

# GEOGRAPHY & ENVIRONMENTAL STUDIES

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The Department of Geography & Environmental Studies offers undergraduate, master's, and doctoral geography degree programs with concentrations in environmental studies and geographic information science and technology.

Geographers study how and why human activities, natural features, and interactions between people and the environment vary across space and through time, and why this matters. Geographers thus address complex challenges ranging from poverty, ethnic conflict, and economic competition to environmental degradation, natural disasters, and climate change. They enter jobs in private, public, or non-profit settings in diverse areas, including and not limited to urban and regional planning, environmental consulting, natural resource management, public health, data and information management, and geospatial intelligence.

Students in the Department of Geography & Environmental Studies can choose from a wide range of courses in physical geography, human geography, human-environment geography, regional geography, and geographic information science and technology, tailoring their educational journey to align with their individual interests and career goals. Within physical geography, we offer classes such as Biogeography, Geomorphology, and Climatology, which focus on plants and animals, landforms, and climate, respectively. Challenges of Globalization, The City, and Geohumanities are among our human geography course offerings. With respect to human-environment geography, Planning a Sustainable World, Field Explorations, and U.S. National Parks are excellent choices. Regional geography classes address the human, physical, and human-environment geography of world regions such as Latin America, Europe, and New Mexico and the American West. Finally, in geographic information science and technology, students have opportunities to solve geographic problems using tools such as Remote Sensing, Geographic Information Systems (GIS), and Global Navigation Satellite Systems (GNSS). Maps are a common output of these efforts.

To support student educational and research needs, the Department of Geography & Environmental Studies has a computer teaching laboratory and a contracts and grants research laboratory (Spatial Applications Research Center – SpARC), both of which are equipped with state-of-the-art workstations that run a wide array of software packages. The Department also has unoccupied aerial systems (aka drones), a field spectroradiometer, survey-grade GPS units, and other equipment to foster research and research training. Excellent working relationships with various units on campus (e.g., the Water Resources Research Institute and Jornada Experimental Range) moreover provide students with opportunities for interdisciplinary and multidisciplinary exchanges.

## Undergraduate Program Information

The Department of Geography & Environmental Studies offers a Bachelor of Science degree in Geography with concentrations in Environmental Studies (ES) (<https://catalogs.nmsu.edu/nmsu/arts-sciences/geography/geography-environmental-studies-bachelor-science/>) and Geographic Information Science and Technology (GIS&T) (<https://catalogs.nmsu.edu/nmsu/arts-sciences/geography/geography-gis-tech-bachelor-science/>). Both concentrations require students to develop a broad geographic foundation by completing core courses in human, physical, and human-environment geography. Both concentrations also address the range of geographic challenges noted above and

complement each other. In fact, some students may wish to pursue both concentrations. However, some students may prefer more quantitative or more qualitative approaches to geographic problem solving and focus on only one of these two concentrations. In those cases, the GIS&T concentration is most suitable for students interested in computers, science, technology, statistics, and spatial analysis and modeling, while the ES concentration is most optimal for students interested in the overlapping cultural, social, and policy-related aspects of environmental issues.

The Department also offers Undergraduate Minors in Geography (<https://catalogs.nmsu.edu/nmsu/arts-sciences/geography/geography-undergraduate-minor/>) and Geographic Information Science and Technology (<https://catalogs.nmsu.edu/nmsu/arts-sciences/geography/geographic-information-science-technology-undergraduate-minor/>).

For more information about the undergraduate programs, please visit the Department of Geography & Environmental Studies home page (<https://geography.nmsu.edu/>). For additional questions, please contact any of the faculty members (<https://geography.nmsu.edu/about-us/faculty.html>) of the Department.

## Graduate Program Information

The Department of Geography & Environmental Studies offers graduate study leading to a Master of Applied Geography (MAG) (<https://catalogs.nmsu.edu/nmsu/graduate-school/geography-master-applied-geography/>) degree and to a Doctor of Philosophy (PhD) (<https://catalogs.nmsu.edu/nmsu/graduate-school/geography-doctor-philosophy/>) in Geography degree. The MAG program offers thesis and non-thesis (i.e., residency) paths for earning the master's degree. The PhD program is offered collaboratively with the Department of Geography & Environmental Studies at the University of New Mexico. The MAG and PhD programs both focus on applied approaches for understanding complex environmental issues, with students' choices of research design ranging from qualitative to quantitative and mixed methods.

The Department also offers a Graduate Minor in Geographic Information Science and Technology (<https://catalogs.nmsu.edu/nmsu/graduate-school/geographic-information-systems-graduate-minor/>).

The Department participates in the Western Regional Graduate Program (WRGP), which is supported by the Western Interstate Commission of Higher Education (WICHE). The WRGP is a tuition-reciprocity arrangement that enables students that are legal residents in WICHE states (Alaska, Arizona, California, Colorado, Hawaii, Idaho, Montana, Nevada, New Mexico, North Dakota, Oregon, South Dakota, Utah, Washington, and Wyoming) to attend NMSU and pay the resident tuition rate, instead of the nonresident rate that an out-of-state student would normally pay.

The Department offers some teaching and research assistantships, which are usually allocated during the admission process based on student qualifications and departmental needs.

For more information about the graduate programs, please visit the Department of Geography & Environmental Studies home page (<https://geography.nmsu.edu/>). For additional questions, please contact any of the faculty members (<https://geography.nmsu.edu/about-us/faculty.html>) of the Department.

