

Institutional Effectiveness
2020-2021

Program: Environmental and Sustainability Studies BS

College and Department: College of Interdisciplinary Studies – School of Environmental Studies

Contact: Dr. Steve Sharp

Mission: The School of Environmental Studies will foster in students the desire to lead purposeful professional lives through the application of scientific principles to environmental issues within the social, political, and economic framework of our society.

Concentrations and Options: The B.S. degree program in Environmental and Sustainability Studies (ESS) has three concentrations. Two of the three concentrations have additional curricular options nested within them as summarized below:

Concentration 1. Environmental Science

Option 1.1. Biology

Option 1.2. Chemistry

Option 1.3. Natural Resources

Concentration 2. Society, Culture and Communication

Option 2.1. Communication and Media

Option 2.2. Social Science and Policy

Option 2.3. Leadership and Environmental Management

Concentration 3. Environmental Technology

Program Goals:

PG 1: Graduates will be able to analyze and propose sustainable solutions for complex, real-world environmental problems.

PG 2: Graduates should understand and integrate ideas from the ecological, social, and physical sciences with technological solutions.

Student Learning Outcomes:

SLO 1: Students will communicate scientific information effectively in writing, orally, and visually.

SLO 2: Students will demonstrate the ability to work collaboratively on interdisciplinary teams.

SLO 3: Students will demonstrate the ability to integrate social, economic, biological, chemical, and physical science knowledge to identify, formulate, and solve environmental problems.

A departmentally developed curriculum map can be found in Appendix 1 that shows the connections between courses and student learning outcomes.

Assessment Methods:

1. *IDEA student evaluation results (indirect measure)*: IDEA evaluations are administered for each course in the curriculum. Students can rate their learning progress in key areas such as interdisciplinary teamwork, oral and written communication, and critical thinking skills. (Outcomes 1, 2, 3)

The director of the school will monitor the percent of instructors identifying interdisciplinary training/teamwork, oral communication, written communication and critical thinking as a key course objective, and the percent of students who report citing progress in these related skills to their course. The results will be summarized by the director and discussed with the associate faculty committee and dean during the Fall Semester meeting each year.

2. *Rubric for senior capstone course (direct measure)*: Each senior capstone proposal and final project will be assessed by faculty using rubrics that evaluate the proposal or final presentation based on criteria such as the quality of the research question, introduction, literature review, documentation, methodology, proposal structure, and budget (Outcomes 1, 2, 3)

The rubric shown in Appendix 1 generates a score that can be converted to an index ranging from 0 to 100 that can be tracked from year-to-year to provide a quantitative assessment of program quality as reflected by the quality of student team proposals and projects. The rubric scores will be monitored by the director and discussed with program faculty and the dean each year during the Fall Semester associate faculty meeting. Another rubric (Appendix 2) was developed this year to evaluate the capstone presentation that is given in the second semester (Spring Semester) of the two-semester capstone sequence.

3. *Senior exit survey (indirect measure)*: Each graduating senior will complete a departmental exit survey on or near the time of the exit interview with the program director. The survey has 31 questions to rate the quality of program components from the student's perspective on a scale from 1 (poor) to 4 (excellent). (Outcomes 1, 2, 3)

The written survey provides the opportunity for quantitative feedback from students about specific aspects of the degree program, including the curriculum, advising, facilities and related student experiences while at TTU. In addition, a number of survey questions are directly related to specific learning outcomes. The results are summarized by the director and discussed with program faculty and the dean during the Fall Semester meeting each year.

4. *Major Field Exam (direct measure)*: Beginning with the 2020-2021 academic year, a major field exam will be administered to each graduating senior. In developing the major field exam, we solicited questions from the instructors of the core courses all our majors must take. Below is the list of our core courses used. In formulating this assessment, we focus on students' knowledge of key concepts selected from the core courses. We asked core course faculty to submit 10-15 questions that would address the most essential elements of their course. Additionally, we have incorporated questions to assess student competence related to our three SLOs.

