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MEMORANDUM

ATTENTION	Senate	DATE	April 28, 2020
FROM	Jon Driver, Vice-President, Academic and Provost <i>pro tem</i> , and Chair, SCUP	PAGES	1 of 1
RE:	Full Program Proposal for a Geographic Information Science Minor (SCUP 20-21)		

At its April 22, 2020 meeting, SCUP reviewed and approved the Full Program Proposal for a Geographic Information Science Minor in the Department of Geography within the Faculty of Environment, effective Spring 2021.

Motion:

That Senate approve and recommend to the Board of Governors the Full Program Proposal for a Geographic Information Science Minor in the Department of Geography within the Faculty of Environment, effective Spring 2021.

c: T. Brennand



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MEMORANDUM

ATTENTION	Senate Committee on University Priorities	DATE	March 6, 2020
FROM	Wade Parkhouse, Chair	PAGES	1/1
	Senate Committee on Undergraduate Studies		
RE:	Faculty of Environment (SCUS 20-14)		

Action undertaken by the Senate Committee on Undergraduate Studies at its meeting of March 5, 2020, gives rise to the following recommendation:

Motion

That SCUP approve and recommend to Senate the Full Program Proposal for the Geographic Information Science Minor in the Department of Geography within the Faculty of Environment.

The relevant documentation for review by SCUP is attached.

SCUS 20-14



SIMON FRASER UNIVERSITY
ENGAGING THE WORLD

Geographic Information Science (GIScience) minor

Full Program Proposal

January, 2020

Department of Geography

1 Credential to be awarded

Geographic Information Science minor

2 Location

Simon Fraser University, Burnaby Campus

3 Department(s), School(s), Faculty(ies) offering program

Department of Geography in the Faculty of Environment

4 Anticipated program start date

Spring 2021

5 Description of proposal program

5.1 Aims, goals and/or objectives

A minor in Geographic Information Science (GIScience) will prepare students from across SFU to use spatial data for analysis, communication and production of maps. Spatial data includes all data sets, including those constituting Big Data, which have location associated with them. In addition to introducing students to the methods and techniques of GIScience in both corporate software and open source environments, a focus on GIScience theory, critique and community engagement will furnish students with the agility to seize a broad range of career opportunities now and adapt to future domain advancements. Students will be able to work in a range of careers including policing, business analytics, community mapping, heritage management, municipal cadastral management, geological science, ecological science, biological monitoring, public health among others.

While students could choose to take a sampling of GIScience courses without undertaking the minor, we believe that having a recognized credential in a well-known and sought-after field is more desirable. In addition, it will help employers recognize their specialized skill set and spatial literacy.

The learning objectives associated with the GIScience minor are focused on the theory, skills and techniques required to prepare, analyze, interpret and communicate spatial data. These skills are described in detail below:

Goal 1: Integrative knowledge of how Geographic Information Science (GIS) theories, methods, and technologies facilitate critical analysis of spatial phenomena.

1a. Identify how GIS theory informs the development of GIS methods and drives the development of new technology

1b. Evaluate the relevance, accuracy and limitations of conventional and emerging geospatial methods, data, and technology

Goal 2: Knowledge of spatial data acquisition, storage, visualization, analysis, and modelling.

2a. Understand the relationships between spatial conceptualization, data collection methods and technologies, field surveys, and resulting representations as a basis for understanding spatial phenomena

2b. Describe the scope of core GIScience theories, practices, software tools, and technical terminology

2c. Use GIS to describe and explain patterns and processes at multiple scales

Goal 3: Understanding of the relationship between GIS and other areas of geographical scholarship, and to the broader social, physical and environmental sciences.

Goal 4: Familiarity with the process, practice and evaluation of knowledge creation in Geographic Information Science research.

