

**Institutional Effectiveness**  
**2018-2019**

**Program:** Environmental Sciences Ph.D.

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

**Contact:** Dr. Hayden Mattingly

**Mission:** The Environmental Sciences (EVS) doctoral program's mission is to advance the knowledge and promote the leadership necessary to understanding natural environments by incorporating perspectives from social sciences, humanities, and environmental sciences in the program's teaching and research in the fields of natural resources and the environment.

Concentrations: There are five concentrations available within the EVS Ph.D. program:

(1) Agriculture; (2) Biology; (3) Chemistry; (4) Geosciences; and (5) Integrated Research.

The Agriculture, Geosciences, and Integrated Research concentrations were officially added in Spring 2018.

**Program Goals:**

1. Environmental Sciences students will receive detailed interdisciplinary training and experience to enable them to address complex environmental problems with greater effectiveness.
2. EVS student research projects will be peer-reviewed and widely recognized for their innovation and relevance to environmental concerns.
3. Add new concentrations to the Environmental Sciences PhD program.

**Student Learning Outcomes**

- 1.1. Students will demonstrate understanding of the interdisciplinary nature of environmental sciences such that they are aware of a wide range of environmental concerns beyond the boundaries of any single, specific discipline.
- 2.1. Students will improve oral and written communication skills by giving technical presentations at symposia, conferences, and similar venues where abstracts are peer-reviewed for acceptance.
- 2.2. Students will improve written communication skills by submitting manuscripts to peer-reviewed publications such as scholarly journals, conference proceedings, books, or similar outlets.

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

## Assessment Methods:

1. *Comprehensive Exams - Outcome 1.1:* The EVS faculty will monitor student understanding of the interdisciplinary nature of environmental science by the administration of oral and written comprehensive exams. The comprehensive exam is interdisciplinary and is comprised of questions written by each member of the graduate advisory committee. The results of these exams are kept on file by the EVS Director.

The timing of the comprehensive exams represents an ideal opportunity for assessment because the student has just completed all or nearly all of his/her coursework. The exams are provided in two different formats (written and oral) that allow better insight into the student's interdisciplinary knowledge and proficiency. The student's graduate advisory committee discusses the results and provides paper copies of the exams to the Director, who monitors the results to maintain integrity and consistency.

2. *Student Annual Reports - Outcomes 2.1 and 2.2:* In December of each year, the program Director requests annual reports from each student that cover the previous 12-month period. Reports are due by the end of January. For example, student reports received in January 2019 covered the reporting period of January-December 2018. Students are provided with a template to follow when preparing reports. The Director and academic staff members review each report and tally the total number of presentations and publications generated by students during the reporting period.

EVS students are required to submit an annual report to allow direct assessment of student productivity and development of written and communication skills in terms of presentations and publications. The report template also requires additional details regarding the nature of the presentation or publication. For example, the presentation might be at an international conference rather than a state meeting, or the publication might be in a high-impact journal as opposed to a regional journal. These details can be used to generate a more refined analysis of the TTU EVS program's impact on the wider discipline of environmental sciences. Annual reports have the added benefit of student professional development because their CVs are current and updated with each successive year's accomplishments.

3. *Annual count of number of concentrations - Program Goal 3:* Once per year (at the end of the state fiscal year in June) the SOES Director will tally the number of available concentrations and track them longitudinally through time.

The EVS Ph.D. program historically only had two concentrations available for students, Biology or Chemistry. Future growth in enrollment and interdisciplinary development was limited; therefore, the EVS Executive Committee voted on September 15, 2017, to approve three additional concentrations: Agriculture; Geosciences; and Integrated Research. Furthermore, in the upcoming 5-year period, we will be discussing the addition of a Low-Residency option for the EVS Ph.D. program. Increasing the number of concentrations will increase the number of students whose background and interests are closely aligned with agriculture and earth sciences, those who have a strong interdisciplinary research focus, as well as those who live and work at a distance.

