# **Council Approval**

Note: This form is intended to track the progress of a proposal (whether from Academic Affairs or Health Sciences) through the Undergraduate and Graduate Councils.

Proposal: BS in Geographic Information Science		
This proposal needs to go through		
Undergraduate Council Graduate Council Both Approvals Grad Approval/Undergrad Notification		
This proposal has been approved by:		
Chair of Undergraduate Council	Date:	9.26.17
Chair of Graduate Council	Date:	

Once the appropriate signature(s) have been obtained, please forward this completed form to the Office of the Senior Vice President for Academic Affairs. (NOTE: The SVP-AA is the Chief Academic Office for the University of Utah and reports to the Board of Regents in this capacity. When necessary, the CAO will get a signature from the SVP-HSC.)

Chief Academic Officer Rwatting Date: 1-27-17

Once the Chief Academic Officer's signature has been obtained, this approval document will be forwarded to the Office of the Academic Senate.

# Utah System of Higher Education New Academic Program Proposal Cover/Signature Page - Full Template

Institution Submitting Request:	University of Utah
Proposed Program Title:	Geographic Information Science (GIS) Bachelor of Science (B $\mathbf{f}$
Sponsoring School, College, or Division:	College of Social & Behavioral Science
Sponsoring Academic Department(s) or Unit(s):	Department of Geography
Classification of Instructional Program Code <sup>1</sup> :	45.0702
Min/Max Credit Hours Required to Earn Degree:	76 / 79
Proposed Beginning Term <sup>2</sup> :	Fall 2018
Institutional Board of Trustees' Approval Date:	

# Program Type (check all that apply):

(AAS)	Associate of Applied Science Degree
(AA)	Associate of Arts Degree
(AS)	Associate of Science Degree
	Specialized Associate Degree (specify award type <sup>3</sup> : )
	Other (specify award type <sup>3</sup> : )
(BA)	Bachelor of Arts Degree
(BS)	Bachelor of Science Degree
	Professional Bachelor Degree (specify award type <sup>3</sup> : )
	Other (specify award type <sup>3</sup> : )
(MA)	Master of Arts Degree
(MS)	Master of Science Degree
	Professional Master Degree (specify award type <sup>3</sup> : )
	Other (specify award type <sup>3</sup> : )
	Doctoral Degree (specify award type <sup>3</sup> : )
	K-12 School Personnel Program
	Out of Service Area Delivery Program

# Chief Academic Officer (or Designee) Signature:

I, the Chief Academic Officer or Designee, certify that all required institutional approvals have been obtained prior to submitting this request to the Office of the Commissioner.

Please type your first and last name Date:

I understand that checking this box constitutes my legal signature.

<sup>&</sup>lt;sup>1</sup> For CIP code classifications, please see <a href="http://nces.ed.gov/ipeds/cipcode/Default.aspx?y=55">http://nces.ed.gov/ipeds/cipcode/Default.aspx?y=55</a>.

<sup>&</sup>lt;sup>2</sup> "Proposed Beginning Term" refers to first term after Regent approval that students may declare this program.

<sup>&</sup>lt;sup>3</sup> Please indicate award such as APE, BFA, MBA, MEd, EdD, JD

### Utah System of Higher Education Program Description - Full Template

#### Section I: The Request

University of Utah requests approval to offer the following Baccalaureate degree(s): Geographic Information Science (GIS) Bachelor of Science (BS) effective Fall 2018. This program was approved by the institional Board of Trustees on .

### Section II: Program Proposal

#### Program Description

Present a complete, formal program description.

The Department of Geography has had instructional and research foci in geographic information science for decades. This field, more commonly termed GIS, is composed of geography concepts allied with technical education in cartography, satellite and aerial imaging/remote sensing, global positioning systems and geospatial statistics, modeling and analysis. The applications of GIS are virtually unlimited from business to natural resources in both private sector and government.

Undergraduate students' impression of the field of geography is largely limited to place-name geography learned in grade school or one course in high school. In reality, 21st Century Geography is a diverse field of study describing and analyzing the physical environment, human societies, and the interaction between them using advanced technologies. Geography has long used maps and images as models of the earth surface and physical/human processes. The advent of digital cartography, satellite imagery, global positioning systems and geographically-informed digital databases has transformed the use of traditional geographic theory, methodology and techniques to address issues confronting human societies. The Department of Labor estimates that employment for Geographic Information Scientists will increase 29% across the United States and 105% in Utah by the year 2022. Many of these positions are in the GIS arena. The Department offers the geography BS with an emphasis in GIS and a certificate program in GIS, however, the need is apparent for a full BS degree in GIS to meet both student and job market demand. If the BS is approved the geography degree emphasis in GIS will be phased out over three years. The creation of a BS degree in GIS at the University of Utah will allow motivated students to better prepare for a career through the GIS course program, and receive a degree labeled as a degree in Geographic Information Science.

The proposed program will require students to complete 75-79 course hours in Geography and 12 hours of allied courses in computer science, math and physics. All courses are currently offered and no new course development will be required. A capstone research/ external client-focused experience will be required of all students.

One of the external review comments from the 2017 review of the Department of Geography was that the Department consider development of a BS degree in GIS to compliment the BS degree in Geography. Given this impetus, faculty and staff developed a program outline and justification. These were discussed in two faculty meetings in Spring, 2017. In July, 2017, the faculty voted 13 for approval, one non-approval and two abstentions leading to the creation and submission of the BS in GIS proposal.

Geographic Information Science is a federally recognized STEM discipline allied with Cartography and the Geospatial Intelligence designations. The U of U Department of Geography is the leading instructional program in GIS on the U of U campus, currently offering courses and certificates in GIS, Remote Sensing and Geospatial Intelligence to supplement our BS degree in Geography. Given the current student demand and expanding career opportunities in this subfield of geography, there is both a student and market demand to create a separate BS degree in Geographic Information Science-GIS.