4a. Describe how existing GIS theory, methods, and technology are advanced, tested and updated

4b. Identify, read, critically evaluate and summarize GIS research

4c. Understand how participation from various stakeholders can impact the outcome of GIS-based solutions

Goal 5: Effective reading, writing, oral, and visual communication skills.

5a. Communicate quantitative, spatial and statistical data effectively in reports and presentations

5b. Create accurate graphic, cartographic, geovisualization and other geospatial products

Goal 6: Use quantitative and qualitative GIS knowledge to inform societal problem-solving and policy at multiple scales.

5.2 Mandate and strategic plan

SFU's strategic plan focuses on innovation (including in the realm of Big Data), community engagement and interdisciplinarity. The GIScience minor is aligned with each of these goals. First, spatial data is ubiquitous and voluminous and constitutes the bulk of existing Big Data. Second, communities are increasingly using mapping to understand and make claims about themselves and their interests, as well as to implement and contest development projects. Third, GIScience is truly multidisciplinary in its reach and scope; there are few units on a university campus in which it is not already contributing to research. The GIScience minor will increase students' ability to engage in data science in ways that can communicate to many audiences in different communities. It can also help those communities speak to each other.

5.3 Target audience

The goal of the GIScience minor is to be attractive and accessible to a range of students from the humanities to natural sciences. The content and delivery of our courses focuses on developing the numeracy and technical skills needed to complete the course work. As a result, we already accommodate many levels of numeracy and technical proficiency while nurturing the required skills as students progress through the program. We anticipate that students with virtually any academic background will be able to thrive in our program. This is a distinguishing characteristic of the GIScience minor, in that it cultivates skills among students who may not have imagined themselves as technically proficient.

5.4 Content and summary of requirements for graduation

The GIScience minor requires 25 credits total, and consists of the following courses:

Lower Division Requirements

Students must complete one of:

GEOG 100 - Our World: Introducing Human Geography (3)

GEOG 111 - Earth Systems (3)

Students complete a total of 6 units from the following:

GEOG 251 - Quantitative Geography (3)

GEOG 253 - Introduction to Remote Sensing (3)

GEOG 255 - Geographical Information Science I (3)

Upper Division Requirements

Students complete a minimum of 16 units from the list below.

GEOG 351 - Multimedia Cartography (4)

GEOG 352 - Spatial Analysis (4)

GEOG 353 - Advanced Remote Sensing (4)

GEOG 355 - Geographical Information Science II (4)

GEOG 356 - 3D Geovisualization (4)

GEOG 451 - Spatial Modeling (4)

GEOG 453 - Theoretical and Applied Remote Sensing (4)

GEOG 455 - Theoretical and Applied GIS (4)

GEOG 457 - Geovisualization Interfaces (4)

5.5 Delivery methods

This minor program will be delivered primarily through classroom and laboratory instruction at SFU Burnaby campus. However, we anticipate that – in the future – blended course delivery might replace some of the face-to-face courses.

5.6 Linkages between program outcomes and curriculum design

The learning goals of the GIScience program are outlined in section 5.1.

The table below demonstrates how each course in the curriculum aligns with the educational goals for the program:

