

Program Assessment Report
B.S. in Environmental, Soil and Water Science
University of Arkansas
Academic Year 2021-2022

1. Department Name & Contact Information

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2. Department Mission

The mission of the Department of Crop, Soil, and Environmental Sciences is to provide superior education programs at the undergraduate and graduate levels, conduct innovative research and extension programs in the crop, soil, and environmental sciences and provide superior service for citizens of Arkansas and the nation.

3. Program Goals

1. Graduates have the discipline-specific knowledge in soil, water, and environmental sciences required to perform successfully in private, government, or academic entry-level positions.
2. Graduates are able to critically analyze, synthesize, and evaluate new information to make informed decisions.
3. Graduates have the ability to solve complex, multidisciplinary problems.
4. Graduates are able to prepare and synthesize information to effectively communicate, both orally and in writing.

4. Student Learning Outcome 1. Students will demonstrate the discipline specific knowledge required to function as environmental, soil, and/or water science professionals.

A. Assessment Measure for Outcome 1

- Achievement is measured using **pre- and post-assessment**.
- This is a **direct** measure of student learning.
- Pre- and post-assessments of 20 test questions from the ESWS faculty represent essential discipline specific knowledge and skills of students completing an environmental, soil, and water science degree.
- The initial assessment was generated by ESWS faculty during the spring 2016. Following performance and feedback from students in 2016, the pre/post-test was reviewed and three questions were revised while two were deleted and replaced with new questions during 2017. Although content overlaps, questions could roughly be divided into 5 water, 7 environmental, and 8 soil science based questions. Questions were conceptual in nature or calculation based. If the calculation based questions are separated and considered a separate category, the tests consists of 4 water, 7 environmental, and 4 soil science based and 5 calculation based questions.
- Target populations are at least half of the incoming freshmen and half of the ESWS graduates.
- ENSC 1001L Environmental Science Laboratory (FA, SP) or CSES 1203 (FA, SP) required courses for all ESWS students are the target courses for the pre-test.

- ENSC 4263 Environmental Soil Science (SP even), CSES 4553 Wetland Soils (SP odd), ENSC 4033 Analysis of Environmental Contaminants (SP even), optional advanced courses for ESWS students that should capture at least half of the senior population are the target courses for the post-test.
- Scores are calculated for each assessment with the range, average, and median calculated for the pre- and post-assessments to calculate the change in scores from pre- to post-assessment.

B. Acceptable and Ideal Targets (not required for indirect measures)

- Acceptable: We are targeting a 50% increase in the mean and/or median test scores between the two populations (incoming and graduating students).
- Ideal: We are initially targeting a 75% increase in the mean and/or median test scores between the two populations (incoming and graduating students).

C. Summary of Findings

- The pre- and post-assessments were not administered during 2021-2022 academic year.

D. Recommendations

- A couple of challenges in the ESWS degree plan are the large percentage of transfer students and the flexibility in course choice for ESWS students. Not all graduates complete the same courses. Nonetheless, the ESWS faculty should review and articulate expectations of ESWS related knowledge within the knowledge dimension (factual, conceptual, procedural, and metacognitive) and administer the pre- and post-tests in the upcoming academic year.

5. Student Learning Outcome 2. Students will demonstrate the ability to critically evaluate situations or scenarios to arrive at well thought out and supported decisions and outcomes.

A. Assessment Measure for Outcome 2

- Achievement will be measured using a critical thinking scenario and rated using a **critical thinking rubric**.
- This is a **direct** measure of student learning.
- ENSC 3933 Environmental Ethics (SP), ENSC 4023 Water Quality (FA), ENSC 4263 Environmental Soil Science (SP even), CSES 4553 Wetland Soils (SP odd), ENSC 4034 Analysis of Environmental Contaminants (SP even), optional advanced courses for ESWS students that should capture at least half of the senior population, are the target courses for the critical thinking assessment.
- Assessment scenarios will be generated to cover application of critical thinking in environmental, soil, water, or ecological contexts.

B. Acceptable and Ideal Targets (not required for indirect measures)

- Acceptable: 50% of seniors assessed will score proficient or greater.
- Ideal: 90% of seniors assessed will score proficient or greater.

