REVIEW OF THE B.S. IN GEOLOGY

Classification of Instructional Programs (CIP) Code: 40.0601
Geology/Earth Science, General

OVERVIEW

The B.S. in Geology program at Illinois State University is housed in the Department of Geography, Geology, and the Environment within the College of Arts and Sciences. The department also offers minors in environmental studies, geography, and geology; a B.A., B.S. in Geography; a M.S. in Hydrogeology; and a Hydrogeology Geographic Information Systems (GIS) Graduate Certificate.

The B.S. in Geology program at Illinois State is recognized by employers and graduate schools for its traditional approach to the instruction of geology and for its balance of application and theory that are firmly rooted in field studies. The geology program at Illinois State is one of three geology programs offered by Illinois public universities that annually sponsor unique capstone field camps. Many undergraduate geology programs nationwide have either ceased offering field camp or no longer offer field camp annually or send their students to field campus sponsored by one or more other institutions.

The design of undergraduate geology programs at Illinois public universities is essentially the same. However, each university fills a niche in the discipline. The niche addressed by the geology program at Illinois State University is teacher education. Students in the geology program choose between a geology plan of study and the earth and space science teacher education sequence. The latter prepares students for initial teacher licensure in Illinois with endorsements that permits the graduate to teach all high school science courses (earth science, environmental science, biology, chemistry, and physics).

Approximately half of the students who graduated from the B.S. in Geology program at Illinois State University between 2008 and 2014 started their careers in the industrial materials, oil and gas, mining, or environmental/geotechnical industries or were hired to teach in Illinois high schools. The other half continued their educations in graduate school.

Enrollment by Plan of Study, Fall Census Day, 2009-2016
B.S. in Geology, Illinois State University
First Majors Only

	2009	2010	2011	2012	2013	2014	2015	2016
Plan of study:								
Geology	53	63	57	55	56	55	66	65
Earth and Space Science Teacher Education	24	32	36	27	21	19	19	19
Total	77	95	93	82	77	74	85	84

Degrees Conferred by Plan of Study, Graduating Fiscal Year, 2010-2016
B.S. in Geology, Illinois State University

	2010	2011	2012	2013	2014	2015	2016
Plan of study:							
Geology	11	16	13	16	16	NA	12
Earth and Space Science Teacher Education	2	2	5	6	9	NA	4
Total	13	18	18	22	25	14	16

EXECUTIVE SUMMARY
PROGRAM REVIEW SELF-STUDY REPORT

Self-study process. Self-study is an ongoing process for the geology and hydrogeology faculty at Illinois State University, either as part of departmental retreats, scheduled meetings, or informal conversations. Having program review scheduled for the geology and hydrogeology programs made little difference in the operation of the department during the last few years with respect to curriculum, assessment, budgeting, and planning. Geology faculty held meetings in January 2016 to discuss the program review process for both the undergraduate geology program and the graduate hydrogeology program. Data from the Office of Planning, Research, and Policy Analysis, Alumni Relations, and the Department of Geography, Geology, and the Environment were gathered and compiled. Four surveys were administered to program graduates and current students. A geology faculty member who was designated as the program review facilitator compiled the data and wrote the first draft of the program review self-study report. The facilitator shared the draft with program faculty and the department chairperson and then sought feedback at faculty meetings prior to preparation and submission of the final draft.

Program curriculum. The curriculum of the B.S. in Geology program provides specialized training for those students who wish to pursue entry-level employment following completion of the program while simultaneously ensuring the breadth of academic background for those who intend to pursue graduate studies. This dual goal is accomplished by offering a rigorous curriculum that includes 66 credit hours of coursework in the discipline, 59 of which are specified and seven of which are elective. Students who pursue the traditional geology plan of study finish the program with a six-week field camp experience in the Rocky Mountain region taught by Illinois State University faculty. Students who pursue the earth and space science teacher education sequence finish the program with a student teaching experience. All students are encouraged to participate in research through an independent study with a faculty member, a class assignment, or a funded research project. Students are often invited by faculty members to attend professional meetings to present research or to network with academicians and practitioners in the field.

Program or academic unit faculty. The geology faculty headcount fluctuated between five and seven during the program review period. Seven faculty members were in residence during the fall 2016 semester. Each geology faculty member has a doctorate from a leading research institution and is recognized university-wide, state-wide, nationally, and internationally as a subject-matter expert and for contributions to teaching, scholarship, and service in their specialization. Among geology programs at Illinois universities, public or private, the geology faculty at Illinois State University graduates the most students per faculty full-time-equivalency than geology faculty at any other institution. From 2008 to 2015 a geology faculty member also served as chairperson of the Department of Geography, Geology, and the Environment.

