

*Department of Earth, Environmental, and Geospatial Sciences*

*Herbert H. Lehman College  
of  
the City University of New York*

# **Self-Study Report**

**May 1, 2018**

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## **1.Introduction**

### **1.1 Mission Statement**

Lehman College serves the Bronx and surrounding region as an intellectual, economic, and cultural center. Lehman College provides undergraduate and graduate studies in the liberal arts and sciences and professional education within a dynamic research environment, while embracing diversity and actively engaging students in their academic, personal, and professional development.

The College, committed to meeting the education needs of its urban population, affirms its objectives to:

- provide access to a common body of knowledge and opportunities to develop a lifelong love of learning,
- promote excellence in scholarship, teaching, research and artistic endeavors,
- develop the ability to think analytically and creatively,
- broaden educational opportunities through joint programs with other institutions locally, nationally, and internationally,
- promote an understanding of and respect for such differences as gender, age, ethnicity, culture, religion, sexual orientation, and physical ability,
- advance the understanding and use of emerging technologies,
- serve as a center for the continuing educational and cultural needs for the region through access to the college's facilities and expertise in the academic disciplines, professional fields and the fine and performing arts.

The Department of Earth, Environmental, and Geospatial Sciences (EEGS) is one of only two major geography programs in the New York metropolitan region, a key player in training earth science teachers for middle and high schools, the hub for environmental education and research and urban studies at Lehman College, and an important component of the Ph.D. Program in Earth and Environmental Sciences at the CUNY Graduate Center. As such, the department has the following important and interrelated missions and goals:

- to provide critical general coursework and guidance in earth sciences, environmental sciences, geographic information science, and geography to the undergraduate and graduate students at Lehman, as a part of their comprehensive education,
- to nurture those students who are particularly interested in geology, geography, geographic information science, and environmental science, to enable them to obtain a thorough grounding in those subjects, and to help prepare them for graduate studies or careers in their chosen field,
- to conduct meaningful and original scientific research, involving the undergraduate students in active research roles as much as possible, wherever practicable, this research should focus on improving the quality of life for the local populations, and conserving and protecting the local environment, and if feasible, the research should involve members of the local community as active participants,

- to serve as a facilitator and leader of interdisciplinary and multidisciplinary education and research, particularly in environmental science, earth science education, global and urban studies,
- to provide service at the highest levels in our professions as well as to the College, community, region, and state.

## 1.2 Department History

The self-study and external review provide an excellent opportunity for us to reflect on what we have done in recent years, to review our accomplishments, valuable experiences and important lessons, to analyze the changed conditions in the department, at the College, in our professional fields, as well as the general society, and to reassess our mission, reshape a new shared vision, and develop effective strategies for achieving the new goals for the next 5-10 years.

To understand recent developments, and gain perspectives for the future, it is helpful to gain some insight into the history of the Department.

Although Lehman began its independent existence in 1968, the Department of Geology and Geography (and indeed most other programs) had long existed here as the Bronx Campus of Hunter College since the early 1930's. During that incubating period, the faculty usually consisted of 2-3 members in both disciplines, offering a standard mix of undergraduate courses and servicing a total of about 10 to 20 majors in any given year. Also at that time, many of the rock/mineral/fossil collections were acquired, and standard field and laboratory equipment was obtained. Library collections were small, with only a couple of journals furnished for each discipline. Although a modest operation, the Department was a continuing presence in the typical liberal arts curriculum of the 40's, 50's and 60's.

In 1968, CUNY (which itself was still a relatively new concept) designated Lehman as the Bronx borough senior campus, analogous to Queens College and Brooklyn College. The College acquired its own administration, which began a program of expansion and improvement matching the general growth of public universities nationwide during the late 60's. Salaries and benefits were high, matching growing enrollments. In 1968, the program had about 6 faculty members, distributed between Geology and Geography. Several of these did not have the Ph.D. There was a body of about 20 majors, an active Geology and Geography Club, and the required year of science in the general curricular requirements kept the Geology side of the program well filled. This was coupled with some employment opportunity in petroleum exploration, and things looked ripe for expansion.

Shortly afterward, in the early 70's, open admissions policies were instituted in CUNY, which had previously been highly restrictive in its enrollment requirements. One now had but to be in the upper third of a graduating high school class to enter a senior campus. Enrollments boomed, Lehman going from about 5,000 students to over 12,000 in a few years. Budgets kept pace to some degree. The Department of Geology and Geography recruited heavily, emphasizing the usual requirements on the doctorate and a research commitment for its new faculty. By about 1976, the program boasted 8 geologists and 8 geographers, all but one with the doctorate. The research interests were of the 'one of these' and 'one of those' sort, ranging from mantle geochemistry to New York City transportation networks. One bright cooperative light emerged; for about five years, the CUNY Institute of Oceanography bankrolled a baseline study of the

Hudson River, which still furnishes data for some Ph.D. students in the Earth and Environmental Sciences (EES) Program of the Graduate Center, CUNY. Enrollments stayed high, based on the standard curriculum requirements, and for the majors, continuing petroleum hiring and faculty contacts with city agencies and private contractors. The honeymoon was not to last.

In 1975, the New York City budget crashed - "Ford to City -- Drop Dead". Perhaps an apocryphal quote, but the City, along with its university, began to decline. That August, the Department fired 3 tenure-line faculty members, and most other departments had proportional experiences. The College had no money to print its catalog, and toilet paper became scarce (literally). In the end, the state took over the senior colleges (we are the City University of New York State, in some real sense). Tuition, to produce parity with SUNY, was introduced, open admissions started to fall out of favor, inflation struck the Carter administration, the petroleum industry collapsed, and so on. The effect at the College was to make tenure a near impossibility for most young faculty. In the Department of Geology and Geography, the program retreated in size to near its 1968 level. Additional inroads on the science requirement by other desperate science departments also further reduced the size of geology. Since the mid-eighties, the Department has remained in this reduced circumstance. The creation of the CUNY Ph.D. Program in Earth and Environmental Sciences in the eighties also largely failed to generate interest among faculty or students here at Lehman. As of April 20, 2018, only one of the original faculty members (Professor Irene Leung who joined the department in 1971) remained in the department.

In the early nineties, it became clear that GIS and related geospatial programs were becoming important, and that these programs had their most natural home in the geosciences. Modest line and equipment support began to dribble into the Geology and Geography program here at Lehman. Professor Juliana Maantay joined the department first as a full-time instructor from Fall 1998 to Spring 2000 and then as a tenure-track Assistant Professor in September of 2000 after she finished her Ph. D. degree. A new Chair (Zong-Guo Xia) was brought in from outside in September of 2003. Professor Hari Pant, an environmental scientist, was hired as a Substitute Assistant Professor in September of 2004 and re-hired into a tenure-track position in September of 2005. A new full-time Senior College Laboratory Technician (Dr. Weirong Chen) was added in October of 2004. A full-time CUNY Office Assistant (Ms. Nina Negron) transferred from Baruch College to provide office support for our department at Lehman. To reflect what the department offers more accurately and create a home for interdisciplinary and multidisciplinary environmental studies at Lehman, the Department changed its name to the Department of Environmental, Geographic and Geological Sciences in 2004.

In 2006, the department consisted of two professors in geology (Zong-Guo Xia, Irene Leung), two professors in geography (Juliana Maantay, Edward Bergman), one professor in Environmental Science (Hari Pant), and a Senior College Laboratory Technician for our teaching and research labs (Dr. Weirong Chen). Another professor of geology (Heather Sloan) from the Department of Middle and High School Education was transferred to the department. Heather Sloan and Juliana Maantay took chair's position before the Department hired a new Chair (Stefan Becker) in 2010. Professor Zong-Guo Xia and Dr. Weirong Chen left the department in 2006, Edward Bergman retired, and Yuri Gorokhovich as an assistant professor and Brian Morgan, as a College Laboratory Technician were hired in 2007. Dr. Sunil Bhaskaran was hired on a tenure track as a GIS/Remote Sensing specialist in 2008, however, his contract was not

extended in 2010. The full-time CUNY Office Assistant for the department office (Ms. Nina Negron) left the department and was replaced by Ms. Gail Markbreit in 2006. In 2010, the departmental members decided to change the name of the department to “Department of Earth, Environmental, and Geospatial Sciences (EEGS)”. The previous name, particularly its acronym “EGGS” was not favorable to the department members.

Since the last Departmental Self-Study in 2011, the Department hired a new full-time faculty Elia Machado, assistant professor, specialization in remote sensing and GISc. In fall 2012, Department Chair Stefan Becker became Interim Dean of School of Natural and Social Sciences (NSS), and Hari K. Pant assumed the Department Chair position. The Department has started offering the MS-GIS program in 2012. Yuri Gorokhovich became Department Chair, and Juliana Maantay became Vice Chair of the Department in fall 2014. Hari K. Pant has again become the Department Chair since fall 2017.

The current self-study and external review will help the Department to define its directions and guide the enhancement and expansion of the academic programs offered by the department that are vital to a solid and well-rounded general education for Lehman students, graduate education and professional careers of our majors, minors, and certificate students, the synergistic effect of researchers in the sciences, and other disciplines at the College, and the revitalization of our surrounding urban communities.

### **1.3 Overview and Highlights of the Self-Study**

The department’s achievements over the last five years are impressive, ranging from establishment of new programs to revisions of existing programs. The BA and Minor in Geology were changed to the BA and Minor in Earth Science. A new Masters in GISc and a graduate Certificate in GISc have been added. A new Accelerated Bachelor’s to Masters Degree Program has also been added in GISc. Environmental Science Program was revised to streamline the program, and meet the contemporary demands of the job arena.

Overall, the number of students enrolled in the Department’s undergraduate majors has risen steadily since 2007. Enrollment in the Masters in GISc has also risen substantially since its inception. The first cohort of five students was recruited in Fall 2012. The current cohort 2017-18 has 33 students, an increase of 560%. The number of undergraduate students completing degrees in the department has risen to 30% since 2011, while the number of graduate degrees completed has also risen substantially, as the first cohorts enrolled in the MS in GISc have graduated.

The multidisciplinary nature of our Department provides the unique opportunity to our students of benefiting from an integrated education in Earth, Environmental and Geospatial Sciences. Most of our faculty has expertise in two of these areas, which promotes collaboration in the department, and allows us to better accommodate a largely undergraduate student body with very diverse needs. Most importantly, this has provided us the flexibility to maintain four programs with only six full-time faculty members. The dedication of our faculty, and strategies such as cross listing our course offerings at undergraduate and graduate levels, as well as developing new courses to serve different programs have helped us to keep our programs thus far.

The Departmental faculty and staff maintain a multi-pronged recruitment strategy, which is somewhat tailored to the different major and graduate programs within the Department, but all of which share common attributes and aims. Potential methods to further increase the efforts and employ new methods to recruit new majors into the programs are continuously discussed by members of the Department, including increasing the visibility of the programs on campus and beyond. We will continue to showcase accomplishments of our majors and graduate students, and the relevance of our programs in the Map Gallery in Gillet Hall, but would like to have greater visibility on campus. We expect all these methods to contribute to continuous and sustainable growth in the number of our majors, graduate students, and general non-EEGS major students taking our courses.

The number of students served by the Department in the last academic year (2016-2017) has increased 18% compared to academic year 2012-2013 (Table 1). There are currently 71 students majoring in the Department's undergraduate programs (earth science = 18, earth science certificate = 2, environmental science= 42, geography = 6, and Geographic Information Science Certificate = 3), and 32 students majoring in the graduate programs (MS-GIS = 30, and Advanced GIS Certificate = 2). The number of Department's full-time faculty members has decreased even though the offerings of courses and programs, including a graduate program (i.e., MS-GIS), have significantly increased over the last six years (since the last self-study in 2011). As the students majoring in the Departmental programs on the rise, Department is in critical need of, at least, three faculty members, one for each program, i.e., earth science, environmental science, and geography and GISc.

The Department is in dire need of teaching laboratories for geology and environmental science courses, and a dedicated but flexible location for the GISc mobile lab. Also, the Department lacks in sufficient office space for faculty members, visiting scholars, adjunct instructors, research staff, emeriti, etc. It is critical that these issues related to laboratories and office space need to be resolved.

## **2. Resources**

### **2.1 Full-time Faculty and Staff Resources**

The number of department's full-time faculty members has decreased even though the offerings of courses and programs, including two new graduate programs (i.e., MS-GIS, Advanced Certificate in GISc), have significantly increased over the last seven years (since the last self-study in 2011). In 2011, there were seven instructional faculty members, a college laboratory technician, and a full-time CUNY college assistant, Level III. Additionally, we lost two faculty members from the Lehman MPH Program, GISc concentration track, Department of Health Sciences who taught almost exclusively in the EEGS Department's GISc Program for a number of years, and were re-assigned to the new CUNY Graduate School of Public Health and Policy in January 2016. As the students majoring in the Departmental programs on the rise, Department is in critical need of, at least, three faculty members, one for each program, i.e., earth science, environmental science, and geography and GISc.

There are now six instructional faculty members, a senior college laboratory technician, and a full-time CUNY college assistant, Level IV.



### 2.1.1 Faculty and Staff

Members of the Department:

- Stefan Becker, tenured full professor (on leave to ECP)
- Irene Leung, tenured full professor
- Juliana Maantay, tenured full professor
- Gautam Sen, tenured full professor (on leave to ECP)
- Heather Sloan, tenured associate professor
- Yuri Gorokhovich, tenured associate professor
- Hari Pant, tenured assistant professor
- Elia A. Machado, tenure-track assistant professor
- Brian Morgan, senior college laboratory technician (non-instructional faculty)
- Gail Markbreit, CUNY college assistant, Level IV

### 2.1.2 Departmental Activity

The Department has organized/participated number of activities ranging from participation in College-wide open house to inviting guest speakers. The number of students served by the Department in the last academic year (2016-2017) has increased 18% compared to academic year 2012-2013 (Table 1). There are currently 71 students majoring in the Department's undergraduate programs (earth science = 18, earth science certificate = 2, environmental science= 42, geography = 6, and Geographic Information Science Certificate = 3), and 32 students majoring in the graduate programs (MS-GIS = 30, and Advanced GIS Certificate = 2).

Table 2.1 The number of students served by, and undergraduate and graduate FTEs of the Department for the past five academic years

Academic Year	2012-2013	2013-2014	2014-2015	2015-2016	2016-2017
<b>Number of students served</b>	907	1174	1177	1029	1070
<b>Undergraduate FTEs</b>	82.67	70.80	80.93	80.13	62.55
<b>Graduate FTEs</b>	17.50	16.59	16.00	21.59	17.50

As per PSC-CUNY (Professional Staff Congress-City University of New York) Contract, the average faculty members'/department chair's teaching load is 21 hours, and all faculty and the Chair are/were maintaining the 21 hours of workload over the last five years. The details about the course loads are provided below in section 2.1.3.

### 2.1.3 Scholarship and Professional Activity

The teaching load, courses taught and course releases granted, and the purpose of course releases for each faculty member have been provided in the tabular form in Appendix I. No reliable information is available about above mentioned items for the academic years 2012-2013 and

2013-2014. However, more detailed data are available for academic years 2014+2015, 2015-2016 and 2016-2017, which are provided in the tables in Appendix I.

### **Accomplishments of Faculty:**

The Department faculty members have published number of peers-reviewed articles, given numerous presentations, and received fellowship and grants. The detailed accomplishments of each faculty and staff are provided in the curriculum vitae, Appendix II.

