HIGHER EDUCATION
COORDINATING
COMMISSION

Proposal for a New Academic Program

Institution: University of Oregon
College/School: College of Arts and Sciences
Department/Program: Department of Geography
Proposed Degree and Title: Major Degree in Spatial Data Science and Technology

1. Program Description

a. Proposed Classification of Instructional Programs (CIP) number (*contact your Registrar or Institutional Research office for this number).*

450701

b. Brief overview (1-2 paragraphs) of the proposed program, including its disciplinary foundations and connections; program objectives; programmatic focus; degree, certificate, minor, and concentrations offered.

The objective of the proposed Spatial Data Science and Technology major is to educate students in the development and use of geospatial data and technologies, the analysis and visualization of geospatial data, and how to employ these skills in a fast growing industry. The Department of Labor classifies Geospatial Technologies as a high growth industry that is currently experiencing an annual growth rate of 35%. Our aim is to prepare students for this industry by providing a curriculum that is unique to our university and the state, and one that would offer a novel undergraduate degree by integrating geospatial technical skills with a societal consciousness that is emphasized through the current general education renaissance. The proposed Spatial Data Science and Technology major is grounded in the disciplinary foundations of Geographic Information Science (GIScience), which couples together theory and methods from Geography and Computer Science. In recent decades, these foundations have led the global pursuit to utilize advances in location-based services, computational sciences, spatial analytics, and visualization approaches to address a diversity of problems facing the world.

Our proposed program will require students to complete 48 credits consisting of four compulsory and eight elective courses on a variety of topics including big data, computer programming, satellites, data analysis, computational modeling, web-mapping and location-aware services. Furthermore, we will provide students with a practicum experience where they can employ their knowledge and skills on the UO campus in both research and administrative settings. The majority of the courses in this major will be offered through the Geography Department; these courses will expose students to a variety of geospatial data and technologies through geographic applications focused on cultural, geopolitical, and environmental phenomena. Students can also select from multiple courses in the Computer Information Science Department from which they will learn the foundations of computational programming that are a necessary skill in today's industry. Students can earn either a BA or BS through the completion of this major.

While the proposed Spatial Data Science and Technology major in itself offers a degree that will make students competitive in a growing job market, it could potentially be paired with other majors and minors in ways to give students a strategic advantage. For example, students could combine a Spatial Data Science and Technology major with a major Computer Science or minor in Computer Information Technology or the proposed Data Science minor to be offered by the department of Computer Information Science. This will help students be more competitive in the market for designers and developers for geospatial technologies. Additionally, students

can double major in SDST and Geography as the two represent very different yet complementary majors. There is no course overlap restriction as the SDST major is significantly different than both Computer Science and Geography, and as such it is unlikely that a student will be able to use more than five courses as overlap between two majors. Regardless of how students utilize the proposed major, our goal is to create a flexible structure with a core focused on the foundations of geospatial data and technologies coupled with computer programming, and a breadth of elective course offerings from which students can select based on their career goals. This structure will provide students with the skills and knowledge to enter both the industry- and government-related job markets as well as obtain relevant graduate research opportunities.

c. Course of study – proposed curriculum, including course numbers, titles, and credit hours.

The SDST major consists of an introductory component and a suite of elective courses, tailored to individual student preferences and industry/employment demands in the fast-changing technology sector. The introductory courses (listed below) will provide foundational skills, concepts, and critical thinking abilities. Some of the introductory courses, such as GEOG 481, are prerequisites for more advanced courses. Students will be required to complete 36 upper division course credit hours, 12 of which must be completed in residence.

Rather than adopting a conventional curricular framework --such as predetermined "specializations"-- we have designed the elective component to meet individual student needs and employment aspirations. Upon declaring the major, students will meet with the Undergraduate Coordinator in Geography who, at 0.75 FTE, is responsible for advising students in both the Spatial Data Science and Technology major and the existing Geography major. The coordinator will develop advising materials, conduct job workshops, and help students identify an elective pathway (i.e. 8 courses) that best fit the student's employment goals or desired knowledge base. The main objective with advising students in this major is to help them identify their career goals, and then suggest to them a series of courses in the major that will allow them to obtain their degree and employment in their area of interest.

On the following page, we have provided four examples of elective pathways. Each of the diagrams depicts elective pathways for real-life job positions that were attained by recent graduates of our Geography program. Flexibility in course selection will help students tailor their program to employment demands of a rapidly changing industry, and will also assist in meeting university aims for shorter completion to degree times.

The SDST major is a total of 48 credits, divided as follows:

Introductory Core (12 credits)
Students must complete the following four courses:

- GEOG 181: Our Digital Earth
- GEOG 281: The World and Big Data *
- GEOG 481/581: GIScience I
- CIS 122: Intro to Programming and Problem Solving

