Geography and Atmospheric Science

Geography as an academic discipline studies the spatial dimensions of, and links between, culture, society, and environmental processes. The study of Atmospheric Science involves weather and climate and how those affect human activity and life on earth. At the University of Kansas, our department's programs work to understand human activity and the physical world.

Why study geography?

Because people, places, and environments interact and evolve in a changing world. From conservation to soil science to the power of geographic information science data and more, the study of geography at the University of Kansas prepares future leaders. The study of geography encompasses landscape and physical features of the planet and human activity, the environment and resources, migration, and more. Our program (http://geog.ku.edu/degrees/) has a unique cross-disciplinary nature with pathway options (http://geog.ku.edu/geography-pathways/) and diverse faculty (http://geog.ku.edu/faculty/) who are passionate about teaching and research. Our students are engaged through internships, undergraduate and graduate research, departmental organizations, and events. Alumni work in a variety of fields including academia, business, conservation, environmental regulation, GIS, regional planning, resource management, soil science, urban planning, and more. A variety of scholarship opportunities are offered through both the University of Kansas and the Department of Geography and Atmospheric Science for qualified undergraduate and graduate students.

Why study atmospheric science?

The study of atmospheric processes enables us to understand human interactions with the environment and generate solutions that make a real difference in people’s lives. The atmospheric science program at the University of Kansas is the only one of its kind in the state, following national meteorological guidelines set by both the American Meteorological Society (AMS) and the National Weather Service (NWS). Our program provides students with a solid foundation, but also options. Our students are engaged through research, internships, and several student organizations including the KU Chapter of the American Meteorological Society (AMS), which sponsors an annual Douglas County Severe Weather Symposium, in addition to monthly events. We recently partnered with the National Weather Service to provide opportunities for students to explore work in a variety of NWS regional offices through the Student Career On-Site Training (SCOut) program.

Facilities

The Department of Geography and Atmospheric Science is housed in Lindley Hall on the KU Lawrence campus, which includes multiple laboratories, computer labs, and a weather station. Additionally, the KU Field Station just north of Lawrence provides students an outdoor lab for field work, research projects and more. The station, established in 1947, is part of the National Ecological Observatory Network (NEON), a National Science Foundation initiative. Classes are held in both Lindley Hall and the new Earth, Energy, and Environment Center.

Geography labs include multiple computer labs and those for Soils and Geomorphology, Palynology, and Pedology. Additional campus resources include the map collections of the Spencer Research Library and University Map Library. The University of Kansas

Undergraduate Programs

Geography

Geography integrates information from a variety of sources to study the nature of culture areas, the emergence of physical and human landscapes, and problems of interaction between people and the environment. Mapping and other techniques for gathering and displaying spatial information are integral parts of the field. We offer BA, BGS, and BS undergraduate degrees in Geography as well as a minor with an emphasis in General Geography or Geographical Information Science (GIS). We also offer an undergraduate GIS Geographical Information Science Certificate.

Geography Pathways include:
Geopolitics and Political Geography, Geospatial Analytics/Geoinformatics, Climate and People, Soils and Ecohydrology, Urban/Economic Geography, and People, Migration, and Globalization.

Atmospheric Science

The atmospheric science program offers undergraduates a fundamental knowledge of the atmosphere and the weather it generates. Interactions between weather phenomena and human decisions and activities give the subject important applications. Several pathways lead to a Bachelor of Science degree, with concentration options in General Meteorology, Air Pollution Meteorology, Hydrometeorology, and News Media Forecasting. A Minor in Atmospheric Science is also available.

Students from other disciplines such as biology, math, psychology, environmental studies, and other subjects, have chosen to have a double major, adding Atmospheric Science to enhance their education, skills, and career options.

Courses for Nonmajors

All geography courses below the 500 level are open to nonmajors, as are several above that level.

Graduate Programs

Geography

The graduate curriculum emphasizes broad geographic training while encouraging in-depth commitment to specialized concentrations. Students also are encouraged to take course work outside the department that complements their degree programs. Programs are tailored by the student and advisor to conform to the student’s interests and needs, as well as to fulfill the general degree requirements.
The central thrust of the department and the chief capabilities and interests of the faculty fall within these research-teaching areas:

1. Human geography including cultural geography, place, regional development, economic geography, health, diaspora, border conflicts, and environmental policy;
2. Geoinformatics including cartography, geographic information systems (GIS), and remote sensing;
3. Physical geography including geomorphology, soils, ecohydrology, and biogeography;
4. Regional geography including Africa, East Asia, Russia, Latin America, and the United States; and
5. Climatology.

Atmospheric Science

The purpose of the program is to expand the student’s knowledge of fundamental atmospheric processes and how the atmosphere interacts with other parts of the environment. Students become familiar with quantitative research methods and how these various approaches can be used to address different problems in atmospheric science. Students gain an in-depth ability to learn specific skills and apply them toward thesis work. These skills consist of, for example, statistical analysis techniques, numerical modeling, or work with atmospheric instrumentation. The breadth of the program and the diverse research topics explored by the faculty are able to accommodate students with a variety of interests.

Graduate Non-Degree Seeking Students

Students who are interested in enrolling in graduate level coursework in the Department of Geography and Atmospheric Science without formal admission to a graduate program at KU are encouraged to apply for graduate non-degree seeking status. See the department’s Admission webpage for further details.

Courses

**ATMO 105. Introductory Meteorology. 5 Hours NE GE3N / N / LFE.**

A lecture and laboratory course introducing students to the atmosphere, weather and climate phenomena, and their controlling physical processes. Topics covered include: the structure of the atmosphere, energy and energy budgets, climate and climate change, air pollution, clouds and precipitation, pressure and wind systems, severe weather, and weather forecasting. LEC.

**ATMO 106. Introductory Meteorology, Honors. 5 Hours NE GE3N / N / LFE.**

Honors version of ATMO 105. A lecture and laboratory course introducing students to the atmosphere, weather and climate phenomena, and their controlling physical processes. Topics covered include: the structure of the atmosphere, energy and energy budgets, climate and climate change, air pollution, clouds and precipitation, pressure and wind systems, severe weather, and weather forecasting. Prerequisite: Membership in University Honors Program or by permission of instructor. LEC.

**ATMO 177. First Year Seminar: _____, 3 Hours GE11 / U.**

A limited-enrollment, seminar course for first-time freshmen, addressing current issues in Atmospheric Science. Course is designed to meet the critical thinking learning outcome of the KU Core. First-Year Seminar topics are coordinated and approved by the Office of First-Year Experience. Prerequisite: First-time freshman status. LEC.

**ATMO 220. Unusual Weather. 3 Hours GE11/GE3N / N.**

An introductory lecture course which surveys the general principles and techniques of atmospheric science and illustrates their application through discussions of natural but unusual weather phenomena such as blizzards, hurricanes, tornados, and chinooks, of the effects of air pollution on weather, and of intentional human alteration of the atmosphere. LEC.

**ATMO 321. Climate and Climate Change. 3 Hours N.**

This course is designed to introduce students to the nature of the Earth’s physical climate. It introduces the basic scientific concepts underly our understanding of our climate system. Particular emphasis is placed on energy and water balances and their roles in evaluating climate change. The course also evaluates the impact of climate on living organisms and the human environment. Finally, past climates are discussed and potential future climate change and its impact on humans is evaluated. (Same as GEOG 321.) Prerequisite: ATMO 105 or GEOG 104. LEC.

**ATMO 499. Honors Course in Atmospheric Science. 2-3 Hours AE61 / N.**

Open to students with nine hours of upper level credit in Atmospheric Science, an average of at least 3.5 in all Atmospheric Science courses, and an overall average of at least 3.25. Includes the preparation of an honors paper and its defense before a committee of at least two regular faculty members. LEC.

