

Geography and Environmental Resources

COLLEGE OF LIBERAL ARTS

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Graduate Faculty:

Baumann, Duane D., Professor, *Emeritus*, Ph.D., Clark University, 1968; 1967.

Duram, Leslie, Professor, Ph.D., University of Colorado at Boulder, 1994; 1994.

Dziegielewski, Benedykt, Professor, *Emeritus*, Ph.D., Southern Illinois University Carbondale, 1983; 1985.

Ford, Trenton, Assistant Professor, Ph.D., Texas A&M University, College Station, 2015; 2015.

Horsley, Doc, Assistant Professor, *Emeritus*, Ph.D., Southern Illinois University Carbondale, 1974; 1968.

Li, Ruopu., Assistant Professor, Ph.D., University of Nebraska, Lincoln, 2012; 2015.

Lieber, Stanley R., Professor, *Emeritus*, Ph.D., University of Iowa, 1974; 1975.

Perk, H.F.W., Lecturer, *Emeritus*, A.B., University of California, Los Angeles, 1951; 1964.

Remo, Jonathan, W.F., Associate Professor, Ph.D., Southern Illinois University Carbondale, 2008; 2012.

Schoof, Justin, T., Professor and *Chair*, Ph.D., Indiana University, 2004; 2006.

Sharpe, David M., Professor, *Emeritus*, Ph.D., Southern Illinois University Carbondale, 1968; 1966.

Wang, Guangxing, Professor, Ph. D., University of Helsinki, Finland, 1996; 2007.

Weinert, Julie, Senior Lecturer, Ph.D. Ohio State University, 2008; 2005.

The Department of Geography and Environmental Resources offers a program that leads to the Master of Science degree in geography and environmental resources. The Department also participates in the Environmental Resources and Policy Doctor of Philosophy program sponsored by the Graduate School (described in greater detail elsewhere in the Graduate Catalog).

Geography and Environmental Resources is the study of how humans modify, impact, adapt to, monitor, and manage the natural environment they inhabit. Geography students study the dynamic relationship between nature and society in the field and the computer laboratory as well as in the traditional classroom. Students choose among three concentrations focusing on different aspects of geography and environmental resources: environmental sustainability, geographic information science (GIS), and climate and water resources.

Students take courses that give them a foundation in these dimensions of environmental resources through a core program, then develop a research focus. Students also develop the analytic and research skills appropriate to their research interest.

The graduate program stresses a problem-solving perspective, for which habits of critical analysis and dialogue are essential. Students take the initiative in designing and carrying out their programs with the guidance of an advisory committee and the departmental faculty. Geography maintains linkages with many other departments. Courses and faculty expertise in other departments complement those in geography, and students are encouraged to take advantage of this. Each student's progress is assessed at regular intervals by the faculty, and the student is notified of the faculty's assessment. The student is expected to show continued progress in carrying out the program of study, and in developing habits of scholarship and professionalism.

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

Requirements for the Master of Science Degree

Advisement. Students newly admitted to the master's degree program are advised by the graduate program director, with the assistance of departmental faculty. Students choose a permanent adviser at the end of the first semester in residence. The choice of permanent adviser and advisory committee is made in consultation with the graduate faculty, taking into consideration such matters as faculty expertise and faculty advisee loads.

Degree Requirements. To obtain the master's degree, the student shall:

1. Complete all degree requirements specified by the Graduate School, and explained under degree requirements, master's degree program in the *Graduate Catalog*. A total of 30 Graduate Credit Hours must be completed, with 15 of these hours at the 500 level or above.
2. Include as required courses the following: GEOG 500, Principles of Research, during the first fall semester in residence; GEOG 501, Seminar in Geography and Environmental Research, the following semester; GEOG 504, Spatial Analysis, or GEOG 512, Applied Geographic Statistics or equivalent, and one research seminar at the 500-level. GEOG 502, Geographic Information Systems is recommended depending on the student's background.
3. In consultation with an adviser, develop a program of study, identifying courses to be taken, research skills to be developed, deficiencies to be rectified. This shall be approved by the faculty. The program of study shall include a core of substantive courses in geography and environmental resources, as explained in the policy statement on core curriculum for master's degree students, available from the graduate program director. The program of study may include courses offered by other departments. The graduate faculty will meet to review and approve/disapprove the program of study of each master's degree student enrolled in GEOG 500. An approved program of study will be filed with the graduate program director and department chair as part of GEOG 500.
4. Develop a thesis or research paper proposal. The thesis or research paper proposal must be approved by the student's

master's advisory committee before the student registers for GEOG 599, Thesis, or GEOG 593A-C, Research in Geography and Environmental Resources. A total of six semester hours of GEOG 599 may be awarded for a thesis at the discretion of the advisory committee upon final examination on the thesis (see #5 below). A total of three semester hours may be awarded for a research paper.

