

# GEOGRAPHY (GEOG)

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## **GEOG 3000 Advanced Geographic Statistics (4 Credits)**

The second in a sequence of two courses that address general statistical applications particular to geography, environmental science and other disciplines dealing with a spatial dimension in the data they work with. The focus of this second course is on the more advanced multivariate statistical techniques. The course has a strong applied orientation as particular attention is given to which technique is the most appropriate to use for a given type of problem and how to interpret and apply the resulting statistics. Extensive use is made of computer statistics packages. Homework exercises involving such statistical techniques as multiple correlation and regression analysis, principle components analysis, discriminate analysis and canonical correlation. Prerequisite: GEOG 2000.

## **GEOG 3010 Geographic Information Analysis (4 Credits)**

Reviews many basic statistical methods and applies them to various spatial datasets. In addition, several spatial statistical methods are applied to spatial datasets. This course is an in-depth study of the interface between GIS, spatial data, and statistical analysis. Preferred prerequisite: GEOG 2000. Prerequisite: GEOG 2100.

## **GEOG 3030 Advanced Field Methods (4 Credits)**

Various field methods used by researchers in physical geography; techniques include field mapping, laboratory analyses, geologic field methods. Prerequisite: GEOG 1201 or equivalent.

## **GEOG 3040 GPS for Resource Mapping (4 Credits)**

This course is an introduction to GPS (Global Positioning Systems) concepts, techniques, and applications as they relate to GIS data collection. Lectures focus on satellite surveying, GPS technology, error sources, program planning, data collection design, and Quality Control and Quality Assurance issues for data collection programs. Hands-on lab exercises include navigation, mission planning for a GPS survey, designing a field data collection plan and associated data dictionary, field data collection, differential correction, and data integration into a GIS and map production.

## **GEOG 3100 Geospatial Data (4 Credits)**

This graduate-level course is designed to provide graduate students from a broad range of disciplines with the skills to carry out applied research tasks and projects requiring the integration of geographic information system technologies and geospatial data. Students are introduced to a collection of techniques and data sources with a focus on acquiring and integrating data. Legal, ethical, and institutional problems related to data acquisition for geospatial information systems are also discussed.

## **GEOG 3110 GIS Modeling (4 Credits)**

This course focuses on the concepts and procedures used in discovering and applying relationships within and among maps. It extends the mapping and geo-query capabilities of GIS to map analysis and construction of spatial models. The course establishes a comprehensive framework that addresses a wide range of applications from natural resources to retail marketing. Topics include the nature of spatial data introduction to spatial statistics and surface modeling in the first five weeks followed by spatial analysis operations and modeling techniques in the second five weeks. The lectures, discussions and independent exercises provide a foundation for creative application of GIS technology in spatial reasoning and decision making.

## **GEOG 3120 Environmental/GIS Modeling (4 Credits)**

Facing challenges brought by the dramatically changing global environment, environmental modeling is increasingly used to support geographical and environmental decision making (e.g., spatial conservation prioritization). Environmental modeling is concerned with the characterization, modeling and simulation of environmental phenomena and processes using conceptual and mathematical models. Environmental phenomena and processes taking place in the geographic space are regulated by spatial principles. They also interact with other phenomena or processes in the attribute space. For example, species distribution is not only constrained by spatial factors such as proximity to other species, but also influenced by environmental factors such as terrain and climatic conditions. Due to its superior capabilities of handling spatial data and modeling spatial and attribute relationships, geographic information system (GIS) provides the ideal tools for environmental modeling. This upper-level undergraduate/graduate-level course surveys the concepts and techniques of GIS supported environmental modeling in three general categories: 1) Modeling in the spatial domain where the focus is on modeling spatial principles (e.g., spatial autocorrelation); 2) Modeling in the attribute domain where the emphasis is on environmental correlations (e.g., environmental niche modeling); 3) Modeling in the combined spatial and attribute domain where both spatial principles and environmental correlations are exploited (e.g., geographically weighted regression). Throughout this course, several real-world applications are used to demonstrate the ideas, concepts, and techniques of GIS supported environmental modeling, including crime spatial pattern modeling, species distribution modeling, and soil-landscape modeling and mapping. Prerequisites: GEOG 2000 and GEOG 2100.