Department of Geography Curriculum Map - BSc GIS minor

EDUCATIONAL GOALS	GEOG 100	GEOG 111	GEOG 251	GEOG 253	GEOG 255	GEOG 351	GEOG 352	GEOG 353	GEOG 355	GEOG 356	GEOG 451	GEOG 453	GEOG 455	GEOG 457
Goal 1: Integrative knowledge of how Geographic Information Science (GIS) theories, methods, and	I		I	I	E	E/R	E/R	E/R	E/R	E/R	A	A	A	A
1a. Identify how GIS theory informs the development of GIS methods and drives the development of new			I/T	I/T	E/T		E/R/T	E/R/T	E/R/T	E/R/T	A/T		A/T	A/T
1b. Evaluate the relevance, accuracy and limitations of conventional and emerging geospatial methods, data,					E/T	E/R/T	E/R/T	E/R/T	E/R/T	E/R/T	A/T	A/T	A/T	A/T
Goal 2: Specialized knowledge of spatial data			I	I	E/R	E/R	E/R	E/R	E/R	E/R	A	A	A	A
2a. Understand the relationships between spatial conceptualization, data collection methods and		I/E/T	I/T	I/T	E/R/T	E/R/T	E/R/T	E/R/T	E/R/T	E/R/T	A/T	A/T	A/T	A/T
2b. Describe the scope of core GIScience theories,			I/T	I/T	E/R/T		E/R/T	E/R/T	E/R/T	E/R/T	A/T	A/T	A/T	A/T
2c. Use GIS to describe and explain patterns and			I/T	I/T	E/R/T	E/R/T	E/R/T	E/R/T	E/R/T	E/R/T	A/T	A/T	A/T	A/T
Goal 3: Understanding of the relationship between GIS and other areas of geographical scholarship, and to	I	I/T	I/T	I/T	E/R/T		E/R/T	E/R/T			A/T	A/T	A/T	A/T
Goal 4: Familiarity with the process, practice and evaluation of knowledge creation in Geographic			I	I	I	E/R		E/R	E/R	E/R	A	A	A	A
4a. Describe how existing GIS theory, methods, and				I	I			E/R/T	E/R/T	E/R/T		A/T	A/T	A/T
4b. Identify, read, critically evaluate and summarize				I	I			E/R/T	E/R/T	E/R/T			A/T	A/T
4c. Understand how participation from various			I/T	I/T	E/R/T						A/T		A/T	
Goal 5: Effective reading, writing, oral, and visual						E/R		E/R	E/R	E/R	A	A	A	A
5a. Communicate effectively in reports and	T		I/T	I/T	I/T							A/T	A/T	
5b. Create accurate graphic, cartographic,		I/T	I/T	I/T	I/T	E/R/T	E/R/T	E/R/T	E/R/T	E/R/T	A/T	A/T	A/T	A/T
Goal 6: Use quantitative and qualitative GIS knowledge to inform societal problem-solving and policy at			I	I	I	E/T	E/R/T	E/R/T	E/R/T	E/R/T	A/T	A/t	A/T	A/T

- I** INTRODUCES- Students are not expected to be familiar with the content or skill at the collegiate level. Instruction and learning activities focus on basic knowledge, skills, and/or competencies and an entry-
- E** EMPHASIZES- Students are expected to possess a basic knowledge and familiarity with the content or skills at the collegiate level. Instruction and learning concentrates on enhancing and strengthening knowledge, skills, and expanding complexity.
- R** REINFORCES- Students are expected to possess a strong foundation in the knowledge, skill, or competency at the collegiate level. Instructional and learning activities continue to build upon previous competencies and increased complexity.
- A** APPLIES- Students are expected to possess an advanced level of knowledge, skill, or competency at the collegiate level. Instructional and learning activities focus on the use of the content or skills in multiple contexts and at multiple levels of complexity.
- T** ASSESSED - This educational goal is assessed for grades in some way in the course (e.g., through testing, assignments, etc.)

5.7 Distinctive characteristics

There are few if any technical and computational programs at SFU that allow entry from a range of Arts, Science, Health, Business, SIAT and Environment students. Moreover, there is no other minor that focuses on *spatial literacy* (data and analysis).

Another distinctive characteristic of the minor is the emphasis on community engagement and empirical application as part of the curriculum. We believe students trained in agile GIScience thinking, methods and technology will be well prepared to work at all levels of industry, government and non-profit throughout their careers in this domain.

5.8 Anticipated completion time

We anticipate that 2-3 years will be required to complete the program from the time of declaration of the minor; like other minors, for most students it will be undertaken while the student is also completing a major program in another department.

5.9 Enrolment plan for the length of the program

Based on Geography's knowledge from hosting the GIScience certificate for more than two decades, we anticipate that the Department will be able to host at least 25 to 30 minor students at any one time.

