

GEOGRAPHY AND ENVIRONMENTAL RESOURCES

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COLLEGE OF LIBERAL ARTS

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

Bigler, Wendy, Assistant Professor, Ph.D., Arizona State University, 2007; 2004.

Christensen, David E., Professor, *Emeritus*, Ph.D., University of Chicago, 1956; 1961.

Denise, Paul S., Assistant Professor, *Emeritus*, Ph.D., University of California, Berkeley, 1974; 1968.

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

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

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

Lant, Christopher L., Professor, Ph.D., University of Iowa, 1988; 1988.

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

Oyana, Tonny J., Assistant Professor, Ph.D., SUNY-Buffalo, 2003; 2003.

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

Schoof, Justin, T., Assistant Professor, Ph.D., Indiana University, 2004; 2006.

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

Therrell, Matthew D., Assistant Professor, Ph.D., University of Arkansas, 2003; 2007.

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

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 will 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 resources, geographic information science (GIS), and water resources management.

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 \$50.00 nonrefundable application fee that must be submitted with the application for Admissions to Graduate Study in Geography and Environmental Resources. Applicants may pay this fee by credit card if applying electronically. Applicants submitting a paper application must pay by personal check, cashier's check, or money order made out to SIU, and payable to a U.S. Bank. Do not send cash.

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 SCHs must be completed, with 15 of these hours at the 500 level or above.
2. Include as required courses the following: GEOG 500-2, Principles of Research, during the first fall semester in residence; GEOG 501-2, Seminar in Geographic and Environmental Research, the following semester; GEOG 404, Spatial Analysis, or equivalent, and one research seminar at the 500-level.
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 593, Research in Geography and Environmental Resources. A total of 4–6 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 2–3 semester hours may be awarded for a research paper.
5. Submit a thesis or research paper to the advisory committee at least 2 weeks before the comprehensive examination. 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 will be evaluated and approved by the advisory committee without public presentation.
6. Complete a comprehensive examination. The statement of departmental policy on the master's comprehensive examination is available from the graduate program director. The comprehensive examination and evaluation of thesis or research paper shall be at least 6 weeks prior to the student's projected graduation date. Upon approval of the comprehensive examination and the thesis or research paper, the advisory committee will request the chair of geography forward to the Graduate School the recommendation that the master's degree be awarded.
7. Persons employed by Federal or State water resources institutions choosing the Water Resources Planning concentration are required to take or receive transfer credit for Geography and Environmental Resources 422 or 522 (4), 425 (4), and 434 (4). These requirements replace GEOG 401 (3), 404 (3) or equivalent, 500 (2) and 501 (2).

Requirements for the Doctor of Philosophy Degree (See Environmental Resources and Policy Ph.D. program.)

Courses (GEOG)

401-4 Introduction to Geographic Information Systems. An introduction to geographic information system (GIS)-related topics, including GIScience (theoretical foundation), GIS technology (software training), and GIS applications (real-world solutions). Provides basic principles, concepts and applications of GIS in the context of GIScience - a basic research field, which seeks to redefine geographic concepts and their use. The theoretical foundations of GIS are informed by three basic areas: cognitive models of geographic concepts, computational and implementations of geographic models, and the interaction between GIS and society. Two hours of lecture and classroom presentations, two hours of laboratory exercises each week. Lab fee: \$20. Prerequisites: GEOG 310i or consent of instructor.

404-3 Spatial Analysis. This spatial analysis course is an introduction to statistical methods for geographers. The course provides an overview of the application of spatial data analysis techniques, with a concentration on 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, distributions, and associations. Two hours of lecture and classroom presentations, one hour of laboratory exercises each week. Prerequisite: 401 or consent of instructor.

406-4 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. One hour of lecture, two hours of lab each week. Lab fee: \$30.

408-4 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. Two hours of lecture, two hours of lab each week. Laboratory fee: \$30. Prerequisite: 406 or consent of instructor.

