From:	Smith, Randy
To:	Basta, Nicholas; Malone, Kelly
Cc:	Leite, Fabio; Miriti, Maria; Reed, Katie; Smith, Randy; Duffy, Lisa; Hunt, Ryan; Gardiner, Mary; Stromberger, Mary
Subject:	Proposal to revise the ESGP Curriculum
Date:	Thursday, March 21, 2024 4:31:17 PM
Attachments:	image001.png

Kelly and Nick:

The proposal from the Environmental Studies Graduate Program to revise its graduate programs leading to the Master of Science and PhD programs was approved by the Council on Academic Affairs at its meeting on March 20, 2024. Thank you for attending the meeting to respond to questions/comments.

No additional level of internal review/approval is necessary. This action will be included in the Council's next Annual Activities Report to the University Senate (July 2024).

The Office of the University Registrar will work you with any implementation issues.

Please keep a copy of this message for your file on the proposal and I will do the same for the file in the Office of Academic Affairs.

If you have any questions please contact the Chair of the Council, Professor Fábio Leite (.11), or me.

I wish you continued success with this important program.

Randy

THE OHIO STATE UNIVERSITY

W. Randy Smith, Ph.D.
Vice Provost for Academic Programs
Office of Academic Affairs
University Square South, 15 E. 15th Avenue, Columbus, OH 43201
614-292-5881 Office
smith.70@osu.edu
Assisted by:
Katie Reed
Executive Assistant
(614) 292-5672
reed.901@osu.edu

TO: Randy Smith, Vice Provost for Academic Programs

FROM: Graduate School Curriculum Services

DATE: **2/26/2024**

RE: Proposal to **Environmental Sciences Program Curriculum Revision** in the **Interdisciplinary Environmental Sciences Graduate Program.**

The **Interdisciplinary Environmental Sciences Graduate Program** is proposing an **Environmental Sciences Graduate Program Curriculum Revision**.

The proposal was received by the Graduate School on **10/05/2023**. The combined GS/CAA subcommittee first reviewed the proposal on **11/30/2023** and requested revisions. Revisions were received on **2/23/2024**. The proposal is supported for elevation to CAA for review.

THE OHIO STATE UNIVERSITY

Environmental Sciences Graduate Program

3138A Smith Laboratory
174 W. Eighteenth Avenue
Columbus, OH 43210

esgp.osu.edu

Date: 2-23024

To: Lisa Kowalski, and OSU Curriculum Committee

From: Mary Gardiner, Professor and Co-Director of Environmental Studies Graduate Program

Subject: ESGP Curriculum Revision, Second Submission

Dear GS/CAA Review Committee,

I am the Graduate Studies Chair and Co-Director of the Environmental Science Graduate Program. We are writing to request a revision of our graduate curriculum for both the MS and PhD programs. The Graduate Studies Committee for our program has reviewed and approved this curriculum revision. We received feedback on our initial submission to the GS/CAA review committee. We thank you all for the time put into the initial review, and after further consultation with T.J. Carpenter, we feel we have been able to address all feedback received.

The Environmental Sciences Graduate Program was established in 1989 and it has been more than a decade since the last substantive update to our curriculum. ESGP has matured since then adding Specialization Tracks and new faculty (e.g. College of Public Health, Environmental Health Sciences).

We underwent an External Review in 2018 made curriculum recommendations that we have addressed with this proposed curriculum revision. First, external reviewers suggested that we add Core Course requirement for all students. **To address this recommendation, we have added a 3-credit core course in Sustainability Science.** This course will be taken by all incoming MS and PhD students. This curriculum change was needed to prepare our students with both the knowledge and professionals skills needed to address complex environmental programs. In this course, our students will gain an understanding of the complex social, economic, and environmental impacts and tradeoffs inherent in sustainable systems. Second, our external reviewers highlighted that as an interdisciplinary program we must ensure that all students are engaged in interdisciplinary research. To make certain that this is opportunity is provided by all faculty mentors we have added an **Interdisciplinary Project requirement for PhD students**. This project is required to appear within a chapter of the student's dissertation. In collaboration with their advisor and at least one committee member from outside their home department, our PhD students will be required to submit a 3-page project proposal to their Student Advisory Committee (SAC), and then with SAC approval to the ESGP Graduate Students Committee (GSC) for approval by the end of the first two years of the student's program. Once approved, the student will present their plan as their Interdisciplinary Project Seminar as part of ENVSCI 7899. Prior to graduation the student is to submit the chapter, approved by their advisor and SAC to the GSC for approval. The student is also required to present their findings as part of their Exit Seminar in ENVSCI 7899. Third, our external reviewers and our GSC saw a need for students to develop professional development skills including **data analysis**, **presentation skills** and **grant writing**. We will require ENTMLGY 7920 Presentation Skills for Scientists and provide students with lists of approved courses in data analysis and grant writing to select from. Both MS and PhD students will be required to complete one course in data analysis. PhD students will be required to complete ENTMLGY 7920 as well as a grant writing course,

while MS students will only be required to complete ENTMLGY 7920. Details about our proposed changes are detailed in our curriculum change request form.

Please note that I have alerted all affiliated college of this pending curriculum change and have approval emails from all four Deans (Appendix 1).

Below is a summary of our proposed changes:

1. We will add one 3 credit course in Sustainability Science, ENVENG 5170 Sustainability and Prevention Practices for both MS and PhD students (Appendix 2) This course will be cross listed as ENVENG 5170 with a new title: Sustainability in the Circular Economy.

2. We will reduce the number of Foundational Knowledge credit hours from 18 to 9 for PhD students. MS will remain unchanged (currently 9, 9 proposed).

