

INDIANA UNIVERSITY

University Graduate School
2005-2006
Academic Bulletin

Geography

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College of Arts and Sciences
Bloomington

Chairperson
Professor William R. Black*

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Graduate Faculty

(An asterisk [*] denotes membership in the University Graduate School faculty with the endorsement to direct doctoral dissertations.)

Professors

William Black*, Dennis Conway*, Christine Susan Grimmond*, Daniel Curtis Knudsen*, John M. Odland*, Sara C. Pryor*, Scott M. Robeson*, Hans Peter Schmid*,

Associate Professors

Charles Greer*, Tom P. Evans,

Assistant Professors

Constance M. Brown, Kelly Caylor, Philip Louis Keating

Emeritus Faculty

Don Bennett*, Ernest Wohlenberg*

Associate Scientist

Rebecca Barthelmie

Assistant Scientist

Danilo Dragoni

Senior Lecturer

Roman Zlotin *

Adjunct Professors

David B. Audretsch* (Public and Environmental Affairs), Bennet Brabson* (Physics), David MacKay* (Business), William J. McConnell-Science Officer, Theodore Miller* (Public and Environmental Affairs), Emilio Moran* (Anthropology, CIPEC)

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Adjunct Associate Professors

Timothy Brothers (Indianapolis), Gregory Olyphant* (Geological Sciences), John Ottensmann* (Indianapolis), Catherine Souch* (Indianapolis), Jeffrey Wilson (Indianapolis)

Adjunct Assistant Professors

Owen Dwyer (Indianapolis), Philip Stevens (Public and Environmental Affairs)

Director of Graduate Studies

Professor Hans Peter Schmid*, Student Building 120, (812) 855-6303

Degrees Offered

Master of Arts, Master of Arts for Teachers, Master of Arts in Geography and Master of Science in Environmental Science (SPEA), Master of Science, Master of Science in Geography and Master of Science in Environmental Science (SPEA), and Doctor of Philosophy

Special Departmental Requirements

(See also general University Graduate School requirements.)

Grades

B (3.0) average or higher; B in core courses.

Master of Arts Degree**Admission Requirement**

Undergraduate major in geography or its equivalent. Applicants not meeting this requirement may be expected to take additional work.

Fields of Study

Atmospheric Science, Human-Environment Interaction, Human Geography, and Geographic Information Science. For subfields available see section about doctoral study.

Course Requirements

A minimum of 30 credit hours, including a core curriculum consisting of G500, G501, and G504. In addition, each student should select one topical field of concentration and complete a sequence of courses involving a minimum of 9 graduate credits in that field (including at least one seminar).

Thesis or Research Papers

Students have the option of writing a thesis (G850) or two research papers (G845). Up to 6 credit hours are allowed for a thesis and up to 3 credit hours are given for each research paper.

Final Examination

Oral examination covering the topic of specialization, the thesis or research papers, and other aspects of geography.

Master of Science Degree**Admissions Requirement**

Undergraduate major in geography, atmospheric science, mathematics, physics, chemistry, biology, or equivalent. Applicants not meeting this requirement may be expected to take additional work.

Fields of Study

Atmospheric science or geographic information science.

Course Requirements

A minimum of 30 credit hours, including a core curriculum consisting of G500, G501, and G504. In addition, each student should select a topical field of concentration in either atmospheric science or geographic information science and complete a minimum of 9 graduate credits in that field (including at least one graduate seminar).

Thesis or Research Papers

Students have the option of writing a thesis (G850) or two research papers (G845). Up to 6 credit hours are allowed for a thesis and up to 3 credit hours are given for each research paper.

Master of Arts for Teachers Degree

Admission Requirements

A full undergraduate major in geography is not required, but applicants should have had introductory courses in physical, environmental, or human geography.

Program

An individual program of study will be arranged for each student. A general description of the M.A.T. requirements is found elsewhere in this bulletin.

