



UNIVERSITY
AT ALBANY

State University of New York

Senior Vice President for Academic Affairs & Provost

UPDATED PROPOSAL – MAY 1, 2017

March 17, 2017

Dr. Alexander Cartwright
Provost and Executive Vice Chancellor
State University of New York
System Administration
State University Plaza
Albany, New York 12246

Dear Dr. Cartwright:

On behalf of the faculty at the University at Albany, I am pleased to transmit the attached proposal for establishment and registration of a Master of Science program in Geographic Information Science. This proposal has been fully considered and approved through our campus governance system.

We are appreciative for anticipated efforts by staff in your Office of Program Review for the consideration of the proposal. Should there be any technical questions or the need for additional materials, please have inquiries directed to Jonathan Bartow, Vice Dean for Graduate Education (jbartow@albany.edu) at our campus. As always, we thank you for your on-going support.

Sincerely,

Darrell P. Wheeler, PHD, MPH
Interim Provost and Senior Vice President for Academic Affairs

Enclosure

- c. Dean Kevin Williams, Graduate Education
- Dean Edelgard Wulfert, College of Arts & Sciences
- Vice Dean Jon Bartow, Graduate Education



New Program Proposal: Graduate Degree Program

Form 2B

This form should be used to seek SUNY’s approval and the State Education Department’s (SED) registration of a proposed new academic program leading to a graduate degree. Approval and registration are both required before a proposed program can be promoted or advertised, or can enroll students. The campus Chief Executive or Chief Academic Officer should send a **signed cover letter and this completed form** (unless a different form applies¹), which should **include appended items** that may be required for Sections 1 through 10 and MPA-1 of this form, to the SUNY Provost at program.review@suny.edu. The completed form and appended items should be sent as a single, continuously paginated document.² Guidance on academic program planning is available at http://www.suny.edu/provost/academic_affairs/app/main.cfm.

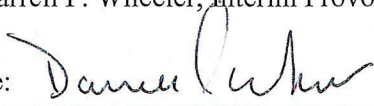
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¹Use a different form if the proposed new program will lead to an undergraduate degree or any credit-bearing certificate; be a combination of existing registered programs (i.e. for a multi-award or multi-institution program); be a breakout of a registered track or option in an existing registered program; or lead to certification as a classroom teacher, school or district leader, or pupil personnel services professional (e.g., school counselor).

²This email address limits attachments to 25 MB. If a file with the proposal and appended materials exceeds that limit, it should be emailed in parts.

Section 1. General Information	
Item	Response (type in the requested information)
a) Institutional Information	Date of Proposal: 12/17/2015
	Institution's <u>6-digit SED Code</u> : 210500
	Institution's Name: University At Albany
	Address: 1400 Washington Ave, Albany, NY 12222
	Dept of Labor/ <u>Regent's Region</u> :
b) Program Locations	List each campus where the entire program will be offered (with each institutional or branch campus <u>6-digit SED Code</u>):
	List the name and address of <u>off-campus locations</u> (i.e., <u>extension sites or extension centers</u>) where courses will offered, or check here [<input type="checkbox"/>] if not applicable :
c) Proposed Program Information	Program Title: Geographic Information Science
	<u>Award(s)</u> (e.g., M.S., Ph.D.): M.S.
	Number of Required Credits: Minimum [36] If tracks or options, largest minimum []
	Proposed <u>HEGIS Code</u> : 2206
	Proposed 6-digit <u>CIP 2010 Code</u> : 45.0702
	If the program will be accredited, list the accrediting agency and expected date of accreditation: If applicable, list the SED <u>professional licensure title(s)</u> ³ to which the program leads:
d) Contact Person for This Proposal	Name and title: Jonathan Bartow, Vice Dean for Graduate Education Telephone: 518-437-5062 E-mail: jbartow@albany.edu
e) Chief Executive or Chief Academic Officer Approval	Signature affirms that the proposal has met all applicable campus administrative and shared governance procedures for consultation, and the institution's commitment to support the proposed program. <i>E-signatures are acceptable.</i>
	Name and title: Darrell P. Wheeler, Interim Provost & Senior Vice President for Academic Affairs
	Signature and date:  17 March 2017
	If the program will be registered jointly⁴ with one or more other institutions, provide the following information for <u>each</u> institution:
	Partner institution's name and 6-digit <u>SED Code</u> :
	Name and title of partner institution's CEO:
	Signature of partner institution's CEO (or append a signed letter indicating approval of this proposal):

Version 2013-10-15

³ If the proposed program leads to a professional license, a specialized form for the specific profession may need to accompany this proposal.

⁴ If the partner institution is non-degree-granting, see SED's CEO Memo 94-04.

Section 2. Program Information

2.1. Program Format

Check all SED-defined [format, mode and other program features](#) that apply to the **entire program**.

a) **Format(s):** Day Evening Weekend Evening/Weekend Not Full-Time

b) **Modes:** Standard Independent Study External Accelerated Distance Education

NOTE: If the program is designed to enable students to complete 50% or more of the course requirements through distance education, check Distance Education, see Section 10, and append a [Distance Education Format Proposal](#).

c) **Other:** Bilingual Language Other Than English Upper Division Cooperative 4.5 year 5 year

2.2. Diploma Program

NOTE: This section is not applicable to a program leading to a graduate degree.

2.3 Program Description, Purposes and Planning

a) What is the description of the program as it will appear in the institution's catalog?

The Master of Science in Geographic Information Science (MSGIS) prepares students for careers in a wide range of social and environmental application areas that make use of the technologies and methodologies of spatial analysis and mapping.

Program of Study

1. Core courses (21 credits) including Gog 529 Spatial Statistics, Gog 584 Remote Sensing I, Gog 585 Remote Sensing II, Gog 590 Advanced Cartography, Gog 597 Advanced GIS, Gog 692 Seminar in GIS, Gog 592 GIS Project Development (capstone).

2. Elective courses (15 credits) chosen from Gog 501 Energy, Environment and Climate Change, Gog 518 Ecological Modeling, Gog 522 GIS for Social Sciences, Gog 524 Landscape Ecology, Gog 579 Fundamentals of Applied Global Positioning Systems, Gog 594 Landscape Rendering, Gog 685 Seminar in Remote Sensing, Gog 695 Graduate Internship in Geography, Gog 697 Independent Study, Ehs 612 Geographic Information Systems and Public Health.

b) What are the program's educational and, if appropriate, career objectives, and the program's primary student learning outcomes (SLOs)? *NOTE: SLOs are defined by the Middle States Commission on Higher Education in the [Characteristics of Excellence in Higher Education](#) as "clearly articulated written statements, expressed in observable terms, of key learning outcomes: the knowledge, skills and competencies that students are expected to exhibit upon completion of the program."*

Graduates of the program will have attained the following educational and career objectives:

They will understand the fundamental theories of spatial analysis and their environmental and social applications. This competency will be assessed through the successful completion of the program's core course Gog 597 Advanced GIS.

They will have achieved facility in the fundamental methodologies, and tools necessary for the analysis of spatially-related data and the communication of their results. These skills arise from continual practice in classroom, lab, and internship environments using state of the art software systems for performing analyses in GIS, Remote Sensing, and GPS applications. Success in these skills translates into the ability to solve real-life problems through the promotion of critical thinking and self-learning. This competency will be assessed by satisfactory completion of the sum of our core courses and, for a student choosing to do an internship at one of our partnering agencies, these competencies can be further verified through the written evaluation of the student's internship mentor.

Students will be prepared for employment at a governmental agency requiring a completed graduate degree in GIS. New

York State Civil Service job title sequences such as Information Technology (<http://www.dec.ny.gov/about/46284.html>) now ask for degrees in computer information systems. Recent experiences of our MA in Geography graduates suggests that the path to jobs with Civil Service titles in this area are becoming difficult, if not impossible, to acquire without a degree title related specifically to GIS.

Graduating students will have demonstrated the following skills and competencies:

Facility with standard techniques of spatial analysis. Facility will be judged with respect to successful completion of the core course Gog 529, Spatial Statistics.

Understanding of the operation and application of standard software and hardware tools for data acquisition and analysis. Understanding will be assessed through the successful completion of coursework for the core courses, most notably Gog 597, Advanced GIS and Gog 585, Remote Sensing II.

c) How does the program relate to the institution's and SUNY's mission and strategic goals and priorities? What is the program's importance to the institution, and its relationship to existing and/or projected programs and its expected impact on them? As applicable, how does the program reflect diversity and/or international perspectives? For doctoral programs, what is this program's potential to achieve national and/or international prominence and distinction?

In his *Fall 2013 Report to the Faculty* (<http://www.albany.edu/administration/president-2013-fall-faculty-speech.php>), President Robert Jones established 4 key priorities for the continuing growth of the University at Albany:

"Expand degree-granting and research programs to meet demands in high-growth, high-needs areas, such as engineering, big data analytics, and allied health sciences;

Recruit and enroll more out-of-state and international students to ensure the diversity of perspectives that equips students to succeed in today's global society;

Deepen the University's engagement with the Capital Region, New York State and the world, forging partnerships that leverage our academic expertise to solve society's most pressing issues; and to sustain the excellence that currently exists,

And grow our financial resources to enable us to realize our ambitions."

The addition of a Master of Science in GIS (MSGIS) will satisfy all 4 of these priorities. First, GIS is both a high-growth and high-needs discipline. A 2012 report from the US Department of Labor (<http://www.bls.gov/emp/#tables>) projects GIS-related job growth (including areas more specifically related to Cartography and Remote Sensing) between 23% and 35% over the period 2010 to 2020.

Second, our location in the New York State Capital Region and our long standing GIS Internship Program relationships at many of those agencies will undoubtedly help to attract a broad range of in-state and out-of-state students. Beyond the attraction of the academic merits of our program, the practical training that internships at our partnering agencies supply will be an equally compelling incentive for applications and enrollments.

Third, internships are not one-sided student opportunities. Our interns and alumni have and will continue to serve in disaster preparedness, relief, and mitigation efforts in New York State Agencies such as the Department of Homeland Security and Emergency Services, the Department of Environmental Conservation, the Department of Health, and many others. On a regional scale, our interns serve in very diverse not-for-profit and governmental agencies ranging from the Early Care and Learning Council to the Hudson River Estuary Project and more. In smaller agencies, our students are often the only GIS experts in their office; their work is often essential to fulfilling the agency's mission of service to its community.

Fourth and last, as a self-paying graduate program (without assistantship offers), the MSGIS will be a lasting benefit to the University's financial well-being. As GIS employment opportunities continue to grow, our program will be a very important source of training for experts in the performance and communication of spatial analytical data products.

On a SUNY-wide level, the implementation of our proposal will also satisfy the criteria for 3 of the 6 strategic initiatives described in the *NYSUNY 2020 Challenge Grant* Executive Summary (September 2012:

http://www.albany.edu/news_images/nysuny2020etecfinal.pdf):

Emerging Technologies. The Department is currently taking a leading role in the development of augmented reality and location-based systems for environmental visualization. One of our faculty members (Mower) holds fundamental patent claims for performing static and mobile augmented reality applications (US Patent 6,930,715). Another faculty member is working with the University's Office of Technology Development exploring the licensing of technology for efficient and effective use of transportation data in intelligent transportation systems and location-based services (Lawson). Through a National Science Foundation grant, a third (Lapenas) has developed a new technology, "nanaphids," that remotely sample tree carbohydrate levels. And a fourth (Buyantuev) has been recently awarded an NSF Major Research Instrumentation grant for studying the use of unmanned aerial vehicles as remote sensing platforms for a range of problems in environmental resource evaluation.

