



BOARD OF REGENTS OF
THE UNIVERSITY SYSTEM OF GEORGIA

CERTIFICATE NOTIFICATION FORM

Institution: Georgia College & State University

College/Division: Arts & Sciences

Department: History & Geography

Name of Certificate: Geographic Information Science

CIP Code: 45.0702

Certificate Acronym: *CERO*

Number of Credit Hours of Core Curriculum Courses: 0

Total Credit Hours for Certificate Completion: 18-22

Start Date: Fall 2017

Approved by: _____
Vice President for Academic Affairs/Provost

**GEORGIA COLLEGE & STATE UNIVERSITY
DEGREE PROGRAM and CURRICULUM CHANGES PROPOSAL COVER SHEET**

PROPOSAL: GIS Certificate	
COLLEGE: Arts & Sciences	DEPARTMENT: History & Geography
DEGREE: Certificate	CIP CODE: 45.0702
MAJOR: N/A	MINOR: N/A
CONCENTRATION NAME: Certificate in Geographic Information Science	PROPOSED EFFECTIVE DATE: (semester/year) : Fall 2017
Description and Rationale for Recommended Action (attach additional pages if needed, this description will be shared at all levels in the University, and the University System and SACS Offices): (SEE ATTACHED)	

Action Item (Check one.)

- New Major, Minor, **Certificate**, or Concentration
- Rename Major, Minor, Certificate, or Concentration
- Deactivate/Discontinue Major, Minor, Certificate, or Concentration
- New Degree or Graduation Requirement
- General Education Requirement or Change
- Curricular Change that Impacts Multiple Colleges
- Modify Existing Major, Minor, Certificate, Concentration Requirements

All **required documentation** must be attached. (Electronic MS Word files with supporting documents are required at each level of review)

Reviewing entity	" • " denotes necessary routing.				Signature and Date	Recommend	*Not Recommended	Reviewed - Information Only
	Major (new, modify, rename, deactivate)	Concentration or Certificate (new, modify, rename, deactivate)	Minor (new, modify, rename, deactivate)	General Education or Curricular Change affecting multiple colleges				
Chair, Department Curriculum Committee	•	•	•	•	Aran MacKinnon 10-13-16	X		
Department Office Department Chair	•	•	•	•	Aran MacKinnon 10-13-16	X		
Chair, College Curriculum Committee	•	•	•	•	Chavonda Mills 11-04-16	X		
Dean's Office Dean	•	•	•	•	Chavonda Mills 11-04-16	X		
Graduate Council (as appropriate for Graduate Curriculum)	•	•	•	•				
Curriculum and Assessment Policy Committee of University Senate	•	•	•	•				
University Senate	•	•	•	•				
Academic Affairs Provost Office	•	•	•	•				
President	•	•	•	•				
USG/BOR Review/Information Item	•	•	•	•				
SACSCOC Notification	•	•	•	•				

*A "Not Recommend" recommendation should include reviewer rationale and recommended action.

Certificate in Geographic Information Science at Georgia College

Justification

Introduction

Geographic Information Science (GISc) involves the application of spatial information and mapping technologies to solving complex problems which exist over space. Since most human pursuits and environmental events of interest occur on the surface of Earth, GISc applies to many fields of academic inquiry, from geography and ecology to marketing, sociology, public health, and political science. This proposal is to create an institutional-level Certificate in Geographic Information Science, so that graduates of Georgia College can demonstrate superior training and thinking as they move into graduate careers and professional opportunities.

