January 30, 2019

TO: Members of the Board of Trustees

FROM: Craig H. Kennedy, Ph.D.
Provost and Executive Vice President for Academic Affairs

RE: Bachelor of Arts and Bachelor of Science in Geographic Information Science

RECOMMENDATION:

That the Board of Trustees approve the Bachelor of Arts and Bachelor of Science in Geographic Information Science in the College of Liberal Arts and Sciences.

BACKGROUND:

The Bachelor of Arts or Bachelor of Science in Geographic Information Science, in the Department of Geography, will train students in spatial thinking and will allow students to gather in-depth knowledge in geospatial technology. Spatial thinking is universal and useful in a wide variety of academic disciplines and everyday problem-solving situations. The National Academy of Sciences states that "spatial thinking is at the heart of many great discoveries in science, that it underpins many of the activities of the modern workforce, and that it pervades the everyday activities of modern life." According to the U.S. Department of Labor, graduates with skills in geospatial technology are in extremely high demand and are one of the highest growth areas in the federal government.

The Bachelor of Arts or Bachelor of Science in Geographic Information Science can attract more major students to the Department of Geography; support interdisciplinary research and educational programs at the University of Connecticut; and provide innovative professional service to broader communities.
Request for New UConn Undergraduate Degree Program

General Information

Name of proposed academic degree program: Geographic Information Science
Name of sponsoring Department: Department of Geography
Name of sponsoring College: College of Liberal Arts and Sciences
Campus: Storrs
Contact person: Chuanrong (Cindy) Zhang
Type of Proposal: New Degrees
Type of Degree: B.A/B.S.
Anticipated Initiation Date: August 2019
Anticipated Date of First Graduation: May 2022
CIP Code: 45.0702

Background & Description

Geographic Information Science (GIScience) is the scientific discipline that conducts spatial analysis to examine economic, environmental, physical, and social phenomena. The study of spatial data structures and computational techniques to capture, represent, process, and analyze geographic information are essential to GIScience. GIScience overlaps with and draws from many research fields such as computer science, statistics, mathematics, and psychology, and contributes to progress in those fields. GIScience also supports research in many academic disciplines such as natural resource management, environmental science and engineering, geosciences, agriculture, marine sciences, sociology, history, public health, business, and anthropology.

Courses in GIScience enable students to develop capability in spatial thinking and gather in-depth knowledge in geospatial technology. Geospatial technology is a term used to describe the range of modern tools contributing to the geographic mapping and analysis of the Earth and human societies, e.g. geographic information systems (GISystems), remote sensing, the global positioning system (GPS), spatial statistics, web mapping and navigation technologies. According to the U.S. Department of Labor, graduates with skills in geospatial technology are in extremely high demand and are one of the highest growth areas in the federal government. Students have employment opportunities in many corporate and government entities. Students with an undergraduate degree in GIScience are also prepared to move on to graduate school to pursue M.A, M.S., and Ph.D. degrees in many fields that enable them to pursue academic jobs or to secure higher ranking positions in the public and private sectors.

Reasons for the Proposed Program

• First, currently Geography Department has very few undergraduate Major students. To survive and develop, we have to change the situation. We did self-study for our eight-year program review last year. Through the self-study and our investigation to the geography departments of other top public universities in our nation, we realized that the GIS Major program is our only hope and chance to solve the problem of lacking Major students.
• Second, it is not a new idea to establish the undergraduate GIScience Major program in a geography department. Many universities have established or are establishing the GIScience undergraduate major program in our nation or in the world, because this is currently the most promising direction to keep geography department or make it more attractive. There are many GIS jobs in current job markets, and all of the Geography departments establishing GIS programs have significantly increased their major students.

• Third, GIS is an interdisciplinary field. Establishing such a Major program and developing strong GIS curricula will not only benefit Geography department but also bring benefits to many related departments or programs across UCONN that involve spatial data in their research and studies.

• Fourth, as mentioned in the proposal, the U.S. Department of Labor recognizes geotechnology as one of the three most progressive professions today, alongside nanotechnology and biotechnology. Many jobs requires this skill. Not only governments and industries needs people with GIS skills, our homeland security and military also need people with such skills.