Environmental and Economic Sustainability. GIS is a universal tool that geographers, economists, and planners apply to the study of spatial patterns and interrelations among natural and human-control processes. Graduates holding our GISSA Certificate find jobs in federal, state and private institutions and participate in projects related to environmental and economic sustainability. During the last few years, the Department has seen a growing demand for graduates with rigorous knowledge of statistics, database management, and the innovative application of Remote Sensing (RS) technologies to the discovery and exploitation of alternate energy sources. We expect that the new MSGIS will also help to support the emerging SUNY Sustainability Initiative.

Public Service and Policy. A new Master of Science in GIS will provide unparalleled opportunities for University at Albany students to study social, economic, and political circumstances of decision making at various levels. As GIS technology becomes ever more pervasive in the public sector, new challenges to and opportunities for democratic decision making will ensue. Through the MSGIS program, existing faculty will be free to offer new courses that demonstrate the use of GIS for democratic policy development and implementation.

d) How were faculty involved in the program's design?

Work on the proposed MSGIS began in Fall 2011 as a response to the Governor's and Chancellor's NY SUNY 2020 Initiative. Although initial work on that proposal began with a core of faculty primarily responsible for teaching and research in GIS and Remote Sensing topics, the general Department of Geography and Planning faculty became involved as the proposal was prioritized among other Department proposals for presentation to College of Arts and Sciences and University governance committees. During the prioritization process, numerous faculty comments and suggestions were incorporated into our proposal. In May 2013, the University at Albany Provost selected the MSGIS for funding and granted our Department permission to submit a Letter Of Intent to SUNY System. The faculty have subsequently refined aspects of the proposal (specifically curricular content) for the full proposal that we are now submitting.

e) How did input, if any, from external partners (e.g., educational institutions and employers) or standards influence the program's design? If the program is designed to meet specialized accreditation or other external standards, such as the educational requirements in [Commissioner's Regulations for the profession](#), append a side-by-side chart to show how the program's components meet those external standards. If SED's Office of the Professions requires a [specialized form](#) for the profession to which the proposed program leads, append a completed form at the end of this document.

Although the MSGIS is not an accredited program, throughout its development Geography and Planning faculty reached out to numerous colleagues in higher education, the community, and industry for their comments and suggestions. We received especially helpful curricular guidance from the University at Albany PhD Program in Informatics, a program with which several members of Geography and Planning are associated. We have attempted to make the MSGIS curriculum a bridge to the Informatics PhD wherever possible, making it as straightforward as possible for our students to remain in the University for further graduate study.

f) Enter anticipated enrollments for Years 1 through 5 in the table below. How were they determined, and what assumptions were used? What contingencies exist if anticipated enrollments are not achieved?

Year	Anticipated Headcount Enrollment		
	Full-time	Part-time	Total
1	10		10
2	20		20
3	25		25
4	30		30
5	35		35

Table 1. Expected new enrollments for the MS in GIS from the starting year through year 5.

The values in Table 1 were drawn from enrollment projections prepared for the Department of Geography and Planning NYSUNY 2020 Challenge Grant proposal and are embedded in the MOU between the Department of Geography and Planning and the University at Albany Office of the Provost. Each enrollee is assumed to take 12 credits for each of 2 semesters per year. Professor Mower, director of the GISSA Certificate program and the GIS track coordinator for the MA in Geography program, reports that most of the graduate application inquiries that he has received for GIS education first ask if the Department offers a master’s-level degree in Geographic Information Science. When they hear that we do not, some choose to enroll in our MA program with a GIS track, others enroll in the 15 credit GISSA program, and the rest look elsewhere for their educational needs. Although enrollment data for graduate GIScience degree programs nationwide are not readily available, the University of Texas-Dallas reports increases in enrollment from 3 in 2003 (the year the program was established) to 20 in 2007. As the major provider of GIS instruction in the Capital Region in New York State, and the program providing the majority of interns to state and regional agencies, we expect to be able to begin our program implementation with a headcount of 10 in our first semester. We plan to advertise the new program aggressively through visits to Geography departments at 4-year SUNY colleges as well as through revamped departmental promotional materials, focusing especially on web-based dissemination.

g) Outline all curricular requirements for the proposed program, including prerequisite, core, specialization (track, concentration), internship, capstone, and any other relevant component requirements, but do not list each General Education course.

Core: (required courses, 21 credits)

- Gog 529 Spatial Statistics
- Gog 584 Remote Sensing I
- Gog 585 Remote Sensing II
- Gog 590 Advanced Cartography
- Gog 597 Advanced GIS
- Gog 692 Seminar in GIS
- Gog 592 GIS Project Development (capstone)

Electives (15 credits) chosen from:

GIS Applications (select 2)

- Gog 501 Energy, Environment and Climate Change
- Gog 518 Ecological Modeling
- Gog 522 GIS for Social Sciences
- Gog 524 Landscape Ecology
- Ehs 612 Geographic Information Systems and Public Health.

GIS Technology (select 2)

- Gog 579 Fundamentals of Applied Global Positioning Systems

*Gog 594 Landscape Rendering
Gog 685 Seminar in Remote Sensing
Independent Study (select 1)
Gog 695 Graduate Internship in Geography
Gog 697 Independent Study

(* indicates new course)

h) Program Impact on SUNY and New York State

h)(1) *Need:* What is the need for the proposed program in terms of the clientele it will serve and the educational and/or economic needs of the area and New York State? How was need determined? Why are similar programs, if any, not meeting the need?

The U.S. Department of Labor notes that

“Geospatial products and specialists are expected to play a large role in homeland security activities. Information gathering needs to protect critical infrastructure have resulted in an enormous increase in the demand for such skills and jobs.” (Lorraine Castro, NIMA Human Resources Department, http://www.doleta.gov/Brg/Indprof/geospatial_profile.cfm., updated March 8, 2010)

William Johnson, Deputy Director of the Office of Cyber Security at the New York State Department of Homeland Security and one of our GIS Internship Program partners, notes that much of his agency’s current GIS application work is contracted out to private firms. He believes that graduates of a Master’s program in GIS possessing an understanding of geospatial application development would be very well received by his office. Another of our partners, Sam Wear, Assistant CIO for GIS at Westchester County writes

“As director of the County’s GIS program over the past twenty years, I have seen tremendous growth in the technology both in government and industry. In the near future, I believe job opportunities in the geosciences will be even better in the private sector, particularly in health and human services, environmental/land use planning, homeland security, and public infrastructure systems (water, sanitary, utilities) to name a few.”

Mauricio Roma, our internship partner at the New York State Office of the Attorney General notes

“Some of their [the GIS interns’] work is in the process of being used as evidence by the New York State Department of Environmental Conservation and the New York City Department of Environmental Protection Police as part of an enforcement case pertaining to the illegal disposal of construction and demolition debris in the NYC Watershed. Students pursuing a MSGIS would certainly have a much better educational background for the work that we do. In addition, I have observed that their work experience in our office, where they have applied their GIS expertise to our environmental needs, have helped them to find jobs in a very difficult job market.”

The structure and content of the degree curriculum will prepare students for positions in homeland security, environmental planning, protection, and management, application development, transportation planning, health, and in other fields requiring advanced skills in the representation and analysis of spatially referenced data. The Department of Geography and Planning maintains memoranda of understanding (MOUs) with several New York State agencies for the provision of GIS services. We currently place our students at the New York State Departments of Health, Environmental Conservation, Homeland Security, and Transportation, as well as in the New York State Office of the Attorney General and the NYS Office of General Services. Our students are held in such high regard that the New York State Office of Homeland Security specifically requested GIS volunteers from our student population to staff the State Emergency Management Office during the recent Hurricane Sandy superstorm event.

Our students have also taken internship positions in regional governmental agencies and NGOs. Participation in an internship has become a critical step toward employment in today’s GIS job market. Just as the required skill set for full-time GIS positions becomes more specialized, so have the qualifications for many of the more advanced GIS internship opportunities. Our proposal to establish the MS in GIS will not only ensure that our graduates remain competitive in

future job markets but that they excel in them. The MS in GIS will also, of course, provide a means by which students can qualify directly for New York State Civil Service GIS and mapping job titles.

The nearest operating MS in GIS program in New York State to our location is at Lehman College (CUNY) in New York City. Our location in New York State's Capital Region gives our students myriad opportunities to interact with the numerous New York State agencies located here. Our established internship relationships with these agencies will prove to be invaluable assets as our graduates search for subsequent employment in GIS-related fields.

h)(2) Employment: For programs designed to prepare graduates for immediate employment, use the table below to list potential employers of graduates that have requested establishment of the program and state their specific number of positions needed. If letters from employers support the program, they may be **appended** at the end of this form.

Employer	Need: Projected positions	
	In initial year	In fifth year

Although the MS in GIS program is designed to prepare graduates for jobs in governmental agencies that provide GIS services, agency policies forbid our GIS internship supervisors from providing letters of support for our program. Currently, 2 students are engaged in paid internships at the NY State Department of Health and 2 others at the NY State Department of Environmental Conservation. We have regularly placed unpaid interns at the NY State Department of Transportation, the NY State Office of the Attorney General, NYS Office of General Services, and other state offices or agencies.

h)(3) Similar Programs: Use the table below to list similar programs at other institutions, public and independent, in the service area, region and state, as appropriate. Expand the table as needed. **NOTE:** *Detailed program-level information for SUNY institutions is available in the [Academic Program Enterprise System \(APES\)](#) or [Academic Program Dashboards](#). Institutional research and information security officers at your campus should be able to help provide access to these password-protected sites. For non-SUNY programs, program titles and degree information – but no enrollment data – is available from [SED's Inventory of Registered Programs](#).*

Institution	Program Title	Degree	Enrollment
Lehman College	Geographic Information Science	MS	Although enrollment data is unavailable, Lehman awarded 2 degrees in 2013 and 2 more in 2014 as reported in Federal IPEDS Completion data
University at Buffalo	Geographic Information Science	MS	This program was approved in August 2015—no enrollment data is available
SUNY ESF	Geospatial Information Science and Engineering	MS	Average of 5 per year, 2011-2015

h)(4) Collaboration: Did this program's design benefit from consultation with other SUNY campuses? If so, what was that consultation and its result?

The design of this program benefitted from informal discussions with our colleagues at the University at Buffalo. No substantive changes from our original plans occurred as a result of this collaboration.

h)(5) Concerns or Objections: If concerns and/or objections were raised by other SUNY campuses, how were they resolved?

No concerns or objections were raised.

2.4. Admissions

a) What are all admission requirements for students in this program? Please note those that differ from the institution's minimum admissions requirements and explain why they differ.

The admission requirements for the MS in GIS include:

- Evidence of academic achievement at other institutions (transcripts and letters of recommendation) and
- Evidence of overall graduate education preparedness (GRE General Test and TOEFL)

The Department reserves the right to rank incoming applications by academic achievement and to limit accepted students up to the number of available program slots.

b) What is the process for evaluating exceptions to those requirements?

The Department of Geography and Planning will have an Admissions Committee in place for evaluation of MS in GIS degree applicants. The Committee will evaluate exceptions on a case-by-case basis. It is likely that conditional admissions will be made based on the successful completion of remedial coursework.

c) How will the institution encourage enrollment in this program by persons from groups historically underrepresented in the institution, discipline or occupation?