Major Field Core Curriculum

- AGBE 4120 / Natural Resource Economics
- BIOL 3120/3130 / General Ecology (with lab or non-lab)
- ESS 1100 / Intro. to Environmental Studies
- ESS 3710 or CHEM 4710 / Chemistry and the Environment
- ESS 3000 / Intro. to Environmental Law
- GEOL 1045 / Earth Environment, Resources and Society
- HIST 3900 / Environmental History
- MATH 3070 / Statistical Methods I
- SOC 3600 / Environmental Sociology

Results:

Rubric for senior capstone course. (Outcomes 1, 2, 3). In the capstone sequence, the first course (ESS 4001) entails exploration of a real-world environmental or sustainability issue offered by a cooperating organization or agency, while the second course (ESS 4002) involves producing a formal proposal for solving the issue and in some cases implementing a portion of the project. During Fall 2020, in collaboration with The Nature Conservancy staff, the capstone teams designed a project focused on carbon neutrality at Bridgestone Nature Reserve at Chestnut Mountain, as well as identifying and developing training for small forest landowners in the Upper Cumberland, with a particular focus on women landowners.

The average student team score in Fall 2020 was 20.25 out of 24 (84%), compared to scores in recent years of 92% in 2019, 91% in 2018, 88% in 2017, 80% in 2016, 86% in 2015, 93% in 2014, and 70% in 2013. The capstone instructors developed a new rubric for evaluation of the final presentation in ESS 4002 (Appendix 2) that was first implemented in the 2018-2019 academic year. The students in Spring 2021 scored 26 out of 28 (93%) on their capstone presentation, as compared with 96% in 2020 and 93% in 2019.

Senior exit survey. (Outcomes 1, 2, 3). Five of the eleven graduating seniors completed exit surveys in 2020-2021, with results shown in Table 1. This cohort of students represented the sixth graduating group of seniors in the ESS degree program. Students rated the quality of the ESS program (1 = poor; 2 = fair; 3 = good; 4 = excellent) for questions related to developing their communication skills, interdisciplinary teamwork, and environmental problem solving. The average scores on scientific literature and collaborative teamwork were 4.0 this year, representing the highest score possible. The average score on communication skills and environmental problem solving dropped slightly to 3.4. As a whole, student perceptions of progress in these key areas related to our program goals have remained stable and high over the last several years.

Table 1. Average scores from ESS senior exit survey results for four survey questions related to student learning outcomes. Questions about the quality of the ESS program components could be answered on a scale of 1 (poor) to 4 (excellent). The values shown for each year are the mean scores on a scale of 1

to 4 from those students who provided answers to each specific question. Sample sizes (n = number of students who completed the senior exit survey) are shown for each academic year.

Survey Question	Associated Learning Outcome	Academic Year					2020-21 ($n = 5$)
		2015-16 ($n = 6$)	2016-17 ($n = 8$)	2017-18 ($n = 14$)	2018-19 ($n = 9$)	2019-20 ($n = 5$)	
Use of scientific literature	1. Communication skills	3.2	3.7	3.6	3.9	3.6	4.0
Communicating scientific information	1. Communication skills	3.3	3.6	3.6	3.7	3.6	3.4
Collaborative capstone teamwork	2. Interdisciplinary teamwork	--	--	3.5	3.8	3.8	4.0
Environmental problem solving	3. Environmental problem solving	3.5	3.8	3.9	3.9	3.8	3.4

IDEA student evaluation results. (Outcomes 1, 2, 3). IDEA results were analyzed for all undergraduate ESS courses taught during 2020-2021. Results from the previous four academic years are also shown for comparison (Table 2). In 2020-2021, average scores for student perception of progress on teamwork, oral and written communication, and critical thinking were all down, perhaps reflecting the unusual experiences associated with the COVID-19 pandemic. It was encouraging to see program-wide average ratings above 4.0 on a 5-point scale, as observed in previous years.