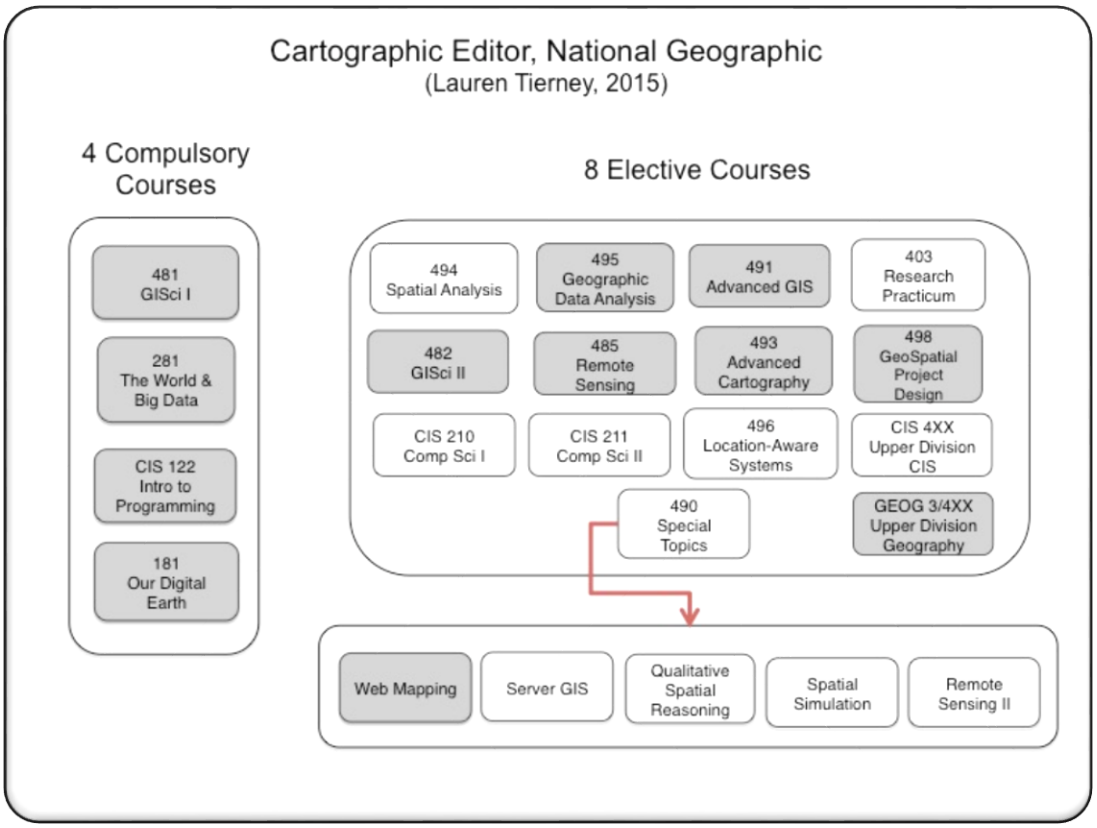
Elective Courses (32 credits)
Students must select eight electives from the following options:

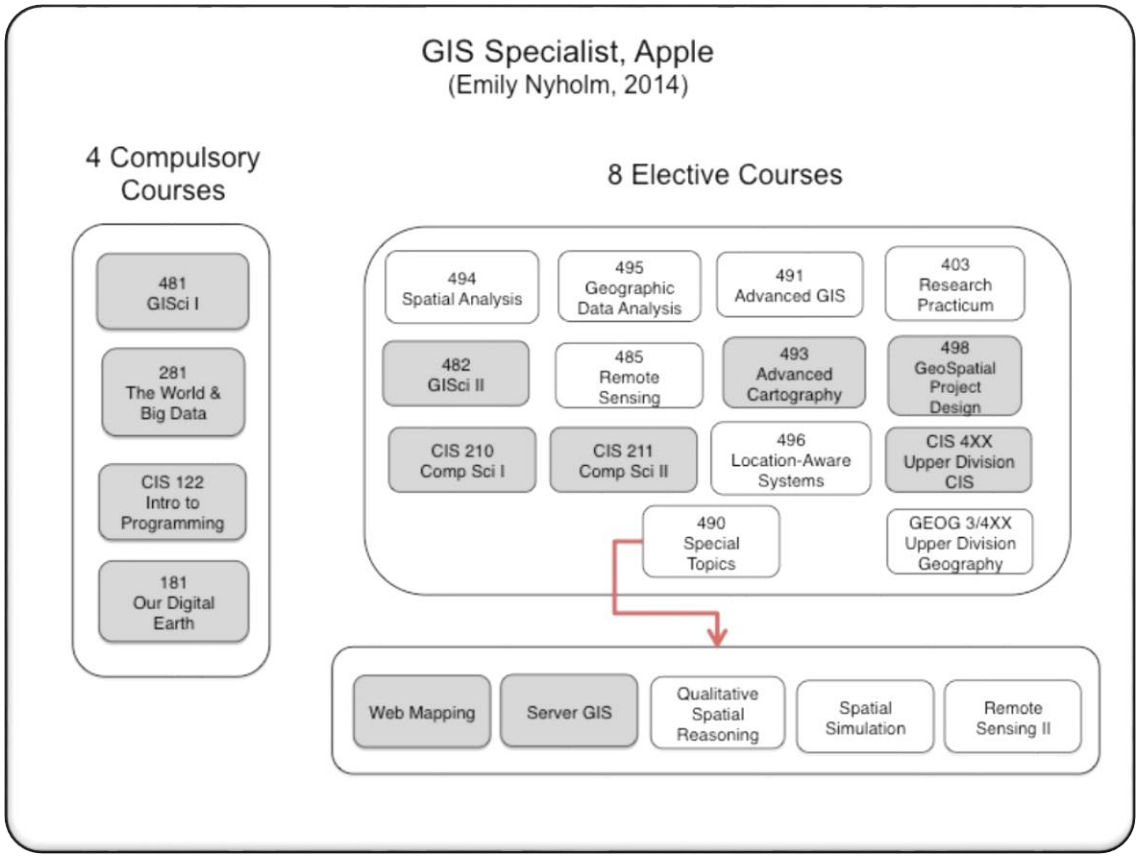
- GEOG 403: Research Practicum
- GEOG 482/582: GIScience II
- GEOG 485/585: Remote Sensing
- GEOG 490/590: Special Topics
- GEOG 491/591: Advanced GIS
- GEOG 493/593: Advanced Cartography
- GEOG 494/594: Spatial Analysis *
- GEOG 495/595: Geographic Data Analysis
- GEOG 496/596: Location-Aware Systems *