The University at Albany has committed itself to the recruitment of underrepresented minorities as encouraged by former President Robert Jones's priority to "Recruit and enroll more out-of-state and international students to ensure the diversity of perspectives that equips students to succeed in today's global society." Our program will also consult with the University at Albany Office of Diversity and Inclusion in the Fall semester of each academic year to implement strategies to attract women and underrepresented minority students. The Department of Geography and Planning has begun the process of establishing an articulation agreement between the Hudson Valley Community College (HVCC) Department of Biology, Chemistry, and Physics to create a clear path to our BA in Geography and to create additional opportunities for undergraduate GIS internship experiences. Since HVCC enrollments represent relatively high numbers of minority students, we hope to not only attract this cohort to our undergraduate programs but to attract them to the MSGIS as well, possibly in the context of a new combined BA/MSGIS program.

d) What is the expected student body in terms of geographic origins (i.e., same county, same Regents Region, New York State, and out-of-state); academic origins; proportions of women and minority group members; and students for whom English is a second language?

We expect that the largest draw to the program will come from New York state residents. However, due to our proximity to western Massachusetts, Vermont, Connecticut, and New Jersey, we expect to draw out-of-state students as well.

2.5. Academic and Other Support Services

a) Summarize the academic advising and support services available to help students succeed in the program.

Currently, 4 Department of Geography and Planning faculty are responsible for core content delivery in the MS GIS curriculum. Given that the 5th year cohort is expected to contain 30 enrollees, each faculty member would be responsible for advising approximately 7-8 students.

b) Describe types, amounts and sources of student financial support anticipated. Indicate the proportion of the student body receiving each type of support, including those receiving no support.

The MS GIS was designed to be a self-paying graduate program. However, several of our internship providers offer paid positions which can partly offset the cost of graduate education.

2.6. Prior Learning Assessment

If this program will grant credit based on Prior Learning Assessment, describe the methods of evaluating the learning and the maximum number of credits allowed, or check here [X] if not applicable.

2.7. Program Assessment and Improvement

Describe how this program's achievement of its objectives will be assessed, in accordance with SUNY policy, including the date of the program's initial assessment and the length (in years) of the assessment cycle. Explain plans for assessing achievement of students' learning outcomes during the program and success after completion of the program. Append at the end of this form, a plan or curriculum map showing the courses in which the program's educational and, if appropriate, career objectives – from Item 2.3(b) of this form – will be taught and assessed. *NOTE: The University Faculty Senate's Guide for the Evaluation of Undergraduate Programs is a helpful reference.*

The Department of Geography and Planning currently maintains a 7-year assessment cycle for its non-accredited programs. The most recent assessment was conducted in the Fall 2015 semester, We expect that the next review of our programs will be conducted in Fall 2020 and that the first assessment of the MS in GIS would occur at that time. The Department will apply the same methodology to the assessment of the MS in GIS that it performed in the Fall 2015 assessment to its other non-accredited programs. This will include:

- Direct assessment of student responses to examinations in selected core courses,
- Indirect assessment through student surveys, and
- Indirect assessment through student focus groups.

The application of these direct and indirect assessment tools will identify both successes and deficiencies in the program implementation. We will use the assessment results to continue to strengthen those factors leading to program strengths and correct those that have contributed to student dissatisfaction or unacceptable levels of performance. We will assess the success of our alumni through follow up email correspondence and through self-reporting on the program's web site.

The Department also conducts yearly assessments of its programs and courses to determine whether learning objectives are being met. Assessments at this level are conducted through item analyses of examination responses with respect to questions specifically related to targeted learning objectives.

Section 3. Sample Program Schedule and Curriculum

Complete the **SUNY Graduate Program Schedule** to show how a typical student may progress through the program. Either complete the blank Schedule that appears in this section, or complete an Excel equivalent that computes all sums for you, and can be found at http://www.suny.edu/provost/academic_affairs/app/forms.cfm. Rows for terms that are not required can be deleted.

NOTES: *The Graduate Schedule must include all curriculum requirements and demonstrate that expectations from Part 52.2(c)(8) through (10) of the Regulations of the Commissioner of Education are met.*

Special Cases for the Sample Program Schedules:

- For a program with multiple tracks, or with multiple schedule options (such as full-time and part-time options), use one Program Schedule for each track or schedule option. Note that licensure qualifying and non-licensure qualifying options cannot be tracks; they must be separate programs.
- When this form is used for a multi-award and/or multi-institution program that is not based entirely on existing programs, use the schedule to show how a sample student can complete the proposed program. **NOTE:** A different form (for program revisions) should be used for new multi-award and/or multi-institution programs that are based entirely on existing programs. SUNY policy governs the awarding of two degrees at the same level.

a) If the program will be offered through a nontraditional schedule (i.e., not on a semester calendar), what is the schedule and how does it impact financial aid eligibility? *NOTE: Consult with your campus financial aid administrator for information about nontraditional schedules and financial aid eligibility.*

b) For each existing course that is part of the proposed graduate program, append a catalog description at the end of this document.

c) For each new course in the graduate program, append a syllabus at the end of this document. *NOTE: Syllabi for all courses should be available upon request. Each syllabus should show that all work for credit is graduate level and of the appropriate rigor. Syllabi generally include a course description, prerequisites and corequisites, the number of lecture and/or other contact hours per week, credits allocated (consistent with [SUNY policy on credit/contact hours](#)), general course requirements, and expected student learning outcomes.*

d) If the program requires external instruction, such as clinical or field experience, agency placement, an internship, fieldwork, or cooperative education, append a completed [External Instruction](#) form at the end of this document.

SUNY Graduate Sample Program Schedule (OPTION: You can insert an Excel version of this schedule AFTER this line, and delete the rest of this page.)
Program/Track Title and Award: Geographic Information Science, leading to the Master of Science ___

- a) Indicate academic calendar type: [X] Semester [] Quarter [] Trimester [] Other (describe):
 b) Label each term in sequence, consistent with the institution's academic calendar (e.g., Fall 1, Spring 1, Fall 2)
 c) Use the table to show how a typical student may progress through the program; copy/expand the table as needed.
 d) Complete the last row to show program totals and comprehensive, culminating elements. Complete all columns that apply to a course.

Term 1: Fall					Term 2: Spring				
Course Number & Title	Credits	New	Co/Prerequisites		Course Number & Title	Credits	New	Co/Prerequisites	
Gog 597 Advanced GIS (core)	3				Gog 529 Spatial Statistics (core)	3			
Gog 590 Advanced Cartography (core)	3				Gog 692 Seminar in GIS (core)	3		Gog 590	
Gog 584 Remote Sensing I (core)	3				Gog 585 Remote Sensing II (core)	3		Gog 584	
Elective from GIS Applications	3				Elective from GIS Applications	3			
Term credit total:	12				Term credit total:	12			
Term 3: Fall					Term 4: Spring				
Course Number & Title	Credits	New	Co/Prerequisites		Course Number & Title	Credits	New	Co/Prerequisites	
Gog 592 GIS Project Development (core, capstone)	3		Gog 597						
Elective from GIS Technology	3								
Elective from GIS Technology	3								
Elective from Independent Study	3								
Term credit total:	12				Term credit total:				

Program Total:	Total Credits: 36	Identify the required comprehensive, culminating element(s), such as a thesis or examination, including course number(s), if applicable:
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New: X if new course Prerequisite(s): list prerequisite(s) for the listed courses

Section 4. Faculty

- a) Complete the **SUNY Faculty Table** on the next page to describe current faculty and to-be-hired (TBH) faculty.
- b) **Append** at the end of this document position descriptions or announcements for each to-be-hired faculty member.

NOTE: *CVs for all faculty should be available upon request. Faculty CVs should include rank and employment status, educational and employment background, professional affiliations and activities, important awards and recognition, publications (noting refereed journal articles), and brief descriptions of research and other externally funded projects. New York State's requirements for faculty qualifications are in [Part 55.2\(b\) of the Regulations of the Commissioner of Education](#).*

- c) What is the institution's definition of "full-time" faculty?

From the document Instructional Faculty and Class Size (http://www.albany.edu/ir/cds/cds_2014_15/classize.htm), the definition of full-time faculty is as follows:

The following definition of full-time instructional faculty is used by the American Association of University Professors (AAUP) in its annual Faculty Compensation Survey (the part time definitions are not used by AAUP). Instructional Faculty is defined as those members of the instructional-research staff whose major regular assignment is instruction, including those with released time for research. Use the chart below to determine inclusions and exclusions:

	Full-time	Part-time
(a) instructional faculty in preclinical and clinical medicine, faculty who are not paid (e.g., those who donate their services or are in the military), or research-only faculty, post-doctoral fellows, or pre-doctoral fellows	Exclude	Include only if they teach one or more non-clinical credit courses
(b) administrative officers with titles such as dean of students, librarian, registrar, coach, and the like, even though they may devote part of their time to classroom instruction and may have faculty status	Exclude	Include if they teach one or more non-clinical credit courses
(c) other administrators/staff who teach one or more non-clinical credit courses even though they do not have faculty status	Exclude	Include
(d) undergraduate or graduate students who assist in the instruction of courses, but have titles such as teaching assistant, teaching fellow, and the like	Exclude	Exclude

(a)	(b)	(c)	(d)	(e)	(f)
Faculty Member Name and Title/Rank (Include and identify Program Director with an asterisk.)	% of Time Dedicated to This Program	Program Courses Which May Be Taught (Number and Title)	Highest and Other Applicable Earned Degrees (include College or University)	Discipline(s) of Highest and Other Applicable Earned Degrees	Additional Qualifications: List related certifications, licenses and professional experience in field.
Alexander Buyantuev, Assistant Professor	60	Gog 584, Remote Sensing I; Gog 585 Remote Sensing II; Gog 685 Seminar in Remote Sensing; Gog 524 Landscape Ecology; GOG 695, Graduate Internship in Geography; GOG 697, Independent Study in Geography	PhD PhD	Geography, Russian Academy of Sciences Plant Biology, University of Arizona	
Rui Li, Assistant Professor	60	Gog 597 Advanced GIS; Gog 592, GIS Project Development; GOG 695, Graduate Internship in Geography; GOG 697, Independent Study in Geography	PhD	Geography, Pennsylvania State University	
Shiguo Jiang, Assistant Professor	60	Gog 529, Spatial Statistics; Gog 518, Ecological Modeling; Gog 522, GIS for Social Sciences; GOG 695, Graduate Internship in Geography; GOG 697, Independent Study in Geography	PhD	Geography, Ohio State University	
Andrei Lapenas, Professor	40	Gog 501, Energy, Environment and Climate Change; GOG	MS PhD	MS, Oceanography, State Leningrad University, St.	