## Degrees for the Department

### Bachelor Degree(s)

- Geography (Environmental Studies) - Bachelor of Science (<https://catalogs.nmsu.edu/nmsu/arts-sciences/geography/geography-environmental-studies-bachelor-science/>)
- Geography (Geographic Information Science & Tech) - Bachelor of Science (<https://catalogs.nmsu.edu/nmsu/arts-sciences/geography/geography-gis-tech-bachelor-science/>)

### Master Degree(s)

- Geography - Master of Applied Geography (<https://catalogs.nmsu.edu/nmsu/graduate-school/geography-master-applied-geography/>)

### Doctoral Degree(s)

- Geography - Doctor of Philosophy (<https://catalogs.nmsu.edu/nmsu/graduate-school/geography-doctor-philosophy/>)

## Minors for the Department

- Geographic Information Systems - Graduate Minor (<https://catalogs.nmsu.edu/nmsu/graduate-school/geographic-information-systems-graduate-minor/>)
- Geographic Information Systems - Undergraduate Minor (<https://catalogs.nmsu.edu/nmsu/arts-sciences/geography/geographic-information-science-technology-undergraduate-minor/>)
- Geography (Environmental Studies) - Bachelor of Science (<https://catalogs.nmsu.edu/nmsu/arts-sciences/geography/geography-environmental-studies-bachelor-science/>)
- Geography - Undergraduate Minor (<https://catalogs.nmsu.edu/nmsu/arts-sciences/geography/geography-undergraduate-minor/>)

### Professor, Michaela Buenemann, Department Head

**Professors** Brown, Buenemann; **Associate Professors** Campbell, Magrane; **Assistant Professors** Dugas, Fan; **Professors Emeriti** Czerniak, DeMers, Wright

*C. P. Brown, Ph.D. (University of California, Santa Barbara / San Diego State University)* – US-Mexico and US-Canada border environment and water resources research, GIS, comparative environmental analysis; *M. Buenemann, Department Head, Ph.D. (University of Oklahoma)* – remote sensing, GIS, spatial modeling, human-environment geography, land system science, landscape ecology, drylands; *C. L. Campbell, Ph.D. (University of California, Los Angeles)* – avian ecology, biogeography and ecology, remote sensing, sustainability, National Parks, human-environment relationships; *D. Dugas, Ph.D. (University of Oregon)* – geomorphology, landscape ecology, paleoclimate and climate change, geographic education; *Chao Fan, Ph.D. (Arizona State University)* – GIScience, spatial analysis and modeling, remote sensing, climate change, land cover land use change; *E. Magrane, Ph.D. (University of Arizona)* – climate & culture, art & environment, human-environment geography, geopoetics, geohumanities, critical methodologies.

*Professors Emeriti: R. J. Czerniak, Ph.D. (University of Colorado, Boulder)* – land use and transportation planning, Europe, urban geography; *M. N. DeMers, Ph.D. (University of Kansas)* – geographic information science, landscape ecology, geographic education; *J. B. Wright, Ph.D. (University of California, Berkeley)* – environmental conservation, cultural geography, American West.

## Geography Courses

### GEOG 1110G. Physical Geography

#### 4 Credits (3+3P)

This course introduces the physical elements of world geography through the study of climate and weather, vegetation, soils, plate tectonics, and the various types of landforms as well as the environmental cycles and the distributions of these components and their significance to humans.

#### Learning Outcomes

1. Define, describe, illustrate, distinguish among or explain the use of maps, map scale, globes, map projections, and remote sensing.
2. Define, describe, illustrate, distinguish among or explain the various elements of the earth's atmosphere, earth's relation to the sun, incoming solar radiation, the ozone layer, the primary temperature controls, and the unequal heating of land and water.
3. Define, describe, illustrate, distinguish among or explain the weather makers (air temperature, air pressure, humidity, clouds, precipitation, visibility, and wind [including pressure gradient, the Coriolis force, and friction]).
4. Define, describe, illustrate, distinguish among or explain air masses, pressure systems, the various fronts and associated types of storms, weather symbols, monsoons, the various forms of precipitation, along with causes and effects of lightning.
5. Define, describe, illustrate or explain the hydrologic cycle, the characteristics and influences of the oceans and continents on the weather, the Southern Oscillation (i.e., El Nino), the effects of land/water distribution, and climates and their global distribution.
6. Define, describe, illustrate or explain the biosphere, including organisms (flora and fauna), food chains, ecosystems and relationships. Define, describe, illustrate or explain soils in terms of soil-forming processes, components, properties, and classification.
7. Define, describe, illustrate or explain the structure of the earth, the internal processes, weathering and mass wasting, fluvial processes, characteristics and processes of arid regions, processes of coastal and Karst topographical regions, the processes and characteristics of glaciation (mountainous and continental).
8. Define, describe, illustrate, distinguish among or explain specific impacts by humans on weather, climate, and on the ecosystem at large.
9. Perform tests and collect data to analyze and classify weather, climate and landforms characteristics, processes, and impacts both quantitatively and qualitatively. This includes reading and extracting basic information from maps, diagrams, remote sensing devices, graphs, and tables. 1
10. Apply critical thinking skills such as inductive, deductive, and mathematical reasoning to solve problems using the scientific method. This includes interpreting maps, graphs and photos. 1
11. Recognize and discuss the effect of human activity on climate, climate change, the greenhouse effect, and on landforms at large. 1
12. Synthesize information from external, current sources and personal observations and discuss their relationships to class material.

### GEOG 1120G. World Regional Geography

#### 3 Credits (3)

Overview of the physical geography, natural resources, cultural landscapes, and current problems of the world's major regions. Students will also examine current events at a variety of geographic scales.

#### Learning Outcomes

1. Identify, describe, illustrate, distinguish among or explain the basic concepts of geography, the major world regions, areal differences and similarities, the processes that shape geography natural

and human, the use of maps, and the key topics of geographical interpretation (e.g., location, world importance, population, political status, resources, etc.).

2. Identify, describe, illustrate, distinguish among or explain the regional groups of Europe, its historical background, its languages and religions, major features, the diversified economy, political structures, and impact on globalization.
3. Identify, describe, illustrate, distinguish among or explain the regional groups of Russia and its satellite nations, its historical background, their languages and religions, major features, their diversified economies, political structures, current problems, and impact on globalization.
4. Identify, describe, illustrate or explain the regional nations of Middle East, their historical background, their languages and religions, the major features, the diversified economies and political structures, the current problems.
5. Identify, describe, illustrate, distinguish among or explain the regional groups of Asia, their historical background its languages and religions, major features, the diversified economy and political structures, current problems, and impact on globalization.
6. Identify, describe, illustrate, distinguish among or explain the regional groups of the Pacific World, their historical background its languages and religions, major features, the diversified economy and political structures, current problems, and impact on globalization.
7. Identify, describe, illustrate, distinguish among or explain the regional groups of Africa, their historical background its languages and religions, major features, the diversified economy and political structures, current problems, and impact on globalization.
8. Identify, describe, illustrate, distinguish among or explain the regional groups of Latin America, their historical background its languages and religions, major features, the diversified economy and political structures, current problems, and impact on globalization.
9. Identify, describe, illustrate, distinguish among or explain the regional groups of Anglo-America, their historical background its languages and religions, major features, the diversified economy and political structures, current problems, and impact on globalization. 1
10. Collect data to analyze or classify the region various historical developments and trends relating to globalization 1
11. Apply critical thinking skills in predicting future developments and impacts in economics, cultural diversity, and political stability globally. 1
12. Recognize and discuss current political "hot-spots," their causes, and potential results with regards to globalization. 1
13. Synthesize information the data into a comprehensive world-view.