**ATMO 505. Weather Forecasting. 3 Hours N.**

A first course in synoptic meteorology designed to introduce students to weather analysis and forecasting through the application of hydrodynamic and thermodynamic principles to operational analysis and forecasting. Topics include analysis and interpretation of surface and upper-air observations and data from satellites, radars, and wind profilers; chart and sounding analysis; and three-dimensional, conceptual models of weather systems. The course includes student-led weather briefings and analysis exercises. Prerequisite: ATMO 105 and MATH 125 or MATH 115. LEC.

**ATMO 521. Microclimatology. 3 Hours N.**

A study of climatic environment near the earth-atmosphere interface. Consideration of rural climates in relation to agriculture and urban climates as influenced by air pollution and other factors. Emphasis is on physical processes in the lower atmosphere, distribution of atmospheric variables, the surface energy budget and water balance. (Same as GEOG 521.) Prerequisite: ATMO 105 and MATH 125. LEC.

**ATMO 525. Air Pollution Meteorology. 3 Hours N.**

A study of background levels and concentrated sources of atmospheric pollution together with considerations of pollution buildup in urban areas as related to particular weather conditions. Inadvertent weather modifications and effects of atmospheric pollution on particular weather events and general climate will be discussed. Prerequisite: ATMO 105, MATH 125, EECS 138 and CHEM 130. LEC.

**ATMO 531. Topics in Atmospheric Science: _____, 1-3 Hours N.**

An investigation of special topics in atmospheric science. May include topics in dynamic, physical or synoptic meteorology or climatology as well as related topics in earth and physical sciences. May be repeated if topic differs. LEC.

**ATMO 605. Operational Forecasting. 2 Hours N.**

Students enhance their forecasting expertise by preparing forecasts for presentation to the public through a variety of media. Classroom activities include weekly map discussions and analysis of current weather situations. Forecasting topics such as forecast verification, aviation forecast products, severe weather, flash floods and watches and warnings are examined. Credit for ATMO 605, ATMO 606, and ATMO 607 is limited to a total of eight hours, six of which may be counted toward a degree in atmospheric science. Prerequisite: ATMO 505 and ATMO 640. FLD.
ATMO 606. Forecasting Practicum - Private Industry. 2 Hours AE61 / N.
Practical experience in private industry working with current and/or archived meteorological data. Possibilities include the preparation of forecasts for TV stations and meteorological consulting firms, and working with environmental consulting firms to assess air pollution hazards. May be repeated two times for credit. Credit for ATMO 605, ATMO 606, and ATMO 607 is limited to a total of eight hours, six of which may be counted toward a degree in atmospheric science. Prerequisite: Instructor permission. INT.

ATMO 607. Forecasting Intern - National Weather Service. 2 Hours AE52/AE61 / N.
Practical experience working in a National Weather Service forecasting center in analyzing weather data and preparing weather forecasts. May be repeated two times for credit. Credit for ATMO 605, ATMO 606, and ATMO 607 is limited to a total of eight hours, six of which may be counted toward a degree in atmospheric science. Prerequisite: Instructor permission. INT.

ATMO 615. Tropical Meteorology. 3 Hours N.
This course presents an undergraduate survey of tropical meteorology with an emphasis on clouds and convection ranging from fair-weather cumulus to hurricanes. Specific topics include the general circulation (climatological, air-sea interactions, Hadley and Walker circulation), convective processes in the topics (diurnal cycles, mesoscale convective systems, convectively coupled waves), and tropical variability (El Nino, Madden-Julian oscillation, monsoons, climate change). The genesis, thermodynamics, dynamics, and other topics related to tropical cyclones and hurricanes are also discussed. This course is offered at the 600 and 700 level with additional assignments at the 700 level. Not open to students with credit in ATMO 715. Prerequisite: ATMO 640 and/or instructor permission. LEC.

ATMO 630. Synoptic Meteorology. 3 Hours N.
Interpretation, development, and analysis of synoptic charts. Prerequisite: ATMO 505 and ATMO 640. LEC.

ATMO 634. Physical Climatology. 3 Hours N.
Atmospheric processes are described and discussed in relation to the climate of the earth's surface. Such topics as the greenhouse effect, ozone depletion, and the effect of solar irradiance on climatic change will be included. The physical processes and relationships between various climatic features will be studied. Prerequisite: ATMO 505 and DSCI 301 or MATH 526. LEC.

ATMO 640. Dynamic Meteorology. 3 Hours N.
This course introduces the student to the fundamentals of fluid dynamics necessary for understanding large scale atmospheric motions. Fundamental physical laws of conservation of mass, momentum and energy are examined and applied to atmospheric flows. Rotation in the atmosphere is examined quantitatively in terms of both circulation and vorticity. Prerequisite: MATH 127 and PHSX 214 or PHSX 212 and PHSX 236. LEC.

ATMO 642. Remote Sensing. 3 Hours AE61.
This course is designed to prepare students to effectively use remotely sensed data in operational or research settings for further work in this field. Topics include radiation and radiation transfer applied to active and remote sensing; radiative properties of space, sun, earth and atmosphere; instrument design considerations and operational characteristics; inversion methods for temperature or concentration profiling; surface temperature measurement; cloud top height determination; rain rate and wind velocity measurement; severe weather detection; satellite photograph interpretation. Prerequisite: ATMO 680, MATH 581. LEC.

ATMO 650. AdvancedSynoptic Meteorology. 3 Hours N.
Analysis and interpretation of synoptic weather charts including treatment of numerical weather forecasting. Prerequisite: ATMO 630 and ATMO 660. LEC.

ATMO 660. Advanced Dynamic Meteorology. 3 Hours N.
Advanced study of the atmosphere including treatment of the vorticity equation. Prerequisite: ATMO 640 and MATH 220 or MATH 320. LEC.

ATMO 680. Physical Meteorology. 3 Hours N.
This course is designed to enhance the student's understanding of atmospheric processes through the study of these processes at molecular through micro scales. Topics include the properties and behavior of gases; transfer processes; phase change; solar and earth radiation; cloud drop, ice crystal and precipitation formation; atmospheric electricity; stratospheric chemistry. Prerequisite: MATH 127; PHSX 214, or PHSX 212 and PHSX 236. LEC.

ATMO 690. Special Problems in Meteorology. 1-3 Hours N.
Prerequisite: Nine hours in meteorology. IND.

ATMO 697. Seminar for Seniors. 1 Hour AE61 / N.
Current research in atmospheric science will be discussed. May be repeated for a total of two credit hours. Prerequisite: Senior level in atmospheric science. LEC.

ATMO 699. Undergraduate Research. 2 Hours AE61 / U.
Work on a research project under the supervision of a faculty member. Prerequisite: Nine credit hours in atmospheric science. May be taken up to three times for credit. IND.

ATMO 710. Atmospheric Dynamics. 3 Hours.
Presentation of contemporary approaches to the study of atmospheric dynamics. May include methodologies that provide insight into global, synoptic, mesoscale or microscale motions. Prerequisite: ATMO 660 or equivalent. LEC.

ATMO 715. Tropical Meteorology. 3 Hours.
This course presents a survey of tropical meteorology at the graduate level with an emphasis on clouds and convection ranging from fair-weather cumulus to hurricanes. Specific topics include the general circulation (climatological, air-sea interactions, Hadley and Walker circulation), convective processes in the topics (diurnal cycles, mesoscale convective systems, convectively coupled waves), and tropical variability (El Nino, Madden-Julian oscillation, monsoons, climate change). The genesis, thermodynamics, dynamics, and other topics related to tropical cyclones and hurricanes are also discussed. This course is offered at the 600 and 700 level with additional assignments at the 700 level. Not open to students with credit in ATMO 615. Prerequisite: Instructor consent. LEC.

ATMO 720. Atmospheric Modeling. 3 Hours.
Illustration and application of contemporary approaches to mathematical and statistical description of atmospheric phenomena. Prerequisite: Consent of instructor. LEC.