### Consistency with Institutional Mission

Explain how the program is consistent with the institution's Regents-approved mission, roles, and goals. Institutional mission and roles may be found at higheredutah.org/policies/policyr312/.

The University of Utah is the leading research university in the state of Utah. The BS in GIS degree fits very well within the instructional mission of the U of U as it will be a vehicle to produce bachelor's degree students educated in the most current geospatial science and technology. Instruction informed by current research is essential for science and technology fields advancing as rapidly as GIS.

### Section III: Needs Assessment

### Program Rationale

Describe the institutional procedures used to arrive at a decision to offer the program. Briefly indicate why such a program should be initiated. State how the institution and the USHE benefit by offering the proposed program.

The GIS field is one of the fastest growing information technology fields in the world. The Department of Geography has been conducting GIS research and transferring that research to the classroom since the creation of the state's first digital cartography and satellite remote sensing courses in the 1960-70s. Relevant and state of the art instruction is aided tremendously by faculty, graduate and undergraduate students performing research in the rapidly advancing GIS area.

The Department is designated by the National Geospatial Intelligence Agency and US Geological Survey as a National Center of Academic Excellence in Geospatial Sciences. These agencies recognize the quality and scope of the GIS instruction and research. The proposed BS degree is a justifiable extension of the past record and current achievements of the Department of Geography in a rapidly expanding student career opportunity space.

#### Labor Market Demand

Provide local, state, and/or national labor market data that speak to the need for this program. Occupational demand, wage, and number of annual openings information may be found at sources such as Utah DWS Occupation Information Data Viewer (jobs.utah.gov/jsp/wi/utalmis/gotoOccinfo.do) and the Occupation Outlook Handbook (www.bls.gov/oco).

According to the U.S. Department of Labor, Bureau of Labor Statistics, Occupational Outlook Handbook, the job outlook for GIS/cartographers and remote sensing/ photogrammetrists is a 29% increase 2014-2024.

A study conducted by EAB (Educational Advisory Board) for the time period of Summer 2016-2017 determined employers from all sectors in Arizona, Colorado, Idaho, Nevada, and Utah predominately seek students for the following GIS- related job positions. At total of

2340 job postings listing GIS or related specialties were identified for the one year period. The most relevant to the proposed BS in GIS proposal are:

Geographic Information Systems Analyst (122 job postings) GIS Technician (42 job postings) GIS Specialist (41 job postings) Data Analyst (23 job postings) Environmental Specialist (21 job postings) Systems Administrator (19 job postings)

Clearly there is labor market demand and demand for the skills that are the core of the proposed BS in GIS degree program.

According to the May, 2017, P&S Market Research's market research report (www.psmarketresearch.com/) "Global Geographic Information System (GIS) Market Size, Share, Development, Growth and Demand Forecast to 2023, the global <u>GIS market</u> is projected to grow at a CAGR of 10.1%, during 2017 - 2023.

This report surveyed agencies and firms in Government at all levels, Water and Wastewater Management, Telecommunications, Engineering and Business Services, Aerospace & Defense, Oil and Gas Refineries, Oil and Gas Exploration, Transportation & Logistics, Healthcare and Others. The report is available at <u>https://www.psmarketresearch.com/market-analysis/geographic-information-system-market</u>

The global GIS market is expected to increase from \$8,985.5 million in 2016, to reach \$17,510.9 million by 2023, growing at a CAGR of 10.1% during 2017 - 2023. Among the various application areas, government sector has been the largest contributor to the global GIS market, accounting for over 28% of the global revenue in 2016. Increasing urbanization, in addition to the surging adoption of enterprise GIS in developing countries is expected to bolster the demand for geographic information systems during the forecast period. Many of the prospective BS degree students have high school courses or job experience as technicians in drafting, computer coding, surveying, GPS, map data collection and other fields that relate to professional GIS education. Given the documented demand for GIS analysts, cartographers, GIS project managers and technical support staff, this program will help to meet the goal for 66% of Utahns from these jobs and others to achieve a post-secondary degree.

### Student Demand

Provide evidence of student interest and demand that supports potential program enrollment. Use Appendix D to project five years' enrollments and graduates. Note: If the proposed program is an expansion of an existing program, present several years enrollment trends by headcount and/or by student credit hours that justify expansion.

Within the Department of Geography, the number of students participating in the GIS courses and the GIS emphasis has increased in the last few years. Since 2000, 228 students, both geography and non-geography majors have completed the Certificate in GIS program.

Within the last two years the Utah State Board of Education has developed an endorsement in GIS in the public school system. Courses in GIS are becoming increasingly prevalent in Utah schools. GIS software is provided to all K-12 schools at no charge by a private vendor (ESRI).

This increased visibility and the use of common GIS software between Utah high schools and the Department of Geography should bolster the number of incoming first year students wanting to major in GIS.

Over the last few years the number of geography majors has increased Salt Lake Community College (SLCC) has a well-developed program in GIS. SLCC provides associate degrees in GIS. Many students transfer from this program at SLCC to complete the BS degree in Geography at the U of U with an emphasis or certificate in GIS. It is expected that SLCC will provide increasing numbers of students who can transfer to obtain a BS degree specifically in GIS.

### Similar Programs

Are similar programs offered elsewhere in the USHE, the state, or Intermountain Region? If yes, identify the existing program(s) and cite justifications for why the Regents should approve another program of this type. How does the proposed program differ from or compliment similar program(s)?

There is no other GIS degree program at the University of Utah. Students in other majors take Geography GIS courses for virtually all of their GIS coursework at the U of U. Utah State University, Weber State University, Snow College and other USHE schools offer degrees in geography with an emphasis or track in GIS or a GIS certificate. Brigham Young University offers a Geography BS - GIS and Technology. No other public or private universities in Utah offer a BS degree in GIS.

