

## Table of Contents

Environmental Resources and Policy..... 1

### **Environmental Resources and Policy**

The School of Earth Systems and Sustainability 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 the social institutions that shape societal and individual reactions to environmental issues. Students become prepared to address complex environmental problems through interdisciplinary scientific research and be qualified for high-level administration positions in academia, government (e.g. U.S. Geological Survey, U.S. Environmental Protection Agency, U.S. Forest Service, Illinois Department 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 enables graduates to address the most compelling and daunting challenges in natural resources and environmental science—identifying and solving problems that cross disciplinary boundaries.

The Ph.D. in Environmental Resources and Policy is housed within the School of Earth Systems and Sustainability and has participating faculty from the Schools of Agricultural Sciences, Biological Sciences, Civil, Environmental, and Infrastructure Engineering, Computing, Forestry and Horticulture, and Law as well as programs in the College of Business and Analytics and the College of Liberal Arts. The program offers the following concentrations:

#### **Climatology Concentration**

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 Concentration**

Students who select this concentration 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 Concentration**

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. Environmental Resources and Policy-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 Concentration**

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 concentration 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 Concentration**

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 Concentration**

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 and Environmental Modeling Concentration**

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 Concentration**

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.

# **Doctor of Philosophy (Ph.D.) in Environmental Resources and Policy**

## **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. Environmental Resources and Policy 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 programs.

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 nine-month academic years.

This program requires a nonrefundable \$65 application fee that must be submitted with the application for admission to Graduate Study in Environmental Resources and Policy. Applicants must pay this fee by credit card.

### **Required Courses:**

- ERP 502: Environmental Decision Making (3 CH)
- ERP 598: Applied Environmental Resources and Policy (1 credit hour each year in residence)

### **One Methodology class listed below:**

- SOC 512: Sociological Research Methods & Design (4 CH)
- ECON 567A: Econometrics I (3 CH)
- QUAN 506: Inferential Statistics (4 CH)
- QUAN 507: Multiple Regression (4 CH)
- GEOL 513: Quantitative Methods in Earth Sciences (3 CH)
- GEOG 512: Applied Geographic Statistics (3 CH)
- ZOOL 557: Biostatistics (4 CH)

### **One Science class listed below:**

- FOR 508: Historical Ecology (2 CH)
- FOR 531: Disturbance Ecology (2 CH)
- GEOG 534: Water Resources Hydrology (3 CH)
- GEOG 536: Natural Hazards (3 CH)
- GEOG 540: Rivers and Their Management (3 CH)
- GEOL 417: Isotope Geochemistry (3 CH)
- GEOL 515: Instrumental Analysis (3 CH)
- GEOL 517: Advanced Topics in Geochemistry (3 CH)
- GEOL 524: Advanced Topics in Sedimentary Geology (3 CH)
- PLB 443: Restoration Ecology (3 CH)
- PLB 445: Wetland Ecology and Management (4 CH)
- PLB 452: Plant Population Ecology (4 CH)
- PLB 545: Ecosystem Ecology (3 CH)
- ZOOL 411: Environmental Risk Assessment (3 CH)
- ZOOL 445: Wetland Ecology and Management (4 CH)
- ZOOL 521: Stream Ecology (3 CH)
- ZOOL 569: Advanced Fisheries Management (3 CH)

### **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 program. 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 computers. For those students without adequate background, identified courses are required to provide students with the background necessary to successfully participate in the program.

| Prerequisites for all Concentrations  | SIU Course if Unfulfilled                    |
|---------------------------------------|--|
| 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 474 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 Credit Hours (including 24 credit hours in ERP 600)

**Concentration:** 24 Credit Hours Minimum

**Total:** 60 Credit Hours

### Core Curriculum for all Concentrations

#### Required Courses:

- ERP 502: Environmental Decision Making (3 CH)
- ERP 598: Applied Environmental Resources and Policy (1 credit hour each year in residence)

#### One Methodology class listed below:

- Qualitative
  - SOC 512: Sociological Research Methods & Design (4 CH)
- Quantitative
  - ECON 567A: Econometrics I (3 CH)
  - QUAN 506: Inferential Statistics (4 CH)
  - QUAN 507: Multiple Regression (4 CH)
  - GEOL 513: Quantitative Methods in Earth Sciences (3 CH)
  - GEOG 512: Applied Geographic Statistics (3 CH)
  - ZOOL 557: Biostatistics (4 CH)
  - ZOOL 558: Advanced Biostatistics (4 CH)

### 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 multidisciplinary 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 climate system 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 and Environmental Modeling Concentration**

Students may elect from several specializations within this concentration including Remote Sensing, Geospatial Modeling, Environmental Modeling, and Geological Modeling.