## **GEOG 3130 GIS Programming with Python (4 Credits)**

This advanced course explores the more technical aspects of GIS functions and data structures. Students have hands-on access to both raster (grid-cell) and vector-based software packages in the form of lab exercises that culminate in a small student-designed GIS project. Prerequisite: GEOG 2100.

## **GEOG 3140 GIS Database Design (4 Credits)**

Designing databases to provide a foundation for GIS functions and applications, including investigating techniques used for designing databases in non-spatial environments and learning the applicability to GIS problems. Building on concepts and techniques introduced in the first half to extend traditional techniques and methodologies to model the requirements of spatial problems. Students learn to translate the conceptual spatial model into a physical implementation specific to GIS products. Prerequisite: GEOG 2100 or GEOG 3100.

**GEOG 3150 GIS Project Management (4 Credits)**

This course provides graduate students seeking a career in GIS, or anyone managing a GIS project, with the knowledge, skill and abilities to take a GIS project or program past the design and implementation phase and into day-to-day operation. Students evaluate and analyze the role of GIS in an organization's overall information system strategy and communicate the importance of geography in an information system. Data sharing in the organization is examined to determine the benefits and costs of distributing data creation and maintenance activities throughout an organization. Finally, the role of GIS professionals and the skill sets required to manage GIS effectively are examined. Students review case studies of successful and not-so-successful GIS projects in North America. GIS management issues are addressed by a series of case studies focusing on various management aspects. Students are also expected to visit operational GIS programs in the metropolitan area and interview GIS managers. Students prepare case study evaluations for review in the classroom. Required for all MSGIS students because of the critical importance of GIS project management.

**GEOG 3160 Web GIS (4 Credits)**

With the development of internet technologies, the architecture of Geographic Information System (GIS) has evolved from the centralized desktop architecture to the distributed web architecture. Numerous web GIS applications are available (e.g., Google Map, Earth Explorer, and National Map). A web GIS application allows GIS analysts to access, manipulate, and visualize geospatial data from the web without the installation of GIS software. To facilitate the development of web GIS applications, geospatial technology vendors have provided application programming interfaces (APIs) through which GIS professionals can build customized web applications. This course focuses on the concepts and the development of web based GIS applications using industry-relevant geospatial APIs and core web technologies of HTML, CSS, and JavaScript. This is an upper-level undergraduate, to graduate-level course in GIS that introduces fundamental Web GIS concepts, applications and development kits. Concepts and techniques to be covered in this course include: • Web GIS concepts: system architecture, components, and workflow • Web programming languages: Hypertext Transfer Markup Language (HTML), Cascading Style Sheet (CSS) and JavaScript • Web mapping tools: ArcGIS online, Leaflet and their APIs. Prerequisites: GEOG 2100 and GEOG 3130.

**GEOG 3190 Lidar: Theory and Applications (4 Credits)**

Overview: Lidar (Light Detection and Ranging) is an active remote sensing system that uses laser pulses to measure the distance between the sensor and a surface or objects. Lidar has become an established method for collecting very dense and accurate elevation values, as well as for characterizing the three-dimensional structure of vegetation and urban land cover. In this course, we will build an understanding of the physical principles behind lidar, develop experience working with Lidar datasets, and survey a wide array of lidar applications for mapping and natural resource management. The course will culminate with a student-directed final projects. Prerequisites: GEOG 2100 or GEOG 3200.

**GEOG 3200 Remote Sensing (4 Credits)**

This course acquaints students with the basic techniques of the collection, processing and interpretation of information about the character of the earth's surface from remote locations. Students become familiar with the use of the visible, infrared, thermal and microwave portions of the electromagnetic spectrum as a means of determining land cover and/or land use. Both manual and computer-assisted techniques are discussed and include hands-on applications.

**GEOG 3230 Advanced Remote Sensing (4 Credits)**

This course will build on the basic remote sensing concepts presented in GEOG 3200. Students will explore more in-depth concepts relevant to satellite and airborne remote sensing, including radiative transfer and information extraction. In addition, students will be introduced to two cutting-edge sources of data about the Earth's surface: hyperspectral and lidar (Light Detection and Ranging) sensors. Students will study specific applications of advanced digital image processing techniques for environmental monitoring, natural resource management, and land-use planning. Finally, students will integrate remote sensing and other spatial datasets in the context of Geographic Information System (GIS) analysis. Prerequisite: GEOG 3200.

