Environmental Resources and Policy

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GRADUATE SCHOOL; COLLEGES OF AGRICULTURAL SCIENCES, LIBERAL ARTS, AND SCIENCE

The Graduate School offers the Doctor of Philosophy degree in Environmental Resources and Policy. This degree provides students with an interdisciplinary education in natural resource and environmental processes with a perspective on public policy and social institutions that shape societal and individual reactions to environmental issues. The education will prepare students to work with multifaceted environmental problems and enable them to carry out interdisciplinary scientific research and be qualified for high-level administration positions in academia, government (e.g. U.S. Geological Survey, U.S. EPA, U.S. Forest Service, Illinois Dept. of Natural Resources, U.S. Department of Agriculture), and the private sector (e.g. environmental consulting firms, electric and water utilities, mining and solid waste firms). This will enable graduates to address the most compelling and daunting challenge in natural resource and environmental issues—identifying and solving problems that cross disciplinary boundaries.

The Environmental Resources and Policy Ph.D. is organized by the Departments of Geography and Geology, and the College of Agricultural Sciences (Departments of Agribusiness Economics, Forestry, and Plant, Soil and Agricultural Systems). The School of Law and the College of Engineering also cooperate in the program.

Areas of Concentration

EARTH AND ENVIRONMENTAL PROCESSES

Students who select this specialization combine elements of the modern, process-oriented geology curriculum (sedimentology, geomorphology, petrology, basin analysis, seismology, potential-field geophysics, organic and water geochemistry, tectonics, and paleo-environmental analysis) with allied disciplines to prepare for research into a broad range of environmental studies. This concentration emphasizes the geological process approach to analysis of such problems as flooding, earthquake hazards, land-use practices, aquifer degradation, and mine site remediation.

ENERGY AND MINERAL RESOURCES

Energy and mineral resources include hydrocarbons (oil, natural gas, coal, and their naturally-occurring and manufactured derivatives), and both metallic and non-metallic (industrial) mineral and rock deposits. This specialization comprises studies of the origins and physical occurrences of these resources, together with technologies and policies concerning their extraction and use.

ENVIRONMENTAL POLICY AND ADMINISTRATION

Making and administering environmental policy has become an exceedingly complex arena where science interacts strongly with law and the political process. Students enrolled in this concentration will examine these interactions and complexities with a focus on the socioeconomic driving forces that generate resource use and attendant environmental problems, and the political and legal frameworks through which societies make and implement public policy in the environmental field.

FORESTRY, AGRICULTURAL, AND RURAL LAND RESOURCES

Many environmental problems, challenges and policies take place on rural landscapes where forestry and agricultural land uses are intermingled with non-farm rural residents and others. Many rural land uses contribute to environmental problems and the development of environmentally benign and sustainable methods of production are goals of environmental policy. Consequently, through this concentration, students will examine the interaction among environmental quality, production, and the process and institutions of public policy.

GEOGRAPHIC INFORMATION SYSTEMS, REMOTE SENSING AND ENVIRONMENTAL MODELING

Modern environmental sciences, management and planning rely on acquisition, analysis and integration of large data bases using remote sensing, digital image processing, geographic information systems and environmental modeling. The purpose of this concentration is to enable students to develop high skills in these areas and to apply them to one or more natural resource domains (e.g., hydrogeology, forest inventory, spatial decision support systems, environmental modeling).

WATER RESOURCES

As a critical flow resource, water is of central importance to society and, through hydrologic processes, is involved in many environmental issues from water shortages in populous arid regions to ground water quality concerns associated with agri-chemical use. Through this concentration, students will examine the interaction among hydrologic processes, environmental quality, water resource use, and the processes and institutions of the private sector and public policy that govern water resources.

ER&P Faculty

Please see the departmental web pages (http://www.siu.edu/siuc/jiffy/) for detailed information on the research activities of individual faculty members. Please also see the departmental entries in this catalog.