Master of Arts/Master of Science in Geography and Master of Science in Environmental Science (Public and Environmental Affairs)

Admission Requirement

The Department of Geography and the School of Public and Environmental Affairs (SPEA) offer a three-year, 60 credit hour program that qualifies students for two master's degrees. A student must apply to and be accepted by the School of Public and Environmental Affairs for study toward the Master of Science in Environmental Science (M.S.E.S.) and by the Department of Geography and the Graduate School for study toward the M.A. or M.S. degree. The student must select an advisory committee of at least three faculty members representing both the Department of Geography and SPEA.

Course Requirements

A minimum of 60 credit hours, distributed as specified among the following six areas in environmental science and geography: (1) environmental sciences (12 cr.), (2) environmental management and policy (10 cr.), (3) environmental science electives (6-9 cr.), (4) geography (13 cr.) including core curriculum, G500, G501, and G504, and one 3-credit seminar, (5) geography electives (11 cr.), and (6) research (6 cr.).

Research Project, Thesis, or Research Papers

Students may opt for either a research project, thesis, or two research papers. They may complete up to 6 credit hours (of the 60 required) of area 6 (research) in SPEA E625 for a research project; GEOG G850 for a thesis; or G845 if choosing the option of two research papers. The research report, thesis, or research papers must be acceptable to the student's advisory committee, the director of graduate studies in geography, and the director of the M.S.E.S. program.

Doctor of Philosophy Degree

Admission Requirement

M.A. or M.S. degree in geography or related discipline.

Fields of Study

Atmospheric Science, Human-Environment Interaction, Human Geography, and Geographic Information Science. Within these broad fields, students may develop research specializations in subfields. In Atmospheric Science, general fields of active research include air pollution meteorology, micro- and boundary-layer meteorology, forest and urban meteorology, climatic change, and statistical climatology.

Within Human-Environment Interaction, the primary areas of research include human-environment interactions, resource management and sustainability, biogeochemical cycling, and global change. In Geographic Information Science (GIS), particular emphasis is placed on the application of GIS, remote sensing and statistical and numerical modeling. In Human Geography, areas of particular focus are development, location analysis, and land use, population, migration and labor markets, and transportation.

Course Requirements

A minimum of 90 credit hours, including dissertation (20 credit hours). Each student must select a major within the field of geography chosen from the fields of study listed above. Students must complete a minimum of 12 credit hours beyond the M.A. in the major. The dissertation must be written in the major field of study within geography.

Minors

At least one outside minor required. It should be closely related to the internal major and must be chosen from approved programs of study outlined in this bulletin (unless exceptions are approved by the University Graduate School).

Qualifying Examination

Written and oral, covering the areas of concentration, other aspects of geography, and the tentative dissertation problem.

Research Proposal

The proposed research for the dissertation must be approved by the research committee and presented at a departmental colloquium.

Final Examination

Oral defense of the dissertation.

Ph.D. Minor in Geography

The requirements for the Ph.D. minor are flexible. A student's specific program should be developed in consultation with the minor-field advisor in geography. Typical fields include Atmospheric Science, Human-Environment Interaction, Human Geography, and Geographic Information Science. A minimum of 9 credit hours of course work, including at least one graduate seminar, is required.

Courses

G425 Africa: Contemporary Geographic Problems (3 cr.)

G427 Russia and Its Neighbors (3 cr.)

G428 Geography of Europe (3 cr.)

G500 Research Problems in Geography (4 cr.) Examination of current research areas and research problems in geography. Introduction to research design and research methods.

G501 Research Problems in Geography II (3 cr.) P: G500. Further development of research formulation and design skills. Approaches to geographic research and the preparation of research problem statements and proposals that may lead to thesis or dissertation research. May be repeated for a maximum of 6 credits in second graduate degree.

G502 Introduction to Transportation Analysis (3 cr.) An examination of classical and contemporary approaches to the analysis of transport systems, spatial interaction, sustainable transport, and related environmental and economic aspects of transport at regional and national scales.

G504 Advanced Quantitative Methods in Geography (3 cr.) P: G488 or G588 or equivalent. Further development of quantitative techniques to geographic problems. Methods of multivariate analysis, multiple response models, and mapping of three-dimensional or greater space.

G505 Hydroclimatology (3 cr.) P: G304 or G532 or consent of instructor. Hydroclimatic processes at a range of spatial scales. Topics include cloud and precipitation processes, soil water physics, runoff, and evaporation. Lecture and laboratory.

