

# Geography

IN THE COLLEGE OF ARTS AND LETTERS

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## Faculty

**Piotr L. Jankowski**, Ph.D., Professor of Geography,  
Chair of Department  
**Stuart C. Aitken**, Ph.D., Albert W. Johnson Distinguished Professor  
of Geography, The June Burnett Chair in Children's and Family  
Geographies  
**Li An**, Ph.D., Professor of Geography  
**Trent W. Biggs**, Ph.D., Professor of Geography  
(Master's Degree Program Adviser)  
**Fernando J. Bosco**, Ph.D., Professor of Geography  
(Doctoral Program Adviser)  
**George Christakos**, Ph.D., Professor of Geography, The Stephen  
and Mary Birch Foundation Chair in Geographical Studies  
**Pascale J. Marcelli**, Ph.D., Professor of Geography  
**John F. O'Leary**, Ph.D., Professor of Geography  
[Senate Distinguished Professor]  
**André Skupin**, Ph.D., Professor of Geography  
**Douglas A. Stow**, Ph.D., Albert W. Johnson Distinguished  
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**Ming-Hsiang Tsou**, Ph.D., Professor of Geography  
**Kathleen A. Farley Wolf**, Ph.D., Associate Professor of Geography  
**Arielle S. Levine**, Ph.D., Associate Professor of Geography  
**Hilary K. McMillan**, Ph.D., Associate Professor of Geography  
**Katherine Elizabeth Swanson**, Ph.D., Associate Professor of  
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**Anne-Marie Debanné**, Ph.D., Assistant Professor of Geography  
**Fernando De Sales**, Ph.D., Assistant Professor of Geography  
**Atsushi Nara**, Ph.D., Assistant Professor of Geography

## The Stephen and Mary Birch Foundation Chair in Geographical Studies

The Stephen and Mary Birch Foundation Chair in Geographical Studies was created through the Birch Foundation's grant to the Department of Geography to endow a chair and create a Center for Earth Systems Analysis Research. Dr. George Christakos, internationally recognized for his expertise in theory and methodology of spatial analysis and mathematical modeling applied to environmental, ecological, health, and geographical systems is the third holder of the chair.

## The June Burnett Chair in Children's and Family Geographies

The Children's and Family Geographies Chair was created in 2013 as part of the Department of Geography's June Burnett Endowment. The chair is in support of the Center for Interdisciplinary Studies of Youth and Space (ISYS), and focuses on spatial research and therapeutic/ethnographic practices related to the well-being of children and young people. Albert W. Johnson Distinguished Professor of Geography Stuart C. Aitken, internationally recognized for his research on children's geographies, youth activism, critical theory, and qualitative methodologies is the first holder of the chair.

## Associateships

Approximately 45 graduate teaching associateships and graduate research associateships in geography are available to highly qualified students. Applications and additional information may be secured from the department. The deadline for submitting applications for teaching associateships or research associateships for the master's degree programs can be found at <https://geography.sdsu.edu/programs/masters/apply>.

The deadline for submitting applications for the Doctor of Philosophy degree program can be found at <https://geography.sdsu.edu/programs/doctoral/apply>.

Applications for associateships must include transcripts, three letters of recommendation, Graduate Record Examination (GRE) scores, and a statement of interests and goals. Our graduate teaching associateships program can prepare students for a teaching career.

## General Information

The Department of Geography offers graduate study leading to the Master of Arts, Master of Science, and Doctor of Philosophy degrees in geography. These degrees provide the essential education, technical training, and creative experience necessary for professional activity or college-level teaching. Graduate programs are generally assigned around one of the following systematic areas:

### Group A – Systematic Areas

- Human Geography — Urban, Social, and Political Geography
- Environmental Geography — Society and Environment, Watershed/Ecosystems Analysis
- Physical Geography — Biogeography, Climatology, Hydrology, Landscape Ecology
- Geographic Information Science and Technology

### Group B – Spatial Analytical Methods and Techniques

- Spatial Statistics
- Qualitative Methods and Ethnography
- Cartography and Internet Mapping
- Geocomputation and Spatial Modeling
- Geographic Information Systems (GIS)
- Remote Sensing and Image Processing
- Visualization and Visual Data Mining
- Spatial Decision Support Systems and Participatory GIS

Each student's program is designed around at least one of the areas selected from Group A and at least one of the technique emphases selected from Group B. The main regional foci are California, Latin America, Mexico-U.S. borderlands, South Pacific Islands, Africa, and Asia. Further information on systematic areas, techniques and regional foci, as well as general program information can be obtained through the Department of Geography's website at <https://geography.sdsu.edu>.