### **Water Resources Concentration**

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

## **Environmental Resources and Policy Courses**

**ERP500 - 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. Credit Hours: 3

**ERP502 - Environmental Decision Making** This course's primary objectives are for the student to gain a firm understanding of the fundamentals of environmental decision making, to be able to communicate conversantly across disciplines in a policy setting and understand the role integrated modeling plays in environmental management. In this course, case studies in U.S. environmental history and policy will be used to provide the student with context for how past environmental decisions have set the template for contemporary natural resource management and policy. Topics to be covered in this course

include regulatory approaches, market-based environmental management, structured decision making, federalism, water rights, and river management. Credit Hours: 3

**ERP590 - Readings in Environmental Resources and Policy** Readings in a specialized topic under the direction of an approved graduate faculty member. Graded S/U only. Credit Hours: 1-3

**ERP598 - 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. Credit Hours: 1

**ERP599 - 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. Credit Hours: 1-3

**ERP600 - Dissertation** Research for and writing of the doctoral dissertation. Special approval needed from the instructor. Credit Hours: 1-12

**ERP601 - 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. Credit Hours: 1

## Environmental Resources and Policy Faculty

### Environmental Resources & Policy Faculty

Please see the program web pages ([erp.siu.edu/faculty-staff/](http://erp.siu.edu/faculty-staff/)) for detailed information on the research activities of individual faculty members. Please also see the program entries in this catalog.

### Animal Science

**Thoms, Sylvia Smith**, Associate Professor, Farmers Markets, Farm to School Programs

### Biological Sciences

**Butts-Wilmsmeyer, Carolyn**, Associate Professor and Director of the Center for Predictive Analytics, Plant Genetics and Predictive Modeling

### Computer Science

**Che, Dunren**, Professor, Big Data, Machine Learning, Cloud Computing

### Economics

**Lahiri, Sajal**, Professor, Distinguished Scholar and Vandever Chair, International and Developmental Economics

### Forestry

**Akamani, Kofi**, Assistant Professor, Human Dimensions of Natural Resource Management

**Carver, Andrew**, Professor and Director of Engagement, Land Use Planning, GIS

**Park, Logan**, Associate Professor, Recreation Ecology

**Ruffner, Charles**, Associate Professor, Forest Ecology

**Schoonover, Jon**, Professor, Watershed Management and Hydrology  
**Williard, Karl**, Professor, Hydrological Modeling, Watershed Management

## **Geography and Environmental Resources**

**Duram, Leslie**, Professor, Agricultural Conservation Policy, Public Lands Policy, Organic Agriculture  
**Hurst, Kristin**, Assistant Professor, Sustainability Psychology, Pro-Environmental Behavior, Climate Change Engagement

**Li, Ruopu**, Associate Professor, GIS-based Land Use Modeling, Water Resources Planning and Management, Groundwater Modeling

**Remo, Jonathan**, Associate Professor and ER&P Director, Hydrology, Water Resources Management, Fluvial Geomorphology, and Natural Hazard

**Schoof, Justin**, Professor, Climate Variability and Change, Climate Extremes

**Wang, Guangxing**, Professor, Remote Sensing, Spatial Statistics and GIS

## **Geology**

**Lefticariu, Liliana**, Professor, Stable Isotope Geochemistry, Aqueous Geochemistry, Radiation Chemistry

## **Mathematics**

**Xu, Jianhong**, Associate Professor, Numerical Analysis, Matrix Theory and Applications

## **Microbiology**

**Hamilton-Bhrem, Scott**, Assistant Professor, Anaerobic and Aerobic Cultivation of Microorganisms, Environmental Sampling

## **Plant Biology**

**Gibson, David**, Professor, Population and Community Ecology

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

**Gage, Karla**, Assistant Professor, Biology and Ecology of Weeds

**Sadeghpour, Amir**, Assistant Professor, Integrated Soil Management

## **School of Law**

**McCubbin, Patricia**, Professor, Environmental Law, Environmental Law, Advanced Environmental Litigation

## **SIUE Cooperative**

**Guehlstorf, Nicholas**, Professor, Environmental Law, Political Theory

**Lin, Zhi-Qing**, Professor, Phytoremediation Technology, Biogeochemistry

**Martinez, Adriana**, Associate Professor, Fluvial Geomorphology, Riparian Zones, GIS

**Retzlaff, William**, Professor, Sustainable Infrastructure, Green Roofs, Green Technology

**Theodarakis, Chris**, Professor, Aquatic Ecotoxicology

**Yoon, Kyong-Sup**, Assistant Professor, Environmental Toxicology, Vector Biology

## **Sociology**

**Barber, Kristen**, Assistant Professor, Work and Organizations, Disaster Research, Qualitative Methods

## **Zoology**

**Brooks, Marjorie**, Associate Professor, Aquatic Ecology, Freshwater and Marine Biogeochemistry

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### **Southern Illinois University**

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### **Catalog Year Statement:**

Students starting their collegiate training during the period of time covered by this catalog (see bottom of this page) are subject to the curricular requirements as specified herein. The requirements herein will extend for a seven calendar-year period from the date of entry for baccalaureate programs and three years for associate programs. Should the University change the course requirements contained herein subsequently, students are assured that necessary adjustments will be made so that no additional time is required of them.