### **Outside Teaching Obligations and Service Activities of Faculty:**

#### **Yuri Gorokhovich**

Prof. Yuri Gorokhovich has been teaching a three-credit course at Columbia University, Department of Earth and Environmental Sciences, New York, NY every other semester, at least, for the past five years. It is not an obligation, however, Prof. Gorokhovich is allowed to do it as per PSC-CUNY contract.

#### **Heather Sloan**

Prof. Heather Sloan taught a course (MLS 704: The Natural Sciences) for the Masters of Liberal Studies Program at Lehman as an adjunct in Spring 2016 and 2018. She taught the same course in Spring 2017, as part of her regular program hours. In January 2018 Prof. Sloan co-taught two course modules for the Masters en Géorisques at the Université d'Etat d'Haiti in Port-au-Prince, Haiti - this was within the context of her NSF-funded Lake Azuei Project, and she was not paid for it.

#### **Juliana Maantay**

- Instructor for 2 or 3 doctoral courses per year;
- Chair of Dissertation Committees of 8 doctoral students in EES program;
- Serve on Dissertation Committees of 11 additional doctoral students in EES and Public Health Programs;
- Supervisor for 4 NOAA-CREST Fellows;
- CUNY Graduate Center EES Program committees – First Exam; Curriculum; Admissions.

- NOAA-CREST Research Scientist:

2001-Present. *National Oceanic and Atmospheric Administration* (NOAA) cooperative center, “Center for Remote Sensing Science and Technology-CREST.” Conduct research into the public health impacts of climate change; green infrastructure; and supervise NOAA-CREST Research Fellows.

### **Physical Resources:**

The Department has a state-of-the-art GISc laboratory, fully equipped with the latest hardware and software, and a full-time Senior College Laboratory Technician to run the facility. This helps us obtain funding for and the ability to conduct more complex research projects, attract a higher caliber of students, and offer better services, not only to our students, but also to members of the wider community who are interested in using GISc to examine local environmental, economic, and health concerns.

The Department is in dire need of teaching laboratories for geology and environmental science courses. Moreover, the Department critically needs a mobile lab for GISc courses. Also, the Department lacks in sufficient office space for faculty members, visiting scholars, adjunct instructors, research staff, emeriti, etc. It is critical that these issues related to laboratories and office space need to be resolved. The detailed about the physical resources, which are available to the Department's faculty, staff and students to carry out the department's goals and objectives, are given in Section 4.2.

#### **2.1.4 Evaluation**

The evaluation of faculty for annual reappointment, tenure, and promotion is based on documented scholarship, teaching, and service performance and guided by the departmental "scholarship guidelines" (a copy is provided in Appendix III– Evaluation Instruments). All the decisions involve a careful assessment of the faculty member by the departmental Personnel and Budget (P&B) committee who votes to make a recommendation in each case.

The evaluation instruments used in these processes include: an updated CV of the faculty member, Annual evaluation reports, Peer teaching Observations reports, and Students evaluation of teaching and learning (SETL) reports. A copy of these instruments is also provided in Appendix III).

These instruments are described in more detail below. In addition, all faculty members are encouraged to maintain digital documentation of all their professional activities using Lehman's online repository "Digital Measures". This repository is also the source of documentation for the departmental P&B as well as the college *Faculty Personnel and Budget* (FP&B) committees in tenure and promotion processes. Therefore, faculty candidates for tenure, promotion, and reappointment should maintain their digital records up to date and submit their promotion and tenure dossiers digitally.

Recommendations for reappointment are made annually by the departmental P&B based on the performance of the faculty member in scholarship, teaching, and service. After six years of service, and following two decanal reviews (second and fifth years), Assistant professors submit their tenure and promotion dossier to Digital Measures. The Chair should solicit and upload at least four letters of recommendation from persons outside the University (approved by the departmental P&B) in addition to the Chair's report to the candidate's personal file section in Digital Measures. The Chair's report is a thorough review of the candidate's professional achievements, teaching, and service as pertinent to tenure and represents the collective judgment of the departmental P&B Committee along with any additional opinion the Chair may wish to express in that title. The report also includes the departmental P&B Committee's vote on the candidate.

Faculty members eligible for promotion should notify the Chair. A Chair's report evaluating the candidate professional activities since tenure or last promotion including the departmental P&B vote and at least four external evaluation letters are also evaluated during this process.

A brief description and a copy of the scholarship guidelines, annual evaluation form, and SETL surveys are provided below.

Departmental Scholarship Statement: defines scholarship, the standards for research, teaching, service, and professional development, and the criteria for renewal (reappointment), tenure and promotion. The document was approved by the departmental P&B committee on October 13<sup>th</sup>, 2017 and submitted to the Provost in spring 2017.

Annual Evaluation Reports: Assistant and Associate professors are required to submit an annual evaluation report summarizing their accomplishments in scholarship, teaching and service. The report is reviewed and discussed with the Chair of the department, who also provides oral and written assessment of the strengths and areas where the faculty member needs to improve to meet the requirements for tenure and promotion.

Peer teaching observations: every semester faculty in the ranks of Assistant and Associate and other instructional staff are observed for an hour by a higher ranked faculty member of the department. The purpose of this process is to help improving the teaching effectiveness in the department but also to provide documentation for reappointment, tenure, and promotion decisions. A written is written by the observer describing the teaching performance of the observee in terms of the material covered, organization of the lecture, the rapport the of the faculty with the students, overall style of presentation, and teaching techniques employed. The report concludes with an overall appraisal of the teaching effectiveness of the observee, after assessing the strengths and aspects that need improvement along with some recommendations. The report is discussed during a meeting of both parties, after which the observee has the opportunity to write his/her comments on the report. A summary of the discussion is also added to the report.

Students evaluation of teaching and learning (SETL) surveys: are administered by the Office of the Provost and Academic Affairs for each course everything semester. Copies of the results are sent to the departments and each faculty member. The college has used different versions of the SETL survey instrument between 2011 and 2018, all are included in Appendix IV.

Service to the department, college, university, profession and community is documented in the CV, annual evaluations.

### **2.1.5 Faculty Development Efforts**

All faculty are encouraged to present their research at professional conferences, improve their teaching effectiveness, seek external funding, and engage in service. Discussions about improving teaching effectiveness, as well as the success of our programs and other professional development opportunities constitute a regular component of our departmental meetings and other departmental events.

In addition, opportunities for service and faculty development are widely distributed via email. The budget of our department is quite limited, so faculty need to seek funding from other sources for professional development. Faculty who present their research at a conference are generally able to cover a portion of the cost from other sources in the college.

Faculty members of this department have benefited from grant training workshops at Lehman (organized by the Office of Research and Sponsored Programs (ORSP)) and other CUNY

colleges, and competed successfully for paid fellowship leaves (at a reduced salary rate), CUNY wide Faculty Fellowship Publication Programs, and training on new research equipment obtained through competitive intramural funding.

## **2.2 Adjunct Faculty**

### **2.2.1 Recruitment**

Adjunct faculty are recruited from doctoral and masters programs in Earth and Environmental Sciences and or Geography, at local and regional professional meetings, and using disciplines or professional email list serves. In some cases exceptional alumni from our programs have also served as adjuncts. Faculty from other CUNY colleges and local higher education institutions (e.g., Columbia) and the private sector have also served as adjuncts in our programs.

### **2.2.2 Selection**

Candidates for adjunct positions are recommended by faculty members who send their CVs and other relevant materials (e.g., course syllabi) to the departmental P&B committee. The candidates are selected and approved by the members of the P&B committee after careful evaluation and discussion of their fit to our programs, and their experience teaching the courses needed, as well as their overall professional achievements, and references.

### **2.2.3 Supervision and Development**

Once the decision to hire an adjunct has been made, one or more faculty members meet with him/her to introduce them to the department and provide a brief training session about teaching effectiveness and the particulars of teaching in our department. The same faculty member(s) also work(s) with the adjunct before the semester starts to help his/her prepare their course(s) and ensure that the standards are met for our programs. All adjuncts are provided copies of relevant syllabi and in most cases, class materials for the course(s) they will be teaching. In addition, adjuncts also receive or seek advice during the semester about teaching or student rapport from the faculty members of the department, but particularly from those that have taught the course before who serve informally as their supervisors and mentors.

### **2.2.4 Evaluation**

Each semester, adjuncts are evaluated by faculty ranked Assistant Professor or higher. The main mechanism used for evaluation and teaching development is Peer teaching observation as described in section 2.1.4 (Evaluation). In addition, adjuncts are also evaluated using the Student Evaluations of Teaching and Learning (SETL) results (described in section 2.1.4 as well).

## **2.3 Organizational Structures**

The current organizational and administrative structure of the department of Earth, Environmental, and Geospatial Sciences is structured is as follows:

**Chair:** Hari Pant

**Faculty members:** Juliana Maantay (Professor), Irene Leung (Professor), Heather Sloan (Associate Professor), Yuri Gorokhovich (Associate Professor), Hari Pant (Assistant Professor), and Elia Machado (Assistant Professor).

**Members on leave to Executive Compensation Plan (ECP):** Gautam Sen (Professor, Dean of School of Natural and Social Sciences, on leave since 20--), Stefan Becker (Professor, Vice Provost for Academic Programs, on leave since 2012).

**Administrative Staff:** Ms. Gail Markbreit

**College Laboratory Technician:** Brian Morgan (Senior College Laboratory Technician)

**Program Directors:**

- Environmental Science (Interdisciplinary BA in Environmental Sciences): no program director.
- Geography and Geographic Information Science (GISc), including graduate GISc programs and internship programs: Juliana Maantay.
- Earth Science: no program director.

**Internship Program:**

Director of the Geography and GISc Internship Program: Juliana Maantay.

Associate Director of the Geography and GISc Internship Program: Elia Machado (2015-present).

**Departmental Committees:**

-Personnel and Budget (P&B):

This committee is chaired by the department chairperson and responsible for evaluating and voting in recommendations about instructional staff appointments, reappointments, reappointments with tenure, promotions, certificates of continuous reappointments (lecturers), and leaves.

There are three student representatives in our department. Students serve the departmental P&B committee in advisory capacity. In addition, students have full voting rights on all departmental standing committees, other than P&B committee, with the number of students and the method of election to be determined by the respective departments.

Faculty members of the P&B committee: Hari Pant, Yuri Gorokhovich, Juliana Maantay, Heather Sloan, Elia Machado

-Curriculum committee:

The function of this committee is to review and discuss proposed curricular changes in our programs and courses and to ensure their alignment with our learning objectives. Curriculum changes that involve changes in credits, requirements or the structure of a course need to be voted upon by all the department members prior to being submitted to the College Curriculum committee for review.

Members: Hari Pant, Yuri Gorokhovich, Juliana Maantay, Irene Leung, and Elia Machado.

-MS-GISc Admissions Committee:

Its function is to review and discuss applications to the MS in GISc and select the students admitted to the Program every semester.

Members: Juliana Maantay, Yuri Gorokhovich, Elia Machado.

-MS-GISc Program Committee

This committee meets periodically to discuss curricular matters, course scheduling, GISc adjunct needs, GISc Lab equipment or software issues, progress with students, internships, and any specific problems that arise within the GISc program.

Members: Juliana Maantay, Yuri Gorokhovich, Elia Machado, Brian Morgan, and other faculty teaching in the GISc Program

### **2.3.1 Administration**

### **2.3.2 Intradepartmental Programs**

Our department offers Bachelor's degrees in Earth Science, Environmental Science, and Geography, and a Master's degree in Geographic Information Science.

The program in Earth Science includes a BA in Earth Science (ES-BA, 30 credits), a Minor in Earth Science (16 credits), and a Certificate in Earth Science (ES-CERT 30 credits).

The ES-BA was approved in May 2012 and replaces the former BA in Geology. The program provides a strong content foundation to students who intend to teach K-12 Earth science that is aligned with teacher certification requirements. It incorporates deeper levels of conceptual understanding as well as field and laboratory experiences that enhance and strengthen future teachers' knowledge and confidence. Students enrolled in the ES-BA are typically also enrolled in a Minor in Education. Undergraduate courses within the ES-BA are run in parallel with graduate courses offered to Masters of Science in Science Education in the Department of Middle and High School Education at Lehman. With the exception of one course, the course requirements for the ES-BA are the same as for the ES-CERT so that we get twice the instructional "mileage" from these programs. The ES-CERT is structured to provide a strong foundation in Earth science content. The program is intended for certified teachers of other science areas who plan to obtain a second certification in Earth Science as well as holders BA or BS degrees who seek a foundation in Earth science before applying to a Masters of Education program. Although the ES-BA was approved May 2012, it was not listed on our College student CUNYfirst<sup>1</sup> or in the Undergraduate Bulletin or the College web page and student were not able to enroll in the program until Feb 2014.

I believe this had a significant impact on enrollment headcount.

The Interdisciplinary program in Environmental Science consists of a B.S. in Environmental Science (46 credits) and a 14-15 credits minor in Environmental Science. The major includes basic and advanced science courses from four participating science departments (Biology, Chemistry, Physics and Astronomy, and EEGS). Students select a specialization area in Ecology, Urban Environmental Management, Environmental Geology, or Environmental Analysis. The program emphasizes students' awareness and appreciation of the natural and built environment, their knowledge of natural systems and ecological concepts, an understanding of current environmental issues, and the ability to use analytical and problem-solving skills on environmental issues.

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<sup>1</sup> CUNYFirst is a CUNY wide integrated digital platform used to manage students' education and records, faculty and staff employment and benefits information, and all college business operations.

The Geography program includes a BA in Geography (28 credits) and a minor in Geography (12 credits). The BA provides a foundation in the discipline of Geography emphasizing different aspects of human, physical, cultural, and regional geography as well as cartography and spatial analysis. To satisfy the graduation requirements the students have the option to complete an internship or the Honors in Geography course.

The GISc program offerings include a Master of Science in Geographic Information Science (MS-GISc, 40 credits), a Certificate in Geographic Information Science (undergraduate level, 17 credits), and an Advanced Certificate in GISc (17-20 credits). In addition, students majoring in Geography have the option completing a BA Major in Geography, with a concentration in GISc (28 credits) and a Minor in Geographic Information Science (14 credits).

The MS-GISc has been offered since 2012. It was designed to prepare students to meet the demands and challenges of theoretical and applied research careers in the field of geospatial sciences, which in recent years has seen an exponential increase in the demand for highly qualified personnel in the fields of health, environmental, and geospatial sciences. Two options are available to satisfy the 8-credit capstone research experience of the MS-GISc degree: a traditional Master's Thesis, or a combination of an applied research project and professional experience through an internship (PEAR option – Professional Experience and Applied Research). The Thesis Option prepares students interested in pursuing doctoral studies in Geography, GISc, or related disciplines. The PEAR option was developed to meet the requirements for a Professional Science Masters (PSM), since CUNY was interested in developing such degrees in order to address the needs in the wider society of having science-literate personnel in professional positions. Students who meet the requirements for the MS-GISc degree (PEAR Option) and also the PSM requirements receive a separate diploma from the Professional Science Master's Program by the *National Professional Science Master's Association (NPSMA)* noting their additional PSM credential. The PSM affiliation with NPSMA requires us to maintain an active External Advisory Board, composed of academics, professionals, and researchers in GISc-related fields, and also to comply with several other reporting criteria. The Advanced Certificate in GISc was approved by CUNY and NYSED in Spring of 2013. In addition, there is also a Memorandum of Agreement with the CUNY Graduate Center, allowing doctoral students to be awarded the Advanced Certificate in GISc by Lehman College.