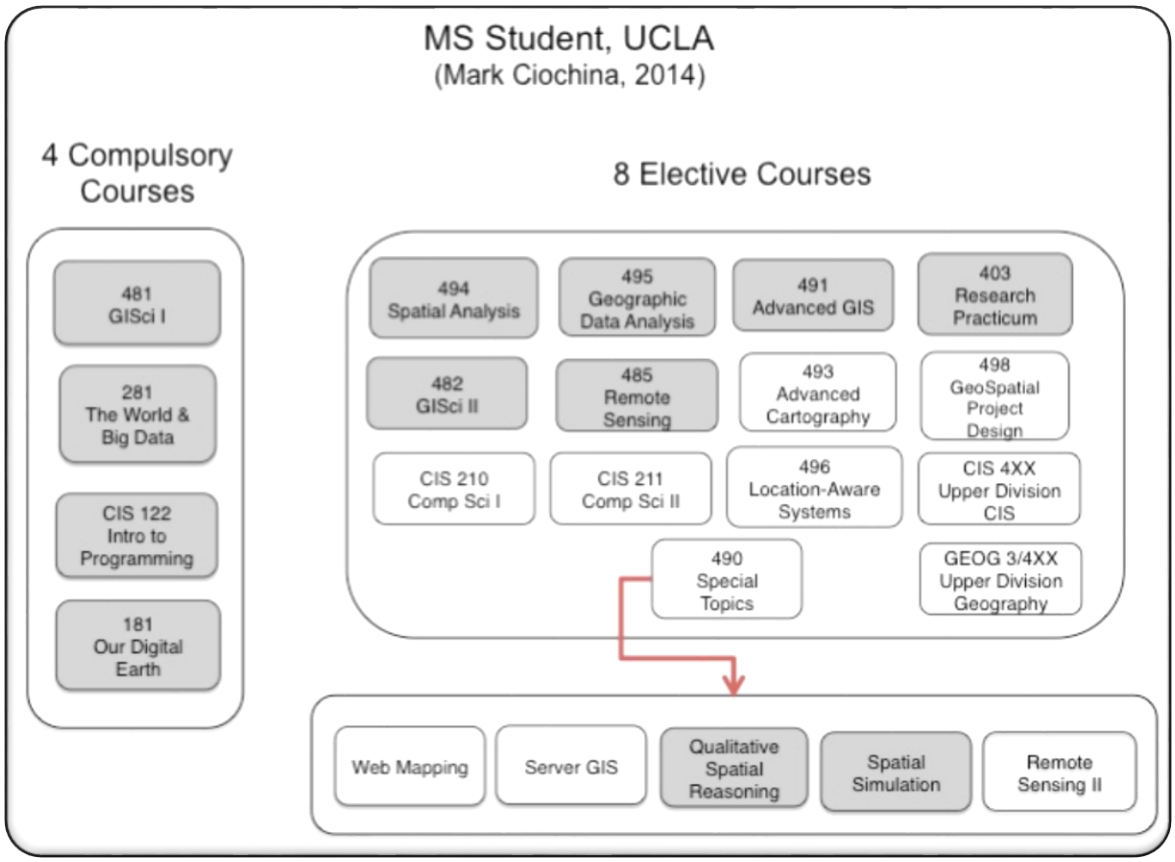
- GEOG 498: Geospatial Project Design*
- CIS 210: Computer Science I
- CIS 211: Computer Science II
- One 300 or 400 level Geography course not listed above
- One 400-level Computer Science course

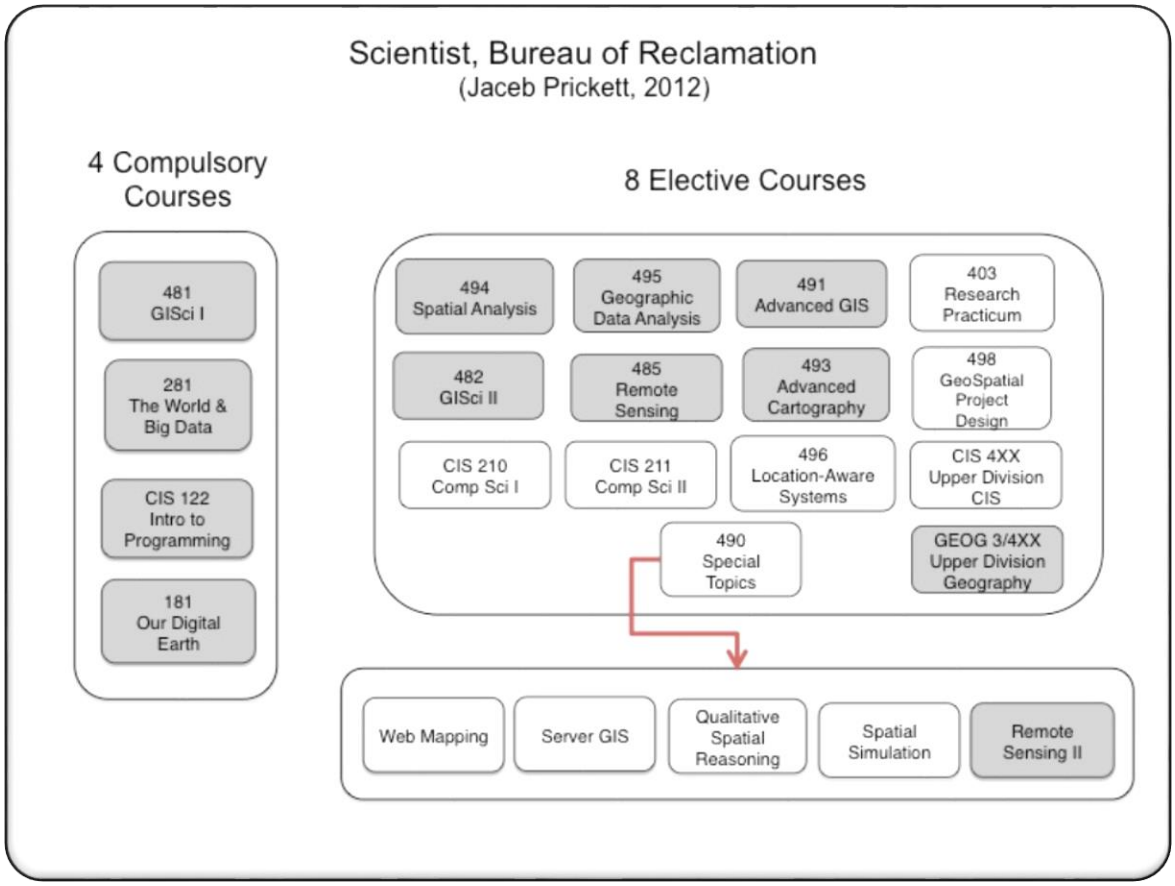
*Indicates new course.
All courses are 4 credit hours.