The master's degree programs are designed to provide advanced training for a) students who plan to terminate their graduate studies at the master's level, and b) those who anticipate additional work leading to the doctoral degree in geography or related fields.

The Master of Arts degree program is designed around one of the systematic areas previously listed in Group A and will generally also include coursework in one or more technical skills in Group B. The Master of Science program has two concentrations (1) geographic information science, and (2) watershed science.

The Doctor of Philosophy program, offered jointly with the University of California, Santa Barbara, provides advanced training for research and teaching at the highest academic level.

Research and instructional facilities provided by the Department of Geography include the Stephen and Mary Birch Center for Earth Systems Analysis Research (CESAR), the Center for Human Dynamics in the Mobile Age (HDMA), the Center for Information Convergence and Strategy (CICS), the Center for Interdisciplinary Studies of Youth and Space (ISYS), and laboratories for physical geography, cartography, remote sensing and aerial interpretation, and equipment for field studies.

## Admission to Master's and Doctoral Study

Students applying for admission should electronically submit the university application available at <http://www.calstate.edu/apply> along with the required application fee.

All applicants must submit admissions materials to SDSU Graduate Admissions and complete the Department of Geography application.

### Graduate Admissions

The following materials should be submitted as a complete package directly to:

**Graduate Admissions**  
Enrollment Services  
San Diego State University  
San Diego, CA 92182-7416

1. Official transcripts (in sealed envelopes) from all postsecondary institutions attended;

#### NOTE:

- Students who attended SDSU need only submit transcripts for work completed since last attendance.
  - Students with international coursework must submit both the official transcript and proof of degree. If documents are in a language other than English, they must be accompanied by a certified English translation.
2. GRE scores (<http://www.ets.org> SDSU institution code 4682);
  3. English language score, if medium of instruction was in a language other than English (<http://www.ets.org> SDSU institution code 4682).

### Master of Arts Degree in Geography

#### Master of Science Degree in Geography

The following admissions materials must be submitted electronically:

1. Copies of transcripts from all colleges and universities attended and copies of GRE (and TOEFL, if applicable) test scores. These do not need to be sent directly from the colleges – scanned copies are acceptable;
2. Statement of geographic research interests and professional goals, and the names of at least one (up to three) SDSU geography faculty who would be suitable program advisers;
3. Three letters of recommendation. Applicant must provide names and email addresses of recommenders. Recommenders will be invited to complete the recommendation electronically;
4. Optional: If you would like to apply for a graduate assistantship, download and complete the application and upload it along with your other application materials.

For information regarding the admissions process, visit the department website at <http://geography.sdsu.edu>.

### Ph.D. Degree in Geography

The following admissions materials must be submitted electronically:

1. Copies of transcripts from all colleges and universities attended and copies of GRE (and TOEFL, if applicable) test scores. These do not need to be sent directly from the colleges – scanned copies are acceptable;
2. Statement of geographic research interests and professional goals and the names of at least one (up to three) UCSB geography faculty who would be suitable program advisers;
3. Three letters of recommendation. Applicant must provide names and email addresses of recommenders. Recommenders will be invited to complete the recommendation electronically;
4. Current curriculum vitae or resume.

For more information about the admissions process, including the admissions materials, consult the department's website at <http://geography.sdsu.edu>.

## Section I. Master's Degree Programs

### Admission to the Degree Curriculum

Admission application deadlines for the upcoming fall semester are given at <https://geography.sdsu.edu/programs/masters/apply>.