Lastly and since Fall 2016, our department started offering an Accelerated Bachelor's/Master's Program in Earth, Environmental, and Geospatial Sciences (EEGS). Students in the program receive a BS in Environmental Science or a BA in Earth Science or Geography, and a Master's of Science in Geographic Information Science (MS-GISc) at the end of the program. The requirements for completion are identical to those for completion of two separate degrees. However, 12 credits of coursework taken for the Bachelor's degree can be at the graduate level and count towards the graduate degree. The program is designed for exceptional Lehman College students, but qualified students transferring from other senior or community colleges are also eligible to apply for this program. Before being considered for this Accelerated Degree program, students must have already completed at least one GISc course at the undergraduate level and received a B+ or better, with at least an 3.0 GPA overall.



The multidisciplinary nature of our department provides the unique opportunity to our students of benefiting from an integrated education in Earth, Environmental, and Geospatial Sciences. Most of our faculty have expertise in two of these areas, which promotes collaboration in the department and allows us to better accommodate a largely undergraduate student body with very diverse needs. Most importantly, such multidisciplinary nature has provided us the flexibility to maintain four programs with only six full-time faculty members.

The dedication of our faculty and strategies such as cross listing our course offerings at undergraduate and graduate levels, as well as developing new courses (e.g., Natural Hazards) to serve different programs have helped us to keep our programs so far. However, even though we are authorized to hire adjuncts, maintaining our programs has become very challenging over the last years, particularly since two faculty members that were affiliated part-time with EEGS left the college at the end of the spring 2016 semester. The college has not committed to any new lines in yet.

### **2.3.3 Interdisciplinary Collaborations**

The faculty in our department collaborates extensively with other departments, programs and initiatives at Lehman and CUNY wide. A few examples of collaborations are described below:

#### **Collaborations with other departments and contributions to course offerings at Lehman:**

The interdisciplinary program in Environmental Science reflects the long term collaboration of our department with the departments of Biology, Chemistry, Physics and Astronomy. Our faculty has also co-taught courses with faculty from the Biology department such as Environmental Conservation (ENV235) and Environmental Pollution (ENV270).

In addition, EEGS contributes significantly to course offerings to fulfill the General Education Requirements in the Required Core (GEO 101 Dynamic Earth, GEO 167 Evolution of the Earth), as well as the following components of the Flexible Core in World Cultures and Global Issues (GEH 101 Introduction to Geography, GEH 240 Urban Geography), and the Scientific World (ENV 210 Environmental Science, ENV/GEH 235 Conservation of the Environment, GEP (GEO) 228: Weather and Climate, and GEP 204 Basic Mapping: Applications and Analysis). The Earth Science program also provides several graduate level courses that fulfill degree requirements in the Masters of Science in Science Education in the Department of Middle and High School Education including GEO 501, GEO 502, GEO 509, GEO 510, GEO 580, GEO 581, GEO 601, GEO 603, and GEO 697.

The Geography/GISc program also contributes courses to two interdisciplinary programs. Two EEGS courses (GEP 230 Urban Environmental Management, and 240 Urban Geography) are part of the Urban Community Development Program (Interdisciplinary minor) and one course (GEH 267 the New York Metropolitan Region) is part of the Urban Studies Interdisciplinary Program Specialization. Additionally, the tight collaboration EEGS and the Health Sciences Department has resulted in the 18-credit Geographic Information Science Specialization of the BS in Public Health (48 credits).

The Geography program also collaborates with other Arts and Humanities departments at Lehman including the Latino, Latin American, and Puerto Rican Studies (LAC), Middle Eastern Studies, and African-American Studies (AAS) by offering co-listed undergraduate courses in

regional geography, such as Regional Geography of Latin America (GEH 289); Africa (GEH 287), and the Middle East (GEH 295).

**Collaborations with other programs and initiatives at Lehman:**

Faculty from the Earth Science program has developed a very successful study abroad program on Crete with the History department consisting of Earth Science and History courses. The program has been running for 8 years and it is the only study abroad program fully organized and run by Lehman College faculty.

Earth Science faculty have also participated actively in the Open Education Resources (OER) initiative at Lehman by developing two OER courses in collaboration with the Library personnel (GEO101 Dynamic Earth and GEP375/675 Data Acquisition and Integration in GIS). The courses were presented at the CUNY-SUNY wide event "CUNY & SUNY Open Educational Resources (OER) Showcase" at Baruch College (CUNY) in March 2018.

Our department also offers several courses on a regular basis as part of the Freshman Year Initiative (FYI). This is a nationally recognized program aimed at offering first-year students a supportive and carefully structured college experience. All first-year students entering Lehman directly from high school participate in the program, which promotes an interdisciplinary curriculum, faculty collaboration, and peer support.

**Collaborations with local and CUNY wide programs:**

Our department works closely with the Earth and Environmental Sciences (EES) Doctoral Program at the Graduate Center, offering many of our graduate courses to the EES students, and serving on important program committees, such as Admissions, Curriculum, and First Exam Committees. EEGS faculty has also served as mentors and dissertation advisors to many EES students. Our faculty also serves as advisors and research fellowship supervisors to students in other CUNY Doctoral programs, such as Public Health, Criminal Justice, Environmental Psychology, and Biology (Plant Science). Additionally, our faculty developed a Memorandum of Agreement between Lehman College and the Graduate Center to be able to award our Advanced Certificate in GISc to doctoral students in any program as an *en route* diploma.

Additionally, faculty from the Earth Science program has also been collaborating with the American Museum of Natural History through Lehman's Science Education Masters program by teaching an Independent research course (GEO 697) in the Summer Educators' Institute on Earth and Space Science.

The EEGS department also participates in the College Now Program by offering College-level GISc courses every year to qualified high school students as part of the College Now Summer Science Academy in GISc.

Lastly, adjuncts from our program teach regularly an intensive 6-week college credit version of the course GEP 204 (Basic Mapping Science: Applications and Analysis) as part of the Van Cortlandt Park Conservancy Summer Forestry Program for High School Students.

### **Research and Participation in CUNY centers:**

EEGS faculty have ongoing research collaborations with other departments at Lehman and CUNY, and has also obtained equipment through these collaborations such as the two XRF analyzers for elemental analysis of rocks and materials (in collaboration with the department of Anthropology).

In addition, EEGS faculty have also collaborated as affiliated researchers with, or are on the various boards and steering committees of a number of CUNY centers and institutes. These include the CUNY Institute for Health Equity, The CUNY Institute for Demographic Research, The CUNY Center for Urban Research, CUNY Remote Sensing Earth Systems Institute, and CUNY Institute for Sustainable Cities.

### **2.3.4 Oversight and Professional Integration**

The MS-GISc Program has an External Advisory Board which strengthens the links between our department and the professional community. The board includes representatives from the GISc industry, private sector consulting firms, not-for-profit organizations, academic research institutes, and local, state, and federal governmental agencies. A few of their members have given talk to our students about their sectors and also taught as adjuncts. The Board meets at least once a year and provides insights and guidance to the curriculum, the internship experience, and research directions. In July 2013, the MS-GISc program gained national affiliation with the National Professional Science Master's Association (NPSMA), which facilitates the accountability and oversight of the Master's program. This was the first CUNY PSM to be affiliated with the national PSM association. PSM programs consist of two years of academic training in an emerging or interdisciplinary area, along with a professional component that may include internships and "cross-training" in workplace skills, such as business, communications, and regulatory affairs. All have been developed in concert with employers and are designed to dovetail into present and future professional career opportunities.

### **2.4 Physical Resources**

All the department facilities are located in the third floor of Gillet Hall and its basement. The space and equipment officially under the control of our Department and are listed in Appendix V. A short summary of our facilities and its usage is provided below along with our equipment. Some rooms are used for different purposed for a more effective use of space.

Our teaching facilities include a computer lab with capacity for 24 students, a teaching lab space mainly used by the Earth Science program, and one teaching/research lab for Environmental Sciences. In addition, there are 7 Faculty offices (some of them used as research space including The Urban GISc Lab at Lehman College, with three student/research assistant/adjunct workstations), two offices for staff (the department main office and the senior lab technician office), a common area with kitchen used for seminars, meetings, which is also used by adjuncts and students. There are also 7 closets storing audio/visual equipment, mineral and rock samples, and teaching materials.

EEGS equipment includes 29 desktop computers for faculty and staff use, 26 desktops computers for student use (mostly teaching), 20 laptops for teaching with a storage cart, 1 server for the GISc lab, 17 printers, 5 ceiling projectors (plus 1 slide and 1 overhead projectors), 1 copier, 1 faxing machine, 1 scanner, and 1 CR/DVD player. The Earth Science equipment consists mainly

of several microscopes and mineral and rock collections, and the Environmental Science lab includes and a Spectrophotometer, a Centrifuge along with other equipment listed in Appendix V.

## **2.5 Funding**

### **2.5.1 Revenue**

A major component of the Lehman College's annual tax levy budget is allocated to Other Than Personal Services (OTPS). This funding is used to procure instructional and non-instructional supplies such as office supplies. The department OTPS budget was \$1,700 per year between 2011 and the end of funding year 2015-2016. The funding increased to \$3,719 in the funding period 2016-2017, but the department was required by the College to pay the license of the software used in one its required classes (Remote Sensing) which ascended to \$2,250, effectively decreasing the funding available for the regular items to \$1,469. A description of how this funding is used in our department is provided in section 2.5.2.

Our department does not engage in external fundraising efforts, but our faculty members actively seek grant funding. The net overhead (after RF and CUNY fees) from faculty grants based on Lehman College federally-negotiated Indirect Cost rate is returned as follows: Principal Investigator - 9%, Department Chair - 4%, Library - 1%.

### **2.5.2 Expenditures**

The OTPS budget is mostly spent on office supplies (mostly printing supplies such as toner and copier paper), teaching supplies (e.g., chalk, textbooks), lab supplies (globes, lenses, lab coats), printing promotional materials for our programs, business cards, and in a few instances, flash drives and books.

## **2.6 College and CUNY Resources**

### **Libraries:**

CUNY's library system consists of 31 libraries and the CUNY Central Office of Library Services (OLS), supporting the University's 24 campuses and 100+ research centers and institutes. Almost all campus libraries respond to phone and e-mail inquiries and some offer instant or chat messaging.

There is a common catalog for all CUNY Libraries, but also individualized for each campus. . The shared catalog provides holdings information from all campuses, including print and electronic books, videos, maps, serials, and titles that are on order. The catalog may be searched by author, title, subject, or keyword, and it is accessible from any computer. Patrons using mobile devices will be automatically rerouted to the mobile version of the catalog for an optimal browsing experience. The library's website at Lehman College has improved its design and functionality over the last years and now features an "OneSearch" option which facilitates the search of books, articles, e-books, and media in a single query.

Additionally, the University licenses a large number of information resources which are available to the entire CUNY community. In addition to this core group of e-books, databases,

and archives, individual campuses offer a rich range of additional electronic resources to support local needs. E-books, online reference collections, full texts of journal articles and electronic journals, as well as document delivery via Interlibrary Loan (ILL), extend services beyond print collections available within library buildings.

Libraries also help instructional activities by promoting Open Educational Resources (OER) for students. CUNY was awarded \$4,000,000 from New York State to establish, sustain, and enhance new and ongoing OER initiatives throughout CUNY. This funding must be spent in FY 2018. In 2017 Dr. Yuri Gorokhovich from EEGS was awarded \$1,000 for development of OER resources for his course GEP3750 “Data Acquisition and Integration in GIS”.

Lehman College has its own Leonard Lief Library that provides excellent search mechanisms for literature and data, and also staff support for the faculty, including organizing specialized classes, information literacy workshops, reservations of books online, research guides for the faculty, interlibrary loans, off campus access to e-resources, CUNY academic works, and copyright resources.

**Labs:**

CUNY has a specialized IT center at the Graduate Center with access to parallel computing and various platforms (PC, Mac) and software for scientific applications.

Lehman College provides EEGS faculty with access to multiple computer labs at Leonard Lief Library and the IT Center (Carman Hall). The IT center at Carman Hall also has computer equipped labs that can accommodate classes up to 20-25 students. The Information Technology Resources (ITR) Division at Lehman College also provides EEGS faculty and labs with CUNY wide GIS software licenses (ArcGIS), and also free one-year individual licenses for students. EEGS also uses and covers the cost of a campus-wide license of the remote sensing software TerrSet (Clark Labs). The yearly license maintenance cost is covered from the budget allocated to our department from the School of Social and Natural Sciences (NSS).

The EEGS Department has also a Geology Lab/Classroom (Gillet 324) with an extensive mineral and rock teaching collection in Gillet 324A (preparation room). Recently EEGS acquired an extensive collection of rocks and fossils from NYU. The GISc Lab (Gillet 322) has 24 Dell workstations available for student use and a designated instructor’s workstation. In addition to the standard MS Office suite, all computers are equipped with GIS, statistical, and Remote Sensing software for teaching and research. Students have storage space on our departmental server, and access to a database of spatial data for analysis. A color laser printer and large format plotter are located in the lab for approved student and faculty use. A full time College Laboratory Technician (Brian Morgan) maintains the facilities and provides technical assistance. In addition, our students benefit from the assistance of Lab tutors a few hours a week.

The Environmental research laboratory (on third floor of the Gillet Hall) has one computer and a printer along with the following major equipment:

Buchii Vacuum Rotatory Evaporator,  
Barnstead Incubator,  
Digestion Block,

Electronic Balances,  
High temperature Furnace,  
Shimadzu UV-VIS 2501 Spectrophotometer,  
58590N Gas Chromatography, and  
Refrigerator (capable of accommodating cores).

In general, this laboratory is equipped with necessary facilities/equipment to conduct limited environmental education/research and analysis. Because of the lack of environmental teaching laboratory in the Department, this research laboratory has also been used as an environmental teaching laboratory.

#### **Computer Hardware and Software:**

CUNY and Lehman College have standard Dell PC and Mac computers equipped with various software including Microsoft Office, Adobe Suite, and others. The IT center of Lehman College also helps to install any custom software that is licensed or shareware and offer faculty workshops. For example, they assisted Dr. Yuri Gorokhovich to install the software “Hydro Desktop” for his course “Environmental Hydrology” classroom located in the IT Center. The IT Center also provides access to plotters, scanners, and printers throughout the college.