5.10 Student evaluation

Student evaluation will be through traditional channels used at SFU (letter marks and percentages). In addition, the fourth-year classes will serve as capstones allowing students to integrate their knowledge, experience and creativity using spatial data.

5.11 Faculty appointments

We do not anticipate any extra faculty requirements to mount the program currently.

5.12 Faculty members

Nick Hedley, Associate Professor, 100% of teaching load
Shivinand Balram, Lecturer, 100% of teaching load
Suzana Dragicevic, Professor, 100% of teaching load.
Nadine Schuurman, Professor, 100% of teaching load.

Remote sensing faculty member, assistant professor, 100% of teaching load.

5.13 Program assessment

Our Department is routinely assessed every 7 years. This minor program will be assessed as part of the external review process.

Though there are no Canadian governing bodies for GIScience programs, there is an Undergraduate Consortium for GIScience (UCGIS) in the United States. The mandate of the UCGIS is to support GIS education and training through advancement of core principles. See: <https://www.ucgis.org/about-and-mission> for more information. The UCGIS maintains materials for teaching on their website. Courses in GIScience at SFU already largely adhere to core UCGIS principles – and will continue to do so.

Our goal is to ensure that our efforts to encourage community engagement and informed global citizenship through the minor will be recognized as part of the program assessment.

5.14 Related programs

Like the proposed GIScience minor, the GIScience certificate in the Department of Geography has a low entry barrier from a math and computing perspective. However, the certificate is intended primarily for Geography majors whereas the minor is targeted at students in non-Geography programs.

There is presently a major in GIScience jointly hosted by Computing Science and Geography. However, there are significant barriers to entry to the major as it requires a solid mathematics and computing background. In addition, it requires 120 credits in total whereas the proposed minor requires 25.

A social data analytics minor program is presently being proposed in FASS. The SDA minor would be complementary to the GIScience minor.

BCIT has three GIS programs. The Advanced Certificate is a part time opportunity to learn basic GIS skills while working. The Advanced Diploma is a post graduate degree that offers training in intensive GIS skills. The Bachelor of Technology in GIS offers the same courses as the Diploma but combines them with other courses in management and liberal arts to comprise a degree. These programs are technology and software focused. We do not anticipate that they will compete with our more theoretically-oriented GIScience minor.

UVic also offers three GIScience programs. The Geomatics Concentration is designed for Geography BA students to acquire basic GIS skills and understanding. The BSc Geomatics major is run jointly by Geography and Computing Science and stresses technical aspects of Geomatics. The Minor in Geographic Information Technology is designed for students pursuing any UVic degree program to acquire a GIS background.

The University of British Columbia (Vancouver) offers a range of GIScience courses between the Department of Geography and the Faculty of Forestry. The Irving K. Barber School of Arts and Sciences (UBC Okanagan) offers four unique GIScience courses.

Likewise, the University of Northern British Columbia offers a suite of GIScience courses. UNBC also offers a Minor in Geographic Information Systems.

Most small universities in BC, including those that were formerly colleges, offer introductory GIScience courses. Many of these courses are articulated and receive transfer credit at SFU. Up to one third of the proposed minor's upper division credit requirement may be filled by course equivalent transfer credits.

5.15 Consultation with and support from other post-secondary institutions

The Department of Geography student body already includes many students who transfer laterally from other postsecondary institutions. We will continue to articulate with and recognize the credentials that transfer students received from Colleges and Universities across BC and elsewhere.

5.16 Evidence of student interest

We base our estimates of student interest on the high and increasing enrollment in our GIScience courses and certificate program. Enrollment in the Certificate has increased almost 300% in the last 4 years, from 36 in Spring 2015 to 102 in Spring 2019. We anticipate this positive trend to continue.