**GEOG 3300 Cultural Geography (4 Credits)**

Themes and methods of cultural geography including cultural area, landscape, history and ecology.

**GEOG 3310 Culture/Nature/Economics-Human Ecology (4 Credits)**

Cultural adaptation, livelihood strategies and environmental modification among subsistence and peasant societies: responses of such groups to technological change and economic integration.

**GEOG 3330 Political Geography (4 Credits)****GEOG 3340 Geographies of Migration (4 Credits)**

This course explores contemporary movement of people across international borders and the social, cultural, political, economic, and environmental repercussions of such movements. The class looks at the global flow of people across national boundaries and the ways in which these dispersed peoples build and maintain social networks across national borders. While doing so, we address the role of globalization in international migration processes. What motivates people to move long distances, often across several international borders and at considerable financial and psychological cost? How do migrants change—and how in turn do they bring change, social as well as economic, to new destinations as well as places left behind? This course examines politics and patterns of migration, transnational migration, and immigration to the United States.

**GEOG 3350 Qualitative Methods in Geography (4 Credits)**

This course focuses upon qualitative methods in the production of geographic knowledge. Qualitative methods are widely employed by geographers to understand patterns and underlying processes of human and human-environment issues in society. The course is designed to expose participants to the theories, purpose, scope, and procedures of qualitative research. Specific topics include: epistemological theories (ways of knowing); ethics and power in research; research design; data collection techniques in interviewing, participant observation and landscape interpretation, discourse and archive analysis, and case studies; data analysis; and writing and disseminating qualitative findings.

**GEOG 3400 Urban Landscapes (4 Credits)**

Urbanization as a process; national urban systems; internal spatial structure of cities; role of transportation in urban development; location of residential, commercial and industrial activities; agglomeration economies; residential congregation and segregation; environmental justice; urban growth and growth coalitions; decentralization and urban sprawl; edge cities; impacts on the urban environment; world cities; globalization.

**GEOG 3410 Urban Applications in GIS (4 Credits)**

This course uses the tools of geographic information systems (GIS) to explore concepts of traditional urban geography, including defining cities/metropolis, internal urban structures, urban systems, industrial location, social and residential patterns, urban form, environmental problems, and urban planning. The course allows students to practice fundamental skills in GIS (e.g., working with attribute tables, spatial analysis, spatial queries) and cartography (map design, color theory, display of information). Depending on the quarter, students pursue individual projects of interest or client-based projects. Prerequisite: GEOG 2100 or GEOG 3100 or equivalent.

**GEOG 3420 Urban and Regional Planning (4 Credits)**

Historical evolution of planning theory and practices; comprehensive planning process; legal, political, economic, social, environmental aspects of urban planning; urban design; urban renewal and community development; transportation planning; economic development planning; growth management; environmental and energy planning; planning for metropolitan regions; national planning.

**GEOG 3425 Urban Sustainability (4 Credits)**

The 21st century is being called the 'century of the city.' Now more than ever, humans across the globe call the city their home. Many of the world's most pressing crises are manifest in cities, including: greenhouse gas emissions, land degradation, high mass production and consumption, widespread poverty and hunger, and expanding socio-economic disparities. As 'sustainability' becomes part of mainstream discourse, this course explores what sustainability means for urban contexts around the globe. Arguably, the city has the potential to be the most efficient, equitable, and environmental form of modern human settlement. Covering all dimensions of sustainability from a social science perspective, this course focuses on theoretical groundings, practices of urban sustainability, and new research agendas. Major topics include cities and nature; planning and land use; urban form; community and neighborhoods; transportation systems and accessibility; livelihood and urban economies; and social justice and the city.

**GEOG 3440 Urban Transportation Planning (4 Credits)**

A specialized course in the urban planning sequence focusing on issues, practices and policies of urban transportation planning. Recommended for anyone interested in timely transportation topics, such as the feasibility and impacts of light rail transit, the planning and implementation of highway projects, and the role of freight and passenger transportation companies in transportation planning.

**GEOG 3445 Sustainability and Transportation (4 Credits)**

Sustainable transportation aims at promoting better and healthier ways of meeting individual and community needs while reducing the social and environmental impacts of current mobility practices. Given the importance of transport for economic growth, the uncertainties surrounding the availability and price of future sources of energy for transport use, as well as the social and environmental externalities of currently-utilized transport modes, it is imperative that more sustainable ways of providing transportation be developed and utilized.