G506 Sustainable Transportation (3 cr.) P: G502. An examination of non-sustainability in the transport sector. Problems of petroleum depletion, air quality and its impact on human health, carbon dioxide emissions and their impact on global warming, transport accidents and congestion are examined along with planning, policy, and technological solutions to these problems.

G507 Climate Dynamics (3 cr.) P: G304 or G532 or consent of instructor. Climate and its interannual and longer-term variations from the perspectives of theory, observations, and modeling. Topics include climate sensitivity, stability, and feedbacks; oceans-air-land-ice interactions; teleconnections and their regional expression; drought; climate reconstruction, and prediction using numerical models.

G508 Mathematical Models in Geography (3 cr.) P: G504 or consent of instructor. An examination of formal mathematical models of spatial processes and spatial structures. Emphasis on optimization models of location and movement, spatial equilibrium models, and probabilistic models of spatial patterns.

G509 Seminar in the History and Philosophy of Geography (3 cr.) P: consent of instructor. This course examines the history of geography. Particular reference is made to the use of philosophical traditions of positivism, structuralism, humanism, and postmodernism within geography and to the major debates about philosophy and methodology in the last two centuries within the discipline.

G511 Sustainable Development Systems (3 cr.) P: G208 or consent of instructor. An examination of the notion of sustainable development and its meaning and implementation in the areas of resources, agriculture, water, transport, cities, and tourism. Also considers how such systems can be implemented in developed countries.

G512 Urban Transportation Analysis (3 cr.) P: G312 or G502 or consent of instructor. Aspects of urban transportation planning process. Existing travel patterns, variations in trip generation, spatial interaction and distribution models, assignment of trips to existing networks, and the evaluation of future networks.

G513 Advanced Economic Geography (3 cr.) P: G313 or consent of instructor. Advanced economic geographic theory and location decision making. Applications include agricultural, industrial, and commercial location decision making as well as geographic understanding of the wider regional development process. Students will be expected to demonstrate understanding of theories and location decision making graphically and mathematically.

G514 Regional Transport Systems (3 cr.) P: G312 or G502 or consent of instructor. Theoretical and empirical analysis of transport problems and policies for state and multi-state areas. Network measurement, location theory, and flows. Regional transport planning methods for flow forecasting, flow distribution, modal choice, impact analysis, and alternative evaluation.

G515 Sustainable Urbanism (3 cr.) P: G314 or consent of instructor. In-depth examination of "green urbanism" and sustainable urban development. Sustainable urbanism is viewed as an integral part of, and not distinct from, global environmental sustainability. Lessons from European cities inform the assessments of North America's urban future.

G517 Geography of Developing Countries: Critical Perspectives (3 cr.) Critical examination of development theories and development experiences of Third World countries in recent times. Emphasis is on global structural forces, spatial processes, political ecological relations of the poor, and the processes of migration, urbanization, rural development, and resource exploitation.

G519 Urban Land Use Planning (3 cr.) P: G314, G415, or consent of instructor. Land use planning principles including the comprehensive planning process, land use assessment, urban design, zoning and

land use regulation, site and subdivision design, capital improvements, and historical preservation. Emphasizes applied aspects of land use planning in public and private sectors.

G520 Migration and Population Redistribution (3 cr.) P: G314, G320, or consent of instructor. Study of international regional and intraurban migration using micro- and macro-level approaches, and the impacts of population redistribution on origin and destination. Topics include illegal immigration to the U.S., rural to urban migration in LDCs, international migration and refugees, and gender differences in migration behavior.

G530 Transport Planning Topics (3 cr.) P: G312 or G502 or consent of instructor. Developments in transportation planning. Topics such as rail planning, urban transit planning, transportation of energy, entropy flow models, behavioral travel models. May be repeated three times for a maximum of 9 credit hours.