#### **Learning Resource Centers:**

Lehman College’s Instructional Support Services Program (ISSP) is home of the Academic Center for Excellence (ACE) and the Science Learning Center (SLC). The ISSP provides Lehman students with the opportunity to achieve academic success through the guidance and encouragement of peer tutors and professional staff members. ACE provides the following services to students and faculty:

- Weekly and Walk-in Tutoring
- ACE Writing Workshops
- Weekly Conversation Groups
- ACE Writing Values

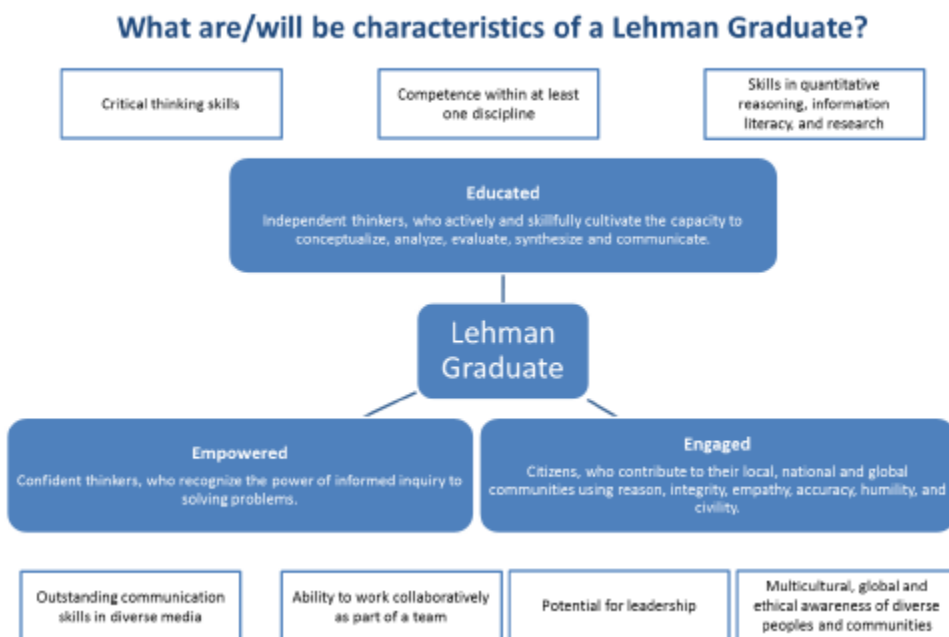
The use of tutors in EEGS classes is very beneficial for the faculty and students since it brings them in direct contact with their peers (tutors) and increases individualized attention to the students in the classroom, which can be limited at times since only one faculty member is available to assist all the students. There are two or three GISc Tutors in the GISc lab who are often advanced GISc students, and work during the GISc Lab’s Open Hours, approximately 4 or 5 hours each day. For support, Brian Morgan, the departmental CLT, is also available to assist students.

### **3. Curriculum**

#### **3.1 Curriculum: Contributions to College Programs**

General education at Lehman College aims to help students develop broadly applicable skills such as critical thinking and writing, enhance their capacity for lifelong learning, and strengthen their ability to contribute effectively within our culturally diverse society. An undergraduate degree at Lehman College provides students with a Liberal Arts Education, which is a broad

knowledge of the wider world (e.g. science, culture, and society) as well as in-depth study in a specific area of interest. It helps students develop a sense of social responsibility, strong intellectual and practical skills that span all major fields of study, such as communication, analytical, and problem-solving skills and a demonstrated ability to apply knowledge and skills in real-world settings (adapted from AAC&U). The diagram below summarizes the main learning goals of undergraduate students at Lehman College:



EEGS contributes to these learning goals through the courses it offers as part of the General Education Required Core:

General Education: Required Core (4 Courses):

Laboratory Science elective:

GEO 101 Dynamic Earth

GEO 167 Earth Evolution

STEM Variant courses:

GEO 101 Dynamic Earth

GEO 167 Evolution of the Earth

GEP 204 Basic Mapping: Applications & Analysis

General Education: Flexible Core (6 courses)

GEH 101 Introduction to Geography

Scientific World\* (choose 1 course):

- ENV 210: Environmental Science
- ENV/GEH 235: Conservation of the Environment
- GEP (GEO) 228: Weather and Climate

Alternative:

- GEO 101: Dynamic Earth
- GEO 167: Evolution of the Earth
- GEP 204: Basic Mapping: Applications & Analysis

### 3.1.1 Other Programs

In addition, our programs contribute to following programs and educational initiatives at Lehman College:

- Regional geography courses are co-listed with other departments, such as Latino, Latin American, and Puerto Rican Studies (LAC), Middle Eastern Studies, etc.

- GEH 289 – Regional Geography of Latin America (LAC 289)
- GEH 295 - Middle East: Regional Geographic Perspectives

#### • Freshman Year Initiative

See sections 2.1.4. - 2.5.

#### • Writing intensive classes

None

#### • Honors programs

None

### 3.1.2 Evening, Weekend, Winter and Summer Classes

#### Evening Classes:

- GEO101/102 Dynamic Earth
- GEO167/168 Evolution of the Earth
- GEO166 Processes of Global Change
- GEO236 Environmental Geology
- GEO245 Earth Materials
- GEO340 Natural Hazards and Disasters
- GEO345 Environmental Hydrology
- GEO501 Earth Processes
- GEO502/510 Earth History
- ENV270 Environmental Pollution
- ENV420 Natural Resources Management
- GEH101 Introduction to Geography



GEH232	Medical Geography
GEH235	Environmental Conservation
GEH 240	Urban Geography
GEH320	Population Geography
GEH501	Principles of Geography
GEP204	Basic Mapping: Application and Analysis
GEP205	Principles of GIS
GEP 299	Cartography
GEP 306	Raster Analysis
GEP 310	Geography of Urban Health
GEP 321	Introduction to Remote Sensing
GEP 330	Geostatistics
GEP350	Special Projects in GIS: Environmental Modeling and Spatial Analysis
GEP 360	Geovisualization and Analytical Cartography
GEP375	Data Acquisition and Integration in GIS
GEP 470	Seminar and Internship Program in Geography
GEP 490	Workshop in GISc Research
GEP504	Basic Mapping: Application and Analysis
GEP505	Principles of Geographic Information Science
GEP605	Special Projects in GIS: Environmental Modeling and Spatial Analysis
GEP 606	Raster Analysis
GEP620	Demography and Population Geography with GISc
GEP 621	Principles of Remote Sensing
GEP 630	Geostatistics and Spatial Analytical Concepts
GEP632	Environmental Health and Geographic Information Sciences
GEP635	Natural Hazards and Risk Analysis with GIS
GEP 645	Water Resources, Hydrology, and GISc
GEP 660	Geovisualization and Analytical Cartography
GEP 662	Programming for GISc
GEP 664	Spatial Database Analysis
GEP 670	Seminar and Internship Program in GISc
GEP 675	Data Acquisition and Integration Methods forGIS Analysis
GEP 680	Emerging Issues and Methods in GISc
GEP 689	Seminar in GISc Methods
GEP 690	Workshop in GISc Research

**Weekend classes:**

GEO 4500 Topics in Earth Science (field trips)

**Winter Classes:**

GEH101 Introduction to Geography (online hybrid); offered since 2015

**Summer Classes (2012 – 2017):**

<b>2012</b>	GEO100	Marine Science
	GEO490	Honors in Geology (Summer study abroad on Crete)

	GEO490	Honors in Geology (American Museum of Natural History Earth and Space Sciences Summer Institute)
	GEO697	Independent Study (American Museum of Natural History Earth and Space Sciences Summer Institute)
<b>2013</b>	GEO490	Honors in Geology (Summer study abroad on Crete)
	GEO580	Introductory Studies in Geology
<b>2014</b>	GEO490	Honors in Geology (Summer study abroad on Crete)
	GEO490	Honors in Geology (American Museum of Natural History Earth and Space Sciences Summer Institute)
	GEO697	Independent Study (American Museum of Natural History Earth and Space Sciences Summer Institute)
<b>2015</b>	GEH101	Introduction to Geography
	GEO490	Honors in Geology (Summer study abroad on Crete)
	GEP605	Special Topics in GIS: Environmental Modeling and Spatial Analysis
	GEP680	Emerging Issues and Methods in GIS: Web Mapping
	GEO580	Introductory Studies in Geology
<b>2016</b>	GEH101	Introduction to Geography
	GEO490	Honors in Geology (Summer study abroad on Crete)
	GEP660	Geovisualization and Analytical Cartography
	GEP680	Emerging Issues and Methods in GIS: Web Mapping
	GEP 680	Emerging Issues and Methods in GIS: Quantitative Reasoning with GISc
	GEP689	Methods Seminar in GIS
	GEO490	Honors in Geology (American Museum of Natural History Earth and Space Sciences Summer Institute)
	GEO697	Independent Study (American Museum of Natural History Earth and Space Sciences Summer Institute)
<b>2017</b>	GEO490	Honors in Geology (Summer study abroad on Crete)
	GEH101	Introduction to Geography
	GEP312/612	Qualitative and Quantitative Methods in Historical and Cultural GIS
	GEP680	Emerging Issues and Methods in GIS: Web Mapping
	GEO580	Introductory Studies in Geology

Offering of evening and weekend classes helps full-time working students to complete their education without jeopardizing their job security. Summer and winter sessions promotes graduation rates by offering students more flexibility to complete their course requirements. These classes offer the opportunity to working students to earn a degree by balancing their job responsibilities and education.

While summer and winter courses are run during shorter periods of time, the actual number of contact hours is the same. This ensures that delivery will not negatively affect the quality of the course. The structure of such courses and amount of material is the same as during the regular Fall and Spring semesters. Summer and Winter session courses are also often offered as hybrid online courses, to maximize flexibility for the students.

### 3.1.3 Other Teaching Contributions

- LEAP

None

- ACE

None

- CUNY Honors programs

None

- CUNY Graduate School master's and PhD Programs

All of the MS-GISc courses are available for master's and doctoral students at the Graduate Center, and most have been taken over the years by the EES students, as well as some students from Biology, Criminal Justice, Public Health, and Environmental Psychology, among other doctoral programs. Below are some of the more frequently offered courses that they tend to take:

EES 79904 Special Topics in GISc: Environmental Modeling and Spatial Analysis (GEP 605)

EES 79904 Workshop in GISc Research (GEP 690)

EES 79904 Principles of Remote Sensing (GEP 621)

EES 79904 Natural Hazards and Risk Analysis (GEP 635)

EES 79904 Water Resources, Hydrology, and GISc (GEP 645)

EES 79903 Spatial Analysis of Urban Health (GEP 610)

EES 79903 Raster Analysis (GEP 606)

EES 79903 Geostatistics and Spatial Analytical Concepts (GEP 630)

**Masters of Science in Science Education (Dept. of Middle and High School Education):**

GEO 501 Dynamic Earth

GEO 509 Dynamic Earth Lab

GEO 502 Earth History

GEO 510 Earth History Lab

GEO 645 Earth Materials and Resources

GEO 603 Global Plate Tectonics

- External master's and PhD programs

Occasionally, graduate and doctoral students from consorcial institutions(Columbia, NYU, New School, etc.) also enroll graduate GISc courses offered by EEGS faculty.

- Interdisciplinary programs

See sections 2.1.4. - 2.5.

- College NOW

GEP 205 Principles of GISc – taught every year as part of the College Now "Summer Science Academy in GISc"

- Early College

None

- Curriculum supporting in-service teachers

None

- NCATE

None

### **3.2 Curriculum: Program for Students**

Discuss the department's offering for students. In a separate section for (1) majors, (2) other undergraduate programs, (3) graduate degree programs, and (4) any other program, describe the courses and activities that students are offered. Include in your discussion the requirements that the students in the department must complete, and how these contribute to their development and degree progress. It is important to discuss best practices for similar programs as established by professional associations and/or comparable departments.

#### **(1) Majors**

**The EECS department offers the following options to study Geography, Geographic Information Science, Earth Science or Environmental Science:**

- **Major (B.A.) in Geography (28 credits)**

Geography matters because it is the only discipline concerned with understanding why and how both physical and cultural phenomena differ from place to place. Geography is vital to an understanding of national and international issues such as global warming, AIDS, or population growth. Geographers' expertise can not only help us understand the world, but also help us improve it. Studying Geography provides access to a diversity of job opportunities in public and private enterprises dealing with the natural environment, human economic and social activities, spatial data; in the government at federal, state, local levels (agriculture, commerce, education, health and human services, housing and urban development); or in teaching from elementary to postgraduate levels. Many Geographers today find excellent employment due to their skills with Geographic Information Systems (GIS). GIS is an area of particular strength in our Geography program. The requirements for the BA in Geography are:

- 6 credits in required courses: GEH 101 or GEH 102; GEP 204.
- 4 credits in either GEP 470 or GEH 490.
- 3 credits in a regional Geography course, chosen from among GEH 267, 281, 283, 285, 287, 289, 291, and 295.

- 15 credits selected from other Geography courses and to be determined by the student's objectives in consultation with a Geography adviser.

- **Major in Geography, with a concentration in GISc (28 credits)**

**6 credits in required courses:**

GEH 101 Introduction to Geography  
Or  
GEH 102 World Regional Geography  
And  
GEP 204 Basic Mapping: Applications and Analysis

**4 credits in:**

GEP 470 Seminar and Internship Program in Geography  
Or  
GEH 490 Honors in Geography.

**3 credits in a regional Geography course chosen from among:**

GEH 267 The New York Metropolitan Region  
GEH 281 Geography of the United States and Canada  
GEH 283 Geography of Western Europe  
GEH 285 Regional Geography of Asia  
GEH 287 Regional Geography of Africa  
GEH 289 Regional Geography of Latin America  
GEH 291 Regional Geography of Eastern Europe and the Former Soviet Republics

15 credits selected from other Geography courses

- **Minor in Geography** 12 credits in Geography courses above the 100 level, and including 6 credits at the 300 or 400 level

- **Minor in Geographical Information Science (14 credits)**

Geographic Information Science (GISc) is a fast growing computer technology field involving mapping and analysis of spatial data. Geographic Information Systems (GIS) enable us to assess and manage existing conditions, and also help predict future conditions, ranging from monitoring disease occurrences, to endangered species preservation, to managing water supplies, to tracking real estate values, to crime solving. GISc is especially valuable in policy- and decision-making, and has become an indispensable component of most planning activities. GISc is used today in fields as diverse as criminal justice, marketing, economic development, public health administration, environmental assessment, risk analysis, ecology, urban planning, emergency management, real estate, government, and education. The Lehman GISc

Program emphasizes “real-world” applications of geotechnologies and geospatial analysis to solve problems and improve conditions, using New York City as a “living laboratory.” Lehman has also developed an Internship Program in GISc, allowing qualified students to earn credits while working in paid and unpaid GISc positions. The requirements for the minor are:

- GEP 204, GEP 205, GEP 350 and either GEP 470 or GEH 490.

- **Certificate in Geographical Information Science (17 credits)**

The certificate is available at the undergraduate level. The courses are credit-bearing, and students must be admitted to Lehman College as matriculated students to enroll in them. The requirements are:

- 14 credits from GEP 204, GEP 205, GEP 350, GEH 490
- 3 credits from GEH 101/GEH 501, GEH 230/GEH 530, GEP 230/GEP 530, GEH 235/GEH 613, GEH 240/GEH 540, GEH 266/GEH 566 or other course in consultation with GISc Program advisor.

- **Major (B.A.) in Earth Science (30 credits)**

**22 credits in required courses:**

GEO 101	Dynamic Earth
GEO 102	Dynamic Earth Laboratory
GEO 167	Earth Evolution
GEO 168	Earth Evolution Laboratory
GEO 228	Weather and Climate
GEO 229	Weather and Climate Laboratory
GEO 245	Earth Materials
GEO 4500	Topics in Earth Science
AST 117	Astronomy of Stellar Systems

**8 credits to be chosen from the following courses:**

GEO 236	Environmental Geology
GEO 340	Natural Hazards and Disasters: A Multidisciplinary Approach
GEO 341	Natural Hazards and Disasters Laboratory
GEO 345	Environmental Hydrology
GEO 350	Topics in regional geology and mapping techniques
GEO 448	Plate Geotectonics
GEO 490	Honors in Geology

- **Minor in Earth Science (16 credits)**

GEO 101	Dynamic Earth
GEO 102	Dynamic Earth Laboratory
GEO 245	Earth Materials

Two courses in Earth Sciences

- **Certificate in Earth Science (30 credits)**

The Certificate in Earth Science is structured to provide a strong foundation in Earth science content. The program is intended for certified teachers of other science areas who plan to obtain a second certification in Earth Science as well as holders BA or BS degrees who seek a foundation in Earth science before applying to a Masters of Education program.