No capital improvements or new faculty are necessary. It is expected that minimal administrative changes in advising of students will result from the consolidation of these emphases. The requirements of the BS degree should compel undergraduate students to select GIS as a major earlier in their time at the University of Utah, which has already started to occur in the BS degree program in Geography,

### Collaboration with and Impact on Other USHE Institutions

Indicate if the program will be delivered outside of designated service area; provide justification. Service areas are defined in higheredutah.org/policies/policyr315/. Assess the impact the new program will have on other USHE institutions. Describe any discussions with other institutions pertaining to this program. Include any collaborative efforts that may have been proposed.

As was mentioned earlier, some USHE institutions, such as SLCC, USU and Snow College offer limited programs. This full BS degree program will not duplicate any other BS degree program in the USHE, but will allow their students opportunities to expand their education with complete BS degree in GIS.

### External Review and Accreditation

Indicate whether external consultants or, for a career and technical education program, program advisory committee were involved in the development of the proposed program. List the members of the external consultants or advisory committee and briefly describe their activities. If the program will seek special professional accreditation, project anticipated costs and a date for accreditation review.

The impetus for this proposal came out of a 2016-17 Geography Program external review committee's suggestion to create a BS degree along with the Geography BS degree. At this

# time, no accreditation programs for a BS in GIS are available or anticipated.

# Section IV: Program Details

### Graduation Standards and Number of Credits

Provide graduation standards. Provide justification if number of credit or clock hours exceeds credit limit for this program type described in R401-3.11, which can be found at higheredutah.org/policies/R401.

Students must complete all courses listed in the Program of Study in Appendix A below with a grade of C or better. The total number of credit hours required is 76-79.

### Admission Requirements

List admission requirements specific to the proposed program.

This major will be open to all students, but students will need to take rigorous, STEM, and intensive courses while maintaining a letter grade of a C or better to graduate with this major. Prospective students will be asked to declare the major and book an advising appointment to go over pre-requisite courses, demanding classes and schedules, and go over grade requirements.

### Curriculum and Degree Map

Use the tables in Appendix A to provide a list of courses and Appendix B to provide a program Degree Map, also referred to as a graduation plan.

# Section V: Institution, Faculty, and Staff Support

### Institutional Readiness

How do existing administrative structures support the proposed program? Identify new organizational structures that may be needed to deliver the program. Will the proposed program impact the delivery of undergraduate and/or lower-division education? If yes, how?

The new program will offer Utah students a BS degree program not offered by any other USHE institution. The University of Utah, the College of Social and Behavioral Sciences (CSBS) and the Department offers a strong system for student advising and support services. The new degree will have minimal impact on existing students.

### Faculty

Describe faculty development activities that will support this program. Will existing faculty/instructions, including teaching/ graduate assistants, be sufficient to instruct the program or will additional faculty be recruited? If needed, provide plans and resources to secure qualified faculty. Use Appendix C to provide detail on faculty profiles and new hires.

No new faculty will be required. The faculty, courses, software and support staff, such as TA lines for GIS lab courses exist at this time. The new degree program may require limited reallocation, but no additional resources are needed at this time.

### Staff

Describe the staff development activities that will support this program. Will existing staff such as administrative, secretarial/ clerical, laboratory aides, advisors, be sufficient to support the program or will additional staff need to be hired? Provide plans and resources to secure qualified staff, as needed.

Since all courses for the proposed program are already being taught with DIGIT Lab, departmental and CSBS technical support, no additional staff resources are anticipated for the foreseeable future.

### Student Advisement

### Describe how students in the proposed program will be advised.

It is expected that this major will start out small and that advising will be easily handled by the lead Geography undergraduate advisor and the fellow advisors in the GEOG, ENVST, & ANTH cluster in the new Collaborative Advising Model in the College of Social and Behavioral Science (CSBS). Once the major attracts more students, more advising may be required. The CSBS Dean's Office has implemented a new advising model that will be better equipped and have more advisors to support the program in the event that this becomes necessary.

### Library and Information Resources

Describe library resources required to offer the proposed program if any. List new library resources to be acquired. The Library has sufficient resources available to meet any faculty or student needs.

# Projected Enrollment and Finance

Use Appendix D to provide projected enrollment and information on related operating expenses and funding sources.

# Section VI: Program Evaluation

### Program Assessment

Identify program goals. Describe the system of assessment to be used to evaluate and develop the program.

The BS in GIS will strive to meet the following program goals, each with prescribed activity outcomes.

- Knowledge Base in GIS: Students completing the BS degree should demonstrate fundamental knowledge and comprehension of the major geographic concepts, theoretical perspectives, historical trends, and analytical methods for the creation and utilization of geographic data and information, geospatial databases, geospatial modeling and statistics. Students should demonstrate a fluency in the supporting data sources and technologies, including satellite imagery, GPS, computer programming and statistics.
  - 1) Develop a working knowledge of GIS content domains.
  - 2) Describe applications of GIS to real world problem solving.

- Scientific Inquiry and Critical Thinking: The skills in this area involve the development of scientific reasoning and problem solving, including effective research methods. Students completing a baccalaureate degree should be grounded in geographic information theory and methodology being able to design and execute research and GIS implementation projects. The goal is higher education in GIS, not simply technical training.
  - 1) Demonstrate geographic information literacy.
  - 2) Engage in innovative and integrative thinking and problem solving.
  - 3) Incorporate the various GIS content domains in scientific inquiry/problem solution.
- Professional Development: The emphasis in this goal is on application of GIS specific content and skills, teamwork skills, project planning and management skills, and career preparation. This goal at the baccalaureate level refer to abilities that sharpen student readiness for post-baccalaureate employment, graduate school, or professional school.

1) Apply their knowledge to understand the best information systems approach to solving a problem.

2) Exhibit the ability to assess the types of information and skills of other team members to problem solution.

3) Exhibit the ability to design and manage a geographic information project.

4) Develop a professional attitude and approach to job and career sustainability.