G531 Dynamic Meteorology (3 cr.) P: MATH M211-M212, PHYS P201 or P221 (P221 recommended), GEOG G304 or G532 or consent of instructor. Introduction to dynamical processes and analysis in the atmosphere. Principles of fluid dynamics and their application to the atmosphere. Basic conservation laws and equations of motion. Circulation and vorticity. Dynamics of synoptic systems: quasigeostrophic analysis; oscillations and waves; baroclinic instability; and cyclogenesis. General circulation. Numerical modeling.

G532 Physical Meteorology and Climatology (3 cr.) Fundamental atmospheric properties and interrelationships. Radiation theory, components of energy and moisture balance, atmospheric circulation, upper-air surface relationships, and global weather system.

G533 Synoptic Meteorology and Climatology (3 cr.) P: G304 or G532 or consent of instructor. Analysis and prediction of synoptic scale weather systems, emphasizing the mid-latitudes. Other topics covered include severe weather and atmospheric/oceanic teleconnections.

G534 Air Pollution Meteorology (3 cr.) P: G304 or G532 or consent of instructor. Analysis of the physical laws that govern the transport, transformation, and removal of atmospheric pollutants. Primary emphasis will be on physical and chemical processes, although biological impacts will also be considered.

G535 Introduction to Remote Sensing (3 cr.) Principles of remote sensing of the earth and its atmosphere, emphasizing satellite data in visible, infrared, and microwave portions of the electromagnetic spectrum. Emphasis on practical applications and digital image analysis. A satellite data analysis project is required.

G536 Advanced Remote Sensing: Digital Image Processing (3 cr.) P: G535 or consent of instructor. Advanced remote sensing theory and digital image processing techniques with an emphasis on environmental science applications. Hands-on computer exercises provide significant experience in digital image processing techniques for extraction of qualitative and quantitative information about Earth's terrestrial and aquatic environments.

G537 Computer Cartography and Graphics (3 cr.) compilation, design, production, and evaluation of maps and related graphic materials. Includes cartometric procedures, symbolization, color use guidelines, map typography, photographic manipulations, computer animation, and geographic visualization techniques.

G538 Geographic Information Systems (3 cr.) Overview of the principles and practices of Geographic Information Systems (GIS). Spatial data models, database design, introductory and intermediate GIS, operations and case studies of real-world GIS applications. Laboratory exercises will provide significant hands-on experience. Lecture and laboratory.

G539 Advanced Geographic Information Systems (3 cr.) P: G538 or consent of instructor. Intermediate and advanced topics in geographic information science and spatial analysis techniques using GIS software. This advanced course is for students who seek a greater understanding of this rapidly developing field and want to learn how to construct, manage, and analyze their own GIS data and models.

G540 Topics in Environmental Geography (3 cr.) P: G305 or G315 or consent of instructor. Selected topics focus on the human dimensions of environmental change/conservation. Example focus topics: population-environment interactions, transport-environment interactions, and urban-environment interactions. May be repeated four times with a different topic for a maximum of 12 credit hours.

G542 Sustainable Energy Systems (3 cr.) Examination of the complex interactions between the production and consumption of energy resources and the socio-economic and environmental effects of these processes. Reasons for current energy systems being non-sustainable and the potential for developing alternative renewable energy sources and the problems associated with these are examined.

G543 Cognitive Mapping and Spatial Analysis (3 cr.) An examination of theoretical, experimental, and empirical studies of cognitive mapping of spatial phenomena. Application of analytical procedures in the construction and analysis of cognitive maps is stressed.

G550 Instrumentation and Field Methods in Atmospheric Science (3 cr.) P or C: G304 or G532 or consent of instructor. Sampling, instrumentation, measurement, analysis, and interpretation of data concerning features and processes of the atmospheric environment. Use of field and laboratory equipment within the context of research and standard projects. Practical application of climatological and meteorological principles.

G560 Geography Internship (1-4 cr.) P: graduate level courses in geography and consent of instructor. Faculty-directed study of geographical problems based on an internship experience. Student's area of placement must be related to major field of study. Offered fall, spring, and each summer session. Student may complete more than one internship, but total credit earned cannot exceed 4 credit hours.

G570 Micrometeorology (3 cr.) P: G304 or G532, MATH M211-M212, or consent of instructor. Atmospheric processes at the micro and local scale. Topics include energy and mass exchange over simple non-vegetated surfaces, vegetated surfaces, non-uniform terrain, and inadvertent climate modification.