**22 Credits in Required Courses:**

GEO 167 Earth Evolution  
GEO 168 Earth Evolution Lab  
GEO 228 Weather and Climate  
GEO 229 Weather and Climate Lab  
GEO 245 Earth Materials  
GEO 301 Earth Science for Educators  
GEO 4500 Topics in Earth Science  
AST 117 Astronomy of Stellar Systems

**8 Credits to be chosen from the following:**

GEO 236 Environmental Geology  
GEO 340 Natural Hazards and Disasters  
GEO 341 Natural Hazards and Disasters Lab  
GEO 345 Environmental Hydrology  
GEO 370 Regional Field Geology and Mapping Techniques  
GEO 448 Plate Tectonics  
GEO 490 Honors Geology

(Other courses may be substituted with department permission.)

- **Interdisciplinary Program in Environmental Science, B.S. is a 46-credit major:**

The core of the interdisciplinary undergraduate program in Environmental Science is a sequence of basic and advanced science courses from four participating science departments. Students select a specialization area in Ecology, Urban Environmental Management, Environmental Geology, or Environmental Analysis.

The Interdisciplinary Program in Environmental Science offers courses to prepare students (1) for environmental science careers, and to become active proponents for their communities in the scientific and policy processes surrounding environmental issues, (2) to meet the environmental science employment demands of local, state, and federal governmental agencies, private consulting, and industry, and (3) to pursue advanced degrees in environmental/physical sciences.

Curriculum:

## Required courses (15-16 credits)

Students are required to take the following courses:

		Credits
ENV 210	Introduction to Environmental Science	3
ENV 211	Introduction to Environmental Science Laboratory	1
GEH 245	Introduction to Quantitative Methods of Geography	3
	Or	
MAT 132	Introduction to Statistics	4
	Or	
BIO 240	Biostatistics.	3
PHY 151	Energy and the Environment	3
ENV 330	Environmental Impact Assessment	3
ENV 420	Natural Resource Management: Senior Seminar	2

MAT 132: This course requires the completion of the College's requirement in mathematics.

BIO 240 or equivalent: This course has prerequisites that are not a part of the major.

ENV 330, ENV 420: These courses have prerequisites that are a part of the major.

## Required courses (15-17 credits)

Students are required to choose one course from each of the following four areas in consultation with a Departmental advisor:

## Biological Sciences

		Credits
BIO 166	Principles of Biology: Cells and Genes	4
BIO 167	Principles of Biology: Organisms	4

## Geosciences

		Credits
GEO 101	Dynamic Earth and	3
GEO 102	Dynamic Earth Laboratory	1
GEP 228	Weather and Climate and	3
GEP 229	Weather and Climate Laboratory	1



ENV 270	Environmental Pollution	4
Geospatial Analysis		Credits
GEP 205	Principles of Geographic Information Science	3
GEP 321	Introduction to Remote Sensing	4
Chemistry		Credits
CHE 136	Elements of Chemistry	4
CHE 166	General Chemistry I and	4
CHE 167	General Chemistry Laboratory I	1.5
CHE 166, CHE 167: These courses require the completion of the College's requirement in mathematics.		
Elective courses (12-15 credits)		
Students choose 12-15 credits in electives to meet the 46 credit requirement in consultation with a departmental advisor. It is recommended that students choose courses that are grouped in one of the following specialization areas:		
Ecology		Credits
BIO 167	Principles of Biology: Organisms	4
BIO 184	Plants and People	4
BIO 242	Flowering Plants	4
BIO 302	Biogeography	4
BIO 330	Plant Physiology	4
BIO 336	Marine Biology Lectures	3
BIO 339	Ecology	4
ENV 235	Conservation of the Environment	3
ENV 255	Regional Topics and Field Methods in Environmental Sciences	1, 2, 3, or 4 credits (may be repeated for a maximum of

		6 credits)
CHE 168	General Chemistry II	4
CHE 169	General Chemistry Laboratory II	1.5
CHE 244	Introduction to Biochemistry	3

BIO 302, BIO 330, BIO 336, BIO 339, CHE 244: These courses have prerequisites that are not a part of the major.

CHE 168, CHE 169: These courses have prerequisites that are a part of the major.

Urban Environmental Management

		Credits
GEP 205	Principles of Geographic Information Science	3
GEP 230	Urban Environmental Management	3
GEP 310	Geography of Urban Health	3
GEP 350	Special Projects in Geographic Information Systems	4
GEP 360	Geovisualization and Analytic Cartography	4
GEP 375	Data Acquisition Gis	3
GEH 240	Urban Geography	3
ENV 235	Conservation of the Environment	3
ENV 255	Regional Topics and Field Methods in Environmental Sciences	1, 2, 3, or 4 credits (may be repeated for a maximum of 6 credits)
ENV 270	Environmental Pollution	4
ENV 326	Environmental Policy	3
HEA 301	Environmental Health	3

GEP 350, HEA 301: These courses have prerequisites that are a part of the major.

Environmental Geology

		Credits
GEO 101	Dynamic Earth	3

GEO 102	Dynamic Earth Laboratory	1
GEO 236	Environmental Geology	4
GEO 245	Earth Materials	4
GEO 340	Natural Hazards and Disasters: A Multidisciplinary Approach	3
GEO 341	Natural Hazards and Disasters Laboratory	1
GEO 345	Environmental Hydrology	4
GEO 350	Topics in regional geology and mapping techniques	4
GEO 375	Field Problems in Geology	3
GEO 410	Environmental Biogeochemistry	4
GEP 228	Weather and Climate	3
GEP 229	Weather and Climate Laboratory	1
GEP 321	Introduction to Remote Sensing	4
ENV 255	Regional Topics and Field Methods in Environmental Sciences	1, 2, 3, or 4 credits (may be repeated for a maximum of 6 credits)

GEO 236, GEO 245, GEO 375, GEO 410: These courses have prerequisites that are a part of the major.

Environmental Analysis

		Credits
GEP 205	Principles of Geographic Information Science	3
GEP 228	Weather and Climate	3
GEP 229	Weather and Climate Laboratory	1
GEP 302	Biogeography	4
GEP 310	Geography of Urban Health	3

GEP 321	Introduction to Remote Sensing	4
GEO 340	Natural Hazards and Disasters: A Multidisciplinary Approach	3
GEO 341	Natural Hazards and Disasters Laboratory	1
GEP 350	Special Projects in Geographic Information Systems	4
GEP 360	Geovisualization and Analytic Cartography	4
GEP 375	Data Acquisition Gis	3
ENV 235	Conservation of the Environment	3
ENV 255	Regional Topics and Field Methods in Environmental Sciences	1, 2, 3, or 4 credits (may be repeated for a maximum of 6 credits)
ENV 270	Environmental Pollution	4
CHE 168	General Chemistry II	4
CHE 169	General Chemistry Laboratory II	1.5
CHE 232	Organic Chemistry Lecture I	3
CHE 233	Organic Chemistry Laboratory I	2
CHE 249	Quantitative Analysis	5
GEP 302, GEP 350, GEP 360, CHE 168, CHE 169, CHE 232, CHE 233, CHE 249: These courses have prerequisites that are a part of the major.		
CHE 168, CHE 169, CHE 249: These courses require the completion of the College's requirement in mathematics.		
Other elective courses		
		Credits
GEP 204	Basic Mapping: Applications and Analysis	3
GEP 470	Seminar and Internship Program in Geography	4

PHY 166	General Physics I	5
	Or	
PHY 168	Physics I for Scientists and Engineers	5
PHY 167	General Physics II	5
	Or	
PHY 169	Physics II for Scientists and Engineers	5

PHY 166, PHY 168, PHY 167, PHY 169: These courses require the completion of the College's requirement in mathematics.

- **Minor in Environmental Sciences** (14 – 15 credits)
  - GEO 101 or GEO 166, GEH 235, GEO 236
  - One additional Geology or Geography course at the 300 or 400 level.
  - GEP 205 is also recommended.

#### **Other undergraduate programs**

**Accelerated Bachelor's to Master's Degree:** Dual Credit Option for High Performing Students in the Earth, Environmental, and Geospatial Sciences Department (See sections 2.1.4. - 2.5).

#### **(1) Graduate degree program**

##### **Master of Science in Geographic Information Science (GISc), Professional Science Master's (PSM).**

The MS-GISc program leads to a Master's of Science in GISc, and requires 40 credits of coursework. The curriculum of the MS-GISc program is comprised of three key elements: 4 core courses (14 credits), 5-6 electives (18 credits), and an 8-credit capstone research experience, with options for either a traditional Master's Thesis, or a combination of an applied research project and professional experience through an internship, (PEAR option –Professional Experience and Applied Research-PSM) for a total of 40 credits to complete the degree.

##### **MS-GISc Degree Requirements:**

Required Core Courses (14 credits): Credits/Hours

GEP 505 Principles of GISc 3/4

GEP 621 Remote Sensing 4/6

GEP 630 Geostatistics and Spatial Analytical Concepts 3/4  
GEP 605 Special Topics in GISc (Environmental Modeling) 4/6

Electives (18 credits) to be selected amongst the following: Credits/Hours

GEP 602 Biogeography and GISc 4/5  
GEP 606 Raster Analysis  
GEP 610 Spatial Analysis of Urban Health 3/4  
GEP 620 Demography and Population Geography with GISc 3/4  
GEP 631 Advanced Remote Sensing 4/6  
GEP 632 Environmental Health and GISc 3/4  
GEP 635 Natural Hazards and Risk Analysis 4/5  
GEP 640 Urban Geography and GISc 3/4  
GEP 641 Image Analysis 4/6  
GEP 645 Environmental Hydrology 4/5  
GEP 650 Topics in Regional Geography and Applied Mapping Techniques 4/5  
GEP 660 Geovisualization and Analytical Cartography 4/6  
GEP 662 Introduction to Programming for GISc 3/4  
GEP 664 Spatial Database Management 3/4  
GEP 675 Data Acquisition and Integration Methods for GISc 3/4  
GEP 680 Emerging Issues and Methods in GISc 3/4  
GEP 689 Methods Seminar in GISc ¾

Of the 18 elective credits required for the degree, up to 9 credits of courses may be taken in a cognate discipline, with permission of program advisor.

Students in the PEAR Option must take 12 credits of their electives in Professional Skills courses within the department, or in Health Sciences Dept., Environmental Engineering, or other appropriate program, in consultation with their program advisor, and reflecting their future career plans.)

Capstone Experience Coursework (8 credits)

An 8-credit capstone experience, either the Thesis Option or the Professional Experience and Applied Research (PEAR) Option (PSM).

Traditional Master's Thesis Option:

GEP 695 Thesis Research in GISc 8 credits

PEAR Option (PSM): GEP 690 Workshop in GISc Research 4/4 and GEP 670 Internship in GISc/Professional Experience 4/4

## **(2)Others**

Advanced Certificate in GISc (graduate level) 17-20 credits)

The Advanced Certificate in GISc is available at the graduate level. The courses are credit-bearing, and students must be admitted to Lehman College as matriculated students to enroll in them.

Required courses (8 credits) GEP 605 and GEP 690 plus 3 GISc courses totaling an additional 9 – 12 credits.

### **3.2.1 Courses and Credits**

Departmental offerings cover a broad spectrum of the social and natural sciences. These offerings integrate the earth sciences and studies of the human environment over a wide range, from urban geography to ocean sediments. Environmental issues such as garbage disposal and recycling options, earthquake and volcanic hazards, coastal erosion, past extinctions of life, and global warming are important parts of various courses listed below. In terms of the traditional disciplines or fields of study, the department touches on environmental science, geography, earth science, geographic information science, earth science education.

Specific course information is in section 3.2 above. Most of the courses are designed to cover the theoretical and conceptual aspects of the discipline in lectures coupled with practical applications during lab sessions. In addition, some GEO courses include field trip components, even abroad, some areas include: Crete, New York, and Pennsylvania areas). Many EEGS courses use GIS, Remote sensing, and statistical software (proprietary and open source) and geology labs use customized mineral and rocks collections, stereo microscopes, sieves and scales. One of the anticipated future revisions in Earth Science program is to improve labs for the “Earth Materials” class by introducing XRF (X-ray fluorescence) analysis of elemental composition of rocks and minerals. The EEGS department in collaboration with the Anthropology department acquired two XRF analyzers in 2017 and Dr. Yuri Gorokhovich has been creating XRF related labs with one of the undergraduate students in the program.

### **Rationales and revisions in Earth Science program:**

#### **Revised geology program into the Earth Science program:**

The changes to the requirements for the B.A. in Geology align it with the conceptual framework set forth by the New York State Education Department (NYSED) for Teachers of Earth Science and with the Physical Science: Earth Science Core Curriculum for middle and high school. The result, if approved, is a program that will provide content courses that, in combination with minors in the appropriate education disciplines, will help to develop well-qualified teachers of Earth Science for grades 7-12 and well prepared general and science teachers for grades K-6. Earth Science is currently and historically the science subject area with the greatest shortage of qualified, certified teachers in New York State and in the New York City Metropolitan Region. Students seeking a degree that will qualify them for a career in the geosciences will be counseled towards the Geosciences cluster of the revised BS in Environmental Science.

#### **Revision of the Earth Science Program from 28-29 credits to 30 credits 2013**

The B.A. in Earth Science is recommended to teacher education students. The New York State Education Department (NYSED) teacher certification requirements have recently been revised. The new requirements for teacher certification in Earth Science include 30 content core credit hours. The proposed changes to the program are designed to allow students to meet this requirement upon completion of the degree. The required course list has been revised to align with the recently adopted “Next Generation Standards” for middle and high school grades that are slated for implementation over the coming 5 years.

**Rationale/explanation for the New Certificate in Earth Science Program 2013:**

The proposed 24-credit certificate program is intended for certified teachers of other science areas who plan to obtain a second certification in Earth Science as well as holders BA or BS degrees who seek a foundation in Earth science before applying to a Masters of Education program. Earth Science is currently and has been historically the science subject area with the greatest shortage of qualified, certified teachers in New York State and in the New York City Metropolitan Region. The proposed certificate content aligns with the conceptual framework set forth by the New York State Education Department (NYSED) for Teachers of Earth Science and with the Physical Science: Earth Science Core Curriculum for middle and high school. In addition, the proposed program will serve teachers seeking to fulfill the 175 hours of professional development per five-year period required by the New York State Education Department to maintain teacher certification. A copy of the full proposal is on file in the CUNY Office of Academic Affairs.

**Revision of the Certificate in Earth Science later in 2013**

The Certificate in Earth Science is intended for certified teachers of other science areas who plan to obtain a second certification in Earth Science as well as holders BA or BS degrees who seek a foundation in Earth science before applying to a Masters of Education program. The New York State Education Department (NYSED) teacher certification requirements have recently been revised. The new requirements for teacher certification in Earth Science include 30 content core credit hours. The proposed changes to the program are designed to allow students to meet this requirement upon completion of the degree. The required course list has been revised to align with the recently adopted “Next Generation Standards” for middle and high school grades that are slated for implementation over the coming 5 years.