*"Geospatial data and tools are essential in almost everything we do as humans, and over the past few years they have become accessible to virtually all of us on the well-endowed side of the digital divide."*¹

There are over three hundred geographic information certificates in place at U. S. institutions of higher education². In Georgia, several University System of Georgia institutions have developed programs (North Georgia University, University of Georgia, Kennesaw State University, University of West Georgia, Georgia State University, Georgia Institute of Technology, and others). Most of these schools are located in the northern part of the state, yet there is a growing demand for Geographic Information Systems (GIS) specialists outside of metropolitan Atlanta.³ At local levels, graduates with degrees in geospatial technology or related fields have enjoyed faster than average growth in jobs offered and in median salaries, as city and county governments prepare for a technologically-driven data management system in the face of rapidly changing socio-economic and environmental factors.⁴

*"Geospatial technology refers to equipment used in visualization, measurement, and analysis of earth's features, typically involving such systems as GPS (global positioning systems), GIS (geographical information systems), and RS (remote sensing). Its use is well-known and widespread in the military and in homeland security, but its influence is pervasive everywhere, even in areas with a lower public profile, such as land use, flood plain mapping and environmental protection."*⁵

The certificate would require students to complete GEOG 3100: Introduction to Geographic Information and GEOG 4100: Advanced Geographic Information, followed by three upper-level electives in related fields and a capstone experience. The successful student would be well-prepared to enter into the growing fields of geospatial technology, including eventual certification as a GIS Professional.⁶ Maintaining this certificate would help Georgia College promote our school's core values and mission, including "a balance of evidence-based, innovative teaching, high-impact pedagogies along with meaningful student-faculty interaction" to "develop students equipped to clearly, critically, and creatively address societal challenges."⁷

¹ Michael F. Goodchild, Emeritus Professor of Geography at the University of California, Santa Barbara

² <http://www.urisa.org/careers/colleges-and-universities/>

³ Georgia Technology Authority Geospatial Information Office Task Force. 2014. A Geospatial Network and Geospatial Information Office for Georgia

⁴ https://www.doleta.gov/BRG/Indprof/geospatial_profile.cfm

⁵ Cimons, Marlene. 2011. Geospatial technology as a core tool. U. S. News & World Report (May 11).

<http://www.usnews.com/science/articles/2011/05/11/geospatial-technology-as-a-core-tool>

⁶ <https://www.gisci.org/>

⁷ <http://www.gcsu.edu/about>

*“With the significant effect of technological innovation and marketplace change, the GIS/Geospatial industry continues to integrate and interoperate among its developing technologies and database management systems... GIS/Geospatial technology is spreading into entirely new markets and there appears to be ample opportunity for strong growth for existing and new players.”*⁸

Justification

A Certificate in Geographic Information Science would provide our students with a supplemental accreditation, along with their degrees, to prepare for a rapidly-growing industry related to spatial science. Georgia College will benefit through improvements in undergraduate education, faculty research, and community involvement. To date, students completing GISc courses at Georgia College have contributed thousands of hours of community service to a wide range of local partners. The certificate, paired with additional faculty support, could allow us to engage students with additional cooperative ventures with K-12 schools, non-profit organizations, and public/private enterprises.

*“Geographic Information Science and Cartography. A program that focuses on the systematic study of map-making and the application of mathematical, computer, and other techniques to the analysis of large amounts of geographic data and the science of mapping geographic information. Includes instruction in cartographic theory and map projections, computer-assisted cartography, geographic information systems, map design and layout, photogrammetry, air photo interpretation, remote sensing, spatial analysis, geodesy, cartographic editing, and applications to specific industrial, commercial, research, and governmental mapping problems.”*⁹

Specifically, the certificate will produce students able to:

- Develop spatial solutions to current economic, environmental, and sociological issues;
- Describe geographic information science (GISc) as a field of research and applied knowledge;
- Produce maps, graphics, and visual images to inform public and academic research;
- Demonstrate GIS skill sets required for public and private applications;
- Construct spatial databases and computer programming tools;
- Engage local communities with information and analysis to improve the condition of our campus and community.

These outcomes would be met primarily through instruction in the five courses which comprise the certificate, as well as a significant capstone experience. The two required courses (GEOG 3100 and GEOG 4100) both have a service learning component, and the Geography Program is seeking additional support for ENGAGE funding to create a streamlined community service training model so that future students can more directly work with local agencies and non-profit organizations. Our proposal neatly aligns with the 2016 Georgia College Strategic Plan, especially Goal 2, to “develop and implement distinctive and transformative undergraduate curricular and co-curricular experiences.”¹⁰ Geographic Information Science develops creative undergraduate research, usually based on a problem-based learning model that contributes service learning, leadership, and community engagement. The capstone requirement is intended to help students integrate their knowledge into internships and public service that will help out our local community.

