy pollution on redevelopment in deindustrialized urban spaces in the U.S.

### **Barry Solomon\*, Ecological Economics and Economic Geography (SS)**

Dr. Solomon is a specialist in energy and environmental policy, and policy instruments for environmental protection. He serves as the director of Michigan Tech's masters program in environmental policy. His current research emphases include sustainable biofuels, wind power, climate change, greenhouse gas markets, and nuclear waste management. His main projects focus on the U.S. and Sweden. He has advised 11 masters and doctoral students and sat on an additional 24 doctoral and masters student committees.

### **Andrew Storer, Insect Ecology (SFRES)**

Dr. Storer studies insect/fungus/plant interactions, impacts of exotic species on forest ecosystems, interactions among fire, insects and disease in forests and urban forest health. His research projects currently focus on insect, disease, weed and fire issues in the U.S. Midwest, California and Ghana. He has advised or is advising 22 masters and doctoral students and has sat on an additional 22 doctoral & masters student committees.

**Introduced to Senate: 17 March 2010**

**Adopted by Senate: 31 March 2010**

**Approved by Administration: 13 April 2010**

**Approved by Board of Control: 19 July 2010**