### **GEOG 1130G. Human Geography** **3 Credits (3)**

This course serves as an introduction to the study of human geography. Human geography examines the dynamic and often complex relationships that exist between people as members of particular cultural groups and the geographical "spaces" and "places" in which they exist over time and the world today.

#### **Learning Outcomes**

1. Locate on maps, globes, and other technologies various geo-political spaces and places around the world, including in the United States.
2. Describe the primary concepts, theories, methods and terms prevalent in the field of human geography.
3. Apply core geographic concepts to the spatial patterns demonstrated in real-world scenarios.

4. Identify the relationships that influence human-environment interaction in a specific location at a specific time.
5. Define and utilize key concepts to explain human social and cultural change over time and across geographical space.
6. Explain the geographic context of a current event or conflict.
7. Identify a current event that illustrates a core cultural geographic concept.
8. Think critically, discuss, and write about the relationships of the natural world to human geography.

### **GEOG 2130. Map Use and Analysis** **3 Credits (2+3P)**

Exploration of the cartographic medium. Development of critical map analysis and interpretation skills, and map literacy. Comprised of traditional lecture, labs, and map use projects.

#### **Learning Outcomes**

1. Accurately measure bearings and distances on maps.
2. Read and interpret terrain and landform representation.
3. Utilize a magnetic compass for basic land navigation and basic map making.
4. Utilize a GPS instrument for basic land navigation.
5. Recognize and describe basic physical and cultural spatial patterns portrayed on maps.
6. Analyze and interpret the significance of spatial patterns portrayed on maps.
7. Perform elementary spatial statistical analysis on geographic data.
8. Appreciate and utilize the significance of place names and cultural patterns.
9. Critically examine maps for evidence of information misuse or propagandist motives. 1
10. Recognize and utilize appropriate map categories, symbols, projections, and coordinate systems to effectively and accurately portray, read, analyze, and interpret geographic data.

### **GEOG 2996. Special Topics** **1-3 Credits**

Specific subjects to be announced in the Schedule of Classes. May be repeated for a maximum of 12 credits.

#### **Learning Outcomes**

1. Varies

### **GEOG 315V. World Agriculture and Food Problems** **3 Credits (3)**

Survey of food and agricultural issues in the U.S. and other countries. Covers: role of agriculture in economic development; trade in food and agricultural products; global food production, consumption, and marketing patterns; economics of technical change and food assistance; agriculture and the environment. Same as AEEC 315V.

### **GEOG 325V. New Mexico and the American West** **3 Credits (3)**

In this course, we will examine the human and cultural geography of New Mexico and the American West. We will explore cultural and historical patterns, economic activities, and environmental and physical characteristics of the region, as well as current challenges in the region.

#### **Learning Outcomes**

1. Explain the human and cultural geography of New Mexico and the American West.

- Critically examine narratives of the American West and different ways of defining the region, as well as the processes that create the cultural landscapes of the West.
- Discuss and analyze contemporary environmental and cultural challenges in the West.
- Articulate an understanding of the landscapes of the West through critically "reading" the landscapes of the West.

#### **GEOG 326. U.S. National Parks**

##### **3 Credits (3)**

Exploration of origins, landscapes, ecosystems, management issues, and conflicts in U.S. National Parks. The regional geography of the United States as seen through the creation and protection of biologically and culturally significant lands. We discuss current park issues and ideology, beginning with the conception of the first national park, the National Park System, current administrative structure, and the goals of the "double mandate". We will explore the parks as commons wherein humans use, and have a duty to protect, these public lands for future generations.

##### **Learning Outcomes**

- Describe the different types/categories of parks included in the National Park System (NPS).
- Provide general statistics about the NPS and parks in the NPS.
- Recognize influential persons and legislation for establishing of the NPS, and agency of the U.S. federal government.
- Locate and access data about parks.
- Search job announcements and positions with the NPS.

#### **GEOG 328V. Environment and Society of Latin America**

##### **3 Credits (3)**

Explores Latin America from a geographical perspective, integrating environmental, cultural and socioeconomic factors in an in-depth study of the development of the region and contemporary issues and challenges facing the region. Special focus is given to examining applied problems facing Latin America at a range of scales.

##### **Learning Outcomes**

- Apply key geographic perspectives and concepts to Latin America.
- Discuss the basic physical and human geography of specific countries and sub-regions of Latin America.
- Describe how the spatial processes of development and globalization occur in Latin America and how they impact the region.
- Explore the root causes of contemporary development and environmental challenges facing Latin America.
- Demonstrate how the geographic concepts we cover in class can be applied to these challenges to develop insights into how they may be solved.
- Demonstrate an improved ability to engage in critical thinking and writing about the physical and human geography of the region and the challenges the region faces.

#### **GEOG 331V. Europe**

##### **3 Credits (3)**

The purpose of this course is to introduce you to the cultural region of Europe. In this regional course, we will explore how various physical and cultural elements integrate to give a unique identity to a place or group of places such as Europe. During the semester we will study the "continent" from a variety of geographic perspectives including physical, environmental, economic, social, and political. We will discuss current issues of Europe, with a particular focus on the European Union.

##### **Learning Outcomes**

- Critically evaluate conceptions of Europe as both a physical place and a cultural idea.
- Locate, identify, and explain the importance of the major countries, cities, and physical features of Europe.
- Discuss the major regional and international issues facing Europe.
- Develop knowledge of the European Union (EU) and current challenges to the EU.
- Demonstrate knowledge of Europe through a variety of forms, including critical discussions on contemporary issues, a writing assignment, and a plan for a detailed European trip.

