

# **GRADUATE CERTIFICATE PROGRAM**

***“GEOGRAPHIC INFORMATION SCIENCES”***

**Department of Geography  
University of North Carolina – Chapel Hill**

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## **Introduction**

Geographic Information Sciences (GISc) are an integrated set of spatial digital technologies including tools, techniques, concepts, and data sets associated with geographic information systems, remote sensing, data visualization, global positioning systems, spatial analysis, and quantitative methods. Together, and separately, these spatial digital technologies have gained prominence in geography and are emerging into associated social, behavioral, and biophysical sciences, as well as into city and regional planning, population-environment interactions, industry, government, health sciences, and health care delivery systems. These spatial digital technologies offer the opportunity to gain fresh insights into the pattern of variables and the behavior of systems through, for example, (1) the spatial, temporal, spectral, and radiometric resolutions of remote sensing systems that are capable of mapping a host of social and ecological landscapes, (2) the analytical and data integration capability of geographic information systems, (3) the locational specificity afforded through global positioning systems, (4) the predictive power of quantitative models and the descriptive capacity of statistical relationships and

spatial analyses, and (5) the importance of data visualizations to characterize pattern and to relate scales of representation to processes influencing areal distributions recorded over space and through time.

As a rapidly growing computer technology, GIScience provides a suite of tools used to support many kinds of decision-making and analyses including environmental policy, marketing, planning, demographic analysis, as well as studies using integrated data within a GIS for resource management, ecological analyses, health care delivery, nutrition and diet, environment and health, epidemiology, information technology, and more. GIScience is routinely used in government agencies, corporations, environmental health and ecological consulting firms, planning organizations, and academic institutions.

### **Program Overview**

The Graduate Certificate Program in *Geographic Information Sciences* offered within the Department of Geography is designed to educate and train students in geographic information systems, remote sensing, quantitative methods, spatial analysis, global positioning systems, and data visualization. The Program is intended to provide a mix of theory and practical knowledge having wide application in business, health, environment, planning, and in other areas. The Program is designed to serve (1) students in the arts and sciences as well as the health sciences and information technologies who wish to acquire technical expertise to support the topical knowledge gained in their undergraduate and graduate programs, and (2) returning students who wish to acquire specialized education and training to meet current or future job requirements calling for knowledge in geographic information sciences. The primary goal of the Program is to ensure that students become sufficiently grounded in theoretical underpinnings of Geographic Information Sciences to enable them to make informed use of existing applications software and to construct new applications of moderate size in both the physical and social sciences. Through lab exercises, course projects, and the Capstone project, experiences will be acquired in the use of major GIScience software packages including ArcView, ArcGIS, ERDAS Imagine, S-Plus, GRASS, Fragstats, IPW, and more. By teaching concepts, spatial reasoning, and hands-on uses, the Program differs from a typical short course designed to teach a particular software package and a relatively narrow range of spatial concepts germane to the software. The basic intent is for students to achieve a balanced combination of education and training in the use of a diverse set of tools, techniques, data, and spatial concepts that collectively reside within the analytical framework that defines Geographic Information Sciences.

### **Program Components**

There are four components to the Program: (1) a set of three core courses (select from the approved list below; substitutions considered) in Geographic Information Sciences required of all students enrolled in the Program, (2) a set of two “primary” elective courses in Geographic Information Sciences in Geography that permit exploration of advanced or associated topics, (3) a set of two “secondary” elective courses in Geographic Information Sciences from throughout the campus community on associated themes, and (4) a creative Capstone project/experience that emphasizes Geographic Information Science applications, Geographic Information Sciences technology, and/or Geospatial data through, for example, an approved internship

program, documented work experiences, an individual research project, development of GIScience software or applications modules, and/or teaching of an approved GISc course at the university level.

### **Program Requirements**

The Program requires 21-hours of graduate-level university credit to obtain a Certificate of Achievement in Geographic Information Sciences from the University of North Carolina – Chapel Hill and the Department of Geography. No grade below “B” is accepted; only one grade of “L” for UNC graduate students will be accepted in this Program. Students who complete three free introductory modules in Geographic Information Science available as part of the ESRI Virtual Campus (see <http://campus.esri.com>) can apply 3-credits towards the “primary” or “secondary” list of courses appropriate to this UNC Certificate Program. It is possible to substitute a mix of ESRI courses in “Applications” and “GIS Technology” for those in “GIScience” (see below and the provided web site).