(a) Faculty Member Name and Title/Rank (Include and identify Program Director with an asterisk.)	(b) % of Time Dedicated to This Program	(c) Program Courses Which May Be Taught (Number and Title)	(d) Highest and Other Applicable Degrees Earned (include College or University)	(e) Discipline(s) of Highest and Other Applicable Earned Degrees	(f) Additional Qualifications: List related certifications, licenses and professional experience in field.
Ray Bromley, Professor	5	695, Graduate Internship in Geography; GOG 697, Independent Study in Geography	PhD	Petersburg, Russia PhD, Climatology and Marine Chemistry, Russian State Hydrometeorological University, St. Petersburg, Russia Geography, Cambridge University	
Carlos Balsas, Assistant Professor	5	GOG 695, Graduate Internship in Geography; GOG 697, Independent Study in Geography	PhD	Regional Planning, University of Massachusetts	
Melissa Anne Currie, Assistant Professor	5	GOG 695, Graduate Internship in Geography; GOG 697, Independent Study in Geography	PhD	Geography and Urban Regional Analysis, University of North Carolina at Charlotte	
Youqin Huang, Associate Professor	5	GOG 695, Graduate Internship in Geography; GOG 697, Independent Study in Geography	PhD	Geography, University of California, Los Angeles	
Catherine T. Lawson, Associate Professor	5	GOG 695, Graduate Internship in Geography; GOG 697, Independent Study in Geography	PhD	Urban Studies and Regional Science, Portland State University	

(a) Faculty Member Name and Title/Rank (Include and identify Program Director with an asterisk.)	(b) % of Time Dedicated to This Program	(c) Program Courses Which May Be Taught (Number and Title)	(d) Highest and Other Applicable Earned Degrees (include College or University)	(e) Discipline(s) of Highest and Other Applicable Earned Degrees	(f) Additional Qualifications: List related certifications, licenses and professional experience in field.
Tom Narins, Assistant Professor	5	GOG 695, Graduate Internship in Geography; GOG 697, Independent Study in Geography	PhD	Geography, University of California, Los Angeles	
John S. Pipkin, Professor	5	GOG 695, Graduate Internship in Geography; GOG 697, Independent Study in Geography	PhD	Geography, Northwestern University	
David A. Lewis, Associate Professor	5	GOG 695, Graduate Internship in Geography; GOG 697, Independent Study in Geography	PhD	Urban Planning and Policy Development, Rutgers University Bloustein School of Planning and Public Policy	
Beth Feingold, Assistant Professor	10	EHS 612, GIS and Public Health	PhD.	Environmental Health Sciences, Johns Hopkins Bloomberg School of Public Health	
Part 2. Part-Time Faculty					
Christopher O'Connor, Lecturer	10	Gog 596, Introduction to GIS	MA	Geography, University at Albany	As Deputy Director for Business Solutions at NY State Office of Information Technology Services, Christopher O'Connor is responsible for managing three organizational units that provide application development, business analysis, and geospatial technology services for 11 state agencies. His educational and professional background make him uniquely qualified to teach an introductory course in GIS.
Part 3. Faculty To-Be-Hired (List as					

Section 5. Financial Resources and Instructional Facilities

a) What is the resource plan for ensuring the success of the proposed program over time? Summarize the instructional facilities and equipment committed to ensure the success of the program. Please explain new and/or reallocated resources over the first five years for operations, including faculty and other personnel, the library, equipment, laboratories, and supplies. Also include resources for capital projects and other expenses.

It is not expected that additional laboratory equipment will be required to offer the proposed program. The Department of Geography and Planning maintains 3 computing labs for classroom teaching, laboratory assignments, and collaborative project development related to the current GIS curriculum supporting our undergraduate and graduate programs. The classroom teaching lab contains 1 instructor station and 26 student stations each consisting of desktop computing equipment. This lab was originally configured in 1994 with funds from a NSF Instrumentation and Laboratory Improvement Program and has since been upgraded many times over with replacement desktop systems acquired from University resources. Additional equipment for the other 2 labs will be acquired from grants awarded to our GIS faculty. The University also maintains several large smart classrooms with sufficient computing resources to teach additional courses, if needs arise.

b) Complete the five-year SUNY Program Expenses Table, below, consistent with the resource plan summary. Enter the anticipated academic years in the top row of this table. List all resources that will be engaged specifically as a result of the proposed program (e.g., a new faculty position or additional library resources). If they represent a continuing cost, new resources for a given year should be included in the subsequent year(s), with adjustments for inflation or negotiated compensation. Include explanatory notes as needed.

SUNY Program Expenses Table

(OPTION: You can paste an [Excel version](#) of this schedule AFTER this sentence, and delete the table below.)

Program Expense Categories	Expenses (in dollars)					
	Before Start	Academic Year 1:	Academic Year 2:	Academic Year 3:	Academic Year 4:	Academic Year 5:
<i>(a) Personnel (including faculty and all others)</i>	\$220,757*	\$220,757	\$220,757	\$220,757	\$220,757	\$220,757
<i>(b) Library</i>	**	**	**	**	**	**
<i>(c) Equipment</i>	**	**	**	**	**	**
<i>(d) Laboratories</i>	**	**	**	**	**	**
<i>(e) Supplies</i>	**	**	**	**	**	**
<i>(f) Capital Expenses</i>	**	**	**	**	**	**
<i>(g) Other (Advertising):</i>	**	\$5,000	\$5,000	\$5,000	**	**
(h) Sum of Rows Above	\$220,757	\$225,757	\$225,757	\$225,757	\$220,757	\$220,757

* Using salary data from November, 2015 for program faculty and % time dedicated to program in SUNY faculty table above

** Not expected to exceed yearly departmental budget allocations

Section 6. Library Resources

a) Summarize the analysis of library collection resources and needs *for this program* by the collection librarian and program faculty. Include an assessment of existing library resources and accessibility to those resources for students enrolled in the program in all formats, including the institution's implementation of SUNY Connect, the SUNY-wide electronic library program.

This program does not require addition library collection resources.

b) Describe the institution's response to identified collection needs and its plan for library development. Not applicable.

Section 7. External Evaluation

SUNY and SED require external evaluation of all proposed graduate degree programs. List below all SUNY-approved evaluators who conducted evaluations (adding rows as needed), and **append at the end of this document** each original, signed External Evaluation Report. **NOTE:** *To select external evaluators, a campus sends 3-5 proposed evaluators' names, titles and CVs to the assigned SUNY Program Reviewer, expresses its preferences and requests approval.*

<u>Evaluator #1</u>	<u>Evaluator #2</u>
Name: Marc Armstrong	Name: Ola Ahlqvist
Title: Professor	Title: Associate Professor
Institution: University of Iowa	Institution: The Ohio State University

Section 8. Institutional Response to External Evaluator Reports

Append at the end of this document a single *Institutional Response* to all *External Evaluation Reports*.

Section 9. SUNY Undergraduate Transfer

NOTE: *SUNY Undergraduate Transfer policy does not apply to graduate programs.*

Section 10. Application for Distance Education

a) Does the program's design enable students to complete 50% or more of the course requirements through distance education? [X] No [] Yes. If yes, **append** a completed *SUNY Distance Education Format Proposal* at the end of this proposal to apply for the program to be registered for the distance education format.

b) Does the program's design enable students to complete 100% of the course requirements through distance education? [X] No [] Yes

Section MPA-1. Need for Master Plan Amendment and/or Degree Authorization

a) Based on [SUNY Guidance on Master Plan Amendments](#) (in the *Guide to Academic Program Planning*), please indicate if this proposal requires a Master Plan Amendment.

No Yes, a completed [Master Plan Amendment Form](#) is **appended** at the end of this proposal.

b) Based on *SUNY Guidance on Degree Authorizations* (below), please indicate if this proposal requires degree authorization.

No Yes, once the program is approved by the SUNY Provost, the campus will work with its Campus Reviewer to draft a resolution that the SUNY Chancellor will recommend to the SUNY Board of Trustees.

SUNY Guidance on Degree Authorization. Degree authorization is required when a proposed program will lead to a new degree (e.g., B.F.A., M.P.H.) at an existing level of study (i.e., associate, baccalaureate, first-professional, master's, and doctoral) in an existing disciplinary area at an institution, based on the [New York State Taxonomy of Academic Programs](#). Degree authorization requires approval by the SUNY Provost, the SUNY Board of Trustees, SED and the Board of Regents.

List of Appended Items

Appended Items: Materials required in selected items in Sections 1 through 10 and MPA-1 of this form should be appended after this page, with continued pagination. In the first column of the chart below, please number the appended items, and append them in number order.

Number	Appended Items	Reference Items
	<i>For multi-institution programs</i> , a letter of approval from partner institution(s)	Section 1, Item (e)
	<i>For programs leading to professional licensure</i> , a side-by-side chart showing how the program's components meet the requirements of specialized accreditation, Commissioner's Regulations for the profession , or other applicable external standards	Section 2.3, Item (e)
	<i>For programs leading to licensure in selected professions for which the SED Office of Professions (OP) requires a specialized form</i> , a completed version of that form	Section 2.3, Item (e)
	<i>OPTIONAL: For programs leading directly to employment</i> , letters of support from employers, if available	Section 2, Item 2.3 (h)(2)
1	<i>For all programs</i> , a plan or curriculum map showing the courses in which the program's educational and (if appropriate) career objectives will be taught and assessed	Section 2, Item 7
2	<i>For all programs</i> , a catalog description for each existing course that is part of the proposed graduate major program	Section 3, Item (b)
3	<i>For all programs with new courses</i> , syllabi for all new courses in a proposed graduate program	Section 3, Item (c)
	<i>For programs requiring external instruction</i> , a completed External Instruction Form and documentation required on that form	Section 3, Item (d)
	<i>For programs that will depend on new faculty</i> , position descriptions or announcements for faculty to-be-hired	Section 4, Item (b)
4	<i>For all programs</i> , original, signed External Evaluation Reports from SUNY-approved evaluators	Section 7
5	<i>For all programs</i> , a single Institutional Response to External Evaluators' Reports	Section 8

	<i>For programs designed to enable students to complete at least 50% of the course requirements at a distance, a <u>Distance Education Format Proposal</u></i>	Section 10
	<i>For programs requiring an MPA, a <u>Master Plan Amendment</u> form</i>	Section MPA-1

Appended Items

1. Curriculum Map for Educational and Career Objectives

The Department of Geography and Planning will perform direct assessment of student responses to examinations in selected core courses. These include:

Course	Offerings
Gog 597 Advanced GIS	Every fall semester
Gog 584 Remote Sensing I	Every fall semester
Gog 590 Advanced Cartography	Every fall semester
Gog 529 Spatial Statistics	Every spring semester
Gog 585 Remote Sensing II	Every spring semester
Gog 692 Seminar in GIS	Every spring semester
Gog 592 GIS Project Development (capstone)	Every fall semester

2. Catalog Description for Each Existing Course in Proposed Graduate Program (referencing Section 3, Item (b))

Core Courses

Gog 529 (Bio 534) Spatial Statistics (3)

This course provides an introduction to spatial statistics for spatially referenced data. Spatial point patterns, geostatistical data, and area (regional/lattice) data are studied using the viewpoint that these are realizations from random processes. Major topics to be covered include spatial stochastic process, exploratory spatial data analysis, intensity function, K function, cluster statistics, spatial interpolation, spatial covariance functions, variograms, kriging, spatial autoregressive models, and geographically weighted regression. Computer exercises with R programming language (www.r-project.org) are designed to help students gain hands-on experience on the topics presented in lectures. Students are required to present and discuss assigned readings and develop an individual research project that applies spatial statistical methods in geographical problem solving.

Prerequisites: Gog502/PLN504 or equivalent. In other words, students should be familiar with basic probability theory, multiple linear regression, and basic linear algebra.

Gog 584 (Pln 551) Remote Sensing I (3)

Introduction to the concepts and interdisciplinary applications of remote sensing. The basic principles of theory and practice are presented for earth resource management. Photographic and non-photographic sensors are examined. Visual and digital image analysis techniques are introduced. Students will interpret color infrared, multispectral, and other sensor imagery for a variety of purposes.

Gog 585 (Pln 553) Remote Sensing II (3)

Examination of current concepts and research in digital image analysis with emphasis on multispectral and radar data sets. Students will utilize a variety of data sources including optical and digital imagery, maps, census data, ground surveys, and other GIS data layers in completing an interpretation and analysis of selected geoscience aspects of environmental concern. Methods and importance of accuracy assessment are introduced. Prerequisite: Gog 584 or equivalent, or consent of instructor.

Gog 590 Advanced Cartography (3)

Maps as information systems with emphasis on data collection, reduction, and symbolization. Error measurement and correction. Introduction to psycho-physical aspects of cartographic presentation.

Prerequisite: Gog 390 or consent of instructor.

Gog 592 GIS Project Development (capstone)

GIS Project Development integrates tools for solving real, small-scale problems in spatial analysis. This course serves as a demonstration that students critically understand GIS-related theories and use them to raise and solve a realistic problem using geospatial technologies. This course puts students in the roles of GIS professionals in industries responsible for addressing specific spatial problems. This course utilizes a systematic approach to the application of underlying theories and to the selection of appropriate tools or technologies to execute and present the entire project professionally.