Evaluation of student performance in meeting these goals and accomplishing these activities will be done in three ways. 1) Every student will need to complete the courses for the major with a grade of "C" or better. 2) Upon completion of the coursework each student will be required to take GEOG 5161- Capstone in Geographic Information Science. This course recruits sponsors - agencies from all levels of government, NGOs and private sector firms to provide and guide a GIS project. Each student will develop an approach to the project working with the sponsor. The student will be responsible for managing the technical, financial and scheduling aspects of the project and providing a work product acceptable to the sponsor at the end of the semester. The students will provide written documents, computer code, databases, cartographic products, and an oral presentation to the sponsor. 3) In the final year of the degree program students will be given an exit survey and test consisting of a series of content and technical questions covering the various content and technical domains of the GIS degree. These will be administered as the students apply for graduation.

#### Student Standards of Performance

List the standards, competencies, and marketable skills students will have achieved at the time of graduation. How and why were these standards and competencies chosen? Include formative and summative assessment measures to be used to determine student learning outcomes.

According to data collected in the EMSI- Q2 2017 Data Set <u>www.economicmodeling.com</u>, the top 20 most relevant "hard" skills for GIS related job positions were:

**Distributed GIS** Spatial Data Infrastructures **Spatial Databases** Geographic Information Systems **GIS** Applications ArcGIS (GIS Software) Aerial Photography **ArcGIS Servers** Spatial Analysis ArcSDE Geoprocessing Cartography Geocoding ArcObjects Digitization **Remote Sensing** ArcMap Erdas Imagine Google Earth Global Positioning Systems (GPS)

The top ten "soft" skills from this report are:

Scheduling (Project Management) Coordinating Leadership Listening Leading Creative Problem-Solving Cooperation Team Building Persuasive Communication Public Speaking

The proposed degree program will have coursework, collaborative projects and the capstone experience that will provide students knowledge and experience in all of these hard and soft skill areas. Mastery of these skills will be essential to be successful in the program coursework and the capstone course experience.

# Appendix A: Program Curriculum

List all courses, including new courses, to be offered in the proposed program by prefix, number, title, and credit hours (or credit equivalences). Indicate new courses with an X in the appropriate columns. The total number of credit hours should reflect the number of credits required to be awarded the degree.

For variable credits, please enter the minimum value in the table for credit hours. To explain variable credit in detail as well as any additional information, use the narrative box at the end of this appendix.

Course Number	NEW Course	Course Title	Credit Hours				
General Education Courses (list specific courses if recommended for this program on Degree Map)							
		General Education Credit Hour Sub-Total					
Required Courses	5						
GEOG 1000		Earth Environments and Global Change	3				
GEOG 1400		Human Geography	3				
GEOG 1100		Exploring the World Through Google Earth	3				
GEOG 1180		Introduction to Geo-Programming	3				
GEOG 3020		Geographical Analysis	4				
GEOG 3100	$\times$	Introduction to GIS & Cartography	5				
CS 1030		Foundations of Computer Science	3				
MATH 1210		Calculus I	4				
PHYS 1010		Elementary Physics: The Way Things Work -OR-	3				
PHYS 2010		General Physics I	4				
GEOG 3/5270		Biogeography: Global Patterns of Life -OR-	4				
GEOG 3/5400		Population Geography	4				
GEOG 3/5170		GeoData Field Methods	3				
GEOG 5140		Methods in GIS	4				
GEOG 5150		Spatial Data Design for GIS	4				
GEOG 5165		Web GIS	3				
GEOG 5680		Introduction to R	2				
GEOG 5180		Geo-Processing with Python	3				
GEOG 5160		Spatial Modeling with GIS	4				
GEOG 5162		Project Management	3				
GEOG 3110		The Earth from Space: Remote Sensing of the Environment	3				
GEOG 5110		Environmental Analysis through Remote Sensing	3				
GEOG 5161		Capstone in Geographic Information Science (GIS)	3				
		Required Course Credit Hour Sub-Total	76				
Elective Courses	ī						
GEOG 5120		Environmental Optics	3				
GEOG 5130		Advanced Remote Sensing Applications	3				
GEOG 5190		GIS for Environmental and Public Health	3				
GEOG 5670		Open Source Geospatial Tools	3				
GEOG 5940		Internship in GIS/Remote Sensing	3				

Course Number	NEW Course	Course Title	Credit Hours
		Elective Credit Hour Sub-Total	3
		Core Curriculum Credit Hour Sub-Total	79

### Program Curriculum Narrative

#### Describe any variable credits. You may also include additional curriculum information.

Students must complete a minimum of six (6) courses of Geographic Core required coursework, plus eight (8) required Applied GIS courses and two (2) required Remote Sensing courses, plus one (1) Geographic CW course, plus one (1) Senior Capstone course, plus one (1) GIS elective course, as well as three (3) required Allied STEM courses for a minimum total of twenty-two (22) required GIS major courses (see list below). All courses for the major must be taken for a letter grade and completed with a C or better.

RESIDENCY REQUIREMENT: Students must complete at least 30 credit hours in the Department of Geography at the University of Utah.

ALLIED CREDIT REQUIREMENT: One extra allied course is also required. These courses will generally be in the student's interest/specialization area and can be done in any of the following departments: Atmospheric Sciences; Biology; Chemistry; City and Metropolitan Planning; Civil Engineering; Computer Science; Geology; Mathematics; Parks, Recreation and Tourism; Philosophy; Physics; or any department\*\* in the College of Social and Behavioral Science. \*\*(Aerospace Studies, Anthropology, Economics, Environmental and Sustainability Studies, Ethnic Studies, Family and Consumer Studies, Gender Studies, Health Society and Policy, Military Science, Naval Science, Political Science, Psychology, Sociology).

\*GEOG 5940 Internship in GIS/RS may be counted only once toward the major elective requirement and must be approved by GIS Director. It is the student's responsibility to find a GIS/RS internship and get it approved by the GIS Director before the add/drop deadline of the semester the student will be working in the internship. Depending on the number of hours working in the internship, GEOG 5940 can count between 3-5 credit hours: this will be decided on by the GIS Director. GEOG 5940: Internships cannot be added retroactively.