#### **Geography Core Courses (choose three courses)**

Geography 477 – Introduction to Remote Sensing of the Environment

Geography 491 – Geographic Information Systems

Geography 577 – Advanced Remote Sensing

Geography 591 – Applied GIS

Geography 593 – GIS Programming

Geography 594 – Global Positioning Systems and Applications

Geography 705 – Advanced Quantitative Methods in Geography

Geography 790 – Spatial Analysis and Computer Modeling

Geography 802 – Seminar in Geographic Information Sciences

#### **Primary Elective Courses (choose two courses)**

Geography 410 – Modeling Environmental Systems

Geography 419 – Field Methods in Physical Geography

Geography 477 – Introduction to Remote Sensing of the Environment

Geography 491 – Geographic Information Systems

Geography 577 – Advanced Remote Sensing

Geography 591 – Applied Issues in Geographic Information Systems

Geography 593 – GIS Programming

Geography 594 – Global Positioning Systems and Applications

Geography 595 – Ecological Modeling

Geography 705 – Advanced Quantitative Methods in Geography

Geography 715 – Land Use/Land Cover Dynamics and Human-Environment Interactions

Geography 790 – Spatial Analysis and Computer Modeling

Geography 802 – Seminar in Geographic Information Sciences

Geography 812 – Readings in Geographic Information Sciences

**Secondary Elective Courses (choose three courses)**

***City & Regional Planning***

491 – GIS for Planners

591 – Advanced GIS

714 – Urban Spatial Structure

721 – Advanced Planning Methods

***Computer Science***

426 – Advanced WWW Programming

431 – Internet Services and Protocols

521 – Files and Databases

665 – Images, Graphics, and Vision

715 – Visualization in the Sciences

761 – Introduction to Computer Graphics

721 – Database Management Systems

775 – Image Processing and Analysis

***Biostatistics***

667 – Applied Stochastic Processes

670 – Demographic Techniques I

735 – Statistical Computing: Basic Principles and Applications

759 – Applied Time-Series Analysis

760 – Advanced Probability and Statistical Inference I

762 – Advanced Linear Models

771 – Demographic Techniques II

***Environmental Sciences & Engineering***

461 – Environmental Systems Modeling

462 – Geo-Statistics for Spatial/Temporal Environmental Phenomena

468 – Advanced Functions of Temporal GIS

661 – Scientific Computation I

662 – Scientific Computation II

668 – Methods of Applied Mathematics I

669 – Methods of Applied Mathematics II

***Geological Sciences***

483 – Geological and Oceanographic Applications of GIS

516 – Environmental Field Mapping and Information Systems

520 – Data Analysis in the Earth Sciences

***Information & Library Science***

520 – Organization of Information

523 – Introduction to Databases

572 – Internet Applications

582 – Systems Analysis

623 – Database Systems I

668 – Advanced Internet Applications

720 – Metadata Architectures & Applications

723 – Database Systems II

***Marine Sciences***

415 – Environmental Systems Modeling

483 – Geological & Oceanographic Applications of GIS

561 – Time Series & Spatial Data Analysis

***Mathematics***

550 – Topology

551 – Euclidean and Non-Euclidean Geometries

555 – Introduction to Dynamics

***Physics & Astronomy***

415 – Optics

595 – NonLinear Dynamics

715 – Visualization in Science

711 – Electromagnetic Theory I

***Sociology***

708 – Linear Regression Models

711 – Analysis of Categorical Data

718 – Longitudinal and Multilevel Data Analysis

***Statistics***

754 – Time Series & Multivariate Analysis

- 734 – Stochastic Processes
- 757 – Bayesian Statistics
- 833 – Time-Series Analysis
- 856 – Multivariate Analysis
- 857 – Non-Parametric Multivariate Analysis