Gog 597 (Pln 557) Advanced GIS (3)

Introduces students to ARC/INFO, a geographic information system (GIS) with extensive analytical and cartographic components. Students will use ARC/INFO to compile and analyze data for selected research projects in Geography and Planning. Major topics include data conversion procedures, registration and rectification of digital data, spatial statistical analysis, and cartographic display. Prerequisites: Gog 496/596/USP 456/PLN 556 or equivalent courses.

Gog 692 (Pln 656) Seminar in Geographic Information Systems (3)

In-depth study of specialized topics of importance to Geographic Information Systems (GIS). In-depth examination of the scientific literature and a substantial research project involving algorithm development and/or modification and/or testing required. May be repeated once for credit. Prerequisites: Gog 496/Gog 596/Pln 556 or equivalent, and Gog 414, Gog 590 or equivalent, or consent of instructor.

Electives

Gog 501 Energy, Environment and Climate Change (3)

This course addresses the response of the global environment to rising energy consumption by human civilization. The structure of this course reflects on the premise that energy consumption and climate change are inherently-connected issues requiring a holistic study approach. First, we begin with basic scientific principles important for understanding energy transformations and historic trends in the use of fossil fuels. Second, we survey ancient climates formed by a combination of natural causes including the greenhouse effect, solar output, the position of continents, earth's orbit, vegetation and volcanic eruptions. All of these examples, as well as the study of recent human-related climatic trends, will help to better understand differences between natural cycles and anthropogenic forces of climatic changes. In the last part of the course, we review existing alternatives to fossil fuels as well as several potential geoengineering projects that can mitigate global warming and its negative consequences.

Gog 518 (Bio 518, Inf 508) Ecological Modeling (3)

This course introduces various theoretical and mathematical approaches to modeling ecological and environmental data through computer-based exercises in the application of existing models and the development of new models. Modeling topics cover animal population models, vegetation models, and large scale landscape models, as well as model applications in decision making. This course is geared towards demystifying models and providing students with the confidence and skills to apply this very useful tool to research projects. Prerequisites: Statistics and either General Ecology, Environmental Analysis, Environmental Studies or equivalent or permission of instructor.

Gog 522 GIS for Social Sciences (3)

The objective of this course is to apply GIS techniques on social sciences. Specific goals are: (1) to provide

students with an understanding of how GIS can be applied in social sciences; (2) to familiarize students with advanced GIS and modeling techniques; (3) to provide students with hands-on experience in working with various data sources through a project related to their own research interest. Applications spread from typical themes in urban and regional analysis (e.g., trade area analysis, regional growth patterns, urban land use and transportation) to issues related to crime and health analyses. It also covers common tasks (e.g., distance and travel time estimation, spatial smoothing and interpolation, accessibility measures) and major issues (e.g., modifiable areal unit problem, rate estimate of rare events in small population, spatial autocorrelation) that are encountered in spatial analysis. Computer exercises with ArcGIS and R are designed to help students gain hands-on experience on the topics presented in lectures. Students are required to present and discuss assigned readings and develop an individual research project that applies geospatial methods in geographical problem solving. Prerequisites: Gog496/PLN456, or equivalent. Students should have some basic GIS and statistical knowledge equivalent to one introductory GIS course and one elementary statistical course.

Gog 524 Landscape Ecology (3)

Landscape ecology is a highly interdisciplinary field, which has its roots in geography and ecology, and has direct relevance to landscape planning and architecture. It deals explicitly with interactions between spatial pattern and ecological processes, including various human influences. This introduction course covers the basic concepts, principles, and methods of landscape ecology, as well as its important applications in nature conservation, resource management, and landscape design and planning. Prerequisites: A general ecology-focused course at the college level or permission of instructor.

Gog 579 Fundamentals of Applied Global Positioning Systems (3)

The course introduces students to fundamentals of Global Positioning System technology as applied to the geosciences. Topics include background and history, signal structure, resolution, accuracy, data collection techniques, basic geodesy, projections and datums, and applications. Field work and lab exercises complement lecture material.

Gog 594 Landscape Rendering (3) (currently using course number Gog 530 Selected Topics: Landscape Rendering)

This course explores 3D rendering of geographic surfaces through modern graphics processing unit (GPU) hardware and shader programming languages. Topics include vector and matrix representations of vertex data and 3D affine transformations, development of client/server graphics applications, acquisition and use of digital elevation models (DEMs), perspective surface modeling, and surveys of current and developing trends in surface representation. Prerequisites: Gog 692 or permission of instructor.

Gog 685 Seminar in Remote Sensing of the Environment (3)

Study of remote sensing in geographic investigation with emphasis on detailed examination of specific sensor systems. Independent research on a sensor-environment problem is mandatory. Prerequisite: Gog 585 or consent of instructor.

GOG 695 Graduate Internship in Geography (3)

Faculty-directed internship with an appropriate agency, enabling qualified students to gain practical experience relevant to their academic program. Ordinarily the internship is part-time and lasts for one semester under the joint supervision of a faculty sponsor and the agency project director. Prerequisite: Permission of instructor. S/U graded.

Gog 697 Independent Study in Geography (1-4)

Directed study and research on selected subjects in geography for the M.A. student. May be repeated once but

not for more than a total of 6 credits. Prerequisites: 9 credits in geography and permission of the instructor.

Ehs 612 Geographic Information Systems (GIS) and Public Health (3)

This course covers the basics of geographic information systems (GIS) as applied toward epidemiologic research and surveillance. GIS software functionality, geocoding, use of global positioning systems (GPS), sources of data and spatial statistical methods are among the topics covered. Prerequisite: Epi 501.

3. Syllabi for New Courses in Proposed Graduate Program (referencing Section 3, Item (c))

Gog 594 Landscape Rendering (Author: James Mower)

Course Description

The course will explore 3D rendering through modern graphics hardware and OpenGL shader programs using Java as the graphics client language and GLSL as the server language. The course will cover standard surface rendering techniques and parallel processing on modern GPUs. Students will work in groups and share ideas among themselves. Although working in modern OpenGL is complicated, the results can be very rewarding.

Course Objectives

At the end of this course you will understand how to write an OpenGL program using the programmable pipeline model. You will also understand coordinate transformation processes from world coordinate systems through perspective and finally to projected screen coordinates. And finally, you will be able to adapt your knowledge to the rendering of 3D geographic surfaces.

Prerequisites

If you have not taken GOG 692/PLN 656 (Seminar in GIS), you should not take this course without the permission of the instructor.

Credits Allocated

This is a new, 3-credit course and has yet to be scheduled. It will meet 3 times per week for 50 minutes per session.

Representative Assignments

Building an OpenGL "Hello World" application

Rendering Triangles

Rendering a Mesh

Implementing Coordinate Transformations

Performing Perspective Rendering

Assessment of Student Achievement

Each student's performance will be assessed through his or her execution of assignments and the final project. Assessment criteria include:

To what degree has the student addressed the assignment or project requirements?

To what degree has the execution of the assignment or project demonstrated mastery of its key theoretical or technical points?

If the assignment or project is collaborative, to what degree has the student demonstrated an ability to work with others in group member or leadership roles?

The instructor will perform the assessment on the basis of submitted code, observance of the working application, and, for the final project, answers to the instructor's and other students' questions regarding the project during a final demo session.

Assignments and projects submitted after their due dates will not be accepted unless the students makes prior arrangements with the instructor. Partial credit will be awarded for assignments and projects that are not fully functional when submitted.

Basis of Grade Determination

The student's grade for individual assignments and for the final project will be determined as follows:

Grade	Criteria
A	80-100% assignment/project requirements met
B	60-79% assignment/project requirements met
C	50-59% assignment/project requirements met
E	Less than 50% assignment/project requirements met

The student's final grade will be based on the average scores for all submitted assignments and the final projects such that the assignment values will be weighted as 80% of the final grade and the final project the remaining 20% of the final grade.

Final Project

A project of the student's choosing, as approved by the instructor, which demonstrates mastery of geographic surface mesh data structures, coordinate transformations, shader program construction, and selected rendering techniques.

Bibliographic Resources

Learning Java, 4th ed., by Niemeyer and Knudsen.

OpenGL Programming Guide, 8th ed., by Shreiner et al.

Supplies

Java and Eclipse are used as the course programming language and integrated development environment (IDE). Assignments will also be using the JOGL libraries for OpenGL in Java. Students may download these packages for their own use. [Click here for instructions.](#)

Topics

History of cartographic landscape representation

Our graphics environment Installing JOGL (for people working with Java)

Installing PyOpenGL (for those working with Python)

Installing C++ bindings for OpenGL

Triangle Demo

Structure of an OpenGL program

GLSL and the OpenGL programmable pipeline

Lab: Drawing a dot and a triangle

Vectors, cross products, and dot products—JOGL vector utilities (Surface shading techniques using linear algebra)

Surface Shader demo

Affine Transformations

Transformation Pipeline

Perspective transformations

Working with DEMs 1 (grid, vector, working with GDAL)

Working with DEMs 2 (triangulation with CGAL, etc)

Shading models (flat, Phong, Gouraud, etc)

Lab: Add sun azimuth and altitude feature to JMSurfaceShaderDemoMacGL3

Vector shaders

Fragment shaders

Tessellation shaders

Compute shaders

Projects

3D transformations (eye, perspective, clipping, etc.)

Mesh topologies and rendering

Contouring

Polynomial surfaces

Visibility

3D interiors (buildings)

4. External Evaluation Reports (to be inserted on completion)

5. Institutional Response to External Evaluators' Reports (to be inserted on completion)



External Evaluation Report

Form 2D

Version 201-08-02

The External Evaluation Report is an important component of a new academic program proposal. The external evaluator's task is to examine the program proposal and related materials, visit the campus to discuss the proposal with faculty and review related instructional resources and facilities, respond to the questions in this Report form, and submit to the institution a signed report that speaks to the quality of, and need for, the proposed program. The report should aim for completeness, accuracy and objectivity.

The institution is expected to review each External Evaluation Report it receives, prepare a single institutional response to all reports, and, as appropriate, make changes to its program proposal and plan. Each separate External Evaluation Report and the Institutional Response become part of the full program proposal that the institution submits to SUNY for approval. If an external evaluation of the proposed program is required by the New York State Education Department (SED), SUNY includes the External Evaluation Reports and Institutional Response in the full proposal that it submits to SED for registration.

Institution: University at Albany

Evaluator Name (Please print.): Marc P. Armstrong

Evaluator Title and Institution: Professor, The University of Iowa

Evaluator Signature:

Proposed Program Title: M.S. in Geographic Information Science

Degree: M.S.

Date of evaluation: Site visit on 1 November 2016

I. Program

1. Assess the program's **purpose, structure, and requirements** as well as formal mechanisms for program **administration and evaluation**. Address the program's academic rigor and intellectual coherence.

This report contains the findings of one member of the external review team that was convened to evaluate a proposed MS in Geographic Information Science that would be offered by faculty at the University at Albany. The purpose of the proposed program is to provide graduate level instruction to students interested in furthering their education in the field of geographic information science. The proposal comprises a 36 credit curriculum that is constructed from core and elective courses. The 18 credit core exposes students to fundamental knowledge (in both theory and practice) in this area of study while the 18 credits of electives enables each student to tailor the curriculum to their particular area of interest. The proposed program has a well-designed progression of core content that builds on the introductory graduate course (GOG 597). The remaining components of the core require students to acquire knowledge about spatial statistics, remote sensing, and principles of cartography and visualization. This core-elective approach also provides a coherent, yet flexible, structure to the curriculum: each student goes through a common core experience with additional room to tailor

the program to individual interests. The home of the proposed program is the Department of Geography and Planning, which will provide any required administrative support. Below the level of the department, a tenured faculty member serves as Program Director and will dedicate 75% effort to the design, delivery and supervision of the curriculum and the students enrolled within it. Four additional faculty will also contribute a significant portion of their faculty effort to the proposed program.