Jeffrey Beaulieu, *Agribusiness Economics,* Quantitative Methods, Rural land use
Roger Beck, *Agribusiness Economics,* Regional Economics
Phil Eberle, *Agribusiness Economics,* Farm Management
Kim Harris, *Agribusiness Economics,* Agricultural Finance, Agricultural Management
Steven Kraft *Agribusiness Economics,* Agricultural Policy, Soil and Water Conservation
Wanki Moon, *Agribusiness Economics,* Consumer Economics and Food Marketing
Matthew Rendleman, *Agribusiness Economics,* Agricultural Policy
Dwight Sanders, *Agribusiness Economics,* Futures and options, Risk Management, Price Analysis
Kenneth Griswold, *Animal Science,* Livestock Waste Management

Sara Baer, *Forestry,* Ecology
John Burde, *Forestry,* Recreational and Public Land Use
Andrew Carver, *Forestry,* Land Use Planning, GIS
John Groninger, *Forestry,* Silviculture
Jean Mangun, *Forestry,* Human Dimensions in Natural Resources Management
John Phelps, *Forestry,* Forest Products Marketing, Wood Science
Paul Roth, *Emeritus*, *Forestry,* Forest Protection and Management
Charles Ruffner, *Forestry,* Forest ecology
Karl Williard, *Forestry,* Hydrological Modeling, Watershed Management
James Zaczek, *Forestry,* Ecology

Leslie Duram, *Geography,* Agricultural Conservation Policy, Public Lands Policy,
Organic Agriculture
Benedkyt Dziegielewski, *Geography,* Water Resources Planning, Hydrology
Bruce Hooper, *Geography*, Water Resources Planning
Doc Horsely, *Geography,* Water Perception, Weather Forecasting and probabilities
Christopher Lant, *Geography,* Water Resources and Wetlands Policy, Non-point Source Pollution
Tonny Oyana, *Geography,* GIS and GIScience
Wanxiao Sun, *Geography*

Ken Anderson, *Geology,* Organic Geochemistry
John Crelling, *Geology,* Coal Geology, Fossil Fuel Issues
Steven Esling, *Geology,* Hydrogeology, Environmental Modeling
Eric Ferre, *Geology,* Structural Geology, Rock Magnetism, Tectonics
Richard Fifarek, *Geology,* Economic Geology, Mining Issues
Scott Ishman, *Geology,* Marine Micropaleontology
John Marzolf, *Geology,* Sedimentology
Nicholas Pinter, *Geology,* Environmental Geology, Geomorphology, GIS, Environmental Modeling
Dhananjay Ravat, *Geology,* Potential-field Geophysics, Geophysical modeling
John Sexton, *Geology,* Seismology

Jason Bond, *PSAS,* Hematology and Plant Pathology
She-Kong Chong, *PSAS,* Soil Physics, Hydrology, Soil and Water Conservation, Groundwater Contamination
Kenneth Diesburg, *PSAS,* Turf and Forage Management
Paul Henry, *PSAS,* Ornamental Horticulture
Brian Klubek, *PSAS,* Soil Microbiology
David Lightfoot, *PSAS,* Biotechnology Applications
Khalid Meksem, *PSAS,* Agronomy and Soil
Karen Midden, *PSAS,* Landscape Planning
John Preece, *PSAS,* Plant Biomass Technology
John Russin, *PSAS,* Agronomy and Soil
Michael Schmidt, *PSAS,* Precision Agriculture
Donald Stucky, *Emeritus, PSAS,* Crop Ecology, Crop Production and Environmental Aspects
Bradley Taylor, *PSAS,* Fruit Production
Edward Varsa, *PSAS,* Soil Chemistry, Fertility and Management
Alan Walters, *PSAS,* Horticulture
Brian Young, *PSAS,* Weed Science