## Results:

*1.1. Students will demonstrate understanding of the interdisciplinary nature of environmental sciences such that they are aware of a wide range of environmental concerns beyond the boundaries of any single, specific discipline.*

All EVS students successfully passed their comprehensive exams on the first attempt during the 2018-2019 reporting period. Student performance and interdisciplinary proficiency on both written and oral aspects were approved by the EVS faculty graduate advisory committees.

*2.1. Students will improve oral and written communication skills by giving technical presentations at symposia, conferences, and similar venues where abstracts are peer-reviewed for acceptance.*

*2.2. Students will improve written communication skills by submitting manuscripts to peer-reviewed publications such as scholarly journals, conference proceedings, books, or similar outlets.*

Student productivity related to written and oral communication in 2018 was generally similar to 2017 productivity. However, the number of conference attendances ( $n = 32$ ) reached its highest point since data collection started in 2012. Students gave a combined total of 34 poster and oral presentations (compared to 40 in 2017) and submitted more manuscripts ( $n = 14$ ) in 2018 than in any previous year since data collection started. The number of manuscripts published has been in double digits for the past three years.

Table 1. Scholarly activity related to oral and written communication skills shown by EVS Ph.D. students in the current (2018) and previous calendar-year reporting periods.

Type of scholarly activity	Student annual report period						
	2012	2013	2014	2015	2016	2017	2018
Conference attendances	25	14	13	15	25	22	32
Poster presentations	22	8	8	14	17	14	15
Oral presentations	6	5	8	8	9	26	19
Manuscripts submitted	9	5	6	12	10	13	14
Manuscripts published	2	6	6	8	12	14	10

In calendar year 2018, students made six local scientific conference attendances, 13 state conference attendances, seven regional conference attendances, and six national or international conference attendances (Table 2). Students authored or co-authored three submitted grant proposals (noticeably down from 19 proposals submitted in 2017) and five grants were successfully awarded in 2018 (also down from nine grants awarded in 2017). In general, however, the students were quite active in 2018 and similarly engaged in developing their written and oral communication skills compared to recent years. Student publications are listed in Table 3. Collectively, the EVS students continue to maintain high productivity in this area despite relatively level enrollments over the past decade. EVS enrollment ranged from 14 to 17 students from 2012-2017 and then climbed to just over 20 students in Fall 2018 with the addition of the new concentrations.

Table 2. EVS student activities during the reporting period of January through December 2018 in the Biology, Chemistry, Integrated Research, and Agriculture concentrations. For scientific conferences, L = local, S = state, R = regional, and N = national or international.