ATMO 725. Clouds, Climate and Precipitation. 3 Hours.
This course includes seminar-style lectures and discussions bridging cloud physics, physical climatology, and climate dynamics with a central theme regarding how clouds and precipitation interact with the Earth's climate system. Specific topics include aerosol-cloud interactions, large-scale convective organization in the tropics, mid-latitudes, and polar regions, diabatic feedbacks on the general circulation, natural climate variability, and cloud effects in global climate models. How cloud systems have changed in recent decades, in addition to future model scenarios, are also discussed. LEC.
ATMO 731. Advanced Topics in Atmospheric Science: _____. 1-3 Hours.
Advanced investigation of special topics in atmospheric science. May include topics in dynamic, physical or synoptic meteorology or climatology as well as related topics in earth and physical sciences. May be repeated if topic differs. LEC.

ATMO 898. Readings in Atmospheric Science. 1-4 Hours.
Independent readings of special problems in Atmospheric Science. IND.

ATMO 899. Master's Thesis. 1-10 Hours.
Thesis credit. Graded on a satisfactory progress/limited progress/no progress basis. THE.

ATMO 998. Research in Atmospheric Science. 1-5 Hours.
Individual investigation of special problems in Atmospheric Science. RSH.

ATMO 999. Doctoral Dissertation. 1-10 Hours.
Enrollment course for writing doctoral dissertation in Atmospheric Science. Graded on a satisfactory progress/limited progress/no progress basis. THE.

Courses

GEOG 100. World Regional Geography. 3 Hours SC AE42 / S.
An introductory survey of the environmental setting, historically formative periods, and present-day issues that distinguish the major culture areas of the world. LEC.

GEOG 101. World Regional Geography, Honors. 3 Hours SC AE42 / S.
An introductory survey of the environmental setting, historically formative periods, and present-day issues that distinguish the major culture areas of the world. Open only to students in the College Honors Program, or by consent of instructor. LEC.

GEOG 102. People, Place, and Society. 3 Hours SC AE42/GE3S / S.
An examination of the relationships between humans and their environments. The course introduces students to basic concepts in human geography relating to economic activities, landscapes, languages, migrations, nations, regions, and religions. Serves as the basis for further course work in cultural, economic, political, population, and urban geography. LEC.

GEOG 103. People, Place, and Society, Honors. 3 Hours SC AE42/GE3S / S.
An introduction to how human societies organize space and modify the world about them. Resultant patterns on the landscape are interpreted through principles of space perception, cultural ecology, diffusion, land use, and location theory. Comparisons are made between urban and rural areas and between subsistence and commercial societies. Open to students who have been accepted into the College Honors Program. LEC.

GEOG 104. Introduction to Physical Geography. 3 Hours NE GE3N / N.
The components of the physical environment are discussed in order to familiarize the student with their distributions and dynamic nature. Major topics include the atmosphere, landforms, soils, and vegetation together with their interrelationships and their relevance to human activity. This course and GEOG 105 together satisfy the laboratory science requirement. Both courses are required for geography majors. LEC.

GEOG 105. Introductory Laboratory in Physical Geography. 2 Hours U / LFE.
A laboratory course designed to complement GEOG 104 in satisfying the laboratory science requirement. It is required for geography majors. Laboratory exercises include a wide variety of analyses using data on the atmosphere, hydrosphere, biosphere, and lithosphere. Prerequisite: GEOG 104, which may be taken concurrently. LAB.

GEOG 111. Mapping Our Changing World. 4 Hours N / LFE.
This course is an introduction to geospatial technologies. It focuses on the conceptual and technical aspects of mapping technologies that transform information about locations, people, objects, environments, events, and phenomena to digital representations of the world and as end-products of geospatial analysis. Topics covered include surveying, aerial photography and photogrammetry, satellite remote sensing, global positioning systems (GPS), geographic information systems (GIS), and thematic mapping. Students will learn how to acquire and develop geospatial data as the sources for mapping, the skills of analyzing and interpreting spatial information, and how geovisualization can be used in addressing real-world problems. (Same as GIS 111.) LEC.

GEOG 140. Global Environment I: The Discovery of Environmental Change. 5 Hours GE3S / U / LFE.
This interdisciplinary course and laboratory sections survey the foundations of environmental understanding and the process of scientific discovery from perspectives that combine the principles and methodologies of the humanities, physical, life and social sciences. Key topics include the history of environmental systems and life on earth, the discovery of biotic evolution, ecological change, and climate change. Laboratory sections apply the principles and methodologies of the humanities, physical, life and social sciences to earth systems and the development of environmental understanding using historical and present-day examples. (Same as EVRN 140 and HIST 140.) LEC.

GEOG 142. Global Environment II: The Ecology of Human Civilization. 5 Hours GE3S / U.
This interdisciplinary course and its laboratory sections survey the history of humanity's relationship with the natural world over the long term from perspectives that combine the principles and methodologies of the humanities, physical, life and social sciences. Key topics include the evolution of Homo sapiens and cultural systems; the development of hunter, gatherer, fisher, agricultural, and pastoral lifeways; the ecology of colonialism and industrial civilization, and the emergence of ideological and ethical perspectives on the relationship between nature and culture. Laboratory sections apply the principles and methodologies of the humanities, physical, life and social sciences to the humanity's engagement with the global environment using historical and present-day examples. (Same as EVRN 142 and HIST 142.) LEC.

GEOG 144. Global Environment I: The Discovery of Environmental Change, Honors. 5 Hours U / LFE.
This interdisciplinary course surveys the foundations of environmental understanding and the process of scientific discovery from perspectives that combine the principles and methodologies of the humanities, physical, life and social sciences. Key topics include the history of environmental systems and life on earth, the discovery of biotic evolution, ecological change, and climate change. Laboratory sections apply the principles and methodologies of the humanities, physical, life and social sciences to earth systems and the development of environmental understanding using historical and present-day examples. (Same as EVRN 144 and HIST 144.) Open only to students admitted to the University Honors Program or by permission of instructor. LEC.

GEOG 145. Global Environment II: The Ecology of Human Civilization, Honors. 5 Hours U.
This interdisciplinary course and its laboratory sections survey the history of humanity's relationship with the natural world over the long term from perspectives that combine the principles and methodologies of the humanities, physical, life and social sciences. Key topics include the evolution of Homo sapiens and cultural systems; the development
of hunter, gatherer, fisher, agricultural, and pastoral lifeways; the ecology of colonialism and industrial civilization, and the emergence of ideological and ethical perspectives on the relationship between nature and culture. Laboratory sections apply the principles and methodologies of the humanities, physical, life and social sciences to the humanity’s engagement with the global environment using historical and present-day examples. (Same as EVRN 145 and HIST 145.) Open only to students admitted to the University Honors Program or by permission of instructor. LEC.

GEOG 148. Scientific Principles of Environmental Studies. 3 Hours NB GE3N / N.
This course provides the scientific knowledge necessary to understand the changing relationships between humans and the natural environment, with an emphasis on the assessment of current environmental problems and critical evaluation of potential solutions. Major topics include fundamental scientific concepts and principles, interactions among the biological and physical components of the environment, implications of a growing human population, water resources, the atmosphere, climate, and energy sources. (Same as EVRN 148.) LEC.

GEOG 149. Scientific Principles of Environmental Studies, Honors. 3 Hours NB GE3N / N.
This course presents an overview of our understanding of environmental processes and issues. Topics include scientific principles, resource issues, pollution and global change, among others. This course gives students a rigorous understanding of interactions between humans and their environment and provides students with a scientific basis for making informed environmental decisions. An honors section of GEOG 148 designed for superior students. (Same as EVRN 149.) Prerequisite: Membership in the University Honors Program or approval of instructor required. LEC.

