



Program Assessment Report (PAR)

Earth & Environmental Sciences, BS (EES) Baccalaureate Degree

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ACADEMIC YEAR COVERED BY THIS REPORT: [AcademicYear]

I. PROGRAM LEARNING OUTCOMES

The Earth & Environmental Sciences baccalaureate degree program (BA & BS) develops many skills • Combining a range of sciences (geology, chemistry, physics, biology, mathematics, and computer science) in creatively solving practical problems • Collaborating with others to complete projects • Interpreting text, numbers, and graphs • Thinking critically • Presenting information and thoughts in written and oral formats Learning Outcomes of the program include 1) Students will master basic concepts of earth and environmental science and be able to apply those concepts within the natural world. 2) Students will display proficiency in field and laboratory techniques used in the practice of earth and environmental sciences. 3) Students will be able to write detailed scientific reports for appropriate audiences. The program does not have professional accreditation.

II. PROCEDURES USED FOR ASSESSMENT

A. Direct Assessment

1) Master basic concepts and apply those concepts in natural world. The department offers an eclectic array of earth and environmental science courses. Our courses are intended to provide students with fundamental knowledge (assessed by objective homework, exams, and essays) that they then apply in independent projects that include either research papers focused on each particular course topic or field research, with associated reporting to instructors and peers. The EES discipline and our baccalaureate degree is characterized by interdisciplinary synthesis of information. Accordingly, these term paper/presentations and field research experiences become increasingly multidisciplinary as students acquire a broader education as they progress through the degree program. Application to the natural world is assessed through multidisciplinary term papers and field/lab research—both of which are important skills (along with communication) of professionals in our field. Data used for

assessment are collected from homework, lab/field reports (written and oral), written exams, and term papers. Most course evaluations are conducted with both an answer key for objective questions and by subjective analysis of conceptual knowledge. A portion of student assessment in field/lab courses is from instructor's evaluation of ability to use learned techniques. 2) Display proficiency in field and laboratory techniques. Students must be proficient in the use of methods and instrumentation used by professionals who work in the earth and environmental sciences. The proper use and fundamental understanding of research-level methods and instrumentation is promoted by the department's requirement that baccalaureate students take at least 26–38% of their total credit hours (depending on whether earth or environmental science concentration) in laboratory- and field-focused courses. Most students also take additional elective courses that have a laboratory or field practicum component. Proficiency is assessed from lab/field reports, notebook evaluation, and instructor evaluation of, for example, use of equipment and reporting methodology (e.g., proper observation methods, quality assurance). Most course evaluations are conducted with both an answer key for objective questions and by semi-subjective analysis, with rubric, of students' notes. 3) Demonstrate ability to write reports. In addition to fundamental knowledge and the ability to conduct research, communication is one of the three most important aspects of science. Scientific writing and oral presentation are instructed in a variety of ways, from our students' first year through their last. We offer a First-Year Seminar (mostly freshmen, but some transfer students) where we work on getting students comfortable speaking in front of their peers weekly and the students write a short essay on a weekly reading assignment. Speaking logically and writing logically go hand-in-hand together. All of our 3000- and 4000-level courses have required writing assignments where students receive instructor feedback on content and grammar. The department teaches a 3-credit hour Scientific Communication course (manuscripts, conference presentations, proposals, etc.). We offer a Writing for Research course in which students work with a faculty member to improve their scientific writing, and we require third- and fourth-year students to attend our weekly department seminar and learn by observation. Assessment of this learning outcome is largely subjective and done by faculty members. Content is important, but an emphasis is placed on improvement from draft-to-draft and demonstration by the student that they are learning from practice and instructor and peer comments.

B. Scoring of Student Work

1) Master basic concepts and apply those concepts in natural world. Data used for scoring are collected from homework, lab/field reports (written and oral), written exams, and term papers. Most course evaluations are conducted with both an answer key for objective questions and by subjective analysis of conceptual knowledge. A portion of student assessment in field/lab courses is from instructor's evaluation of ability to use learned techniques. 2) Display proficiency in field and laboratory techniques. Students are scored on their lab/field reports, notebook evaluation, and instructor evaluation of, for example, use of equipment and reporting methodology (e.g., proper observational

methods, quality assurance). Most course evaluations are conducted with both an answer key for objective questions and by semi-subjective analysis, with rubric, of students' notes. 3) Demonstrate ability to write reports. Scoring of this learning outcome is from student homework, their written essays, and their ability to critically revise their own text and that of others. Assessment of this learning outcome is largely subjective and done by faculty members. Content is important, but an emphasis is placed on improvement from draft-to-draft and demonstration by the student that they are learning from practice and instructor and peer comments.

C. Indirect Assessment

1) A valuable metric to indirectly assess the three Learning Outcomes is the professional success of our students. While data for 2019–2020 are not yet available, we have data for 2014–2019. These data indicate the following for EES baccalaureate graduates • About 21% of EES graduates go on to pursue advanced degrees, with most being M.S. and a few Ph.D. and M.D. This percentage is in line with the national average in geosciences (21%, American Geosciences Institute). • A majority of EES graduates are employed within the state of Ohio, and recent graduates earn a median annual salary in excess of \$35,000, which is considerably greater than the median per capita annual income of Ohioans (\$30,000, U.S. Census Bureau). Importantly, the median salary of recent graduates will continue to increase substantially and at a rate greater than inflation as our alumni mature in their professions. • A vast majority of EES graduates (75%) are either seeking advanced degrees or employed within Ohio, indicating that they are making a significant contribution to the economic and professional structure of the state and region. These broad and ultimate measures of student success integrate the program's ability to either meet or exceed our Learning Objectives and prepare students for professional careers. 2) Our Indirect Assessment included, so far, one organized faculty meeting, in Spring 2020, about how department curriculum could better serve our students and address Learning Outcomes 1–3. Outcomes from this meeting are outlined in the Assessment Results table. 3) Our Indirect Assessment also included an email questionnaire sent to all B.S./B.A. EES majors who graduated in 2019–2020. The email that was distributed to alumni is appended. We asked our recent baccalaureate degree graduates ($n = 22$) to rank, on a scale from 1 to 5 (with 5 being highest proficiency and 1 lowest) the degree to which they felt like they had mastered each of the Learning Outcomes. Four graduates responded. The results of the survey are listed below Learning Outcome, Mean \pm SD response ($n = 4$)

