: CYBERGIS AND GEOSPATIAL DATA SCIENCE, MS

In Workflow

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Approval Path

1. Mon, 29 Mar 2021 20:33:54 GMT
   Deb Forgacs (dforgacs): Approved for U Program Review
2. Mon, 29 Mar 2021 21:01:10 GMT
   Shaowen Wang (shaowen): Approved for 1872 Head
3. Mon, 29 Mar 2021 21:07:16 GMT
   Jonathan Tomkin (tomkin): Approved for SESE Head
4. Mon, 29 Mar 2021 21:19:06 GMT
   Kelly Ritter (ritterk): Approved for KV Dean
5. Mon, 29 Mar 2021 21:27:15 GMT
   John Wilkin (jpwilkin): Approved for University Librarian
6. Thu, 01 Apr 2021 20:42:41 GMT
   Allison McKinney (agrindly): Approved for Grad_College
7. Fri, 09 Apr 2021 17:10:22 GMT
   Kathy Martensen (kmartens): Approved for Provost

New Proposal

Date Submitted:Mon, 29 Mar 2021 20:22:07 GMT

Viewing:: CyberGIS and Geospatial Data Science, MS

Changes proposed by: Beth McKown

Proposal Type

Proposal Type:

Major (ex. Special Education)

Proposal Title:

If this proposal is one piece of a multi-element change please include the other impacted programs here.*example: A BS revision with multiple concentration revisions*

Establish a Master of Science degree in CyberGIS and Geospatial Data Science non-thesis - online within the Department of Geography and Geographic Information Sciences in the College of Liberal Arts & Sciences

EP Control Number

EP.21.125

Official Program Name

CyberGIS and Geospatial Data Science, MS

Effective Catalog Term

Fall 2022

Sponsor College

Liberal Arts & Sciences

Sponsor Department

Geography and Geographic Information Science

Sponsor Name

Shaowen Wang, Head of the Department of Geography and Geographic Information Science

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Program Description and Justification

Provide a *brief* **description and justification of the program, including highlights of the program objectives, and the careers, occupations, or further educational opportunities for which the program will prepare graduates, when appropriate.**

The Department of Geography and Geographic Information Science (GGIS) proposes a non-thesis Master of Science (M.S.) degree in CyberGIS and Geospatial Data Science, designed to meet the existing high demand for advanced GIS skills like cyberGIS, geospatial big data analytics, geospatial visualization, needed in many industries. This new degree will be able to satisfy demand from non-traditional students, from both domestic and international markets, seeking to obtain an advanced degree in GIS focused on cyberGIS and geospatial data science, and from working professionals whose employers may pay some or all of the tuition. The proposed M.S. degree program in CyberGIS and Geospatial Data Science satisfies the growing demand from an under-served educational community while not detracting from on-campus undergraduate and graduate-level GGIS programs. The new M.S. will accommodate remotely located students, building upon existing GGIS faculty expertise in innovative online pedagogy. The requested new program will enable this expansion without drawing resources from other GGIS graduate programs; to the contrary, it will increase course offerings.

CyberGIS – cyber geographic information science and systems (GIS) – are the latest innovative development in the fast-growing field of geospatial data science. Combining advances in high-performance and data-intensive computing with developments in geospatial data processing, analysis,

and visualization, cyberGIS has rapidly emerged as a major force in private and public sector organizations and in higher education for harnessing the rapid geospatial data revolution. Our Department of Geography and Geographic Information Science (GGIS) together with the campus CyberGIS Center for Advanced Digital and Spatial Studies (CyberGIS Center), the birthplace of cyberGIS, is well positioned to establish an online, revenue-generating, Master's degree program to lead instruction on this cutting-edge area.

The proposed M.S. program in CyberGIS and Geospatial Data Science fills a gap in the current offerings and prepares students for entering the workforce. Whereas universities like Penn State and Southern California have successful online GIS programs each generating over one million dollars in annual revenue, our program would be the first to deliver an online program focused on cyberGIS and geospatial data science. The new M.S. degree is designed to accommodate a demographic comprised of nontraditional and working learners by offering online coursework, advising, and capstone research. The online degree will be particularly attractive to professionals who are working full time and might be looking to enhance their skill set in cyberGIS and geospatial data science. GGIS faculty include global leaders in the areas of cyberGIS, geospatial big data, high-performance geospatial computing, and a variety of geospatial applications such as public health and water resources.

The proposed CyberGIS and Geospatial Data Science online M.S. degree program is part of three connected, synergistic M.S. programs in development with funding from an Office of the Provost's "Investment for Growth" (IFG) Program Grant (https://provost.illinois.edu/about/initiatives/investment-for-growth-program/), housed in the School for Earth, Society, and the Environment (SESE). The proposed "Weather and Climate Risk and Analytics" (Dept. of Atmospheric Sciences) and "Environmental Geology" (Dept. of Geology) online M.S. degree programs will both enhance GGIS's proposed CyberGIS and Geospatial Data Science online M.S. program by providing shared courses, specialized courses in certain key areas, and a larger group of faculty and staff collaborating to achieve overall program success, both on-campus and online. Recognizing assimilating and analyzing "geospatial big data" is a key challenge faced by industry and government, we will leverage the strengths of GGIS faculty and CyberGIS Center staff in these areas and build upon data science synergies with GEOL and ATMS through IFG funding, as illustrated in Fig. 1 attached.

In summary, GGIS's new online M.S. degree program will provide a high-quality, cutting-edge M.S. degree while targeting a more diverse cross-section of learners previously unable to complete this degree program on campus. GGIS notes that the UIUC 2018-2023 strategic plan articulates the goal of making UIUC "the go-to place for professional and continuing education programs" through "the creation of workforce-development strategies and related partnerships across the public and private sectors…using Illinois expertise to create new jobs and enhance the skill sets of new and continuing workers." The proposed online M.S. degree program will align GGIS's graduate programs with this campus-wide goal while simultaneously benefitting both on-campus and remotely placed GGIS graduate students and programs.

Fig. 1 illustrates the relationships between the new or existing 400 and 500-level online courses developed and offered by each of the three departments within SESE through IFG funding, providing educational advancement for SESE online, non-thesis graduate students while taking advantage of the strengths of each department's expertise in computational and data sciences as well as geospatial analysis. Courses related to common core learning objectives, specifically Principles of GIS, and Geocomputation and Data Science with Python and R, can be taken by students in the Environmental Geology online M.S. as part of their core course requirements (see Academic Catalog Entry section below for details).

In addition to the core courses in cyberGIS and geospatial data science, students have the opportunity to select, with the aid of their advisors, 400 and 500 level coursework focusing on advanced subjects and case studies. As such, students will work closely with their advisors to select advanced courses that provide the cutting-edge knowledge to successfully complete the capstone research project.

Corresponding Degree

MS Master of Science

Is this program interdisciplinary?

No

Academic Level

Graduate

Will you admit to the concentration directly?

No

Is a concentration required for graduation?

No

CIP Code

450702 - Geographic Information Science and Cartography.

Is This a Teacher Certification Program?

No

Will specialized accreditation be sought for this program?

No

Institutional Context

University of Illinois at Urbana-Champaign

Describe the historical and university context of the program's development. Include a short summary of any existing program(s) upon which this program will be built.

Explain the nature and degree of overlap with existing programs and, if such overlap exists, document consultation with the impacted program's home department(s).

The University of Illinois at Urbana-Champaign is the birthplace of cyberGIS and currently hosts a leading center for cyberGIS in the world, CyberGIS Center for Advanced Digital and Spatial Studies (CyberGIS Center). Our international visibility continues to grow as ground-breaking research is being generated from the CyberGIS Center. Over the past several years, cyberGIS has been recognized and established across diverse academic, governmental, and industrial communities as employers increasingly desire workers that are well prepared in cyberGIS and geospatial data science. This provides GGIS and the University with an unprecedented opportunity to build on its unique strength and establish a leading online education program that leverages its unparalleled research and technical capabilities.

The GGIS Department currently offers an M.S. degree focused on residential students for preparing students for pursuing further research in GGIS. The Department also offers a Professional Science Master's program which again is available for residential students to prepare them with both GIS and business management skills. The new M.S. in CyberGIS and Geospatial Data Science will be in contrast focused on working professionals and remote students who are currently being underserved by the University.

Overall, there are no conflicts with the existing programs on campus. The coursework as part of the proposed online M.S. degree program will not detract from on-campus offerings of the face-to-face courses. The new program will in fact increase the variety of advanced coursework offered by the Department and help to attract new students who would otherwise not have applied to graduate programs at the University. Additionally, on-campus students will benefit from this new program, as on-campus students will also be able to enroll in the online courses of the program.

University of Illinois

Briefly describe how this program will support the University's mission, focus and/or current priorities. Demonstrate the program's consistency with and centrality to that mission.

The proposed CyberGIS and Geospatial Data Science online M.S. degree program will not only leverage departmental and University research strengths, but also advance our University's strategic area of data science and multiple related strategic areas including energy, globalization, health, urban sustainability, and water. We believe that this online program will be a crucial asset to the University in meeting its cutting-edge teaching mission and crucial research agendas. The degree program will be application-driven and use-inspired while offering a set of core courses on cyberGIS and geospatial data science which the University is well positioned to deliver. Furthermore, this program will help the University achieve important and well-deserved global leadership and visibility. The program will help make advances in the following UIUC strategic initiatives.
• "Strengthen our faculty and align resources with academic and research units to capitalize on our scholarly synergies across campus" [Goal 1.A]
Through the online program multiple new specialized faculty members can be recruited into the Department and will be able to deliver a number of new courses and conduct leading-edge research. The M.S. in CyberGIS and Geospatial Data Science also leverages the unparalleled research strength of the Department to offer cutting-edge educational materials that are unique in comparison with our peers.

