IBHE PROGRAM REVIEW REPORT
MS in Geographic Information Sciences

1. **Reporting Institution**: Eastern Illinois University
2. **Program Reviewed**: PSM in Geographic Information Sciences (CIP 45. 0702)
3. **Date:** January 20, 2021
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5. Overview

The GIScience Masters at Eastern Illinois University was established in 2013 for the purpose of training students in the principles of Geographic Information Science. The program seeks to deliver focused training within the geospatial discipline which can be integrated within the greater context of STEM skills. The curriculum focuses on database management and design, data acquisition, enhanced visualization, geospatial data analysis, and web-based development. Upon completion, students should have the ability to plan, prepare, and carry out GIS-based problem-solving and effectively communicate results in oral or written form. The goal is to provide students the skills they need to succeed and advance professionally within the contemporary workforce.

The program was certified as a Professional Science Master's (PSM) degree shortly after inception. PSMs emphasize experience (both individual and team-based), leadership, and communication skills while providing hands-on experience in a mentored, professional environment. As such, the focus of the GIScience PSM at Eastern has shifted to emphasize communication and management skills as well as technical expertise. Efforts are being made to address the needs of working professionals in Illinois, by providing greater flexibility in curriculum and modes of delivery.

The GIScience PSM degree utilizes classes from a great number of cooperating departments at the university including Geology/Geography, Technology, Political Science, Masters in Business Administration, Biological Sciences, Computer and Information Technology, Math and Computer Science, and Operations and Supply Chain Management. Though originally conceived as an interdisciplinary degree housed in both Geology/Geography and Biological Sciences, the loss of key faculty in Biological Sciences resulted in the degree being housed in the Geology/Geography department since 2017. Though advised and coordinated in GEO, the participation and input of the aforementioned departments remains key. Core courses still include mandatory interdisciplinary work (MBA or Political Science courses).

The rationale of the degree remains training professionals capable of planning, implementing, and managing GIS projects, either alone or in a cooperative setting. The target market is early to mid-career professionals seeking to enhance their skills and advance their career. To this end the focus remains on internships or mentored independent work to prepare students for the workforce. The vast majority of graduates to date have engaged in professional internships, many leading to permanent employment with the sponsoring organization. The culmination of the degree is an internship or research report, communicated in both written as well as oral form. This work is

overseen by a committee of professors who evaluate candidates based on preparedness and professionalism in addition to technical skills.

To date, the program has drawn a diverse pool of applicants, including traditionally underserved constituencies in STEM. Our program currently serves individuals from the African-American and Latinx communities and includes several first-generation college students. An international component has participated in the program over the past few years, with especially strong representations of African and South Asian students.

Students have earned several awards and achievements during the short time the degree has been in place. Several EIU PSM students have been recognized by the Illinois GIS Association as outstanding student of the year for their contributions to the discipline, many national and international conference presentations have resulted from student/professor collaborations, and at least one refereed publication has resulted. Students are encouraged to remain active in local and national associations to build professional networks of support.

To ensure the PSM GIScience experience conforms to industry needs, an advisory committee composed of individuals from city, county, state, federal and private workforces convenes on a semi-annual basis to review the status of the program. This professional board offers suggestions and feedback about student skills and program deficiencies. Many of these suggestions have been incorporated into curricular changes over the past eight years. These industry professionals have also been a key source of internships for students. In one case, a board member has agreed to serve as an adjunct faculty member to broaden our course offerings. Additionally, follow-up surveys have been conducted with alumni to gather feedback on their experience in the program and success in the job market.

A number of changes have been implemented since the start of the program. The overall degree plan has been refined and focused into a much clearer path. Several courses have been removed and replaced with more timely offerings to ensure students retain a competitive edge in skills. In recognition of the non-traditional status of many students, improvements have been made (and continue to be executed) to offer multiple, flexible paths to degree completion. These resulted in Fall 2020 producing the largest group of successful degree candidates to date.

The list of graduates from the PSM in GIScience to date includes:

Name	Graduated	Internship or Research	Current Job
Sanjiv Vajjala	SP13		Continental Mapping Consultants
Clayton Ballerine	FA13	Illinois State Water Survey	Illinois State Water Survey
Dian Nurhayti	FA13	Champaign County Public Health	Illinois State Water Survey
Justin Pinnell	FA13	EIU Facilities	City of Decatur
George Cernetig	FA14	EIU Facilities	Sanchez and Assoc.