412-3 Applied Geographic Statistics. Introduction to basic statistical methods and skills related to the application of statistics to problems in geography. Lectures are supplemented with meetings in computer labs to stress the applied aspects of the course. Topics covered include descriptive statistics, time series analysis, probability, confidence intervals, hypothesis testing, correlation and regression, and spatial statistics.

416-4 Cartographic Design. Introduction to the concepts and principles of map design and automated cartographic techniques use 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. Laboratory fee: \$20. Prerequisite: 401 or consent of instructor.

417-3 GIS Programming and Customization. An intro to computer programming principles and their application in a Geographic Information Systems environment. GIS scripting language principles will be introduced and students will learn the structure of ArcObjects, the program organization of ESRI and ArcGIS products as well as the use of Visual Basic application to manipulate the basic mapping objects. Coursework will involve developing a more advanced program using an extension of choice. Prerequisite: GEOG 420 or consent of instructor.

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 420 or consent of instructor.

420-4 Advanced Geographic Information Systems (GIS) Studies. This course focuses on six emerging themes of geographic information science: geospatial ontologies, enterprise GIS, GIS design, geographic data mining and knowledge discovery, geographic data structure and algorithms, 3D imaging and visualization. A seminar approach will be adapted to organize the class into five groups to capture skills in computer programming, cognitive science, database design and systems, computational and mathematical knowledge, and 3D imaging and visualization. Five studio exercises to provide hands-on training and practice will be conducted in the GIS laboratory. Students will be expected to develop individual problem-driven projects that use the knowledge, tools, and techniques that are developed in this course. Two hours of seminar and classroom presentations, two hours of studio exercise each week. Lab fee: \$20. Prerequisite: 401 or consent of instructor.

421-3 Urban Geography. Urban geography is concerned with the spatial interpretations of city centered populations and phenomena. This course uses the geographical perspective to focus on the complex relationships between and among cultural, economic, environmental, political and social phenomena. Considerable time is devoted to identifying, describing, analyzing, and explaining selected urban problems. Prerequisite: 300i or consent of instructor.

422-4 Economics in Environmental Management. Economics of natural resources use and environmental policy with a focus on efficiency and sustainability. Cost-benefit, cost effectiveness, and policy analysis are applied to environmental management problems in water resources, energy, agriculture, global warming, and other problem areas. Concepts addressed include discounting, uncertainty, risk, externalities, market failure, and policy tools available to governments. Prerequisite: 320, graduate standing or consent of instructor.

424-4 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 (1) population, (2) energy and the atmosphere, and (3) agricultural impacts on soil and water resources. Prerequisite: 422 or ABE 440 or consent of instructor.

425-3 Integrated Water Management. The course provides students with an understanding of the philosophy, procedures, techniques and products of Integrated Water Resources Management - a coordinated approach to land and water resources management at the strategic, regional scale. The course focuses on the tools to implement IWRM - in the enabling environment, institutional roles and the use of management instruments. Case studies and international experiences used to illustrate IWRM implementation failures and successes. Prerequisite: 320, 424 or consent of instructor.

426-4 Administration of Environmental Quality and Natural Resources. (Same as Political Science 445.) An examination of institutional arrangements and administrative practices in the protection and use of land, water, air, and mineral resources. The course includes analysis of responsibility and decision-making at all levels of government (federal, state, and local) as well as corporate, interest group, and individual responses to public programs. Particular attention will be given to administration of federal environmental quality legislation including the National Environmental Policy Act, the Clean Air Act, the Water Pollution Control Act, and the Surface Mining Reclamation Act. Prerequisite: 300 or consent of instructor.

428-3 GIS and Environmental Modeling. This course will examine the applications of advanced geographic information system (GIS) techniques in environmental management. Particular emphasis will be placed on how to use spatial modeling techniques to analyze environmental impacts of human activities. Topics include the nature of environmental modeling, acquisition and processing of GIS information, spatial models, GIS and modeling, spatial decision support systems, and model integration. These topics will be introduced with case studies. Students will have the opportunity to work on projects of interest to them. Two hours of seminar and classroom presentation, one hour of lab each week. Prerequisite: 401 and/or 406, or consent of instructor.