5. Submit a thesis or research paper to the advisory committee at least two weeks before the defense. A student who writes a thesis will be examined by the committee at a meeting that may be attended by other faculty and students. A research paper may be evaluated and approved by the advisory committee with or without public presentation.

Certificate in GIS

The Graduate GIS Certificate enables students to focus on advanced geospatial techniques and analytical skills. This certificate meets the needs of the expanding job opportunities for Masters' and Ph.D. students. Students must be admitted to an SIU graduate program or the SIU non-declared graduate program and maintain a 3.0 GPA in the certification courses. This certificate ensures that the students understand advanced mapping technologies; know how to combine individual models and functions in ArcGIS to carry out a complicated spatial analysis task; master advanced digital image processing and analysis technologies; and obtain competence in designing, developing, and managing spatial databases. Further, they will demonstrate an understanding of GIS's relationships with remote sensing, global positioning system (GPS), mathematics, statistics, and other sciences and obtain capacity in integrating multi-disciplinary methods for problem-solving. Finally, they will be competent in planning, developing, and implementing a complex GIS project. The program requires students to complete 18 credit hours of graduate level coursework from the following:

- GEOG 502(3) Geographic Information Systems
- GEOG 504(3) Spatial Analysis
- GEOG 506(3) Intro to Remote Sensing
- GEOG 508(3) Advanced Remote Sensing
- GEOG 520(3) Advanced GIS Studies
- GEOG 528(3) GIS Portfolio/GIS Capstone Project

Certificate in Sustainability

The Graduate Certificate in Sustainability enables students to expand their knowledge and understanding of the long-term sustainable use of the earth's resources, including water, land use and food systems, climate change, urban sustainability, and "green" energy. This certificate meets the needs of the expanding job opportunities in environmental sustainability. Students must be admitted to an SIU graduate program or the SIU non-declared graduate program and maintain a 3.0 GPA in the certification courses. The program requires students to complete 18 credit hours of graduate level coursework, as follows:

- GEOG 524(3) Sustainable Development

Total of 15 or more Credit Hours from the following:

- GEOG 521(3) Urban Sustainability
- GEOG 522(3) Environmental and Energy Economics
- GEOG 526(3) US Environmental Policy
- GEOG 529(3) Geography of Local and Organic Food

- GEOG 531(3) Climatology
- GEOG 536(3) Natural Hazards
- GEOG 539(3) Global Climate Change
- GEOG 554(3) Conservation and Environmental Movements
- GEOG 570(3) Contemporary Issues in Environmental Studies

Students interested in Environmental Sustainability or Climate and Water Resources concentrations delivered through distance education should contact the Chair or Graduate Program Director to discuss opportunities for transfer credits and flexibility in course requirements. Requirements for the Doctor of Philosophy Degree (See Environmental Resources and Policy Ph.D. program.)

Courses (GEOG)

GEOG 419-3 Enterprise GIS Planning and Implementation. Students will gain both theoretical and practical understanding of the design process of enterprise GIS; be able to assess the scope of a system and address data and technology requirements of that system; become exposed to a host of the state-of-the-art tools and concepts in enterprise GIS; and learn skills for hardware, software and computer networking issues. Students are expected to have a basic working knowledge of ArcGIS and ArcIMS. Prerequisite: GEOG 401 or consent. Lab fee: \$20.

GEOG 430-3 Environmental Systems Analysis. Exploration of the major environmental systems relevant to planning. Topics include concepts of systems and system behavior; basics of systems analysis and modeling environmental systems; environmental fluxes of energy and materials (e.g., hydrologic cycle, carbon cycle, energy budgets, erosion and sediment transport, role of biosphere in organizing fluxes); environmental variability.

GEOG 452-3 Environment and Population. Introduction to population geography. Emphasis is on the relationships between population trends, resource use patterns and environmental impacts. Topics include methods and data used to describe and predict populations, theories of population and policy issues that relate to the interaction between population, quality of life and environmental quality. Prerequisite: GEOG 320 or consent of instructor.

GEOG 454-3 Conservation and Environmental Movements. Emphasizes the ways in which humans view and interact with the environment. Conservation literature and the works of influential environmentalists are studied. Specific theories and environmental movements which help to explain society's current perception and use of the environment are studied.