#### **GEOG 351. Biogeography**

##### **3 Credits (3)**

Exploration of life in space and time. Floristic and physiognomic characteristics of the Earth's major ecosystems and their distributions, ecosystem dynamics, evolution, and physical environment. Includes an individual research project resulting in a poster presentation. Taught with GEOG 557.

##### **Learning Outcomes**

- Provide background information about researchers who quantify patterns of biodiversity in space and time.
- Evaluate species and biodiversity patterns based on the abiotic template.
- Describe global patterns in the shape and size of species geographical ranges.
- Apply biogeographic terminology to effectively describe and explain patterns of life across Earth's surface.
- Identify resources for an analysis of biogeographic data, including satellite imagery, aerial photography, and field survey records.
- Document your sources by including proper citations and references in your writing.
- Conduct original research and present research findings in written and oral formats.

#### **GEOG 353. Geomorphology**

##### **3 Credits (2+3P)**

Examination of the principal theories and concepts of landform creation; exploration of the roles of structure, processes, climate, and time in the formation of various types of landforms. Cross-listed with GEOG 553 and GEOL 353.

##### **Learning Outcomes**

- Outline the basic history of geomorphic theory and research methods.
- Describe the trends and probable causes of Cenozoic climate change and its links to basic landform processes.
- Describe the main landform processes including weathering, soil formation, hillslope evolution and associated natural hazards, fluvial processes, arid land processes, glacial/interglacial climates and processes.
- Integrate field observations into basic landscape evolution reconstructions.
- Design and implement a fluvial system experiment and analyze the data.

#### **GEOG 357. Climatology**

##### **3 Credits (3)**

Elements and controls of climate. Energy and hydrologic cycles, general circulation, climate classification, distribution of climate types, microscale effects, applications.

**Learning Outcomes**

1. Explain the fundamental processes that create climate on Earth.
2. Discuss the physical laws that comprise the climate system.
3. Describe the trends in Earth's climate system.
4. Summarize our current knowledge of climate change.

**GEOG 361V. Challenges of Globalization****3 Credits (3)**

Challenges of Globalization focuses on the spatial configuration of the global economy and its many regional variations. In doing so, the class has a special focus on exploring how the variables involved in globalization yield the geography of uneven development that exists across spatial scales, from the local to the global. We do this through a combination of relevant course readings, in class discussion exercises, and short, focused writing assignments on current issues of relevance in economic geography.

**Learning Outcomes**

1. Define the process of globalization, and describe the drivers and impacts involved.
2. Define the concept of uneven development and explore the regional geographies that this process yields.
3. Define the roles of The State, private sector capital, and multi-national corporations, and apply these concepts to understand the landscape of uneven development.
4. Articulate key variables in the global production networks and discuss how these processes drive the economic geographies of regions we study.
5. Explore and critique alternate models of economic geography, especially those involving free versus fair trade arguments and gender and power roles in the economy.
6. Demonstrate an improved ability to engage in critical thinking about economic geography and write coherent narratives about issues we examine.
7. Review basic geographic concepts and demonstrate a "geographic eye" in looking at issues,

**GEOG 363V. Cultural Geography****3 Credits (3)**

In this course, we will consider the intersections between geography and culture, and explore key cultural geographic concepts such as landscape, place, nature, and environment. We will consider multiple ways of doing cultural geography, focusing on cultural geography as both a critical and creative practice. Key topics and themes that we will focus on include the cultural geography tradition, critical cultural geographies, and cultural geography and creativity. May be repeated up to 3 credits.

**Learning Outcomes**

1. Describe and explain critical approaches to the cultural geographic concepts of landscape, place, space, nature, and environment.
2. Discuss contemporary cultural geographic approaches to topics such as place and capitalism, place and nature, environmental narratives, and the Anthropocene.
3. Discuss and articulate the connections between geography and artistic/literary practices.
4. Articulate and apply their own practice of cultural geography through multiple forms of output, such as essays, discussions, story maps, or visual essays.

**GEOG 365V. The City****3 Credits (3)**

The global historical development of urban areas, as well as the changing functions of today's cities. A comparison between the North American city system and cities in Europe, Asia, and South America, including the development of the city form, the internal spatial organization of commercial, residential, and industrial areas, and socio-economic and political factors.

**Learning Outcomes**

1. Define the concept of a city from various statistical and historical perspectives.
2. Analyze how the historical formation of cities affects their form and function.
3. Relate how the spatial processes of globalization, migration, transportation, informationalization, and development impact form and function of urban areas.
4. Articulate how cultural and economic landscapes of cities impact residents and their quality of life.
5. Conduct library research on key concepts from class and articulate your results through clear and concise writing.
6. Synthesize research findings to solve contemporary real-world problems in urban areas.

**GEOG 373. Introduction to Remote Sensing****4 Credits (3+3P)**

Introduction to the theory, techniques, and applications of remote sensing. Topics include electromagnetic radiation; remote sensing systems; remote sensing of the biosphere, hydrosphere, atmosphere, lithosphere, and cultural landscapes. Course includes lectures and also labs focused on the basic analysis and interpretation of remote sensing products. Taught with GEOG 573.

**Learning Outcomes**

1. Explain basic remote sensing concepts and methods.
2. Analyze remotely sensed data.
3. Interpret remotely sensed data.
4. Evaluate the quality of remote sensing products.
5. Produce information about the built and natural environments using remote sensing data and methods.

**GEOG 381. Cartography and GIS****4 Credits (3+3P)**

This course introduces you to the fundamental concepts and methods of cartography and geographic information systems (GIS) through both lectures and labs. In the lectures, you will learn about key principles of cartography such as map scale, projections, and symbolization. In the labs, you will apply those principles to create functional and aesthetically pleasing maps. Taught with GEOG 571.

**Learning Outcomes**

1. Explain key cartographic concepts and methods.
2. Analyze maps.
3. Interpret maps.
4. Evaluate the quality of maps.
5. Create functional and aesthetically pleasing maps.