Satisfaction of the minimum requirements of San Diego State University and of the Department of Geography does not guarantee admission to the master's program for either the fall or spring semester. Department requirements are normally a minimum grade point average of 3.0 in the last 60 semester units taken as an undergraduate and a satisfactory combined score (minimum 300, old test: 1000) on the verbal and quantitative section of the GRE. The minimum English language score is 550. Applicants taking the Computer Based Test of English must present a score of 80 or above.

Candidates whose preparation is considered insufficient by the master's advising committee will be required to complete specified courses in addition to the minimum 30 units required for the degree.

We will notify applicants of our recommendation on admission to the master's program in geography after application files in Enrollment Services and in the Department of Geography are complete. Enrollment Services will notify you of admission to the Division of Graduate Affairs.

### Advancement to Candidacy

All students must satisfy the general requirements for candidacy, as stated in Part Four of this bulletin.

### Specific Requirements for the Master of Arts Degree (Major Code: 22061) (SIMS Code: 112901)

In addition to meeting the requirements for classified graduate standing and the basic requirements for the master's degree as described in Part Four of this bulletin, the student must complete a graduate program of at least 30 units of upper division and graduate courses selected with the approval of the master's advising committee. The department requires students to complete all degree requirements within seven years of the semester that they entered the M.A. program.

The requirements for students electing the Master of Arts degree program are as follows:

1. A minimum of 30 units of courses numbered 500 or above as approved by the geography department master's advising committee. At least 24 of these units must be from the geography department.
2. A minimum of 18 of the 30 units of coursework must be 600- or 700-level courses.
3. Geography 700 and 701, normally taken during the first two semesters.
4. Completion of Geography 799A (Thesis).

### Specific Requirements for the Master of Science Degree (Major Code: 22061) (SIMS Code: 112991)

In addition to meeting the requirements for classified graduate standing and the basic requirements for the master's degree as described in Part Four of this bulletin, the student must complete a graduate program of at least 30 units of upper division and graduate courses selected with the approval of the master's advising committee. The department requires students to complete all degree requirements within seven years of the semester that they entered the M.S. program.

### Concentration in Geographic Information Science (SIMS Code: 112990)

1. A minimum of 30 units of which not more than six may be in disciplines other than geography and at least 15 units from 600- and 700-numbered courses in geography.
2. Geography 700 and 701.
3. A thesis in the area of geographic information science (Geography 799A).

4. Fifteen units from the following list of geographic information science courses: Geography 581 through 585, 589, 591 through 594, 683 through 688L, 780.
5. Additional 500-, 600-, and 700-level coursework determined in consultation with the student's thesis adviser.

#### Concentration in Watershed Science (SIMS Code: 112995)

1. A minimum of 30 units with no more than nine units from disciplines other than geography and at least 15 units from 600- and 700-numbered courses.
2. Geography 700 and 701.
3. A thesis in the area of watershed science (Geography 799A).
4. Geography 511 and six units of methods courses selected from Geography 576, 581 through 585, 589, 683 through 688L, 780.
5. Advanced coursework (12 units) in watershed science to be determined in consultation with the student's adviser.

## Section II. Doctoral Program

**WEBSITE:** <http://geography.sdsu.edu/programs/doctoral>

### General Information

(Major Code: 22061) (SIMS Code: 112901)

The cooperating faculties of the Department of Geography at San Diego State University and the University of California, Santa Barbara, offer a joint doctoral program in geography. The research interests of the participating faculty members cover a range of geographic problems. The joint doctoral program offers work leading to the Ph.D. in the following systematic areas (Group A) with supporting development of skills in spatial techniques (Group B) as previously listed.

Each student's program is designed around one of the areas selected from Group A and at least one of the technique emphases selected from Group B. Students must attain the requisite skills in programming, statistics, mathematics, and foreign language necessary to successfully pursue their research goals.

### Admission to the Degree Curriculum

Applicants for admission to the doctoral program in geography offered jointly by SDSU and UCSB must meet the general requirements for admission to both universities with classified graduate standing as outlined in the respective current catalogs. There are no inflexible requirements for entrance to graduate study in this program, but a strong background in geography or a closely related field is essential. Admission to the program requires acceptance by the graduate deans and by the participating departments at UCSB and SDSU. Applications from outstanding students in other majors are encouraged, but such students should expect to take additional courses during their first year to improve their background. All students entering the program should have completed a lower and upper division statistics course and the appropriate mathematics and computer science courses for the specialty chosen.