Figures 1-4: Examples of SDST Elective Pathways by Recent Geography Graduates. Names of individual students, graduate date, their chosen course plan (highlighted in grey), and their current employment are listed.


Cartographic Editor, National Geographic
(Lauren Tierney, 2015)
4 Compulsory Courses
481 GISci I
281 The World & Big Data
CIS 122 Intro to Programming
181 Our Digital Earth
8 Elective Courses
494 Spatial Analysis
495 Geographic Data Analysis
491 Advanced GIS
403 Research Practicum
482 GISci II
485 Remote Sensing
493 Advanced Cartography
498 GeoSpatial Project Design
CIS 210 Comp Sci I
CIS 211 Comp Sci II
496 Location-Aware Systems
CIS 4XX Upper Division CIS
490 Special Topics
GEOG 3/4XX Upper Division Geography
Web Mapping
Server GIS
Qualitative Spatial Reasoning
Spatial Simulation
Remote Sensing II


GIS Specialist, Apple
(Emily Nyholm, 2014)
4 Compulsory Courses
481 GISci I
281 The World & Big Data
CIS 122 Intro to Programming
181 Our Digital Earth
8 Elective Courses
494 Spatial Analysis
495 Geographic Data Analysis
491 Advanced GIS
403 Research Practicum
482 GISci II
485 Remote Sensing
493 Advanced Cartography
498 GeoSpatial Project Design
CIS 210 Comp Sci I
CIS 211 Comp Sci II
496 Location-Aware Systems
CIS 4XX Upper Division CIS
490 Special Topics
GEOG 3/4XX Upper Division Geography
Web Mapping
Server GIS
Qualitative Spatial Reasoning
Spatial Simulation
Remote Sensing II


MS Student, UCLA
(Mark Ciochina, 2014)
4 Compulsory Courses
481 GISci I
281 The World & Big Data
CIS 122 Intro to Programming
181 Our Digital Earth
8 Elective Courses
494 Spatial Analysis
495 Geographic Data Analysis
491 Advanced GIS
403 Research Practicum
482 GISci II
485 Remote Sensing
493 Advanced Cartography
498 GeoSpatial Project Design
CIS 210 Comp Sci I
CIS 211 Comp Sci II
496 Location-Aware Systems
CIS 4XX Upper Division CIS
490 Special Topics
GEOG 3/4XX Upper Division Geography
Web Mapping
Server GIS
Qualitative Spatial Reasoning
Spatial Simulation
Remote Sensing II


Scientist, Bureau of Reclamation
(Jaceb Prickett, 2012)
4 Compulsory Courses
481 GISci I
281 The World & Big Data
CIS 122 Intro to Programming
181 Our Digital Earth
8 Elective Courses
494 Spatial Analysis
495 Geographic Data Analysis
491 Advanced GIS
403 Research Practicum
482 GISci II
485 Remote Sensing
493 Advanced Cartography
498 GeoSpatial Project Design
CIS 210 Comp Sci I
CIS 211 Comp Sci II
496 Location-Aware Systems
CIS 4XX Upper Division CIS
490 Special Topics
GEOG 3/4XX Upper Division Geography
Web Mapping
Server GIS
Qualitative Spatial Reasoning
Spatial Simulation
Remote Sensing II

d. Manner in which the program will be delivered, including program location (if offered outside of the main campus), course scheduling, and the use of technology (for both on-campus and off-campus delivery).

All courses will be offered in residence on the University of Oregon campus. The table below shows the terms during the regular academic year in which each course will be offered. Geog 181 will be offered twice a year to anticipate capturing a large first-year enrollment. Geog 281 will initially be offered once a year, with the possibility of offering the course twice a year once enrollment demand increases. Geog 481 and 482 will be offered twice a year with smaller enrollment caps due to the desire to have a lower student-instructor ratio in the more advanced courses. Beyond Geog 482, courses will be offered once a year to continue with lower student-instructor ratios as courses become more specialized.