**GEOG 401. Internship/Co-op****1-3 Credits (1-3)**

Provides an opportunity whereby students work with a local, regional, or federal agency, or private sector firm on applied geographic work, under the supervision of an agency or firm professional and a geography faculty member. Consent of instructor required.

**GEOG 435. Planning a Sustainable World****3 Credits (3)**

Exploration of planning tools that advance the management of land and water resources, meeting current societal needs, while also minimizing damage to nature and society. Class activities include applied exercises that explore contemporary planning issues, including land conservation, natural hazards, biophysical analysis, water resource management, Federal land issues, and remediation of Superfund sites. Taught with GEOG 535. May be repeated up to 6 credits.

#### **Learning Outcomes**

1. Describe the basic elements of traditional urban planning and articulate how traditional tools are used.
2. Unpack the many layers of sustainable development and link this to the emerging practices of environmental planning.
3. Explore current planning issues and how environmental planning ideas can inform them.
4. Through focused library research, explore and discuss current environmental planning issues that are of interest to YOU.
5. Through both written article reviews and a presentation you make to the class, critically review research articles you discovered in your literature review.
6. Working in teams, conduct a focused research project that explores an environmental planning scenario.

#### **GEOG 441. GIS Design**

##### **3 Credits (3)**

This course introduces you to the diverse considerations that are necessary to develop a Geographic Information System (GIS) in a governmental or other institutional setting. Taught with GEOG 581.

#### **Learning Outcomes**

1. Discuss concepts of GIS development and use.
2. Explain GIS design and implementation processes.
3. Apply principals of GIS design and implementation to meet local needs.

#### **GEOG 442. Programming for GIS**

##### **3 Credits**

This course will introduce you to the fundamental concepts of programming for geographic information systems (GIS). Topics to be mastered include and are not limited to the basics of GIS software environments; the syntax and styles of various programming languages; and ways to create GIS programming applications, customizations, automations, and extensions. With this foundation in place, we will then use these tools to solve applied geographic riddles through a series of hands-on exercises.

#### **Learning Outcomes**

1. Explain fundamental programming concepts for GIS applications
2. Employ different programming languages to conduct spatial analyses.
3. Develop an original GIS programming application, customization, automation, and/or extension.
4. Implement an original GIS programming application, customization, automation, and/or extension.
5. Communicate an original GIS programming application, customization, automation, and/or extension.

#### **GEOG 452. Landscape Ecology**

##### **4 Credits (3+3P)**

Analysis of the structure, function, and change of natural and anthropogenic landscapes. Patches, corridors, matrix and network, spatial organization, landscape dynamics, and role of disturbance in

overall functioning of landscapes. Role of landscape heterogeneity in landscape management.

#### **Learning Outcomes**

1. Apply a vocabulary of terms and phrases employed by landscape ecologists.
2. Demonstrate familiarity with articles and researchers in landscape ecology.
3. Identify influences of scale and spatial configuration on ecosystem processes.
4. Discuss approaches, tools, and techniques to describe, quantify, and analyze landscape characteristics.
5. Demonstrate knowledge of various landscape ecology approaches by accurately applying landscape ecology terms and concepts in answers to a select group of the end-of-chapter questions as well as in discussion posts.

#### **GEOG 455. Southwest Environments**

##### **3 Credits (3)**

This course introduces you to the U.S. Southwest, including its physical and human geography, coupled human-environment interactions, causes and consequences of environmental issues, and implications for sustainable development. Taught with GEOG 555.

#### **Learning Outcomes**

1. Describe physical and human geographic patterns of the U.S. Southwest.
2. Discuss coupled human-environment interactions in the U.S. Southwest.
3. Explain how these interactions have produced a series of societal and/or ecological problems in the U.S. Southwest.
4. Assess critically the challenges and potentials of sustainability in the U.S. Southwest.

#### **GEOG 473. Advanced Remote Sensing**

##### **4 Credits (3+3P)**

Introduction to advanced topics in digital image processing, analysis, interpretation, and visualization. Topics include geometric and radiometric correction, image enhancement, image classification, change detection, and accuracy assessment. Lectures focus on the discussion of advanced remote sensing concepts, techniques, and applications; labs are applications-oriented. Taught with GEOG 573.

**Prerequisite:** C- or better in GEOG 373.

#### **Learning Outcomes**

1. Explain advanced remote sensing concepts and methods.
2. Acquire remote sensing images.
3. Process remote sensing images to obtain spatio-temporal information about the environment.
4. Evaluate remote sensing products.
5. Communicate the data, methods, and findings of remote sensing investigations.

#### **GEOG 481. Fundamentals of GIS**

##### **4 Credits (3+3P)**

This course introduces you to concepts and methods of geographic information systems (GIS) and teaches you how to use a GIS to manage, integrate, analyze, and visualize geospatial data and information. Taught with GEOG 578.

#### **Learning Outcomes**

1. Explain fundamental concepts, data, methods, applications, and software used in GIS.
2. Apply diverse GIS methods for analyzing and modeling spatial data.

3. Interpret the results of spatial data analysis and modeling efforts.
4. Evaluate the quality of spatial data analysis and modeling efforts.
5. Communicate GIS analysis and modeling investigations.

### **GEOG 482. Geodatabase Design**

#### **3 Credits (2+3P)**

A practical introduction to designing geodatabases. The course takes you through the eleven steps of geodatabase design divided into four stages: thematic characterization; developing the database elements, relationships and properties; capture and collection; and finally, implementation and documentation. Taught with GEOG 572.

**Prerequisite(s):** C- or better in GEOG 481.

### **GEOG 483. Field Explorations in Geography**

#### **3 Credits (6P)**

A field-based class where students complete exercises in physical, human, and environmental geography in the Southwest. May be offered as a two-week intensive class where students are away from Las Cruces and camping; or may be offered with weekend field trips depending on the instructor. A lab fee for transportation and other expenses is required. Taught with GEOG 583.

### **GEOG 488. GIS and Water Resources**

#### **3 Credits (3)**

Explores a range of GIS tools, routines, and data structures and then applies them to a range of research questions and management issues in the area of Water Resources. The class has both a lecture and laboratory component, and students will have opportunities to explore a range of GIS tools in formal lab exercises and a project in the student area of interest. Taught with GEOG 588.