**Rationales, structure and status for new programs in Geographic Information Science:**

The new Master’s of Science in Geographic Information Science (MS-GISc) was approved by CUNY and the NYSED in June 2012, and accepted its first graduate student cohort in Fall 2012. The College and the EEGS Department had long wanted a graduate program in GISc to allow students to continue their education at Lehman after earning a Bachelor’s degree here, and also to attract students from outside of Lehman to the program. The Department had been offering graduate-level GISc courses since 2001, which were very popular with mid-career professionals and recent graduates interested in pursuing GISc as a career option, but these courses did not lead to a degree, which put the department at a disadvantage compared to other colleges offering graduate GISc degrees. In order to better serve our students, we developed a 40-credit MS-GISc program which was intended to meet the requirements for a Professional Science Masters (PSM), since CUNY was interested in developing such degrees in order to address the needs in the wider society of having science-literate personnel in professional positions. The intent of the MS-GISc program is to prepare students to meet the demands and challenges of theoretical and applied research careers in the field of geospatial sciences, which in recent years has seen an exponential increase in the demand for highly qualified personnel in the fields of health, environmental, and geospatial sciences. The program also prepares students interested in pursuing doctoral studies in Geography, GISc, or related disciplines by offering a Thesis Option.



### **Program Curriculum and Structure:**

The curriculum of the MS-GISc is comprised of three key elements: 4 core courses (14 credits), 5-6 electives (18 credits), and an 8-credit capstone research experience, with options for either a traditional Master's Thesis, or a combination of an applied research project and professional experience through an internship (the PEAR Option – Professional Experience and Applied Research) for a total of 40 credits required to complete the degree. There are three possible areas of concentration available; Environmental and Health Spatial Sciences; Urban Sustainability; and Geospatial Technologies.

At the time the program was approved, we already had been offering 18 GISc courses at the graduate level, and we added 11 more GISc courses since 2012. This enables us to offer sufficient courses each term to accommodate full- and part-time students at various levels (intro-level to advanced) who may be starting the program in either the Fall or Spring terms. This goal requires us to offer 8 to 9 courses each term, including a decent range of elective choices for the concentration areas. (See Appendix – Orientation Packet for complete course listing with descriptions, course sequencing, full- and part-time student schedules, etc.)

### **MS-GISc Program Status:**

The program has accepted over 80 students so far, with over 40 graduated. Most graduates of the program have found careers in GISc and related fields. It should be noted that we have more than doubled the student enrollments and graduations that were projected in our initial program proposal document.

### **Professional Science Masters Program (PSM):**

We applied for and received acceptance by the NPSMA as a **Professional Science Master's Program**, based on our MS-GISc PEAR Option. The PSM affiliation requires us to maintain an active External Advisory Board, composed of academics, professionals, and researchers in GISc-related fields, and also to comply with several other reporting criteria. Students who meet the requirements for the MS-GISc degree (PEAR Option) and also the PSM requirements receive a separate diploma from the NPSMA noting their additional PSM credential. (See Appendix – for PSM application and acceptance letter.)

### **Advanced Certificate in GISc:**

In Spring of 2013, we received approval from CUNY and the NYSED for a 17-20 credit *Advanced Certificate in GISc*. We also have a Memorandum of Agreement with the CUNY Graduate Center, allowing doctoral students to be awarded the Advanced Certificate In GISc by Lehman College.

### **Accelerated Bachelor's to Master's Program in GISc:**

With the collaboration of the Lehman Office of Graduate Studies, we have instituted an *Accelerated Bachelor's to Master's Degree Program* for qualified undergraduate students, allowing them to take up to 12 credits of graduate-level GISc courses that count towards both their Bachelor's and Master's degrees, thus reducing the amount of time needed for completing the Master's degree. Additionally, we are currently working out articulation agreements with LaGuardia Community College and the Borough of Manhattan Community College – both CUNY 2-year schools that offer some GISc courses – to enable high achieving students to enter

Lehman with much of their introductory GISc coursework automatically approved for transfer and to receive advanced consideration for acceptance into the Accelerated Program.

### 3.2.2 Internships or other Activities

Discuss the learning outcomes for the internships or activities; how are these structured to meet the learning outcomes. Discuss how internship sites are selected, supervised, and the relationship between the internship and the courses.

#### **Description of the internship requirements and learning outcomes:**

At least 10 hours per week of work (for a 15 week term), or about 150 hours total, in a GISc analyst or cartographer position conducting meaningful work on a project or projects related to the student's interests and in keeping with the needs of the host institution. Hours per week can be more than 10 if student intern is receiving a salary.

**Pre-Requisite:** GEP 505 or equivalent GISc coursework or experience and Instructor's permission

#### **Learning Objectives – By the Completion of the Course, Students are expected to be able to:**

- Express theoretical foundations of Geographic Information Science (GISc), cartography, and geography in general.
- Interpret, acquire, manage, analyze, display, and synthesize geospatial data, using both quantitative and qualitative methods.
- Design and create accurate, meaningful, and unbiased maps and cartographic products that are easily understood by the target audience.
- Integrate spatial analysis and GISc applications in an interdisciplinary manner, incorporating information and research questions from other fields, such as public health, botany, political science, geology, demography, criminology, environmental science, sociology, urban planning, etc.
- Design, implement, and present a substantive research project using GISc as the organizing framework.
- Have a better understanding of the job market in GISc.

#### **Internship sites, supervision, and evaluation:**

Internships can be carried out on- or off-campus and can be hosted by private consulting firms, governmental agencies, non-profit organizations, community groups, academic research centers, etc. Most of our students have completed internships in New York City agencies including: New York City Department of Transportation (DOT), New York City Department of City Planning, New York City Department of Parks & Recreation, and New York City Department of Environmental Protection.

The intern will meet with the supervising professor at least four times during the term (approximately once per month) to discuss the progress on the completion of the internship project(s), analytical and methodological issues, and professional practice.

**Evaluation and link to learning outcomes:**

The students are evaluated based on several deliverables (see below) and an evaluation form about their performance completed by their internship coordinator. At the end of the course the students also complete a questionnaire about their internship experience reflecting on how our program has prepared them to succeed. The deliverables are:

- An Internship Project Report, summarizing their work at the host institution, providing background, methodology, analysis, findings, and so forth, as appropriate, including explanatory maps, graphs, and other illustrations, as required to fully describe the work. Report to be 3,000-5,000 words plus graphics and references.
- A poster in the standard EEGS Dept. format describing the project work, suitable for display in EEGS Dept.
- An oral presentation of the internship project work to an EEGS Dept. GISc class, or to a group of GISc students and faculty, if presenting to a class is not possible due to scheduling issues.

**3.2.3 Student Advisement**

Academic advisement is provided during all common advisement hours in fall and spring semester and during the summer. Each EEGS faculty member has regularly scheduled office hours each week during which they are available for advisement as well as questions specific to courses they are teaching. In addition, faculty regularly mentor one to three independent study student projects and help students with advisement issues and career decisions as they arise during these sessions. Most faculty are also available virtually 24/7 via e-mail to respond to students' questions or problems, and to advise prospective students to the EEGS programs.

In a small department like ours, everybody is heavily involved in student advising. The advising responsibilities are loosely divided as follows:

- Elia Machado – all GISc students (graduate and undergraduate levels), Geography students, and others as necessary;
- Heather Sloan – all Earth Science students and others as necessary;
- Juliana Maantay – all GISc students (graduate and undergraduate levels), Geography students, and others as necessary; Advisement for graduate GISc students consists of, at a minimum, a mandatory ½ hour meeting for each student each term they are in the program. The department also provides a comprehensive graduate student orientation session prior to each fall and spring terms for in-coming MS-GISc students.
- Hari Pant – all environmental science students and others as necessary;
- Yuri Gorokhovich – all students as necessary.

**3.2.4 Student/Faculty Contact Outside Class**

EEGS faculty members maintain contact with departmental Majors and Minors throughout the semester in courses and during advisement. Contact is both formal and informal and student progress is followed closely. Every effort is made to tailor course days and times to meet the needs of as many students as possible. Students are consulted about convenient course times

during the programming period each semester, and to avoid potential conflict with other departments' courses. Information regarding departmental course offerings, internships, and field course opportunities is regularly communicated in person, posted on department announcement boards and on the department web site. The department holds holiday and commencement celebration parties to which students are invited. In addition, Lehman College has a fairly active Office of Student Advising on general issues relevant to all Lehman College students.

### **3.2.5 Relationship between Major and Specialized and Pre-Professional Programs**

We maintain active coordination with the National Professional Science Master's Association (NPSMA) which accredits PSM programs such as the MS-GISc Program in EEGS.

### **3.2.6 Courses Appended**

See appendix VI

### **3.2.7 Plans for New or Revised Programs**

There are no major changes proposed for the MS-GISc or Advanced Certificate Programs, although we are considering a slight revision in the set of required courses to include GEP 662, Programming for GISc, which is now a frequently-offered elective. We will also likely continue to add new courses as the need arises, due to the continuing evolution of the field and changes in the expected body of knowledge of graduates entering the field professionally. Up until now, most of this need has been satisfied by offering multiple sections of GEP 680, Emerging Methods and Issues in GISc, which is a variable topics course that students can take up to 3 times for a total of 9 credits as the topic changes. But this has proven to be somewhat restrictive in many cases, as a number of students have reached the 3 course limit for GEP 680 and would still like to take new courses listed as sections of GEP 680 as they are offered, but currently are not allowed to do so. This limitation is particularly problematic if graduate students have taken their undergraduate degree here in the EEGS Dept., and even more so if the student is in the Accelerated Bachelor's to Master's Degree Program.

For the undergraduate Geography program, we have been considering some more drastic changes, largely due to the low popularity of the Geography major, and our efforts to increase enrollment and visibility of the program, making it more attractive, and also possibly creating more of an educational pipeline between our undergraduate geography degree and the graduate GISc programs. There are three possible options: 1.) Eliminate the Geography major altogether, and replace it with a new Bachelor's degree program in GISc or Geospatial Sciences; 2.) Keep the Geography major as is, and add a new Bachelor's degree program in GISc or Geospatial Sciences. 3.) Combine the two as one major, with two options or concentration tracks. Any of these options would be possible without adding new courses, but the difficulties come in with our overall lack of GISc faculty. Right now, our GISc classes are taught with undergraduate and graduate sections meeting together, which works out well since as a rule there are so few undergrad students in the classes (aside from a few classes that are also general education distribution courses, and they serve mainly undergrads). We have 2.5 full-time GISc faculty and this would need to be increased if the Geography major became more popular. With the emphasis we have placed on developing articulation agreements with CUNY community colleges, we may well see a significant increase in Geography undergrads within the next five

years, particularly if we start offering a Bachelor's degree in GISc or Geospatial Sciences, as this would be a unique major within CUNY and SUNY.

### **3.2.8 External accreditation**

#### **Professional Science Master's (PSM):**

The MS-GISc Program at Lehman has been officially recognized as a Professional Science Master's (PSM) by the National PSM Association (NPSMA). The NPSMA describes PSM programs as follows: "The Professional Science Master's (PSM) is an innovative, new graduate degree designed to allow students to pursue advanced training in science or mathematics, while simultaneously developing workplace skills highly valued by employers. PSM programs consist of two years of academic training in an emerging or interdisciplinary area, along with a professional component that may include internships and "cross-training" in workplace skills, such as business, communications, and regulatory affairs. All have been developed in concert with employers and are designed to dovetail into present and future professional career opportunities." (from <http://www.sciencemasters.com/>)

Completion of the PEAR Option (GEP 690 Workshop in GISc Research 4/4 and GEP 670 Internship in GISc/Professional Experience 4/4) of the MS-GISc fulfills the requirements for the PSM.

### **3.3 Effectiveness of Curriculum**

#### **3.3.1 Assessment Activities**

##### **3.3.1.1 Methods and Instruments Used**

Each course syllabus provides learning objectives specific to that course, against which the formal course assessments for the students are measured. Assessment outcomes are evaluated according to an Assessment plan that describes the learning objectives to assess, and defines the measures to assess each objective, as well as an implementation timeline. The success attaining each learning objective is assessed according to the acceptable and ideal performance targets (e.g., we expect that 80% of students will perform at level 3 on a particular rubric) defined in the assessment plan for each learning objective. Any supporting documents that will be used in the assessments (e.g., rubrics, scoring guides, surveys, etc.) are also attached.

The methods used to evaluate the performance of our students have included assignments, tests, quizzes, participation, and other efforts throughout the term. When feasible "Before" and "After" versions of tests are given, one before the topic pertaining to a learning objective is covered, and once after, or at the beginning of the term and end of the term, and the differences in performance can be measured. (See Appendix VII for examples of Assessment Methods and Instruments used).

The assessment involves an examination of the mean (average) scores of the students with respect to the target set as well as their minimum and maximum scores, in relation to the specific

student body in the class (e.g., freshmen intro courses are evaluated differently than advanced undergrad courses or graduate level courses, and courses with a large diversity of students in terms of academic status are also taken into account).

Each undergraduate major program (Earth Science, Geography, Environmental Science) and graduate program (Geographic Information Science) has general stated learning objectives and a “Curriculum Map” which matches up the courses with the learning objectives. [See Appendix VII- for documents on Learning Objectives and Curriculum Maps outlining this information.]

### **3.3.1.2 Measured Effectiveness in Achieving Desired Objectives:**

Students while in the department are evaluated as above, and students who are departmental majors are tracked by the specific program director and/or Department Chair as to monitoring and following up with any lapses in achievement below the standards for individual courses as well as for the major as a whole. Programmatic learning objectives for required courses for each major discipline are outlined in the documents “Learning Objectives” and “Curriculum Maps” tables in Appendix VII.

Alumni of the department are not officially tracked by Lehman or the department, but they are followed informally, in so far as practicable, to evaluate their post-Lehman career or higher education status. For instance, a few months after graduation, a survey form is sent out to the former-EEGS graduate students asking them for an update on their progress since leaving Lehman, as well as some details about their experience in our programs. The surveys provide valuable feedback from the students, and are used in evaluating the program’s successes and shortcomings. Students are asked to comment about the program’s courses, how well the program prepared them for their current position, and the most and least beneficial aspects of the program. The main drawbacks of the surveys are that the return rate is not extremely high, and the students who self-select to answer may not be completely representative of the program’s student body. [See Appendix VIII for Post-Graduate Student Exit Survey Form, and “Life After Lehman: Student Success Stories” survey form for alumni of all EEGS Programs. Also see <http://www.lehman.edu/academics/eggs/student-success-stories.php> for the results of the “Life After Lehman” surveys, Appendix IX]

### **3.3.2 Use of Assessment to Improve Department**

Individual courses and overall program curriculum are improved by taking into account the information given in the assessments done in individual courses, as well as considering overall performance in the programs’ learning goals. Additionally, information given in the students’ course evaluations in individual courses in the SETL documents are used to help improve and change courses. In many cases the students also provide informal feedback to the faculty about each course. Some of our faculty also requires their students to write a “feedback” paragraph at the end of practical assignments describing their experience with the assignment and identifying any difficulties completing it. This information is used to revise the assignments.

In individual courses, reading lists have been modified, lab assignments expanded or eliminated, in-class activities have been added, and various other changes made in response to the assessments and information mentioned above. Faculty has met frequently to discuss changes suggested by assessments and evaluations, especially in the case of courses with multiple

sections and multiple faculty teaching each of them, or courses which are co-taught with other EEGS faculty. We also meet to identify potential overlaps or gaps among GIS courses to ensure that we just have the “necessary” to meet the learning objectives.

Additionally, changes to the program as a whole have been undertaken in some instances, adding courses that address deficiencies that were discovered through assessments, and resulting in such actions as adding a required quantitative reasoning course to the GISc Program (Geospatial Statistics and Spatial Analytical Concepts); developing some more detailed technical courses (Spatial Database Management; Programming for GISc; Web Mapping; Cartographic Design and Presentation); and offering some of the more advanced courses as hybrid online courses when it was clear that students enrolling in these courses could do most of the lab work on their own outside of the classroom at their own pace and produce higher quality work.