**GEOG 3450 Transportation and Mobilities (4 Credits)**

The geographical study of transport has grown considerably and become more diverse, encompassing new areas of inquiry generated from economic, urban, environmental, political, social, and cultural geography, as well as from transport geography itself. The most notable expansion has been in the area of 'mobilities' research, which is focused on the social aspects of mobility, including both the large-scale movements of people, objects, capital, and information across the world, as well as the more local processes of daily transportation, movement through public space and the travel of material things within everyday life.

**GEOG 3500 Reconstructing Quaternary Environments (4 Credits)**

Nature, magnitude, sequence and causes of Pleistocene and Holocene climatic changes; effects of climatic change on plant/animal distributions and human populations; paleoclimatic research methods. Laboratory and field trips. Prerequisites: GEOG core, ENVI 3000.

**GEOG 3510 Biogeography (4 Credits)**

Biogeography focuses on present and past distributions of plants and animals. In this course we consider a number of themes central to biogeography, including plate tectonics and biogeography, the effects of climate change of plant and animal distributions, biogeographic realms, island biogeography, biodiversity, human impacts on plants and animals, and the origins of agriculture.

**GEOG 3520 Geography of Soils (4 Credits)**

Spatial variation in soil characteristics; soil processes, soil morphology, their application in soil studies. Prerequisite: GEOG 1201-1203 Environmental Systems or instructor's permission.

**GEOG 3550 Topics in Physical Geography (1-5 Credits)**

Investigations into various aspects of physical environment.

**GEOG 3560 Fluvial Geomorphology (4 Credits)**

Examines how water and sediment interact at Earth's surface to create a variety of landforms ranging from small rills to continental-scale river systems. Introduces fundamental fluvial processes or channel hydraulics and sediment transport. Examines common fluvial landforms including alluvial streams, bedrock streams, floodplains and alluvial fans. Combines traditional lectures and in-class discussions with numerous field excursions to rivers in the Rocky Mountains and Great Plains. Prerequisite: GEOG 1203, GEOG 1218, or GEOG 1266.

**GEOG 3600 Meteorology (4 Credits)**

The basic theory and skills of weather forecasting. Topics include thorough coverage of atmosphere dynamics and thermodynamics, the evolution of various weather types, the mechanics of storm systems (cyclones, severe storms, hurricanes), creation and interpretation of weather maps, and forecasting techniques.

**GEOG 3610 Climatology (4 Credits)**

Climatology is the study of the processes that result in spatial and temporal variation of weather. This course introduces the student to the processes responsible for the transfer of matter and energy between the Earth's surface and the atmosphere and the average weather conditions that result. In addition, topics of global concern, such as greenhouse effect, El Nino, urban heat islands and acid rain, are discussed. Laboratory exercises provide an opportunity to investigate climate variation and climatic change through the use of a variety of computer simulations. Prerequisites: GEOG 1201, GEOG 1216, & GEOG 1264.

**GEOG 3620 Applied Climatology (4 Credits)**

Climatic impact on environmental systems and human behavior; techniques to investigate climatic characteristics of environmental extremes (floods, blizzards), urban climatology and socioeconomic impacts of climate. Prerequisite: GEOG 1201. Recommended Prerequisite: GEOG 3600 or GEOG 3610.

**GEOG 3630 Dendroclimatology (2-4 Credits)**

Systematic variations in tree ring width and/or density can be used to reconstruct changes in precipitation or temperature well before humans were around to record the variability. This class utilizes hands on methods to introduce the fundamental principles of dendroclimatology. Through readings and lectures, students will learn how tree ring growth can be correlated to climate change. Students will then undertake several research projects to reconstruct past climate variability in the Denver metro area using tree rings. Prerequisite: permission of instructor.

**GEOG 3640 Climate Change and Society (4 Credits)**

The science of anthropogenic climate change will be presented with an emphasis on critical evaluation of the evidence of climate change and future scenarios and migration strategies. Students will be introduced to the latest climate change research, including the Intergovernmental Panel on Climate Change report, and the most recent literature from the field. The societal and cultural implications of climate change will also be discussed. Prerequisites: GEOG 1201, GEOG 1216, or GEOG 1264.