# Degree Map

Degree maps pertain to undergraduate programs ONLY. Provide a degree map for proposed program. Degree Maps were approved by the State Board of Regents on July 17, 2014 as a degree completion measure. Degree maps or graduation plans are a suggested semester-by-semester class schedule that includes prefix, number, title, and semester hours. For more details see http://higheredutah.org/pdf/agendas/201407/TAB%20A%202014-7-18.pdf (Item #3).

Please cut-and-paste the degree map or manually enter the degree map in the table below.

See Attached. Appendix B

# Appendix C: Current and New Faculty / Staff Information

Part I. Department Faculty / Staff

Identify # of department faculty / staff (headcount) for the year preceding implementation of proposed program.

	# Tenured	# Tenure -Track	# Non -Tenure Track
Faculty: Full Time with Doctorate	9	4	3
Faculty: Part Time with Doctorate	0	0	5
Faculty: Full Time with Masters	0	0	1
Faculty: Part Time with Masters	0	0	4
Faculty: Full Time with Baccalaureate	0	0	0
Faculty: Part Time with Baccalaureate	0	0	1
Teaching / Graduate Assistants			10TA/ 8GA
Staff: Full Time			3
Staff: Part Time			2

# Part II. Proposed Program Faculty Profiles

List current faculty within the institution -- with academic qualifications -- to be used in support of the proposed program(s).

	First Name	Last Name	Tenure (T) / Tenure Track (TT) / Other	Degree	Institution where Credential was Earned	Est. % of time faculty member will dedicate to proposed program.	lf "Other," describe
Full Time Faculty					T		
	Simon	Brewer	TT	Ph.D.	Université d'Aix-Marseille I, 2002	25	
	Andrea	Brunelle	Т	PhD.	University of Oregon, 2002	10	
	Thomas	Cova	Т	Ph.D.	UC-Santa Barbara, 1999	40	
	Phillip	Dennison	Т	Ph.D.	UC Santa Barbara, 2003	40	
	Richard	Medina	Т	Ph.D.	Univ. of Utah, 2009	40	
	Mckenzie	Skiles	TT	Ph.D.	UCLA, 2014	40	
	Neng	Wan	TT	Ph.D.	Texas State Univ.,2011	40	
	Yehua	Wei	Т	Ph.D.	UCLA, 1998	15	
					Other Geography faculty will be teaching core/elective geography		
	-						
Part Time Faculty	ſ	1			I	1 1	
	Richard	Forster	Т	Ph.D.	Cornell, 1997	15	
	George	Hepner	Т	Ph.D.	Arizona State Univ. 1979	15	
	Phoebe	McNeally	Other	Ph.D.	Univ. of Utah, 2008	15	

# Part III: New Faculty / Staff Projections for Proposed Program

Indicate the number of faculty / staff to be hired in the first three years of the program, if applicable. Include additional cost for these faculty / staff members in Appendix D.

	# Tenured	# Tenure -Track	# Non -Tenure Track	Academic or Industry Credentials Needed	Est. % of time to be dedicated to proposed program.
Faculty: Full Time with Doctorate					
Faculty: Part Time with Doctorate					

	# Tenured	# Tenure -Track	# Non -Tenure Track	Academic or Industry Credentials Needed	Est. % of time to be dedicated to proposed program.
Faculty: Full Time with Masters					
Faculty: Part Time with Masters					
Faculty: Full Time with Baccalaureate					
Faculty: Part Time with Baccalaureate					
Teaching / Graduate Assistants					
Staff: Full Time					
Staff: Part Time					

# Appendix D: Projected Program Participation and Finance

### Part I.

Project the number of students who will be attracted to the proposed program as well as increased expenses, if any. Include new faculty & staff as described in Appendix C.

Inree Year Projection: Program Participation	am Participation and Department Budget								
	Year Preceding								
	Implementation	Year 1	Year 2	Year 3	Year 4	Year 5			
Student Data									
# of Majors in Department	134								
# of Majors in Proposed Program(s)									
# of Graduates from Department	33								
# Graduates in New Program(s)									
Department Financial Data									
		Department	Budget						
		Year 1	Year 2	Year 3					
Project additional expenses associated with offering new program(s). Account for New Faculty as stated in Appendix C, "Faculty Projections."	Year Preceding Implementation (Base Budget)	Addition to Base Budget for New Program(s)	Addition to Base Budget for New Program(s)	Addition to Base Budget for New Program(s)					
EXPENSES - nature of additional costs requi	red for proposed p	rogram(s)							
List salary benefits for additional faculty/staff each year 2, include expense in years 2 and 3. List one	year the positions wi -time operating expe	ill be filled. For enses only in th	example, if hin ne year expend	ring faculty in led.					
Personnel (Faculty & Staff Salary & Benefits)	\$2,380,815								
Operating Expenses (equipment, travel, resources)	\$91,865								
Other:									
TOTAL PROGRAM EXPENSES	///////////////////////////////////////	\$0	\$0	\$0					
TOTAL EXPENSES	\$2,472,680	\$2,472,680	\$2,472,680	\$2,472,680					
FUNDING – source of funding to cover addition	onal costs generate	ed by propose	ed program(s	)					
Describe internal reallocation using Narrative 1 on Narrative 2.	the following page. I	Describe new s	cources of fund	ling using					
Internal Reallocation									
Appropriation									
Special Legislative Appropriation									
Grants and Contracts									
Special Fees									
Tuition									
Differential Tuition (requires Regents approval)									
PROPOSED PROGRAM FUNDING	//////	\$0	\$0	\$0					
TOTAL DEPARTMENT FUNDING	\$0	\$0	\$0	\$0					
Difference									
Funding - Expense	(\$2,472,680)	(\$2,472,680)	(\$2,472,680)	(\$2,472,680)					

Part II: Expense explanation

### **Expense Narrative**

Describe expenses associated with the proposed program.