**Application.** Admission application deadlines for the upcoming fall semester are given at <https://geography.sdsu.edu/programs/doctoral/apply>. Applicants are not admitted for the spring semester. Review procedures begin in January with admission notification beginning mid-March and continuing through mid-April.

A high undergraduate grade point average, normally 3.25 or better for the last 60 units taken (90 quarter units), and/or a graduate grade point average of 3.50 or better are required for admission. A minimum combined score of 1100 (for tests taken prior to August 2011) or 307 (for tests taken after August 2011) on the GRE is expected. Scores on both the verbal and quantitative sections of the GRE should exceed the 50th percentile. Foreign students whose preparatory education was not in English should receive a minimum Test of English as a Foreign Language (TOEFL) score of 600 for the paper-based test and 100 for the Internet-based test.

Satisfaction of the minimum requirements at San Diego State University or the Department of Geography does not guarantee admission to the doctoral program.

### Specific Requirements

**Residency Requirements.** After formal admission to the joint doctoral program, the student must spend at least one academic year in full-time residence on each of the two campuses. The definition of residence must be in accord with the regulations of UCSB and SDSU. Usually, the first year is spent at SDSU, the second at UCSB, and subsequent years at SDSU.

**Advising Committee.** Upon admission to the program, the joint doctoral graduate advisers of the two institutions will establish an advising committee for each student. The committee will consist of four faculty members, normally two from each campus. In consultation with the student, the committee will develop a course of study, including identifying academic deficiencies and recommending remedies for them. The advising committee will be the official advising group for the student until a joint doctoral committee has been chosen and recommended to the Divisions of Graduate Affairs by the advising committee.

**Language Requirement.** There is no specific foreign language requirement for this program, but knowledge of a foreign language may be deemed necessary by the advising committee to successfully pursue the student's research goal.

**Course Requirements.** Students admitted into the joint doctoral program are expected to take common core courses. At SDSU, these include: Geography 700 (Seminar in Geographic Research Design) and Geography 701 (Seminar in Development of Geographic Thought). At UCSB, students are required to register in Geography 200A (Introduction to Geographic Research) and Geography 201 (Colloquium) each quarter. No specified number of courses beyond core courses is required for the doctoral degree. However, students are expected to have a broad understanding of modern geographic principles in addition to a specialist's competence in their own sub-field. In addition, all doctoral students must have computational skills and knowledge of spatial analysis.

### Qualifying Examinations

**Joint Doctoral Committee.** When a doctoral student makes a definitive selection of the systematic area and technique emphasis as well as the general topic of their dissertation research, she/he will select a dissertation supervisor (major professor), who can be from either department but who normally will be a member of the SDSU faculty, and the members of his/her joint doctoral committee. The joint doctoral committee shall be composed of at least four members (with the rank of Assistant Professor or above), two from the SDSU department and two from the UCSB department. The committee may be augmented as needed by an additional member from outside geography at UCSB or a member of the faculty at SDSU from outside of geography or, when authorized, another university. Chaired by the student's major professor, the joint doctoral committee shall be responsible for evaluating the dissertation proposal, administering and evaluating the qualifying examination, judging the dissertation, and administering and evaluating the dissertation defense.

**Qualifying Examinations.** The process of qualifying to write a Ph.D. dissertation has three steps. First, the student must take a written qualifying examination that normally consists of three portions devoted to: 1) the student's substantive area, 2) the technical or methodological field(s) of interest, and 3) general geographic thought and inquiry. Second, the student prepares a dissertation proposal that describes the dissertation topic, summarizes the relevant background literature, and presents a comprehensive research plan for the dissertation. Third, the student's doctoral committee will conduct an oral qualifying examination to ensure that the student possesses the full knowledge and competence required to carry out her or his dissertation research. The doctoral committee will assign a pass or fail grade for each examination. Passing the written examination allows the student to proceed to the preparation of the dissertation proposal. The doctoral committee must conditionally approve the dissertation proposal before the student takes the oral qualifying examination. Passing the oral examination signifies that the doctoral dissertation proposal is approved. A student may repeat each examination once.