2. Comment on the **special focus** of this program, if any, as it relates to the discipline.

The special focus of the proposed program is on geographic information science. This is an increasingly important component of geography programs throughout North America. Narrowing the focus even further, there are strengths within the curriculum in remote sensing and cartography (or what is sometimes known as geographic visualization).

3. Comment on the plans and expectations for **self-assessment and continuous improvement**.

The Department has a 7-year assessment cycle for its non-accredited programs and the new MS GIS is expected to follow the same schedule. As described in section V, a student portfolio might be considered as a means to provide a capstone experience. Such a portfolio would contain key assignments or projects that would demonstrate how students make progress in acquiring knowledge and skills. These materials can also help the program to identify how specific courses and activities contribute to moving the students toward completing degree requirements and achieving program goals.

4. Discuss **the relationship** of this program to other programs of the institution and collaboration with other institutions, and assess available support from related programs.

The structure of the curriculum provides a mechanism through which additional links to other programs can be developed. There are now existing courses being provided by the School of Public Health and the School of Criminal Justice. Additional opportunities for collaboration are highly plausible with the Department of Informatics and the new College of Emergency Preparedness, Homeland Security and Cybersecurity.

5. What is the evidence of **need and demand** for the program locally, in the State, and in the field at large? What is the extent of occupational demand for graduates? What is the evidence that demand will continue?

The GIScience & Technology profession continues to experience growth according to the U.S. Department of Labor. The proposed program would matriculate well-educated students who would satisfy this increased demand for employees. Locally, there appears to be a market for the degree given the location of the University at Albany in the Capital District of NY, a multi-county metropolitan region with a population of approximately one million, and the seat of government for the State of New York. For students who look beyond the immediate area there are many exciting career opportunities in government, industry and business.

II. Faculty

6. **Evaluate the faculty**, individually and collectively, with regard to training, experience, research and publication, professional service, and recognition in the field.

The Department of Geography and Planning has recently added three Assistant Professors who have teaching and research expertise in GIScience; these additional faculty brings the faculty strength to a level suitable for the MS program. However, since these GIS faculty are recent graduates, it is difficult to judge their recognition in the field. Nevertheless, these faculty have graduated from high quality PhD programs and have injected considerable intellectual energy into the department. In addition, to these new hires, one long-term tenured faculty member in this area has recently accelerated his scholarly activity. This is a good sign of an engaged

faculty. There is also leadership at the senior ranks with one faculty member recently promoted to the rank of Professor and the department chair maintaining an active geospatial-related research program. Taken together, this holds promise for the future of the program.

7. **Assess the faculty in terms of number and qualifications and plans for future staffing.** Evaluate **faculty responsibilities** for the proposed program, taking into account their other institutional and programmatic commitments. Evaluate **faculty activity in generating funds** for research, training, facilities, equipment, etc. Discuss any **critical gaps and plans for addressing them.**

We feel that the proposed program can be delivered without additional faculty resources. This assessment is based on discussions with the interested and affected faculty members in the core department, as well as a careful examination of the documents provided to the reviewers. The current core faculty have active research programs and participate in scholarly conferences. The amount of effort that will be required to maintain the program appears reasonable and the faculty are committed to ensuring programmatic success. However, any reduction in faculty positions through retirement or resignation would likely have a detrimental effect on the ability of the faculty to deliver the curriculum. Given that the majority of the core faculty are relatively recent PhD graduates they have yet to establish a sustained record of funding. This situation, however, will likely resolve in a satisfactory way. It is also true that the National Science Foundation recognizes that training in STEM fields is a priority (e.g., the NRT program) and this may lead to improved opportunities for funding. Decisions about the allocation of faculty and staff positions are beyond the scope of this review.

8. Evaluate credentials and involvement of **adjunct faculty and support personnel.**

The tenured and tenure-track faculty quite rightly provide the curricular core. The current roster of adjuncts appear to be well-qualified and many have taught in the program for several years. However, state and local government agencies in the region employ GIS professionals and this provides an opportunity to tap into a pool of potential adjuncts who would offer application-oriented courses and supervise internship experiences. Support personnel include administrative support positions as well as IT support. These appear to be adequate for the proposed program.

III. Students

9. Comment on the **student population the program seeks to serve**, and assess plans and projections for student recruitment and enrollment.

The location of the program in New York's Capital District provides an opportunity to recruit applicants who may already be employed in IT positions as well as others who have low-level GIS positions and wish to pursue professional development opportunities. Another option is to consider recruiting students from other SUNY schools. The Department should investigate how to articulate with such schools in a way that would enable graduates to transition to the proposed MS program. It might make sense to pilot such arrangements with SUNY schools that are in relatively close proximity to Albany (e.g., Oneonta, New Paltz, and Plattsburgh).

10. What are the prospects that recruitment efforts and admissions criteria will supply a **sufficient pool of highly qualified applicants and enrollees?**

It is likely that there are Office of Graduate Education rules that govern general admissions processes and those rules would serve as a baseline for admission decisions. GRE scores may provide some insight and TOEFL scores should be required for most international students. The MS faculty should investigate ways of ensuring basic GIS competency and make advising decisions accordingly. A remedial class in basic GIS may

be required for some applicants. In a similar vein, the Department should evaluate the multivariate statistics requirement and develop a plan that would enable out-of-compliance students to satisfy this requirement during the first semester of enrollment.

11. Comment on provisions for encouraging participation of **persons from underrepresented groups**. Is there adequate attention to the needs of part-time, minority, or disadvantaged students?

The proposal states that the program will “connect with University diversity resources” to accomplish its goal of recruiting underrepresented minorities. However, the achievement of this objective as a recruiting goal may possibly require additional effort by the program to reach out to potential students.

12. Assess the system for monitoring **students’ progress and performance** and for **advising students** regarding academic and career matters.

Since the program will convene an *ad hoc* admissions committee, it will be able to assess student backgrounds and provide quality control at the intake step. The design of the curriculum requires that all students pass through a common core, thus ensuring some degree of direct comparability of performance across students. The faculty have indicated that advising duties will be equitably among the faculty, and as described in the proposal (page 9), this will yield approximately 7 advisees per faculty member each year. This seems reasonable. It is recommended that the faculty meet each spring (preferably prior to the time admission decisions are made for the subsequent fall semester) to discuss the progress of each student in completing degree requirements.

13. Discuss prospects for graduates’ post-completion success, whether **employment, job advancement, future study, or other outcomes related to the program’s goals**.

The location of the University in the Albany area represents a significant strategic advantage for employment and internship opportunities. The program should also investigate options that would prepare students for the Certified GIS Professional (GISP®) certification administered by the GIS Certification Institute (www.gisci.org) as well as Universal Geospatial Intelligence (GEOINT) Certification administered by the United States Geospatial Intelligence Foundation (usgif.org).

IV. Resources

14. Comment on the adequacy of physical **resources and facilities**, e.g., library, computer, and laboratory facilities; practica and internship sites or other experiential learning opportunities, such as co-ops or service learning; and support services for the program, including use of resources outside the institution.

The available resources and facilities appear to be adequate for supporting the proposed program. Informal conversations indicate that access to relevant journals is available. There are also computer laboratories where students can complete assignments and learn about various GIS-related techniques. It cannot be over-emphasized that this academic area of inquiry changes rapidly and requires that graduates be provided experience with current technologies. The SUNY system seems to have negotiated favorable terms with respect to the site licensing of the most widely used GIS software products. Open source software options are also a viable option in some circumstances.

15. What is the **institution's commitment** to the program as demonstrated by the operating budget, faculty salaries, the number of faculty lines relative to student numbers and workload, and discussions about administrative support with faculty and administrators?

We met with groups of faculty including those who comprised the core and those who had no, or only peripheral, involvement with the proposed curriculum. All were very positive in their appraisals. The chair was very enthusiastic in endorsing the proposed program and the program also appears to have solid support in other levels of academic administration at Albany. We were not provided with detailed information about the operating budget aside from the SUNY Program Expenses Table (page 15). In general, the program is designed to be relatively inexpensive and will, ultimately, generate additional tuition revenue.

V. Summary Comments and Additional Observations

16. Summarize the **major strengths and weaknesses** of the program as proposed with particular attention to feasibility of implementation and appropriateness of objectives for the degree offered.

- The proposed program will provide students with a highly marketable degree and skillset.
- There are significant employment opportunities across the public and private sectors at both the local and national scale.
- The program can be positioned to receive a stream of talented undergraduates from the entire SUNY system.
- There is a potential pool of professionals that could seek out this academic development opportunity.
- The program is well connected within the Albany capital region in terms of adjunct professional faculty, and the ability to create a well-developed internship program.
- The core group of faculty bring talent and energy, as well as experiences and competency from several top tier GIScience programs.

With a core group of faculty largely composed of untenured Assistant Professors it is important that a plan be implemented to ensure their continued professional development. This concern should turn into a significant strength with the same group of faculty eventually establishing themselves as rising stars with funded research programs and laboratories.

17. If applicable, particularly for graduate programs, comment on the ways that this program will make a **unique contribution** to the field, and its likelihood of achieving State, regional and/or national **prominence**.

The proposed program should play a prominent role in providing educational experiences for students interested in learning about GIScience. The focus of the program has been placed on achieving State and regional prominence, and it is here that the program will likely succeed. If the built-in market, as described above, is tapped, the program should attract talented students and, ultimately, place them into prominent positions in government and industry.

18. Include any **further observations** important to the evaluation of this program proposal and provide any **recommendations** for the proposed program.

The program may wish to consider the design and adoption of a professionalization course (or modules) in which students would be instructed ethics, communication skills, job search strategies, and other aspects of professional development.

A concluding element was not part of the proposal reviewed by the external evaluators. Several options might be pursued to achieve this goal. First, as students progress through the degree program, they will produce a number of digital map or map-like products (e.g., story maps, animations, imagery) that can be compiled into a digital portfolio of accomplishments that can be evaluated by faculty members in the program. Such a portfolio would likely enhance placement since employers would be able to observe tangible evidence of accomplishments. Alternatively, each student might meet with their advisor and internship supervisor to

compose a memo of understanding about the scope of work to be accomplished during the period of an internship. Toward the end of the internship experience, each student would compose an internship report that provides information about student developmental experiences and any digital products that arise as a consequence of the work accomplished. This report would then be evaluated by the advisor and additional faculty members.



The State University
of New York

External Reviewer Conflict of Interest Statement

I am providing an external review of the application submitted to the State University of New York by:
University at Albany

(Name of Institution or Applicant)

The application is for (circle A or B below)

A) New Degree Authority

B) Registration of a new academic program by an existing institution of higher education:

M.S. in Geographic Information Science

(Title of Proposed Program)

I affirm that I:

1. am not a present or former employee, student, member of the governing board, owner or shareholder of, or consultant to the institution that is seeking approval for the proposed program or the entity seeking approval for new degree authority, and that I did not consult on, or help to develop, the application;
2. am not a spouse, parent, child, or sibling of any of the individuals listed above;
3. am not seeking or being sought for employment or other relationship with the institution/entity submitting the application?
4. do not have now, nor have had in the past, a relationship with the institution/entity submitting the application that might compromise my objectivity.