The BS in GIS will not require any new expenditures. Faculty, staff, TAs, hardware and software are already in place. The new advising program being instituted by the College and the Department will handle the additional, limited amount of advising.

Part III: Describe funding sources

#### **Revenue Narrative 1**

Describe what internal reallocations, if applicable, are available and any impact to existing programs or services.

We expect some current and potential students to enroll in the BS GIS rather than the Geography degree. This is a shift that will not require additional resources. Hopefully, the newly recruited number of BS GIS students will grow which may require a reallocation of existing faculty teaching opportunities, but that is a few years into the future.

Revenue Narrative 2

Describe new funding sources and plans to acquire the funds.

# BS degree in Geographic Information Science -Program Purpose

The mission of the Department of Geography at the University of Utah is to generate high quality research and teaching focused on the interactions between the human and physical environment. Geographical information science (GIS) is the 21<sup>st</sup> century integration of geography and computer science and technology with applications in many scientific fields. We are motivated to educate students to provide professional and community service and to prepare students for in-demand careers in GIS and related fields.

# **Learning Outcomes & Assessments**

1. Demonstrate a basic understanding of the scientific discovery process in the discipline of geography

Assessment: Have a 3-4 question Canvas quiz they take in either GEOG 3270/5270 or GEOG 3400/5400 (the two upper division content courses of which all students must take one) on the scientific discovery process;

2. Demonstrate a basic understanding of geographic information science

Assessment: Have a 3-4 question Canvas quiz they take in GEOG 3100/6100; Introduction to GIS and Cartography

3. Demonstrate a knowledge of general computer science practices utilized in GIS database development and implementation:

Assessment: Have a 3-4 question Canvas quize they take in GEOG 5150 (Spatial Database Design) upon completion of the GEOG 5140-5150 course sequence.

4. Indicate the ability to think spatially and conduct basic spatial analysis using analytical methods and quantitative techniques.

Assessment: Have a 3-4 question Canvas quiz they take in GEOG 3020 (Geographical Analysis) on spatial analysis literacy;

# **Assessment Team**

The Undergraduate Curriculum Committee will meet in May of each year and review work samples (20% of submissions) for one of the 4 Learning Outcomes listed above. Data will be evaluated on the success of the students in meeting the criteria (based on a rubric for each, to be developed) and a report generated.



August 4, 2017

Mathematics

# To Whom It May Concern.

I am writing to confirm that I have reviewed the course requirements of the Department of Geography's proposal for a new B.S. degree in Geographic Information Science (GIS), and find its mathematics content to be entirely appropriate, as well as timely. As I understand things, our students at the U currently can prepare for a certificate in GIS, but that there is no rigorous program that trains them in this rapidly-growing discipline. I believe that the introduction of this degree option will address this issue, thereby satisfy the increased student and industry demands in this important direction. Based on this, I am happy to strongly support Geography's proposal for a BS in GIS.

Sincerely,

Davarthode -

Davar Khoshnevisan Professor and Chair



J. Willard Marriott Library 295 South 1500 East Salt Lake City, Utah 84112-0860 (801) 585-9521

George F. Hepner, Professor Department of Geography Building 73 Room 206 332 S 1400 E University of Utah Salt Lake City, UT 84112

August 29, 2017

Dear Dr. Hepner,

The J. Willard Marriott Library appreciates your request to comment on our ability to support students in a new Bachelor of Science degree program in Geographic Information Science (GIS).

The Library has sufficient collections to support undergraduate study in GIS. The Department of Geography already offers a graduate master's program in GIS, and I feel the current Library collections have proven to be sufficient in serving the master's program. The Library has also proven to be sufficient in serving Ph.D. students in the Department of Geography. The proposed GIS undergraduate program will rely on the same collections.

The Marriott Library annually purchases a selection of new scholarly books in geography, remote sensing, spatial modeling and other related topics. And we are usually able to order any specific books necessary to support classes or individual students. We encourage faculty to work with librarians to improve any areas where the Library may need additional books to support this new program.

Although the Library doesn't currently maintain subscriptions to several important journals in the field like *International Journal of Remote Sensing, GeoInformatica* and *Geomatica*, the Marriott Library does have significant holdings of scholarly journals to support an undergraduate GIS program. The Library has current subscriptions to these vital journals, for example:

Int. Journal of Geographical Information Science Photogrammetric Engineering & Remote Sensing Computers & Geosciences Transactions in GIS Environment and Planning IEEE Trans. Geoscience and Remote Sensing Remote Sensing of Environment Computers, Environments and Urban Systems

Annals of the Assoc of American Geographers Remote Sensing Letters Journal of Applied Remote Sensing The Photogrammetric Record Geographical Journal Geoforum Journal of Geographical Systems Cartographica The Marriott Library would like to work with faculty to evaluate the most workable preferences for providing any additional necessary periodical literature necessary to support the program.

Many GIS data sources providing information sets used in geographic information systems, spatial modeling, geospatial analysis and cartographic mapping are freely available, for example the National Geophysical Data Center data; the National Hydrology Dataset; the National Atlas Boundary and Shape Files; and the Utah Automated Geographic Reference Center datasets.

We feel that our collection is also fairly strong in indexes, abstracts, and databases which support the discovery of GIS literature. Examples of specific databases supporting a GIS program include:

Acadmeic One File	GREENR
Academic Search Premier	Inspec
The Computer Database	PAIS International
Dissertations & Theses: Global	POPLINE
Environmental Studies and Policy	Scopus
GeoRef	Social Explorer
GeoScienceWorld	Web of Science

The Library also has significant resources to support the multimedia communication projects that students in the new program may be undertaking. Students may take advantage of the software packages and computer workstations available in the Knowledge Commons as well as the expertise and equipment available in the Library.

Student difficulties in locating materials often stem not from collection weaknesses, but from the complexities of using a large research library. We offer class presentations and one-to-one consultations with library specialists who will help students find the most relevant works and suggest the most appropriate search strategies. The Marriott Library employs a GIS specialist, a statistician, and a number of librarians with specializations in engineering, science, government documents, and research data to help students in GIS find and use the information they need.