3. We will add one course in data analysis, which students will select from a list of approved options (Appendix 3). Course will be a minimum of 2 credits.

4. We will require ENTMLGY 7920, Presentation Skills for Scientists (Appendix 4). Course will be 2 credits. Course will be required for PhD students and MS students.

5. We propose adding one course in grant writing required for PhD students, who will select from a list of approved options (Appendix 5). Course will be a minimum of 1 credit.

6. We will change the course requirements of ENVSCI 7899 for PhD Students. Currently students take 3 credits (1 credit, enroll for three semesters, present Entry and Exit seminar). We propose that PhD students will enroll for three semesters, and present each time (Entry, Interdisciplinary Project Seminar, and Exit seminar). This will not change for MS students.

7. To account for these changes to our curriculum we have added 4 new Learning Outcomes:

- Students will demonstrate an understanding of Sustainability Science: Principles and Practice Reading tests and project reports will be used to evaluate.

- Students will demonstrate the ability to produce an extramural grant for scientific research for funding. Graded grant proposals will be tracked.

- Students will demonstrate the ability to conduct an interdisciplinary project in addition to their interdisciplinary thesis. Oral and/or poster presentations will be judged.

- Students will demonstrate the communication skills needed to communicate interdisciplinary research effectively in poster and oral presentation formats. A Preliminary and Final Report will be scored by the student's research committee and GSC.

We are confident that we have addressed all feedback provided following our first submission. Below is the request for revisions we received along with our responses:

Cover Letter and Curriculum Checklist

1. Add to the curriculum checklists the total credit hours to earn each degree and indicate whether the program is requesting a change to the current total credit hours. If the total credit

hours are changing, add a statement to the comment box of the curriculum checklist that describes total credit changes.

Response:

The following has been added to each degree checklist:

MS Program: Our proposed changes will add 8 new credit hours of required coursework to the MS program. This change will represent a 26.6% change in our curriculum.

PhD Program: Our proposed changes include a maximum of 12 credits of change. In total, these changes represent no more than a 15% change in required credit hours.

In the curriculum checklist and proposal narrative, provide a brief statement about the percentage of the existing curriculum that is changing. This information is necessary due to reporting requirements of the Higher Learning Commission and the Chancellor's Council on Graduate Studies (a curriculum change of 50% or more requires Senate, Board of Trustees, and CCGS review). Percentage change is defined by courses changing one or more of three criteria:

a. Changing the meaning of expected learning outcomes (ELOs). If the wording or grammar of an ELO changes, but its meaning and intent do not, this ELO is not changed by this criterion and would not count toward the percent change.
b. Adding a course to a program, removing a course from a program, or changing a course from "required" to "elective" or "elective" to "required" within the curriculum.
c. Changing the mode of delivery of a course (50% or more of formalized instruction is provided in a different delivery mode from what was originally approved). This includes adding a section or sections delivered by different delivery modes (e.g., adding a section of hybrid (HY), distance enhanced (DH), or distance learning (DL) to an approved in-person (P) courses.

Response: Please see calculations above that address these suggestions.

Attachments

1. Provide a letter of support for the curriculum changes from academic deans in colleges affiliated with the ESGP.

Response: We have obtained letters of support from the four colleges who participate in ESGP. See Appendix 1.

Curriculum

1. Add to the cover letter or proposal narrative a statement about whether the learning goals and assessment plan will change as a part of the curricular revision. If the assessment plans will change, please provide updated assessment plans as an attachment.

Response: We propose adding three additional learning outcomes to our MS curriculum and five to our PhD curriculum. Below we detail each outcome and our assessment method. New outcomes are highlighted in yellow.

THE OHIO STATE UNIVERSITY

MS Proposed Curriculum Learning Outcomes and Evaluation

Outcome 1: Students will demonstrate an understanding of sustainability science.
Evaluation: All students will be required to complete ENVENG/ENVSCI 5170 Sustainability and Pollution Prevention Practices. Students will complete a semester long group project and be assessed with weekly quizzes and three exams.

Outcome 2: Students are familiar with the diversity and functioning of organisms and the interactions among species and between organisms and the environment.
Evaluation: Students will complete at least one Foundational Knowledge Course in Biological Science. Because the environmental sciences focus on the relationships between living organisms and their environment, the basic principles of ecology and a solid understanding of ecosystems structure and function is the focus of this Foundational Knowledge Area. This understanding can be gained through coursework that focuses on a particular taxon or a particular kind of ecosystem but must be broadly applicable to any environment. Students will select the course from a list of courses approved by the ESGP Graduate Studies Committee.

Outcome 3: Students will understand the physical structure and processes in which ecosystems must function. Physical structure includes soil, water, air, geological media, climate, nutrients, and contaminants. Physical science processes include movement of "abiotic" matter and energy through ecosystems.
Evaluation: Students will complete at least one Foundational Knowledge Course in Physical Sciences. These courses must (1) study fundamental physical, hydrological, chemical, or biogeochemical processes and (2) study and emphasize the effects of physical structure and processes on ecosystem biotic components and function and the interactions between the biotic and abiotic components of the ecosystem. Students will select the course from a list of courses approved by the ESGP Graduate Studies Committee.

Outcome 4: Students will gain an understanding of the concepts related to the study of human society and/or individuals and their relationships to the structure and function of the ecosystem(s) of which they are a part.
Evaluation: Students will select at least one Social Sciences and Policy Foundational Knowledge Course from a list of courses approved by the ESGP Graduate Studies Committee. Methodology taught within these courses includes a range of approaches, both qualitative and quantitative. Courses must engage social science in a combined theoretical and/or applied study of a physical, cultural, regulatory, or economic relationship between humans and the natural and physical environment.