429-3 Geography and Organic Farming. (Same as Geography 529.) A discussion of geographic topics in organic farming including: spatial distribution of organic farms, agriculture and landscapes, policy influences on agriculture, organic agricultural productivity, food safety and consumer concerns, organic farmers' motivations and decisions, organic marketing, local food systems, and organic certification.

430-3 Environmental Systems Analysis. Exploration of the major environmental systems relevant to environmental 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.

431-3 Climatology. Contemporary view of climatology as an interdisciplinary science which focuses on advanced understanding of the physical processes that drive the climate system and the development of skills related to climate prediction and assessment of human impacts on global and regional climate. Prerequisite: 330 or 303i, or graduate-level status.

433-4 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 SIUC campus and surrounding region as a laboratory, lab exercises will include human geography, geomorphology, climatology and biogeography. Analytical techniques will include introductory statistics and mapping. Lab fee: \$20. Prerequisite: Open only to senior majors in Geography and Environmental Resources or consent of instructor.

434-4 Water Resources Hydrology. Microclimatic factors which affect the hydrologic events of various climatic regions are treated extensively. Methods of estimating geographic variations in hydrologic relations to climatic and microclimatic especially evapotranspiration, are compared and evaluated. Consequences of alternative land uses on climate and hydrology are considered regionally. Prerequisite: 303i or consent of instructor.

435-3 Energy Planning. Regional and national differences in energy supply and demand are reviewed followed by a study of current energy resources, the range of demands and environmental impacts. National and international planning strategies for dealing with changes in energy demand and supply are explored and assessed for present and future implementation probability.

436-3 Natural Hazards. This course develops the skills and perspectives needed to effectively manage natural and technological disasters. Major themes include risk analysis, hazard mitigation and preparedness, response and recovery of the economic and social infrastructure in areas impacted by earthquakes, floods, drought, toxic material releases and other catastrophic events. Geographic training places a geographer at the forefront of developing hazard management solutions for society.

438-3 Weather Forecasting. Analysis of meteorological forecasting technique including: (1) interpretation of satellite images and soundings, radar algorithms, severe weather models (NGM, ETA, RUC), and global warning forecasting models; and (2) prediction of air mass/front motion, cloud and precipitation formation, El Nino effects, and isentropic effects on the atmosphere. Charges not to exceed \$5.00 for field trips. Prerequisite: 330 or consent of instructor.

439-3 Global Climatic Change. (Same as 539.) (539 will have additional research paper requirements.) Climate change is emerging as one of the key environmental, economic and social issues of our time. This course explores this complex topic, focusing on its many components. Subjects to be covered include: (a) an overview of climate, climate variability and natural change; (b) man-induced causes of climate change; (c) social and environmental relationships; (d) international policy; and (e) understanding potential impacts. Prerequisite: GEOG 330 or 303i or consent of department.

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: 320 or consent.

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. Prerequisite: 320 or consent.

456-3 Geographic Visualization. This course will provide an overview of geographic visualization with a concentration on the 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 multi-media applications. The course will provide students with a working knowledge of commercial software commonly used for graphic-based applications. Students are expected to utilize their 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.

457-3 American Environmental History. (Same as History 456) 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.

458-3 Analysis of Risk and Bioterrorism Using GIS. Emphasizes the way in which Geographic Information Systems (GIS) technologies can be utilized to track and detect emergencies such as 911 response, crime, disease, bioterrorism, homeland security, emergency infrastructure, food and water security. Prerequisite: 401, 420, or consent of instructor.

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.

480-3 to 6 Internship in Geography. Supervised field work in private or public organization dealing with planning, environmental management, or cartography and geographic information management. A written proposal about the planned internship must be submitted to a faculty supervisor prior to beginning of the internship. A faculty supervised report on the work is required after the internship. Courses may be repeated, but no more than 3 credit hours of geography 480 or 481 may be applied to an undergraduate major. A graduate student may enroll for three credit hours. Prerequisite: geography major and consent of department.