Upon satisfactory completion of the oral examination and prescribed coursework, the student must apply to the graduate dean

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at UCSB for advancement to candidacy. Upon payment of the candidacy fee to UCSB, and after approval by the graduate deans of both campuses, students will be notified of their advancement to candidacy by the UCSB graduate dean.

**Dissertation.** Following the successful completion of all prescribed coursework and qualifying examinations, the major remaining requirement for the Ph.D. degree will be the satisfactory completion of a dissertation consisting of original research of publishable quality carried out under the guidance of the major professor. Approval of the completed dissertation by the joint doctoral committee implies that an organized investigation has been carried out yielding substantial conclusions of interest which expand the frontiers of knowledge and understanding in the discipline. Results must be reported in a manner demonstrating the ability of the candidate to effectively pursue and report independent investigation.

The requirement for completing and filing the dissertation, including the number of copies required, will be decided jointly by the graduate deans and in accordance with regulations of the Divisions of Graduate Affairs.

**Final Examination.** The final examination, organized and administered by the joint doctoral committee, shall consist of a public dissertation defense, before the joint doctoral committee.

**Award of the Degree.** The Doctor of Philosophy degree in geography will be awarded jointly by the Regents of the University of California and the Trustees of The California State University in the names of both institutions.

**Financial Support.** The Department of Geography at SDSU has a number of research and teaching associateships available to support students admitted to the joint doctoral program. All students applying to admission to the joint doctoral program will be considered for financial support.

## Courses Acceptable for Master's and Doctoral Degree Programs in Geography (GEOG)

*Refer to Courses and Curricula and Regulations of the Division of Graduate Affairs sections of this bulletin for explanation of the course numbering system, unit or credit hour, prerequisites, and related information.*

### UPPER DIVISION COURSES

#### **GEOG 506. Landscape Ecology (3)**

Prerequisite: Geography 101. Recommended: Geography 370 or 385.

Links between landscape patterns and ecological processes at a variety of spatial scales to include causes and measures of landscape patterns, effects of landscape patterns on organisms, landscape models, landscape planning and management.

#### **GEOG 507. Geography of Natural Vegetation (3)**

Prerequisite: Geography 101, Biology 100, or Environmental Science 100 [or Sustainability 100].

The natural vegetation formations of the world and their classifications, development, distribution, and environmental influences to include relationships to human activities. Field trips may be arranged.

#### **GEOG 509. Regional Climatology (3)**

Prerequisite: Geography 101, 103, or Environmental Science 100 [or Sustainability 100].

Regional distributions of Earth's climates and basic principles governing atmospheric processes that control global distributions of climate types.

#### **GEOG 511. Hydrology and Global Environmental Change (3)**

Prerequisite: Geography 101 or 103.

Hydrologic processes and regimes, how these are affected by environmental change and how hydrologic process and regimes affect patterns of environmental change. Processes operating at global, regional, and local scales are examined, including land-use/land-cover change and climate change.

#### **GEOG 512. World on Fire (3)**

Prerequisite: Geography 101 or 103 or Biology 100 or Environmental Science 100 [or Sustainability 100] or Geological Sciences 100 or 104.

Wild-land fire processes, controls, and effect on soils, water resources, and vegetation in contrasting ecosystems. Fire regimes and mitigation strategies. Fire research.

#### **GEOG 554. World Cities: Comparative Approaches to Urbanization (3)**

Prerequisite: Geography 354.

Worldwide trends in urbanization. Case studies of selected cities from various culture areas with focus on international variations in city structure and urban problems.

#### **GEOG 570. Environmental Conservation Practice (3)**

Prerequisite: Geography 370.

Management of environmental and natural resources. Effective programs and the institutional frameworks in which they occur.

#### **GEOG 572. Land Use Analysis (3)**

Prerequisite: Geography 370.

Theoretical and practical approaches to land use management. Current and relevant techniques and policies at local, state and federal levels, aimed toward providing healthy and environmentally sound communities that provide positive benefits to society and the economy. Field trips may be arranged.