Name of External Reviewer (please print):

Marc P. Armstrong

Signature:



External Evaluation Report

Form 2D
Version 201-08-02

The External Evaluation Report is an important component of a new academic program proposal. The external evaluator's task is to examine the program proposal and related materials, visit the campus to discuss the proposal with faculty and review related instructional resources and facilities, respond to the questions in this Report form, and submit to the institution a signed report that speaks to the quality of, and need for, the proposed program. The report should aim for completeness, accuracy and objectivity.

The institution is expected to review each External Evaluation Report it receives, prepare a single institutional response to all reports, and, as appropriate, make changes to its program proposal and plan. Each separate External Evaluation Report and the Institutional Response become part of the full program proposal that the institution submits to SUNY for approval. If an external evaluation of the proposed program is required by the New York State Education Department (SED), SUNY includes the External Evaluation Reports and Institutional Response in the full proposal that it submits to SED for registration.

Institution: University at Albany

Evaluator Name (Please print.): Karl Ola Ahlqvist

Evaluator Title and Institution: Associate Professor, The Ohio State University

Evaluator Signature: 

Proposed Program Title: M.S. in Geographic Information Science

Degree: M.S.

Date of evaluation: Site visit on 1 November 2016

Because the report was developed in close collaboration with the second reviewer, Marc P Armstrong, several sections have very similar wording with his report.

I. Program

1. Assess the program's **purpose, structure, and requirements** as well as formal mechanisms for program **administration and evaluation**. Address the program's academic rigor and intellectual coherence.

The proposed program will provide graduate level instruction to students in the theory, principles, and applications of geographic information science. The proposal presents a curriculum that is composed of a set of core and elective courses. The courses in core provides students with a common base in knowledge areas that has been recognized widely (in the 2006 GIS&T Body of Knowledge core curriculum) as being fundamental knowledge in this domain. The electives then provides each student with opportunities to tailor their degree to their particular area of interest. This core-elective structure is typical of many graduate level programs and also enables the curriculum to adapt when new courses are developed, or in response to changing demands and abilities of students and the workforce. The selection of core and elective courses signals a coherent and rigorous approach to a graduate program in GIS. The proposed program will be housed in and administered by the Department of Geography and Planning, where a tenured faculty member will act as Program Director and four other faculty will provide instruction and advising to students in the program.

2. Comment on the **special focus** of this program, if any, as it relates to the discipline.

The special focus of the proposed program is on geographic information science. Though this is a wide and highly interdisciplinary field, many similar programs are tied to geography departments, so the departmental home in this case seems like a good and natural fit. In fact, many 'traditional' geography programs have seen an increased emphasis on GIS as the workforce demand has continued to grow in this area.

3. Comment on the plans and expectations for **self-assessment and continuous improvement**.

The Department has developed a 7-year assessment cycle for its other programs and the new MS GIS assessment plan seeks to follow a similar pattern. The proposed plan consists of primarily summative elements toward the end of the students' studies. While this is an important part of an assessment strategy, it is also equally important to gather formative evidence about students' progress through the program. In our deliberations we discussed several possible 'capstone' experiences (see section V). These would be natural instruments to assess (in a summative way) the program outcomes. As an example, the currently well-developed internship program can provide a direct assessment opportunity by soliciting structured evaluations from the internship site supervisors. Additionally, the use of a portfolio as one capstone experience option, also offers an opportunity to look at key artefacts from different points in time in the program. These can help to longitudinally identify how specific courses and activities contribute to moving the students toward completing degree requirements and achieving program goals. As such, they provide important evidence for a formative assessment process.

4. Discuss **the relationship** of this program to other programs of the institution and collaboration with other institutions, and assess available support from related programs.

The department already has two other graduate programs in Geography and Regional Planning. It seems that the proposed program has been developed as a natural complement to these degrees and has a strong support from key faculty in those programs.

As mentioned above, the field of GIS is highly interdisciplinary and lends itself to collaboration with many other disciplines. Some of the faculty we met already have close collaborations or connections with the Schools of Public Health and Criminal Justice. During our meetings with faculty we heard numerous accounts of additional ongoing and possible partnerships that are actively being pursued. Some of the most logical collaborators would be in the Department of Informatics. The field of Geospatial Intelligence has seen tremendous growth lately and here the new College of Emergency Preparedness, Homeland Security and Cybersecurity will most likely be a critical partner to position the University as a key institution in that arena. Another natural collaboration would be with the School of Business as more and more business decisions and logistics operations are making increasingly sophisticated uses of GIS.

5. What is the evidence of **need** and **demand** for the program locally, in the State, and in the field at large? What is the extent of occupational demand for graduates? What is the evidence that demand will continue?

The GIScience & Technology profession is by now an established field, yet its sustained growth potential keeps it on the list of "Bright Outlook" occupations published by the U.S. Department of Labor. Most estimates see continued growth in employment of GI scientists, technicians, and analysts.

Locally, there is a "built-in" market for graduates as evidenced by the many adjunct faculty employed by government and business in the region, and well-stocked internship opportunities provided by local and regional organizations. Regionally and nationally the job market for graduates of GIS programs is very good.

II. Faculty

6. **Evaluate the faculty**, individually and collectively, with regard to training, experience, research and publication, professional service, and recognition in the field.

With the recent addition of three faculty members at the rank of Assistant Professor, who each has teaching and research expertise in an area closely related to the proposed MS program, the Department has suitable strength in appropriate areas. All of the GIS faculty are graduates of high quality PhD programs in GIS or related areas. Since a majority of core GIS faculty are recent hires and are only beginning their careers, it is too early to judge their recognition in the field. However, we are impressed by their quality and energetic scholarly activity. The more senior faculty provides balance and natural leadership as well as an opportunity for some more structured mentorship activities.

7. **Assess the faculty in terms of number and qualifications and plans for future staffing.** Evaluate **faculty responsibilities** for the proposed program, taking into account their other institutional and programmatic commitments. Evaluate faculty **activity in generating funds** for research, training, facilities, equipment, etc. Discuss any **critical gaps and plans for addressing them.**

There is a good balance between the number of tenured and tenure-track faculty and a pool of adjunct instructors in the department. This together with a few elective courses offered by faculty in other units provides a diversified and well-resourced platform for program delivery, and we saw no need for additional faculty resources at this time. The core faculty, as stated above, are all graduates of high quality PhD programs with strong traditions of geospatial research activity. I want to stress though that any reduction in faculty through retirement or departure need to be strongly considered for an equal new hire to sustain the program, especially in the critical early years.

8. Evaluate credentials and involvement of **adjunct faculty and support personnel.**

There is a substantial pool of potential adjuncts that could be further developed to primarily offer application-oriented courses or other opportunities for MS students. These adjuncts often provide an important and welcome enrichment of professional insights and opportunities for students to pursue. There seems to be an informal exchange between tenure-track and adjunct faculty. This is good but it could be formalized in order to ensure alignment of the curriculum to keep gaps and redundancies at a minimum.

III. Students

9. Comment on the **student population the program seeks to serve**, and assess plans and projections for student recruitment and enrollment.

The location of the program in New York's Capital District provides for a large local pool of potential applicants who may wish to pursue professional development opportunities. A directed media campaign may be in place to advertise the new program to this constituency.

Another option is to consider exploiting the position of The University at Albany as a natural progression from other campuses in the SUNY system. These other schools could provide an important source of talented undergraduates who want to pursue further educational opportunities. Again, an well-designed and intentional effort to market the new program to students throughout the SUNY system seems appropriate.

10. What are the prospects that recruitment efforts and admissions criteria will supply a **sufficient pool of highly qualified applicants and enrollees?**

Admissions decisions should preferably be informed by considering GPA, GRE and TOEFL scores, even if these only serve as crude metrics, they do provide some insights into the maturity and preparedness of students applying to the program. Reference letters are also a possible requirement but would add administrative burden on the faculty. Either way, without some form of minimum bar the program runs the risk of admitting unprepared students that require substantial resources in terms of mentoring and remedial support.

Students will come to the program from a variety of backgrounds and it is important that the program is able to accommodate for different levels of background knowledge and experience with spatial thinking and software. While I would anticipate that most students who seek this program will already have had some basic GIS and/or cartography training, this cannot be taken for granted. In order to cater to the already well-prepared, it is likely that there will need to be some pathway for entirely unprepared students to get up to speed with the most basic things in order for the core courses to really become rigorous offerings at a graduate level. There are options for remedial training with the online training the Esri site license offers and that is something that incoming students could be given access to before getting to campus.

11. Comment on provisions for encouraging participation of **persons from underrepresented groups**. Is there adequate attention to the needs of part-time, minority, or disadvantaged students?

We did not see much in the proposal that directly addressed this issue. As a first step I would recommend that the department consider ensuring that all new and existing staff and faculty have received appropriate training in. Additionally, the SUNY system has an established Graduate Tuition Opportunities Program that provides full tuition scholarship support to former recipients of support for economically and educationally disadvantaged undergraduate students. This sounds like an appropriate target group for directed marketing. It is good to see that the department plans to engage in close collaboration with university diversity resources.

12. Assess the system for monitoring **students' progress and performance** and for **advising students** regarding academic and career matters.

The Department currently houses a MA program and thus, there is local knowledge about the protocols and practices that lead to good student outcomes. As mentioned above, the program will have its own admissions committee and will be able to perform quality control at the intake step. All students will pass through a common core, thus ensuring some degree of direct comparability of performance across students. Other similar programs have instituted regular joint advising sessions during which different advisors together with some of their students discuss progress and performance. Some version of this might be a workable model to both ensure similar support and advice to students but also to help distribute advising duties equitably among the faculty. The advising load of approximately 7 students per faculty member each year seems reasonable for an established MS program, but it may be that it needs to be kept a bit lower during the build-up.

13. Discuss prospects for graduates' post-completion success, whether **employment, job advancement, future study, or other outcomes related to the program's goals**.

As described in point 9, above, the location of the University represents a strategic advantage for employment and internship opportunities. We see an additional opportunity for the program to ensure that the MS GIS program prepares students for the two major professional certifications available for GIS&T professionals. The most established is the Certified GIS Professional (GISP®) certification administered by the GIS Certification Institute (www.gisci.org). The second path is the Universal Geospatial Intelligence (GEOINT) Certification, a professional designation administered by the United States Geospatial Intelligence Foundation (usgif.org).

IV. Resources

14. Comment on the adequacy of physical **resources** and **facilities**, e.g., library, computer, and laboratory facilities; practica and internship sites or other experiential learning opportunities, such as co-ops or service learning; and support services for the program, including use of resources outside the institution.

The University maintains excellent facilities on the Albany campus and the Department provides a well-established internship program to help students get valuable experiential learning and networking opportunities. Of some concern to the reviewers was the maintenance and upkeep of lab spaces that seemed to rely on a relatively slow hardware and software update cycle. The GIS&T field is tremendously dynamic and it requires not only foundational skills, but also that graduates be provided experience with the most current technologies. It was discovered during the site visit that the SUNY system has negotiated favorable financial terms with respect to the site licensing of the most widely used GIS software products. This is a positive signal.

15. What is the **institution's commitment** to the program as demonstrated by the operating budget, faculty salaries, the number of faculty lines relative to student numbers and workload, and discussions about administrative support with faculty and administrators?

The Department provides a supportive intellectual environment for a diverse collection of scholars, both senior and pre-tenure, and with that in mind, the proposed MS degree has the full support of the faculty in the Department of Geography and Planning. The chair enthusiastically endorsed the proposed program. The program also appears to have solid support in the upper levels of academic administration at Albany.

V. Summary Comments and Additional Observations

16. Summarize the **major strengths and weaknesses** of the program as proposed with particular attention to feasibility of implementation and appropriateness of objectives for the degree offered.