GEOG 150. Environment, Culture and Society. 3 Hours SC GE3S / S.
An introduction to geographic approaches to the study of the environment, emphasizing societal and cultural factors that influence human interaction with the biosphere, hydrosphere, lithosphere, and atmosphere. The course involves analysis of a broad range of contemporary environmental issues from the local to global scales. (Same as EVRN 150.) LEC.

GEOG 177. First Year Seminar: _____. 3 Hours GE11 / U.
A limited-enrollment, seminar course for first-time freshmen, addressing current issues in Geography. Course is designed to meet the critical thinking learning outcome of the KU Core. First-Year Seminar topics are coordinated and approved by the Office of First-Year Experience. Prerequisite: First-time freshman status. LEC.

GEOG 201. Culture and Health. 3 Hours AE42 / H/W.
This course offers a holistic, interdisciplinary approach to understandings of health, well-being, and disease within and across cultures. It draws upon the subfields of anthropology, as well as the humanities, natural sciences, and social sciences. This course should be of special interest to premedical students and majors in the allied health professions. (Same as AAAS 203 and GIST 210.) LEC.

GEOG 202. Culture and Health, Honors. 3 Hours AE42 / H/W.
Honors version of AAAS 203, GEOG 201 and GIST 210. This course offers a holistic, interdisciplinary approach to understandings of health, well-being, and disease within and across cultures. It draws upon the subfields of anthropology, as well as the humanities, natural sciences, and social sciences. This course should be of special interest to premedical students and majors in the allied health professions. (Same as AAAS 204 and GIST 211.) LEC.

GEOG 304. Environmental Conservation. 3 Hours NE GE3N / N.
A survey of current methods of describing and modeling the function, structure, and productivity of natural and anthropogenically modified earth resource systems, along with a discussion of contemporary views of what constitutes a natural landscape. Fundamental natural science principles about the interplay among lithospheric, atmospheric, hydrospheric, and biospheric components of earth systems are emphasized. Uses of natural resources, including fossil fuels, minerals, and water are described with attention to the earth’s total energy budget. Human activities that affect preservation, conservation, and multiple uses of earth regions receive attention. Systems under stress through population and other contemporary forces serve as examples. (Same as EVRN 304.) LEC.

GEOG 311. Introductory Cartography and Geovisualization. 4 Hours N / LFE.
This course is an introduction to cartography and focuses on computer-based map making skills. It begins with the history of cartography, cognitive maps, and the use of maps in the past and modern times. Topics covered in this course emphasize spatial data handling, principles of cartography and symbolization, map elements and design, and mapping techniques such as choropleth, proportional symbol and dot maps. Students will learn to adopt appropriate spatial data and mapping techniques to create accurate and creative digital maps reflecting given phenomena. LEC.

GEOG 316. Methods of Analyzing Geographical Data. 4 Hours N / LFE.
Introduces the benefits and limitations of using quantitative methods to analyze geographical problems. Covers traditional descriptive (e.g., measures of central tendency) and inferential statistics (e.g., hypothesis testing) but also inherently geographical approaches such as shape and point pattern analysis, and spatial autocorrelation. Laboratory emphasizes using the computer to explore and analyze geographical problems. LEC.

GEOG 319. Topics in Techniques: _____. 1-3 Hours N.
An investigation of special topics in Techniques. May include coursework in cartography, GIS, or remote sensing. May be repeated if topic differs. LEC.

GEOG 321. Climate and Climate Change. 3 Hours N.
This course is designed to introduce students to the nature of the Earth's physical climate. It introduces the basic scientific concepts underlying our understanding of our climate system. Particular emphasis is placed on energy and water balances and their roles in evaluating climate change. The course also evaluates the impact of climate on living organisms and the human environment. Finally, past climates are discussed and potential future climate change and its impact on humans is evaluated. (Same as ATMO 321.) Prerequisite: ATMO 105 or GEOG 104. LEC.

GEOG 332. Glaciers and Landscape. 3 Hours N.
Elements from glaciology, geology, and climatology are merged to examine the interactions between glaciers and their natural environments, including the processes involved in glacier formation, the relationship between glaciers and climate, the mechanisms of glacier flow, and interpretation of the Earth's glacial record. Emphasis is placed on an interdisciplinary approach to study environmental change and paleoclimate reconstruction. Prerequisite: GEOG 104 or GEOL 101, or consent of instructor. LEC.

GEOG 335. Introduction to Soil Geography. 4 Hours N / LFE.
This course focuses on the properties and processes of soils as they occur in their environment. The student is introduced to the nature of soil as it functions as a body: genesis of soils; properties of soil solids, especially colloids; soil chemical composition, properties, and reactions; interaction between solid, liquid, and gaseous components in soils; plant-soil-water relationships; biological interactions with soil; classification
of soils; and the distribution of soils on the landscape. Not open to students who have taken EVRN 535 or GEOG 535. (Same as EVRN 335.) Prerequisite: GEOG 104 or GEOG 101 or consent of instructor; BIOL 100 and CHEM 130 or CHEM 190 and CHEM 191 recommended. LEC.

GEOG 336. Introduction to Environmental Hydrology and Water Resources. 3 Hours N.
Water is vital to life on earth. In this course we cover components of the water or “hydrologic” cycle, how management has altered them, and how they are predicted to change with the changing climate. We discuss the evolution of water policy, its implications for managements and the economic impact of human perturbation on water. We study the physical processes that govern the water cycle, learn how they are measured, and estimate hydrologic fluxes. (Same as EVRN 363.) Prerequisite: GEOG 104 or GEOG 101 or GEOG 102. LEC.

GEOG 338. Introduction to River Systems. 3 Hours N.
A course of fluvial geomorphology. Topics include the drainage basin, fluvial processes, river channel adjustment and forms, human disturbance and geomorphic response, and research methods in fluvial geomorphology. Field trip. Prerequisite: GEOG 104. LEC.

GEOG 339. Topics in Physical Geography: _____ 1-3 Hours N.
An investigation of special topics in Physical Geography. May include coursework under headings of soils, vegetation, climate, or geomorphology. May be repeated if topic differs. LEC.

GEOG 351. Africa’s Human Geographies. 3 Hours NW AE42/GE3H/GE3S/S/W.
An introduction to historical, cultural, social, political, and economic issues in Africa from a geographic perspective. The course begins with the historical geography of humanity in Africa, from ancient times through to the present. Other topics include cultural dynamics, demography, health, rural development, urbanization, gender issues, and political geography. Case studies from Eastern and Southern Africa will be used to illustrate major themes. (Same as AAAS 351.) LEC.

GEOG 352. Economic Geography. 3 Hours S.
This course offers an overview of contemporary economic geography with an underlying theme of uneven regional development. Topics examined include: the historical context in which capitalism emerged; the major theoretical approaches used to understand the temporal and spatial dynamics of capitalist society; a series of case studies of different economic sectors; and the global economy, including its development with respect to colonialism, neocolonialism, international trade, third world development, and population growth. LEC.

GEOG 354. Globalization: A Geographic Approach. 3 Hours S.
This course is designed to provide a broad overview of some major facets of the historical, economic, political, cultural, and geographical dimensions of contemporary globalization, the process by which individual regions and nations have become progressively linked to, and structured by, the world-system of states and markets, and the cultural contradictions associated with this process. (Same as GIST 354.) LEC.

GEOG 356. Introduction to Geographic Information Systems. 4 Hours N / LFE.
An introduction to computer-based analysis of spatial data. Covers basic principles of collecting, storing, analyzing, and displaying spatial data. Emphasis is on problem-solving activities using common spatial analytical techniques (e.g., map overlay). The student will gain extensive hands-on experience with state-of-the-art GIS software. LEC.

GEOG 360. Computer Programming for Mapping and Spatial Analysis. 3 Hours N.
This course teaches basic computer programming concepts and skills for mapping and spatial analysis using various scripting languages. The goal is to enable students to write computer programs, develop mapping applications, and perform spatial data analysis. This course will lay the foundation for computerized problem solving skills that can be applied in later courses. This course assumes no previous programming experience. LEC.