481-6 to 12 Cooperative Work Experience in Geography. Placement of advanced undergraduate or graduate student in private or public organization in paid career-related position. Student gains professional experience under faculty and on-site supervision. A written proposal about the planned cooperative work experience must be submitted to a faculty supervisor before it begins. A report summarizing the work experience is required after the experience ends. Course may be repeated. Three credit hours of either 480 or 481 may apply toward requirements for a geography major; three additional credit hours may apply toward degree requirements as elective. Prerequisite: geography major and consent of department.

490-2 to 4 Readings in Geography. Supervised readings in selected subjects. Prerequisite: geography major, advanced standing.

500-2 Principles of Research. Problem identification in research, review of examples of geographic research, analysis of results of research and project statements are explored with appropriate faculty. Presentation of student research problems justification and identification of student program to complete degree are required.

501-2 Seminar in Geographic Research. Seminar approach to problems of completing background research design of project statements, identification of research methodology and completion of thesis/dissertation project statements. Prerequisite: graduate standing.

510-4 Multivariate Techniques in Geography. Introduction to matrices, vectors and linear equations; multiple regression and correlation, cononical correlation, multivariate analysis of variance and covariance, analysis of variance in two- and three-way designs, multiple discriminant analysis, classification procedures, introduction to elementary factors analysis. Examples and demonstrations of each method; basic introduction to computer applications of multivariate analyses. Prerequisite: graduate standing.

520-2 to 4 Seminar in Physical Systems Evaluation. Prerequisite: graduate standing.

521-2 to 4 Seminar in Resource Planning. Prerequisite: graduate standing.

522-4 Economics of Environmental Resources. A neo-classical, institutional and ecological economics approach to natural resources, environmental services, and policies governing them. Benefit-cost and cost-effectiveness analysis are applied to problems in various natural resource sectors and to analyzing environmental policies with an emphasis on water resources. Market failure in environmental services as well as valuation techniques and institutional arrangements to overcome it are also addressed in a sustainability context. These issues are addressed in a more advanced mathematical form than in Geography 422. Prerequisite: graduate standing.

524-2 to 4 Seminar in Water Resources Analysis (same as GEOG 425, 524 will have additional research paper requirements). The major goal of this course is to provide the student with the necessary quantitative skills and perspectives needed to assess water resources management problems. Prerequisite: graduate standing.

528-2 to 4 Seminar in Geographic Information Systems and Environmental Modeling. This course will examine the applications of advanced geographic information system (GIS) techniques in environmental management. Particular emphasis will be placed on how to use spatial modeling techniques to analyze environmental impacts of human activities. Topics include the nature of environmental modeling, acquisition and processing of GIS information, spatial models, GIS and modeling, spatial decision support systems, and model integration. These topics will be introduced with case studies. Students will have the opportunity to work on projects of interests to them. Two hours of seminar and classroom presentation, one hour of lab each week. Prerequisite: consent of instructor.

529-2 to 4 Seminar: Geography of Local and Organic Food. (Same as 429) (529 will have additional research paper requirements.) 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. Prerequisite: graduate standing.

539-2 to 4 Seminar on Global Climate Change. (Same as 439.) (539 will have additional requirements.) 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. Prerequisite: graduate standing.

591-2 to 4 Independent Studies in Geography. Prerequisite: graduate standing.

593A-2 to 24 (2 to 6 per semester) Research in Environmental Management. Prerequisite: graduate standing.

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

593C-2 to 24 (2 to 6 per semester) Research in Water Resources Management. Prerequisite: graduate standing.

596-2 to 4 Field Course. Prerequisite: graduate standing.

599-2 to 6 Thesis. Prerequisite: graduate standing.

600-1 to 32 (1 to 16 per semester) Dissertation. Prerequisite: graduate standing.

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 dissertation, thesis, or research paper. The student must have completed a minimum of 24 hours of dissertation research, or 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* only.