Brittany Walbright	FA14	Illinois State Geological Survey	Ameren
Hayden Passarelli	SP15	City of Danville	Burns and McDonnell
Anwesh Punogumati	SP15	Coles County Regional Planning	Cognizant
Grant Woods	SP15	Army Corps of Engineers	Army Corps of Eng.
Daniel Odili	SU15	TDS Telecom	TDS Telecom
Nathan Hardwick	FA15	Grand Island Archaeology Project	National Information Solutions Cooperative
Brian Howard	FA15	EIU Facilities	Utilimap
David Hopkins	SP15	Lockport Public Works	Montrose Air Quality Services
Srikanth Vykuntapu	SP16	Coles County Regional Planning	
Ali Akbar Moghaddem	SP16	City of Charleston	Stantec Consulting Servieces
Miles Dwiggins	FA16	City of Danville	CN Rail
Roger Cunningham	FA18	Bureau of Land Management	
Annie Cerminara	SP18	City of Charleston	Home Depot
Scott Hall	SP18	EIU Facilities	IDOT
Matt Wellbrook	SP18	Northern Illinois University	GIS Employment – Denver CO
Ademola Adayemo	SU18	Village of Elk Grove	Google
Kailash Subrumanian	SU19	Utilities Incorporated	Utilities Incorporated
Bolarinwa Oladipupo	SU19	Coles County Regional Planning	Coles County Regional Planning
Allison Hudson	FA19	Coles County Regional Planning	Coles County Regional Planning
Balogun Adams Damilare	FA19	Coles County Regional Planning	
Shirley Mensah	SP20	Rural King	Working on Ph.D.
Abdulaziz Albahouth	SU20	Fox Ridge State Park	King Fahd University
Agenda Nawa	SU20	Homeless Accessibility Study (Dr. Kronenfeld)	
Kwang-Il Yoo	FA20	State of Indiana	Working on Ph.D.
Micah Williamson	FA20	Cloudpoint Geospatial	GIS, Inc.
Phillip Garrett	FA20	NIR Study of Cahokia Mounds (Dr. Viertel)	
Sushma Saragadam	FA20	TEK SPIKES (HAIS)	TEK SPIKES (HAIS)
Veeren Poola	FA20	C4 Tech Services	C4 Tech Services
Veda Vemulpalli	FA20	COVID Vaccine Distribution Study (Dr. Viertel)	
Raju Thupran	FA20	TEK SPIKES (AT&T)	TEK SPIKES (AT&T)

6. Major Findings and Recommendations

a. Description and assessment of major changes in the program/disciplinary context

Several shifts in context have occurred resulting in major programmatic changes. First, the departure of several key Biological Sciences faculty led to the movement of the program to the Geology/Geography Department. This faculty shift also led to the inclusion of more Technology and Political Science-focused courses to take advantage of university expertise and provide greater synergy. Changes also work to better-align with the interests and demands of incoming students. It was observed many students were either interested in GIS as an adjunct of technology, or as a skill to be practiced in the planning/municipal management discipline. The addition of appropriate classes to our curriculum supports these needs.

In approximately 2015 it became clear that growing hardware needs were difficult to keep pace with in a timely manner. To ease the costs of physical hardware demands, all the GIScience courses shifted to virtualized server software, better able to flexibly meet software demands. This had the benefit of allowing classes to be offered online without students meeting specific hardware demands at home. By logging in to the university portal and accessing the software on EIU servers, all students are able to share the same seamless experience (dependent only upon a certain minimum bandwidth). Students successfully complete labs using only cell data service on a regular basis. Having this in place some years ago not only helped immensely when the 2019 COVID pandemic arrived, but is facilitating the upcoming move for faculty to offer the full PSM degree online.

Efforts have been made to increase the potential points of entry for the degree for GIScience students. An increasing number of EIU undergraduates have expressed an interest in staying on for the Master's degree after completing their undergraduate work. To this end, we worked with the EIU Graduate College to craft an accelerated Masters which allows students to reserve certain classes taken while still of undergraduate status towards later use in the PSM in GIScience. This can conceivably shorten the term of the degree by a semester for students, while keeping them on campus and actively engaged in their education. The first accelerated student completed the graduate program in the Spring of 2020. Currently, three more of these accelerated students have moved on to graduate status in the PSM program. In an effort to better meet our students where they need us, we have also established a joint Master's degree available in conjunction with EIU's Sustainability Masters. To date several students have chosen to pursue this option.

