

Institutional Effectiveness
2021-2022

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.

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. *Rubrics for senior capstone course (direct measure):* Each senior capstone team 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 in 2019 to evaluate the capstone presentation that is given in the second semester (Spring Semester) of the two-semester capstone sequence.

In order to also evaluate individual research and communication skills, the instructors began in fall 2020 having each student write a literature review and present their findings to the class. In fall 2021, they developed a separate rubric for evaluating these presentations. The full rubric can be found in Appendix 3.

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 was administered to graduating seniors. Since there is, as of yet, no national exam that fits our curriculum, we developed an exam tailored to our program. 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:

Rubrics 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 Semester 2021, in collaboration with The Nature Conservancy staff, the capstone teams continued with a project from the previous academic year that 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 team proposal score in Fall 2021 was 21.5 out of 24 (90%), compared to scores in recent years of 84% in 2020, 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. For spring 2022, the students did not do a formal presentation to the clients. Instead, they presented a final white paper to the clients regarding carbon neutrality efforts at the Bridgestone property. They also planned and conducted a workshop for small forest landowners on the Upper Cumberland.

Additionally, each student wrote a literature review focused on some aspect of the client project and then presented it via PowerPoint. Instructors evaluated these literature review papers, PowerPoint slides and presentations to better assess individual communication skills (SLO 1). The instructors used the Rubric for a Research Presentation to assess each presentation. The summary of those is included in Table 1 below.

Table 1: Rubric Summary for Individual Literature Reviews and Presentations

n=21	PowerPoint Slides	Oral Presentation	Literature Sources	Grammar Usage	Timing
Average	3.4	3.5	3.8	3.7	3.6
Range	3.0-3.8	3.0-3.8	1.0-4.0	3.0-3.9	1.0-4.0
Mode	3.5	3.8	4.0	3.8	4.0
Comments	Slides were generally informative and visually appealing	Several students were too informal	Students found a much valuable information	Several students were somewhat colloquial	Some presentations were too short, others too long

Students overall did well finding quality sources for their literature reviews and putting together informative and visually appealing slides. For several, their oral presentation was somewhat informal and colloquial.

Senior exit survey. (Outcomes 1, 2, 3). Five graduating seniors completed exit surveys in 2021-2022, with results shown in Table 2. This cohort of students represented the seventh 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 use of scientific literature and environmental problem solving were highest. As a whole, student perceptions of progress in these key areas related to our program goals took a slight dip this year but have remained relatively stable over the last several years.

Table 2. 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						
		2015-16 ($n = 6$)	2016-17 ($n = 8$)	2017-18 ($n = 14$)	2018-19 ($n = 9$)	2019-20 ($n = 5$)	2020-21 ($n = 5$)	2021-22 ($n = 5$)
Use of scientific literature	1. Communication skills	3.2	3.7	3.6	3.9	3.6	4.0	3.4

Communicating scientific information	1. Communication skills	3.3	3.6	3.6	3.7	3.6	3.4	3.2
Collaborative capstone teamwork	2. Interdisciplinary teamwork	--	--	3.5	3.8	3.8	4.0	3.0
Environmental problem solving	3. Environmental problem solving	3.5	3.8	3.9	3.9	3.8	3.4	3.4

IDEA student evaluation results. (Outcomes 1, 2, 3). IDEA results were analyzed for undergraduate ESS courses taught during 2021-2022. Results from the previous four academic years are also shown for comparison (Table 3). In 2021-2022, average scores for student perception of progress on teamwork, as well oral and written communication were moving upward again. It was encouraging to see program-wide average ratings above 4.0 on a 5-point scale, as observed in previous years.

Table 3. 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 “18” = academic year 2017-2018, “19” = 2018-2019, 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 2018-2019 academic years (all data were reported for the 2019-2020, 2020-21 and 2021-2022 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				
	18	19	20	21	22	18	19	20	21	22	18	19	20	21	22
ESS 1020	--	no	5.0	3.8	5.0	--	no	5.0	4.3	4.0	--	no	5.0	3.8	4.0
ESS 1100	4.7	4.6	4.2	4.0	4.2	--	--	3.5	3.8	3.9	4.6	4.5	4.1	4.4	4.3
ESS 2100	--	--	--	--	3.0	--	--	--	--	5.0	--	--	--	--	4.5
ESS 3000	3.3	4.2	4.5	1.9	4.9	3.6	3.9	4.3	2.9	4.5	3.4	3.8	4.8	3.3	4.8
ESS 3710	--	--	3.0	1.7	2.4	--	--	3.4	3.1	3.3	--	--	3.6	3.0	3.5
ESS 3100	--	--	--	--	4.7	--	--	--	--	5.0	--	--	--	--	5.0
ESS 4001	4.8	5.0	5.0	4.2	4.4	4.4	--	5.0	4.0	4.0	--	--	5.0	3.8	3.8
ESS 4002	4.6	4.3	5.0	4.6	4.5	4.5	--	4.9	4.3	3.6	--	--	4.9	4.3	3.6
ESS 4100	--	--	--	--	2.5	--	--	--	--	4.0	--	--	--	--	3.8
ESS 4110	--	--	--	3.4	--	--	--	--	4.4	--	--	--	--	4.8	--
Average Score	4.3	4.5	4.5	3.6	4.0	4.3	3.8	4.4	4.0	4.1	4.1	4.2	4.6	4.1	4.1