A partial listing of other SIUC faculty active in environmental research and teaching:
Don Rice, *Anthropology,* Human Ecology
John Bozzola, *Center for Electron Microscopy,* Biological Applications of Electron Microscopy
John Koropchak, *Chemistry,* Environmental Chemistry
Rolando Bravo, *Civil Engineering,* Hydrological Modeling
Lizette Chevalier, *Civil Engineering,* Physical Remediation
Bruce Devantier, *Civil Engineering,* Hydrology
John Nicklow, *Civil Engineering,* Hydrology, Hydrological Modeling
William Ray, *Civil Engineering,* Water Quality
John Mead, *Coal Extraction and Utilization Research*
Trudy Volk, *Curriculum and Instruction,* Environmental Education
Kay Carr, *History,* Environmental History
Robert Beck, *School of Law,* Oil and Gas, Mining, Water Law
Patricia McCubbin, *School of Law*, Environmental Law, Advanced Environmental Litigation, Environmental Law for Business Transactions
James Blackburn, *Mechanical Engineering,* Bioremediation
Edwin Hippo, *Mechanical Engineering,* Coal Resources
Manohar Kulkarni, *Mechanical Engineering,* Thermal Analysis, Thermal Modeling and Energy Management
Laurie Achenbach, *Microbiology,* Microbial Remediation, Life in Extreme Environments
Michael Madigan, *Microbiology,* Bacterial Diversity, Phototrophic Bacteria, Extreme Environments
Paul Chugh, *Mining Engineering,* Minerals and Residues Processing
Manoj Mohanty, *Mining Engineering,* Coal mining and Mineral, Mineral and Coal Processing
Bradley Paul, *Mining Engineering,* Air Quality Remediation
Stephen Ebbs, *Plant Biology,* Phytoremediation Of Contaminated Soil
David Gibson, *Plant Biology,* Plant Population And Community Ecology
Sedonia Sipes, *Plant Biology,* Plant Biodiversity And Conservation Biology
Dale Vitt, *Plant Biology,* Peatland Ecosystem Dynamics and Biogeochemistry, Climate Change
Jonny Gray, *Speech Communication,* Environmental Rhetoric
Brooks Burr, *Zoology,* Ichthyology
George Feldhamer, *Zoology,* Mammalogy, Wildlife Ecology
James Garvey, *Zoology,* Fish Management, Fish Ecology
Richard Halbrook, *Zoology,* Wildlife Toxicology, Population Dynamics
Kamal Ibrahim, *Zoology,* Population Biology
Christopher Kohler, *Zoology,* Fish Population Ecology, Fisheries Management
Karen Lips, *Zoology,* Herpetology, Conservation Biology
John McPherson, *Zoology,* Entomology, Insect Ecology
Michael Lydy, *Zoology,* Aquatic Toxicology
John Reeve, *Zoology,* Quantitative Ecology
George Waring, *Zoology,* Animal Behavior, Vertebrate Natural History, Ornithology
Matt Whiles, *Zoology,* Stream Ecology, Freshwater Invertebrates
Frank Wilhelm, *Zoology,* Limnology

Admission and Retention

Students will be admitted to the program on the basis of academic merit, statement of interest, and the availability of a willing Ph.D. advisor. Ph.D. students will be selected on a national and international competitive basis. Admissions will not be rationed by concentration.

Students must have a Master's Degree or a J. D. Students with a Bachelor's Degree may be admitted conditional upon completion of a master's degree from one of the participating departments.

Admission and financial aid are competitive on the basis of Master's-level GPA, professional work experience, and GRE scores, as well as letters of recommendation. Applicants must have a Master's-level GPA of at least 3.25, and meet one of the following:

1) a combined verbal and quantitative GRE score of 1100,
2) three years of successful professional experience in the environmental/natural resources field.

Highly qualified applicants will be nominated for Doctoral Fellowships and Morris Fellowships.

Students must remain in good standing with a GPA of 3.0 or higher and be making good progress toward identification and completion of a dissertation project. Students in good standing who have qualified for assistantships will be offered funding for at least three 9-month academic years.

A non-refundable application fee of $20.00 must be submitted with the application. Attach your check or money order, payable to Southern Illinois University, to the top of the application form. Do not send cash. Only checks or money orders payable to United States banks will be accepted.

Candidacy and Dissertation

By the end of their second semester in residence, students must have chosen a concentration and formed a graduate committee to oversee their dissertation research. The graduate committee may have a maximum of three of the five members from one department. Completion of research tools will be determined by committee. Written and oral preliminary examinations consist of two parts, one based on the program core material, and one on the student's chosen concentration. When the student has passed prelims and a dissertation proposal is accepted by the committee, students are admitted to candidacy. If prelims are not passed, they must wait a minimum of three months for the second and final attempt to pass the exam.

Candidates will be required to present an acceptable dissertation describing original research. Dissertation approval is based on a successful oral defense of the dissertation research and approval of the dissertation by the graduate committee. The dissertation research must also be presented in ERP 598.

Curriculum

Pre-requisites: Students must have at least three of the seven courses listed below to be admitted and must have five upon completion of the program. It is anticipated that most students will fulfill many of the pre-requisites through their previous work at the undergraduate and Master's level and will have working facility with micro-computers. For those students without adequate background, identified courses are required to provide students with the background necessary to successfully participate in the program.

Pre-requisites for all concentrations:	SIUC Course if Unfulfilled:
One course in statistics	EPSY 506 or more advanced
One course in calculus	MATH 150 or more advanced
One course in chemistry	CHEM 200 or more advanced
One course in earth science	GEOG 303I OR GEOL 478 or more advanced
One course in ecology	BIOL 307 or more advanced
One course in resource economics	ABE 440, FOR 411, GEOG 422, or more advanced
One course in the U.S. env. law or policy	FOR 410, GEOG 426, LAW 548, or more advanced

Core: 36 Credits (including 24 in ERP 600)
Concentration: 24 Credits Minimum
Total: 60 Credits

Core Curriculum for all Concentrations
Required Courses:
ERP 500 - *Physical and Biological Environmental Systems* (3)
ERP 501 - *Economic Systems and Environmental Change* (3)
ERP 502 - *Environmental Decision-Making* (3)
ERP 598 - *Applied Environmental Resources and Policy* (1 credit each year in residence.)