Outcome 5: Students will demonstrate the communication skills needed to communicate interdisciplinary research effectively in poster and oral presentation formats.
Evaluation: Students will satisfactorily complete ENTMLGY 7920 Presentation Skills for Scientists. Students will present an elevator speech, research 10-minute oral presentation and research poster for grades. Each assignment will be presented for feedback in class first prior to grading, which will be collected using the same rubrics used to grade each assignment. Students will also present both an Entry and Exit seminar within ENVSCI 7899. Students will receive feedback on these presentations from instructors and students via in-class rubrics.

Outcome 6: Students will demonstrate proficiency in data analysis related to their research area.
Evaluation: Students will select a course in data analysis relevant to their area of research offered within one of the four colleges associated with our program and successfully complete the course. The selection of the course must be approved by the student's Student Advisory Committee.

PhD Proposed Curriculum Learning Outcomes and Evaluation

Outcome 1: Students will demonstrate an understanding of sustainability science.
Evaluation: All students will be required to complete ENVENG/ENVSCI 5170 Sustainability and Pollution Prevention Practices. Students will complete a semester long group project and be assessed with weekly quizzes and three exams.

Outcome 2: Students are familiar with the diversity and functioning of organisms and the interactions among species and between organisms and the environment.
Evaluation: Students will complete at least one Foundational Knowledge Course in Biological Science. Because the environmental sciences focus on the relationships between living organisms and their environment, the basic principles of ecology and a solid understanding of ecosystems structure and function is the focus of this Foundational Knowledge Area. This understanding can be gained through coursework that focuses on a particular taxon or a particular kind of ecosystem but must be broadly applicable to any environment. Students will select the course from a list of courses approved by the ESGP Graduate Studies Committee.

Outcome 3: Students will understand the physical structure and processes in which ecosystems must function. Physical structure includes soil, water, air, geological media, climate, nutrients, and contaminants. Physical science processes include movement of "abiotic" matter and energy through ecosystems.
Evaluation: Students will complete at least one Foundational Knowledge Course in Physical Sciences. These courses must (1) study fundamental physical, hydrological, chemical, or biogeochemical processes and (2) study and emphasize the effects of physical structure and processes on ecosystem biotic components and function and the interactions between the biotic and abiotic components of the ecosystem. Students will select the course from a list of courses approved by the ESGP Graduate Studies Committee.

Outcome 4: Students will gain an understanding of the concepts related to the study of human society and/or individuals and their relationships to the structure and function of the ecosystem(s) of which they are a part.
Evaluation: Students will select at least one Social Sciences and Policy Foundational Knowledge Course from a list of courses approved by the ESGP Graduate Studies Committee. Methodology taught within these courses includes a range of approaches, both qualitative and quantitative. Courses must engage social science in a combined theoretical and/or applied study of a physical, cultural, regulatory, or economic relationship between humans and the natural and physical environment.

Outcome 5: Students will demonstrate the communication skills needed to communicate interdisciplinary research effectively in poster and oral presentation formats.

Evaluation: Students will complete ENTMLGY 7920/ENVSCI 7920 Presentation Skills for Scientists. Students will present an elevator speech, research 10-minute oral presentation and research poster for grades. Each assignment will be presented for feedback in class first prior to grading, which will be collected using the same rubrics used to grade each assignment. Students will also present an Entry, Interdisciplinary Project, and Exit seminar within ENVSCI 7899. Students will receive feedback on these presentations from instructors and students via in-class rubrics.

Outcome 6: Students will demonstrate the ability to produce a fundable extramural research grant.
Evaluation: Students will select from a list of grant writing courses offered within one of the four colleges associated with our program and successfully complete the course. A list of possible courses is

included as part of our proposal. Assessment varies, but all courses provide an opportunity to write and revise a research grant proposal.

Outcome 7: Students will demonstrate proficiency in data analysis related to their research area.
Evaluation: Students will select a course in data analysis relevant to their area of research offered within one of the four colleges associated with our program and successfully complete the course. This course must be approved by the student's Student Advisory Committee.

Outcome 8: Students will demonstrate the capacity to design, execute and summarize an interdisciplinary environmental science research project.
Evaluation: Students will complete an interdisciplinary research project in collaboration with their advisor and at least one committee member from outside their home department. This will appear as a chapter included in their dissertation. By the end of the first two years of the student's program they will submit a 3-page project proposal to the GSC for approval. The proposal is to be approved by the students SAC prior to submission to the GSC. Once approved, the student can enroll in ENVSCI 7899 and present their Interdisciplinary Project Seminar. Prior to graduation the student is to submit the chapter, along with a completion form to the GSC for approval.

2. So that reviewers can clearly see the full curricular changes proposed for each degree, please provide lists of the full current and revised MS and PhD curricula, including the following as applicable: core degree required courses, research courses, elective courses, current course numbers and titles, total required credit hours.

Response: These summaries have been added as Appendices 6 and 7.

For the lists of revised curricula, use tracked changes or highlighted text to indicate aspects of each program that are changing. The full curricular comparisons can be provided as an attachment (e.g., before the syllabi) and can either be displayed side-by-side in a table or on separate pages.

Response: We provide our curriculum comparison in the provided table in the Curriculum Modification Form. All changes are now highlighted in yellow.

- Provide separate curriculum comparisons for each degree – one for the MS and one for the PhD.

Response: We provide a separate Curriculum Modification Form for each degree.

- Indicate in the side-by-side comparisons any new courses, as well as the status of new course development/approvals.