Major Field Exam Results: (Outcome 3)

During the spring of 2021, we administered a pilot of the ESS Major Field Exam. Students were informed that the exam would consist of 50 multiple-choice questions, would come from the core courses, and would focus on the core concepts from those courses, but were given no other information or study guides. This is currently a paper-pencil exam but we are working on converting it to a computer-based exam. For the pilot administration of the exam (2020-21), students answered approximately two of every three questions correctly (66%), with a range of 48% to 76% correct. For the 2021-22 administration, the student average was 61% with a range of 50% to 76%. The range of scores by core course or section were from a low of 43% to a high of 83% for 2020-21 and 39% to 87% for 2021-22. The results of these core or section scores will be shared with instructional faculty. See Table 4.

Table 4: Summary of Major Field Exam Scores

ESS Major Field Exam Summary		Percent Correct	
		2020-21	2021-22
Core Courses/Exam Sections			
1	Introduction to Environmental Studies	71	60
2	Earth, Environment, Resources, and Society	71	43
3	Statistical Methods	54	45
4	General Ecology	66	68
5	Chemistry and the Environment	43	39
6	Environmental Law	74	57
7	Environmental Sociology	83	87
8	Environmental History	57	44
9	Natural Resource Economics	57	60
10	ESS Broad Student Learning Objectives	80	68
Average Score on All Sections		66	57
Range of Scores by Students		48-76	50-76
Mean Score of Students		66	61

Modifications for Improvement:

In fall of 2021, the university returned to a more normal operation in the classroom. This was a welcome change for faculty and students.

Over the past couple of years, we have begun to address the expressed student desire for more specialized course offerings, as well as upper division courses specifically offered by our school. We have created 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 (Natural Resources, Parks and Protected Areas, and Environmental Sustainability).

These minors have grown quickly, with seventeen students currently minoring in Parks and Protected Areas, seven in Environmental Sustainability and two in Natural Resources. The creation of these minors also resulted in an increase in the class size of several of the ESS courses. This growth has also resulted in a greater diversity of student perspectives in these classes, which is always welcome.

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 and 2021. 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

Final Grade: Fall 2020 - 20.25/24= 84%

Fall 2021 – 21/24 = 88%

	Thesis/ Problem/ Question	Introduction	Literature Review	Documentation	Methodology	Proposal Structure	Budget	Total Score
Fall 2020	N/A	3.5	3	3.5	3.25	3.75	3.25	84%
Fall 2021	N/A	3.5	4.0	3.5	3.5	3.5	3.0	88%

Scores from 2020 showed a particular need for strengthening the literature review process. We began to address this by dividing the class into teams to address particular parts of the overall project. Each team member then selected a piece of their team’s section, submitted an annotated bibliography, and wrote and presented a literature review. The students then worked with their team to address their portion of the project, eventually combining these into a coherent whole to present to the cooperating client. A better understanding of the literature review process was evident in 2021.

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). This past spring, the students did not do a formal presentation, so we have no presentation rubric scores to report. Instead, when the client group the students were working with had to back out of sponsoring the proposed workshop for small forest landowners on the Upper Cumberland, the capstone

class decided to organize the workshop themselves, which they did. It was a success. This was perhaps one of the most challenging, yet practical and beneficial exercises undertaken of any of our capstone groups.

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	Total Score
3.75	3.75	3.75	4.0	4.0	3.75	3.0	93%

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 have begun collecting data 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. Rubric for ESS 4001 Capstone course to evaluate the quality of the team project proposal

Student Name(s) _____ Final Grade _____

Rubric for a Research Project

	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 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 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
	Comments						

Appendix 3. Rubric for ESS 4002 Capstone course to evaluate the quality of the team research presentation

Student Name(s) _____

Final Grade _____

Rubric for a 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.	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
Comments							

Appendix 3. Rubric for ESS 4001 Capstone course to evaluate the quality of the individual literature review and presentation.

Student Name(s) _____

Final Grade _____

Rubric for a Research Lit Review and Presentation

	Power Point Slides	Oral Presentation	Literature Sources	Grammar Usage	Timing
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.	Enough sources are used and described in enough detail for the audience to understand.	Proper English grammar was used.	Presentation was 8-10 minutes
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.	Enough sources are used and described, but the connection between the sources and the issue may be unclear.	Students used proper grammar most of the time.	Presentation was 7 or 11 minutes
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.	Sources are described, but there are still gaps in the literature.	Presentation was too colloquial.	Presentation was 6 or 12 minutes
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.	Too few sources are used and the connection between sources and the issue are unclear.	Students used poor English.	Presentation was <6 minutes or >12 minutes
Comments					