Courses in the Spatial Data Science and Technology major will utilize existing technologies in the Department of Geography and in the College of Arts and Sciences' Social Science Instructional Lab to deliver our courses. These technologies include laptop and desktop computers, GPS devices, and various sources of geospatial data. Courses will utilize a mix of existing software licensed at the University of Oregon for geographic information systems and remote sensing as well as free and open-source software for conducting geospatial analysis.

Number	Name	FALL	WINTER	SPRING
GEOG 181	Our Digital Earth	X		X
GEOG 281	The World & Big Data		X	
GEOG 481/581	GIScience I	X	X	
GEOG 482/582	GIScience II		X	X
GEOG 485/585	Remote Sensing I	X		
GEOG 490/590	Special Topics: Advanced Remote Sensing			X
GEOG 491/591	Advanced GIS	X		
GEOG 493/593	Advanced Cartography		X	
GEOG 494/594	Spatial Analysis			X
GEOG 495/595	Advanced Data Analysis		X	
GEOG 496/596	Location-Aware Systems	X		
GEOG 498/598	Project Design		X	
GEOG 3XX/4XX	Upper Division Geography Course	X	X	X
CIS 122	Intro to Programming and Problem Solving	X	X	X
CIS 210	Computer Science I	X	X	
CIS 211	Computer Science II		X	X
CIS 4XX	Upper Division CIS	X	X	X

e. Adequacy and quality of faculty delivering the program.

The Spatial Data Science and Technology program will be delivered by a diverse group of five tenure track faculty, one non-tenure track career instructor, and two officers of administration, all of whom have instructed courses in this discipline at the University of Oregon for multiple years (with the exception of new faculty member Dr. Schmidtke). Tenure track faculty will be offering courses in their area of expertise, which includes Geographic Data Analysis (Bartlein); Out Digital Earth, GIScience II, Spatial Analysis, Special Topics (Bone); Remote Sensing I, Special Topics (Fonstad); Our Digital Earth, GIScience I, Research Practicum, Special Topics (Lobben); World and Big Data, GIScience I, Location Aware Services (Schmidtke). Career Instructor faculty (Kohler) will be teaching a range of core lower and upper division courses such as GIScience I & II and Advanced GIS, as well as replace certain faculty on when on sabbatical. Officers of Administration (Kato and Meacham) will provide applied curriculum through Project Design and Advanced Cartography that will enhance student opportunity for future employment as students will learn and apply skills used by these OAs in their positions on campus.

The Spatial Data Science and Technology instructional staff is diverse as it is represented by one full professor, two associate professors, and two assistant professors who, along with NTTF and OAs, have accumulated over eighty years of teaching experience at the University of Oregon. Additionally, female TTFs Lobben and Schmidtke belong to an underrepresented group in the discipline of geospatial data and technologies. Having these two faculty members instructing 3-4 courses each year in the program will strengthen opportunities for recruiting and maintaining female students in our program that shares many curricular aspects with STEM-related disciplines such as computer science. The OAs who will be teaching in this program bring diversity through their more applied focus and connections to industry that have provided employment opportunities for students on campus and prepared them for obtaining post-graduation employment in technology hubs like Silicon Valley. Finally, while the majority of instructional staff have degrees in Geography, the recent addition of Dr. Schmidtke with a doctorate in Computer Science further diversifies this group and will help build alternative disciplinary lenses into the program.

f. Faculty resources – full-time, part-time, adjunct.

Dr. Patrick Bartlein, Professor, 1 course per year

Dr. Christopher Bone, Assistant Professor, 3-4 courses per year

Dr. Mark Fonstad, Associate Professor, 1-2 courses per year

Dr. Nicholas Kohler, NTTF Career Instructor, 4 courses per year

Ken Kato, Associate Director, InfoGraphics Lab; Officer of Administration, 1 course per year

Dr. Amy Lobben, Associate Professor, 3-4 courses per year

James Meacham, Director, InfoGraphics Lab; Officer of Administration, 1 course per year

Dr. Hedda Schmidtke, Assistant Professor, 3-4 courses per year

All faculty are in the Department of Geography while Officer of Administration are in the InfoGraphics Lab. In addition, we will be offering courses that have the potential to be delivered by sessional instructors who are located in Eugene, Oregon and have industry or government employment experience in the field of geospatial data and technologies. The success of the program will not be contingent on sessional instructor availability. Rather, we will aim to hire sessional instructors based on their availability and their ability to instruct a relevant and topical course.

g. Other staff.

None.

h. **Facilities, library, and other resources.**

- Courses requiring licensed software will hold lab sessions in the Social Science Instructional Laboratory in McKenzie Hall.
- Courses using free and/or open source software will hold lab sessions in either the Social Science Instructional Laboratory in McKenzie Hall, Condon 206 (teaching classroom) or Condon 207 (seminar room).
- Data for courses in which labs are provided in the Social Science Instructional Laboratory will have course data stored on servers hosted by the College of Arts and Science's Information Technology unit.

This proposed format for instruction is currently in place for assisting in the delivery of our curriculum each term. Therefore, the successful implementation of the proposed major will not require a substantial change or investment in new resources.

i. Anticipated start date.

Fall Term 2017

2. Relationship to Mission and Goals

a. Manner in which the proposed program supports the institution's mission, signature areas of focus, and strategic priorities.