### **GEOG 491. Special Topics**

#### **1-3 Credits**

Specific subjects to be announced in the Schedule of Classes. May be repeated for a maximum of 12 credits.

### **GEOG 493. Special Problem Research**

#### **1-3 Credits**

For advanced and exceptional students. Research, and preparation of a paper in some phase of geography. A maximum of 6 credits may be earned. Consent of instructor required.

### **GEOG 495. Directed Readings**

#### **1-3 Credits**

Individual study through selected readings. A maximum of 6 credits may be earned. Consent of instructor required.

### **GEOG 501. Introduction to Geographic Theory and Application**

#### **3 Credits (3)**

Overview of geographic philosophies and methodologies, with emphasis on relationship between theory and practice. Includes virtual and in-person meetings with students from both UNM and NMSU. Taught with GEOG 601.

#### **Learning Outcomes**

1. Compare, contrast, and evaluate contemporary philosophies and methodologies in major areas of geographical research.
2. Discuss diverse contemporary applications of geographic research.
3. Communicate effectively in written and oral formats.

### **GEOG 502. Integrative Research Design**

#### **3 Credits (3)**

Introduction to research design in geography, with emphasis on integration of qualitative and quantitative methods. Includes virtual and in-person meetings with students from both UNM and NMSU. Taught with GEOG 602.

**Prerequisite:** GEOG 501.

#### **Learning Outcomes**

1. Design a significant and feasible research project.
2. Communicate effectively in written and oral formats.
3. Identify and engage key stakeholders to the successful execution of the proposed research project.

### **GEOG 505. GIS&T Capstone I - Geospatial Research Design**

#### **3 Credits**

This course is designed to support the professional development of students with an interest in conducting research using Geographic Information Science and Technology (GIS&T). More specifically, the course asks you to dig into the literature in an area of geospatial research of interest to you and to develop a plan for a research project that aligns with your interests and/or professional work.

#### **Learning Outcomes**

1. Conceptualize an independent geospatial research project.
2. Plan an independent geospatial research project.
3. Propose an independent geospatial research project.

### **GEOG 506. GIS&T Capstone II - Geospatial Research Implementation**

#### **3 Credits**

This course is designed to support the professional development of students with an interest in conducting research using Geographic Information Science and Technology (GIS&T). The course provides you an opportunity to implement the geospatial work you proposed in Capstone I. You will then share the results of this research through oral presentations and a written document that supports your professional portfolio and work.

**Prerequisite:** GEOG 505.

#### **Learning Outcomes**

1. Implement an independent geospatial research project.
2. Present orally the rationale, data, methods, results, and implications of this independent geospatial research project.
3. Present in writing the rationale, data, methods, results, and implications of this independent geospatial research project.

### **GEOG 512. Geohumanities**

#### **3 Credits (3)**

In recent years, artists, writers, and humanities scholars have increasingly engaged with geographic concerns, and geographers have incorporated humanities-based approaches to their work. Broadly known as the geohumanities, these interdisciplinary endeavors offer exciting ways to engage with key geographic concepts such as place, landscape, and nature. This graduate level seminar will examine both critical and creative approaches to the geohumanities.

#### **Learning Outcomes**

1. Articulate an understanding of the geohumanities as an interdisciplinary field, including its practices and its histories that draw on geography's intersection with multiple humanities fields.
2. Identify key texts, thinkers, and practices in the geohumanities, as well as spaces (such as both scholarly and public-facing journals and digital spaces) where geohumanities work is currently being advanced and developed.
3. Analyze, critique, and engage with current debates and directions within the geohumanities.
4. Develop and produce a creative and/or critical project that uses geohumanities approaches and advances your research/scholarly/creative interests.

**GEOG 535. Planning a Sustainable World****3 Credits (3)**

Exploration of planning tools that advance the management of land and water resources, meeting current societal needs, while also minimizing damage to nature and society. Class activities include applied exercises that explore contemporary planning issues, including land conservation, natural hazards, biophysical analysis, water resource management, federal land issues, and remediation of Superfund sites. Taught with GEOG 435.

**Learning Outcomes**

1. Describe the basic elements of traditional urban planning and articulate how traditional tools are used.
2. Unpack the many layers of sustainable development and link this to the emerging practices of environmental planning.
3. Explore current planning issues and how environmental planning ideas can inform them.
4. Through focused library research, explore and discuss current environmental planning issues that are of interest to YOU.
5. Through both written article reviews and a presentation you make to the class, critically review research articles you discovered in your literature review.
6. Working in teams, conduct a focused research project that explores an environmental planning scenario.

**GEOG 542. Programming for GIS****3 Credits**

This course will introduce you to the fundamental concepts of programming for geographic information systems (GIS). Topics to be mastered include and are not limited to the basics of GIS software environments; the syntax and styles of various programming languages; and ways to create GIS programming applications, customizations, automations, and extensions. With this foundation in place, we will then use these tools to solve applied geographic riddles through a series of hands-on exercises.

**Learning Outcomes**

1. Explain fundamental programming concepts for GIS applications.
2. Employ different programming languages to conduct spatial analyses.
3. Develop an original GIS programming application, customization, automation, and/or extension.
4. Implement an original GIS programming application, customization, automation, and/or extension.
5. Communicate an original GIS programming application, customization, automation, and/or extension.

**GEOG 544. GIS&T Professional Portfolio****1 Credit**

This course provides students with the opportunity to develop their GIS&T professional portfolio and disseminate it via multiple platforms. The portfolio will showcase students' experience, knowledge and skills, and potential for professional development and employment in the geospatial workforce.

**Learning Outcomes**

1. Identify content for a GIST professional portfolio.
2. Visualize the portfolio content.
3. Describe the portfolio content.
4. Reflect on the portfolio content.
5. Create a compelling static document and interactive web versions of the portfolio.

**GEOG 545. Geospatial Professionalism****2 Credits**

Geospatial data, technologies, and applications are influenced by and shape our social, political, and legal environments in numerous ways. This course introduces you to these environments and provides opportunities to explore them through a series of readings, writing exercises, and class discussions. We also examine in detail the moral and ethical implications of geospatial data, technologies, and applications. With this grounding in place, we develop skills to communicate the results of our geospatial work in a professional, effective, and morally and ethically responsible manner.

