GRADUATE CERTIFICATE PROGRAM

GEOGRAPHIC INFORMATION SCIENCES

Department of Geography
University of North Carolina – Chapel Hill
Conghe Song, Director
csong at email dot unc dot edu
919-962-6816 (voice)
919-962-1537 (fax)
http://www.unc.edu/depts/geog/

Nell Phillips, Manager
nphillip@email.unc.edu (email)
919-962-8901 (voice)
919-962-1537 (fax)

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Introduction

Geographic Information Sciences (GIScience) study geospatial phenomena using 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 geospatial theories and 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. GIScience offers the opportunity to gain fresh insights into the spatio-temporal patterns of variables and the behaviors of both social and ecological systems through, for example, (1) remotely sensed data that are capable of mapping a host of social and ecological landscapes using information from spatial, temporal, spectral, and directional domains, (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. Due to the rapid growth of these spatial digital technologies, GIScience uses a suite of tools to support many kinds of decision-making and analyses with spatial data from multiple dimensions, such as 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 541 – GIS in Public Health
Geography 577 – Advanced Remote Sensing
Geography 591 – Applied Issues in Geographic Information Systems
(Urban GIS **AND/OR** Watershed 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 541 – GIS in Public Health
Geography 577 – Advanced Remote Sensing
Geography 591 – Applied Issues in Geographic Information Systems
(Urban GIS **AND/OR** Watershed GIS)
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 two courses)

Anthropology
419 – Anthropological Applications and GIS
725 – Quantitative Methods in Anthorpology

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

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

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
415 – Environmental Systems Modeling
480 – Modeling of Marine and Earth Systems
483 – Remote Sensing and GIS for Earth Scientists

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 (Conghe Song (chair), Stephen Walsh, Aaron Moody, Xiaodong Chen, 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 15th for fall admission, and November 15th 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 and/or graduate transcript(s), two letters of recommendation directly sent to the program director, 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.

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:

Dr. Conghe Song Director
Department of Geography
University of North Carolina at Chapel Hill
Chapel Hill, NC 27599-3220
csong at email dot unc dot edu
919-962-6816 (voice), 919-962-1537 (fax)
Ms. Nell Phillips, Program Manager
nphillip@email.unc.edu (email)
919-962-8901 (voice); 919-962-1537 (fax)