5.17 Evidence of labour market demand

The demand for people trained in the use of GIS is widely remarked upon. The University of Southern California website describes demand for GIS professionals as follows:

As **GIS** opportunities and salaries continue to grow, there will be a high **demand** for **professionals** who combine the technical acumen to source accurate spatial data with the critical and spatial thinking skills to apply that information in solving complex problems.

They go on to cite 2018 market research that estimates the value of the GIScience field as potentially \$17.5 billion by 2023. They also note that the U.S. Bureau of Labor Statistics projects employment for GIScience specialists to grow 19 percent between 2014 and 2024

(<https://www.bls.gov/ooh/architecture-and-engineering/cartographers-and-photogrammetrists.htm>) – which is a much higher rate than most professions grow (see: <https://gis.usc.edu/blog/4-reasons-to-consider-gis-as-a-career/>)

Our program includes courses in spatial/geographic augmented reality (AR) and spatial virtual reality (VR). VR and AR are two market sectors that have exploded in the past few years and are Canada's fastest-growing tech sector: with market valuations of between \$70-75Bn by 2023 for AR, and \$10-15Bn for VR (VentureBeat, May 2019). Vancouver is a hotbed of innovation and investment in these areas and is one of only two Digital Superclusters invested in by the Federal Government.

(<https://digitalsupercluster.ca/canadas-digital-technology-supercluster-receives-funding/>)

Geography has extensive experience with the SFU Co-op program through which we have learned that GIScience credentials are among the most requested by potential employers, and the most important predictor of landing a job. The minor program will extend that opportunity to other Schools and Departments across many faculties at SFU.

In addition, the minor will familiarize students with both large commercial software environments and open source GIScience programs. Through these joint avenues, we will prepare students to work with corporations and government, as well as non-profits and NGOs. We anticipate that the inclusion of open source teaching environments in the program will prepare students for community engagement throughout their subsequent careers. In this way, we plan to instantiate community engagement and outreach as part of a lifelong process of work and being an informed global citizen.

5.18 Resources

This program will not reduce nor significantly impact other programs or resources within the Department of Geography. However, should it prove very popular (which we anticipate), we may be forced to respond by increasing both our computer lab capacity and faculty teaching capacity. The problems of lab space and computing resources are the main limitations on increasing student numbers and have proven the most intractable and expensive. We are working with the Dean's office to resolve them. Should additional faculty be needed we will integrate this need into our Faculty Renewal Plan.

5.19 Budget

Currently, we do not anticipate charging extra fees for equipment use or tuition.

6 Contacts

Professor Tracy Brennand, Chair and Professor, Department of Geography,
SFU, tabrenna@sfu.ca

Appendix A: Proposed Calendar Entry

Geographic Information Science Minor

Admission Requirements

All students must be in good academic standing and must obtain approval from the Geography Academic Advisor in order to be enrolled in the Geographic Information Science (GIScience) Minor. Students may apply for admission to the minor program at any time.

Program Requirements

The GIScience minor requires 25 credits total, and consists of the following courses:

Lower Division Requirements

Students must complete one of:

GEOG 100 - Our World: Introducing Human Geography (3)
GEOG 111 - Earth Systems (3)

Students complete a total of 6 units from the following:

GEOG 251 - Quantitative Geography (3)
GEOG 253 - Introduction to Remote Sensing (3)
GEOG 255 - Geographical Information Science I (3)

Upper Division Requirements

Students complete a minimum of 16 units from the list below.

GEOG 351 - Multimedia Cartography (4)
GEOG 352 - Spatial Analysis (4)
GEOG 353 - Advanced Remote Sensing (4)
GEOG 355 - Geographical Information Science II (4)
GEOG 356 - 3D Geovisualization (4)
GEOG 451 - Spatial Modeling (4)
GEOG 453 - Theoretical and Applied Remote Sensing (4)
GEOG 455 - Theoretical and Applied GIS (4)
GEOG 457 - Geovisualization Interfaces (4)



OFFICE OF THE DIRECTOR
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ATTENTION Dr. Paul T. Kingsbury
Associate Dean, Undergraduate, Faculty of Environment | TEL
FROM Bryan Kinney, Acting Director, School of Criminology
RE Geography, Support for GISc Minor
DATE February 10, 2020



Please accept this, my belated and brief, memo of support for the GISc Minor in Geography.