Finally, to gain a greater understanding of how the PSM in GIScience fits into the shifting professional market, the coordinators have instituted embedded assessments of both technical proficiency and communications skills. This is assessed both within individual classes and within final internship/research project presentations. This effort has been paired with outreach to alumni through surveys conducted on a three year basis. The results of the first such survey indicated a high degree of satisfaction with course preparation and career success among graduates. The input of these and other stakeholders helped direct our development of new courses as well (see part C below).

b. Description of major findings and recommendations for program improvement

First and foremost, being a degree catering to working professionals, greater flexibility in delivery is essential. Today this clearly means online delivery. The location of EIU limits the number of students available to commute to our campus. To this end we are moving all necessary components to complete the graduate degree online beginning in Fall 2021. With all the building blocks for delivering remote instruction in place, opening up the degree to a wider audience can vastly improve reach and efficiency in class delivery. With limits on the faculty available to teach within the program, this road was not open in the past. But moves to broaden the curriculum allow this degree to make use of other online assets at the university (such as the popular online Master's in Political Science).

Secondly, this leads to the need for greater flexibility in course acceptance, particularly in non-core offerings. The current list of acceptable electives is unnecessarily restrictive. Not all of these courses are offered on a regular basis. Opening up the options for the management side of the degree (for instance, accepting Budgeting classes or Technology Management courses) will allow students to meet professional standards in a less rigid manner. By revising and refining the curriculum, we can deliver a more tailored degree without the need for extra resources.

The third need is to evolve course offerings. Though several courses have been added throughout the past several years (see part C below), more offerings are necessary. New classes (such as Web Mapping) are currently in the preparation stage, catering to growing trends in communication and dissemination of data. In such a technical area of expertise as GIScience it is recognized subject matter must constantly evolve to remain relevant.

Finally, there may be opportunities to exchange credit or "course share" with other Illinois institutions. Preliminary talks have been held with Western Illinois about allowing our students to enroll in particular specialty courses they offer online, while welcoming their students to our own unique offerings. Though in the nascent stage, this could lead to greater efficiencies and allow students to acquire specialized knowledge otherwise unavailable locally.

c. Description of actions taken since the last review

It should be noted that this is the first full review of the PSM in GIScience. As such, the scope of actions discussed is from the approval of the program by the IBHE in 2013.

Several specific changes have been executed over the past eight years. First, the curriculum has been refined from what was originally a loose set of class selections across a number of disciplines in order to sharpen focus. The original curriculum involved just three core courses, one course from each participating discipline, as well as twelve to fifteen hours from any single participating discipline. While certainly flexible, this led to an ill-defined structure for students. This course of study was amended in 2016 to instead feature four core courses (two in GIS, two in Management/Business), one statistics course, one internship (or mentored research with faculty approval), and fourteen additional hours from across the participating disciplines. This encourages students to take core courses first while continuing to provide flexibility in specialty later on. As

mentioned, the schedule of elective classes is currently in review as well as some possible minor modifications to the core classes.

The courses offered have also been overhauled since the degree started. Outdated courses such as GIS 2 and GPS were retired, allowing for a smoother pathway for students to move from GIS 1 to specialty classes such as Geodatabases. New classes have been added to reflect changing needs. These courses include GIS Programming, Mapping Lidar, Geospatial Data Models among other additions from disciplines such as Technology (Management of Technology) and Operations and Supply Chain Management (Big Data). A number of other courses have been offered as seminars and are in the process of becoming permanent classes. This list includes Web Mapping, Cartography, Spatial Statistics, Geospatial Intelligence, and the PSM in GIScience Seminar. This last course is a one-hour offering we plan to require all students take to orient them to the university, the department, and the discipline. Implementing this with the last three cohorts of PSM students has led to better outcomes in student production, leading to less attrition in the program and greater clarity of research and professional expectations.