GEOG 370. Introduction to Cultural Geography. 3 Hours GE3S/H.
Charts some of the major lines of research in cultural geography, including critical theory, political economy, poststructuralist thought, feminism, and global consumption. Through fieldwork, diverse research methods are applied to issues such as community development, cultural patterns on the landscape and global impacts on local economies. Prerequisite: GEOG 100, GEOG 101, GEOG 102 or GEOG 103; or consent of instructor. LEC.

GEOG 371. Environmental Geopolitics. 3 Hours S.
This course examines how human relationships with the biophysical world are politicized. Examines key contributions to debates surrounding environmental security, resource conflicts, and related issues, as well as geopolitical assumptions on which these debates build. (Same as EVRN 371 and GIST 371.) LEC.

GEOG 372. Environmental Policy. 3 Hours N.
An historical and analytical study of the formulation, implementation, and consequences of environmental policy in the United States. Attention is directed at relevant interest groups, issues specific to both rural and urban populations, relationships between national policies and international organizations concerned with environmental problems. Prerequisite: GEOG 148 or EVRN 148; and either EVRN 103 or HIST 103, EVRN 347 or HIST 347, or GEOG 150 or EVRN 150. LEC.

GEOG 373. Political Geography. 3 Hours S.
Political Geography is concerned with spatial dynamics of power. It concerns issues such as territory, boundaries, and identity as well as feminist, post-colonial, geopolitical, and environmental perspectives. This class will consider the development of this subfield, the role it has played in imperial expansion, and ways in which more recent critiques have shaped political geography to be a means of understanding different forms of power and its relationship to people and places. Prerequisite: GEOG 100 or GEOG 102 or equivalent or consent of instructor. LEC.

GEOG 374. Vulnerability and Adaptation. 3 Hours S.
The course objective is to understand and analyze human adaptation to environmental change by focusing on disasters and climate change. Each semester, the course rotates topics ranging from oil spills, hurricanes, sea-level rise to infectious disease. It provides undergraduate students with research experience and service learning, and offers opportunities for certificates through the Center for Undergraduate Research and the Center for Civic and Service Responsibility at KU. Students learn theories relevant to the case study, work in groups to generate research themes, conduct literature search and review, learn research methods, and write and present their work. LEC.

GEOG 377. Urban Geography. 3 Hours S.
This course explores the city from the multiple perspectives of its inhabitants. The cultural viewpoints of place, gender, age, and ethnicity are stressed. Traditional topics such as urban hierarchy, functions of the city, suburbanization, and ongoing changes in core and peripheral areas also receive attention. The distinctive landscapes of individual North American cities are emphasized, but examples also are drawn from throughout the world. LEC.

GEOG 379. Topics in Cultural Geography: _____ 1-3 Hours S.
An investigation of special topics in Cultural Geography. May include coursework under headings of culture theory, material culture, language, foodways, or religion. May be repeated if topic differs. LEC.
GEOG 390. Geography of the United States and Canada. 3 Hours S.
A study of the different physical, economic, and cultural settings in the United States and Canada which form the basis for the various forms of livelihood. Emphasis on the United States. (Same as AMS 390.) Prerequisite: An introductory geography course or background in the United States or Canadian history, social science, or culture or consent of instructor. LEC.

GEOG 395. Environmental Issues of: ______, 3 Hours S.
This regional geography course examines contemporary environmental issues of a particular region of the world based on the expertise of the professor. Course emphasis is on the interaction of natural, socio-economic, and cultural factors of development that give rise to environmental problems. Students learn how local, national, and international government and non-governmental stakeholders address environmental problems. Course may be repeated with different professors. LEC.

GEOG 396. East Asia. 3 Hours NW AE42/GE3H/GE3S / S/W.
This course is an introduction to the contemporary politics, economy, and culture of Korea, China, and Japan in the context of globalization. In addition to the discussion of individual countries, the course examines the cross-cutting themes such as international relations, cultural exchange, and economic development in the region of East Asia. LEC.

GEOG 397. Geography of Kansas and the Plains. 3 Hours S.
A study of the different physical, economic, and cultural settings in Kansas and the Plains that form the basis for various kinds of livelihood. LEC.

GEOG 399. Topics in Regional Studies: ______, 1-3 Hours S.
An investigation of special topics in Regional Studies. May include coursework related to a specific country or region. May be repeated if topic differs. LEC.

GEOG 451. Ecosystems Stewardship. 4 Hours.
This course sits at the crossroads between the discipline of ecology and the practice of stewardship, specifically the Indigenous Knowledge that is born from these landscapes over millennia in a place. Students will interact with research that establishes scientific foundations as a method to engage environmental problems in the anthropocene. The concept of stewardship is a core tenet of this course, students will engage with many approaches of stewardship, centering primarily on humans as a part of, not apart from, the environment. This course is offered at the 400 and 700 level with additional assignments at the 700 level. Not open to students with credit in EVRN 451 or EVRN 751, GEOG 451 or GEOG 759, BIOL 451 or BIOL 759. (Same as BIOL 451 and EVRN 451.) FLD.

GEOG 458. Geographical Information Systems: ______, 1-6 Hours N.
An introduction to the organization and components of geographic information systems and their software. Fundamental concepts and their implementation with applications to physical and human systems. LEC.

GEOG 490. Geographic Internship. 1-6 Hours AE61 / N.
Supervised practical experience. The student submits a proposal describing the internship prior to enrollment. Upon acceptance, regularly scheduled meetings with the advisor provide assistance, guidance and evaluation of progress in the professional experience. A written summary of the experience or outcomes of the research project are prepared independently by the student, a representative of the host agency, and the advisor. Total credit not to exceed six hours. Prerequisite: Fifteen hours of geography and permission of instructor. INT.

GEOG 498. Special Topics in Geography: ______, 1-5 Hours U.
Prerequisite: Fifteen hours of geography. IND.

GEOG 499. Honors Course in Geography. 2-3 Hours AE61 / U.
Open to students with nine hours of upper level credit in geography, an average of at least 3.5 in all geography courses, and an overall average of at least 3.25. Includes the preparation of an honors paper and its defense before a committee of at least two regular faculty members. IND.

GEOG 500. Senior Capstone in Geography. 3 Hours AE61 / N.
The capstone project provides students with a broad-based, interdisciplinary educational experience and allows them to integrate and synthesize the knowledge they have gained in their studies. The major goals of this course are to help students synthesize an integrated view of geography, advance steps toward career preparation, and develop networking and professional skills. The course will provide an overview of geography as a unified, coherent discipline with multiple perspectives, emphasize writing and analytical skills, introduce students to a major research project that integrates elements of physical and human geography, cultivate knowledge for future professional development, and introduce students to professional organizations. Students will gain experience applying and/or interviewing for professional positions and be introduced to multiple professional development and career services on campus. Graduate students may take this course by permission only. Prerequisite: Nine hours in Geography and status as a senior major in the department; or permission of instructor. LEC.

GEOG 512. Advanced Cartography and Geovisualization. 4 Hours N.
This is an advanced computer-based scientific cartography course. It covers mapping techniques such as dasymetric mapping, multivariate mapping, cartogram and flow map, map animation, geovisual analytics, web and interactive mapping, and mapping from remotely sensed imagery. This course focuses on practical and hands-on experience. Students will learn theoretical concepts, principles, and design examples, and produce a cartographic portfolio of well-designed and professional maps. Prerequisite: GEOG 311 or equivalent; or consent of instructor. LEC.

GEOG 516. Applied Multivariate Analysis in Geography. 3 Hours N.
An introduction to the application of multivariate statistical analysis in geography. Techniques covered include univariate and multivariate analysis of variance, multiple regression, logistic regression, principle components analysis, and spatial regression. Practical applications of the techniques in a geographical research context are emphasized. Students will learn how to use statistical packages such as SPSS. Prerequisite: GEOG 316 or equivalent. LEC.