Response: Provided

- The subcommittee raised questions about ENVSCI 7899:
- Will both MS and PhD students be required to take this course?

Response: Yes, ENVSCI 7899 is our seminar course. MS students present an Entry and Exit presentation. PhD students will present an Entry, Interdisciplinary Project, and Exit presentation. Both MS and PhD students must enroll for a total of 3 credits (three semesters).

- The proposal, submission of a chapter, and submission of the project completion form prior to graduation seem to be degree milestones separate from graded course assignments. If these are indeed separate degree milestones, please provide a list of degree milestones students must complete prior to graduation for each degree.

Response: Correct, these are degree milestones not part of the graded course. We have removed these components from section 2 of the Curriculum Modification Form and include our PhD degree milestones as an appendix (Appendix 8). These requirements do not pertain to MS students.

- Minor edits
- For readability, on PDF p. 9, please indent items 1 – 4, and bold italicized item 8.
- PDF p. 10, correct the spelling of "Interdisciplinary" in the syllabus title for ENVSCI 7XXX.

CHANGE REQUEST FORM
CURRICULUM MODIFICATION

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Change requests must be submitted through the institution's CCGS representative. In order to ensure sufficient time for review, please submit all requests **at least four weeks prior to an upcoming meeting of the CCGS**. Documents may be submitted as PDF or Microsoft Office documents (e.g., Word or Excel).

Date of submission:

5-9-2022 (initial) 10-19-23 (first revision), 2-23-24 (second revision)

Name of institution:

The Ohio State University, Environmental Science Graduate Program

Primary institutional contact for this request:

Name	Mary Gardiner
Title	Professor and Co-Director
Phone number	330-601-6628
E-mail	Gardiner.29@osu.edu

Proposed implementation date:

Spring Semester 2024

Date that the request received final approval from the appropriate institutional committee(s):

Educator Preparation Programs:
Indicate whether the program being modified leads to educator preparation licenses or endorsements.

Licensure *Yes/No*
Endorsement *Yes/No*

Curriculum Change Details:

1. *Describe the rationale for the proposed curricular change.*

The Environmental Sciences Graduate Program was established in 1989 and it has been more than a decade since the last substantive update to our curriculum. ESGP has matured since then adding Specialization Tracks and new faculty (e.g. College of Public Health, Environmental Health Sciences). Our External Review of 2018 recommended we have a Core Course requirement for all students. We agree and this proposed curricular change will implement their recommendation. This curriculum change was needed to prepare our students with both the knowledge and professionals skills needed to address complex environmental programs. **First, we identified the need for a core course in Sustainability Science.** We have identified ENVENG 5170 Sustainability and Pollution Prevention Practices to meet this need. This course will be taken by all MS students. In this course, our students will gain an understanding of the complex social, economic, and environmental impacts and tradeoffs inherent in sustainable systems. **Second, we saw a need to target the development of critical professional development skills.** For MS students we will focus on data analysis and presentation skills. Students will select a data analysis course appropriate for their research project, which must be approved by their Student Advisory Committee as part of their Plan of Study. These courses can vary in credit hours from 2-4 credits. We have identified **ENTMLGY 7920 Presentation Skills for Scientists** to train our students in the development of effective oral and poster-based scientific presentations. We have submitted course change requests to cross one of these courses as part of this curriculum change:

ENVENG/ENVSCI 5170 Sustainability and Pollution Prevention Practices (Proposed Title: Sustainability in the Circular Economy)

We have added three new learning goals and added three new components to our assessment plan for these goals. Those components are detailed below.

Our proposed changes will add 8 new credit hours of required coursework to the MS program. This change will represent a 26.6% change in our curriculum.

Submit course descriptions and (short) syllabi for all new courses *as appendix items. As requested in our prior feedback, new requirements are highlighted in yellow.*

Previously Authorized Curriculum	*Credit Hours*	*Proposed Curriculum*	***Credit Hours***
		ENVENG/ENVSIC 5170 Sustainability and Pollution Prevention Practices. This will serve as a core course for the program, offered annually in the spring. A syllabus for this course is included with our proposal. **Status:** A course change request has been submitted add ENVSCI 5170 annually in the spring.	3
Foundational Knowledge Courses	3	**Foundational Knowledge**	3

– Biological Sciences (Students select from a list of approved courses: https://esgp.osu.edu/current-students/courses)		**Courses – Biological Sciences** (Students select from a list of approved courses: https://esgp.osu.edu/current-students/courses)	
Foundational Knowledge Courses – Physical Sciences (Students select from a list of approved courses: https://esgp.osu.edu/current-students/courses)	3	**Foundational Knowledge Courses – Physical Sciences** (Students select from a list of approved courses: https://esgp.osu.edu/current-students/courses)	3
Foundational Knowledge Courses – Social Sciences and Policy (Students select from a list of approved courses: https://esgp.osu.edu/current-students/courses)	3	**Foundational Knowledge Courses – Social Sciences and Policy** (Students select from a list of approved courses: https://esgp.osu.edu/current-students/courses)	3
		Data Analysis Methods. Students will select form list of courses from across our participating colleges that meet this requirement.	3
		ENTMLGY 7920 Presentation Skills for Scientists. This course (currently offered as ENTMLGY 7920) will be cross listed as ENVSCI 7920. The updated syllabus submitted for a course change request to add this section in the spring of even years is attached.	2
ENVSCI 7899. Issues in Environmental Science. Students are required to enroll in seminar for 3 semesters. They are to present during two of those semesters: Entry Seminar and Exit Seminar	3	**ENVSCI 7899 Issues in Environmental Science.** Students are required to enroll in seminar for 3 semesters. MS students are required to present during two of those semesters: Entry Seminar and Exist Seminar.	3

3. ***Describe changes to the following because of the request (if applicable):***

- ***Total number of credit hours for program completion***

Our MS Degree requires a minimum of 30 credit hours. Of these hours, 12 hours of required coursework were included in our previously authorized curriculum. In our proposed curriculum, 17 hours of required coursework are included. Remaining credits can be fulfilled with elective courses and research and thesis (7999) hours.