The use of geospatial data and technologies is inherently trans-disciplinary in application. While Geography is its historic home, the use and study of geospatial data and technologies has already and will continue to broaden outside of a singular discipline. Core faculty are involved in the Environmental Science Institute, the Institute of Cognitive and Decision Science, and the Sustainable Cities Initiative. Not only does that involvement provide cross-disciplinary research activities for the faculty, but it also provides direct impact on the curriculum. Through a grant from the National Institute of Transportation Communities, we have formally linked with the Sustainable Cities Initiative through integrating geospatial data and technology exercises and lecture topics that directly focus on sustainable cities into our courses.

b. Manner in which the proposed program contributes to institutional and statewide goals for student access and diversity, quality learning, research, knowledge creation and innovation, and economic and cultural support of Oregon and its communities.

Research, teaching and recruitment

Core program faculty are staunch advocates for student access and diversity. One of our main focuses has always been to actively and routinely recruit women into our courses and program, as females are traditionally underrepresented in this field. This has led to improved gender ratios in the classroom, and to the mentoring and training of specific female students who have demonstrated academic excellence

and career potential. Examples include Emily Nyholm (2014) who is now a GIS Specialist at Apple, Carolyn Gilchriese (2015) who is now a GIS Technician at a mapping venture in Silicon Valley, and Lauren Tierney (2015) who is a Cartographic Editor at the National Geographic Society. We aim to continue these efforts to increase the number of women in the technology industry and STEM research positions.

Core faculty also incorporate learning on issues of diversity and equity through the curriculum and their research. Key examples include Dr. Lobben's research concerning people with disabilities, Dr. Schmidtke's research on spatial technologies in developing countries, and Dr. Bone's first-year curriculum that focuses on spatial issues related to social and economic disparities across the U.S. We will ensure that the majority of courses in the major expose students to issues of diversity and equity through the use and critiques of existing and emerging geospatial technologies.

Previous studies have shown that first-generation college students tend to declare majors in more technical and professionally focused areas. We anticipate that the SDST major will attract first generation college students while exposing them to critical and interdisciplinary thinking skills so important to a liberal arts education.

c. Manner in which the program meets regional or statewide needs and enhances the state's capacity to:

We aim to make this major accessible to Oregonians from across the state. Thus far, we have put in place two mechanisms to make this happen. First, we have begun transitioning some of our compulsory courses to online offerings in order to allow provide more flexibility of when and where students can complete these courses. Second, we have been working with Oregon community colleges to help them develop courses that articulate to the ones we offer as part of our major. Thus far we have been working with Lane Community College and Umpqua Community College to develop a first-year course that articulates with Geog 181: Our Digital Earth. We have begun transitioning lower-division courses into online courses in order to allow students more opportunities

We also aim to provide Oregonians with job-ready skills. With geospatial data and technologies absolutely booming in both the private and public sectors of the economy, students with an academic degree or even some training in this area receive skills that are sought-after. Through the hands-on training, students will apply geospatial data and technologies to environmental, cultural, social, and economic projects. This training will provide tangible experience in a broad range of issues facing modern society.

3. Accreditation

a. Accrediting body or professional society that has established standards in the area in which the program lies, if applicable.

Not applicable.

b. Ability of the program to meet professional accreditation standards. If the program does not or cannot meet those standards, the proposal should identify the area(s) in which it is deficient and indicate steps needed to qualify the program for accreditation and date by which it would be expected to be fully accredited.

Not applicable.

c. If the proposed program is a graduate program in which the institution offers an undergraduate program, proposal should identify whether or not the undergraduate program is accredited and, if not, what would be required to qualify it for accreditation.

Not applicable.

d. If accreditation is a goal, the proposal should identify the steps being taken to achieve accreditation. If the program is not seeking accreditation, the proposal should indicate why it is not.

Not applicable.

4. Need

a. Anticipated fall term headcount and FTE enrollment over each of the next five years.

Based on current student interest and course enrollments, we estimated a number of expected major for each year.

2016 = 20

2017 = 30

2018 = 50

2019 = 75

2020 = 100

The projected growth emulates the current growth in the number of GIS-related majors in our current Geography degree program, and in our first-year course, Geog 181: Our Digital Earth. Furthermore, we anticipate that potential students will be increasingly drawn to this major due to the rapid growth in employment in this field.

b. Expected degrees/certificates produced over the next five years.

2017 = 5

2018 = 10

2019 = 20

2020 = 40

We anticipate that students will slowly begin declaring the SDST as their major in the first year that it is offered. However, enrollment will quickly increase once students become more aware of how this major provides opportunity for employment in the geospatial technology industry.

c. Characteristics of students to be served (resident/nonresident/international; traditional/ nontraditional; full-time/part-time, etc.).

- We aim to attract both resident and nonresident students who are interested in joining the geospatial workforce. We anticipate attracting a large number of students from both Oregon and California where there exists multiple hubs for geospatial technology development. Two examples of such hubs are San Francisco/Silicon Valley in California and Portland, Oregon. We also anticipate attracting non-resident

students throughout the PAC-12 as no institutions in this group currently offer an undergraduate degree in Spatial Data Science and Technology.

- We aim to attract full-time students who are interested in completing the Spatial Data Science and Technology major and immerse themselves into our geospatial community on campus by seeking student employment in our research or design labs or in other units on campus. Yet, we also aim to attract part-time students who have limited time to complete their degree, as our program could technically be completed in 2 years.
- We also aim to attract international students to our major who are from countries where the geospatial data and technologies job market is rapidly growing. Three examples of such counties are China, India and Korea.

d. Evidence of market demand.