• "Provide new educational pathways and enhance current programs to increase flexibility and to foster education across disciplines" [Goal 2.C]

The new online program will provide new pathways and educational opportunities that do not currently exist in the Department. This will attract new students to the program that would not have considered a graduate program at Illinois otherwise.

• "Innovate in graduate, professional, and continuing edition, with new degree programs and certificates at the intersection of disciplines, and support recruitment and retention of graduate students" [Goal 2.F].

The new and innovative online M.S. degree in CyberGIS and Geospatial Data Science will help achieve UIUC Strategic Initiative Goal 2.F through synergies with the two additional proposed SESE online M.S. programs. Specifically, shared online courses and cross-discipline teaching and learning environments as part of the three new SESE online M.S. programs will increase graduate student enrollment while not detracting from on-campus programs.

• "Create workforce-development strategies and related partnerships across the public and private sectors, with an emphasis on using Illinois expertise to create new jobs and enhance the skill sets of new and continuing workers" [Goal 3.H].

The online nature of the proposed online M.S. degree program will be of particular interest to continuing workers. We anticipate that individuals already working in industry positions will obtain enhanced skill sets in cyberGIS and geospatial data science through our online, graduate-level degree program. The new degree will help these potential applicants and workers in public and private sector organizations to advance in their respective organizations and conduct cutting-edge work with cyberGIS and geospatial big data.

• "Develop and execute an integrated, coordinated, and sustained marketing and communications effort to all stakeholders and influencers: students, alumni, parents and friends, business and government leaders, and residents of the state of Illinois" [Goal 3.I].

GGIS will participate in the College of Liberal Arts and Sciences (LAS) new Corporate Affiliates Program (CAP), the goal of which is to achieve Goal 3.I through sustained, coordinated, and integrated relationships with alumni positioned in related public and private sector organizations. Online M.S. marketing strategies will build on these relationships, focusing particular attention on Illinois-based organizational connections. Strategic marketing communications will be developed with the help of LAS and the Center for Innovation in Teaching and Learning (CITL) at UIUC.

• "Actively explore additional revenue sources by increasing online education, corporate partnerships, and royalty and patent revenue through creating the proper infrastructure for building large-scale research proposals, and supporting scholars as they commercialize research for entrepreneurial opportunities that bring cutting-edge technologies to market." [Goal 4.B]

The establishment of this online M.S. program directly contributes to the goal of increasing online education by creating a unique program that will attract new students to Illinois and generate significant revenue.

• "Understand that the largest resource on campus is its employees and students while creating an inclusive and welcoming campus climate" [Goal 4D].

The online nature of the proposed M.S. degree program will directly benefit non-traditional students through the more flexible and affordable nature of online education. Because students living in any location, nationally or internationally, can obtain the new degree, overall diversity will be increased. Additionally, several new specialized faculty members recently hired by the Department will participate in the development of the program creating a diverse and unique talent pool. Fostering safe and welcoming working environments will be a continuing focus for advising students. Virtual events will be organized to help students access diverse campus resources.

State of Illinois

Indicate which of the following goals of the Illinois Board of Higher Education's Strategic Initiative are supported by this program: (choose all that apply)

College Affordability - ensure college affordability for students, families, and taxpayers.
Educational Attainment - increase educational attainment to match the best-performing states.
High Quality Credentials to Meet Economic Demand - Increase the number of high-quality post-secondary credentials to meet the demands of the economy and an increasingly global society.
Integration of Educational, Research and Innovation Assets - Better integrate Illinois' educational, research and innovation assets to meet economic needs of the state and its regions.

Describe how the proposed program supports these goals.

With the majority of Illinois population situated outside the Urbana-Champaign area, the educational resources available at the Department are not easily accessible to the majority of Illinois population. Our proposed online program will drastically increase educational attainment by helping mitigate against the geographic obstacle.

The online degree program will be more affordable than other similar degree programs in Illinois. Not only does the online format allows for much lower tuition costs for students, it makes it possible for workers to simultaneously further their education while supporting their families. This is also a great deal for taxpayers: the self-supporting nature of the degree will mean that taxpayers are not supporting the program.

Analyzing, managing, processing and visualizing geospatial "big data" is becoming an increasingly sought-after skillset as geospatial data plays important roles in forming the digital fabric of our society. There is an urgent need in both public and private sectors for people who are well versed in handling such data. The proposed program will meet this rapidly growing need for geospatial data scientists.

One of the requirements of the proposed degree program is a capstone research project, designed to help online M.S. students apply cutting-edge cyberGIS knowledge of geospatial "big data" and "big computing" problems" to their specific industry and application domains. The M.S. program

builds on the University of Illinois unmatched leadership in cyberGIS through leveraging research innovation for generating unique educational experiences. GGIS is working closely with LAS to pilot the new LAS Corporate Affiliates Program so that industry partnerships are in place to help identify capstone research project collaborations.

Admission Requirements

Desired Effective Admissions Term

Fall 2022

Provide a brief narrative description of the admission requirements for this program. Where relevant, include information about licensure requirements, student background checks, GRE and TOEFL scores, and admission requirements for transfer students.

Students in the proposed online M.S. program will need to fulfill the key requirements listed on GGIS's graduate admissions page. Examples include
• B.S. degree (ideally in Geography, Computer and Information Sciences, or GIS, but other degrees will be considered) from an accredited college in the United States or an approved institution of higher learning abroad.
• GPA of 3.0/4.0 or higher for the last 60 semester hours in a B.S. program. Students who do not meet the 3.0/4.0 GPA criterion may still be eligible to enroll if they have significant experience outside of the classroom.
• TOEFL scores are required for applicants whose native language is not English.
Please refer to the Academic Catalog Entry section for more detail.

Describe how critical academic functions such as admissions and student advising are managed.

Students in the online M.S. program in CyberGIS and Geospatial Data Science will follow GGIS's existing admissions and advising structures. Advising will be conducted by a team of specialized faculty led by Dr. Anand Padmanabhan, who will work closely with GGIS Graduate Admission Committee and other faculty to design a list of courses and capstone research project unique to each student in the program. The creation of a separate degree code that incorporates revenue-sharing will support the planned expansion and increased faculty advising and teaching loads.

From the GGIS Graduate Handbook:

Advising
Students enter the Master's program intending to work with a particular faculty member, and the faculty member serves as the student's advisor. The advisor, who must be a member of the Geography & Geographic Information Science graduate faculty, will aid the student in formulating a tentative degree program comprising the most appropriate courses according to the student's background, interests, and career objectives. The advisor and student should meet regularly to discuss progress and future plans. Effective communication between student and advisor are critical for Master's success. Either the student or the faculty advisor is free at any time to request a change in advising assignment.

At these meetings the student's career objectives and primary interests within the discipline and cognate fields will be reviewed, as well as any deficiencies and appropriate measures to overcome them. The advisor will assist the student in selecting courses for the first semester.

In addition, all graduate students follow an annual review in which their progress is assessed.

Annual Review Process for Academic Progress
Graduate student progress and accomplishments are reviewed annually to provide constructive feedback for students and their faculty advisors. Annual reviews of students will involve a two-step procedure. First, each students will schedule a meeting with his/her advisor, discuss academic progress, and complete an online self-evaluation. The advisor will then respond by completing their portion of the online evaluation, available at https://my.atlas.illinois.edu/gradrecs.

The student's advisor must inform the Director of Graduate Studies (DGS) of any disagreement of opinion between the student and the advisor on the performance evaluation, proposed plan of action, or both. The Department Head or another faculty member will provide the second review if the student's advisor is the DGS. It is stressed that the primary purpose of this review is to provide constructive feedback and discussion to assist the student in their progress towards graduation and other career goals. The review will also be used as the basis for appointment and funding decisions.

At the final faculty meeting of each academic year, GGIS faculty will discuss their individual students' degree progress and share concerns about particular students, as needed.

Enrollment

Number of Students in Program (estimate)

Year One Estimate

25

5th Year Estimate (or when fully implemented)

200

Estimated Annual Number of Degrees Awarded

Year One Estimate

0

5th Year Estimate (or when fully implemented)

100

What is the matriculation term for this program?

Fall

What is the typical time to completion of this program?

1.5 to 2 years

What are the minimum Total Credit Hours required for this program?

32

Delivery Method

This program is available:

Online Only

Describe the use of this delivery method:

GGIS's online M.S. degree program will provide a high-quality, cutting-edge M.S. degree while targeting a more diverse cross-section of learners previously unable to complete this degree program on campus.
With the majority of Illinois population situated outside the Urbana-Champaign area, the educational resources available at the Department are not easily accessible to the majority of Illinois population. Our proposed online program will drastically increase educational attainment by helping mitigate against the geographic obstacle.
The online degree program will be more affordable than other similar degree programs in Illinois. Not only does the online format allow for much lower tuition costs for students, it makes it possible for workers to simultaneously further their education while supporting their families.