**GEOG 3701 Topics in Geographic Information Science (1-4 Credits)**

Topics vary by instructor.

**GEOG 3720 Mountain Environments and Sustainability (4 Credits)**

Mountain Environments and Sustainability explores the unique physical and cultural aspects of high relief and/or high altitude environments. Covering one quarter of the Earth's land surface, mountains directly or indirectly impact the lives of millions of people. We examine the significance of mountains to climate, water resources, and human activities, and discuss the sustainability of these environments and communities in light of rapid changes in many mountain regions resulting from anthropogenic factors and global change. GEOG 1201, 1202, and 1203 or instructor approval.

**GEOG 3750 Topics in Human-Environment Interactions (1-4 Credits)**

This course investigates various aspects of the relationships between human societies and the natural environment.

**GEOG 3755 Geography of Health (4 Credits)**

The geography of health is a thriving area of study that considers the impact of natural, built, and social environments on human health. This course introduces students to three geographical contributions to health studies. First, it emphasizes the importance of ecological approaches to health, which consider interactions between humans and their environments, including topics such as how climate change might influence disease distributions, and how the built environment can influence patterns of physical activity. A second focus is social theory, exploring how aspects such as race, socioeconomic status, and identity play a critical role in influencing human health. A third section of the course considers how spatial methods (cartography, GIS, and spacial statistics) can help answer health-related questions.

**GEOG 3800 Geography of Colorado (4 Credits)**

This course focuses on the physical and human geography of Colorado, a state that includes the western Great Plains, the southern Rocky Mountains, and the eastern Colorado Plateau. Colorado's varied natural landscapes provide equally varied settings for human settlement and resource use. Recommended Prerequisites: GEOG 1201, GEOG 1202, and GEOG 1203.

**GEOG 3820 Kiwis and Kauris: Sustainability in New Zealand (4 Credits)**

With its tourist tagline of "100% Pure New Zealand," New Zealand prides itself as a world leader in sustainability, with great efforts made towards sustainable use of resources and renewable energy, conservation of indigenous species, and integration of indigenous Maori understandings of the land into sustainability approaches. At the same time, New Zealand faces significant sustainability challenges, particularly related to climate change, invasive species, continued reliance on extractive industries, and histories of oppression/exploitation of native peoples. This class uses a field-based case study approach to unpick some of these complex issues, as we visit local sites and explore topics such as preserving native species, sustainable resource use, ecotourism, and indigeneity.

**GEOG 3840 Water Resource Analysis (4 Credits)**

The focus of this course is on complex policy, economic and local, national and international, and political issues surrounding resource use in the western U.S. Issues include exploitation of nonrenewable and renewable energy and mineral resources; and flexible responses to changing public policy.

**GEOG 3860 GIS Applications and Natural Resources (4 Credits)**

In this course we will use a case study approach to examine domestic and international natural resources such as oil, coal, timber, minerals, and recycled materials. We will use a case study approach to look at resource distribution, and the environmental impacts of extraction, production, and disposal, as well as the legal and economic context. We will use GIS data and analysis to enhance our understanding of these case studies, and students will do a project and paper using GIS data and image analysis at a local, regional or global scale. Prerequisite: Introduction to GIS or Introduction to GIS Modeling.

**GEOG 3870 Water Resources & Sustainability (4 Credits)**

In this course, we look at water as both a local and global resource and examine what sustainability means for human and ecological realms. After an overview of the physical processes that drive the hydrologic cycle, surface and groundwater hydrology, we examine how we humans have harnessed water for our use and how we both alter and treat its quality. We examine the legal aspects of water allocation in the U.S. and the groups and agencies that are most involved in managing and overseeing water issues. Finally, we examine the most pressing water "issues" related to wildlife, development, scarcity and conflict. We look forward to imagining the power of both the individual and the collective in meeting our future, global water needs.

**GEOG 3890 Ecological Economics (4 Credits)**

Ecological Economics is an emerging transdisciplinary endeavor that reintegrates the natural and social sciences toward the goal of developing a united understanding of natural and human-dominated ecosystems and designing a sustainable and desirable future for humans on a materially finite planet. In this course we start with a basic overview and summary of the neo-classical economic perspective with a particular focus on the recognized market failures of public goods, common property, and externalities. We begin with a reconceptualization of economic theory by imposing scientific constraints (e.g. conservation of mass and energy, the laws of thermodynamics, evolutionary theory, etc.). Using the ideas developed in this reconceptualization of economic theory we explore the implications for international trade and myriad public policies associated with the ethical, environmental, and economic aspects of sustainability.