On behalf of the School of Criminology, please register our full support for the proposed Minor. I can see great potential for improving access to spatial competency and a wider fluency in spatially relevant theory and methodology. Criminology has a long tradition (at least as far back as my joining the SFU community in 1997 as a graduate student) of sending our spatially minded students and faculty of the School to Geography to get precisely this training.

The real value of the Geographic Information Science Minor is the structured training students will receive in order become more theoretically and methodological aware of the issues involved in curating GIS datasets, their academic uses (and potential abuses or misuses). These are the key distinctions between academic pedagogy and the training of technical skills/methods needed to operate a Geographic Information System (GIS) proficiently.

At the undergraduate level is clear to Criminology that there is no compete / overlap of courses here. Quite the opposite in fact. Criminology has at least four (4) 3cr classes that would benefit greatly from spatially aware students: Crim 340 (Criminal Justice Policy Making and Analysis); crim 352 "environmental criminology theory and practice"; as well the pair of courses on crime prevention techniques and analysis (crim 350 and 450).

Please advise if you would like additional discussion.



FACULTY OF
HEALTH SCIENCES

MEMO

ATTENTION Paul Kingsbury, Associate Dean, Undergraduate, Faculty of Environment	TEL
FROM Nienke van Houten, Director, Undergraduate Programs, Faculty of Health Sciences	
RE GISc Minor Proposal	
DATE February 19, 2020	TIME

The Undergraduate Studies Committee for the Faculty of Health Sciences strongly supports the proposal for the GISc Minor in Department of Geography in the Faculty of Environment. This program will be valuable for students to gain theory, skills and techniques required for analysis and interpretation of spatial data and we acknowledge that these skills are transferable to many disciplinary contexts.

The program proposal has many novel and exciting aspects that will create a unique opportunity for students to train in an area that is currently underserved at SFU. The goals are well constructed and aligned to the curriculum.

Though our GIS course is not a good fit for the minor program at this time, we envision future opportunities to collaborate in this program as there are many real-world applications to GIS and health.

Nienke van Houten, Ph.D.



FACULTY OF
ENVIRONMENT

DEPARTMENT OF
ARCHAEOLOGY

January 30, 2020

RE: GIScience Minor Full Program Proposal

Dear Margaret

The Archaeology Department UEC has reviewed the GIScience minor and the committee chair has informed me that no concerns were identified.

We appreciate the opportunity to review it.

I wish you success with this new program.

Sincerely,

George

George Nicholas
Chair



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Date: February 11, 2020

Memo To: Paul Kingsbury, Associate Dean, Undergraduate, Faculty of Environment

Re: GISc Minor Proposal

From: Catherine Murray, Associate Dean Undergraduate, FASS

FASS strongly supports the GISc Minor, recognizing the historical and interdisciplinary links to the Department of Geography at this University, and the productive partnership between Urban Studies and Geography.

I note that the technical training these students will acquire is thorough and timely. As FASS launches its own new interdisciplinary minor in Social Data Analytics in the Fall of 2020, I expect there will be a number of synergies emerge between the teaching and research missions of the two programs. The Chair of Criminology has also identified the salience of the courses in the minor for research into the social and spatial dimensions of criminal behavior. We look forward to exploring future mutual opportunities to co-promote courses, schedule them non-competitively, and perhaps even collaborate on future "Semesters In..." seminars where interdisciplinary capstones in service of academically grounded, community-based learning may occur. Urban Studies is also supportive.