Budget

Will the program or revision require staffing (faculty, advisors, etc.) beyond what is currently available?

Yes

Please explain/describe:

The requested tuition revenue return to the Department (70%) will sustain the new CyberGIS and Geospatial Data online M.S. degree program without additional expenditures by the College of LAS. The program's start-up costs are covered by support from the Provost's "Investment for Growth" (IFG) fund. After the startup phase, the long-term additional costs related to the online option will be covered sustainably by tuition return, with net positive revenue for the Department and revenue for the College of LAS. See Resources section below for details regarding IFG funding and sustainability of finances.

Faculty costs are budgeted to:
• enhance, develop, and/or deliver online versions of current courses;
• develop new courses aimed at the high-demand areas of cyberGIS and geospatial data science;
• advise the additional M.S. students;
• coordinate capstone projects for the additional M.S. students; and
• handle administrative tasks related to admissions, advertising, and other general aspects.
Research Associate Professor Anand Padmanabhan; Teaching Assistant Professors Michael Minn, Su Yeon Han, and Xuantong (Tony) Wang; and Visiting Assistant Professor Ziqi Li have been recently hired by the Department. Dr. Padmanabhan will serve as the program coordinator and will support students to choose their individual advisors and coordinate the design of capstone projects. All the faculty listed above will develop and deliver several courses. Clerical tasks to be handled by a planned administrative hire will be shared with the counterpart programs in ATMS and Geology. Some courses are already taught online as part of existing programs; no additional costs are budgeted as enrollments are expanded. Several new courses specific to this program will require expenditures for overload or summer faculty pay, or payments to adjunct faculty.

GGIS's 70% share of the tuition revenue will cover, with a substantial enrollment of approximately 200 students after the program will be fully implemented, the program's instructional effort costs described above and other miscellaneous costs of the program (e.g., IT support, advertising costs). Importantly, the new, fully online M.S. program will not be allowed to have negative effects on teaching efforts serving our face-to-face degrees. The Department has no excess teaching capacity among the state-funded faculty, and thus the teaching effort for the new program will be supplied in various ways described above.
The additional instructional, support, and administrative effort will be provided by:

• Multiple specialized faculty members in GGIS who will develop and teach new courses for the online program, and help design, plan and lead program development. These faculty will also be responsible for general academic advising of new students and overseeing some of the capstone projects.
• One School-level program administrative staff member covered 33% by GGIS, who will have responsibility to manage miscellaneous program advertisement and upkeep in collaboration with pertinent specialized faculty in GGIS, as well as recruiting, applications and admission, course registration, grades, and related duties.
• Online Course Development Support – Support for online education professional staff and teaching assistants to assist in developing online course materials.
• Summer and/or overload salary for current faculty to develop and offer online courses.
• Education Software – Support for customizing cyberGIS software for best online learning experience and performance.
• TA support, if needed to expand courses.
• Infrastructure and marketing support
• Additional IT support effort at the School level to help administer the online courses.

These activities are fully funded via the "Investment for Growth" grant for the first 3 years of the program and are fully costed as part of the self-sustaining model, thereafter.

Additional Budget Information

Although the new program will be initially supported by IFG grant funds, the program is planned to be self-supporting, with AY 22/23 tuition set at the Base + Differential tuition rate, currently at $712/credit hour. The Department will be responsible for all costs and will receive 70% of the net tuition (an agreement is in negotiation with the LAS Dean's office). 30% of the net tuition income is to go to the College of LAS.

Resource Implications

Facilities

Will the program require new or additional facilities or significant improvements to already existing facilities?

No

Technology

Will the program need additional technology beyond what is currently available for the unit?

No

Non-Technical Resources

Will the program require additional supplies, services or equipment (non-technical)?

No

Resources

For each of these items, be sure to include in the response if the proposed new program or change will result in replacement of another program(s). If so, which program(s), what is the anticipated impact on faculty, students, and instructional resources? Please attach any letters of support/ acknowledgement from faculty, students, and/or other impacted units as appropriate.

Faculty Resources

Please address the impact on faculty resources including any changes in numbers of faculty, class size, teaching loads, student-faculty ratios, etc. Describe how the unit will support student advising, including job placement and/or admission to advanced studies.

Multiple specialized faculty members and a 33% FTE program coordinator will be employed as part of this new initiative (see "Budget", above), and thus we do not expect significant impacts will occur for existing faculty.

The specialized faculty for supporting development and teaching of online courses in the program will handle most of the additional instruction and coordination workload. These faculty will also be responsible for general academic advising of new students and placement efforts.

There is no expectation to increase regular semester teaching loads for current faculty. Some overload or summer teaching is expected to occur on an optional basis. If enrollments are much greater than expected, additional specialized faculty member will be hired to teach additional sections or classes.

Library Resources

Describe your proposal's impact on the University Library's resources, collections, and services. If necessary please consult with the appropriate disciplinary specialist within the University Library.

Current collections and services are adequate for the proposed program as existing courses from GGIS, GEOG, GEOL, IB, NRES, are being used in the curricula.

Instructional Resources

Will there be any reduction in other course offerings, programs or concentrations by your department as a result of this new program/proposed change?

No

Does the program include other courses/subjects impacted by the creation/revision of this program?

No

Financial Resources

How does the unit intend to financially support this proposal?

The first 3 years of the online M.S. program are supported by the Provost's "Investment for Growth" program; it is planned to be self-supporting after that, with AY 22/23 tuition set at the Base + Differential tuition rate, currently $712/credit hour. The Department will be responsible for all costs and will receive 70% of the net tuition (an agreement is in negotiation with the LAS Dean's office). 30% of the net income is to go to the College of LAS.

Will the unit need to seek campus or other external resources?

No

Are you seeking a change in the tuition rate or differential for this program?

Yes

If yes, please enter your college budget office contact information and have them contact provostbudget@illinois.edu for next steps.

Bob Kessler, rkessler@illinois.edu
Mike Wellens, wellens@illinois.edu

Is this program requesting self-supporting status?

Yes

Market Demand

What market indicators are driving this proposal? If similar programs exist in the state, describe how this program offers a unique opportunity for students:

Combining advances in high-performance and data-intensive computing with developments in geospatial data analysis, management, processing, and visualization, cyberGIS represents the latest innovative development in the fast-growing field of geospatial data science. CyberGIS has rapidly emerged as a major force in private and public sector organizations and in higher education for harnessing the rapid geospatial data revolution. The Department is the birthplace of cyberGIS, and thus well positioned to establish an online, revenue-generating, Master's degree program to lead instruction on this cutting-edge area. Whereas universities like Penn State and Southern California have successful online GIS programs each generating over one million dollars in annual revenue, our program would be the first to deliver an online program focused on cyberGIS and geospatial data science.

The University of Illinois at Urbana-Champaign has established international visibility in this field which continues to grow as ground-breaking research is being generated from the CyberGIS Center. Increasingly employers are looking for workers who are well prepared with skills in cyberGIS

and geospatial data science. Additionally, the university is home to powerful digital infrastructure (see Virtual ROGER – CyberGIS Supercomputer - http://cybergis.illinois.edu/infrastructures/) which continues to be innovated by CyberGIS Center leveraging both campus and external support. Such advanced cyberGIS infrastructure established through multi-year investment from the National Science Foundation and our University does not exist at any of our peer institutions, and thus offers an unparalleled strength for developing the proposed revenue-generating graduate program. In summary, the new program would be the first fully online M.S. degree in CyberGIS and Geospatial Data Science and would therefore have global reach and a large pool of potential applicants.

What type of employment outlook should these graduates expect? Explain how the program will meet the needs of regional and state employers, including any state agencies, industries, research centers, or other educational institutions that expressly encourage the program's development.

The new online M.S. degree in CyberGIS and Geospatial Data Science will prepare this cross-section of students to work, or continue to work as GIS Analysts, Geospatial Data Scientists in private or public-sector jobs that focus on the analysis, management, processing, and visualization of geospatial data. These skills will be useful to a variety of sectors and industries ranging from local and regional to national and global employers including such areas as emergency management, energy, health, infrastructure, public safety, transportation, sustainability, and water resources. Having the skills in cyberGIS and geospatial data science also enables students to compete for jobs in the broader data science. An M.S. degree is essential for desirable jobs in many industries that employ Geospatial Data Scientists, specifically for career advancement. Key skills developed through the program include, high-performance and data-intensive geospatial computing, geospatial data management, geospatial visualization and visual analytics, and innovative cyberGIS applications.

As discussed in the "Program Description and Justification" section, the new online M.S. program in CyberGIS and Geospatial Data Science is designed to meet high demand for geospatial data science and would be a unique program that focuses on cyberGIS when compared to other GIS programs offered by peer schools. A market analysis at https://www.geospatialworld.net/blogs/gis-and-spatial-analytics-market/ projects the global GIS and spatial analytics market to grow 10+ % in the next several years without any sign of slowing down in the foreseeable future. A major driver of this growth is rooted in geospatial big data being generated ubiquitously via remote sensing, social media, sensor networks, and mobile devices, all of which have geographic and location components. Already a leader in this cutting-edge field of harnessing the geospatial data revolution through cyberGIS discovery and innovation, GGIS within SESE and the University have a remarkable opportunity to take advantage of this leadership to become a major player in cyberGIS and geospatial data science online education. Tremendous impacts are expected to make the University a global leader in this strategically important science and technology context.