We look forward to working with the faculty and students in this new program.

Sincerely,

Mark England

Mark England, Associate Librarian Head, Collections Management J. Willard Marriott Library



University of Utah Salt Lake City, UT 84112

27 July, 2017

To Whom It May Concern,

I am writing this letter in support of the new Bachelor of Science in Geographic Information Science (BS-GIS) being proposed by my department. We are the main provider of GIS education, research and training at the University of Utah and believe that this degree will provide an increased marketability for student job placement upon graduation.

Often the existing impression of Geography is limited to states, capitols, country identification on maps, etc. In reality, 21st Century Geography is a diverse field of study describing and analyzing the physical environment, human societies, and the interaction between them using advanced technologies. There is a long tradition in Geography to use maps to identify patterns in human and natural systems. The advent of digital cartography, satellite imagery, and global positioning systems has increased the applications and value of geographic analysis.

The Department of Labor estimates that employment for Geographers will continue to increase and many of these positions are in the GIS arena. The Department offers an emphasis in GIS and a certificate program in GIS, however, the need is apparent for a full BS degree in GIS to meet both student and job market demand. The creation of a BS degree in GIS at the University of Utah will allow motivated students to better prepare for a career through the GIS course program, and receive a degree labeled as a degree in Geographic Information Science.

The proposed program will require students to complete 75-79 course hours in Geography and 12 hours of allied courses in computer science, math and physics. All courses are currently offered and no new course development will be required. A capstone research/external client-focused experience will be required of all students. The development of this degree program not only meets student needs but also responds to external review comments from our 2017 Graduate Council Review that suggested the development of a BS degree in GIS to compliment the BS degree in Geography.

Department of Geography 332 S 1400 E, Rm. 217 Salt Lake City, Utah 84112 (801) 581-8218 FAX (801) 581-8219



The new BS-GIS program in Geography allows us to provide students deeper access to our faculty's strengths in GIS while also providing them a degree option that will increase their post-graduation marketability. My faculty and I strongly support this effort and are confident that it will be valuable opportunity for students.

Sincerely,

IBrunelle

Andrea Brunelle Professor and Chair

Department of Geography 332 S 1400 E, Rm. 217 Salt Lake City, Utah 84112 (801) 581-8218 FAX (801) 581-8219



50 S. Central Campus Drive RM 3190 Salt Lake City, UT 84112 801.581.8224 (Fax) 801.581.5843

August 10, 2017

Dr. Andrea Brunelle, Professor & Chair Department of Geography University of Utah

Dear Dr. Brunelle:

I am writing to express my support for your newly proposed Bachelor's of Science in Geographic Information Systems (BS-GIS). I have read the proposed curriculum, I think that the proposed degree complements existing degree programs and offers a very useful educational opportunity for undergraduates. We can make the CS1030 class available to your students, as indicated in the proposed curriculum, but I would also encourage you to consider our newly creating Computer Programming 1-2 sequence, which is designed to provide undergraduates from all over campus a practical set of software development skills. In the meantime, I wish you the best of luck in this new endeavor.

Yours truly,

Ross Whitaker Professor, Director

#### DEPARTMENT OF GEOGRAPHY REQUIREMENTS FOR THE MAJOR – GEOGRAPHIC INFORMATION SCIENCE (GIS)

Students must complete a minimum of six (6) courses of Geographic Core required coursework, plus eight (8) required Applied GIS courses and two (2) required Remote Sensing courses, plus one (1) Geographic CW course, plus one (1) Senior Capstone course, plus one (1) GIS elective course, as well as three (3) required Allied STEM courses for a minimum total of twenty-two (22) required GIS major courses (see list below). All courses for the major must be taken for a letter grade and completed with a C or better.

RESIDENCY REQUIREMENT: Students must complete at least 30 credit hours in the Department of Geography at the University of Utah.

ALLIED CREDIT REQUIREMENT: One extra allied course is also required. These courses will generally be in the student's interest/specialization area and can be done in any of the following departments: Atmospheric Sciences; Biology; Chemistry; City and Metropolitan Planning; Civil Engineering; Computer Science; Geology; Math; Parks, Recreation and Tourism; Philosophy; Physics; or any department\*\* in the College of Social and Behavioral Science. \*\*(Aerospace Studies, Anthropology, Economics, Environmental and Sustainability Studies, Ethnic Studies, Family and Consumer Studies, Gender Studies, Health Society and Policy, Military Science, Naval Science, Political Science, Psychology, Sociology).