Most importantly, the proposed program provides students with a highly marketable degree and skillset with employment opportunities across the public and private sectors at both the local and national scale. The institutional context is favorable since the program can be positioned to receive a solid stream of talented undergraduates from the entire SUNY system. Finally, the program is well connected within the Albany capital region in terms of adjunct professional faculty, and the ability to create a well-developed internship program. Additionally, there is a potential local-regional pool of professionals that could seek out this academic development opportunity.

A mixed point concerns the composition of the core group of faculty in the program. On the strongly positive side, they bring talent and energy, as well as experiences and competency from several top tier GIScience programs. Yet, with this group largely composed of untenured Assistant Professors it is important that they be provided with room to grow professionally and with sufficient time to develop their research programs. This investment will help the program gain stature and increase its attraction to a broader clientele. With a plan in place to ensure continued professional development, this weakness should fairly quickly (within 5-10 years) turn into a significant strength; it is not difficult to imagine the same group of faculty having established themselves as rising stars with funded research programs and laboratories.

17. If applicable, particularly for graduate programs, comment on the ways that this program will make a **unique contribution** to the field, and its likelihood of achieving State, regional and/or national **prominence**.

As it is conceptualized, the proposed program will play a prominent role in providing well-designed educational experiences for students interested in learning about GIScience. It does not seek, nor does it need

to aspire to gain, national prominence, at least not at the outset. Instead the focus has been placed, correctly in our view, on achieving State and regional prominence, and it is here that the program will likely succeed. As described above, there is a built-in market from which it will attract students and, ultimately, place them. Over time, there may be potential for the program to rise to the top nationally. With some strategic collaborations around GIS & health and Geospatial Intelligence those areas look particularly promising.

18. Include any **further observations** important to the evaluation of this program proposal and provide any **recommendations** for the proposed program.

Professionalization

A goal of the program is to provide significant education experiences to students who will graduate as well trained professionals. To achieve this goal, it is important to consider this professionalization can be nurtured, and developed. One way is to design a professionalization course in which students would be instructed in subjects such as ethical considerations around the use of geospatial information (e.g. privacy), project management, software systems development methodologies, communication skills, job search, and paths for professional certification (e.g., GISP , USGIF) and other aspects of professional development. Alternatively, instruction in such areas could be provided as 1 semester hour stand-alone courses or as multi-lecture/discussion modules within existing courses.

Capstone Experience

A concluding element was not part of the proposal reviewed by the external evaluators, but we considered options for how students could demonstrate their knowledge and skills as well trained professionals at the very end of their program. This would both serve as an important assessment strategy and as a way for graduates to strengthen their job applications. Two options were discussed in more detail as outlined below:

Portfolio. As students progress through the degree program, they will produce a number of products such as digital maps (e.g., story maps, animations, imagery), lab reports, smaller software development projects, etc.. These could be assembled in a comprehensive digital portfolio of accomplishments, each signifying evidence of a certain set of skills and abilities. Near the conclusion of the degree program, each student could compose an overarching narrative that reflects on this body of work in a broader learning context and present this as a “master’s portfolio” to the academic advisor (and possibly additional faculty) for approval.

Internship. Before pursuing this track a student would meet with their advisor and internship site supervisor to compose a memo of understanding about the scope of work to be accomplished during the period of the internship. At the conclusion of this experience, each student will compose an internship report that provides information about student learning and developmental experiences and any artefacts that were produced during the internship. This report will be reviewed by the internship supervisor for accuracy and quality (see above comments on using this for direct assessment). The report is then evaluated by the advisor (and possibly additional faculty) for approval.



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of New York

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University at Albany

(Name of Institution or Applicant)

The application is for (circle A or B below)

A) New Degree Authority

B) Registration of a new academic program by an existing institution of higher education:

M.S. in Geographic Information Science

(Title of Proposed Program)

I affirm that I:

1. am not a present or former employee, student, member of the governing board, owner or shareholder of, or consultant to the institution that is seeking approval for the proposed program or the entity seeking approval for new degree authority, and that I did not consult on, or help to develop, the application;
2. am not a spouse, parent, child, or sibling of any of the individuals listed above;
3. am not seeking or being sought for employment or other relationship with the institution/entity submitting the application?
4. do not have now, nor have had in the past, a relationship with the institution/entity submitting the application that might compromise my objectivity.

Name of External Reviewer (please print):

Karl Ola Ahlqvist

Signature:



Response to the External Review Reports

On November 1, 2016, the Department of Geography and Planning hosted an external evaluation of its proposed Master of Science in Geographic Information Science (MSGIS). Our reviewers, Marc Armstrong, Professor of Geography and Associate Dean for Research and Infrastructure from the University of Iowa and Karl Ola Ahlqvist, Associate Professor of Geography at Ohio State University, prepared separate evaluations of our proposed MSGIS. The conclusions of both reports were very positive and provided thoughtful recommendations and refinements for the proposal as it moves forward through University at Albany, SUNY System, and New York State Department of Education governance. The Department has already begun the implementation of their requests, as noted in this response.

Both reviewers state that the MSGIS curriculum provides a balanced set of core and elective courses, combining academic rigor with appropriate room for individual specialization. Noting that the MSGIS would be appropriately housed in the Department of Geography and Planning, Armstrong identifies curricular strengths in geographic visualization that have been introduced with the recruitment of Drs. Rui Li and Shiguo Jiang through NYSUNY 2020 funded lines. Both Li and Jiang, as well as Dr. Alexander Buyantuev, another of our Department's junior faculty members and a specialist in remote sensing, have already collaborated with colleagues in other University units on projects involving spatial analysis and geographic visualization. We look forward to exploring further partnerships with our colleagues in the Schools of Public Health and Business as well as with the new College of Emergency Preparedness, Homeland Security, and Cybersecurity (CEHC).

While noting that the Department of Geography and Planning already follows a 7-year program assessment cycle, Armstrong and Ahlqvist both suggest that the MSGIS self-assess through the implementation of a capstone requirement, taking the form of a student portfolio containing examples of work derived from a mix of in-class and internship experiences (depending on each student's course of study). This requirement has been added to the curriculum as Gog 592, *GIS Project Development* (see SUNY Form 2B, sections 2.3.a, 2.3.g). Already established as a culminating academic experience, the course has added a learning objective for professional portfolio assembly and presentation.

The reviewers see continued growth in employment opportunities for geographic information scientists and state that the MSGIS will feed this increased demand both at the regional and national levels. Already serving the 'built-in' GIS market at New York State government offices and agencies, our existing GIS programs have long produced graduates who have also sought and attained positions in other regions and at the federal level. We therefore agree with our reviewers that the MSGIS is likely to produce yet more highly-qualified applicants for such positions, especially as spatial data components become further embedded within information technologies and the internet of things.

Commenting on our faculty and staff resources, the reviewers note that all of our GIS faculty are graduates of high-quality PhD programs in GIS and that the MSGIS can be delivered without additional faculty support. They caution, however, that any reduction of faculty through retirement or other circumstances should be matched by new hires. With respect to opportunities

for funded research, Armstrong suggests that current NSF priorities for STEM-related projects should benefit the ability of our new faculty to enhance their research portfolios, ultimately helping MSGIS recruitment efforts.

Both Armstrong and Ahlqvist note that the Capital Region is home to a large pool of GIS professionals. Ahlqvist suggests that we formalize the MSGIS full-time and adjunct faculty relationships to ensure curricular alignment. We will do so by establishing a Curriculum Committee that will coordinate program updates, rules, and other administrative matters. Committee membership will be composed of our active full-time and adjunct staff. The program director will be responsible for calling committee meetings.

Regarding student recruitment, the reviewers suggest implementing GRE and TOEFL score evaluations, removing a multivariate statistics admission requirement, and introducing provisional admissions through the satisfactory completion of remedial GIS instruction for students lacking basic geographic information science instruction. The GRE and TOEFL requirements have been added to our proposal and the multivariate statistics requirement has been removed (see SUNY Form 2B, section 2.4.a). Remedial instruction options for provisional admission will be implemented on a per case basis.

Both reviewers suggest that our program add paths to professional GIS certification, specifically GISP and GEOINT. We will add learning objectives to selected courses that would address key elements of these certification programs. It is important to note that the MSGIS would not conduct certification examinations—these activities are handled by the relevant certification agencies (the GIS Certification Institute awards GISP certification; the United States Geospatial Intelligence Foundation awards GEOINT).

Armstrong notes that the MSGIS will likely draw heavily from a large pool of current GIS professionals in state and regional offices and agencies. However, he also raises the interesting possibility of creating articulation agreements between the University at Albany and other SUNY units that would allow a '3+2' or similar path from undergraduate to graduate studies, similar to current internal University at Albany combined degree programs. We are currently exploring this option in talks with the Graduate School, the Office of the Vice Provost for Educational Studies, and the College of Arts and Sciences Office of the Dean. We expect that establishing such agreements would enhance our ability to create sustainable recruitment channels with our collaborating programs across SUNY.

Armstrong also commented on the need to establish a specific plan for minority student recruitment. Geography and Planning faculty members Mower, Buyantuev, Jiang, Lawson, Li, and Lapenas have submitted a proposal for NSF GEOPATHS funding that would in part create an undergraduate articulation agreement between the Hudson Valley Community College (HVCC) Department of Biology, Chemistry, and Physics and the University at Albany Department of Geography and Planning BA in Geography and create additional opportunities for undergraduate GIS internship experiences. Since HVCC enrollments represent relatively high numbers of minority students, we hope to not only attract this cohort to our undergraduate

programs but to attract them to the MSGIS as well, possibly in the context of a new combined BA/MSGIS program.

With regard to program resources, both reviewers note that the MSGIS receives strong support from the Department of Geography and Planning Chair and faculty as well as other levels of University administration. The program will benefit from existing New York State licensing agreements with major GIS software providers and will be able to continue using open source GIS tools at no cost. The reviewers also note that there are sufficient lab resources to promote research and instruction.

Concluding their reports, both reviewers identify a number of key factors that predict a successful rollout of the MSGIS. Quoting Armstrong:

- “The proposed program will provide students with a highly marketable degree and skillset.
- There are significant employment opportunities across the public and private sectors at both the local and national scale.
- The program can be positioned to receive a stream of talented undergraduates from the entire SUNY system.
- There is a potential pool of professionals that could seek out this academic development opportunity.
- The program is well connected within the Albany capital region in terms of adjunct professional faculty, and the ability to create a well-developed internship program.
- The core group of faculty bring talent and energy, as well as experiences and competency from several top tier GIScience programs.”

Ahlqvist agrees on several of these factors but cautions that our untenured Assistant Professors must be provided with sufficient room to develop their research programs. To ensure that our junior faculty are not overly burdened with administrative responsibilities, the core duties for program administration will rest with Dr. Mower as initial program director. As our junior faculty receive permanent appointment, they will begin to assume greater administrative oversight of the program. Importantly, most of the courses listed in the proposed curriculum have already been developed by our core faculty.

Among their further observations, Armstrong identifies the importance of offering instruction on professionalization for our program graduates, either as a unique course experience or as a set of lecture topics offered in existing courses. As the faculty currently offer informal instruction on professionalization in their courses, we will use the newly-created Curriculum Committee to coordinate their presentation (where appropriate), thus ensuring compatibility between full-time and adjunct instruction and eliminate redundancies.

In conclusion, the Department of Geography and Planning is pleased to have received such a positive review of its proposed Master of Science degree in Geographic Information Science. As previously noted, we have already implemented several of the reviewers’ suggestions and are working to complete the rest. We do not expect that any of the remaining changes will pose an

impediment to the rollout of the program. We look forward to admitting our first student cohort in the near future.