

## 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 Environmental Resources, 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

##### CLIMATOLOGY

Students who take the Climatology concentration will study the past, present, and future of Earth's atmospheric system that, in interaction with the land and the hydrosphere, generate long-term weather patterns—that is climate. Methods for investigating paleoclimates such as dendrochronology, ice and sediment cores, will be emphasized along with use of Atmospheric-Oceanic General Circulation Models for the investigation of future climate change.

##### 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.

##### ECOLOGY

Students who take the ecology concentration will work with faculty from the Center for Ecology. Ecology studies the complex relationships between organisms, populations, communities, ecosystems, biomes and the biosphere, which are deeply affected

by human decisions, actions and policies—actions and policies which are themselves influenced by the environment. ER&P-ecology students will focus on the ecosystem-society relationship, such as the provision and management of ecosystem services. As the human footprint widens, and active management of ecosystems becomes more policy-relevant, understanding these connections is a vital component of training the next generation of scientists.

##### 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.

#### Environmental Resources & Policy Faculty

Please see the departmental web pages (<http://info.erp.siu.edu/facultyandstaff/default.html>) for detailed information on the research activities of individual faculty members. Please also see the departmental entries in this catalog.

#### **Agribusiness Economics:**

**Altman, Ira**, Renewable Energy Industries, Organizational, Rural and Regional Economics  
**Moon, Wanki**, Consumer Economics and Food Marketing  
**Rendleman, Matthew**, Agricultural Policy  
**Sanders, Dwight**, Futures and options, Risk Management, Price Analysis

#### **Forestry:**

**Akamani, Kofi**, Human Dimensions of Natural Resource Management  
**Carver, Andrew**, Land Use Planning, GIS  
**Ruffner, Charles**, Forest ecology  
**Schoonover, Jon**, Watershed Management and Hydrology  
**Williard, Karl**, Hydrological Modeling, Watershed Management  
**Zaczek, James**, Ecology

#### **Geography and Environmental Resources:**

**Duram, Leslie**, Agricultural Conservation Policy, Public Lands Policy, Organic Agriculture  
**Ford, Trent**, Hydroclimatology, Land-atmosphere Interaction, Soil Moisture and Drought  
**Li, Ruopu**, GIS-based Land Use Modeling, Water Resources Planning and Management, Groundwater Modeling  
**Remo, Jon**, Hydrology, Geomorphology  
**Schoof, Justin**, Climatology  
**Secchi, Silvia**, ER&P Co-Director, Environmental and Energy Economics, Land Resource Development  
**Wang, Guangxing**, Remote Sensing, Spatial Statistics and GIS

#### **Geology:**

**Anderson, Ken**, Organic Geochemistry  
**Conder, James**, Seismology, Plate Boundary Processes-Geodynamics and Seismotectonics  
**Esling, Steven**, Hydrogeology, Environmental Modeling  
**Ferre, Eric**, Structural Geology, Rock Magnetism, Tectonics  
**Filiberto, Justin**, Igneous and Metamorphic Petrology, Volcanology  
**Ishman, Scott**, Marine Micropaleontology  
**Lefticariu, Liliana**, Stable Isotope Geochemistry/Aqueous Geochemistry/Radiation chemistry.  
**Potter-McIntyre, Sally**, Sedimentology  
**Rimmer, Sue**, Petrology of Coal and Dispersed Organics; Coal Geology and Geochemistry

#### **Plant, Soil and Agricultural Sciences:**

**Bond, Jason**, Hematology and Plant Pathology  
**Cook, Rachel**, Soil Management, Soil and Water Conservation  
**Ebbs, Stephen**, Plant Ecophysiology, Exotoxicology, Pollutant Biogeochemistry, Phytotechnologies  
**Henry, Paul**, Ornamental Horticulture  
**Lightfoot, David**, Biotechnology Applications

**Meksem, Khalid**, Agronomy and Soil  
**Midden, Karen**, Landscape Planning  
**Taylor, Bradley**, Fruit Production  
**Walters, Alan**, Horticulture

#### **A partial listing of other SIU faculty active in environmental research and teaching:**

**Chevalier, Lizette**, *Civil Engineering*, Physical Remediation  
**McCubbin, Patricia**, *School of Law*, Environmental Law, Advanced Environmental Litigation, Environmental Law for Business Transactions  
**Chugh, Paul**, *Mining Engineering*, Minerals and Residues Processing  
**Mohanty, Manoj**, *Mining Engineering*, Coal mining and Mineral, Mineral and Coal Processing  
**Baer, Sara**, *Plant Biology*, Ecosystem, Soil and Restoration Energy/  
**Gibson, David**, *Plant Biology*, Plant Population and Community Ecology  
**Whiles, Matt**, *Zoology*, Stream Ecology, Freshwater Invertebrates

#### **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 at least the 50th percentile.
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.

This program requires a nonrefundable \$65.00 application fee that must be submitted with the application for admission to Graduate Study in Environmental Resources & Policy. Applicants must pay this fee by credit card.

#### **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**

**Prerequisites:** 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 prerequisites 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.

<b>Prerequisites for all Concentrations:</b>	<b>SIU Course if Unfulfilled:</b>
One course in statistics	QUAN 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 U.S. env. law or policy	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 502 Environmental Decision Making (3)
- ERP 598 Applied Environmental Resources and Policy (1 credit each year in residence)
- One Methodology class listed below
- Qualitative Social Science
  - SOC 512 Sociological Research Methods & Design (4)

Quantitative Social Science

- ECON 567A Econometrics I (3)
- QUAN 507 Multiple Regression (4)
- Quantitative Biophysical Science
  - GEOL 513 Quantitative Methods in Earth Sciences (3)
  - GEOG 512 Applied Geographic Statistics (3)
  - ZOOL 557 Biostatistics (4)

**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.

**CLIMATOLOGY CONCENTRATION**

The curriculum may include courses in Geography and Environmental Resources, Geology, Physics, Mathematics, and other areas relevant to the atmospheric processes.

**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.

**ECOLOGY CONCENTRATION**

The curriculum will include PLB 589A and other courses in Zoology, Plant Biology, Forestry, Geology, Geography and Environmental Resources, and other areas relevant to ecology.

**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 ENVIRONMENTAL MODELING CONCENTRATION**

Students may elect from several specializations within this concentration including Geoprocessing, Biometrics, Environmental Modeling, and Geological Modeling.

**WATER RESOURCES CONCENTRATION**

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

**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.

**502-3 Environmental Decision Making.** (Same as ABE 502)

The objective of the course is twofold. The first part of the class will be devoted to case studies of environmental decision making which use a variety of approaches to environmental policy. Topics to be covered include market-based environmental management versus regulatory approaches, climate change, conservation and floodplain management policy. The second part of the class will focus on the challenges of interdisciplinary communication and collaboration, methodological research issues and the role of integrated modeling. We will consider different issues such as qualitative and quantitative evidence, validation, and the role of values and objectivity in the scientific process.

**590- 1 to 8 Readings in Environmental Resources and Policy.**

Readings in a specialized topic under the direction of an approved graduate faculty member. Graded *S/U* only.

**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. Restricted to 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. Restricted to 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. Special approval needed from the instructor.

**601-1 Continuing Enrollment.** For those graduate students who have not finished their degree and who are in the process of working on their dissertation. The student must have completed a minimum of 24 hours of dissertation research before being eligible to register for this course. Concurrent enrollment in any other course is not permitted. Graded *S/U* or *DEF* only.