#### **PROGRAM OF STUDY**

Code	Course Number and Title	Credit Hrs	Sem/Year	Grade
	<b>Doguired Courses:</b> (Initial Core Paguirements)		Taken	
SE	GEOG 1000 Earth Environments and Global Change	3		
DE	GEOG 1400 – Earth Environments and Giobal Change	3		
SE SE	GEOG 1400 – Hullian Geography GEOG 1100 – Exploring the World Through Google Earth	3		
51	CEOC 1100 – Exploring the world Thilough Google Earth	3		
OB/OI	GEOG 1180 – Introduction to Geo-Programming ( <i>nyoria – Fau or spring</i> )	3		
	GEOG 5020 – Geographical Analysis ( <i>Spring</i> )	4		
QI	One of the following: (Geography CW Choice List)	5		
CW	GEOG 3/5270 Riggoography: Global Patterns of Life (Spring) <b>OP</b>	4		
CW	GEOG 3/52/0 - Biogeography. Global Fatterns of Life (Spring) OK	4		
CW	Dequired Allied Courses: (Allied Pequirements)	4		
	CS 1020 Ecundations of Computer Science	2		
OP	CS 1050 – Foundations of Computer Science	3		
QK	MATH 1210 - Calculus I DUVS 1010 - Elementary Division <b>OB</b> DUVS 2010 - Conversi Division I	4		
SF	PHYS 1010 – Elementary Physics <b>OR</b> PHYS 2010 – General Physics I	3-4		
	Applied GIS Core: (Applied GIS Requirements)	2		
	GEOG 5/5170 – GeoData Field Methods ( <i>Fall</i> )	3		
	GEOG 5140 – Methods in GIS	4		
	GEOG 5150 – Spatial Data Design (Fall)	4		
	GEOG 5165 – Web GIS	3		
	GEOG 5680 – Introduction to R	2		
	GEOG 5180 – Geo-processing with Python ( <i>Fall</i> )	3		
	GEOG 5160 – Spatial Modeling with GIS (Spring)	4		
	GEOG 5162 – Project Management	3		
	Remote Sensing Core: (Remote Sensing Requirements)			
SF	GEOG 3110 – The Earth from Space: Remote Sensing of the Env't (Fall)	3		
	GEOG 5110 – Environmental Analysis through Remote Sensing (Spring)	3		
	<b>Senior Capstone:</b> (required core course for major in final year)			
	GEOG 5161 – Capstone in Geographic Information Science (Spring)	3		
	<b>Electives:</b> (select at least one elective course from list)			
	GEOG 5120 – Environmental Optics	3		
	GEOG 5130 – Advanced Remote Sensing Applications	3		
	GEOG 5190 – GIS for Environmental and Public Health	3		
	GEOG 5670 – Open Source Geospatial Tools	3		
	GEOG 5940 – Internship in GIS/Remote Sensing	3-5		
	TOTAL COURSES 22, TOTAL CREDIT HOURS 75-79			
	TOTAL RESIDENCY HRS. (30 cr. hrs. at U of U Geog. Dept.)			

\*GEOG 5940 Internship in GIS/RS may be counted only once toward the major elective requirement and must be approved by GIS Director.

#### **ALLIED COURSES**

Code	Course Number and Title	Credit Hrs	Sem/Year	Grade
			Taken	
	CS 1030 – Foundations of Computer Science	3		
	MATH 1210 – Calculus I	4		
	PHYS 1010 – Elementary Physics <b>OR</b> PHYS 2010 – General Physics I	3-4		
	TOTAL CREDIT HOURS (min. 12 credit hours)			
	Students who have questions should book an appointment with the undergraduate advisor at geog.uta	h.edu.	6/16/	17

Remaining Total Hours	122	NAME	GIS Major (BS)	DATE
aining Upper Division Credits	40	ulD	#	Catalog Year

		Remaining Upper Divis	sion Credits	40				ul	ID	#		Catalog Year			
	Fall Year 1						Spring Year 1				Summer 20##				
Day/Time	Code	Class		Credits	Day/Time	Code	Class	C	Credits	Day/Time	Code	Class	Credits		
	SF	GEOG	1000	3			GEOG 11	180	3						
		GEOG	1400	3	Intro CS course		CS 10	)30	3						
gen ed	QA	MATH	1050	4	pre-req for Calculus		MATH 10	)60	3						
gen ed	WR2	WRTG	2010	3	gen ed	AI	AI		3						
		ANY		2	gen ed	FF	FF		3						
		Total Semester Ca	redits:	15			Total Semester Credits:		15			Total Semester Credits:	0		
		Total Credits Rema	aining	107			Total Credits Remaining		92			Total Credits Remaining	93		
		Upper Division Credits I	Remaining	40			Upper Division Credits Remainin	g	40			Upper Division Credits Remaining	4(		

	Fall Year	2	Spring Year 2					Summer 20##					
Day/Time	Code	Class	C	Credits	Day/Time	Code	Class	Credi	its	Day/Time	Code	Class	Credits
	SF	GEOG	1100	3			GEOG	5140	4				
	QI	GEOG	3100	5	gen ed	DV	DV		3				
Calculus I		MATH	1210	4	gen ed	HF	HF		3				
gen ed	HF	HF		3			PHYS	1010	3				
							ANY		3				
		Total Semester Credits: 15					Total Semester Credits:		16			Total Semester Credits:	0
		Total Credits Remaining	g	77			Total Credits Remaining		61			Total Credits Remaining	61
		Upper Division Credits Rema	aining	35			Upper Division Credits Remain	ing	31			Upper Division Credits Remaining	31

	Fall y	Year 3			Spring Year 3	Summer 20##						
Day/Time	Code	Class		Credits	Day/Time	Code	Class	Credits	Day/Time	Code	Class	Credits
		GEOG	5150	4		QB/QI	GEOG 3020	) 4				
or 5170		GEOG	3170	3	need to teach spring?		GEOG 5680	) 2				
		GEOG	5180	3			GEOG 5110	) 3				
		GEOG	3110	3			GEOG 5160	) 4				
		ANY		2			ANY	2				
		Total Semester C	Credits:	15			Total Semester Credits:	15			Total Semester Credits:	0
		Total Credits Rem	naining	46			Total Credits Remaining	31			Total Credits Remaining	31
		Upper Division Credits	s Remaining	18			Upper Division Credits Remaining	5			Upper Division Credits Remaining	5

	Fall Year	4		Spring Year 4					Summer 20##				
Day/Time	Code	Class		Credits	Day/Time	Code	Class	Credits		Day/Time	Code	Class	Credits
		GEOG GIS	elective	3			GEOG 516	1 3					
		GEOG	5162	3	or 5270	CW	GEOG 327	0 4					
gen ed	IR	IR	3000	3			ANY	9					
gen ed	FF	FF		3									
		GEOG	5165	3									
		Total Semester Credits: 15					Total Semester Credits:	16				Total Semester Credits:	0
		Total Credits Remaining	g	16			Total Credits Remaining	0				Total Credits Remaining	0
		Upper Division Credits Rema	aining	-4			Upper Division Credits Remaining	-11				Upper Division Credits Remaining	-11

DISCLAIMER:

Graduation is ultimately the students responsibility. Double check all calculations, frequently review your DARS, beware of accidental retakes, ask questions, get a second opinon when needed!