Curriculum for Concentrations

Each concentration will require mastery of one or more research tools. Specific courses and research tools will be determined by the student and the research supervisor in consultation with the student's faculty advisory committee. The multi-disciplinary curriculum for each concentration is customized to meet the student's individual interests and career goals.

EARTH AND ENVIRONMENTAL PROCESSES CONCENTRATION

The curriculum may include courses in geology, biological science, physical science areas other than geology, geography (GIS and cartography), environmental law, remote sensing, soil science, mining and civil engineering, computer science and statistics.

ENERGY AND MINERAL RESOURCES CONCENTRATION

The curriculum may include courses in geology, biological science, physical science areas other than geology, geography (GIS and cartography), environmental law, remote sensing, soil science, mining and civil engineering, computer science and statistics.

ENVIRONMENTAL POLICY AND ADMINISTRATION CONCENTRATION

The curriculum may include courses in environmental law, political science, geography, forestry, agribusiness economics, economics, anthropology, zoology, and statistics. Emphasis is on the processes of public policy formulation and implementation.

FORESTRY, AGRICULTURAL, AND RURAL LAND RESOURCES CONCENTRATION

The curriculum may include courses in agribusiness economics, plant, soil, and agricultural systems, animal science, geography, remote sensing and GIS, human dimensions of natural resource management, plant biology, zoology,

and statistics. Emphasis is on the processes of changing land uses of rural landscapes and the implications for the environment and adjacent land uses.

GEOGRAPHIC INFORMATION SYSTEMS, REMOTE SENSING AND ENVORNMENTAL MODELING CONCENTRATION

Students may elect from several specializations within this concentration including Geoprocessing, Biometrics, Environmental Modeling, and Geological Modeling. The following represent recommended, but not required, sequences of courses in these areas.

Geoprocessing
CS 430 - Database Systems (3)
CS 470 - Environmental Simulation Techniques (3)
GEOG 408 - Advanced Remote Sensing (3)
GEOG 416 - Analytical Cartography (3)
GEOG 420 - Advanced Geographic Information Systems (3)
GEOG 528 - Seminar in Geo-Processing Technology (3)

Biometrics
FOR 414 - Information Management (3)
FOR 452 - Natural Resources Inventory (2)
FOR 453 - Environmental Impact Assessment in Forestry (2)
FOR 516 - Advanced Forest Management (2)

Environmental Modeling
CE 471 - Modeling Ground Water Flow and Pollution (3)
GEOG 430 - Environmental Systems Analysis (3)
PLB 444 - Quantitative Plant Ecology (3)
ZOOL 534 - Wildlife Habitat Analysis (3)

Geological Modeling
GEOL 413 - Quantitative Methods of Geology (3)
GEOL 460 - Geological Data Processing (3)
GEOL 470 - Hydrogeology (3)
GEOL 570 - Advanced Hydrogeology (3)
GEOL 577 - Contaminant Transport Modeling (3)

WATER RESOURCES CONCENTRATION

The curriculum should include courses in Water Policy and Planning and Hydrological Sciences

Water Policy and Planning
GEOG 422 - Economics in Geography and Planning (4)
GEOG 425 - Water Resources Planning (3)
GEOG 471 - Environmental Impact Analysis (3)
LAW 548 - Environmental Policies and Laws (3)
LAW 568 - Water Law (3)

Hydrological Sciences Group
CE 415/7 - Wastewater Treatment and Lab (3)
CE 419 - Water Supply and Treatment (3)
CE 473 - Hydrologic Analysis and Design (3)
CE 516 - Water Resources Management (3)
FOR 402 - Wildland Hydrology (3)
FOR 430 - Watershed Management (3)
GEOG 434 - Water Resources Hydrology (4)
GEOL 470 - Hydrogeology (3)
GEOL 478 - Environmental Geology (3)
GEOL 570 - Advanced Hydrogeology (3)
GEOL 577 - Contaminant Transport Modeling (3)
GEOL 578 - Fluvial Geomorphology (3)
PLB 445 - Wetland Plant Ecology (4)
PLSS 442 - Soil Physics (3)
PLSS 445 - Irrigation (3)
PLSS 446 - Soil and Water Conservation (3)
ZOOL 415 - Limnology (3)
ZOOL 458 - Issues in Aquatic Ecology (3)
ZOOL 521 - Stream Ecology (3)