**ESRI Virtual Campus (<http://campus.esri.com>): See the Simple Courses Below**

***GIScience***

- “Introduction to Geostatistical Analysis”
- “Cartographic Design”
- “Planning for a GIS”
- “Protecting your Investment in Data with MetaData”
- “Turning Data into Information”
- “Understanding Geographic Data”
- “Understanding GIS Operations: A Transformational Approach”
- “Understanding Map Projections and Coordinate Systems”

***Applications***

- Agriculture
- Business
- Census
- Conservation
- Earth Science
- Forestry
- Health
- Hydrology
- K-12 Education
- Marine Science
- Public Safety & State and Local Government

***GIS Technology***

- ArcGIS and Extensions
- ArcIMS
- ArcInfo and Extensions
- ArcLogistics Route

ArcPad  
 ArcSDE  
 ArcView 3.x and Extensions  
 Avenue  
 Geography Network  
 MapObjects  
 MapShop  
 Visual Basic  
 Visual Basic for Applications

### **Capstone Project/Experience in Geographic Information Sciences**

Required of all enrolled students, the creative Capstone project/experience must clearly emphasize Geographic Information Sciences, be documented in a 3-5 page proposal submitted to the Program Director, and be subsequently approved by the Program Coordinating Committee (Stephen J. Walsh (chair), Aaron Moody, Conghe Song, and Jun Liang).

It is possible to waive the requirement with satisfactory documentation and compelling evidence of appropriate prior experiences. This Program requirement may be satisfied by the following examples: individual research projects with pronounced emphasis on Geographic Information Science technology and/or applications; geospatial data handling; development of spatial software tools, techniques, and instructional modules in Geographic Information Science; teaching an approved course in Geographic Information Science at the university- or community college-level; an internship that emphasizes Geographic Information Sciences in research, applications, or technology; and other ways appropriate to the student's interests and opportunities. Approved courses will be periodically revised. Students can petition the Program Coordinating Committee to consider alternate courses that have pronounced and documented spatial elements.

### **Admission to the Program**

Admission is competitive. The minimum requirements are a bachelor's degree in any of the physical or social sciences or the humanities, and an introductory course in statistical methods (univariate statistics through bivariate correlation and regression). Application deadlines are June 15<sup>th</sup> for fall admission, and November 15<sup>th</sup> for spring admission. There are no summer admissions. Students pay fees according to the graduate tuition rates. See the Office of the Registrar for current tuition rates. Loans, student hourly positions, and similar financial aid administered through the University are available. Certificate students (i.e., externally-admitted students for the Certificate Program; students not admitted into normal Graduate Programs in Geography or elsewhere on campus) are not eligible for teaching assistantships in Geography or Graduate School Fellowships (University regulations), but students can apply for research assistantships associated with externally-funded projects and other department activities. The Program is intended as a 3-semester (full-time) course of study. Part-time students have up to 4-years to complete the Program. On-campus graduate students can

enroll in the Certificate Program throughout the academic year by contacting the Department of Geography. Up to 6-credit hours may transfer to meet Program requirements. A Program Director and Coordinating Committee will review applications for admission and consider other program elements as needed (e.g., course and credit transfer, appropriateness of the Capstone project/experience). Upon completion of the Program, a Certificate of Accomplishment will be awarded by the Department of Geography and a “Certificate” stamp or notation will be added to the transcript by the UNC Office of the Registrar, thereby, indicating a satisfactory completion of the Program. No credit is offered for the Capstone project/experience, but its completion is required.

### **Application Material**

To apply, please send an undergraduate or graduate transcript, GRE scores for verbal and quantitative (encouraged, but not required for students beyond 5-years of completing their undergraduate degree), two letters of recommendation, and an essay that describes your interest in the program and your rationale for applying. Indicate your requested start date (i.e., fall or spring semester), course listings and descriptions of any possible transfer credit requested, discussion of possible Capstone interests or prior experiences that might serve as the Capstone requirement, and full contact information.

While research assistantship funding by the department should not be expected, your application may indicate your possible interest in an assistantship or other department activities with suitable justification.

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### **Contact Information**

Students should enroll in the GISc Certificate Program within the Department of Geography by completing the required application material (see above) and sending it electronically or in hardcopy to:

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