GEOG 518. Geoinformatics Internship. 1-3 Hours.
Real world experience with geospatial technologies is not only essential for understanding and using geospatial knowledge but also beneficial for students to start a career path in geospatial technologies. Approved internships are supervised development and applications of geospatial technologies in business, government, non-profit, educational or other related fields. They can involve field work, data collection, processing, and analysis. Internship supervisors must agree to mentor the student and to complete necessary evaluations within a timely manner. Prerequisite: GEOG 358 or consent of instructor. INT.

GEOG 521. Microclimatology. 3 Hours N.
A study of climatic environments near the earth-atmosphere interface. Consideration of rural climates in relation to agriculture and urban climates as influenced by air pollution and other factors. Emphasis is on physical processes in the lower atmosphere, distribution of atmospheric variables, the surface energy budget, and water balance. (Same as ATMO 521.) Prerequisite: ATMO 105 and MATH 125. LEC.

GEOG 526. Remote Sensing of Environment I. 4 Hours N / LFE.
Introduction to study of the environment through air photos and satellite imagery, including principles of remote sensing, interactions of
electromagnetic energy with the atmosphere and earth's surface, aerial
photography, satellite systems, and sensors (electro-optical, thermal, and
radar). Emphasis in the latter part of the course is on such applications
as global monitoring, land cover mapping, forestry, agriculture, and
oceanography. Laboratory emphasizes visual interpretation of aerial
photography and satellite imagery and an introduction to digital image
processing in the department's NASA Earth Science Remote Sensing
Laboratory. (Same as EVRN 526.) Prerequisite: MATH 101 or equivalent.
GEOG 358 recommended. LEC.

GEOG 528. Spatial Databases. 3 Hours N.
This course covers concepts in spatial databases and their relevance in
geographic information systems (GIS) and spatial analysis. It introduces
the fundamental theories of data management behind Geographic
Information Systems and imparts hands-on experience with mainstream
spatial database management systems (DBMS), standard query
languages and necessary tools to query/transform geospatial data, and
perform spatial and network analysis. The course provides more in-depth
coverage on database-oriented approaches for GIS geospatial analysis.
Prerequisite: GEOG 358; or instructor permission. LEC.

GEOG 531. Topics in Physical Geography: _____. 1-3 Hours N.
An investigation of special topics in physical geography. May include
specific course work under the headings of geomorphology, climatology,
soils, vegetation, quaternary, paleoenvironments, hydrology, etc. May be
repeated, if topic differs. LEC.

GEOG 532. Geoaichaeology. 3 Hours N.
Application of the concepts and methods of the geosciences to
interpretation of the archeological record. The course will focus primarily
on the field aspects of geoaichaeology (e.g., stratigraphy, site formational
processes, and landscape reconstruction), and to a lesser extent on the
array of laboratory approaches available. (Same as ANTH 517.)
Prerequisite: GEOG 104, ANTH 110, or ANTH 310. LEC.

GEOG 535. Soil Geography. 4 Hours N / LFE.
A broad study of the principles and properties of soils and their distribution
on the landscape. Topics covered include: pedology, clay mineralogy, soil
physics, soil chemistry, management of soils, soil biology, taxonomy, and
soil geomorphology. Laboratory section and a field project are required.
Not open to students who have taken GEOG 335 or EVRN 335. (Same
as EVRN 535.) Prerequisite: GEOG 104 or GEOG 101 or consent of
the instructor; BIOL 100 and CHEM 130 or CHEM 190 and CHEM 191
recommended. LEC.

GEOG 538. Soil Chemistry. 3 Hours N / LFE.
This course examines the chemical properties and processes of soils and methods of evaluation. Topics include solid and solution
speciation, mineral solubility, soil colloidal behavior, ion exchange, surface
complexation, soil salinity and sodicity, soil acidity, oxidation-reduction
reactions, and kinetics of soil chemical processes. (Same as EVRN 538.)
Prerequisite: GEOG 335 or GEOG 535 or EVRN 335 or EVRN 535,
CHEM 135 or CHEM 195 and CHEM 196, MATH 125, or consent of the
instructor. LEC.

GEOG 540. Ecohidrology. 3 Hours N.
Ecohidrology is the discipline that answers real world hydrologic and
biological questions through integrating knowledge from hydrology,
ecology, atmospheric science and biogeochemistry. We focus on the key
concepts, methodological approaches and analytical techniques utilized
in ecohidrology to understand and quantify: plant water use, evolution of
hydrologic properties, groundwater-surface water interactions, controls
on landscape patterns, spatial and temporal patterns of soil moisture and
nutrient concentrations, and vegetation competition. Students should
leave the class having developed critical skills in: 1) reviewing scientific
literature, 2) collecting environmental samples, 3) analyzing ecohidrologic
data, 4) writing a scientific research paper, 5) working collaboratively and
independently. (Same as EVRN 540.) Prerequisite: GEOG 104 or GEOG
101 or GEOG 102, or EVRN 363 or GEOG 336 or permission of instructor.
LEC.

GEOG 541. Geomorphology. 4 Hours N / LFE.
A critical study of land forms in relation to tectonics, climatic environment,
and geologic processes. The use of geomorphic methods in the
interpretation of Cenozoic history is emphasized. Laboratory exercises in
analysis of field observations, maps, and photographs. Required field trip
and fee. (Same as GEO 541.) Prerequisite: GEOG 101 and GEOG 103,
GEOG 104 and GEOG 105, or GEOG 103 and GEOG 304. LEC.

GEOG 550. Environmental Issues in Africa. 3 Hours S.
Acquaints students with the complexities of debates on environmental
problems in Sub-Saharan Africa. Topics addressed may include
deforestation, desert expansion, wildlife conservation, soil erosion,
climate change, coral reef destruction, water resources development,
mangrove preservation, the environmental effects of war, industrialization,
and urbanization. Class presentations and projects synthesize the
perspectives of both human and physical geography. (Same as AAAS
551.) Prerequisite: GEOG 104 or permission of instructor. LEC.

GEOG 552. Topics in Urban/Economic Geography: _____. 1-3 Hours
S.
An investigation of special topics in urban/economic geography. May
include specific course work under the headings of energy, economic
development, international trade, environmental perception, housing,
transportation, and migration. May be repeated. LEC.

GEOG 553. Geography of African Development. 3 Hours NW AE42/
GE3H/GE3S / S.
Acquaints students with the values of social parameters of African
agricultural and pastoral practice. Topics include customary land rights,
African perspectives on the natural world, gender issues in African
agriculture, and the urbanization of African cultures. The course also
contrasts African views with those of Western development practitioners
and donor agencies. Case studies from different countries are used to
highlight the continent's regional differences. (Same as AAAS 553.) LEC.

GEOG 555. Seminar in Urban Geography. 3 Hours S.
This course is a survey of recent literature and conceptual advances
within the broad domain of urban geography. It begins by examining a
few classic works, and then explores several topics within urban political
economy, including the urban division of labor and restructuring, changing
modes of urban governance, suburbanization, gentrification, global cities,
and gender and the city. It also delves briefly into the issue of urbanization
in the developing world. (Same as GIST 555.) Prerequisite: Any upper
division course in human geography or urban planning. LEC.

GEOG 556. Geography of the Energy Crisis. 3 Hours S.
A discussion and analysis of the basic facts and causes of energy
problems on a national and world scale. Examines current production,
consumption, efficiency, reserves, conservation, and other energy policy
options, including adjustments that will affect consumer use, national
politics, and strategic issues. Prerequisite: GEOG 102. LEC.