C. Summary of Findings

- Critical thinking was not assessed in 2021-2022.

D. Recommendations

- With ENSC 3933 Environmental Ethics being taught each spring, that course is an appropriate choice for implementation of the critical thinking rubric to assess the performance of ESWS student learning and could be encouraged for 2022-2023.
- Critical thinking requires analysis, synthesis, and evaluation, i.e. learning at high cognitive levels. Results from assessment in previous years in ENSC 3933 indicate acceptable target proficiency achievement for most of the criteria assessing critical thinking.

6. Student Learning Outcome 3. Students will demonstrate the ability to work through and solve complex, multidisciplinary problems.

A. Assessment Measure for Outcome 3

- Achievement will be measured using a problem based scenario and scored using a **problem solving rubric**.
- This is a *direct* measure of student learning.
- ENSC 4023 Water Quality (FA), ENSC 4263 Environmental Soil Science (SP even), CSES 4553 Wetland Soils (SP odd), ENSC 4034 Analysis of Environmental Contaminants (SP even), or CSES 4224 Soil Fertility, optional advanced courses for ESWS students that should capture at least half of the senior population, are the target courses.
- Assessment scenarios will be generated to cover application of problem solving in environmental, soil, water, or ecological contexts.

B. Acceptable and Ideal Targets (not required for indirect measures)

- Acceptable: 50% of seniors assessed will score proficient or greater.
- Ideal: 75% of seniors assessed will score proficient or greater.

C. Summary of Findings

- In 2022, nine ESWS students were evaluated during a multi-step computation and decision making problem-solving exercise from CSES 4224 Soil Fertility. Students were assigned a complex problem where they first worked through real-world data and determined whether soil test or plant tissue concentrations were better predictors of crop yield. They then worked in consultation with others to develop their own fertilization philosophy and had to explain their logic substantiating recommendation decisions with data.
- Scores for all components rated a median level of proficient and this score held for at least 67% for all components of the rubric. Scores ranged from basic to proficient or basic to mastery for each component except for identifying strategies, which spanned from unprepared to mastery.
- For a small portion of students, more effort for learning how to identify strategies in problem solving may be beneficial, in particular as these data aligned with data for the Crop Science students for 2021-2022 in problem solving.

D. Recommendations

- Problem solving does require comprehension, application, analysis, synthesis, and evaluation, i.e. learning at high cognitive levels; therefore, in general, faculty should continue to consider and articulate where and when students have opportunities to develop (learn and repeatedly practice) those cognitive skills across the curriculum.

7. Student Learning Outcome 4a. Students will demonstrate the skills required to effectively communicate technical/scientific information in oral platforms.

A. Assessment Measure for Outcome 4a

- Achievement will be assessed using an **oral communication rubric** during oral presentations where the student has compiled and evaluated the scientific literature as part of a class project and/or completed an independent research project as part of a special problems, research project or internship class.
- This is a **direct** measure of student learning.
- CSES 3023 CSES Colloquium (FA), an upper division, professional development, communication-intensive course that should capture at least half of the senior population, is one target course for the assessment.
- CSES 4253 Soil Genesis and Classification, provides another opportunity for students to present a term paper and for the oral communication rubric to be used to evaluate communication skills.

B. Acceptable and Ideal Targets (not required for indirect measures).

- Acceptable: 50% of seniors assessed will score proficient or greater.
- Ideal: 75% of seniors assessed will score proficient or greater.

C. Summary of Findings

- CSES Colloquium is a fall course that is one of two courses that is required for ESWS students as a second communication-intensive course. Most enroll as seniors, although some students are juniors when they take the course.
- Fourteen of the students enrolled in the course during the fall 2021 were ESWS students.
- Performance was evaluated during a 10-12-minute presentation that was given by each student as a member of a paired research team. Teams selected overarching topics and individual's subtopics support a single overarching thesis. Students were taught how to work in a team, research and cite evidence, and develop and deliver a presentation to a scientific audience of peers. Scores were assessed individually for organization, language, delivery, supporting material, and central message.
- Scores for all criteria ranged from basic to proficient (language) or mastery. The median score for organization, language, delivery, supporting material, and central message was 3.0 or proficient for more than 50% of students assessed, meeting acceptable target levels for this student learning outcome.