What resources will be provided to assist students with job placement?

The students in the online program will receive academic advising and mentoring by a team of GGIS specialized faculty led by Research Associate Professor: Dr. Anand Padmanabhan. More generally, the Department of GGIS will continue to communicate all job announcements to all students. Furthermore, GGIS will participate in the LAS new Corporate Affiliates Program (CAP), the goal of which is to foster relationships with alumni positioned in related public and private sector organizations. GGIS will also build on the relationships it has built with employers for many of its programs to provide students with opportunities like internship and capstone projects to give them exposure to potential employers.

Program Regulation and Assessment

Briefly describe the plan to assess and improve student learning, including the program's learning objectives; when, how, and where these learning objectives will be assessed; what metrics will be used to signify student's achievement of the stated learning objectives; and the process to ensure assessment results are used to improve student learning. (Describe how the program is aligned with or meets licensure, certification, and/or entitlement requirements, if applicable).

N/A

Is the career/profession for graduates of this program regulated by the State of Illinois?

No

Program of Study

"Baccalaureate degree requires at least 120 semester credit hours or 180 quarter credit hours and at least 40 semester credit hours (60 quarter credit hours) in upper division courses" (source: https://www.ibhe.org/assets/files/PrivateAdminRules2017.pdf). For proposals for new bachelor's degrees,

if this minimum is not explicitly met by specifically-required 300- and/or 400-level courses, please provide information on how the upper-division hours requirement will be satisfied.

All proposals must attach the new or revised version of the Academic Catalog program of study entry. Contact your college office if you have questions.

For new programs, attach Program of Study

Figure 1 Geography and Geographic Info Science CyberGIS and Geospatial Data Science MS non-thesis.docx
Appendix A CyberGIS & Geospatial Data Science Electives List.docx
GGIS_ Geospatial Data Science OnlineMS FINAL 2-18-21.docx
Program Tuition Waiver Policy Proposal- request self supporting-GGIS Cyber MS FINAL.pdf

Catalog Page Text

Statement for Programs of Study Catalog

Code	Title	Hours
Complete 2 of the following courses focusing on GIS:		6-7
GEOG 403	Geographic Information Science and Systems	
GEOG 477	Introduction to Remote Sensing	
GEOG 480	Principles of GIS	
Complete 2 of the following courses focusing on core concepts of cyberGIS and geospatial data science topics:		8
GEOG 407	Foundations of CyberGIS & Geospatial Data Science	
GEOG 507	High-Performance Geospatial Computing	
GEOG 570	Advanced Spatial Analysis	
Complete the following 2 advanced courses in cyberGIS and geospatial data science:		8
GEOG 517	Geospatial Visualization & Visual Analytics	
GEOG 527	Geospatial Artificial Intelligence and Machine Learning	
Additional 400-500 level courses as needed to meet or exceed the minimum credit hour requirement of the program. Selected in consultation with the student's advisor; chosen from courses in the GIS and core concepts lists (if not taken to meet those requirements) or from a list of electives maintained by the department.		6
GEOG 598 Capstone Research Project		4
Total Hours		**32**

Other Requirements[1]

Code	Title	Hours
Proposed Requirements		
Other requirements may overlap		
Minimum Hours Overall Required Within the Unit		16
Requires a written capstone report		
At least 12 of the 32 required hours must be in 500-level courses (8 in GGIS).		
Course substitutions are permitted with the consent of the program coordinator.		
A maximum of 2 elective courses may be taken CR/NC.		
All students must maintain a minimum grade point average (GPA) of 3.0 (A = 4.0). If the GPA falls below this minimum after 12 or more graduate hours of graded coursework, it must be raised to 3.0 or above after the completion of 12 additional graduate hours of graded coursework and must be maintained at or above the minimum thereafter.		

EP Documentation

Attach Rollback/Approval Notices

Re_ CyberGIS proposal.pdf

DMI Documentation

Program Reviewer Comments

Kathy Martensen (kmartens) (Fri, 09 Apr 2021 17:10:19 GMT): Editorial changes to Additional Budget Information and Fin Resources - how does unit intend to support - sections made at request of Budget and Resource Planning.
Kathy Martensen (kmartens) (Mon, 19 Apr 2021 15:55:49 GMT): Deleted Catalog Page Text per request of K. Ritter; see uploaded PDF of email in EP Documentation.

Key: 1030

From:	Ritter, Kelly Allison
To:	Martensen, Kathy; Miller, Nolan H
Cc:	FMS Catalog; Lehman, Barbara J
Subject:	Re: CyberGIS proposal
Date:	Monday, April 19, 2021 10:08:35 AM
Attachments:	image001.png
	image002.png

Hi Kathy:

Yes, I've spoken with Nolan and agree that the catalog text should be deleted, as it's just the draft language we used to build the table, which was then built correctly as you can see in the proposal. The catalog text section has an error that we resolved in the table, so the table is correct and should be what is the focus of the review. If you are able to delete the catalog text, which Amy Elli agrees is the easiest/best course of action at this point, to avoid any confusion, we would appreciate that. We often don't even keep that text in proposals as we send them forward, but this one just slipped by us without noticing. Our error, but we would appreciate the correction.

Thanks!

Kelly

KELLY RITTER
Associate Dean for Curricula and Academic Policy
Professor of English and Writing Studies
University of Illinois at Urbana-Champaign
College of Liberal Arts & Sciences
2090 Lincoln Hall | M/C 448
Champaign, IL 61820
217.333.1350 | ritterk@illinois.edu
english.illinois.edu/directory/profile/ritterk

Under the Illinois Freedom of Information Act any written communication to or from university employees regarding university business is a public record and may be subject to public disclosure.

From: "Martensen, Kathy" <kmartens@illinois.edu>
Date: Monday, April 19, 2021 at 9:50 AM
To: "Miller, Nolan H" <nmiller@illinois.edu>
Cc: "Ritter, Kelly Allison" <ritterk@illinois.edu>, FMS Catalog <FMS-Catalog@illinois.edu>, "Lehman, Barbara J" <bjlehman@illinois.edu>

Subject: RE: CyberGIS proposal

Kelly, can we get a note from you as the college contact indicating this is okay? I'd like to include that then as a PDF with the proposal; otherwise, it will appear that I'm making unauthorized changes! ☺

From: Miller, Nolan H <nmiller@illinois.edu>
Sent: Monday, April 19, 2021 9:46 AM
To: Martensen, Kathy <kmartens@illinois.edu>
Cc: Ritter, Kelly Allison <ritterk@illinois.edu>
Subject: CyberGIS proposal

Hi Kathy

CyberGIS left some placeholder text in the "unofficial catalog page text" above the requirements grid in their proposal that is not consistent with the requirements for the current program. This is left over from a previous program. Can you just delete it? The Statement for Programs of Study Catalog entries in the table are all correct.

Thanks,

Nolan

_____

ILLINOIS

NOLAN H MILLER
Daniel and Cynthia Mah Helle Professor in Finance | Department of Finance
Director, Center for Business and Public Policy
Gies College of Business | University of Illinois at Urbana-Champaign
217.244.2847 | nmiller@illinois.edu | http://www.business.illinois.edu/nmiller

ILLINOIS

Proposal for new curricula (degree, major, concentration, minor)

Submit completed proposals via email to Associate Dean Kelly Ritter (ritterk@illinois.edu). Please obtain Executive Officer and School Director (if applicable) approval via email and forward with the proposal to LAS.

Proposal Title: A new online, non-thesis Master of Science degree in CyberGIS and Geospatial Data Science

Proposed effective date: August 2022

Sponsor(s): Shaowen Wang, Head of the Department of Geography and Geographic Information Science, shaowen@illinois.edu

College contact: Kelly Ritter, Associate Dean for Curricula and Academic Policy, College of Liberal Arts and Sciences, ritterk@illinois.edu

Is this program interdisciplinary: Yes, through collaboration with the Departments of Atmospheric Sciences and Geology

PROGRAM DESCRIPTION and JUSTIFICATION

1) **Provide a brief but concise description of your proposal**

   The Department of Geography and Geographic Information Science (GGIS) proposes a non-thesis Master of Science (M.S.) degree in CyberGIS and Geospatial Data Science, designed to meet the existing high demand for advanced GIS skills like cyberGIS, geospatial big data analytics, geospatial visualization, needed in many industries. This new degree will be able to satisfy demand from non-traditional students, from both domestic and international markets, seeking to obtain an advanced degree in GIS focused on cyberGIS and geospatial data science, and from working professionals whose employers may pay some or all of the tuition. The proposed M.S. degree program in CyberGIS and Geospatial Data Science satisfies the growing demand from an under-served educational community while not detracting from on-campus undergraduate and graduate-level GGIS programs. The new M.S. will accommodate remotely located students, building upon existing GGIS faculty expertise in innovative online pedagogy. The requested new program will enable this expansion without drawing resources from other GGIS graduate programs; to the contrary, it will increase course offerings.