G571 Topics in Micro- and Boundary- Layer Meteorology (3 cr.) P: G570, MATH M211-M212, PHYS P201 or P221 (P221 recommended), or consent of instructor. Topics may include surface-vegetation-atmosphere interaction; dynamics of turbulent transport; boundary-layer dynamics; turbulent kinetic energy and stability; dimensional analysis and similarity theory; effects of surface inhomogeneity on boundary-layer dynamics; patchiness; urbanization; regional aggregation of surface atmosphere exchange; applications to mesoscale modeling and air pollution dispersion modeling.

G572 Advanced Instrumentation and Field Methods in Atmospheric Science (3 cr.) P: G350 or G550 or consent of instructor. Sampling, instrumentation, measurement, analysis and interpretation of data concerning fluxes and variables in the boundary layer. Emphasis is on research and practical applications of micrometeorological principles.

G573 Topics in Mesoscale Meteorology (3 cr.) P: MATH M211-M212 PHYS P201 or P221 (P221 recommended), and GEOG G304 or G532 or consent of instructor. Topics may include application of principles of dynamic meteorology and thermodynamics to mesoscale atmospheric phenomena; mesoscale circulations and boundary layer; fronts and frontogenesis; hurricanes and tornadoes; and flow topography interactions.

G575 Climate Change (3 cr.) P: at least two undergraduate courses in the physical sciences or consent of instructor. Evidence for and theories of climate change over a range of time scales. Sources and

interpretation of proxy climate data are presented along with modeling tools for assessing climate response to a range of forcing and paleoclimate perspectives on future climate change.

G577 Topics in Atmospheric Science (3 cr.) P: G304 or G532 or consent of instructor. Selected topics in microclimatology, dynamic meteorology, statistical methods in climatology and meteorology. May be repeated for a maximum of 12 credit hours.

G588 Applied Spatial Statistics (3 cr.) P: consent of instructor. Extension of traditional statistical analysis to spatial data. Spatial means and spatial variances, the examination of differences in samples over space, spatial autocorrelation, nearest neighbor analysis, map comparison techniques. Emphasis on practical applications.

G589 Atmospheric Data Analysis (3 cr.) P: an introductory course in statistics or consent of instructor. Introduction to methods of data analysis used in the atmospheric sciences, emphasizing applications. Topics include statistical forecasting, spatial interpolation, spectral analysis and filtering, vector data analysis, and model evaluation.

G602 Topical Seminar in Atmospheric Science (3 cr.) Topics will vary to consider aspects of atmospheric science. May be repeated for a maximum of 12 credits.

G603 Topical Seminar in Urban and Regional Systems (3 cr.) P: consent of instructor. Topics will vary to consider aspects of urban and regional geography. May be repeated for a maximum of 12 credits.

G604 Topical Seminar in Environmental Geography (3 cr.) Topics will vary to consider aspects of environmental geography. May be repeated for a maximum of 12 credits.

G639 Topical Seminar in Geographic Information Science (3 cr.) Applications of geographic information science principles in the collection and analysis of spatial data. Integration of GIS, remote sensing, and GPS technologies. Review of current literature on techniques, theory, technology, and applications with an emphasis on environmental topics. Discussion, laboratory, and research project.

G830 Readings in Geography (cr. arr.; 12 cr. max.) P: advanced courses in geography or closely related fields. Supervised readings on selected topics.

G831 Advanced Research in Geography (1-6 cr.) P: Consent of faculty member. Individual research. S/F grading.

G840 Research in Geography (cr. arr.)** P: consent of faculty member. Individual research.

G845 Master's Papers (1-6 cr.) P: consent of instructor. Research papers under supervision of faculty.

G850 Master's Thesis (cr. arr.; 6 cr. max.)** Thesis.

G860 Ph.D. Thesis (cr. arr.)**

Education

M530 Geography in Education (2 cr.)

Graduate

G591 Methods of Population Analysis and Their Applications (3 cr.)

**These courses are eligible for a deferred grade.