GEOG 558. Intermediate Geographical Information Systems. 4 Hours
N / LFE.
An intermediate level course in geographic information science designed
for advanced undergraduate and graduate level students who already
have an introductory understanding of GIS. Emphasis will be placed on
the application of spatial analytical techniques to geographical problem-
solving. Topics include spatial data structures, interpolation techniques,
terrain analysis, cost surfaces, and database management technique.
Students will apply knowledge gained in lecture and reading to natural
resource, urban, and scientific applications using state-of-the-art GIS software. Prerequisite: GEOG 358 or consent of instructor. LEC.

GEOG 560. GIS Application Programming. 3 Hours N.
This course teaches programming within Geographic Information Systems. Students learn how to customize GIS applications to automate data processing and spatial analysis through programming languages. GIS programming concepts and methods are introduced from the aspects of spatial data management and analysis covering both the vector and raster data models. Prerequisite: GEOG 558 and a course in programming languages. LEC.

GEOG 570. Geography of American Indians. 3 Hours NW AE42/GE3H/GE3S/S.
A survey of the culture and history of selected indigenous peoples of the Americas. Emphasis is placed on the environmental setting, the settlement and subsistence patterns, and the impact of European colonization. Discussion includes present-day ethnic and resource issues. LEC.

GEOG 571. Topics in Cultural Geography: ______. 1-3 Hours S.
An investigation of special topics in cultural geography. May include specific course work under the headings of cultural theory and methodology, material culture, foodways, religion, and similar topics. May be repeated, if topic differs. LEC.

GEOG 574. Exploring Oceania. 3 Hours S.
Acquaints students with the culture and history of Oceania including its settlement and the impacts of European and American colonialism on Australasia, Melanesia, Micronesia and Polynesia. Emphasis is placed on applying broad geographical concepts to this vast Oceanic region through the lenses of development, media and migration studies. Prerequisite: GEOG 102 or GEOG 103; or consent of instructor. LEC.

GEOG 576. Cultural Geography of the United States. 3 Hours S.
Distributions of major culture elements including folk architecture, religion, dialect, foodways, and political behavior are systematically studied from a predominately historical perspective. These discussions are followed by a survey of the major culture regions in America. Although not absolutely necessary, familiarity with concepts treated in any of the following courses would be helpful: AMS 100, AMS 110, ANTH 108, ANTH 308, GEOG 102, or GEOG 390. (Same as AMS 576.) LEC.

GEOG 577. Human Dimensions of Global Change. 3 Hours S.
This class introduces concepts such as coupled human and natural systems, social-ecological resilience, and sustainability science, examines people's responses to major climate, land, water, and coastal change, and discusses case studies. One hour of each seminar will be devoted to individual needs that address topical or methodological issues. Class requirements include presentations, biweekly papers, and a term paper. (Same as GIST 577.) Prerequisite: One of the following: GEOG 100, GEOG 104, GEOG 374, or an Environmental Studies introductory course. LEC.

GEOG 578. Geopolitics and Genocide. 2-3 Hours S.
Explores the inherently geographical and geopolitical nature of genocide and related mass violence and introduces an overarching concept, territorial cleansing, that foregrounds the spatial and territorial nature of these events. Detailed studies of cases at a range of scales and locales provide the major context for critical examination and comparison of territorial cleansing concepts. Students enrolling for 3 credits will prepare and present a substantial independent research paper. (Same as GIST 582.) Prerequisite: GEOG 102 or GEOG 103; or ANTH 108 or ANTH 109; or permission of instructor. LEC.

GEOG 583. Migration, Diasporas and Development. 3 Hours S.
This course introduces students to key concepts in global migration and its implications on development in migrant sending states particularly those on the African continent. It will explore the various migration patterns from Africa (e.g. migration between North Africa and Europe in the aftermath of the Arab Spring), South-South migration, the 'brain drain' of skilled professionals and its implications for development, and the role of diasporas in development. The course will also assess the integration of migrants in major migrant destination regions. Finally, the course will provide students with an opportunity to critically examine the relationship between migration and development in a particular national context of their choice. (Same as AAAS 583.) Prerequisite: GEOG 102 or consent of instructor. LEC.

GEOG 586. Sustainable Food Systems and Food Security in the Global South. 3 Hours S.
The course adopts an interdisciplinary approach to study food systems and food security in the Global South. It incorporates multiple perspectives ranging from the local to the global level to explore the cultural, ecological/environmental, economic, sociopolitical, and ethical dimensions connected to the global food system. It also examines several dimensions of food insecurity. Students will also examine the impact of food insecurity on health as well as racial and economic disparities in access to food. The course will also examine the research and conceptualization of food systems and analyze concepts such as "food deserts," "food oases," "food swamps," and "food grasslands." We will examine food production and food acquisition strategies in low-income areas. Case studies will be drawn on experiences from diverse regions particularly Southern Africa even though other regions such as Latin America and Southeast Asia will be considered. Prerequisite: GEOG 102 or consent of instructor. LEC.

GEOG 590. Understanding Central Asia. 3 Hours NW / S.W.
An intensive, multidisciplinary survey of Central Asia, focusing on the former Soviet republics-Kazakhstan, Kyrgyzstan, Tajikistan, Turkmenistan, Uzbekistan-with additional coverage of neighboring regions (the Caucasus and the Caspian basin, Afghanistan, and western China). The course addresses the history of the region (from the Silk Road to Soviet rule), geography, religion, and the building of post-Soviet states and societies. (Same as REES 510.) LEC.

GEOG 591. Geography of Latin America. 3 Hours SC AE42/GE3S/S/W.
A study of the different physical, economic, and cultural settings in Latin America which form the basis for the various forms of livelihood. LEC.

GEOG 592. Middle American Geography. 3 Hours S.
This regional study of the natural environments and cultural-historical backgrounds of Mexico, Central America, and the Caribbean details the physical and historical processes that have shaped the cultural landscape. LEC.

GEOG 597. Geography of Brazil. 3 Hours S.
Study of geographic factors, physical and cultural, that are basic to understanding the historical development of Portuguese South America and the contemporary and cultural geography of Brazil. Course also includes a survey of Brazil's South American neighbors. LEC.

GEOG 601. Indigenous Peoples of the World. 3 Hours S.
A survey of the varied responses of global Indigenous peoples as a result of the imposition of external economic and political systems. An overview of diverse, thematic issues such as land rights, economic development, resources and cultural patrimony, languages, knowledge systems, and women's rights from the perspectives of Indigenous societies around the world. Detailed studies of Indigenous peoples seeking recognition and
protection under international law are used. (Same as GIST 601 and ISP 601.) Prerequisite: Permission of instructor. LEC.

GEOG 635. Soil Physics. 3 Hours N.
Provides theoretical and practical foundations for understanding physical properties and processes of variably-saturated porous media. Focus is on the transport, retention, and transformation of water, heat, gas, and solutes through the soil. We examine modern vadose zone measurement methods, analytical tools, and numerical models for data collection and interpretation. (Same as EVRN 635.) Prerequisite: GEOG 335 or EVRN 335; or GEOG 535 or EVRN 535, and MATH 125, PHSX 114; or consent of instructor. LEC.

GEOG 648. Location Modeling. 3 Hours N.
This course provides an overview of advanced location analysis and modeling in the context of GIS. Introduces students to principles of location analysis, methods for making strategic location decisions as well as existing classic location problems. Demonstrates analytical approaches by which location problems can be solved using mathematical programming, GIS and other optimization software. This course is a specialized course with an emphasis on the spatial analysis function of Geographic Information Systems, which covers many concrete applications of GIS geospatial analysis in urban planning, transportation, and service systems planning, ranging from firefighting stations to forestry management to transportation facilities. Prerequisite: GEOG 358; or instructor permission. LEC.

GEOG 658. Topics in Geospatial Technologies: ____. 1-6 Hours / LEC.
An investigation of special topics in geoinformatics. May include specific coursework under the headings of methodology, basic research, thematic or regional applications, geographic information systems (GIS), Global Positioning System (GPS), and geostatistics. May be repeated if topic differs. Prerequisite: GEOG 111 or GEOG 358 or consent of instructor. LEC.