2) **Provide a justification of the program**

   CyberGIS – cyber geographic information science and systems (GIS) – are the latest innovative development in the fast-growing field of geospatial data science. Combining advances in high-

performance and data-intensive computing with developments in geospatial data processing, analysis, and visualization, cyberGIS has rapidly emerged as a major force in private and public sector organizations and in higher education for harnessing the rapid geospatial data revolution. Our Department of Geography and Geographic Information Science (GGIS) together with the campus CyberGIS Center for Advanced Digital and Spatial Studies (CyberGIS Center), the birthplace of cyberGIS, is well positioned to establish an online, revenue-generating, Master's degree program to lead instruction on this cutting-edge area.

The proposed M.S. program in CyberGIS and Geospatial Data Science fills a gap in the current offerings and prepares students for entering the workforce. Whereas universities like Penn State and Southern California have successful online GIS programs each generating over one million dollars in annual revenue, our program would be the first to deliver an online program focused on cyberGIS and geospatial data science. The new M.S. degree is designed to accommodate a demographic comprised of nontraditional and working learners by offering online coursework, advising, and capstone research. The online degree will be particularly attractive to professionals who are working full time and might be looking to enhance their skill set in cyberGIS and geospatial data science. GGIS faculty include global leaders in the areas of cyberGIS, geospatial big data, high-performance geospatial computing, and a variety of geospatial applications such as public health and water resources.

The proposed CyberGIS and Geospatial Data Science online M.S. degree program is part of three connected, synergistic M.S. programs in development with funding from an Office of the Provost's "Investment for Growth" (IFG) Program Grant (https://provost.illinois.edu/about/initiatives/investment-for-growth-program/), housed in the School for Earth, Society, and the Environment (SESE). The proposed "Weather and Climate Risk and Analytics" (Dept. of Atmospheric Sciences) and "Environmental Geology" (Dept. of Geology) online M.S. degree programs will both enhance GGIS's proposed CyberGIS and Geospatial Data Science online M.S. program by providing shared courses, specialized courses in certain key areas, and a larger group of faculty and staff collaborating to achieve overall program success, both on-campus and online. Recognizing assimilating and analyzing "geospatial big data" is a key challenge faced by industry and government, we will leverage the strengths of GGIS faculty and CyberGIS Center staff in these areas and build upon data science synergies with GEOL and ATMS through IFG funding, as illustrated in Fig. 1.

In summary, GGIS's new online M.S. degree program will provide a high-quality, cutting-edge M.S. degree while targeting a more diverse cross-section of learners previously unable to complete this degree program on campus. GGIS notes that the UIUC 2018-2023 strategic plan articulates the goal of making UIUC "the go-to place for professional and continuing education programs" through "the creation of workforce-development strategies and related partnerships across the public and private sectors…using Illinois expertise to create new jobs and enhance the skill sets of new and continuing workers." The proposed online M.S. degree program will align GGIS's graduate programs with this campus-wide goal while simultaneously benefitting both on-campus and remotely placed GGIS graduate students and programs.

Fig. 1 illustrates the relationships between the new or existing 400 and 500-level online courses developed and offered by each of the three departments within SESE through IFG funding, providing educational advancement for SESE online, non-thesis graduate students while taking advantage of the strengths of each department's expertise in computational and data sciences as well as geospatial analysis. Courses related to common core learning objectives, specifically Principles of GIS, and

Geocomputation and Data Science with Python and R, can be taken by students in the Environmental Geology online M.S. as part of their core course requirements (see Academic Catalog Entry section below for details).
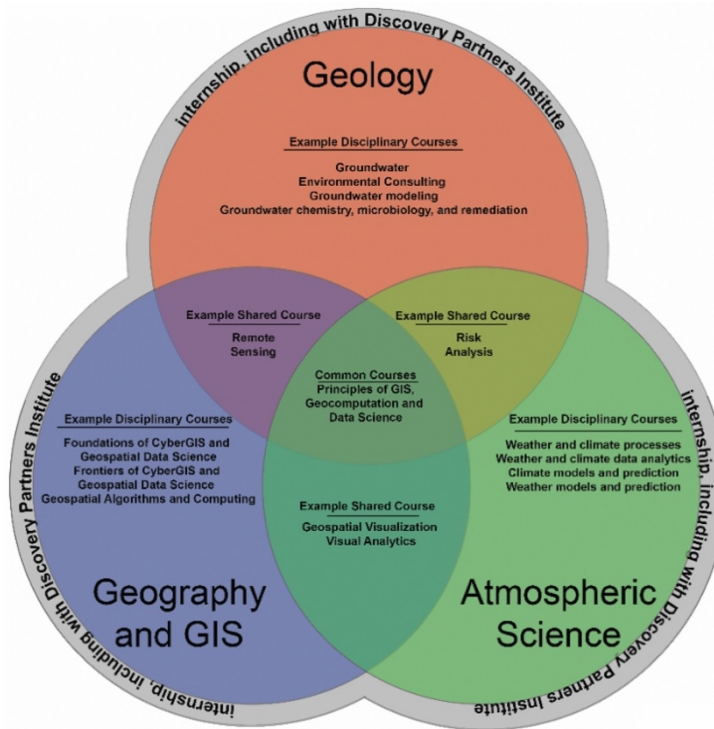

Fig. 1: The relationship between the Investment for Growth-funded courses offered in the proposed online SESE non-thesis M.S. degree programs.

In addition to the core courses in cyberGIS and geospatial data science, students have the opportunity to select, with the aid of their advisors, 400 and 500 level course work focusing on advanced subjects and case studies. As such, students will work closely with their advisors to select advanced courses that provide the cutting-edge knowledge to successfully complete the capstone research project.

INSTITUTIONAL CONTEXT (new majors and degrees ONLY)

University of Illinois at Urbana-Champaign

Mission: The University of Illinois at Urbana-Champaign is charged by our state to enhance the lives of the citizens in Illinois, across the nation, and around the world through our leadership in learning, discovery, engagement, and economic development.

1) Describe the historical and university context of the program's development. Include a short summary of any existing program(s) upon which this program will be built. Also, explain the nature and degree of overlap with existing programs and, if such overlap exists, document consultation with the impacted program's home department(s).

The University of Illinois at Urbana-Champaign is the birthplace of cyberGIS and currently hosts a leading center for cyberGIS in the world, CyberGIS Center for Advanced Digital and Spatial Studies (CyberGIS Center). Our international visibility continues to grow as ground-breaking research is being generated from the CyberGIS Center. Over the past several years, cyberGIS has been recognized and established across diverse academic, governmental, and industrial communities as employers increasingly desire workers that are well prepared in cyberGIS and geospatial data science. This provides GGIS and the University with an unprecedented opportunity to build on its unique strength and establish a leading online education program that leverages its unparalleled research and technical capabilities.

The GGIS Department currently offers an M.S. degree focused on residential students for preparing students for pursuing further research in GGIS. The Department also offers a Professional Science Master's program which again is available for residential students to prepare them with both GIS and business management skills. The new M.S. in CyberGIS and Geospatial Data Science will be in contrast focused on working professionals and remote students who are currently being underserved by the University.

Overall, there are no conflicts with the existing programs on campus. The coursework as part of the proposed online M.S. degree program will not detract from on-campus offerings of the face-to-face courses. The new program will in fact increase the variety of advanced coursework offered by the Department and help to attract new students who would otherwise not have applied to graduate programs at the University. Additionally, on-campus students will benefit from this new program, as on-campus students will also be able to enroll in the online courses of the program.

2) Briefly describe how this program will support the University's mission, focus and/or current priorities. Demonstrate the program's consistency with and centrality to that mission.

The proposed CyberGIS and Geospatial Data Science online M.S. degree program will not only leverage departmental and University research strengths, but also advance our University's strategic area of data science and multiple related strategic areas including energy, globalization, health, urban sustainability, and water. We believe that this online program will be a crucial asset to the University in meeting its cutting-edge teaching mission and crucial research agendas. The degree program will be application-driven and use-inspired while offering a set of core courses on cyberGIS and geospatial data science which the University is well positioned to deliver. Furthermore, this program will help the University achieve important and well-deserved global leadership and visibility. The program will help make advances in the following UIUC strategic initiatives.

- "Strengthen our faculty and align resources with academic and research units to capitalize on our scholarly synergies across campus" [Goal 1.A]

    Through the online program multiple new specialized faculty members can be recruited into the Department and will be able to deliver a number of new courses and conduct leading-edge research. The M.S. in CyberGIS and Geospatial Data Science also leverages the unparalleled research strength of the Department to offer cutting-edge educational materials that are unique in comparison with our peers.

- "Provide new educational pathways and enhance current programs to increase flexibility and to foster education across disciplines" [Goal 2.C]

    The new online program will provide new pathways and educational opportunities that do not currently exist in the Department. This will attract new students to the program that would not have considered a graduate program at Illinois otherwise.

- "Innovate in graduate, professional, and continuing edition, with new degree programs and certificates at the intersection of disciplines, and support recruitment and retention of graduate students" [Goal 2.F].

    The new and innovative online M.S. degree in CyberGIS and Geospatial Data Science will help achieve UIUC Strategic Initiative Goal 2.F through synergies with the two additional proposed SESE online M.S. programs. Specifically, shared online courses and cross-discipline teaching and learning environments as part of the three new SESE online M.S. programs will increase graduate student enrollment while not detracting from on-campus programs.

- "Create workforce-development strategies and related partnerships across the public and private sectors, with an emphasis on using Illinois expertise to create new jobs and enhance the skill sets of new and continuing workers" [Goal 3.H].