Our proposed changes will add 8 new credit hours of required coursework to the MS program. This represents a percentage change of 29.4% in the number of required credit hours of coursework.

- ***Time to complete program***

NA

4. ***Describe how the change will affect students currently in the program.***

Current students will have the option to complete their degree program following our previous curriculum or transition to the new curriculum.

5. ***Describe any faculty changes because of the request.***

NA

6. ***Describe any administrative or support services changes because of the request.***

NA

7. ***Describe how the effectiveness of the new curriculum will be monitored over time.***

Prior to the development of our new curriculum our program our learning outcomes focused specifically on three Foundational Knowledge Areas: Biological Sciences, Physical Sciences and Engineering and Social Science and Policy. We have developed three additional learning outcomes for our new MS curriculum focused on the addition of three new required courses (ENVENG/ENVSCI 5170, ENTMLGY 7920, and a course in data analysis).

Previously Authorized Curriculum Learning Outcomes and Evaluation

Outcome 1: Students are familiar with the diversity and functioning of organisms and the interactions among species and between organisms and the environment.
Evaluation: Students will complete at least one Foundational Knowledge Course in Biological Science. Because the environmental sciences focus on the relationships between living organisms and their environment, the basic principles of ecology and a solid understanding of ecosystems structure and function is the focus of this Foundational Knowledge Area. This understanding can be gained through coursework that focuses on a particular taxon or a particular kind of ecosystem but must be broadly applicable to any environment. Students will select the course from a list of courses approved by the ESGP Graduate Studies Committee.

Outcome 2: Students will understand the physical structure and processes in which ecosystems must function. Physical structure includes soil, water, air, geological media, climate, nutrients, and contaminants. Physical science processes include movement of "abiotic" matter and energy through ecosystems.
Evaluation: Students will complete at least one Foundational Knowledge Course in Physical Sciences. These courses must (1) study fundamental physical, hydrological, chemical, or biogeochemical processes and (2) study and emphasize the effects of physical structure and processes on ecosystem biotic components and function and the interactions between the biotic and abiotic components of the ecosystem. Students will select the course from a list of courses approved by the ESGP Graduate Studies Committee.

Outcome 3: Students will gain an understanding of the concepts related to the study of human society and/or individuals and their relationships to the structure and function of the ecosystem(s) of which they are a part.
Evaluation: Students will select at least one Social Sciences and Policy Foundational Knowledge Course from a list of courses approved by the ESGP Graduate Studies Committee. Methodology taught within these courses includes a range of approaches, both qualitative and quantitative. Courses must engage social science in a combined theoretical and/or applied study of a physical, cultural, regulatory, or economic relationship between humans and the natural and physical environment.

Proposed Curriculum Learning Outcomes and Evaluation

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Evaluation: Students will select a course in data analysis relevant to their area of research offered within one of the four colleges associated with our program and successfully complete the course. This course must be approved by the student's Student Advisory Committee.

8. *Provide evidence that the appropriate accreditation agencies have been notified of the proposed change (if applicable). NA*

The person listed below verifies that this request has received the necessary institutional approvals and that the above information is truthful and accurate.

_____

Signature (Chief Academic Officer or Delegate – e.g., Graduate Dean)

_____

Typed Name & Title

_____

Date of Approval

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Name of institution:

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Primary institutional contact for this request:

Name	Mary Gardiner
Title	Professor and Co-Director
Phone number	330-601-6628
E-mail	Gardiner.29@osu.edu

Proposed implementation date:

Spring Semester 2024

Date that the request received final approval from the appropriate institutional committee(s):

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Indicate whether the program being modified leads to educator preparation licenses or endorsements.

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The Environmental Sciences Graduate Program was established in 1989 and it has been more than a decade since the last substantive update to our curriculum. ESGP has matured since then adding Specialization Tracks and new faculty (e.g. College of Public Health, Environmental Health Sciences). Our External Review of 2018 recommended we have a Core Course requirement for all students. We agree and this proposed curricular change will implement their recommendation. This curriculum change was needed to prepare our students with both the knowledge and professionals skills needed to address complex environmental programs.

First, we identified the need for a core course in Sustainability Science. We have identified ENVENG 5170 Sustainability and Pollution Prevention Practices to meet this need. In this course, our students will gain an understanding of the complex social, economic, and environmental impacts and tradeoffs inherent in sustainable systems. This course will be taken by all PhD students. See Appendix 2.

Second, as an interdisciplinary program we want to ensure that all students within our program conduct interdisciplinary research. To make certain that this is opportunity is provided by all faculty mentors we have added an Interdisciplinary Project requirement for PhD students. This project is required to appear within a chapter of the student's dissertation. In collaboration with their advisor and at least one committee member from outside their home department, our PhD students will be required to submit a 3-page project proposal to their Student Advisory Committee (SAC), and then with SAC approval to the ESGP Graduate Students Committee (GSC) for approval by the end of the first two years of the student's program. Once approved, the student will present their plan as their Interdisciplinary Project Seminar as part of ENVSCI 7899. Prior to graduation the student is to submit the chapter, approved by their advisor and SAC to the GSC for approval. The student is also required to present their findings as part of their Exit Seminar in ENVSCI 7899. These degree milestones are included in Appendix 8.