GEOG 457-3 American Environmental History. (Same as HIST 457) An exploration of the attitudes toward and the interaction with the natural resource environment of North America by human settlers. Coverage from the Neolithic Revolution to the present.

GEOG 458-3 Applied GIS. This course provides practical GIS applications and draws from special topics in data visualization and environmental applications. The topic on data visualization includes an overview of techniques for visualizing large-scale datasets and is inspired by concepts from information visualization. Topics in environmental applications consist of risk assessment, digital elevation model processing, and

watershed delineation and hydrological modeling. Students taking this course will distinctively learn: (1) how to visualize geographic data; (2) how to use different environmental risk assessment methods; (3) how to assess, detect, and characterize environmental risks and potential threats; and (4) how to create meaningful visualization scenes to support environmental decision-making. Active learning experiences will be achieved through the use of classroom lectures, lab exercises, group tasks, and presentations. Prerequisite: GEOG 401 or GEOG 310I or consent of instructor. Lab fee: \$20.

GEOG 471-3 Environmental Impact Analysis. Techniques of assessing the impact of human activities on the environment, including weighting schemes, cost-benefit analysis, linear programming, ecological impact assessment. Emphasis is on placing NEPA and EIS writing in legal, economic, and environmental perspective.

GEOG 481-3 to 12 Cooperative Work Experience in Geography. Placement of advanced undergraduate or graduate student in private or public organization for one or more semesters in paid career-related position identified by student. Student gains professional experience, under faculty and on-site supervision. A report or professional poster on the work is required at the end of the semester. Three credit hours of either 480 or 481 may apply toward requirements for a Geography undergraduate major or graduate degree. Restricted to students majoring in Geography and Environmental Resources or minoring in Environmental Studies. Special approval needed from the department.

GEOG 500-3 Principles of Research. This course teaches students the key components of graduate research: identify a research problem, determine research questions, structure a literature review, and develop research methods. Examples of geographic research are discussed and students work to identify independent research projects. The course culminates with students developing their own research proposals.

GEOG 501-3 Seminar in Geography and Environmental Research. Seminar approach to problems of completing background research design of project statements, identification of research methodology and completion of thesis/dissertation project statements. Restricted to graduate standing.

GEOG 502-3 Geographic Information Systems. This course will prepare students with comprehensive working knowledge and technical skills related to geographic information systems (GIS). It covers important topics in the context of GIScience, including coordinate systems and georeferencing, data structures (vectors and rasters), map principles and design, spatial analysis and modeling, GIS software, GPS, GIS data sources, and data uncertainty, which are critical to support the implementation of a GIS project. A series of GIS labs and a final class project will help equip students with necessary skills (e.g., mapping, spatial analysis, and geocoding) to fulfill the tasks of an entry-level GIS position. Recommended: GEOG 310I or CE 263. Lab fee: \$20.

GEOG 504-3 Spatial Analysis. This spatial analysis course is an introduction to statistical methods for geographers. The course provides an overview of the application of spatial statistical theories, concepts and approaches in the general context of the emerging fields of geographic information system (GIS) and science (GISci). The main focus of this course is on how techniques for the analysis of spatial data can effectively

be applied in a GIS environment, with a particular emphasis on the study of spatial patterns, distribution, and associations. Prerequisite: GEOG 401 or GEOG 502, with grade of C or higher, or consent of instructor. Lab fee: \$20.

GEOG 506-3 Introduction to Remote Sensing. An introduction to the fundamentals of remote sensing as applied to environmental management. This course will examine the theoretical and practical aspects associated with the use and analysis of aerial photography and satellite imagery. These include how remote sensing data are acquired, displayed, analyzed and how information on our environment can be extracted from such data. Students will be introduced to manual interpretation and digital image processing techniques of remotely sensed imagery. Students will have the opportunity to gain hands-on experience using image processing software. Lab fee: \$30.

GEOG 508-3 Advanced Remote Sensing. Advanced techniques in the analysis of remotely sensed data. Emphasis is placed on digital image processing using state-of-the-art technology. Students will be expected to develop individual problem-driven projects that use the knowledge, tools, and techniques that are developed in this course. Prerequisite: GEOG 406 or GEOG 506, with grade of C or higher, or consent of instructor. Lab fee: \$30.