    The online nature of the proposed online M.S. degree program will be of particular interest to continuing workers. We anticipate that individuals already working in industry positions will obtain enhanced skill sets in cyberGIS and geospatial data science through our online, graduate-level degree program. The new degree will help these potential applicants and workers in public and private sector organizations to advance in their respective organizations and conduct cutting-edge work with cyberGIS and geospatial big data.

- "Develop and execute an integrated, coordinated, and sustained marketing and communications effort to all stakeholders and influencers: students, alumni, parents and friends, business and government leaders, and residents of the state of Illinois" [Goal 3.I].

    GGIS will participate in the College of Liberal Arts and Sciences (LAS) new Corporate Affiliates Program (CAP), the goal of which is to achieve Goal 3.I through sustained, coordinated, and integrated relationships with alumni positioned in related public and private sector organizations. Online M.S. marketing strategies will build on these relationships, focusing particular attention on Illinois-based organizational connections. Strategic marketing communications will be developed with the help of LAS and the Center for Innovation in Teaching and Learning (CITL) at UIUC.

- "Actively explore additional revenue sources by increasing online education, corporate partnerships, and royalty and patent revenue through creating the proper infrastructure for building large-scale research proposals, and supporting scholars as they commercialize research for entrepreneurial opportunities that bring cutting-edge technologies to market." [Goal 4.B]

The establishment of this online M.S. program directly contributes to the goal of increasing online education by creating a unique program that will attract new students to Illinois and generate significant revenue.

- "Understand that the largest resource on campus is its employees and students while creating an inclusive and welcoming campus climate" [Goal 4D].

    The online nature of the proposed M.S. degree program will directly benefit non-traditional students through the more flexible and affordable nature of online education. Because students living in any location, nationally or internationally, can obtain the new degree, overall diversity will be increased. Additionally, several new specialized faculty members recently hired by the Department will participate in the development of the program creating a diverse and unique talent pool. Fostering safe and welcoming working environments will be a continuing focus for advising students. Virtual events will be organized to help students access diverse campus resources.

3) Indicate which of the following goals of the Illinois Board of Higher Education's Strategic Initiative are supported by this program: (choose all that apply)

1. Educational Attainment - increase educational attainment to match the best-performing states.
2. College Affordability - ensure college affordability for students, families, and taxpayers.
3. High Quality Credentials to Meet Economic Demand - Increase the number of high-quality post-secondary credentials to meet the demands of the economy and an increasingly global society.
4. Integration of Educational, Research and Innovation Assets - Better integrate Illinois' educational, research and innovation assets to meet economic needs of the state and its regions.

    The proposed M.S. degree program in CyberGIS and Geospatial Data Science supports all four goals (1, 2, 3 and 4).

4) Describe how the proposed program supports the goals above:

With the majority of Illinois population situated outside the Urbana-Champaign area, the educational resources available at the Department are not easily accessible to the majority of Illinois population. Our proposed online program will drastically increase educational attainment by helping mitigate against the geographic obstacle.

The online degree program will be more affordable than other similar degree programs in Illinois. Not only does the online format allows for much lower tuition costs for students, it makes it possible for workers to simultaneously further their education while supporting their families. This is also a great deal for taxpayers: the self-supporting nature of the degree will mean that taxpayers are not supporting the program.

Analyzing, managing, processing and visualizing geospatial "big data" is becoming an increasingly sought-after skillset as geospatial data plays important roles in forming the digital fabric of our society. There is an urgent need in both public and private sectors for people who are well versed in handling such data. The proposed program will meet this rapidly growing need for geospatial data scientists.

One of the requirements of the proposed degree program is a capstone research project, designed to help online M.S. students apply cutting-edge cyberGIS knowledge of geospatial "big data" and "big computing" problems" to their specific industry and application domains. The M.S. program builds on the University of Illinois unmatched leadership in cyberGIS through leveraging research innovation for generating unique educational experiences. GGIS is working closely with LAS to pilot the new LAS Corporate Affiliates Program so that industry partnerships are in place to help identify capstone research project collaborations.

ADMISSION REQUIREMENTS

1) Desired admissions term: *For LAS units, a fall semester effective term for all curricula will be requested, please indicate the proposed year*

Fall,   2022

2) Provide a brief narrative description of the admission requirements for this program. Where relevant, include information about licensure requirements, student background checks, GRE and TOEFL scores, and admission requirements for transfer students. (degrees, majors, concentrations ONLY)

Students in the proposed online M.S. program will need to fulfill the key requirements listed on GGIS's graduate admissions page. Examples include

- B.S. degree (ideally in Geography, Computer and Information Sciences, or GIS, but other degrees will be considered) from an accredited college in the United States or an approved institution of higher learning abroad.
- GPA of 3.0/4.0 or higher for the last 60 semester hours in a B.S. program. Students who do not meet the 3.0/4.0 GPA criterion may still be eligible to enroll if they have significant experience outside of the classroom.
- TOEFL scores are required for applicants whose native language is not English.

    Please refer to the Academic Catalog Entry section for more detail.

3) Describe how critical academic functions such as admissions and student advising are managed.

Students in the online M.S. program in CyberGIS and Geospatial Data Science will follow GGIS's existing admissions and advising structures. Advising will be conducted by a team of specialized faculty led by Dr. Anand Padmanabhan, who will work closely with GGIS Graduate Admission Committee and other faculty to design a list of courses and capstone research project unique to each student in the program. The creation of a separate degree code that incorporates revenue-sharing will support the planned expansion and increased faculty advising and teaching loads.

From the GGIS Graduate Handbook:

Advising
Students enter the Master's program intending to work with a particular faculty member, and the faculty member serves as the student's advisor. The advisor, who must be a member of the Geography & Geographic Information Science graduate faculty, will aid the student in

formulating a tentative degree program comprising the most appropriate courses according to the student's background, interests, and career objectives. The advisor and student should meet regularly to discuss progress and future plans. Effective communication between student and advisor are critical for Master's success. Either the student or the faculty advisor is free at any time to request a change in advising assignment.

At these meetings the student's career objectives and primary interests within the discipline and cognate fields will be reviewed, as well as any deficiencies and appropriate measures to overcome them. The advisor will assist the student in selecting courses for the first semester.

In addition, all graduate students follow an annual review in which their progress is assessed.

Annual Review Process for Academic Progress
Graduate student progress and accomplishments are reviewed annually to provide constructive feedback for students and their faculty advisors. Annual reviews of students will involve a two-step procedure. First, each student will schedule a meeting with her/his advisor, discuss academic progress, and complete an online self-evaluation. The advisor will then respond by completing their portion of the online evaluation, available at https://my.atlas.illinois.edu/gradrecs.

The student's advisor must inform the Director of Graduate Studies (DGS) of any disagreement of opinion between the student and the advisor on the performance evaluation, proposed plan of action, or both. The Department Head or another faculty member will provide the second review if the student's advisor is the DGS. It is stressed that the primary purpose of this review is to provide constructive feedback and discussion to assist the student in their progress towards graduation and other career goals. The review will also be used as the basis for appointment and funding decisions.

At the final faculty meeting of each academic year, GGIS faculty will discuss their individual students' degree progress and share concerns about particular students, as needed.

ENROLLMENT

1) **Number of students in program estimates**

   Year 1 estimate: 25

   Year 5 estimate (or when fully implemented): 200

2) **Estimated Annual Number of Degrees Awarded (degrees, majors, concentrations ONLY)**

   Year 1: 0

   Year 5 (or when fully implemented): 100

3) **Delivery Method, what is the program's primary delivery method?**

   The proposed M.S. degree program will be completed fully online.

GGIS's online M.S. degree program will provide a high-quality, cutting-edge M.S. degree while targeting a more diverse cross-section of learners previously unable to complete this degree program on campus.

With the majority of Illinois population situated outside the Urbana-Champaign area, the educational resources available at the Department are not easily accessible to the majority of Illinois population. Our proposed online program will drastically increase educational attainment by helping mitigate against the geographic obstacle.

The online degree program will be more affordable than other similar degree programs in Illinois. Not only does the online format allow for much lower tuition costs for students, it makes it possible for workers to simultaneously further their education while supporting their families.

4) What is the matriculation term for this program?

Program matriculation will be on a rolling basis. As such, matriculation term will vary depending on each student in the program. Students can therefore start the new online M.S. beginning with a Fall, Spring, or Summer academic term.

5) What is the typical time to completion of this program?

Students should be able to complete the program in 3-4 academic terms, although working professionals may take longer if they do not wish to enroll in as high of a course load per semester. 1.5 to 2 years for completion

6) What are the minimum Total Credit Hours required for this program?

The minimum Total Credit Hours required for completion of this program are 32 min. hours, (including a minimum of 16 GGIS hours; minimum 12 500-level GGIS hours and 4 credit (8 max.) hours of GEOG 598: *Capstone Research Project* credit.

BUDGET

1) Please describe any budgetary implications for this new program - addressing applicable personnel, facilities, technology and supply costs.

The requested tuition revenue return to the Department (70%) will sustain the new CyberGIS and Geospatial Data online M.S. degree program without additional expenditures by the College of LAS. The program's start-up costs are covered by support from the Provost's "Investment for Growth" (IFG) fund. After the startup phase, the long-term additional costs related to the online option will be covered sustainably by tuition return, with net positive revenue for the Department and revenue for the College of LAS. See Resources section below for details regarding IFG funding and sustainability of finances.