**GEOG 3910 Geomorphology (4 Credits)**

An advanced course that examines how Earth's landforms are created by a range of physical processes. Most landforms can be viewed as a result of some combination of erosion, transport and deposition of rock, soil and sediment. The most common agents causing these geomorphic processes are water, wind, ice and waves. This course examines the processes responsible for eroding, transporting and depositing earth materials and compares these processes with the resulting landforms. Prerequisites: GEOG 1202 or GEOG 1217 or instructor's permission.

**GEOG 3920 Remote Sensing Seminar (4 Credits)**

Special topics in advanced remote sensing.

**GEOG 3930 Cultural Geography Seminar (4 Credits)**

Topics, methods and current research in cultural geography.

**GEOG 3940 Urban Geography Seminar (4 Credits)**

International comparison of economic and social, positive and negative aspects of urban systems.

**GEOG 3950 Physical Geography Seminar (2-4 Credits)****GEOG 3955 Pollen Analysis Seminar (3 Credits)**

Pollen grains preserved in sediment provide long-term records of vegetation conditions. Changing proportions of pollen types may reflect climatic fluctuation or human impacts. We review important recent research in pollen analysis (palynology), pollen sampling, laboratory techniques and pollen identification. Students are responsible for counting a number of samples and contributing data for a pollen diagram.

**GEOG 3990 Undergraduate Research Seminar (1 Credit)**

This course is designed to prepare students who will participate in faculty-supervised summer research projects. Students are introduced to research design, use of the scientific method, research expectations and reporting of results. Preparation of formal research proposal with adviser.

**GEOG 3991 Independent Study (1-5 Credits)****GEOG 3995 Independent Research (1-5 Credits)****GEOG 4000 Fundamental Geographic Perspectives (4 Credits)**

A foundation course for persons in the community, without a degree in geography, who want to pursue an education in or make use of computer-based geographic technology but who need a foundation in geographic concepts and perspectives.

**GEOG 4020 Geographic Research Design (4 Credits)**

This class prepares you to undertake creative geographic research leading to the generation of new knowledge. You will produce a NSF-style proposal by the end of the class. In this class, we focus on your idea generation and proposal writing rather than philosophy or specific methods. Specific objectives of the course include providing you the following skills: 1. The ability to create and communicate scholarly work in writing and orally 2. The ability to critique your own work and the work of other in a constructive fashion 3. Incorporation of the core ideas of geography and your field into your research 4. An understanding and appreciation of the various research methods in geography and other cognate disciplines. This understanding includes a discussion of ethics in research. 5. Ability to write an effective vita, statement of area of specialization, literature review, problem statement, and research proposal.



**GEOG 4030 Advanced Field Research (1-5 Credits)****GEOG 4040 Research Topic Identification (0-5 Credits)****GEOG 4110 Geospatial Data (4 Credits)**

This graduate-level course is designed to provide graduate students from a broad range of disciplines with the skills to carry out applied research tasks and projects requiring the integration of geographic information system technologies and geospatial data. Students are introduced to a collection of techniques and data sources with a focus on acquiring and integrating data. Legal, ethical, and institutional problems related to data acquisition for geospatial information systems are also discussed.

**GEOG 4140 GIS Database Design (4 Credits)**

Designing databases to provide a foundation for GIS functions and applications, including investigating techniques used for designing databases in non-spatial environments and learning the applicability to GIS problems. Building on concepts and techniques introduced in the first half to extend traditional techniques and methodologies to model the requirements of spatial problems. Students learn to translate the conceptual spatial model into a physical implementation specific to GIS products.

**GEOG 4150 GIS Project Management (4 Credits)**

This course provides graduate students seeking a career in GIS, or anyone managing a GIS project, with the knowledge, skill and abilities to take a GIS project or program past the design and implementation phase and into day-to-day operation. Students evaluate and analyze the role of GIS in an organization's overall information system strategy and communicate the importance of geography in an information system. Data sharing in the organization is examined to determine the benefits and costs of distributing data creation and maintenance activities throughout an organization. Finally, the role of GIS professionals and the skill sets required to manage GIS effectively are examined. Students review case studies of successful and not-so-successful GIS projects in North America. GIS management issues are addressed by a series of case studies focusing on various management aspects. Students are also expected to visit operational GIS programs in the metropolitan area and interview GIS managers. Students prepare case study evaluations for review in the classroom. Required for all MSGIS students because of the critical importance of GIS project management.