EVS Ph.D. Student Annual Report for January-December 2018*											
Concentration	Technical Presentation (Oral)	Technical Presentation (Poster)	Manuscripts Submitted	Manuscripts Accepted	Manuscripts Published	Grant Proposals Submitted	Grant Proposals Awarded	Non-Technical Presentation	Awards and Honors	Scientific Conferences Attended	Other Related Activities
<b>BIOLOGY</b>											
Student A	1	2	1	0	0	0	1	0	2	L1, S1, R0, N1	2
Student B	0	2	3	3	3	0	0	1	0	L0, S2, R0, N1	2
Student C	0	2	0	0	0	0	0	0	0	L0, S0, R0, N1	0
Student D	1	1	0	1	1	1	1	3	1	L0, S2, R1, N1	9
Student E	0	0	0	0	0	1	1	0	0	L0, S0, R0, N0	1
Student F	1	1	1	0	0	1	0	0	2	L1, S0, R1, N0	3
Student G	1	1	4	1	4	0	0	0	1	L0, S0, R0, N0	9
Student H	0	0	0	0	0	0	0	0	0	L0, S0, R0, N0	2
Student I	5	0	2	0	1	0	1	0	2	L0, S5, R0, N0	7
Total	9	9	11	5	9	3	4	4	8	L2, S10, R2, N4	35
<b>CHEMISTRY</b>											
Student J	0	0	0	0	0	0	0	1	0	L0, S0, R1, N0	0
Student K	1	1	0	0	0	0	1	0	0	L1, S0, R1, N0	0
Student L	4	4	0	0	1	0	0	1	0	L1, S1, R2, N1	3
Student M	0	0	1	0	0	0	0	0	0	L0, S0, R0, N0	1
Student N	0	0	0	0	0	0	0	0	0	L0, S0, R0, N0	0
Student O	0	1	0	0	0	0	0	0	0	L1, S0, R0, N0	0
Total	5	6	1	0	1	0	1	2	0	L3, S1, R4, N1	4
<b>INTEGRATED RESEARCH</b>											
Student P	0	0	1	1	0	0	0	0	1	L0, S0, R0, N0	1
Student Q	3	0	0	0	0	0	0	0	1	L1, S1, R1, N0	2
Student R	2	0	1	0	0	0	0	1	0	L0, S1, R0, N1	2
Total	5	0	2	1	0	0	0	1	2	L1, S2, R1, N1	5
<b>AGRICULTURE</b>											
Student S	0	0	0	0	0	0	0	4	0	L0, S0, R0, N0	9
Total	0	0	0	0	0	0	0	4	0	L0, S0, R0, N0	9
<b>GRAND TOTAL</b>	<b>19</b>	<b>15</b>	<b>14</b>	<b>6</b>	<b>10</b>	<b>3</b>	<b>5</b>	<b>11</b>	<b>10</b>	<b>L6, S13, R7, N6</b>	<b>53</b>

\*These data are from January - December 2018 to display the productivity of our program on a 12-month basis.

Table 3. Ten journal publications co-authored in 2018 by EVS Ph.D. students (EVS students shown in bold text).

- **Lahiru Gamage** and Wilson Gichuhi. 2018. Efficacy of a wavelength-scanned cavity ring-down spectroscopic technique in estimating enteric methane emissions in ruminants. *ACS Earth and Space Chemistry* 2(7): 673-682.
- **Jessica West** and M. Klukowski. 2018. Seasonal changes in plasma corticosterone and association with innate immunity in free-ranging Eastern Box Turtles, *Terrapene carolina carolina*. *General and Comparative Endocrinology* 262: 71-80.
- **Matthew Grisnik**, Jacob Leys, Danny Bryan, Rebecca Hardman, Debra Miller, Vincent Cobb, Chris Ogle, Chris Simpson, Joshua Campbell, **Roger Applegate**, Matthew Allender, Eric Nordberg, Alyssa Hoekstra, and Donald Walker. 2018. Host and geographic range of snake fungal disease in Tennessee, USA. *Herpetological Review* 49: 682-689.
- Brian Flock, **Roger Applegate**, Richard McKown, Philip Gipson, Kevin Cummings, Jeremy Tieman. 2018. Amphibious snails attached to the breast feathers of a northern bobwhite. *Transactions of the Kansas Academy of Science* 121: 84-86.
- Frank Loncarich, Brian Flock, **Roger Applegate**, and Philip Gipson. 2018. Unusual loggerhead shrike and Cooper's hawk captures in funnel traps. *North American Bird Bander* 43: 18-20.
- Cristina Watkins, Neelam Poudyal, Carlotta Caplenor, David Buehler, and **Roger Applegate**. 2018. Motivations and support for regulations: a typology of eastern wild turkey hunters. *Human Dimensions of Wildlife* 23: 433-445.