Third, we saw a need to target the development of critical professional development skills. For PhD students we will focus on data analysis, grant writing and presentation skills. Students will select a data analysis course appropriate for their research project, which must be approved by their Student Advisory Committee as part of their Plan of Study. Students will select from a lists of approved grant writing courses, which vary from 1-4 credit hours. We have identified ENTMLGY 7920 Presentation Skills for Scientists to train our students in the development of effective oral and poster-based scientific presentations (Appendix 4)

Our PhD program requires completion of a minimum of 80 credit hours (50 hours post MS degree). In our current curriculum we require 21 hours of coursework (+ electives and research hours) as detailed above. In the new proposed curriculum students will be required to take between 21 and 24 hours, depending on the grant writing course taken.

Our proposed changes include a maximum of 12 credits of change. In total, these changes represent no more than a 15% change in required credit hours.

2. *Submit a comparison of the currently authorized curriculum and the proposed curriculum.* ***Submit course descriptions and (short) syllabi for all new courses*** *as appendix items. New Requirements or changes in the number of credit hours required are highlighted in yellow, as requested by our prior review.*

Previously Authorized Curriculum	*Credit Hours*	*Proposed Curriculum*	***Credit Hours***
		ENVENG/ENVSIC 5170 Sustainability and Pollution Prevention Practices. This will serve as a core course for the program, offered annually in the spring. A syllabus for this course is included with our proposal. **Status:** A course change request has been submitted add ENVSCI 5170 annually in the spring.	3
Foundational Knowledge Courses – Biological Sciences (Students select from a list of approved courses: https://esgp.osu.edu/current-students/courses)	6	**Foundational Knowledge Courses – Biological Sciences** (Students select from a list of approved courses: https://esgp.osu.edu/current-students/courses)	3
Foundational Knowledge Courses – Physical Sciences (Students select from a list of approved courses: https://esgp.osu.edu/current-students/courses)	6	**Foundational Knowledge Courses – Physical Sciences** (Students select from a list of approved courses: https://esgp.osu.edu/current-students/courses)	3
Foundational Knowledge Courses – Social Sciences and Policy (Students select from a list of approved courses: https://esgp.osu.edu/current-students/courses)	6	**Foundational Knowledge Courses – Social Sciences and Policy** (Students select from a list of approved courses: https://esgp.osu.edu/current-students/courses)	3
		Data Analysis Methods. Students will select form list of courses from across our participating colleges that meet this requirement.	2
		ENVSCI 7920 Presentation Skills for Scientists.	2
		Grant Writing. Students will select form list of courses from across our participating colleges that meet this requirement.	1-4
ENVSCI 7899. Issues in Environmental Science. Students are required to enroll in seminar for 3 semesters. They are to present during two of those semesters: Entry Seminar and Exit Seminar	3	**ENVSCI 7899 Issues in Environmental Science.** Students are required to enroll in seminar for 3 semesters. PhD students are required to present during all three semesters: Entry	3

		Seminar, Interdisciplinary Project Seminar and Exit Seminar.	

3. ***Describe changes to the following because of the request (if applicable):***

- ***Total number of credit hours for program completion***

Our PhD program requires completion of a minimum of 80 credit hours (50 hours post MS degree). In our current curriculum we require 21 hours of coursework (+ electives and research hours) as detailed above. In the new proposed curriculum students will be required to take between 20 and 24 hours, depending on if the grant writing course taken.

- ***Time to complete program***

NA

4. ***Describe how the change will affect students currently in the program.***

Current students will have the option to complete their degree program following our previous curriculum or transition to the new curriculum.

5. ***Describe any faculty changes because of the request.***

NA

6. ***Describe any administrative or support services changes because of the request.***

NA

7. ***Describe how the effectiveness of the new curriculum will be monitored over time.***

Prior to the development of our new curriculum our program our learning outcomes focused specifically on three Foundational Knowledge Areas: Biological Sciences, Physical Sciences and Engineering and Social Science and Policy. We have developed five additional learning outcomes for our new PhD curriculum focused on the addition of five new required courses (ENVENG/ENVSCI 5170, ENTMLGY 7920, course in grant writing, course in data analysis), as well as the addition of the interdisciplinary dissertation chapter requirement.

Previously Authorized Curriculum Learning Outcomes and Evaluation

Outcome 1: Students are familiar with the diversity and functioning of organisms and the interactions among species and between organisms and the environment.
Evaluation: Students will complete two Foundational Knowledge Courses in Biological Science. Because the environmental sciences focus on the relationships between living organisms and their environment, the basic principles of ecology and a solid understanding of ecosystems structure and function is the focus of this Foundational Knowledge Area. This understanding can be gained through coursework that focuses on a particular taxon or a particular kind of ecosystem but must be broadly applicable to any environment. Students will select the course from a list of courses approved by the ESGP Graduate Studies Committee.

Outcome 2: Students will understand the physical structure and processes in which ecosystems must function. Physical structure includes soil, water, air, geological media, climate, nutrients, and contaminants. Physical science processes include movement of "abiotic" matter and energy through ecosystems.

Evaluation: Students will complete two Foundational Knowledge Courses in Physical Sciences. These courses must (1) study fundamental physical, hydrological, chemical, or biogeochemical processes and (2) study and emphasize the effects of physical structure and processes on ecosystem biotic components and function and the interactions between the biotic and abiotic components of the ecosystem. Students will select the course from a list of courses approved by the ESGP Graduate Studies Committee.