Opportunities for partnerships with undergraduate research ventures (e.g. MURACE), faculty scholarship, and community outreach abound in our campus and community. The major limitation at the moment is

⁸ <https://www.gim-international.com/content/news/daratech-gis-geospatial-industry-research>

⁹ <http://nces.ed.gov/ipeds/cipcode/cipdetail.aspx?y=55&cipid=88586>

¹⁰ Our Path to Preeminence: The 2016 – 2021 Georgia College Strategic Plan

sufficient faculty support and an organized pathway for our students. The certificate will provide the pathway, and additional trained faculty and community partners are being developed through a variety of means.

Several of the American Association of Colleges & Universities VALUE Rubrics¹¹ would be used to assess and evaluate this project:

- Civic knowledge and engagement: Students frame responses designed to help others;
- Critical thinking: Students examine evidence to question assumptions;
- Global learning: Students develop personal responsibility and respect for diversity;
- Information literacy: Students evaluate and acquire information effectively;
- Inquiry and analysis: Students design questions to respond to issues and make conclusions;
- Integrative and applied learning: Students connect to experience and transfer knowledge;
- Problem solving: Students identify strategies, propose solutions, and evaluate outcomes;
- Quantitative literacy: Students interpret and represent data to calculate real-world models; and
- Teamwork: Students engage each other in constructive team climate.

Viability

The GISc certificate has been designed to adapt current resources to national model programs while encouraging the addition of a limited number of additional resources. Five of the courses included are already offered on a regular basis. Two additional courses in geography are being proposed, and these classes would be worked into a regular rotation with additional faculty support or summer semester offerings. Management of the certificate would be maintained by the Geography Program within the College of Arts & Science's Department of History and Geography, assisted by trained faculty from across the university. Faculty training is available online, at regional training sites, and through regular faculty development workshops.

"Many educational professionals believe that GIS acts as a catalyst for creative thought and problem-solving skills and facilitates spatial reasoning that supports higher levels of learning among students."¹²

The hardware and software requirements for this proposal are already in place, through funding from the Student Technology Fee, College of Arts & Sciences, and external funding. A campus instructional cooperative, the Geographic Research Commons¹³, has been created to serve as a training center and workspace for collaborative research and activities. A campus-wide group of GIS users is coordinated by the Geography program faculty, and includes staff and faculty from Biological & Environmental Sciences, Government & Sociology, Russell Library, Institutional Research, and Facility Operations. Georgia College belongs to state-wide licensing agreements with the University of Georgia's Information Technology Outreach Services and Georgia Institute of Technology's Center for GIS. We have a cooperative agreement with the University of West Georgia to participate in the U. S. Geological Survey's America's View data distribution program.

¹¹ <https://www.aacu.org/value/rubrics>

¹² ESRI. 2002. Guidelines for Developing a Successful and Sustainable Higher Education GIS Program. Redlands, California: ESRI Press.

¹³ <http://grc.gcsu.edu/>

Prospects

The U. S. Bureau of Labor Statistics¹⁴ classifies Geospatial Technology as a high-growth industry, promoting job classifications including:

- Geographers: Geographers study the Earth and its land, features, and inhabitants. They also examine phenomena such as political or cultural structures and study the physical and human geographic characteristics of regions ranging in scale from local to global.¹⁵
- Geoscientists: Geoscientists study the physical aspects of the Earth, such as its composition, structure, and processes, to learn about its past, present, and future.¹⁶
- Cartographers and Photogrammetrists: Cartographers and photogrammetrists collect, measure, and interpret geographic information in order to create and update maps and charts for regional planning, education, emergency response, and other purposes.¹⁷
- Urban and Regional Planners: Urban and regional planners develop land use plans and programs that help create communities, accommodate population growth, and revitalize physical facilities in towns, cities, counties, and metropolitan areas.¹⁸
- Market Research Analysts: Market research analysts study market conditions to examine potential sales of a product or service. They help companies understand what products people want, who will buy them, and at what price.¹⁹
- Surveying and Mapping Technicians: Surveying and mapping technicians collect data and make maps of the Earth's surface. Surveying technicians visit sites to take measurements of the land. Mapping technicians use geographic data to create maps. They both assist surveyors, cartographers, and photogrammetrists.²⁰