Program goals and quality indices. The B.S. in Geology program is designed to further seven goals: 1) to provide all students with the opportunity to learn about the nature of science and basic scientific principles through the study of geology, 2) to introduce all students to the many ways in which geology is interwoven into the fabric of modern civilization, 3) to provide geology majors with a solid background in the natural sciences, 4) to prepare geology majors to apply mathematics and computer science as tools for performance in geology, 5) to provide geology majors with the range of basic geologic concepts covering the breadth of the discipline, 6) to help students develop the communication, analytical, quantitative, and critical thinking skills necessary for success as a professional scientist, and 7) to provide specialized training for those students who wish to pursue entry-level employment following completion of the program while simultaneously ensuring the breadth of academic background for those students who will pursue graduate studies in geology.

Student learning outcomes assessment plan and process. Students who complete the B.S. in Geology program should be able to identify, describe, and classify common, and some uncommon, earth materials (minerals and rocks); to make scientific observations of these earth materials in the field and in the laboratory and interpret their observations in a scientifically sound manner; to be familiar with the arrangement and structure of these earth materials, including how they originally form and how they are affected by physical, chemical, and biological activity after they form; to develop skill in the area of constructing and interpreting geologic maps; to develop models of the geometry and spatial relations of earth materials at depth; and to develop an appreciation for the enormity of time and the history of the Earth. Graduates are also expected to develop an appreciation for the dependence of society on earth resources and on the interaction between human activities and the natural

environment, to learn the theoretical bases of geology and utilize opportunities to apply theoretical knowledge to field based problems, and to develop analytical and quantitative skills and written and oral communication skills appropriate for a geology career or for advanced study in the discipline.

Annual assessment of student learning outcomes in the geology program has three parts. The first is based on rubrics applied to the research project in the stratigraphy course required of all majors. The second is an exit interview of all geology graduates each May. Historically the survey has been administered using printed forms, but beginning in 2017 the survey will be administered electronically. The third part occurs at the end of the six-week field camp and involves comparison of student outcomes against expected benchmarks and against performance of students from other universities who attend the camp. In addition to these assessment activities, faculty members carefully evaluate transcripts of each program graduate and monitor each graduate's first career steps.

Specialized accreditation. Geology, as a discipline, does not have an accreditation or certification process. Thus, the geology plan of study is not affiliated with or recognized by a specialized accreditation association. However, the earth and space science teacher education sequence of the program is part of the teacher education unit at Illinois State University that is accredited by the National Council for Accreditation of Teacher Education (NCATE). The unit was reaccredited by NCATE in 2012. The next accreditation review, scheduled for 2019, and will be conducted by the Council for the Accreditation of Educator Preparation (CAEP), as successor to NCATE.

Responses to recommendations resulting from the previous program review. The 2008-2009 previous program review resulted in recommendations by the Academic Planning Committee to consider four issues: cultural diversity of students in the program, gender diversity of faculty teaching in the program, student participation in the Honors program, and student participation in the research symposium at the University. The level of cultural diversity among students in the geology program remained stable during the program review period, closely mirroring the level of cultural diversity across the geology discipline nationwide. A major success with regard to cultural diversity is a significant increase in diversity among students participating in the six-week field camp. This was achieved by recruiting international students and students from other universities who self-identify with racial or ethnic groups traditionally underrepresented in the discipline. The geology program also made important progress in advancing demographic diversity of its faculty. All four recent faculty hires, in addition to being the top candidate in their respective search pool, are either female or self-identify with a racial or ethnic group traditionally underrepresented in geology faculty ranks nationwide. Student participation in the Honors program and the University Research Symposium also increased during this program review period.

Changes in the academic discipline, field, societal need, and program demand. No profession other than geology is tasked with understanding the composition of the Earth and how it works. As a result, geologists continue to be in demand. Over the next decade, a 14 percent increase in geoscience jobs is predicted nationally, which is three percentage points higher than projected growth of the entire United States workforce. Among geoscience positions, employment of environmental scientists and environmental engineers is expected to grow most. In Illinois the locus of many new geoscience positions will be the Chicago metropolitan area. Physical development in the Chicago area requires the preparation of environmental impact statements, which geologists will have a hand in preparing. Geologists also will be tasked with formulating remediation plans for sites where environmental problems arise.

Major findings of this program review self-study. The B.S. in Geology program at Illinois State University is rigorous and robust and serves in an aspirational position relative to other undergraduate geology programs in Illinois and the Midwest. Since the last program review, the position of the program relative to others has been strengthened through numerous program improvements. However, significant opportunities for program improvement and growth remain. They are identified below.

Initiatives and plans for the next program review cycle.