Outcome 3: Students will gain an understanding of the concepts related to the study of human society and/or individuals and their relationships to the structure and function of the ecosystem(s) of which they are a part.

Evaluation: Students will select two courses from a list of courses approved by the ESGP Graduate Studies Committee. Methodology taught within these courses includes a range of approaches, both qualitative and quantitative. Courses must engage social science in a combined theoretical and/or applied study of a physical, cultural, regulatory, or economic relationship between humans and the natural and physical environment.

Proposed Curriculum Learning Outcomes and Evaluation

Outcome 1: Students will demonstrate an understanding of sustainability science.

Evaluation: All students will be required to complete ENVENG/ENVSCI 5170 Sustainability and Pollution Prevention Practices. Students will complete a semester long group project and be assessed with weekly quizzes and three exams.

Outcome 2: Students are familiar with the diversity and functioning of organisms and the interactions among species and between organisms and the environment.

Evaluation: Students will complete at least one Foundational Knowledge Course in Biological Science. Because the environmental sciences focus on the relationships between living organisms and their environment, the basic principles of ecology and a solid understanding of ecosystems structure and function is the focus of this Foundational Knowledge Area. This understanding can be gained through coursework that focuses on a particular taxon or a particular kind of ecosystem but must be broadly applicable to any environment. Students will select the course from a list of courses approved by the ESGP Graduate Studies Committee.

Outcome 3: Students will understand the physical structure and processes in which ecosystems must function. Physical structure includes soil, water, air, geological media, climate, nutrients, and contaminants. Physical science processes include movement of "abiotic" matter and energy through ecosystems.

Evaluation: Students will complete at least one Foundational Knowledge Course in Physical Sciences. These courses must (1) study fundamental physical, hydrological, chemical, or biogeochemical processes and (2) study and emphasize the effects of physical structure and processes on ecosystem biotic components and function and the interactions between the biotic and abiotic components of the ecosystem. Students will select the course from a list of courses approved by the ESGP Graduate Studies Committee.

Outcome 4: Students will gain an understanding of the concepts related to the study of human society and/or individuals and their relationships to the structure and function of the ecosystem(s) of which they are a part.

Evaluation: Students will select at least one Social Sciences and Policy Foundational Knowledge Course from a list of courses approved by the ESGP Graduate Studies Committee. Methodology taught within these courses includes a range of approaches, both qualitative and quantitative. Courses must engage social science in a combined theoretical and/or applied study of a physical, cultural, regulatory, or economic relationship between humans and the natural and physical environment.

Outcome 5: Students will demonstrate the communication skills needed to communicate interdisciplinary research effectively in poster and oral presentation formats.

Evaluation: Students will complete ENTMLGY 7920/ENVSCI 7920 Presentation Skills for Scientists. Students will present an elevator speech, research 10-minute oral presentation and research poster for grades. Each assignment will be presented for feedback in class first prior to grading, which will be collected using the same rubrics used to grade each assignment. Students will also present an Entry, Interdisciplinary Project, and Exit seminar within ENVSCI 7899. Students will receive feedback on these presentations from instructors and students via in-class rubrics.

Outcome 6: Students will demonstrate the ability to produce a fundable extramural research grant.
Evaluation: Students will select from a list of grant writing courses offered within one of the four colleges associated with our program and successfully complete the course. A list of possible courses is included as part of our proposal. Assessment varies, but all courses provide an opportunity to write and revise a research grant proposal.

Outcome 7: Students will demonstrate proficiency in data analysis related to their research area.
Evaluation: Students will select a course in data analysis relevant to their area of research offered within one of the four colleges associated with our program and successfully complete the course. This course must be approved by the student's Student Advisory Committee.

Outcome 8: Students will demonstrate the capacity to design, execute and summarize an interdisciplinary environmental science research project.
Evaluation: Students will complete an interdisciplinary research project in collaboration with their advisor and at least one committee member from outside their home department. This will appear as a chapter included in their dissertation. By the end of the first two years of the student's program they will submit a 3-page project proposal to the GSC for approval. The proposal is to be approved by the students SAC prior to submission to the GSC. Once approved, the student can enroll in ENVSCI 7899 and present their Interdisciplinary Project Seminar. Prior to graduation the student is to submit the chapter, along with a completion form to the GSC for approval.

8. *Provide evidence that the appropriate accreditation agencies have been notified of the proposed change (if applicable). NA*

The person listed below verifies that this request has received the necessary institutional approvals and that the above information is truthful and accurate.

_____

Signature (Chief Academic Officer or Delegate – e.g., Graduate Dean)

_____

Typed Name & Title

_____

Date of Approval

Appendix 1

Subject: RE: Approval of Environmental Science Graduate Program Curriculum Revision
Date: Wednesday, March 29, 2023 at 11:26:19 AM Eastern Daylight Time
From: King, Ryan
To: Gardiner, Mary
CC: Orefice, Brian
Attachments: image003.png

Dear Mary,

Arts and Sciences approves. Please let me know if you need the document signed and dated.

Ryan King

Ryan D. King
Dean of Social and Behavioral Sciences
College of Arts and Sciences
The Ohio State University
186 University Hall, 230 N. Oval Mall, Columbus, OH 43210
king.2065@osu.edu / https://artsandsciences.osu.edu

From: Gardiner, Mary <gardiner.29@osu.edu>
Date: Friday, March 24, 2023 at 8:54 AM
To: Stiner-Jones, LaTonia <stiner-jones.1@osu.edu>, Bisesi, Michael <bisesi.12@osu.edu>, Pierzynski, Gary M. <pierzynski.3@osu.edu>, Orefice, Brian <orefice.1@osu.edu>, Malone, Kelly <malone.381@osu.edu>, Basta, Nicholas <basta.4@osu.edu>
Subject: FW: Approval of Environmental Science Graduate Program Curriculum Revision

Dear Academic Deans, Thank you so much to those who have responded regarding your approval of the ESGP curriculum. I know you are all very busy, when you have a chance please let us know if you support the changes we have made to our curriculum to address recommendations of our external reviewers. Please see details below and in the attached document.