“Employment of cartographers and photogrammetrists is projected to grow 29 percent from 2014 to 2024, much faster than the average for all occupations. The increasing use of maps for government planning should fuel employment growth. For this reason, job prospects are likely to be excellent.”²¹

Students who complete the Certificate will be able to:

- Explain the geospatial science approach to problem solving;
- Design and develop a geographic information system;
- Apply geospatial information from a variety of sources to solve local, regional, and global problems;
- Integrate computer programming, cartographic design, and database manipulation to advanced GIS solutions;
- Represent ethical and social responsibility in geospatial technologies;
- Communicate with public and private clients in a professional manner.

¹⁴ https://www.doleta.gov/BRG/Indprof/geospatial_profile.cfm

¹⁵ <http://www.bls.gov/ooh/life-physical-and-social-science/geographers.htm>

¹⁶ <http://www.bls.gov/ooh/life-physical-and-social-science/geoscientists.htm>

¹⁷ <http://www.bls.gov/ooh/architecture-and-engineering/cartographers-and-photogrammetrists.htm>

¹⁸ <http://www.bls.gov/ooh/life-physical-and-social-science/urban-and-regional-planners.htm>

¹⁹ <http://www.bls.gov/ooh/business-and-financial/market-research-analysts.htm>

²⁰ <http://www.bls.gov/ooh/architecture-and-engineering/surveying-and-mapping-technicians.htm>

²¹ <http://www.bls.gov/ooh/architecture-and-engineering/cartographers-and-photogrammetrists.htm>

“Because the uses for geospatial technology are so widespread and diverse, the market is growing at an annual rate of almost 35 percent, with the commercial subsection of the market expanding at the rate of 100 percent each year.”²²

We anticipate five to ten students per year will seek to complete the Certificate in Geographic Information Science. While it is difficult to predict popularity, our faculty desire to remain relevant in today’s competitive market for top college prospects, and recommend that Georgia College should adapt our offerings to include geographic information science.

²² Geospatial Information & Technology Association. <https://www.gita.org/>

Certificate in Geographic Information Science at Georgia College

Requirements

The Certificate in Geographic Information Science is designed to prepare students for entry-level jobs in geospatial technology, graduate degrees in related fields, and entrepreneurial experiences in a variety of professional applications. Students who complete the certificate will be capable of gathering and creating spatial information, analyzing spatial patterns, and presenting advanced geospatial solutions for critical problems in business and computer science, human and natural sciences, public health, community service, and education.

Total Credit Hours = 18-22

A. Core (6 hours)

GEOG 3100- Introduction to Geographic Information (3 hours)

An introduction to the basic types of geographic data and their analysis. Emphasis on the acquisition, display, and query of digital data using Geographic Information Systems in real-world applications.

This course is a requirement for the Certificate in Geographic Information, and is a major requirement for the BA in Geography and the BS in Environmental Science. The course can be used as an upper-level elective in other degrees. This course is a prerequisite for advanced geospatial courses in geography. Currently, this course is taught once a year in the Fall, but with additional support we could offer it in Spring semester as well.

GEOG 4100- Advanced Geographic Information (3 hours)

Prerequisite: GEOG 3100 or permission of instructor. Advanced topics in geographic analysis, including types of spatial data and their acquisition, field methods, spatial database design, geospatial modeling, automated scripting, spatial analysis, geostatistics, and cartographic design. Students will be expected to complete a course project that applies geographic information science to a local problem.

This course is currently offered each Spring semester by Dr. Doug Oetter. It fulfills part of the Geographic Techniques tract in the BA in Geography degree, and counts toward the Physical Sciences tract for the BS in Environmental Sciences students. It can count toward upper-level electives for majors in other fields.