Faculty costs are budgeted to:
- enhance, develop, and/or deliver online versions of current courses;
- develop new courses aimed at the high-demand areas of cyberGIS and geospatial data science;
- advise the additional M.S. students;
- coordinate capstone projects for the additional M.S. students; and
- handle administrative tasks related to admissions, advertising, and other general aspects.

Research Associate Professor Anand Padmanabhan; Teaching Assistant Professors Michael Minn, Su Yeon Han, and Xuantong (Tony) Wang; and Visiting Assistant Professor Ziqi Li have been recently hired by the Department. Dr. Padmanabhan will serve as the program coordinator and will support students to choose their individual advisors and coordinate the design of capstone projects. All the

faculty listed above will develop and deliver several courses. Clerical tasks to be handled by a planned administrative hire will be shared with the counterpart programs in ATMS and Geology. Some courses are already taught online as part of existing programs; no additional costs are budgeted as enrollments are expanded. Several new courses specific to this program will require expenditures for overload or summer faculty pay, or payments to adjunct faculty.

GGIS's 70% share of the tuition revenue will cover, with a substantial enrollment of approximately 200 students after the program will be fully implemented, the program's instructional effort costs described above and other miscellaneous costs of the program (e.g., IT support, advertising costs). *Importantly, the new, fully online M.S. program will not be allowed to have negative effects on teaching efforts serving our face-to-face degrees.* The Department has no excess teaching capacity among the state-funded faculty, and thus the teaching effort for the new program will be supplied in various ways described above.

2) **Will the new program require staffing (faculty, advisors, etc.) beyond what is currently available?**

The additional instructional, support, and administrative effort will be provided by:

- Multiple specialized faculty members in GGIS who will develop and teach new courses for the online program, and help design, plan and lead program development. These faculty will also be responsible for general academic advising of new students and overseeing some of the capstone projects.
- One School-level program administrative staff member covered 33% by GGIS, who will have responsibility to manage miscellaneous program advertisement and upkeep in collaboration with pertinent specialized faculty in GGIS, as well as recruiting, applications and admission, course registration, grades, and related duties.
- Online Course Development Support – Support for online education professional staff and teaching assistants to assist in developing online course materials.
- Summer and/or overload salary for current faculty to develop and offer online courses.
- Education Software – Support for customizing cyberGIS software for best online learning experience and performance.
- TA support, if needed to expand courses.
- Infrastructure and marketing support
- Additional IT support effort at the School level to help administer the online courses.

These activities are fully funded via the "Investment for Growth" grant for the first 3 years of the program and are fully costed as part of the self-sustaining model, thereafter.

3) **Please provide any additional budget information needed to effectively evaluate the proposal.**

Although the new program will be initially supported by IFG grant funds, the program is planned to be self-supporting, with AY 22/23 tuition set at $686/credit hour. The Department will be responsible for all costs and will receive 70% of the gross tuition (an agreement is in negotiation with the LAS Dean's office). 30% of the gross income is to go to the College of LAS.

RESOURCE IMPLICATIONS

1) Facilities - Will the program require new or additional facilities or significant improvements to already existing facilities?

No new facilities will be required.

2) Technology - Will the program need additional technology beyond what is currently available for the unit?

Needed technology is currently available but support is needed for customizing cyberGIS software for best online learning experience and performance.

3) Non-Technical Resources - Will the program require additional supplies, services or equipment (non-technical)?

The new online M.S. program in CyberGIS and Geospatial Data Science will not require additional supplies, services or non-technical equipment.

RESOURCES

1) Faculty Resources: Please address the impact on faculty resources including any changes in numbers of faculty, class size, teaching loads, student-faculty ratios, etc. Describe how the unit will support student advising, including job placement and/or admission to advanced studies.

Multiple specialized faculty members and a 33% FTE program coordinator will be employed as part of this new initiative (see "Budget", above), and thus we do not expect significant impacts will occur for existing faculty.

The specialized faculty for supporting development and teaching of online courses in the program will handle most of the additional instruction and coordination workload. These faculty will also be responsible for general academic advising of new students and placement efforts.

There is no expectation to increase regular semester teaching loads for current faculty. Some overload or summer teaching is expected to occur on an optional basis. If enrollments are much greater than expected, additional specialized faculty member will be hired to teach additional sections or classes.

2) Library Resources: Describe your proposal's impact on the University Library's resources, collections, and services. If necessary, please consult with the appropriate disciplinary specialist within the University Library.

Current collections and services are adequate for the proposed program as existing courses from GGIS, GEOG, GEOL, IB, NRES, are being used in the curricula.

3) Instructional Resources: Will there be any reduction in other course offerings, programs or concentrations by your department as a result of this new program/proposed change?

No – to the contrary, course offerings and impact will expand. Online course content will benefit on-campus teaching and learning efforts through hybridized course structures. Additionally, new courses are being developed as part of this program that would not have been available to on-campus learning otherwise.

4) Does this new program/proposed change result in the replacement of another program?

No. The new, fully online M.S. program in CyberGIS and Geospatial Data Science will leave all existing programs intact.

5) Does the program include any required or recommended subjects that are offered by other departments? If yes, please list the courses. Explain how these additional courses will be used by the program and provide letters of support from the departments.

No, the program does not include any required or recommended subjects that are offered by other departments.

FINANCIAL RESOURCES

1) How does the unit intend to financially support this proposal?

The first 3 years of the online M.S. program are supported by the Provost's "Investment for Growth" program; it is planned to be self-supporting after that, with AY 22/23 tuition set at $686/credit hour. The Department will be responsible for all costs and will receive 70% of the gross tuition (an agreement is in negotiation with the LAS Dean's office). 30% of the gross income is to go to the College of LAS.

2) Will the unit need to seek campus or other external resources? If yes, please provide a summary of the sources and an indication of the approved support.

No.

3) Will an existing tuition rate be used or continue to be used for this program?

The $686/credit hour rate is an established existing tuition rate for graduate programs in CITL.

4) Is this program requesting self-supporting status? (degrees, majors and concentrations ONLY)? If yes, please explain.

As mentioned above, the first 3 years of the online M.S. program are supported by the Provost's "Investment for Growth" program; it is planned to be self-supporting after that, with AY 22/23 tuition set at $686/credit hour. The Department will be responsible for all costs and will receive 70% of the gross tuition (an agreement is in negotiation with the LAS Dean's office). 30% of the gross income is to go to the College of LAS.

MARKET DEMAND

1) What market indicators are driving this proposal? If similar programs exist in the state, describe how this program offers a unique opportunity for students.

Combining advances in high-performance and data-intensive computing with developments in geospatial data analysis, management, processing, and visualization, cyberGIS represents the latest innovative development in the fast-growing field of geospatial data science. CyberGIS has rapidly emerged as a major force in private and public sector organizations and in higher education for harnessing the rapid geospatial data revolution. The Department is the birthplace of cyberGIS, and thus well positioned to establish an online, revenue-generating, Master's degree program to lead instruction on this cutting-edge area. Whereas universities like Penn State and Southern California have successful online GIS programs each generating over one million dollars in annual revenue, our program would be the first to deliver an online program focused on cyberGIS and geospatial data science.

The University of Illinois at Urbana-Champaign has established international visibility in this field which continues to grow as ground-breaking research is being generated from the CyberGIS Center. Increasingly employers are looking for workers who are well prepared with skills in cyberGIS and geospatial data science. Additionally, the university is home to powerful digital infrastructure (see Virtual ROGER – CyberGIS Supercomputer - http://cybergis.illinois.edu/infrastructures/) which continues to be innovated by CyberGIS Center leveraging both campus and external support. Such advanced cyberGIS infrastructure established through multi-year investment from the National Science Foundation and our University does not exist at any of our peer institutions, and thus offers an unparalleled strength for developing the proposed revenue-generating graduate program. In summary, the new program would be the first fully online M.S. degree in CyberGIS and Geospatial Data Science and would therefore have global reach and a large pool of potential applicants.

2) What type of employment outlook should these graduates expect? Explain how the program will meet the needs of regional and state employers, including any state agencies, industries, research centers, or other educational institutions that expressly encourage the program's development.

The new online M.S. degree in CyberGIS and Geospatial Data Science will prepare this cross-section of students to work, or continue to work as GIS Analysts, Geospatial Data Scientists in private or public-sector jobs that focus on the analysis, management, processing, and visualization of geospatial data. These skills will be useful to a variety of sectors and industries ranging from local and regional to national and global employers including in such areas as emergency management, energy, health, infrastructure, public safety, transportation, sustainability, and water resources. Having the skills in cyberGIS and geospatial data science also enables students to compete for jobs in the broader data science. An M.S. degree is essential for desirable jobs in many industries that employ Geospatial Data Scientists, specifically for career advancement. Key skills developed through the program include, high-performance and data-intensive geospatial computing, geospatial data management, geospatial visualization and visual analytics, and innovative cyberGIS applications.