#### **GEOG 573. Population and the Environment (3)**

Prerequisite: Geography 102.

Population distribution, growth, and characteristics as they relate to environmental degradation, both as causes and consequences. Roles of women, sustainable development, carrying capacity, optimum population, and policy initiatives in relationships between population and environment.

#### **GEOG 574. Water Resources (3)**

Prerequisites: Geography 370 and 375.

Occurrence and utilization of water resources and the problems of water resource development. Field trips may be arranged.

#### **GEOG 575. Geography of Recreational Land Use (3)**

Prerequisite: Geography 101 or 102.

Importance of society, environment, and location in the use, management, and quality of recreation areas. Direct observation of practices and policies with field trips to local (San Diego) areas and an optional four-day trip to Yosemite National Park.

#### **GEOG 576. Advanced Watershed Analysis (3)**

Prerequisite: Geography 101, 103, or 104. Recommended: Geography 375 and 484.

Theory and techniques in watershed analysis. Use of GIS and statistical programming for analyses of geomorphology, hydrology, and water quality data.

#### **GEOG 580. Data Management for Geographic Information Systems (3)**

Two lectures and three hours of laboratory.

Prerequisites: Geography 381 or 484; Computer Science 107 or 108; or graduate standing.

PostgreSQL, PostGIS, and open source databases to store, manage, and query geospatial data.

#### **GEOG 581. Cartographic Design (3)**

Two lectures and three hours of laboratory.

Prerequisite: Geography 381.

Computer-assisted map production techniques with emphasis on map design and color use.

#### **GEOG 582. GIS Programming with Python (3)**

Prerequisite: Geography 381, 484, or graduate standing. Recommended: Computer Science 107 or 108.

Automating geocoding processes by Python scripting, managing vector and raster data, and preprocessing geospatial data.

**GEOG 583. Internet Mapping and Distributed GIServices (3)**

Two lectures and three hours of laboratory.  
Prerequisite: Geography 381 or 484.

Current development of Internet mapping and cartographic skills for web-based maps (multimedia, animation, and interactive design). Fundamental theories of distributed GIS to support Internet mapping with focus on distributed component technologies, Internet map servers, and web services.

**GEOG 584. Geographic Information Systems Applications (3)**

Two lectures and three hours of laboratory.  
Prerequisite: Geography 484.

Spatial analysis methods in GIS, to include terrain, raster, and network analysis. Feature distributions and patterns. GIS data processing techniques to include spatial interpolation, geocoding, and dynamic segmentation. Designing and executing analytical procedures.

**GEOG 585. Quantitative Methods in Geographic Research (3)**

Prerequisite: Geography 385.

Application of statistical techniques to geographic research to include simple regression and correlation, multiple regression, geographically weighted regression, classification, factor analysis, and computer applications.

**GEOG 586. Qualitative Methods in Geographic Research (3)**

Prerequisite: Geography 102.

Application of qualitative techniques to geographic research including reflexive survey design and in-depth interviews, non-obtrusive methods, landscape interpretation, textual methods and discourse analysis, feminist criticism, and humanistic and historical materialist perspectives on measurement.

**GEOG 589. GIS-Based Decision Support Methods (3)**

Prerequisite: Geography 484.

Integration of Geographic Information Systems (GIS) with discrete and continuous multiple criteria decision making (MCDM) methods. Applications of MCDM in land use planning, site selection, and resource management spatial decision problems.

**GEOG 590. Community-Based Geographic Research (3)**

One lecture and four hours of activity or fieldwork.

Prerequisite: Consent of instructor. Recommended: Statistics 119.

Local social and/or environmental issues. Research design, data collection and analysis, collaboration with community-based organizations, reflection on research and social responsibility, communication of findings. Maximum credit six units.

**GEOG 591. Remote Sensing of Environment (3)**

Prerequisites: Geography 101, Environmental Science 100 [or Sustainability 100]. Recommended: Physics 180A-180B. Undergraduate students must be concurrently registered in Geography 591 and 591L. Graduate students may take Geography 591L concurrently or after Geography 591.