**GEOG 4170 Geospatial Analysis and Project Management (4 Credits)**

This course provides an opportunity for students to apply geospatial data analysis to real-world applications. Students will work as a team to develop a project that requires GIS analysis and/or application development, design a project work flow and management plan, and implement a solution. Students will demonstrate competence in GIS techniques, geospatial data analysis, and project management at a professional level. This course may substitute for GEOG 3150 - GIS Project Management. Prerequisites: Completion of a minimum of two GISc courses.

**GEOG 4400 Urban Landscapes (4 Credits)**

Urbanization as a process; national urban systems; internal spatial structure of cities; role of transportation in urban development; location of residential, commercial and industrial activities; agglomeration economies; residential congregation and segregation; environmental justice; urban growth and growth coalitions; decentralization and urban sprawl; edge cities; impacts on the urban environment; world cities; globalization.

**GEOG 4410 Economic Geography (4 Credits)**

The study of the location and spatial organization of economic activities at the local, national, and global scales. Concerned with the spatial configuration of firms, networks, industries, and regions within the emerging global economy. Cross listed with INTS 4410.

**GEOG 4420 Urban and Regional Planning (4 Credits)**

The field of urban and regional planning is concerned with the future of cities, neighborhoods, metropolitan areas, and extended regions. How do local governments (cities, counties) and metropolitan planning organizations (regional planning agencies, councils of governments) work with community stakeholders (neighborhood associations, chambers of commerce, businesses, citizens, non-governmental organizations) to formulate plans that will guide the future development of a city and its region? Cities and their regions face numerous challenges including population and employment growth or decline, economic development, neighborhood vitality, housing availability and affordability, urban design, land use, transportation, sustainability, access to parks and open space, air quality, floodplain management, water resources, and social equity among many others. How places address these challenges is critical to the future health and livability of our cities, neighborhoods, metropolitan areas, and extended regions. This course will have a community-engaged service learning component. Community-engaged scholarship and teaching comprise intellectually and methodologically rigorous work that is grounded in the norms of democratic education: inclusiveness, participation, task sharing, reciprocity in public problem solving, and an equality of respect for the knowledge and experience that everyone involved contributes to education and community building. The specific service learning project for the class will be to assist the Metropolitan Denver Nature Alliance (Metro DNA) with its goal to increase the community's engagement with nearby nature by reviewing, analyzing, and collecting data from park/ open space plans of cities and counties in the Denver metropolitan area. Cross-listed with GEOG 3420.

**GEOG 4425 Urban Sustainability (4 Credits)**

The 21st century is being called the 'century of the city'. Now more than ever, humans across the globe call the city their home. Many of the world's most pressing crises are manifest in cities, including: greenhouse gas emissions, land degradation, high mass production and consumption, widespread poverty and hunger, and expanding socio-economic disparities. As 'sustainability' becomes part of mainstream discourse, this course will explore what sustainability means for urban contexts around the globe. Arguably, the city has the potential to be the most efficient, equitable, and environmental form of modern human settlement. Covering all dimensions of sustainability from a social science perspective, this course will focus on theoretical groundings, practices of urban sustainability, and new research agendas. Major topics include: cities and nature; planning and land use; urban form; community and neighborhoods; transportation systems and accessibility; livelihood and urban economies; and social justice and the city.

**GEOG 4440 Urban Transportation Planning (4 Credits)**

A specialized course in the urban planning sequence focusing on issues, practices and policies of urban transportation planning. Recommended for anyone interested in timely transportation topics, such as the feasibility and impacts of light rail transit, the planning and implementation of highway projects, and the role of freight and passenger transportation companies in transportation planning.