As discussed in the "Program Description and Justification" section, the new online M.S. program in CyberGIS and Geospatial Data Science is designed to meet high demand for geospatial data science and would be a unique program that focuses on cyberGIS when compared to other GIS programs offered by peer schools. A market analysis at https://www.geospatialworld.net/blogs/gis-and-spatial-analytics-market/ projects the global GIS and spatial analytics market to grow 10+ % in the next several years without any sign of slowing down in the foreseeable future. A major driver of this growth

is rooted in geospatial big data being generated ubiquitously via remote sensing, social media, sensor networks, and mobile devices, all of which have geographic and location components. Already a leader in this cutting-edge field of harnessing the geospatial data revolution through cyberGIS discovery and innovation, GGIS within SESE and the University have a remarkable opportunity to take advantage of this leadership to become a major player in cyberGIS and geospatial data science online education. Tremendous impacts are expected to make the University a global leader in this strategically important science and technology context.

3) What resources will be provided to assist students with job placement?

The students in the online program will receive academic advising and mentoring by a team of GGIS specialized faculty led by Research Associate Professor: Dr. Anand Padmanabhan. More generally, the Department of GGIS will continue to communicate all job announcements to all students. Furthermore, GGIS will participate in the LAS new Corporate Affiliates Program (CAP), the goal of which is to foster relationships with alumni positioned in related public and private sector organizations. GGIS will also build on the relationships it has built with employers for many of its programs to provide students with opportunities like internship and capstone projects to give them exposure to potential employers.

PROGRAM REGULATION

1) **Describe how the program is aligned with or meets licensure, certification, and/or entitlement requirements, if applicable.**

   Not applicable. This is not a licensure or certification program and it is not regulated.

2) **Is the career/profession for graduates of this program regulated by the State of Illinois?**

   No

ACADEMIC CATALOG ENTRY

1) **All proposals must submit the major requirements (courses, hours) for the proposed curricula. Please see the University of Illinois Academic Catalog- http://catalog.illinois.edu/ for your unit for an example of the entry.**

CyberGIS and Geospatial Data Science, MS (Overview)

Head of Department: Dr. Shaowen Wang
Director of Graduate Studies: Dr. Brian Jefferson

Department Website: ggis.illinois.edu
College Website: https://las.illinois.edu/

Overview of Graduate College Admissions & Requirements: https://grad.illinois.edu/admissions/apply
email: geography@illinois.edu
phone: (217) 333-1880
Office address:
2044 Natural History Building
1301 W. Green Street
Urbana, IL 61801

The fully online M.S. degree program in CyberGIS and Geospatial Data Science requires 32 credit hours (thesis not required), 12 of which must be from GGIS (12 at the 500-level). Students must work with their advisors to individualize their program and the required capstone research project. Students must complete a minimum of 24 hours of coursework, 16 of which must be from within the unit. All students must maintain a minimum grade point average (GPA) of 3.0 (A = 4.0). If the GPA falls below this minimum after 12 graduate hours of graded coursework, it must be raised to 3.0 or above after the completion of 12 additional graduate hours of graded coursework and must be maintained at or above the minimum thereafter.

For additional details and requirements refer to the department's Graduate Degree Programs and the Graduate College Handbook.

Proposed Requirements	Proposed Credit Hours
Complete 2 of the following courses focusing on GIS GEOG 403,- 4 hours GEOG 477, - 3 hours GEOG 480- 3 hours 	 6-7
Complete 2 of the following courses focusing on core concepts of cyberGIS and geospatial data science topics : GEOG 407, - 4 hours GEOG 507, - 4 hours	

GEOG 570 - 4 hours	
	8
Complete the following 2 advanced courses in cyberGIS and geospatial data science: GEOG 517, - 4 hours GEOG 527- 4 hours	
	8
Additional 400-500 level courses as needed to meet or exceed the minimum credit hour requirement of the program. Selected in consultation with the student's advisor; chosen from courses in the GIS and core concepts lists (if not taken to meet those requirements) or from a list of electives maintained by the department.	
	6
GEOG 598 Graduate Capstone Project 4 hours	4
Total Hours	**Minimum: 32**

Other Requirements[1]

Proposed Requirement	
Other requirements may overlap	
Minimum Hours Overall Required Within the Unit	16
Requires a written capstone report	
At least 12 of the 32 required hours must be in 500-level courses (8 in GGIS).	
Course substitutions are permitted with the consent of the program coordinator.	
A maximum of 2 elective courses may be taken CR/NC.	
All students must maintain a minimum grade point average (GPA) of 3.0 (A = 4.0). If the GPA falls below this minimum after 12 or more graduate hours of graded coursework, it must be raised to 3.0 or above after the completion of 12 additional graduate hours of graded coursework and must be maintained at or above the minimum thereafter.	

[1] *For additional details and requirements refer to the Department's Graduate Degree Programs the Graduate College Handbook.*

Appendix A
CyberGIS and Geospatial Data Science, MS Non Thesis

Elective 400-500 level courses, selected with help from the student's advisor   6 hours

Atmospheric Sciences
ATMS 523   Weather and Climate Data Analytics

Geography and GIS
GEOG 473   Digital Cartography & Map Design
GEOG 476   Applied GIS to Environ Studies
GEOG 477   Introduction to Remote Sensing
GEOG 489   Programming for GIS

Appendix A
CyberGIS and Geospatial Data Science, MS Non Thesis

Elective 400-500 level courses, selected with help from the student's advisor   0-4 hours

Atmospheric Sciences
ATMS 523   Weather and Climate Data Analytics

Geography and GIS
GEOG 473   Digital Cartography & Map Design
GEOG 476   Applied GIS to Environ Studies
GEOG 477   Introduction to Remote Sensing
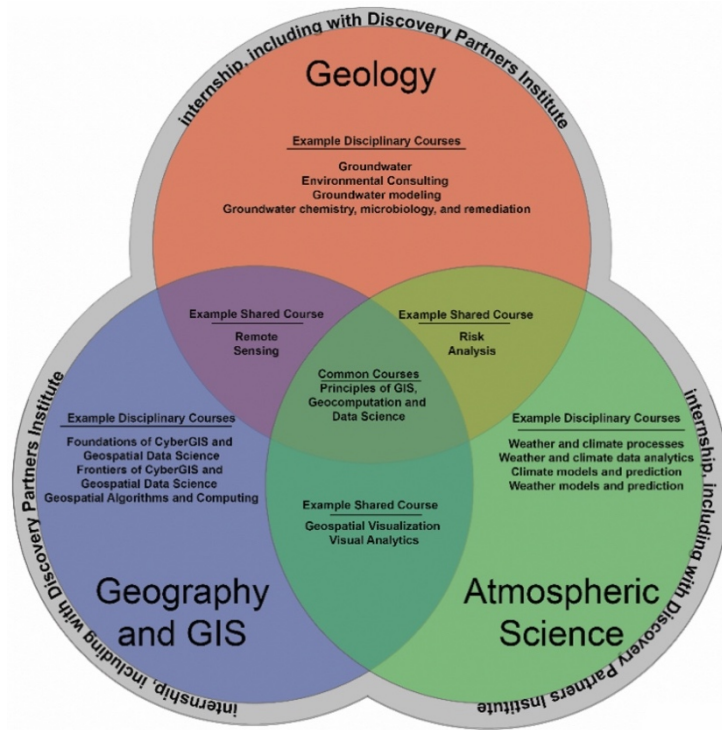GEOG 489   Programming for GIS

Fig. 1: The relationship between the Investment for Growth-funded courses offered in the proposed online SESE non-thesis M.S. degree programs.

GRADUATE COLLEGE

110 Coble Hall, MC-322
801 S. Wright St.
Champaign, IL 61820

PROGRAM TUITION WAIVER POLICY PROPOSAL

Proposals to establish or revise tuition waiver policy for a graduate program will follow a shared governance approval process (Department, School, College, Graduate College).

Definitions of Tuition Waiver Policy Designations:

Traditional Programs. Programs either designated as generating **full or base-rate** tuition waivers. Base rate waivers waives only the Resident Graduate Base tuition amount. Non-Residents or students in a program with an additional tuition differential will be responsible for the remaining portion of tuition.

Reimbursable Programs. Programs identified as programs that would be reimbursed from an appointing unit outside their academic college.

Cost-recovery and self-supporting programs. Students in approved cost-recovery and self-supporting programs are not eligible to receive tuition and fee waivers except statutory waivers. Students in these programs are not eligible to hold a waiver generating graduate appointment (Assistantship or Fellowship). Full time employees may be admitted to these programs, but their employee waiver is not eligible for use towards a program with this designation.

Additional information related to these tuition waiver designations can be found here: http://www.grad.illinois.edu/gradhandbook/2/chapter7/tuition-waivers#otherprovisions.

PROGRAM INFORMATION

COLLEGE OR SCHOOL: _____

PROGRAM(s) (Include Program Codes if applicable):
_____

REQUESTED DESIGNATION (Check box next to desired designation type):

☐

Comments:

JUSTIFICATION: On a separate sheet, please address the following.

1. Describe the reasons for this request and explain: (a) the pros and cons of the classification requested, and (b) how the requested classification will benefit and not adversely affect the academic quality of the program.

2. What type of financial assistance will be offered to students in the program?

3. Has this program had past practice of offering graduate assistantships? If so, please describe.

4. What provisions will be made to communicate the new classification to prospective and newly admitted students?

APPROVALS: (May use Adobe Signature or print and sign the document)

Department Executive Officer Signature and Date: _____

Disciplinary College Signature and Date: _____

Graduate College Signature and Date: _____