B. Upper-Level Electives (3 courses totaling 9-10 hours)

BIOL/ENSC 3800 GI Science Tech-Landscape Ecology (4 hours)

Prerequisite: BIOL 2800 or permission of instructor. An introduction to the principles of landscape ecology, emphasizing how spatial heterogeneity and human activities influence ecological systems and the use of Geographic Information science techniques to analyze ecological patterns at the landscape level.

This course is currently taught by Dr. Christine Mutiti one semester per year in Spring semester. It can now be used as a substitute for the GEOG 3100 requirement for BS in Environmental Science students, but if we are able to offer GEOG 3100 each semester, we would like to encourage biology and environmental sciences students to take both GEOG 3100 and ENSC 3800, so that they can develop geospatial skills in the GEOG 3100 introduction course, and then apply their knowledge to biological and environmental sciences applications in this course. The BIOL and ENSC majors who pursue the certificate would be allowed to incorporate this class into their degree requirements. It can count toward upper-level electives for majors in other fields, as well as the Geography Minor.

CSCI 4710- Databases (3 hours)

Prerequisite: A grade of C or higher in CSCI 3410. An introduction to managing data as a resource by examining basic concepts in database management systems and contrasting them with standard file systems. Topics include data modeling, relational databases, database query languages, relational database design, transaction processing, and distributed databases.

Database structure and design are both integral components of Geographic Information Science, and a firm foundation in databases is essential to the success of our students. Because of multiple prerequisites, however, this course would mainly be used by students pursuing the BS in Computer Science or the Computer Science Minor. This course is currently offered each semester.

CSCI 4830 Computer Graphics (3 hours)

Prerequisites: C or better in MATH 2150, CSCI 3410 and CSCI 3680. An introduction to the basic principles and techniques of computer graphics emphasizing development and implementation of graphics algorithms and applications in a high level programming language.

The programming languages popular in current geospatial applications (Python and Visual Basic) are not consistent with current offerings in computer science, however, the inclusion of this course supports computer mapping in geographic information, and would help students pursuing the BS in Computer Science or the Computer Science Minor to achieve the certificate. This course does not appear to be offered in the current rotation.

GEOG 4105- Geospatial Data Management (NEW COURSE) (3 hours)

Prerequisite: GEOG 3100 or permission of instructor. Development of spatial database design, workload programming, and enterprise solutions for geographic information systems. The successful student will be able to create and manipulate spatial databases, integrate real world digital geographic data with a variety of computer software programs and applications, and program rudimentary scripts in Python and Visual Basic to automate processes for enterprise solutions. This course has not yet been created, but with additional support, we would be able to offer it once per year.

GEOG 4110- Remote Sensing (3 hours)

Prerequisite: GEOG 3100 or permission of instructor. Survey of remote sensing methods, including aerial photography, satellite imagery, and digital image processing.

This course has been taught on a two-year rotation in the past by Dr. Doug Oetter, and could be offered once a year with additional instructional support. It could count toward upper-level electives for majors in other fields, for example the B. S. in Environmental Science.

GEOG 4115- Computer Cartography (NEW COURSE) (3 hours)

Prerequisite: GEOG 3100 or permission of instructor. Applications of computer technologies to cartographic design. Students will explore cartographic history, mapping design, and symbology theory to create a variety of reference and thematic maps for both analog and digital applications. This course has not yet been created, but with additional support, we would be able to offer it once per year.

C. Certificate Capstone (3-6 hrs)

GEOG 4940- Independent Study

ENSC/GEOG 4960- Internship

ENSC 4999- Undergraduate Research

Internship, independent study, or other capstone experience directed by a faculty member who instructs courses in geographic information. We hope that we will be able to incorporate geospatial information into additional degree programs in the future, for example Criminal Justice, Economics, History, Liberal Studies, Marketing, Mass Communications, Mathematics, Political Science, Public Health, Sociology, and Middle Grades Education. As faculty are trained in geospatial technologies, they would be able to direct certificate capstone courses within their area of expertise.