A PSM advisory board was established and has met on several occasions, bringing outside oversight and input to program's evolution. This board is composed of stakeholders from local, regional, state, federal, and private sectors. These professionals have provided useful feedback and mentoring to our graduate students. Several of these individuals have provided internship opportunities. In one case, a board member not only identified the unique opportunity for a class on GIS in intelligence agencies (Geospatial Intelligence), he also agreed to teach this course as an adjunct faculty member. This gives EIU students unique insight into a corner of the GIScience discipline not covered in any other class in Illinois.

As mentioned, both an accelerated option and a dual-degree with Sustainability have been added as possible pathways into the GIS degree. Excellent students have emerged from each pathway to date, demonstrating research acumen during their studies as well as long-term success in the field. Work continues to market and raise the profile of the program among interested parties.

d. Description of actions to be taken as a result of this review

This review has benefitted the PSM in GIScience by underlining opportunities for continued improvement. The strongest priority is to move the curriculum fully online. By providing greater flexibility in terms of timing and mode of delivery, this change will broaden the appeal of the program and allow it to serve a greater number of working, non-traditional students looking for professional advancement. Investing the available faculty resources in online delivery allows a greater impact while still meeting the needs of local students.

Revisions to curriculum cannot end with current proposed changes. It is evident the shifting needs of the discipline will require evolution of curriculum to ensure relevance. By moving traditional subjects (such as Cartography) to new formats (Web Mapping) the PSM degree can keep skills fresh and responsive without losing core theoretical competencies.

A greater effort is possible to engage advisory board members and alumni. Making better use of these assets (for instance symposia or alumni panels), can provide useful dividends to current students, alumni, and outside stakeholders as well. More effort to quickly engage students in professional organizations and encourage presentations (rather than waiting until the end of their graduate program) could polish communication skills long-term and benefit employability. Greater community engagement as a formal part of the program would also help diversify experience beyond the classroom.

And finally, there is always opportunity to better listen and respond to student needs. The current pandemic is an objective lesson in the need for adaptability as we serve graduate students. Responsive and active engagement with students (whether past, present, or yet to come) will define the effectiveness of the PSM in GIScience at EIU.

7. Responses to Institution-Assigned Issues – N/A

8. Outcome

Dean's Comment:

The Professional Science Masters in Geographic Information Sciences (PSM in GISci) has developed into a successful program. As highlighted in section 5, a large percentage of students who completed the program have been able to secure employment in their field of study and a few have moved on to Ph.D. programs. While the program continues to attract quality students, a recent downturn in enrollment (particularly among international students) led to the decision to shift from primarily face-to-face to fully online delivery. The program has also instituted several curricular changes to better reflect faculty expertise and address changing disciplinary demands. In an effort to improve the program and better engage with stakeholders, an advisory board was created soon after the PSM in GISci was launched. Some recently instituted new student pathways include an accelerated option for undergraduate students to enter the program and a dual degree with the M.S. in Sustainability.

We recommend a decision of **Program in Good Standing.**

8.1 Academic Affairs Decision:

___X__ Program in Good Standing

_____ Program flagged for Priority Review

_____ Program Enrollment Suspended

8.2 Explanation

First and foremost, the PSM graduates are of the highest quality and the program has a record of outstanding outcomes/student placements. Having said that, the Office of Academic Affairs

recognizes that the program has had a record of relative, sometimes uneven, success meeting the minimum benchmarks for degrees awarded (a 3-year average of 5 degrees awarded) and the overall enrollment has consistently been at, or slightly below, the IBHE benchmark of 10 enrolled students per year. Despite lower enrollments, the program benefits by its his high completion rate and relatively quick time to degree. Unfortunately, based on current enrollment, the prospect of 5 or more degrees being awarded per year over a sustained three year period is unlikely in the near term.

Given the challenges facing the program, I applaud the faculty for being proactive and moving towards a more flexible online program that seeks to be as interdisciplinary and collaborative as possible. Likewise, I appreciate the recognition that a dynamic PSM needs to embrace emerging technologies—such as web mapping—and I would AI/machine learning, too.

In the end, the program quality is outstanding and merits the "good standing" designation. If the enrollments and total degrees awarded do not materialize over the next few years though, the program will be flagged by the IBHE and classified as "priority review" as part of the biennial APEER process. As Fall 2021 is a new APEER cycle, enhanced enrollments will be essential.

Jay D. Gatrell
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