GEOG 711. Advanced Topics in Geovisualization: ____. 4 Hours.
This course is an investigation of special topics in cartography and geovisualization. It takes the fundamentals learned in GEOG 311 and GEOG 512 and expands them in several aspects such as techniques and applications of web mapping, interactive web maps, virtual environments, volunteered geographic information (VGI), and uncertainty visualization. Prerequisite: GEOG 311 and GEOG 512. LEC.

GEOG 716. Advanced Geostatistics. 3 Hours.
An introduction to the practical application of advanced geospatial statistical techniques. Potential topics include: spatial regression, interpolation, clustering, and advanced nonparametric statistics. Knowledge of a statistical package and GIS is assumed. Prerequisite: GEOG 516 or equivalent and GEOG 358 or equivalent. LEC.

GEOG 719. Development of Geographic Thought. 2-3 Hours.
Critical analysis of the growth of geographic thought from antiquity to the present: emphasis on structure of modern geography. Prerequisite: Twenty hours of geography or consent of instructor. LEC.

GEOG 726. Remote Sensing of Environment II. 4 Hours.
An overview of techniques for computer analysis of digital data from earth orbiting satellites for environmental applications. Topics covered include: data formats, image enhancements and analysis, classification, thematic mapping, and environmental change detection. The laboratory exercises provide hands-on experience in computer digital image processing in the department’s NASA Earth Science Remote Sensing Laboratory. Prerequisite: Introductory statistics and GEOG 526 or equivalent. LEC.

GEOG 731. Topics in Physical Geography: ____. 1-3 Hours.
An investigation of special topics in physical geography. May include specific course work under the headings of geomorphology, climatology, soils, vegetation, Quaternary, paleoenvironments, hydrology, etc. May be repeated. RSH.

GEOG 735. Soil Geomorphology. 3 Hours.
Examines the interaction of pedogenic and geomorphic processes during the Quaternary with an emphasis on strategies and methodologies employed in soil-geomorphic studies. Group research projects incorporating field data collection and analyses are required. Prerequisite: GEOG 335 or GEOG 535 or consent of the instructor. LEC.

GEOG 741. Advanced Geomorphology. 1-3 Hours.
Detailed discussions of processes and landforms characteristic of specific environments. Considered during separate semesters will be general methodology, and fluvial, arid regions, glacial, and shoreline geomorphology. Course may be taken more than once. (Same as GEOL 741.) Prerequisite: GEOG 541. LEC.

GEOG 752. Topics in Urban/Economic Geography: ____. 1-3 Hours.
An investigation of special topics in urban/economic geography. May include specific coursework under the headings of energy, economic development, international trade, environmental perception, housing, transportation, and migration. May be repeated. LEC.

GEOG 758. Geographic Information Science. 3 Hours.
This course integrates topics in geographical information science (GISc) with spatial analytical techniques to solve spatial problems. Focuses on the most current research in GISc and its relevance to the environmental sciences, natural resource management, and spatial decision-making. Students are expected to apply the concepts and techniques learned in this class to their own research projects. Prerequisite: GEOG 316 and GEOG 558, or consent of instructor. LEC.

GEOG 759. Ecosystems Stewardship. 4 Hours.
This course sits at the crossroads between the discipline of ecology and the practice of stewardship, specifically the Indigenous Knowledge that is born from these landscapes over millennia in a place. Students will interact with research that establishes scientific foundations as a method to engage environmental problems in the anthropocene. The concept of stewardship is a core tenet of this course, students will engage with many approaches of stewardship, centering primarily on humans as a part of, not apart from, the environment. This course is offered at the 400 and 700 level with additional assignments at the 700 level. Not open to students with credit in EVRN 451 or EVRN 751, GEOG 451 or GEOG 759, BIOL 451 or BIOL 759. (Same as BIOL 759 and EVRN 751.) FLD.

GEOG 771. Topics in Cultural Geography: ____. 1-3 Hours.
An investigation of special topics in cultural geography. May include specific course methodology, material culture, foodways, religion, and similar topics. May be repeated. LEC.

GEOG 781. Environmental Geopolitics. 3 Hours.
This course examines how human relationships with the biophysical world are politicized. Examines key contributions to debates surrounding environmental security, resource conflicts, and related issues, as well as geopolitical assumptions on which these debates build. This course is a more advanced and rigorous version of the undergraduate version of this course. It is not open to students who have taken or are enrolled in GEOG 371 or EVRN 371, Environmental Geopolitics. (Same as GIST 781.) LEC.

GEOG 791. Latin American Regions: ____. 3 Hours.
A description and analysis of the principal sources of geographic information pertaining to portions or all of Latin America. Prerequisite:
GEOG 591 or concurrent auditing of GEOG 591, or consent of instructor. LEC.

GEOG 801. Indigenous Peoples of the World. 3 Hours.
A survey of the varied responses of global Indigenous peoples as a result of the imposition of externally-dominated economic and political systems. An overview of diverse, thematic issues such as land rights, economic development, resources and cultural patrimony, languages, knowledge systems, and women’s rights from the perspectives of Indigenous societies around the world. Detailed studies of Indigenous peoples seeking recognition and protection under international law will be used. The course is offered at the 600 and 800 levels, with additional assignments at the 800 level. (Same as ISP 801.) LEC.

GEOG 805. Perspectives in Geography. 2 Hours.
This course provides background on the discipline of geography and how it is practiced by the faculty in the department. It provides a foundation of knowledge of geography's role within the human and physical sciences as well as the humanities. Students will gain a critical perspective into the breadth of geography, including the ways in which geographers view the world through the lenses of place, space, and scale and the debates and approaches within the changing landscape of geographic inquiry. LEC.

GEOG 806. Proposal Writing and Research Design. 2 Hours.
The course is designed to assist graduate students in developing their research project, including refining research questions, creating a literature review, and defining appropriate methods to aid in successfully answering their questions. Learning outcomes include the production of an individual draft research proposal based upon the student's research design. LEC.

GEOG 875. Qualitative Research Methods. 3 Hours.
This course provides background on qualitative research methods used in human geography. Students will gain a critical perspective into relevant issues of qualitative methods with specific regard to ethical concerns related to human subjects research within the social sciences and humanities and the debates and approaches within the changing landscapes of qualitative methods. Students will have the opportunity to practice these techniques and strategies in a group research project. Prerequisite: GEOG 805 or consent of instructor. LEC.

GEOG 890. Geographic Internship. 1-6 Hours.
Supervised professional experience. The student submits to the program committee a proposal describing the internship prior to enrollment. Upon acceptance, regularly scheduled meetings with the advisor provide assistance, guidance and evaluation of progress in the professional experience. A written summary of the experience or outcomes of the research project are prepared independently by the student, a representative of the host agency, and the advisor. Total credit not to exceed six hours. Prerequisite: Twelve hours of graduate level geography courses and consent of program committee. INT.

GEOG 898. Readings in Geography. 1-4 Hours.
RSH.

GEOG 899. Master’s Thesis. 1-10 Hours.
Thesis credit. Graded on a satisfactory progress/limited progress/no progress basis. THE.

GEOG 911. Seminar in Geovisualization. 3 Hours.
Students will explore current opportunities and challenges in geovisualization. This research seminar is devoted to topics of geospatial technology, cartographic visualization and communication, the history of cartography, and new perspectives and methodologies in geovisualization. Prerequisite: GEOG 311 and GEOG 512. LEC.

GEOG 980. Seminar in Geography: ____. 1-3 Hours.
LEC.

GEOG 990. Seminar in Regional Geography: ____. 1-3 Hours.
(Selected areas to be specified.) LEC.

GEOG 998. Research in Geography. 1-5 Hours.
RSH.

GEOG 999. Doctoral Dissertation. 1-10 Hours.
Dissertation credit. Graded on a satisfactory progress/limited progress/no progress basis. THE.