A report by the United States Department of Labor's Employment and Training administration states "Because the uses for geospatial technology are so widespread and diverse, the market is growing at an annual rate of almost 35 percent, with the commercial subsection of the market expanding at the rate of 100 percent each year." We have already witnessed the impact of this demand on our program as multiple graduates from our current programs in Geography have been recruited to work in this industry in cities across the country. Examples include alumni who are have recently been employed by Apple and MapBox (a web mapping company) in Silicon Valley, National Geographic in Washington, D.C., and The New York Times in New York City. The successful employment of these alumni resulted from a combination of coursework and employment in the Geography Department and InfoGraphics Laboratory.

Moreover, with smart phone prices projected to drop below the critical $20 mark and 4G infrastructure under construction, emerging economies present new opportunities for the software industry as approximately 4 billion new users will be able to install apps serving their everyday needs. Companies like IBM and Microsoft are already reacting to this projected demand, however, neither engineering, business or computer science majors have the necessary skill set to position companies to successfully enter the developing markets in all their geographic diversity. By expanding our curriculum, providing more employment opportunities, and offering a distinctive degree in Spatial Data Science and Technology, we anticipate a significant increase in the number of University of Oregon graduates who will be employed in this quickly expanding industry. Companies are looking for graduates who are able to analyze not only the technological but also the local, cultural and social aspects of remote production facilities. Globally expanding companies need technologically savvy and geographically aware experts who can guide their global management strategy.

In addition to the market demand of industry, the demand for a Spatial Data Science and Technology major is evident by the increase in student enrollment in our existing courses and in the GIScience focus of our Geography major. One clear example is the increase in enrollment in Geog 181: Our Digital Earth, which was first offered in fall 2012 to 28 students, and is being offered in fall 2015 with an enrollment cap of 127 students. Furthermore, of the multiple focus streams that Geography majors can declare, the GIScience focus stream contained 44% of our programs major in 2014, a number that has rapidly increased in the past five years.

e. If the program's location is shared with another similar Oregon public university program, the proposal should provide externally validated evidence of need (e.g., surveys, focus groups, documented requests, occupational/employment statistics and forecasts).

Not applicable.

f. Estimate the prospects for success of program graduates (employment or graduate school) and consideration of licensure, if appropriate. What are the expected career paths for students in this program?

The main objective of the proposed program is to facilitate student employment in the geospatial data and technologies industry. We look to our recent alumni and the types of employment they have received as the future direction of this proposed program. We aim to graduate students who can enter the technology sector with a marriage of computation skills learned in specific courses and knowledge gained more broadly from a liberal arts education. That is, graduates from our program will not only possess skills on how to develop and use geospatial data and technologies, but will also be able to speak to the societal issue surrounding privacy, security and safety that are tightly associated with how such data and technologies are utilized. Furthermore, for students wishing to engage in a double major between Spatial Data Science and Technology and Geography, this knowledge could be contextualized in issues of globalization and global environmental change, which would make students competitive for employment in international settings where geospatial data and technologies are used in ways to facilitate social justice, development, and for understanding potential impacts of climate change and natural disasters. In this sense, the Spatial Data Science and Technology major has the potential to graduate individuals who are technologically savvy and socially and environmentally conscious and motivated.

While some academic programs that teach aspects of geospatial data and technologies offer industry certification to students, these existing certificates do not correspond well with emerging market demand and the recent employment success of our students. Existing certification is focused on government-related employment in which traditional geographical information systems and remote sensing are employed for policy planning and implementation. This certification does not include curriculum aspects that focus on new skills needed to deal with, for example, location-based services and big data that are in high demand.

5. Outcomes and Quality Assessment

a. Expected learning outcomes of the program.

- Students completing the program will be able to utilize geospatial data and technologies for collecting a data, employ analytical and visualization methods for interpreting such data, and provide efficient communication of findings from these analyses to a range of academic, public and private stakeholders.
- Students will be able to assist in the development of geospatial data and technologies through knowledge on the geographic context of technology infrastructure, geographic data needs, technology interface design, and geographic data communication.
- Students from the program will have an understanding of the societal implications of geospatial data and technologies, including issues surrounding privacy and security of individual-level data containing locational information, the types of inequalities that certain geospatial technologies produce, and the role that geospatial technologies play in humanitarian crises. This outcome is intended to demonstrate the benefit of having a technology-focused program delivered through a liberal arts education.

b. Methods by which the learning outcomes will be assessed and used to improve curriculum and instruction.

- We will expand our current efforts to survey students in our existing geospatial data and technology-related courses at the end of each term. In addition to university-administered course evaluations, we recently began survey students to evaluate if course curriculum was providing adequate opportunities to learn how to use geospatial data and technologies in meaningful ways. We will enhance these survey efforts to evaluate our performance across all courses in this program to ensure that students themselves agree that they are meeting our expected learning outcomes.
- All students in the program will be required to enroll in a capstone course (Project Design or Research Practicum). Instructors of these courses will be using a learning outcomes rubric to assess that students have obtained the necessary skills and knowledge outlined in our expected learning outcomes.
- We will track graduates of our program to determine the number of students receiving employment in the geospatial data and technology industry, what skills acquired in the program are being used in their employment, and what skills needed in their employment that they did not receive in our program.
- We will maintain contact with program graduates in the geospatial data and technology industry to solicit feedback regarding the ways in which our program could change to meet potential changing needs of the industry.

c. Nature and level of research and/or scholarly work expected of program faculty; indicators of success in those areas.