GEOG 512-3 Applied Geographic Statistics. Introduction to basic statistical methods and skills related to the application of statistics to problems in geography. Lectures are supplemented with practical exercises to stress the applied nature of statistics in environmental decision making. Topics covered include descriptive statistics, time series, probability, point and interval estimation, hypothesis testing, correlation and regression, analysis of variance, and spatial statistics.

GEOG 516-3 Cartographic Design. Introduction to the concepts and principles of map design and automated cartographic techniques used to promote the understanding of a map as a powerful communication model. Examines techniques for the representation, manipulation, display, and presentation of spatial data using computer mapping techniques and graphics software. Team based projects will address a geographic problem and produce a professional final map. Prerequisites: GEOG 401 or GEOG 502, with grade of C or higher, or consent of instructor. Lab fee: \$20.

GEOG 517-3 GIS Programming and Customization. GIS programming trains students in customizing GIS applications and streamlining spatial analysis by assembling functions provided by the underlying GIS platforms. This course is an introduction to programming and scripting for intermediate GIS users who need to automate the geoprocessing of GIS datasets. This course focuses the most popular commercial platform, ArcGIS ModelBuilder and Python Scripting for ArcGIS. Through this course, students will understand the object-oriented programming principles, master the advanced skills of building a complex work flow for GIS analysis, and develop customized geoprocessing programs to edit, manipulate and analyze spatial data using ArcPy and Python. Prerequisite: GEOG 401 or GEOG 502, with grade of C or higher, or consent of instructor. Lab fee: \$20.

GEOG 520-3 Advanced GIS Studies. This course focuses on advanced conceptual and technical issues underlying GIS, including GIS data modeling, geodatabase model and

structure, analytical methods and procedures associated with geospatial modeling, and the latest developments in geospatial sciences. Laboratory assignments include the analysis of digital geographic information of physical and social phenomena, emphasizing the use of standard GIS software to illustrate techniques of geodatabase, map digitization, spatial data exploration, spatial analysis/modeling, and GIS-based decision support. Students have the opportunities of designing, implementing and presenting a GIS project that takes full advantage of the advanced GIS theories and techniques to solve spatial problems chosen by students. Prerequisite: GEOG 401 or GEOG 502, with grade of C or higher, or consent of instructor. Lab Fee: \$20.

GEOG 521-3 Urban Sustainability. Sustainability of urban areas is viewed from a geographical perspective to focus on the complex relationships among environmental, sociocultural, economic, and political phenomena. Considerable time is devoted to identifying, analyzing and explaining selected urban problems and their sustainable solutions.

GEOG 522-3 Environmental and Energy Economics. Economics of renewable and nonrenewable natural resources management and environmental policy. Topics covered include: static and dynamic efficiency, market efficiency and market failures (market power, externalities, and public goods), the economics of nonrenewable resource extraction, renewable resources management (with a focus on forests and water), mechanism design choices and their implementation in the real world, and the role of the private and public sectors in research and development.

GEOG 524-3 Sustainable Development. Analysis of the human, economic, technological, environmental and political dimensions of sustainable development focusing on public and private sector institutions that manage renewable and non-renewable natural resources. Emphasis is sustainable development as applied to: (a) population, (b) energy and the atmosphere, and (c) agricultural impacts on soil and water resources.

GEOG 526-3 US Environmental Policy. This course investigates the US system of environmental regulation: the background of social and environmental movements that influence US policy and the agencies involved in US environmental regulation. Emphasis is on US regulations and US participation in global environmental policies. Overall, the focus is on spatial variations in environmental regulations; or the geography of environmental quality.

GEOG 528-3 GIS Portfolio/GIS Capstone Project. Independent development and implementation of a major GIS project based on analysis of spatially referenced data sets to produce digital products and to solve real world problems. Data obtained from multiple sources, including downloads from online sources, field collected data, and published map data. A project portfolio and a poster approved by the instructor must be submitted for successful completion. Prerequisite: GEOG 401 or GEOG 502 and GEOG 406 or GEOG 506, with a grade of C or higher, or consent of instructor. Lab fee: \$20.

GEOG 529-3 Seminar: Geography of Local and Organic Food. A discussion of geographic topics in local and organic food and farming. This includes: spatial distributions, landscapes, policy influences, organic agricultural productivity, food safety, consumer concerns, organic farmers' decision making, organic

marketing, local food systems, and organic certification. Restricted to graduate standing.