[For an example of how assessments have been used to make curricular changes, please see the Geography and Geology Programs’ Assessment Reports in Appendix VII.]

## **4. Students and Enrollments**

### **4.1 Student Selection and Profile**

#### **4.1.1 Recruitment Process**

EEGS faculty and staff maintain a multi-pronged recruitment strategy, which is somewhat tailored to the different major and graduate programs within EEGS, but all of which share common attributes and aims.

Students are actively recruited into the Earth Science Major and Minor from introductory General Education Core Requirements courses (GEO 101, GEO 167, GEO 228). Students are actively recruited into the Geography Major, Minor, GISc Minor, and GISc certificate program from introductory General Education Core Requirements courses in Geography (GEH 101, GEH 235, GEH 240, and GEP 204) and other EEGS Department courses. Environmental Science majors are recruited from all the Earth Science and Geography Core Requirements courses as well as ENV 210, which is also a Core Requirements course. The EEGS Department courses that are part of the Freshman Year Initiative (FYI) Program also help attract majors to our programs.

The EEGS Department has completely revamped the one-pager flyers for each of the major, certificate, and graduate programs, and these flyers are available to students outside the main departmental office and in the GISc Lab, as well as distributed on Incoming Student Open Houses, and suchlike events. All flyers are also available to view on the departmental website, and in downloadable format online. [See Appendix VIII for flyers.]

Students are recruited into the GISc master’s and graduate certificate programs via the website, program-specific brochures and flyers, and importantly, by word-of-mouth from former students who have gone on to positions of responsibility at many of the city’s agencies, non-profit organizations, and private consulting firms. GISc faculty also make presentations about the program to Graduate Studies Fairs and such events at the Graduate Center and elsewhere, and as part of the CUNY effort to promote the PSM programs (Professional Science Master’s), of

which our MS-GISc degree is an accredited program. [See Appendix x for an example of recruitment presentation slides.] Another avenue for recruitment into the Master's program is through our External Advisory Board members. One of the requirements of being a PSM-affiliated master's program is to maintain an external advisory board, and these members are active in mentoring and helping students find internships and entry level jobs. They also help us spread the word about the existence of our program to other colleagues and employees interested in earning an MS-GISc or Advanced Certificate in GISc. Additionally, a number of our former students from the graduate program are now in managerial positions in various city agencies and other organizations, and they also help spread the word about our programs to fellow employees and other colleagues.

Additionally, every year since 2014 our undergrad and graduate GISc, Geography, Earth Science, and Environmental Science programs have appeared in the *AAG Guide to Geography Programs in America*, which is a comprehensive compendium of geography programs consulted by prospective students, academic advisors, and professional geographers. In the past we have also advertised the graduate GISc programs in the *ESRI Arc User* newsletter, *Arc News*, and the *Professional Geographer*, respected publications which are widely read by those in the discipline. Unfortunately, advertising in these journals is quite expensive, and the funding is not available to continue the print advertising campaign. [See Appendix x for EEGS entry in the *AAG Guide* and examples of print advertisements.]

EEGS faculty members participate in Freshman Open House events in fall and spring semesters as well as the annual Sophomore Major Fair. We staff tables at these events and present displays of maps, posters, rocks, minerals, and videos of field research carried out by faculty and students. Advisors are regularly available throughout the semester and during the summer to discuss program enrollment and encourage students who stop by with questions about the programs or who have heard about the programs from other students. Department brochures and web pages, which are updated frequently, describe the fields of study and potential career opportunities, introduce faculty and their research and teaching interests, examples of student work, student success stories after graduating from Lehman, and present program requirements.

Faculty also make presentations to classes in other departments to inform students in Biology, Health Sciences, etc., about opportunities in EEGS as well as the intersection between some of the other disciplines and majors with EEGS programs. Additionally, we visit introductory classes within our department to inform students, especially those with undeclared majors, about the EEGS programs and courses. Several of our courses are integral parts of other Lehman interdisciplinary programs, such as Urban Community Development, and the Urban Studies Program (see section --- for a full description of interdisciplinary efforts). These courses also serve to interest and attract students to our programs.

The 3<sup>rd</sup> floor corridors in Gillet Hall where the EEGS Dept. is located, have been utilized as a "Map Gallery," to showcase student and faculty research work in the form of posters, photos, and maps. This is a very effective way to interest students who are passing by the department's classrooms and offices, in considering the department's courses and programs for their own majors or minors. The display rotates each term, with new work displayed, highlighting student awards and publications as well as typical class projects.



We have also made presentations to high school students in the Bronx and nearby suburban communities regarding opportunities available in Lehman's EEGS Dept. Local high school classes visit the GISc Lab in EEGS and receive an introduction to GISc and the EEGS programs. Additionally, we host two high school groups each summer to take intensive 6-week college-level GISc courses in our department. One is through the College Now! Program, and the other is a collaborative effort with the Van Cortlandt Park Conservancy Program. On a number of occasions, we have hosted Map-a-Thons for various purposes (such as the earthquake in Nepal, and the hurricane in Puerto Rico) where our GISc students have helped facilitate the event which was advertised and open to the public. We have also hosted workshops for the public to learn more about GISc, and every year we give a GISc "boot camp" to a group of physician residents interested in learning how GIS can be used in medical service provision and epidemiological research.

The EEGS Department completely over-hauled our web site, departmental major brochures, and GISc Programs brochures. The website, in particular, was revamped to reflect more up-dated information about programs, faculty, student success stories, courses offered, student and faculty activities, examples of student work, research, and so forth. We believe that the revised website presents the department in a much more professional and attractive light and has been extremely helpful in drawing in prospective students. [See Appendix VIII for links to EEGS web pages.]

An important and often overlooked avenue of recruitment (as well as retention) is the presence and activities of graduate students within the department. We have been fortunate to have as "peer-ambassadors" a number of doctoral students and GISc graduate certificate and master's degree students who have been working on research projects, tutoring, adjunct teaching, and in general performing unofficial "role model" duties, which helps inspire the undergraduates who may not ever have considered graduate study beforehand, and also provides them with mentoring that augments the official mentoring that takes place between faculty and students.

Potential methods to further increase the efforts and employ new methods to recruit new majors into the programs are continuously discussed by members of the department. They include increasing the visibility of the programs on campus and beyond. We will continue to showcase accomplishments of our majors and graduate students and the relevance of our programs in the Map Gallery in Gillet Hall, but would like to have greater visibility on campus. We expect all these methods to contribute to continuous and sustainable growth in the number of our majors, graduate students, and general non-EEGS major students taking our courses.

[See Appendix VIII -- for flyers and brochures advertising major and program, presentation slides of recruitment presentations, and copies of print advertisements, *AAG Guide*, and links to updated webpages.]

#### **4.1.2 Selection Process**

We do not have any special requirements for undergraduate admission or graduation beyond what is specified in the general requirements for admission to and graduation from Lehman College, which is all indicated in the *Undergraduate Bulletin*. The students majoring in an EEGS discipline are expected to maintain a 2.0 GPA index overall and a 2.0 GPA in their Major

courses (alternatively, not less than a 2.0 in any Major course). There is one exception: Students minoring in ECCH (Early Childhood and Childhood Education) must select a liberal arts major, such as Geography, one of the approved majors, and maintain a 3.0 GPA in the major for graduation.

Students are informed of major requirements during advisement. There is no official departmental admissions process other than the departmental approval of the online major declaration form, which is also frequently used as an opportunity to encourage students to come in for additional advisement. We generally try to sit down with each EEGS Department major or certificate student at some point when they are about half way through the program to have a comprehensive discussion about their progress and steps they might need to take to remedy any deficiencies or problems areas, and also to review what courses they still need in order to graduate on time and fulfill all the Major (or Certificate) requirements. We meet with most majors and certificate students usually once per term for registration advisement, more often in individual cases if necessary.

Prospective graduate students apply to the 40-credit MS-GISc or 20-credit Advanced Certificate in GISc programs via the Apply Yourself website, which handles all graduate program applications at Lehman. Applicants must provide official transcripts of any post-secondary institutions attended and show a minimum GPA of 3.0, at least two letters of recommendation evaluating their academic achievements and their potential to succeed in graduate school, an up to date CV, a personal essay describing their interests and abilities in GISc and what they are expecting to do with a MS-GISc degree from Lehman. The GISc faculty make up an admissions committee to evaluate each application and make a determination. Applicants are frequently interviewed by one or more members of this committee, especially if there are any items needing clarification or augmentation. Most applicants do visit the department to meet faculty students, and to get some preliminary advisement prior to entering the program. [See Appendix VIII for Application Evaluation Matrix.]

#### **4.1.3 Applicant Profiles**

Undergraduate applications are not reviewed by the department and admissions decisions are made in the Office of Undergraduate Admission. The following therefore applies to the graduate student applicants only. Graduate student applicants are a diverse group. Many of the applicants to the GISc graduate programs are mature students, with about half already working in the field. The other half are either applying directly from an undergraduate program, or have been out of college for only a short while. Some of these students studied Geography as an undergraduate, but quite a few have no prior GISc coursework or experience. Because the students who apply are typically quite focused and know what they want to do with GISc, the pool of applicants is basically self-selected to be highly motivated and/or high achievers, and therefore the acceptance rate is high.

The demographic make-up of the graduate applicants is also very diverse. Quite a few are international students, either those on an international student visa, or those who are from foreign countries originally but who have been settled in New York City for some time. About 35% have been women, and about 45% overall have been from minority racial/ethnic groups traditionally under-represented in the STEM fields.

## 4.2 Enrollments

**Note:** Data provided by the Office of Institutional Research for some sections of this report span different periods of time, not all of which extend back 10 years. Accordingly, our analysis corresponds to the years for which data were provided. Also, note that there are discrepancies between the figures provided by the Office of Institutional Research for this report, and the data provided annually from the Office of the Registrar. Major enrollment totals reported by the Office of the Registrar (confirmed by program faculty) are greater than those which appear here in some cases significantly. In addition, no enrollment data were provided for the undergraduate Certificate in Earth Science, the undergraduate in Certificate in GIS, or the graduate Certificate in GIS.

### Enrollment Trends

#### Enrollment in EEGS Courses by Subject Area

	2010- 2011	2011- 2012	012-2013	2013-2014	014-2015	015-2016	016-2017
ENV			3	197	90	58	54
IEH	293	339	50	293	27	56	82
IEO	423	384	02	307	30	99	05
IEP	191	287	02	377	30	16	29
Total	907	1010	07	1174	177	029	070

#### Department FTEs

Undergraduate FTEs	Lower Division	Upper Division	Total Undergrad	Grad Division	Total FTEs
F 2017	35.27	27.08	62.35	0.20	62.55
F 2016	25.07	33.47	58.54	21.59	80.13
F 2015	29.73	35.20	64.93	16.00	80.93
F 2014	40.07	30.73	70.80	-	70.80
F 2013	38.93	32.74	71.67	11.00	82.67

#### Graduate FTEs

F 2017	17.50
F 2016	21.59
F 2015	16.00
F 2014	16.59
F 2013	17.50

There has been an 18% increase in overall course enrollment and FTEs in the department since 2013. This reflects increased enrollment in pre-existing department major programs and the initiation of the BS in Environmental Science and the growth of the new MS in GISC in 2012. These numbers also reflect service provided to other programs such as the Masters of Science in Science Education and several Required Core: Life and Physical Sciences and Flexible Core:

Scientific World courses: ENV 210, ENV 235, GEH 101, GEH 235, GEH 240, GEO 101, GEO 167, GEO 228, GEP 204, and GEP 228.

**Enrollment by Majors**

Environmental, Geographic and Geological Sciences – Undergraduate											
EEGS Program		2007	2008	2009	2010	2011	2012	2013	2014	2015	2016
Earth Science	N	0	0	0	0	0	0	1	19	19	20
	%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.6%	0.5%	0.5%
Environmental Science	N	0	0	0	2	9	15	18	25	29	32
	%	0.0%	0.0%	0.0%	0.1%	0.3%	0.5%	0.6%	0.8%	0.8%	0.8%
Geography	N	3	6	7	5	7	6	7	3	5	3
	%	0.1%	0.2%	0.2%	0.2%	0.2%	0.2%	0.2%	0.1%	0.1%	0.1%
Geology	N	2	8	11	12	12	7	4	1	0	0
	%	0.1%	0.3%	0.4%	0.4%	0.4%	0.2%	0.1%	0.0%	0.0%	0.0%
Total		5	14	18	19	28	28	30	48	53	55

Environmental, Geographic and Geological Sciences – Graduate											
EEGS Program		2007	2008	2009	2010	2011	2012	2013	2014	2015	2016
Geography (GIS)	N	0	0	0	0	0	5	22	22	24	33
	%	0.0%	0.0%	0.0%	0.0%	0.0%	2.2%	8.1%	7.7%	8.6%	11.9%
Total		0	0	0	0	0	5	22	22	24	33

Overall the number of students enrolled in department undergraduate majors has risen steadily since 2007. This growth is shared amongst the various major programs except for Geography, which has declined. Reflected in the figures is the replacement of the BA in Geology and by the BA in Earth Science in 2013, the initiation of the BS in Environmental Science in 2010, and the commencement of the MS-GISc degree in Fall 2012.

Since its inception in 2012, enrollment in the Masters in GISc has risen. The first cohort recruited in Fall 2012 numbered 5. The current cohort 2017-18 has 33 students, an increase of 560%.

### **Average Student GPAs for Departmental Programs**

<b>Average GPA</b>	2013	2014	2015	2016	2017
Undergraduate	2.97	3.32	3.07	3.00	2.96
Graduate	3.29	3.68	3.54	3.60	3.76

Average GPA hovers around 3.0 for undergraduates and 3.5 for graduates.

### **Student Completion Rate for the Department**

Degrees Granted	2012-13	2013-14	2014-15	2015-16	2016-17
Undergraduate	10	12	13	13	13
Graduate	2	22	14	1	15

The number of undergraduate students completing degrees in the department has risen 30% since 2011 while the number of graduate degrees completed has risen very significantly as the first cohorts enrolled in the MS in GISc have graduated.

### **Diversity of Student Demographics**

#### **Demographics—Undergraduate**

	2013	2014	2015	2016	2017
<b><u>Gender</u></b>					
Women	20	23	25	28	29
Men	11	26	32	31	29
<b><u>Avg Age</u></b>					
	30	32	27	28	29
<b><u>Status</u></b>					
Full time	20	26	42	44	39
Part time	11	23	15	15	19
<b><u>Ethnicity</u></b>					
American Indian/Native					
Alaskan	0	0	0	1	1
Asian	2	2	4	2	1
Black	17	26	25	28	25
Hispanic	10	15	23	19	23
White	2	6	5	9	8

**Demographics—Graduates**

	2013	2014	2015	2016	2017
<b>Gender</b>					
Women	7	12	11	11	10
Men	15	10	13	22	16
<b>Avg Age</b>					
	35	35	33	35	36
<b>Status</b>					
Full time	3	5	2	0	1
Part time	19	17	22	33	25
<b>Ethnicity</b>					
Asian	1	2	3	4	3
Black	9	10	8	11	6
Hispanic	6	6	4	4	6
White	6	4	9	14	11

EEGS undergraduate students are a diverse group, the majority of which are identified as “Black” or “Hispanic”. There are approximately equal numbers of men and women enrolled in the department’s undergraduate programs and there are twice as many full-time students as part time students. Average undergraduate age is about 30.

EEGS graduate students are also diverse with a majority of students identified as either “Black” or “White”. In most years since 2011, male graduate students outnumber female graduate students and the average age is about 35.