Table 2. Student-rated progress on three IDEA Objectives related to student learning outcomes for ESS courses taught during the most recent five academic years. Abbreviations: column headings “16” = academic year 2015-2016, “17” = 2016-2017, and so forth; “no” indicates that a course either was either not offered or not evaluated in that particular year; and “--” indicates that the instructor did not select that particular IDEA objective as important or essential during 2015-2019 academic years (all data were reported for the 2019-2020 and 2020-21 academic years, regardless of whether the instructor selected the objective as important or essential).

Course	IDEA Objectives														
	Acquiring skills in working with others as a member of a team					Developing skill in expressing myself orally or in writing					Learning to analyze and critically evaluate ideas, arguments, and viewpoints				
	17	18	19	20	21	17	18	19	20	21	17	18	19	20	21
ESS 1020	4.6	--	no	5.0	3.8	4.4	--	no	5.0	4.3	3.6	--	no	5.0	3.8
ESS 1100	--	4.7	4.6	4.2	4.0	--	--	--	3.5	3.8	--	4.6	4.5	4.1	4.4
ESS 3000	no	3.3	4.2	4.5	1.9	no	3.6	3.9	4.3	2.9	no	3.4	3.8	4.8	3.3
ESS 3710	--	--	--	3.0	1.7	--	--	--	3.4	3.1	--	--	--	3.6	3.0
ESS 4001	4.7	4.8	5.0	5.0	4.2	--	4.4	--	5.0	4.0	4.5	--	--	5.0	3.8

ESS 4002	4.9	4.6	4.3	5.0	4.6	--	4.5	--	4.9	4.3	--	--	--	4.9	4.3
ESS 4092	--	--	--	--	4.7	--	--	--	--	5.0	--	--	--	--	5.0
ESS 4093	no	4.0	--	4.7	3.7	no	4.5	--	4.7	4.3	no	4.4	4.3	4.9	4.3
ESS 4300	3.0	--	--	no	no	--	--	3.7	no	no	--	--	--	no	no
ESS 4110					3.4					4.4					4.8
Average Score	4.4	4.3	4.5	4.5	3.6	4.7	4.3	3.8	4.4	4.0	4.4	4.1	4.2	4.6	4.1

Modifications for Improvement:

The 2020-2021 academic year was an unusual one by any standard. Spring of 2020 saw the genesis of the COVID-19 pandemic. As a precaution, all courses moved to online delivery after spring break. Faculty and students overall responded well, but it was a difficult transition for everyone to make. For example, courses that emphasized “working with others as a team,” had to either move to online teams or change strategies for completing the course emphasizing individual work more. When students returned to campus Fall 2020, faculty (and students) had to adjust once again, but this time either returning to in-class traditional delivery but with spacing (and masks), remaining fully online, or creating some level of hybrid course. This no doubt affected the effectiveness of the courses. An upside is that this pandemic forced faculty to begin to learn how to deliver courses in novel ways.

In the 2019-2020 Institutional Effectiveness Report, it was noted that students, “expressed an interest in more specialized environmental course offerings and the ability to receive credit for internships as required courses in the curriculum.” Additionally, feedback on the senior exit survey from this year indicated a desire for more ESS upper level courses because of the problem of access to higher level courses outside the school:

Several required courses are higher level classes in other departments. It was frustrating having to get permits almost every semester. It would be nice if more classes were offered as strictly ESS.

We have already begun to address the desire for more specialized course offerings, as well as upper division courses specifically offered by our school, by creating several new courses: ESS 2100 – Environment and Ethics, ESS 3100 – Global Sustainability Issues and Initiatives, ESS 3200 – Nonprofit Organizations and the Environment, ESS 4100 – National Parks and Protected Public Lands and ESS 4110 – Human Dimensions of Natural Resources. In order to reach more students outside our school, we also created three new minors built around some of these new courses. The new minors are Natural Resources, Parks and Protected Areas, and Environmental Sustainability.

Again, in the 2019-2020 report, an increasing recognition of the importance of internships was noted so, stopping short of requiring internships, we have added internships as directed electives in all of the ESS concentration/options.

An issue mentioned in the last two senior exit surveys, and reinforced in discussions with faculty and alumni, is the desire for more students to develop Geographic Information System (GIS) skills. We are

currently. We are currently looking at all our concentrations/options to see where we can fit GIS courses.