In general, 1) the GIS programs can support interdisciplinary research at UCONN, which will increase the reputation of UCONN as a research university. 2) the GIS programs can support multiple disciplinary education programs at UCONN. GIS courses offered in the geography department can be taken by students from other various disciplines. 3) the GIS programs can provide innovative professional service to broader communities. We can educate the public about the important GIS skills and methods of the 21st century through outreach programs based on the GIS curricula.

Curriculum & Program Outline

B.S. or B.A.
Students can obtain a B.S. or B.A. degree. The GIScience B.A. degree does not require students to take biology, chemistry, physics, and calculus, and focuses on classes related to spatial analysis of social issues. The GIScience B.S. degree requires students to take biology, chemistry, physics and calculus and is intended as preparation for students pursuing a career in natural science or engineering with geospatial technology. Students can keep track of their graduation requirements at http://studentadmin.uconn.edu.

Major Requirements
The major in GIScience requires at least 31 credits of 2000-level or higher courses in the Department of Geography. GIScience majors complete basic core courses before beginning advanced courses. Recommended preparation for the major: GEOG 1302 - GIS Modeling of Environmental Change and GEOG 2410 - New Digital Worlds of Geographic Information Science

Required Core Courses (at least 16 credits)
The following must be part of the plan of study for the major:

- GEOG 2500 (4 cr) - Introduction to Geographic Information Systems
- GEOG 2505 (4 cr) - Applications of Geographic Information Systems
- New: GEOG 3530 (3 cr) - Introduction to GeoComputing
- GEOG 3510 (4 cr) - Cartographic Techniques or GEOG 3500Q (4 cr) Geographic Data Analysis
- Writing course (1 or 3 cr)- Any GEOG W course at the 2000 level or above

**Electives (15 credits)**

In addition to the required courses above, the plan of study must include 15 credits of electives from courses below. At least 9 credits of electives must be selected from the list of GIScience courses. At least 6 credits of electives must be selected from the list of Human Geography or Physical Geography courses. At least 3 credits must be 4000-level.

**GIScience courses:**
- GEOG 2510 - Visualizing Geographic Data
- GEOG 3110 - Location Analysis
- GEOG 3500Q - Geographic Data Analysis *
- New: GEOG 3512 – Introduction to Spatial Data Science
- GEOG 3505 - Remote Sensing of Marine Geography
- GEOG 3510 - Cartographic Techniques*  

(* if it’s not chosen as a core course)

- GEOG 4130 - Geographical Analysis of Transportation
- GEOG 4230 - GIS and Remote Sensing for Geoscience Applications
- GEOG 4515 - Web GIS
- New: GEOG 4516 - Fundamentals of Spatial Database Systems
- New: GEOG 4518 – Mobile GIS

**Human and Physical Geography courses:**
- GEOG 2000, 2100, 2200, 2400, 3000, 3200, 4210, 4220
- GEOG 2300, 2310, 2320, 3310, 3400, 3410, 3420, 4300

**Related Courses (12 credits)**

12 credits of related coursework taken in other departments. At least 3 credits of related courses must be selected from the list of Remote Sensing courses. The following is a list of pre-approved related courses that may be relevant to the GIScience major. This is not a complete list. Other courses possible with approval of a student’s Geography advisor.

**Remote Sensing courses:** NRE 3535, 4535, 4545, 4575

**Computer Science and Engineering courses:** CSE 2050, 2100, 2102, 2300, 2304, 2500, 3000, 3100, 3150; 3300, 3400, 3500; CE 2251, 2310, 2410, 2710

**Math and Statistics courses:** MATH 2110Q, 2130Q, 2143, 2144, 2210Q, 2410Q, 2420Q; 3160.
BA/BS in Geographic Information Science

3410, 3435, 3710; STAT 2215Q, 3025Q, 3115Q, 3375Q, 3445, 3515Q

Social Science courses: ANTH 2510, 3003, 3090, 3503, 3512, 3513, 3514, 3515; INTD 3584, 3594; POLS 2062, 2072Q; SOCI 3201, 3211Q; URBN 2000, 2100, 2301Q, 2302, 2400, 3000, 3993, 3981/3991, 3998; COMM 2110, 2940, 3000Q, 3300; WGSS 2124, 2255, 2255W, 3255, 3255W, 3269

Natural Science courses: GSCI 2500, 3230, 4050W, 4210, 4735; EEB 4100, 4230W; MARN 2060, 3000, 3014, 3030, 3812