GEOG 531-3 Climate Data and Analysis. This course focuses on identifying, locating, and applying appropriate climate data sets (e.g., station observations, atmospheric reanalyses, and climate model output), techniques for obtaining and processing these data sets, and methods commonly used for applied climate analysis. Student-lead, applied research projects provide students with the opportunity to utilize a variety of data sets and analytical tools introduced during the semester. The curriculum is organized around current practical problems from a variety of disciplines and identifying and analyzing appropriate data sets to address them. Students will become familiar with a range of computational packages, including Excel, SPSS, and Matlab. Students should have a basic understanding of climatology and statistics prior to taking this class.

GEOG 533-3 Advanced Field Methods in Geography. Quality geographic research depends on obtaining reliable data through an informed research design. Exploring both social and environmental processes, students will actively participate in developing and conducting investigations. Using the SIU Carbondale campus and surrounding region as a laboratory, lab exercises will include human geography, geomorphology, climatology and biogeography. Analytical techniques will include statistics and mapping. Lab fee: \$20.

GEOG 534-3 Water Resources Hydrology. This course covers the major components of the hydrologic cycle with emphasis on surface water and fluvial (stream) processes. Students will gain a detailed understanding of the major hydrologic processes and develop substantial experience in collecting, compiling, and analyzing hydrologic data for use in water resource analysis and management.

GEOG 536-3 Natural Hazards. This course introduces students to the geophysical and human dimension of natural hazards and focuses on five main areas: 1) characterization of natural hazards; 2) human dimensions of natural hazards; 3) natural hazard risk assessment; 4) natural hazard mitigation planning; and 5) the use of geospatial tools and models used in risk assessments and mitigation planning activities. Students will develop a fundamental understanding of both geophysical and human dimensions of natural hazards and an awareness of how natural hazards can develop into disasters.

GEOG 539-3 Seminar on Global Climate Change. This course examines the major environmental, social and policy issues relevant to global climate change, including natural and anthropogenic causes, environmental pollution, land use/land cover change, extinction and biodiversity issues, and potential climate change-related impacts on human health. Restricted to graduate standing.

GEOG 540-3 Water Resources Management. This interdisciplinary course is taught in a hybrid lecture/seminar style. Students review the physical science, biological science, and environmental policy which underpin water resource management. In addition, students explore human impacts on water resources and the role that water management plays in striking a sustainable balance between needs of humans and aquatic ecosystems.

GEOG 554-3 Conservation and Environmental Movements. Emphasizes the ways in which humans view and interact

with the environment. Conservation literature and the works of influential environmentalists are studied. Specific theories and environmental movements which help to explain society's current perception and use of the environment are studied.

GEOG 556-3 Geographic Visualization. This course will provide an overview of geographic visualization with a concentration on theories, concepts and approaches of information visualization. Lectures and laboratory exercises will focus on the practical issues of exploratory data analysis (EDA), cartographic design process, web cartography, data quality and generalization, thematic mapping, map animation and multimedia applications. The course will provide students with a working knowledge of commercial software commonly used for graphic-based applications. Students are expected to utilize the hands-on experience gained from the lab exercises to further enhance their proficiency in graphic software. Two hours of seminar and classroom presentations, two hours of studio exercises each week. Lab fee: \$30.

GEOG 570-3 Contemporary Issues in Environmental Studies. Background, current, and future issues linking social responses to scientifically relevant environmental issues. Students learn about the multiple geographic, social and ecological factors that influence environmental citizenship and participation. Topics include conservation/preservation, green jobs, environmental non-governmental organizations, policy influences, and environmental education. Lectures, guest lectures, and seminar style discussions. Students develop and demonstrate skills in problem solving, communication, and professionalism.

GEOG 580-3 Internship in Geography. Supervised field work in private or public organization dealing with environmental management or GIS. A report or professional poster on the work is required at the end of the semester. Special approval needed from the department.

GEOG 591-2 to 4 Independent Studies in Geography. Restricted to graduate standing.

GEOG 593A-2 to 24 (2 to 6 per semester) Research in Environmental Sustainability. Restricted to graduate standing.

GEOG 593B-2 to 24 (2 to 6 per semester) Research in Geographic Information Science. Prerequisite: GEOG 500 and GEOG 501. Restricted to graduate standing.

GEOG 593C-2 to 24 (2 to 6 per semester) Research in Climate & Water Resources. Restricted to graduate standing.

GEOG 596-2 to 4 Field Course. Restricted to graduate standing.

GEOG 599-2 to 6 Thesis. Restricted to graduate standing.

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

GEOG 699-1 Postdoctoral Research. Must be a Postdoctoral Fellow. Concurrent enrollment in any other course is not permitted.