In order to collect more detailed information through the capstone rubrics shown in Appendices 1 and 2, we created a spreadsheet to track how individual student groups perform in the various categories (column headings in the rubrics) for the fall semester (Table 3) and spring semester (Table 4) of the capstone sequence. Collecting and tracking these additional data can provide insight into more focused sub-areas that might need future improvement.

Table 3: Rubric scores for capstone project proposal/white paper for Fall 2020. Each rubric category is scored from a range of 1 to 4, with 4 being the highest score given (See Appendix 1).

Rubric for Research Project Proposal, Fall 2020

Final Grade: 20.25/24=0.84

Thesis/ Problem/ Question	Introduction	Literature Review	Documentation	Methodology	Proposal Structure	Budget
N/A – Students were given the research question/ topic	3.5	3	3.5	3.25	3.75	3.25

Table 3 shows a particular need for strengthening the literature review process. We have begun to address this by dividing the class into teams to address particular parts of the overall project. Each team member then selects a piece of their team’s section, submits an annotated bibliography, and writes and presents a literature review. The students then work with their team to address their portion of the project, eventually combining these into a coherent whole to present to the cooperating client.

Table 4: Rubric scores for capstone project final presentation for Spring 2021. Each rubric category is scored from a range of 1 to 4, with 4 being the highest score given (See Appendix 2).

Rubric for Research Project Presentation, Spring 2021

Final Grade: 26/28=0.93

Power Point Presentation	Oral Presentation	English Grammar	Questions	Professional Appearance	Organization	Budget
3.75	3.75	3.75	4.0	4.0	3.75	3.0

Table 4 indicates a need to provide more support for budget development.

Each year during our summer retreat, we discuss, among other things, the effectiveness of our capstone classes during the previous year. This past year we noted that the students needed more focused attention on conducting literature searches and reviews and honing writing skills, so are planning to increase the expectation (and support needed) during fall semester.

As the capstone project has evolved over the years from the original concept whereby the capstone class developed an environmental/sustainability research question of their own design, proposed a solution, and then implemented that solution to a process of working with an organizational or agency client to research and propose a solution to a real-world problem that they present, the assessment rubric will need to also evolve to better reflect that.

As mentioned earlier, a major field exam was developed in 2020-21 to assess the core knowledge base of graduating seniors. We will begin collecting data this year so that we can determine specific knowledge base strengths and room for growth.

Appendices

1. Curriculum Map
2. Research Proposal Rubric
3. Research Presentation Rubric

Appendix 1: Curriculum Map

Environmental Studies BS

Course	Title	Goals/Learning Outcomes		
		Integrate Knowledge	Communication skills	Teamwork skills
ESS 1100	Intro to Environmental Studies	X	X	X
ESS 1020	Connections to the Environment and Sustainability Studies	X		
GEOL 1045	Earth Environment, Resources and Society	X		
BIOL 3120/3130	General Ecology	X		
ESS 3710/ 4710 CHEM 3710/ 4710	Chemistry and the Environment	X	X	
ESS 3000	Intro to Environmental Law	X	X	X
HIST 3900	Environmental History	X	X	
MATH 3070	Statistical Methods I	X	X	
SOC 3600	Environmental Sociology	X	X	
AGBE 4120	Natural Resource Economics	X	X	
ESS 4001	Capstone Experience I	X	X	X
ESS 4002	Capstone Experience II	X	X	X

Appendix 2: Research Proposal Rubric

Rubric for ESS 4001 Capstone course to evaluate the quality of the students' research project proposal.