**Learning Outcomes**

1. Discuss the moral and ethical implications of geospatial data, technologies, and applications.
2. Examine the social, political, and legal implications of geospatial data, technologies, and applications.
3. Communicate geospatial work in a professional, effective, and morally and ethically responsible manner.

**GEOG 552. Landscape Ecology****4 Credits (3+3P)**

Analysis of the structure, function, and change of natural and anthropogenic landscapes. Patches, corridors, matrix and network, spatial organization, landscape dynamics, and role of disturbance in overall functioning of landscapes. Role of landscape heterogeneity in landscape management.

**Learning Outcomes**

1. Apply a vocabulary of terms and phrases employed by landscape ecologists.
2. Demonstrate familiarity with articles and researchers in landscape ecology.
3. Identify influences of scale and spatial configuration on ecosystem processes.
4. Discuss approaches, tools, and techniques to describe, quantify, and analyze landscape characteristics.
5. Demonstrate knowledge of various landscape ecology approaches by accurately applying landscape ecology terms and concepts in answers to a select group of the end-of-chapter questions as well as in discussion posts.

**GEOG 553. Geomorphology****3 Credits (2+3P)**

Examination of the principal theories and concepts of landform creation; exploration of the roles of structure, processes, climate, and time in the formation of various types of landforms. Cross-listed with GEOG 553 and GEOL 353.

**Learning Outcomes**

1. Outline the basic history of geomorphic theory and research methods.
2. Describe the trends and probable causes of Cenozoic climate change and its links to basic landform processes.
3. Describe the main landform processes including weathering, soil formation, hillslope evolution and associated natural hazards, fluvial processes, arid land processes, glacial/interglacial climates and processes.
4. Integrate field observations into basic landscape evolution reconstructions.
5. Design and implement a fluvial system experiment and analyze the data.



**GEOG 555. Southwest Environments****3 Credits (3)**

This course introduces you to the U.S. Southwest, including its physical and human geography, coupled human-environment interactions, causes and consequences of environmental issues, and implications for sustainable development. Taught with GEOG 455.

**Learning Outcomes**

1. Describe physical and human geographic patterns of the U.S. Southwest.
2. Discuss coupled human-environment interactions in the U.S. Southwest.
3. Explain how these interactions have produced a series of societal and/or ecological problems in the U.S. Southwest.
4. Assess critically the challenges and potentials of sustainability in the U.S. Southwest

**GEOG 557. Biogeography****3 Credits (3)**

Exploration of life in space and time. Floristic and physiognomic characteristics of the Earth's major ecosystems and their distributions, ecosystem dynamics, evolution, and physical environment. Includes an individual research project resulting in a poster presentation. Taught with GEOG 351.

**Learning Outcomes**

1. Provide background information about researchers who quantify patterns of biodiversity in space and time.
2. Evaluate species and biodiversity patterns based on the abiotic template.
3. Describe global patterns in the shape and size of species geographical ranges.
4. Apply biogeographic terminology to effectively describe and explain patterns of life across Earth's surface.
5. Identify resources for an analysis of biogeographic data, including satellite imagery, aerial photography, and field survey records.
6. Document your sources by including proper citations and references in your writing.
7. Conduct original research and present research findings in written and oral formats.

**GEOG 571. Cartography and GIS****4 Credits (3+3P)**

This course introduces you to the fundamental concepts and methods of cartography and geographic information systems (GIS) through both lectures and labs. In the lectures, you will learn about key principles of cartography such as map scale, projections, and symbolization. In the labs, you will apply those principles to create functional and aesthetically pleasing maps. Taught with GEOG 381.

**Learning Outcomes**

1. Explain key cartographic concepts and methods.
2. Analyze maps.
3. Interpret maps.
4. Evaluate the quality of maps.
5. Create functional and aesthetically pleasing maps.

**GEOG 572. Geodatabase Design****3 Credits (2+3P)**

Graduate level introduction to designing geodatabases. The course takes you through the eleven steps of geodatabase design divided into four stages: thematic characterization; developing the database

elements, relationships and properties; capture and collection; and finally implementation and documentation. Taught with GEOG 482.

**GEOG 573. Introduction to Remote Sensing****4 Credits (3+3P)**

Graduate level introduction to the theory, techniques, and applications of remote sensing. Topics include electromagnetic radiation; remote sensing systems; remote sensing of the biosphere, hydrosphere, atmosphere, lithosphere, and cultural landscapes. Course includes lectures and also labs focused on the basic analysis and interpretation of remote sensing product. Taught with GEOG 373.

**Learning Outcomes**

1. Explain basic remote sensing concepts and methods.
2. Analyze remotely sensed data.
3. Interpret remotely sensed data.
4. Evaluate the quality of remote sensing products.
5. Produce information about the built and natural environments using remote sensing data and methods.

**GEOG 578. Fundamentals of GIS****4 Credits (3+3P)**

This course introduces you to concepts and methods of geographic information systems (GIS) and teaches you how to use a GIS to manage, integrate, analyze, and visualize geospatial data and information. Taught with GEOG 481.

**Learning Outcomes**

1. Explain fundamental concepts, data, methods, applications, and software used in GIS.
2. Apply diverse GIS methods for analyzing and modeling spatial data.
3. Interpret the results of spatial data analysis and modeling efforts.
4. Evaluate the quality of spatial data analysis and modeling efforts.
5. Communicate GIS analysis and modeling investigations.

**GEOG 581. GIS Design****3 Credits (3)**

This course introduces you to the diverse considerations that are necessary to develop a Geographic Information System (GIS) in a governmental or other institutional setting. Taught with GEOG 441.

**Learning Outcomes**

1. Discuss concepts of GIS development and use.
2. Explain GIS design and implementation processes.
3. Apply principals of GIS design and implementation to meet local needs.

**GEOG 582. Advanced Remote Sensing****4 Credits (3+3P)**

Graduate level introduction to advanced topics in digital image processing, analysis, interpretation, and visualization. Topics include geometric and radiometric correction, image enhancement, image classification, change detection, and accuracy assessment. Lectures focus on the discussion of advanced remote sensing concepts, techniques, and applications; labs are applications-oriented. May be repeated up to 4 credits.