**GEOG 4460 Air Transportation, High-Speed Rail and Tourism (4 Credits)**

This course delves into the world of commercial air passenger transportation, studying the foundations of the industry, its role in the travel and tourism, and strategies for the future. Foundational topics include the history and geography of air transportation, air travel and tourism, the geography of tourism, airline corporate cultures, the role of government, aviation law, regulation, deregulation, and globalization. Study of the principal elements of airline economics, finance, planning, management, operations, pricing, promotion, cost containment, marketing, and policy provide the opportunity for consideration of strategic options within the contemporary airline industry. Further discussion focuses on the planning and management of airport and airway system infrastructure, the issue of sustainable air transportation, and the role of the airline industry within the context of intermodalism. Cross listed with GEOG 3460.

**GEOG 4701 Topics in Geography (4 Credits)**

Topics vary by instructor.

**GEOG 4810 Geography of Latin America (4 Credits)**

In this course, we examine how past and present cultural preferences and political economies effect changes in Latin American landscapes. Cross listed with GEOG 2810.

**GEOG 4825 Geographies of International Development in Africa (4 Credits)**

What are the historical roots of (under)development in sub-Saharan Africa? How is sub-Saharan Africa typically depicted in the media? How can we explain the fact that the Niger Delta provides the bulk of Nigeria's revenue, and yet, it remains the poorest part of the country? Is climate change the major cause of persistent food insecurity in the drylands of Ethiopia and Burkina Faso? How can we make sense of the uneven geography of poverty in Ghana? What explains urban food insecurity in Cape Town, or land struggles in rural South Africa? What are the social processes underlying the spatial disparity in health status in Malawi, or gender differences in HIV rates in Nyanza province, Kenya? And why do land users often resist state conservation efforts in Tanzania? These are some of the critical questions explored in this course. The primary aim is to provide a critical introduction to the geography of sub-Saharan Africa. We will begin by exploring how "the Africa story" is told by the media, scholars and policymakers. Attention will then shift to understanding the key historical processes that shape (under)development in the region. We will cover a broad range of topics, including governance, colonial history, debt and structural adjustment, foreign aid, food and agriculture, gender, climate change, land grabbing, health, population growth, migration, remittances, and resource extraction. We cannot possibly cover all these topics in greater detail; indeed, some are too vast and complex. We will however use specific case studies to illustrate and discuss each of the topics.

**GEOG 4880 Geographies of South Africa (4 Credits)**

This travel course is designed to give students a first-hand look at the physical and cultural landscapes of South Africa. We will study the varied natural landscapes that produce the commodities (e.g., gold, diamonds, wine, and agriculture) that have attracted the interest of outsiders for centuries and that have influenced the cultural landscapes particular to South Africa. A systematic presentation of the geology of South Africa, and its human history, will unfold throughout our travels.

**GEOG 4900 Graduate Colloquium in Geog (0 Credits)**

Solid foundation in history and philosophy of the discipline of geography; basis for further exploration of major research specialization.

**GEOG 4930 Nicaragua: Development Dilemmas (4 Credits)**

This class takes students to post-revolutionary Nicaragua to examine the consequences of recent land grabs by foreigners and transnational companies. Students learn to operate in a country with minimal "western" infrastructure. They learn to examine developing landscapes (that is, resorts and tourism infrastructure) with new eyes and from the perspective of locals who have been left out of the development loop. By the end of the class, students begin to understand the "development game", begin to question the role of tourism in developing economies, begin to know how to interact with other cultures, and finally learn to question the landscapes we "see" and begin to peel back the layers to understand the social and physical evolution of the landscape before their eyes. This class takes an experiential approach and requires students to participate in a service learning experience. Service learning is defined as a course-based, credit bearing educational experience in which faculty, students, and community members participate in an organized service activity that addresses a self-identified community need. We work with several community-based and non-governmental organizations to ensure a good fit between community needs and student expertise.

**GEOG 4950 Advanced Field Research (1-17 Credits)****GEOG 4991 Independent Study (1-5 Credits)****GEOG 4993 Capstone or Project (1-4 Credits)**

Includes technical design and development for MA geotechnical track project and MS-GIS capstone project.

**GEOG 4994 Report (1-5 Credits)****GEOG 4995 Independent Research (1-5 Credits)**

Includes field research for doctoral dissertation.

**GEOG 4999 Geographic Internship (0-5 Credits)**

Supervised internship in a government office at local, state or federal level or within private sector. Prerequisite: Permission of instructor.

**GEOG 5991 Independent Study (1-5 Credits)**

**GEOG 5995 Independent Research (1-10 Credits)**