Courses (ERP)

500-3 Physical and Biological Environmental Systems. Application of principles of systems analysis, including chaos and complex adaptive systems, to Earth biogeochemical cycles (e.g. energy, carbon, water, nutrients), inter-relations among them and disruptions to them. Topical focus will vary among: the analysis of how contaminants

travel, especially through ground water, and become dispersed in the environment; the origin of soils and the movement of nutrients among plants, water and soils; the origin and distribution of natural resources such as metals and fossil fuels and of natural hazards such as flooding, earthquakes, landslides and volcanism; the global carbon cycle, especially its role in global climate change.

501-3 Economic Systems and Environmental Change. Investigation of the social forces driving natural resource use and environmental change, including population growth, the globalization and migration of economic activity, changing land use patterns, and economic and technological trends in the major resource use sectors; energy, agriculture, water, and forestry. Principles of environmental impact assessment, ecological footprint analysis and industrial ecology are introduced. The challenge of sustainable development sets the state for an analysis of the future adequacy of the natural resources based on which societies and economics depend. Prerequisite: 500.

502-3 Environmental Decision Making. Analytical concepts relevant for environmental professional will be taught and demonstrated through case studies. Topics to be covered include risk assessment and risk management formulation of environmental impact statements, cost effectiveness and cost benefit analysis, and methods of conflict resolution. The role of economic incentives in encouraging conservation, the role of multiple institutional players in environmental decision-making at various geographic scales (local, state, international, global), and the use of the Internet as a source of environmental information will be emphasized.

591-3 Seminar in Earth and Environmental Processes. Research seminar for Environmental Resources and Policy students who are taking the Earth and Environmental Processes concentration. Topics may vary. Can be offered concurrently with other graduate seminars offered by departments affiliated with or participating in the Environmental Resources and Policy program. Prerequisite: 500.

592-3 Seminar in Energy and Mineral Resources. Research seminar for Environmental Resources and Policy students who are taking the Energy and Mineral Resources concentration. Topics may vary. Can be offered concurrently with other graduate seminars offered by the departments affiliated with or participating in the Environmental Resources and Policy program. Prerequisite: 500.

593-3 Seminar in Environmental Policy and Administration. Research seminar for Environmental Resources and Policy students who are taking the Environmental Policy and Administration concentration. Topics may vary. Can be offered concurrently with other graduate seminars offered by the departments affiliated with or participating in the Environmental Resources and Policy program. Prerequisite: 502.

594-3 Seminar in Forestry, Agricultural and Rural Land Resources. Research seminar for Environmental Resources and Policy students who are taking the Forestry, Agricultural and Rural Land Resources concentration. Topics may vary. Can be offered concurrently with other graduate seminars offered by the departments affiliated with or participating in the Environmental Resources and Policy program. Prerequisite: 501.

595-3 Seminar in Geographic Information Systems and Environmental Modeling. Research seminar for Environmental Resources and Policy students who are taking the Geographic Information Systems, Remote Sensing and Environmental Modeling concentration. Topics may vary. Can be offered concurrently with other graduate seminars offered by the departments affiliated with or participating in the Environmental Resources and Policy program. Prerequisite: 500.

596-3 Seminar in Water Resources. Research seminar for Environmental Resources and Policy students who are taking the Water Resources concentration. Topics may vary. Can be offered concurrently with other graduate seminars offered by the departments affiliated with or participating in the Environmental Resources and Policy program. Prerequisite: 500.

598-1 Applied Environmental Resources and Policy. Invited speakers from federal, state, or local agencies; nongovernmental organizations; academic institutions; and Environmental Resources and Policy faculty will present case studies on the conduct of environmental research, the development of environmental laws and regulation, and the implementation of environmental policies. Additionally, students will present dissertation proposals and defend their dissertations. Taken for one credit each year in residence in the Environmental Resources and Policy program. Prerequisite: enrollment in the Environmental Resources and Policy program.

599-1 to 3 Individual Research in Environmental Resources and Policy. Individual investigation under faculty guidance in environmental resources and policy other than that for the dissertation. Only three hours may be credited toward the degree. Prerequisite: admission to Environmental Resources and Policy Program.

600-1 to 24 (1 to 12 hours per semester) Dissertation. Research for and writing of the doctoral dissertation. Prerequisite: consent of instructor.