The tenure-track faculty instructing in this program include researchers centered in the discipline of GIScience as well as those who utilize geospatial data collection and analytical methods for informing specific research problems. The research conducted by faculty in this program covers the broad area of GIScience. Dr. Lobben's research focuses on spatial cognition, specifically how individuals interact with and navigate through space. Dr. Bone's research focuses on the use of computational spatial models to simulate geographic processes such as forest disturbances. Dr. Schmidtke's research focuses blends geospatial reasoning, computer science, and location-aware systems. Dr. Bartlein utilizes a wide array of geographic data analytical and modeling approaches to analyze climate data records and climate model simulations in order to information science on climate change. Dr. Fonstad's research employs a range of emerging remote sensing technologies for collecting and processing data related rivers and landscapes. The range of journals that this group of faculty publishes in includes *Nature, Science, Annals of the Association of American Geographers, International Journal of Geographic Information Science, Spatial Information Theory, Quaternary Science Reviews,* and *Geomorphology*. Members of this group have received funding from the National Science Foundation and the National Institute for Health, amongst others, to accomplish their research.

6. Program Integration and Collaboration

a. Closely related programs in this or other Oregon colleges and universities.

Two related programs currently exist in Oregon:

- Geographic Information Science Certificate offered by the College of Earth, Ocean and Atmospheric Sciences Program at Oregon State University (https://ceoas.oregonstate.edu/giscience/).

- Graduate Certificate in Geographic Information Systems in the Department of Geography at Portland State University (https://www.pdx.edu/geography/GIS).

b. Ways in which the program complements other similar programs in other Oregon institutions and other related programs at this institution. Proposal should identify the potential for collaboration.

The proposed program most significantly complements the University of Oregon Geography major for students specializing in Physical Geography, Environmental Geography, or Culture, Politics and Place. As mentioned above, graduating with a double major in Spatial Data Science and Technology and Geography with any of these specializations would enhance students' ability to attain employment and provide meaningful contributions to the rise of the geospatial data and technology industry in the context of globalization and global environmental change.

Other programs that share similar interests at the University of Oregon include Computer Information Science (CIS) and Planning, Public Policy and Management (PPPM). We are in the process of building curricular ties with CIS to ensure that students are aware of course offerings and ways in which majors from both programs can assist students with attaining employment in related fields. We will also continue our existing relationship with PPPM to ensure that students in that program are able to take courses and potentially also major in Spatial Data Science and Technology, which would assist their potential for employment in planning and policy.

Outside of the UO, this major complements a proposed major at Oregon State University by The College of Earth, Ocean and Atmospheric Sciences. But it should be clear that the two proposed majors are fundamentally different. While our Spatial Data Science and Technology Major is a flexible, 48 credit major that makes students career ready for the geospatial technology industry, OSU's proposed major is a traditional Geography degree (of which they do not currently have – hence the reason for their proposal) consisting of 80+ credits, in which courses in GIS complement the ability of students to conduct geographic research in such areas as natural resource management, planning, etc. In addition, while our program exposes students to computational programming and literacy and teaches students a variety of geospatial software applications and technologies in order to make them adept in a fast changing industry, the OSU program is mostly focused on training students GIS with a single software platform.

Another complementary program external to UO is the Graduate Certificate in GIS offered by Portland State University. Again, these two programs share similarities in that they are both training students in the use of various geospatial technology and data formats. However, PSU's program is a graduate program (unlike ours which is solely focused on undergraduates), and is focused on solely training GIS skills rather considering how geospatial technologies and data can be considered in the broader general education requirements.

c. If applicable, proposal should state why this program may not be collaborating with existing similar programs.

Not applicable.

d. Potential impacts on other programs.

Our aim with the proposed major is to attract potential undergraduate students to the University of Oregon to enroll in this specific program. Undergraduate students typically discover Geography as a discipline during their early years at the University of Oregon, and we want to change that by making Geography at our institution visible to potential university students from around the country. As such, we are not looking to

merely draw potential students away from other programs within our university or state, but to make this program the reason why they come here. We anticipate this having a positive impact on the Geography Department as a whole by increasing the number of majors in our department and potentially drawing more people towards the more traditional cores of the discipline.

The proposed program will not directly compete with Oregon State University's undergraduate certificate in GIScience because the two programs offer distinct curriculum and future employment opportunities. OSU's certificate is more focused on the use of geographic information systems and remote sensing for natural resource management, whereas our program will focus more broadly on the use of geospatial technologies, big data, satellites, data analysis, computational modeling, web-mapping and location-aware services in a growing global industry.

7. Financial Sustainability Business plan for the program that anticipates and provides for its long-term financial viability, addressing anticipated sources of funds, the ability to recruit and retain faculty, and plans for assuring adequate library support over the long term.

a. Plans for development and maintenance of unique resources (buildings, laboratories, technology) necessary to offer a quality program in this field.

   No new buildings, laboratories or technologies will be requested as part of this new major. We will resume offering new and existing courses in the Social Science Instructional Laboratory (SSIL) that is currently under the supervision of CAS-IT, but will be moving under the supervision of the Library in the near future. This lab is equipped with the necessary computers and software to offer each of the SDST courses.

b. Targeted student/faculty ratio (student FTE divided by faculty FTE).

   We anticipate having a classroom student/faculty ratio of 40:1. Most current SDST courses are computationally intensive, and thus are capped at 40 students for one instructor and one GTF.

c. Resources to be devoted to student recruitment.

   We will devote a portion of our current Undergraduate Advising FTE to student recruitment. Our current Undergraduate Advisor has begun the process of drafting recruitment materials and meeting with SDST faculty to discuss recruitment strategies.

8. External Review

If the proposed program is a graduate level program, follow the guidelines provided in *External Review of New Graduate Level Academic Programs* in addition to completing all of the above information.

Not applicable.

Revised 7/14 – hhs