- Remain vigilant in student recruitment and retention efforts
- Add faculty expertise in glacial geology and geophysics
- Increase start-up funding for newly hired faculty
- Ensure quality student mentoring and advising of students enrolled in the earth and space science teacher education sequence

- Maintain the ability to offer the capstone field camp experience, which is critical in helping the program maintain its uniqueness and standing in the discipline
- Maintain the ability to offer field experiences in courses other than the six-week field camp and in new courses
- Renovate and upgrade research facilities
- Renovate and upgrade teaching facilities including traditional classrooms and computer laboratories
- Identify new, stable revenue streams to supplement state-appropriated funds
- Explore developing metrics for including student research mentoring in an individual faculty member's teaching load
- Explore new ways to help increase student diversity
- Explore ways to support the development of additional environmental curricula in ways that would further advance the mission of the program
- Involve more alumni in the departmental culture; such involvement is essential for fundraising as well as for student engagement and professional development
- Increase external communication of program relevance and accomplishments
- Transition student academic advisement from University College to the Department at an earlier point in the plan of study

PROGRAM REVIEW OUTCOME AND RECOMMENDATIONS FROM THE ACADEMIC PLANNING COMMITTEE

Review Outcome. The Academic Planning Committee, as a result of this review process, finds the B.S. in Geology program to be in Good Standing.

The Academic Planning Committee thanks faculty and staff of the B.S. in Geology program for a thorough, insightful, critical, and forward-looking program review self-study report. Particularly noteworthy are the numerous examples and anecdotes used to support assertions and recommendations and the summary of program strengths, weaknesses, opportunities, and threats.

The committee commends program faculty and staff for offering an undergraduate geology program whose curriculum balances theory and application and is characterized by rigor in math and science, a capstone field experience offered annually, and an emphasis on involving students in research. The committee also commends faculty and staff for its implementation of the earth and space science teacher education sequence, new in 2007, through which students are credentialed to teach physical sciences to students in Illinois K-12 schools. Success of the B.S. in Geology program is evidenced by 90 percent of graduates since the last program review either obtaining geology-related jobs or being admitted to graduate school. Seventy-five percent of students graduating from the teacher education sequence have earned teaching positions in the field. Levels of satisfaction with the program among its graduates remain high.

The committee recognizes faculty and staff for the individualized attention they extend to students, from the time of their application to the program to well past their matriculation from it. Faculty and staff facilitate transition into the program through contacts with students who have applied to but not yet enrolled in the program and with community college students who are preparing to transfer into the program. Faculty members mentor students in courses and field experiences, engage them in collaborative faculty-student scholarship, and encourage them to pursue original research. The committee commends the program for the financial assistance it provides to students so they can communicate their research results through presentations in professional settings. With respect to the teacher education sequence, the committee commends the program for paying fees associated with the capstone teacher preparation experience required for state licensure (edTPA).

The committee recognizes the program for cultivating and maintaining contacts with alumni. Those efforts continue to benefit the program and its students as alumni employ students as interns or as permanent employees upon their graduation, contribute to the Powell (scholarship) Fund, and participate as speakers for the colloquium series sponsored by the department. While not required by the program, internships have been completed by approximately one in three graduates since 2008, with many internship sponsors paying substantial stipends that help students offset the cost of their education.

The committee recognizes faculty for its dedication to balancing program development and student-centered teaching with scholarship and service contributions to the discipline. The committee recognizes efforts of faculty to evaluate and revise the curriculum for its currency and relevancy. One example involves changes to the teacher education sequence to make it possible for sequence graduates to qualify for licensure or endorsement in Illinois in three content areas: earth and space science, physics, and biology. The committee thanks faculty members for their instruction of the nearly 1,500 students enrolling each year in a geology course that meets general education requirements and for their collaboration with geography faculty to explore development of an environmental science major. Faculty members publish in high-impact journals in the discipline, produce maps and field guides, and regularly present at professional conferences. Faculty members have received numerous internal and external awards for their scholarship and service. Examples include Outstanding College Researcher and Research Initiative awards at Illinois State, recognition of a faculty member as a University Professor, and participation by a faculty member in the International Panel on Climate Change, which subsequently was awarded a Nobel Peace Prize. The committee acknowledges successes by geology faculty in obtaining external funds to support faculty and student scholarship, at an average rate of $100,000 per year per faculty member since the last program review.

The committee further recognizes faculty members for their service to groups external to the University and for engaging students in those efforts. Examples include water quality research in the Bloomington-Normal area, professional development workshops held during the summer for practicing K-12 teachers across the state, and production of geologic maps used to inform land use decisions by local or regional governments.