**Career Choices (career, graduate study) after Graduation**

**Note:** There is no official mechanism to track the activities of Lehman graduates after graduation. The information we do have is culled from personal correspondence with the students before and after graduation, the writing of reference letters for the students for graduate school applications and to prospective employers, meeting them at professional conferences, and other anecdotal sources. However, for several of our programs, program directors and other faculty do manage to maintain reliable information on students’ immediate activities after graduation, and in some cases, we keep in touch with former students throughout their careers.

Many graduates of EGGs Dept. Programs have decided to enter the job market directly after graduating from Lehman, and due in large part to the solid groundwork in their field that they obtained at Lehman, and the robust preparation afforded them through coursework and other learning experiences here, they have had good success in finding jobs in their fields.

The majority of student completing the BA in Earth Science go on to a masters degree in science education. The BA in Earth Science curriculum is well-aligned with the NYS Conceptual Framework for Teachers of Earth Science. As a result our students typically excel on the NYS

Teacher Certification Content Specialty Test. During the last 5 years, five graduates of the Earth Science program have been accepted into the prestigious and fully funded (including \$30,000 stipend) Master of Arts in Teaching: Earth Science at the Richard Gilder Graduate School of the American Museum of Natural History. Others have enrolled in the NOYCE funded Masters of Science in Science Education program at Lehman. Earth Science is and has historically been the science subject with the highest teacher shortages in New York City and New York State middle and high schools. One hundred percent of BA in Earth Science and Certificate in Earth Science completers seeking jobs as Earth science teachers are successful in finding positions, most of them in New York City. Information on other Earth Science graduate employment records is not currently available.

The Environmental Science Major completing the BS Program in Environmental Science are well-prepared for success in the job market. The curriculum provides students with a strong integrated science foundation, which can be further enhanced by suggested minors focusing on the social, political, ethical, historical and legal issues intertwined with environmental issues/science. In addition to a rigorous sequence of foundation courses in the natural sciences, the program requires students to select an advanced course sequence from a selection of specialization areas. This flexibility allows students to tailor their program to reflect their own interests and align it with a specific career objective. It can also be combined with a minor in a variety of specialization fields or as a second major for students in pre-law, pre-med, public health programs, as well as any program of study that involves environmental issues.

The Geography Major, the GISc Certificate Program, and the Masters in GISc have been designed to maximize graduates' chances of securing a good position in the fields of Geography and GISc, or one of Geography's many affiliated fields, such as urban planning, biogeography, environmental analysis, demography, international development, health sciences, natural resource management, meteorology, and risk assessment. Our Geography graduates have found employment in many municipal, state, and federal governmental agencies, as well as environmental, engineering, and planning consulting firms, non-profit organizations, research institutions and "think tanks," community-based development groups, as well as international non-governmental organizations and international development agencies. Through a sequence of introductory courses leading up to specialization courses and a capstone experience course, they receive both the theoretical framework and technical knowledge, as well as applications-oriented experience, and thus the students are prepared to contribute to solving "real world" problems.

The Geography graduates, and especially those graduating with GISc experience, have had excellent success in obtaining positions in the fields of geotechnology and spatial sciences. Examples of employers who have hired our Geography/GISc graduates include the United Nations, TeleAtlas, NYC Department of City Planning, NYC Department of Health, NYC Department of Environmental Protection, New York State Economic Development Corporation, Cameron Environmental Engineering Consulting LLP, Municipal Arts Society, Columbia-Presbyterian Medical Center, Millennium Villages Project, Clarksons GIS Research Lab, Harlem Children's Health Zone, United States Department of Agriculture's US-Mexico Border County Demographics and Health Statistics Project, Center for Urban Research, New Yorkers for Parks, Great Swamp Watershed Association, and the Center for Hazards Assessment, Response and Technology. Several of these positions have stemmed from GISc Internships.

## 5. Critical Self-Analysis and Priorities of Department<sup>[L]</sup><sub>[SEP]</sub>

### 5.1. Progress since Prior Academic Program Review<sup>[L]</sup><sub>[SEP]</sub>

The prior 5-year plan focused on four areas: curriculum, faculty, students (enrollment) and resources. Major changes made in each of these areas since the last report are summarized and the changes proposed in the previous 5-year plan are reviewed.

#### **Curriculum**

At the time of the last review the department offered the following program options in Geography, Geographic Information Science, Geology, and Environmental Science:

- BA in Geography
- Minor in Geography
- Minor in Geographical Information Science
- Certificate in Geographical Information Science
- BA in Geology
- Minor in Geology
- BS in Environmental Sciences
- Minor in Environmental Sciences

Currently the department offers the following programs:

- BA in Geography
- Minor in Geography
- Minor in Geographical Information Science
- Certificate in Geographical Information Science (undergraduate)
- BA in Earth Science
- Minor in Earth Science
- Certificate in Earth Science
- BS in Environmental Sciences
- Minor in Environmental Sciences
- Masters in Geographic Information Science
- Advanced Certificate in Geographic Information Science (graduate)
- Accelerated Bachelor's to Master's Degree Program in GISc

#### Summary of Major Changes:

The options available to students have expanded, particularly in Earth Science and GISc. The BA and Minor in Geology were changed to the BA and Minor in Earth Science. A new Masters in GISc and a graduate Certificate in GISc have been added to the department offerings. A new Accelerated Bachelor's to Masters Degree Program has been added in GISc.

#### Environmental Science

Changes Proposed in Previous 5-year Plan: It was proposed in the previous review to offer two tracks in the Environmental Science program: "Environmental Sciences" track to focus on natural sciences, resulting in a B.S. degree; the "Environmental Studies" track emphasizing Environmental Policy, Planning, and Resource Management, resulting in B.A. degree. A



significant reduction in the number of required foundation courses, and an increase in the number of electives were also proposed. Instead, students will be offered a larger number of electives to choose from.

Actual Changes: The proposed changes to the Environmental Science curriculum as described below:

The Interdisciplinary Program in Environmental Science, B.S. is a 46-credit major.

The core of the interdisciplinary undergraduate program in Environmental Science is a sequence of basic and advanced science courses from four participating science departments. Students select a specialization area in Ecology, Urban Environmental Management, Environmental Geology, or Environmental Analysis. The Interdisciplinary Program in Environmental Science offers courses to prepare students (1) for environmental science careers, and to become active proponents for their communities in the scientific and policy processes surrounding environmental issues, (2) to meet the environmental science employment demands of local, state, and federal governmental agencies, private consulting, and industry, and (3) to pursue advanced degrees in environmental/physical sciences.

#### Earth Science (Geology)

Changes Proposed in Previous 5-year Plan: Within the geology program itself we suggest to offer a B.S. in geology with two tracks: The Geology (Geosciences) track is recommended to students who wish to enter careers in geosciences or to pursue graduate study in geology. The Environmental Geology track is recommended to students who wish to enter careers in environmental consulting and governmental environmental agencies. In addition, we suggest offering a B.A. in Geology (Earth Science) for teachers.

Actual Changes: In spite of a full new degree program proposal being developed and written, a new two-track BS in Geology did not receive sufficient departmental or divisional support to move forward. Instead the BA in Earth Science (30 credits) was created. With a curriculum closely align to the NYS Teacher Certification Conceptual Framework in Earth Science, this program was designed to provide the required content for undergraduates preparing to become Earth Science educators. A new Certificate in Earth Science (30 credits) was created with the aim of providing teachers with an existing NYS teacher certification in another science subject to earn the 30 credits required by NYS to obtain a second teaching certification in Earth Science.

#### Geography / GISc

Changes Proposed in Previous 5-Year Plan: There were no changes proposed in the previous 5-year plan to the Geography Major, GISc Certificate, or GISc Minor. The proposed MS-GISc degree that was mentioned in the 2011 report was approved as a Letter of Intent in 2008, but for various reasons within CUNY it was not acted upon. Finally, it was approved by CUNY and the NYSED in June 2012, and we accepted our first cohort of graduate students in Fall 2012.

Actual Changes: The MS-GISc degree commenced in Fall 2012, the Advanced Certificate in GISc was approved in May 2013, we received our PSM accreditation in January 2013, and a new Memorandum of Agreement with the CUNY Graduate Center was established in July, 2016, allowing CUNY doctoral students to be awarded the Advanced Certificate in GISc from Lehman. Additionally, a new program was added in 2016, the Accelerated Bachelor's to

Master's Degree Program, allowing qualified undergraduates to take up to 12 graduate credits whilst still undergrads, credits which would be counted towards both their Bachelor's and their Master's degree, expediting the amount of time necessary to obtain their MS-GISc. Please refer to the section on curriculum for a detailed list of new courses.

### **Faculty**

Changes Proposed in Previous 5-year Plan: The GIS Program including the envisioned MGISc Program are adequately staffed in terms of full-time faculty. The fields of Human and Regional Geography are not well represented by the current faculty members. To be able to offer a well-rounded and comprehensive geography education it is therefore desirable to hire at least one additional faculty member.

Actual Changes: One additional faculty member was hired, but her specialty was in physical geography rather than human or regional geography. Additionally, in 2014 we lost two Health Sciences faculty members who were "on loan" to EEGS to teach co-listed courses in the Lehman Master's of Public Health GISc concentration and the MS-GISc Program. We have not been authorized to replace them. They taught 8 GISc courses on a regular basis, several of which are required for the MS-GISc degree program (GEP 605, 610, 620, 630, 632, 640, 660, 690).

Changes Proposed in Previous 5-year Plan: With the expected growth of the Environmental Science Program it will become necessary to hire at least one additional faculty member. With the suggested expansion of the Geology program, it will become necessary to evaluate potential needs for additional or alternative staffing or collaborations with other campuses within the CUNY system.

Actual Changes: No new faculty were hired to teach in the Environmental Science or Earth Science Programs, nor were alternative or collaborative staffing solutions found.

Changes Proposed in Previous 5-year Plan: The previous review characterized scholarly accomplishments and current activity of the faculty members as largely variable. The then-chair engaged to hold discussions with all faculty members to increase the overall amount of research collaborations, funded research projects and peer-reviewed journal articles.

Actual Changes: As far as this author knows, those discussions did not take place. Soon after the prior review was completed the then-chair left the department for an administrative post in the college.

### **Students (Enrollment)**

Changes Proposed in Previous 5-year Plan: Proposed approaches to increase enrollment in department majors included plans to restructure the programs to make them more competitive, relevant and attractive to students. Other ideas aimed at increasing the visibility of the programs on campus and beyond. It was proposed to showcase accomplishments of our majors and relevance of our programs on campus TV, banners and large screens in our building. It was expected that all of these methods would contribute to continuous and sustainable growth, both, in the number of our majors and students taking our courses.

Actual Changes: Extensive program restructuring has occurred as outlined above and this may account for some of increased enrollment in department majors. Student work and research projects have been showcased on the department web pages, on independent faculty developed web and YouTube channels, in student presentations at international scientific conferences and at the annual Lehman Research and Scholarship Day. Although it is difficult to assess the impact of these activities, the faculty effort that has gone into them does not seem to have been balanced by the amount of increased enrollment.

### **Resources**

Changes Proposed in Previous 5-year Plan: Critical needs of the department cited in the previous review included office space for faculty members, visiting scholars, adjunct instructors, research staff, emeriti, etc. Resolution of this issue was termed “absolutely essential.”

Actual Changes: The purpose-built cabinetry in room 323, a prep and storage room for the geology thin section and sample collections and mineralogy lab equipment, was gutted to provide office space for a faculty member of another department who taught GIS course in EEGS. The cabinetry was irreplaceable. The collections and equipment were piled into a basement room and is now inaccessible. The faculty member occupying the space has since moved on.

### **5.2. Proposed Changes in Department Organization, Programs, and Curriculum<sup>[SEP]</sup>**

EEGS faculty have consistently a broad range of recruitment efforts. Given our teaching load and research and service obligations, the additional effort put into recruitment has been extraordinary. The result has increased enrollment in all programs except the BA in Geography, but not to a degree proportionate to our efforts. The targeted recruitment needed is beyond what faculty are reasonably able to perform. Assistance from the Office of Admissions has been sought in the past, but their efforts produced no increase in enrollment. This issue has been discussed with the Dean, as well. This is a problem that must be addressed.

Although no major changes are currently being planned in the B.S. in Interdisciplinary Environmental Science Program, we would like to develop a new track, namely, a B.A. degree Program in Environmental Studies, i.e., emphasizing environmental policy, planning, and resource management in the future to make environmental program as a more comprehensive one.

Currently no changes to the Earth Science curriculum are being planned: the program was last revised in 2015. The current program curriculum fulfills the program learning objectives and goals. In addition, the current curriculum works well with the limited Earth Science staffing, allowing us to provide sufficient course offering for students to complete the degree requirement within 2.5 years on average after declaring the major. Given the career stage of 2 out of the 2.5 faculty members teaching in the Earth Science Program, creation of 1 or 2 new faculty lines should be considered. Alternatively, engagement of 1 or 2 part-time faculty could be phased into Earth Science Program instruction so that the sudden departure/retirement of Earth Science faculty does not arrest program instruction or prohibit student progress towards degree completion.

In spite of the increased program enrollment, recruitment should be addressed. Support should be provided from the Admissions Office in the form of targeted external recruitment. The 100-level Core Requirement courses should be redesigned and staffed with faculty that are welcoming and encouraging. These courses (GEO 101, GEO 167) should include a greater degree of student engagement in in-class activities and field trips as well as incorporated other strategies that have been proven to increase recruitment and retention.

There are no major changes proposed for the MS-GISc or Advanced Certificate Programs, although we are considering a slight revision in the set of required courses to include GEP 662, Programming for GISc, which is now a frequently-offered elective. We will also likely continue to add new courses as the need arises, due to the continuing evolution of the field and changes in the expected body of knowledge of graduates entering the field professionally. Up until now, most of this need has been satisfied by offering multiple sections of GEP 680, Emerging Methods and Issues in GISc, which is a variable topics course that students can take up to 3 times for a total of 9 credits as the topic changes. But this has proven to be somewhat restrictive in many cases, as a number of students have reached the 3 course limit for GEP 680 and would still like to take new courses listed as sections of GEP 680 as they are offered, but currently are not allowed to do so. This limitation is particularly problematic if graduate students have taken their undergraduate degree here in the EEGS Dept., and even more so if the student is in the Accelerated Bachelor's to Master's Degree Program.

For the undergraduate Geography program, we have been considering some more drastic changes, largely due to the low popularity of the Geography major, and our efforts to increase enrollment and visibility of the program, making it more attractive, and also possibly creating more of an educational pipeline between our undergraduate geography degree and the graduate GISc programs. There are three possible options: 1.) Eliminate the Geography major altogether, and replace it with a new Bachelor's degree program in GISc or Geospatial Sciences; 2.) Keep the Geography major as is, and add a new Bachelor's degree program in GISc or Geospatial Sciences. 3.) Combine the two as one major, with two options or concentration tracks. Any of these options would be possible without adding new courses, but the difficulties come in with our overall lack of GISc faculty. Right now, our GISc classes are taught with undergraduate and graduate sections meeting together, which works out well since as a rule there are so few undergrad students in the classes (aside from a few classes that are also general education distribution courses, and they serve mainly undergrads). We have 2.5 full-time GISc faculty and this would need to be increased if the Geography major became more popular. With the emphasis we have placed on developing articulation agreements with CUNY community colleges, we may well see a significant increase in Geography undergrads within the next five years, particularly if we start offering a Bachelor's degree in GISc or Geospatial Sciences, as this would be a unique major within CUNY and SUNY.