D. Recommendations

- Assessment showed an acceptable target of proficiency for most criteria within oral presentation skills.
- We will continue to collect data to assess performance in oral communication. Supporting and delivering concise, unbiased, well-supported arguments with scientific data to diverse audiences presents difficult challenges. However, the development of these skills are critical to functioning in society and in the workforce in the applied sciences. These are skills that employers often complain are lacking in college graduates.

8. Student Learning Outcome 4b. Students will demonstrate the ability to integrate, organize, and effectively present written reports of technical/scientific information.

A. Assessment Measure for Outcome 4b

- Achievement will be assessed using a **written communication rubric** for laboratory reports and technical/scientific proposals or term papers where the student has analyzed, synthesized and evaluated information from independent sources as part of a class project and/or completed an independent research project as part of a special problems, research project or internship class.
- CSES 462V Internship, Special Problems, and Honors thesis research provide opportunities where students have completed independent research projects. Students have to write papers in which they organize data and information they have analyzed, synthesized and evaluated to clearly and fluently convey a message.
- This is a **direct** measure of student learning.

B. Acceptable and Ideal Targets (not required for indirect measures).

- Acceptable: 50% of seniors assessed will score proficient or greater.
- Ideal: 75% of seniors assessed will score proficient or greater.

C. Summary of Findings

- An internship or special problem experience is not required for the ESWS degree but was utilized for the assessment of writing. Two ESWS students were included in assessment for writing and scored through the assessment rubric.
- Student writing skills remain between basic and proficient; however, of the five components evaluated, proficiency was achieved for one of the two students for each outcome. Thus, the acceptable level of 50% was achieved.

D. Recommendations

- The acceptable level for proficiency was achieved with a small dataset, while assessments from 2019 indicated that writing skills remained at a basic level (below proficiency), even if discipline specific skills and content development skills progress.
- Writing skills assessment will continue in order to establish longer-term assessment results. If future assessment data indicate less than desired proficiency, curriculum revision to include more opportunities for development of writing skills should be supported.

9. Results of Analysis of Assessment of Student Learning Outcome

The Environmental, Soil, and Water Science (ESWS) degree-seeking students were evaluated for problem solving, oral communication, and writing skills during the 2021-2022 academic year.

Environmental, Soil, and Water Science faculty have assessed knowledge, critical thinking, problem solving, oral and written communication skills throughout the past six years. Problem solving was evaluated for the second year using a designated exercise in CSES 4224 Soil Fertility, which is one of the courses that can be selected from within the second soil science block. Oral communication skills were evaluated using a presentation from CSES 3023 CSES Colloquium, and writing was evaluated from the internship report of CSES 462V. Acceptable targets of 50% of students scoring proficient or greater for categories related to problem solving, oral communication, and writing were met.

10. Any Changes to Degree/Certificate Planned or Made on the Basis of the Assessment and Analysis

Data indicating that not all students are achieving proficiency in all areas of problem solving and writing skills may be opportunities for targeted improvements within the ESWS curriculum. The lack of students achieving ideal targets means either that target levels are too high or that these outcomes need

continued and perhaps additional emphasis in the curriculum. One suggestion may be to emphasize writing and problem solving throughout the curriculum while continuing assessment in future years.

The ESWS program supports a relatively large transfer student population, rather than attracting solely incoming high school graduates into the major as traditional freshmen. Furthermore, the difficulties of dealing with COVID-19 during the past two academic years may have affected student learner outcome performance. Considerations for effects of COVID on learning should be accounted for in evaluating assessment data.

11. Any Changes to the Assessment Process Made or Planned

Environmental, Soil, and Water Science faculty have been assessing critical thinking, problem solving, oral and written communication skills throughout the past several years. Faculty may want to revitalize pre- and post-tests. In particular, it may be helpful for faculty to revisit what areas are fundamental to the Environmental, Soil, and Water Science degree and if the pre- and post-tests are covering those knowledge areas in current assessment questions.

12. Supporting Attachments

- Problem solving rubric adapted from Association of American Colleges and Universities
- Oral communication skills rubric adapted from Association of American Colleges and Universities
- Written communication skills rubric adapted from Association of American Colleges and Universities