Finally, the committee expresses appreciation to the program for its efforts to assemble the highly-credentialed yet diverse faculty responsible for these achievements. While the field of geology is predominately white and male, all four recent geology faculty hires have self-identified as female and/or with a racial or ethnic group traditionally underrepresented among faculty at Illinois State and nationally across the discipline.

Recommendations. The Academic Planning Committee makes the following recommendations to be addressed within the next regularly scheduled review cycle. In the next program review self-study, tentatively due October 1, 2024, the committee asks the program to describe actions taken and results achieved for each recommendation.

- The committee commends faculty for recognizing and trying to help students who struggle to complete science, mathematics, and foreign language requirements of the program. The committee encourages faculty to continue to explore strategies for assisting students through those courses. The committee suggests that the program seek guidance with this challenge from other physical science programs at Illinois State, from undergraduate geology programs regionally and nationally (including aspirational programs), and from professional organizations. Given the nature of the careers pursued by geology majors, the committee does not see as appropriate a lessening of the foreign language requirement for them. The committee instead encourages the department to work with the College of Arts and Sciences and the Department of Languages, Literatures, and Cultures to strategize additional ways to facilitate completion of the foreign language requirement.

- Satisfaction among alumni with the overall quality of their academic experience in the program was 100 percent, according to the alumni survey administered by the program for this program review. Satisfaction with specific aspects of the program exceeded 85 percent in most instances. However, satisfaction rates among students enrolled in the teacher education sequence were generally lower then among students in the non-teacher education sequence. According to the self-study report, teacher education students may not fully understand the design of the curriculum and may have lesser access to tenure-line faculty than the non-teacher education students. The committee recognizes recent steps taken by the program to modify the teacher education sequence, including its curriculum, and urges faculty to track the impact of those changes on student learning, outcomes, and satisfaction. The committee also notes opportunities for the program to increase student satisfaction with respect to cultural awareness.

- The committee acknowledges the challenges the program faces in diversifying its student body and efforts by the program to do so. The percentage of students in the program who are female has increased in recent years to levels that are near or above the average across undergraduate geology programs nationwide. However, a continuing challenge is increasing the percentage of students who self-identify with a racial or ethnic group traditionally underrepresented at Illinois State. That percentage has been lower than the

percentage across all undergraduate programs at the University. The program has made admirable efforts to increase that percentage among students enrolling in the six-week field camp by recruiting international students and by strategically selecting the universities from which field camp students are recruited. Similarly creative and unique approaches may be needed to increase the percentage among students enrolling in the undergraduate geology program at Illinois State. Given the commitment faculty has made to its robust field camp experience, the committee suggests exploring ways to recruit students from other states who may be interested in a geology program with such a field experience.

- The committee heartily commends the program for its attention to student learning outcomes assessment. It is evident from the self-study report that the assessment plan is being faithfully implemented and that assessment results are being used to guide program improvements. Particularly noteworthy is the administration of exit interviews to each graduating senior. The committee encourages faculty to continue its assessment efforts during the next program review cycle while periodically reviewing the assessment plan itself to ensure its alignment with program goals and curricula. One assessment enhancement faculty might consider is assessing additional learning outcomes prior to the capstone field experience, which might be particularly helpful in assessing learning in the teacher education sequence. The program might also consider additional use of rubrics, which could aid longitudinal analysis of student learning in courses taught by multiple faculty members using differing grading schemes. Whatever assessment changes are considered by faculty during the next review cycle, the committee encourages faculty members to consider their ability to sustain their assessment work over time given the faculty resources likely to be available to the program. Strategies such as staggering assessment of learning goals over multiple years and sampling student work rather than assessing the work of every student can help minimize the burden assessment may otherwise have on program faculty.

- With continued uncertainty regarding public support for higher education in Illinois, it is unlikely that the University will have sufficient funds in the near term to meet all infrastructure needs of its academic units including the Department of Geography, Geology, and the Environment. Accordingly, the committee suggests that the department maintain its plan for infrastructure development and recapitalization to support the B.S. in Geology program while exploring options for funding the highest priority projects identified in it. The committee suggests exploring coordination of equipment purchases with other physical science units at the University and continuing to seek external funds either through single purpose funding requests or as part of requests to fund research initiatives. The committee encourages the department to continue exploring partnerships with business and industry and outreaching to alumni, which could lead to additional private contributions to the program.

- The committee enthusiastically notes collaboration of geology faculty members with their counterparts in geography to develop a proposal for an interdisciplinary undergraduate environmental systems program. The committee encourages faculty to continue that collaborative work and to explore other environmental curricula that would meet student needs while advancing the department mission. Concepts to explore might include a “four plus one” program for high-achieving students seeking an undergraduate degree in geology and a master’s degree in hydrogeology.