- **Cody Godwin**, Oliver Ljustina, and James Erdmann. 2018. Natural History Notes: *Gastrophryne carolinensis* (Eastern Narrow-mouthed Toad). Arboreal activity. *Herpetological Review* 49(1): 95-96.
- **Cody Godwin** and Andrew Moore. 2018. Geographic Distribution: *Carphophis amoenus helenae* (Midwestern Wormsnake). *Herpetological Review* 49(4): 717.
- James Erdmann, **Cody Godwin**, Martha Villalba-Guerra, Cooper Campbell, Jordan Donini, Elyse Parker, Ariana Rupp, Courtney Weyand, Melanie Partin, Timothy Borgardt, and Christopher Beachy. 2018. Larval life history of *Lithobates sphenoccephalus* (Southern Leopard Frog) in Southeast Louisiana. *Southeastern Naturalist* 17(2): 221-229.
- Kristen Bouska, Amanda Rosenberger, Stephen McMurray, Garth Lindner, and **Kayla Key**. 2018. State-level freshwater mussel programs: current status and a research framework to aid in mussel management and conservation. *Fisheries* 43(8): 345-360.

*Program Goal 3: Add new concentrations to the Environmental Sciences PhD program.*

The number of concentrations in the EVS PhD program increased from two in 2016 to five in 2017 (with formal THEC approval received in Spring 2018). There is a possibility of adding one or more concentrations in the future, pending future deliberations of the EVS Executive Committee. Recent committee discussions have also included the possibility adding a low-residency option to the program.

#### **Modifications for Improvement:**

*Outcome 1.1 (student understanding of interdisciplinary nature of environmental sciences):*

Currently, the existing assessment approach for interdisciplinary evaluation of comprehensive exams is recognized as being too coarse (i.e., we can only say how many students passed the exams and provide a qualitative description of the exams). Therefore, a more quantitative rubric was drafted by the EVS Curriculum Committee in 2017-2018 to provide a refined, commonly used tool for assessing student interdisciplinary performance on their exams. The EVS Curriculum Committee suggested minor changes to the rubric prior to its presentation to the EVS Executive Committee. The rubric was approved by the executive committee, but the addition of the three new concentrations in Spring 2018 will necessitate further revisions to the rubric. In short, the rubric is still in a phase of revision and has not been implemented as an assessment tool.

As part of emphasizing the interdisciplinary nature of environmental sciences, the EVS Curriculum Committee presented a short narrative to the EVS Executive Committee for approval in 2018. The narrative was designed to inform students about interdisciplinary learning and to better communicate faculty expectations about interdisciplinary learning associated with the comprehensive exams. The approved narrative is now posted on the EVS program website:

<https://www.tntech.edu/cis/pdf/soes/InterdisciplinaryLearningforAnInterdisciplinaryDegree.pdf>

*Outcome 2.1 (student technical presentations and communication skills):*

The School of Environmental Studies often supports student travel to meetings for the purposes of making presentations, in order to augment the support that students might already have from their external grants, faculty advisors, or concentration departments. Several students and their faculty advisors made formal requests to the School of Environmental Studies for travel support, and most of those requests were honored up to an amount of \$1,000 per request. The School will continue to place a priority on supporting student travel to scientific conferences.

*Outcome 2.2 (student publications and communication skills):*

The EVS 7900 Scientific Writing and Grantsmanship course was altered in 2016 to allow students the option to develop a journal manuscript (instead of only allowing a grant proposal). In 2018, many of the EVS 7900 students elected to prepare a journal manuscript and worked one-on-one with the instructor during editing sessions. In addition, the EVS Executive Committee created a new policy, effective for students starting the program on or after August 1, 2017, to require doctoral students to submit at least a portion of their dissertation for peer review before they can defend their dissertation. The new policy was submitted to GSEC and has now been approved and finalized. The implementation date for the peer-review policy was August 2, 2017. We expect this new policy to further increase student proficiency in their scientific writing and publication skills.

*Program Goal 3:*

The EVS Executive Committee has set a future goal of having a total of six concentrations. Discussions will occur in 2019 to determine how to move forward with adding one or more new concentrations to support the growth and health of the EVS program. The committee will also continue to address the possible addition of a low-residency option to make the program available to those students living some distance away from Cookeville.

**Appendices**

1. Curriculum Map