1. Students will master basic concepts of earth and environmental sciences and be able to apply those concepts within the natural world. Student response = 4.5 ± 0.6 (i.e., high to very high proficiency)
2. Students will display proficiency in field and laboratory techniques used in the practice of earth and environmental sciences. Student response = 4.0 ± 0.8 (i.e., high proficiency)
3. Students will be able to write scientific reports for appropriate audiences. Student response = 4.5 ± 0.6 (i.e., high to very high proficiency)

This assessment indicates that our recent graduates feel like they have accomplished the Learning Outcomes set forth by the program. These results are reinforced by

students' written responses to two open questions that also were included in the questionnaire Question 1 What aspects of your EES education helped you achieve each Learning Outcome? Question 2 What might EES faculty do differently to help students learn more effectively? All responses to these questions are included in an appended document. Students' responses were mostly positive and reflected a high degree of satisfaction with their education. The few criticisms focused on a need for more field courses, research opportunities, and additional experience writing. These are curriculum and research deficiencies also noted by the department faculty, and as described briefly below, we are already addressing these items. The department is working to add more field courses, open research labs for greater research opportunities, and putting additional focus on student writing and feedback.

III. ASSESSMENT RESULTS/INFORMATION:

a) Graduation rate b) Grade point earned in summer field courses. Calculated as average (0-4, where A = 4, etc.) c) Grade point earned in Scientific Communication. Calculated as average (0-4, where A = 4, etc.) d) Curriculum e) Curriculum f) Curriculum g) Curriculum h) Research opportunities

a) Graduation rate has increased steadily from 14-21% in 2014 to 24-31% in 2019
b) Averaged 3.9 ± 0.3 (Mapping Methods, $n = 39$), 4.0 (Limnology, $n = 22$), and 3.2 ± 1.0 (Environmental Field Techniques, $n = 16$) c) Averaged 3.0 ± 1.0 over 4 years of data and 58 students. Average in Spring 2020 (2.5 ± 1.2 , $n = 20$) was less than that in the preceding 3 years (3.3 ± 0.8 , $n = 38$, $p = 0.01$) d) Current curriculum is biased heavily toward 1000-level "service courses" and upper-division 4000-level and graduate courses e) Selection and availability of summer field courses currently underserves our students f) Retention of 1st-year students in the Department averaged an underwhelming 45% during past five years g) Not enough EES courses are designated as Integrated Writing (IW), which is a curricular requirement of WSU h) There are insufficient experiential learning (research) opportunities to meet the desire of our students

a) This is a positive trend, but more needs to be done with regard to student retention and success. Integrated measure of all three Learning Outcomes b) Students are proficient in field (Mapping Methods) and field/lab techniques (Limnology and Environmental Field Techniques). They excel because they enjoy these types of courses. Learning Outcome #2 c) Above average (3.0 = B) score among all students shows most are able to write scientific reports. In-class teaching in Spring 2020 was interrupted by COVID-19, whereas other years were entirely in-class. Learning Outcome #3 d) Reinvigorate retired and develop new 2000- and 3000-level courses with a proportional reduction of 4000-level. This is expected to create a clearer education path for our majors, help ensure they are prepared for upper-division courses, and possibly help student retention. This process began in spring 2020. Learning Outcome #1 e) New field courses are

needed to complement existing ones. Also noted by students. New courses are being planned for sampling and analysis in Iceland and Bahamas as early as Summer 2021. Learning Outcome #2 f) Develop a First-Year Seminar course to help retain students. Such a course was instructed successfully, based on student feedback, for the first time in Spring 2020. Learning Outcomes #1 and #3 g) Modify (as needed) existing courses so they meet IW standards. This process was initiated in Fall 2019, with two courses meriting IW status, and several others are being considered by undergrad studies committee. Writing for Research (new course) was developed in Fall 2020. Learning Outcome #3 h) Faculty need to create more opportunities for undergraduate involvement in research. Learning Outcomes #1 and #2

IV. ACTIONS TO IMPROVE STUDENT LEARNING

Information sharing. As noted above, one aspect of Indirect Assessment was a faculty discussion about curriculum in Spring 2020. Meeting minutes were not taken. Results of the Program Review from Spring 2020 were shared with EES faculty. The assessments of curricular needs in the department largely stemmed from this meeting. Alumni feedback (Fall 2020) will be shared with faculty in Spring 2021. Actions. We have included our Action Items in the “Analysis in Relation to Learning Outcome” column in the table above. This format allows for a clearer connection between specific issues, the affected Learning Outcome, and what is being done for improvement. Resultant curriculum changes will be shared with students through modified course-planning fact sheets, by the Department’s primary academic advisor for all EES majors, and by communication with faculty members.

V. SUPPORTING DOCUMENTS

Additional documentation, when provided, is stored in the internal Academic Program Assessment of Student Learning SharePoint site.