	Thesis/ Problem/ Question	Introduction	Literature Review	Documentation	Methodology	Proposal Structure	Budget
4	Students posed a thoughtful, creative question that engaged them in challenging or provocative research. The proposal contributes to knowledge in a focused, specific area.	Provides a clear and thorough introduction and background that provides clear information about the proposed project. A novice could understand the proposed project.	Students gathered information from a variety of quality electronic and print sources, including appropriate licensed databases. Sources are relevant, balanced and include critical readings relating to the thesis or problem.	Students documented all sources, including visuals, sounds, and animations. Sources are properly cited, both in-text/in-product and on Works-Cited/Works-Consulted pages/slides. Documentation is error-free.	Students effectively and creatively used appropriate communication tools to provide a clear explanation of the proposed experimental methods	Students addressed each required section of the proposal and provided an adequate explanation/description for each section.	Students presented a detailed budget, outlining all supplies and/or equipment needed to carry out the proposed project. Budget was appropriate
3	Students posed a focused question involving them in challenging research.	Provides an introduction and background that is adequate. A novice would not be able to completely understand the proposed project.	Students gathered information from a variety of relevant sources--print and electronic.	Students documented sources with some care, Sources are cited, both in-text/in-product and on Works-Cited/Works-Consulted pages/slides. Few errors noted.	Students provided an adequate explanation of proposed experimental methods.	Students addressed each required section of the proposal. Explanation/description for each selection was less than adequate.	Students submitted a budget, but it lacked some detail. Not all supplies and/or equipment needed were listed. Budget was appropriate.
2	Students constructed a question that lends itself to readily available answers.	Provides an introduction and background that is only somewhat significant to the proposal. A novice would not be able to understand the proposed project.	Students gathered information from a limited range of sources and displayed minimal effort in selecting quality resources.	Students needed to use greater care in documenting sources. Documentation was poorly constructed or absent.	Students provided a less than adequate explanation of proposed experimental methods.	Students did not address all required sections of the proposal, but most sections were there. Explanation/description was inadequate	Students submitted a short budget with no detail. Budget was not appropriate for the proposed project.
1	Students developed a question requiring little creative thought.	Students gathered information that lacked relevance, quality, depth and balance. Even someone familiar with the proposed project would have trouble understanding.	Students did not gather any references for the proposal.	Students clearly plagiarized materials.	Students no explanation of methods to be used to carry out proposed project.	Students did not address most of the required sections of the proposal and those addressed were inadequate.	Students did not submit a budget

Appendix 3: Research Presentation Rubric

Rubric for ESS 4002 Capstone course to evaluate the quality of the students' research presentation.

	Power Point Presentation	Oral Presentation	English Grammar	Questions	Professional Appearance	Organization	Budget
4	Presentation is effective, and all information is presented thoroughly. Slides are not too wordy, and pictures are used effectively.	Presentation was professional, with smooth transitions. Students gave an effective presentation and didn't just read slides.	Proper English grammar was used.	Students were able to think about and answer all questions asked.	Students had a professional appearance.	Students addressed each part of the proposal in some fashion in the presentation.	Students presented a detailed budget, outlining all supplies and/or equipment needed to carry out the proposed project. Budget was appropriate
3	Presentation is effective, but some information is missing. Slides have more words than needed.	Presentation was effective with a few missteps in transitions. Students read from some slides, but not all of them.	Students used proper grammar most of the time.	Students were able to answer most of the questions asked.	Students dressed professionally, although there were some missteps in dress.	Each part of the proposal was presented, but some detail was lacking.	Students presented a budget, but it lacked some detail. Not all supplies and/or equipment needed were listed. Budget was appropriate.
2	Presentation is not effective in giving information. Slides are wordy.	Presentation was lacking in information and students had little additional information than was in each slide.	Presentation was too conversational.	Students had difficulty answering the majority of the questions asked.	Students did not take much care in their professional appearance (e.g. stains, wrinkles, no tie, etc.)	Students did not address all required sections of the proposal, but most sections were there. Explanation/description was inadequate	Students presented a short budget with no detail. Budget was not appropriate for the proposed project.
1	Presentation doesn't give adequate information. Slides have too many words.	The presentation was inadequate at addressing the problem. Students read exclusively from slides.	Students used poor English.	Students clearly did not understand the project and could not answer questions.	Students made no effort to dress in a professional manner.	Students did not address most of the required sections of the proposal and those addressed were inadequate.	Students did not submit a budget