Acquiring and interpreting remotely sensed data of environment. Electromagnetic radiation processes, aerial and satellite imaging systems and imagery. Geographic analysis of selected human, terrestrial, and marine processes and resources. (Geography 591 and 591L formerly numbered Geography 587.)

**GEOG 591L. Remote Sensing of Environment Laboratory (1)**

Three hours of laboratory.

Prerequisites: Geography 101, Environmental Science 100 [or Sustainability 100]. Recommended: Physics 180A-180B. Undergraduate students must be concurrently registered in Geography 591 and 591L. Graduate students may take Geography 591L concurrently or after Geography 591.

Practical exercises, introductory processing, visual interpretation and mapping of remotely sensed imagery. (Geography 591 and 591L formerly numbered Geography 587.)

**GEOG 592. Intermediate Remote Sensing of Environment (3)**

Prerequisites: Geography 385, 591, 591L. Undergraduate students must be concurrently registered in Geography 592 and 592L. Graduate students may take Geography 592L concurrently or after Geography 592.

Digital image processing. Thermal infrared and microwave imaging systems and image interpretation principles. Geographic analysis of selected human, terrestrial, oceanographic, and atmospheric processes and resources. (Geography 592 and 592L formerly numbered Geography 588.)

**GEOG 592L. Intermediate Remote Sensing of Environment Laboratory (1)**

Three hours of laboratory.

Prerequisites: Geography 385, 591, 591L. Undergraduate students must be concurrently registered in Geography 592 and 592L. Graduate students may take Geography 592L concurrently or after Geography 592.

Digital image processing, visual interpretation, mapping of thermal infrared, and microwave imagery. (Geography 592 and 592L formerly numbered Geography 588.)

**GEOG 593. GIS for Business Location Decisions (3)**

Two lectures and three hours of laboratory.

Prerequisite: Geography 484 or graduate standing. Recommended: Geography 584, 589.

Geographic Information Systems (GIS) and location analysis methods to include modeling and spatial analysis. Applications of GIS and location analysis in business site selection, market segmentation, retail marketing, and service area analysis.

**GEOG 594. Big Data Science and Analytics Platforms (3)**

Prerequisites: Geography 104, Computer Science 100 or 107, and Geography 385, Sociology 201, Statistics 250, or graduate standing.

Big data science to include analysis, data collection, filtering, GIS, machine learning, processing, text analysis, and visualization. Computational platforms, skills, and tools for conducting big data analytics with real world case studies and examples.

**GEOG 595. Geographic Internship (3)**

Prerequisites: Six upper division units in geography and consent of instructor.

Students will be assigned to various government agencies and industry and will work under the joint supervision of agency heads and the course instructor.

**GEOG 596. Advanced Topics in Geography (1-3)**

Prerequisites: Six upper division units in geography.

Advanced special topics in geography. May be repeated with new content. See *Class Schedule* for specific content. Limit of nine units of any combination of 296, 496, 596 courses applicable to a bachelor's degree. Credit for 596 and 696 applicable to a master's degree with approval of the graduate adviser.

**GRADUATE COURSES**

**GEOG 670. Environmental Conservation Theory (3)**

Prerequisite: Graduate standing.

Theories and principles involved in natural and environmental resources management.

**GEOG 683. Advanced Geographic Information Systems (3)**

Prerequisites: Geography 484 and Computer Science 108.

Scripting techniques with Python for automating geoprocessing tasks and developing GIS tools. Use of Bayes' Theorem in spatial modeling.

**GEOG 683L. Advanced Geographic Information Systems Laboratory (1-2)**

Three to six hours of laboratory.

Prerequisite: Concurrent registration in Geography 683.

Geoprocessing Python scripting techniques with applications to spatial modeling and analysis.

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### **GEOG 688. Advanced Remote Sensing (3)**

Prerequisite: Graduate standing.

Sensor systems, image interpretation and geographic applications in thermal infrared and microwave remote sensing. Principles of digital image processing.

### **GEOG 688L. Advanced Remote Sensing Laboratory (1-2)**

Two or four hours of laboratory.