**Learning Outcomes**

1. Explain advanced remote sensing concepts and methods.
2. Acquire remote sensing images.
3. Process remote sensing images to obtain spatio-temporal information about the environment.
4. Evaluate remote sensing products.

5. Communicate the data, methods, and findings of remote sensing investigations.

### **GEOG 583. Field Explorations in Geography**

#### **3 Credits (6P)**

A graduate level field-based class where students complete exercises in physical, cultural, and environmental geography in the Southwest. May be offered as a two-week intensive class where students are away from Las Cruces and camping; or may be offered with weekend field trips depending on the instructor. A lab fee for transportation and other expenses is required. May be repeated up to 3 credits.

### **GEOG 584. Critical Methodologies**

#### **3 Credits (3)**

This course explores critical, qualitative, and creative methods within human geography and related fields. We will examine epistemology, methodology, ethics, and critical reflexivity in research, as well as particular methods such as interviews, oral histories, questionnaires, participant observation, focus groups, archival research, visual methodologies, textual and discourse analysis, and arts-based approaches.

#### **Learning Outcomes**

1. Discuss the relationship between epistemology, methodology, and methods.
2. Develop and articulate a nuanced understanding of multiple critical, qualitative, and/or creative methods within human geography and related fields.
3. Demonstrate knowledge of research ethics and the role of NMSU's Institutional Review Board (IRB) in human subjects research, including the completion of the CITI Human Subjects training.

### **GEOG 585. Spatial Analysis and Modeling**

#### **3 Credits (3)**

Introduction to aspatial and spatial analysis and modeling techniques for geographic investigations. Includes several hands-on assignments and an independent research project.

#### **Learning Outcomes**

1. Explain aspatial and spatial tools for geospatial analysis and modeling.
2. Apply diverse aspatial and spatial tools for geographic problem solving.
3. Develop an original spatial analysis and/or modeling investigation.
4. Implement an original spatial analysis and/or modeling investigation.
5. Communicate in written and oral formats an original spatial analysis and/or modeling investigation.

### **GEOG 588. GIS and Water Resources**

#### **3 Credits (3)**

This is a graduate level class that explores a range of GIS tools, routines, and data structures and then applies them to a range of research questions and management issues in the area of Water Resources. The class has both a lecture and laboratory component, and students will have opportunities to explore a range of GIS tools in formal lab exercises and a project in the student's area of interest. Taught with GEOG 488.

### **GEOG 595. Directed Readings**

#### **1-3 Credits**

Advanced individual study through selected readings. May be repeated for a maximum of 6 credits.

### **GEOG 596. Residency**

#### **1-12 Credits (1-12)**

A contractual learning experience in the public or private sector under the supervision of a field supervisor and two faculty members. May be repeated up to 12 credits. Consent of Instructor required. Restricted to: Geography majors.

### **GEOG 598. Selected Topics**

#### **1-3 Credits**

Readings, discussions, lectures or laboratory studies of selected geographic themes. May be repeated for unlimited credit.

### **GEOG 599. Master's Thesis**

#### **1-12 Credits (1-12)**

Supervised individual study of a student's thesis topic. May be repeated for an unlimited number of credits. Thesis/Dissertation Grading.

### **GEOG 601. Introduction to Geographic Theory & Application**

#### **3 Credits (3)**

This course is intended to introduce Ph.D. and Masters level students to the history, theory, methods, and contemporary literature of Geography as a discipline. It also serves to prepare incoming students to engage in an integrative, theoretically informed and applied research project. Crosslisted with: GEOG 501.

#### **Learning Outcomes**

1. Students will be able to demonstrate a clear understanding of multiple themes and topics in Geography.
2. Students will be able to demonstrate a clear understanding of multiple methods suitable for geographic research
3. Students will be able to identify and summarize recent scholarship relevant to the student's own research interests.
4. Students will be able to communicate clearly and effectively in an oral format.
5. Students will be able to communicate clearly and effectively in a written format.
6. Students will be able to identify a committee chairperson who will guide her or his graduate work.
7. Students will be able to design an integrative program of studies for the remainder of her or his graduate work.

### **GEOG 602. Integrative Research Design**

#### **3 Credits (3)**

Introduction to research design in geography, with emphasis on integration of qualitative and quantitative methods. Includes virtual and in-person meetings with students from both UNM and NMSU. Taught with GEOG 502.

**Prerequisite:** GEOG 601.

#### **Learning Outcomes**

1. Design a significant and feasible research project.
2. Communicate effectively in written and oral formats.
3. Identify and engage key stakeholders to the successful execution of the proposed research project.

### **GEOG 603. Professional Geographic Practice**

#### **3 Credits (3)**

This core course focuses on a variety of professional development topics that prepare students for teaching and applied community engagement projects. All students in this course will receive training in professional communication, professional ethics, and grant proposal writing. Depending on their individual professional goals, the course will allow students to undertake practical training in a variety of areas that range from academic teaching to applied policy work to scientific communication. All students in the joint doctoral program are expected to engage in applied projects as part of their research design, and this course will lay the foundation for these pursuits. Unlike GEOG 601 and

GEOG 602, the final core course will be taught independently on each campus, to maximize the potential for faculty-student interaction on specific location-based project planning. This course will be offered every fall semester.

**Prerequisite:** GEOG 602.

**Learning Outcomes**

1. Identify professional geography as it relates to project management.
2. Explore professional communication in various settings in a variety of workplace settings.

**GEOG 700. Doctoral Dissertation**

**1-18 Credits (1-18)**

This highly individualized independent study course is for students who have completed their comprehensive exams and are currently working on their doctoral dissertation. May be repeated up to 18 credits. Thesis/Dissertation Grading.

**Learning Outcomes**

1. Expand their knowledge in a specific area of interest in the discipline of geography.
2. Develop their skills in analyzing, synthesizing, and interpreting geographic data and information.
3. Develop their skills in technical and/or professional writing.
4. Develop their skills in the management and completion of a professional research project.

**Name:** Geography and Environmental Studies Office

**Office Location:** Breland Hall, Room 137

**Phone:** (575) 646-3509

**Website:** <http://geography.nmsu.edu>