Economics courses: ECON 2201, 2202, 2211Q, 2212Q, 2301, 2311, 2312, 2326, 2327, 3103, 3313, 3421, 3439

Learning Outcomes

The GIScience programs, such as the proposed B.S. and B.A., train students in spatial thinking, including new geographical concepts, tools, and technologies. This will advance understanding of topics such as environmental change, sustainability, globalization, public health, and population dynamics through the spatial lens. Spatial thinking is universal and useful in a wide variety of academic disciplines and everyday problem-solving situations. The National Academy of Sciences states that "spatial thinking is at the heart of many great discoveries in science, that it underpins many of the activities of the modern workforce, and that it pervades the everyday activities of modern life."

The GIScience major programs help answer the following questions identified by the 2010 National Research Council (NRC) report—“Understanding the Changing Planet: Strategic Directions for the Geographical Sciences”: 1) How to understand and respond to environmental change; 2) How to promote sustainability; 3) How to recognize and cope with the rapid spatial reorganization of economy and society; and 4) How to leverage technological change for the benefit of society and environment.

Learning outcomes from the GIS Major program include:

- Exhibiting the ability of spatial thinking.
- Comprehending fundamental concepts and practices of GIScience and geospatial technology.
- Demonstrating proficiency in using GIS or geospatial technology to critically analyze geospatial problems, ask research questions, understand methods, and conduct research.
- Applying GIS knowledge and skills to address geospatial related problems and/or research questions.
- Demonstrating effective written, verbal, and graphic visualization and communication skills in GIS.

In general, the courses required for the GIScience majors train students in spatial thinking, and help students master geospatial technology. This training will provide students with excellent career opportunities.
**Enrollment & Graduation Projections**

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**Financial Resources**

Two new faculty in GIS with an expected start date of August 2019 have been allocated to Geography. One new hire is tenure tracked assistant professor in GIS. Another new hire is non-tenure tracked visiting assistant professor in GIS.

In fact, the external reviewers for Geography eight-year program review recommended as the following:

“At minimum, either through expansion or retirement, the department needs three new additional hires; two of these need to be broadly GIS related and one needs to be in Climate Science/Modeling.”

**Facilities//Equipment/Library/Special Resources**

With the increased number of GIS majors, additional GIS lab space with computers is needed.

In fact, the external reviewers for Geography eight-year program review recommended as the following:

“We strongly recommend the addition of a second GIS teaching lab. GIS is an exciting growth area but is currently constrained by lack of a dedicated second teaching lab.”

**Program Administration**

With the increased number of GIS majors, an additional program assistant in Geography is needed for administration purpose.

In fact, the external reviewers for Geography eight-year program review recommended as the following:

“The roles and responsibilities for the Geography department’s single staff member (budgets, curriculum planning, front office management, some informal advising with students) far exceed
a normal work load. We strongly recommend that at least one additional support staff member is required, and that the job descriptions of the support staff be carefully evaluated and perhaps upgraded.”

Faculty

The involved faculty members in Department of Geography include:
Amy Burnicki,
Kenneth Foote,
Debarchana Ghosh,
Weidong Li,
Rich Mrozinski,
Scott Stephenson,
Dan Weiner,
Chuanrong (Cindy) Zhang

In addition, two new faculty members in GIS will be hired for the proposed GIS Major B.S. or B. A. program in Fall 2019. One new hire is a tenure-tracked assistant professor in GIS. Another new hire is a non-tenure tracked visiting assistant professor in GIS.

Similar Programs in Connecticut or Region

Department of Geography in Central Connecticut State University offers an undergraduate degree: Geographic Information Science, B.A.

In fact, not only UCONN’s geography faces the declining number of major students, most of Geography departments in other universities in the nation or around the world also face the declining number of Geography Major students. This is a national or world trend, because the conventional geography program has become less attractive to undergraduate students and at the same time GIS has become a driving force in geographical science. To keep the geography department or make it more attractive, many Geography departments have to change their programs or rebrand themselves with new department names like Geography and Geographical Information Science. To attract more major students, many Geography departments developed GIS major program. All of the Geography departments establishing GIS major programs have significantly increased their major students. Now GIS is the only choice and promising direction that UCONN Geography can attract more major undergraduate students.