Prerequisite: Concurrent registration in Geography 688.

Processing and analysis of remotely sensed data. Laboratory training in sensor systems and digital image-processing methods including thermal infrared and microwave data analysis.

### **GEOG 696. Advanced Special Topics in Geography (3)**

Prerequisite: Consent of instructor.

Advanced special topics in geography. May be repeated with new content. See *Class Schedule* for specific content. Credit for 596 and 696 applicable to a master's degree with approval of the graduate adviser.

### **GEOG 700. Seminar in Geographic Research Design (3)**

Prerequisite: Graduate standing.

Definition of spatial problems, hypothesis formulation and testing, selection of appropriate methodology. Development of research proposals, conduct of research, written and oral presentations.

### **GEOG 701. Seminar in Development of Geographic Thought (3)**

Prerequisite: Graduate standing.

Evolution of concepts concerning the nature, scope, theories, and methodologies of geography.

### **GEOG 710. Seminar in Physical Geography (3)**

Prerequisites: Six units of upper division or graduate level courses in physical geography.

Intensive study of an aspect of physical geography. May be repeated with new content. See *Class Schedule* for specific content. Maximum credit six units applicable to a master's degree.

### **GEOG 740. Seminar in Human Geography (3)**

Prerequisites: Six units of upper division or graduate level courses in human geography.

Intensive study of a spatial aspect of human geography. May be repeated with new content. See *Class Schedule* for specific content. Maximum credit six units applicable to a master's degree.

### **GEOG 760. Seminar in Behavioral and Social Geography (3)**

Prerequisites: Six units of upper division or graduate level courses in behavioral or social geography.

Intensive study of a spatial aspect of behavioral or social geography. May be repeated with new content. See *Class Schedule* for specific content. Maximum credit six units applicable to a master's degree.

### **GEOG 770. Seminar in Environmental Conservation (3)**

Prerequisites: Geography 670 and six units of upper division or graduate level courses in environmental or resource conservation.

Natural and environmental resource conservation. May be repeated with new content. See *Class Schedule* for specific content. Maximum credit six units applicable to a master's degree.

### **GEOG 780. Seminar in Techniques of Spatial Analysis (3)**

Prerequisites: Six units of upper division or graduate level courses in spatial analytic techniques.

Spatial analytic techniques from image processing, remote sensing, geographic information systems, cartography or quantitative methods. May be repeated with new content. See *Class Schedule* for specific content. Maximum credit six units applicable to a master's degree.

### **GEOG 797. Research (1-3) Cr/NC/RP**

Research in one of the fields of geography. Maximum credit six units applicable to a master's degree.

### **GEOG 798. Special Study (1-3) Cr/NC/RP**

Prerequisite: Consent of staff; to be arranged with department chair and instructor.

Individual study. Maximum credit six units applicable to a master's degree.

### **GEOG 799A. Thesis (3) Cr/NC/RP**

Prerequisites: An officially appointed thesis committee and advancement to candidacy.

Preparation of a project or thesis for the master's degree.

### **GEOG 799B. Thesis Extension (0) Cr/NC**

Prerequisite: Prior registration in Thesis 799A with an assigned grade symbol of RP.

Registration required in any semester or term following assignment of RP in Course 799A in which the student expects to use the facilities and resources of the university; also student must be registered in the course when the completed thesis is granted final approval.

## DOCTORAL COURSES

### **GEOG 890. Independent Study for Doctoral Examination (1-9) Cr/NC**

Prerequisite: Consent of instructor or graduate adviser.

Tutorial with student's major professor in preparation for qualifying examinations. No unit credit allowed toward advanced degree. Maximum credit nine units.

### **GEOG 897. Doctoral Research (1-15) Cr/NC/RP**

Prerequisite: Admission to the doctoral program.

Independent investigation in the general field of the dissertation.

### **GEOG 899. Doctoral Dissertation (1-15) Cr/NC/RP**

Prerequisites: Advancement to candidacy and an officially constituted dissertation committee.

Preparation of a dissertation for the doctoral degree. Enrollment is required during the term in which the dissertation is approved. No unit credit allowed toward advanced degree.