Thank you!

Sincerely, Mary Gardiner

From: Gardiner, Mary <gardiner.29@osu.edu>
Date: Tuesday, March 7, 2023 at 9:50 AM
To: Stiner-Jones, LaTonia <stiner-jones.1@osu.edu>, Bisesi, Michael <bisesi.12@osu.edu>, Pierzynski, Gary M. <pierzynski.3@osu.edu>, Orefice, Brian <orefice.1@osu.edu>, Malone, Kelly <malone.381@osu.edu>, Basta, Nicholas <basta.4@osu.edu>
Subject: Approval of Environmental Science Graduate Program Curriculum Revision

Dear Academic Deans,

As Co-Directors of the Environmental Science Graduate Program (ESGP), we are writing to alert you to a change in our graduate curriculum. ESGP underwent an External Review in 2018, and all curriculum recommendations made by these reviewers have been addressed.

Please note that this revision does not involve any changes to Specialization tracks (such as EPH), only to the core curriculum taken by all graduate students.

Our Graduate Studies Committee (GSC), which includes faculty from each participating college, has worked together to develop this curriculum. As a GSC, we have reviewed and approved the curriculum proposed herein. To submit this curriculum change we require a brief email response from the Dean of each college associated with the ESGP program stating support for our revised curriculum. Please review our proposed changes attached and let us know if you approve of this much needed update. Once we hear from each of you, we can submit our documents to OAA for a formal review.

Thank you so much for your time and support of ESGP. Please reach out with any questions.

Sincerely,

Mary Gardiner and Nick Basta
ESGP Co-Directors

Subject: RE: Approval of Environmental Science Graduate Program Curriculum Revision
Date: Friday, March 24, 2023 at 2:23:29 PM Eastern Daylight Time
From: Pierzynski, Gary M.
To: Gardiner, Mary, Stiner-Jones, LaTonia, Bisesi, Michael, Orefice, Brian, Malone, Kelly, Basta, Nicholas
Attachments: image001.png

Mary,

Apologies for missing this the first time. I support.

THE OHIO STATE UNIVERSITY

Gary Pierzynski, PhD
Associate Dean for Research and Graduate Education
Director, Ohio Agricultural Experiment Station
College of Food, Agricultural and Environmental Sciences
106 Ag Administration, 2120 Fyffe Road, Columbus, OH 43210
614-688-5681 Office
pierzynski.3@osu.edu / research.cfaes.ohio-state.edu
Pronouns: he/him/his

Buckeyes consider the environment before printing.

From: Gardiner, Mary <gardiner.29@osu.edu>
Sent: Friday, March 24, 2023 8:54 AM
To: Stiner-Jones, LaTonia <stiner-jones.1@osu.edu>; Bisesi, Michael <bisesi.12@osu.edu>; Pierzynski, Gary M. <pierzynski.3@osu.edu>; Orefice, Brian <orefice.1@osu.edu>; Malone, Kelly <malone.381@osu.edu>; Basta, Nicholas <basta.4@osu.edu>
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Thank you!

Sincerely, Mary Gardiner

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Date: Tuesday, March 7, 2023 at 9:50 AM
To: Stiner-Jones, LaTonia <stiner-jones.1@osu.edu>, Bisesi, Michael <bisesi.12@osu.edu>, Pierzynski, Gary M. <pierzynski.3@osu.edu>, Orefice, Brian <orefice.1@osu.edu>, Malone, Kelly <malone.381@osu.edu>, Basta, Nicholas <basta.4@osu.edu>
Subject: Approval of Environmental Science Graduate Program Curriculum Revision

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Thank you so much for your time and support of ESGP. Please reach out with any questions.

Sincerely,

Mary Gardiner and Nick Basta
ESGP Co-Directors

Subject: Re: Approval of Environmental Science Graduate Program Curriculum Revision
Date: Sunday, March 26, 2023 at 7:51:22 PM Eastern Daylight Time
From: Stromberger, Mary
To: Gardiner, Mary, Basta, Nicholas, Malone, Kelly

Dear Mary and Nick,

Thank you for the email. I appreciate your work to update the curriculum for the master's and PhD tracks of the Environmental Science Graduate Program. The addition of core requirements to enhance student learning in sustainability science, communication & grant writing, and data analysis is commendable and will further strengthen this program and the caliber of its students. I support the revised curriculum.

Best regards,

Mary

Mary Stromberger, PhD
Vice Provost for Graduate Education
Dean of the Graduate School
ENGIE-Axium Endowed Dean's Chair

The Ohio State University
Graduate School
250 University Hall
230 N. Oval Mall, Columbus, OH 43210
614-292-6031 Office
stromberger.1@osu.edu / https://gradsch.osu.edu/.osu.edu

Pronouns: she/her/hers

From: Gardiner, Mary <gardiner.29@osu.edu>
Date: Friday, March 24, 2023 at 8:56 AM
To: Stromberger, Mary <stromberger.1@osu.edu>, Basta, Nicholas <basta.4@osu.edu>, Malone, Kelly <malone.381@osu.edu>
Subject: Approval of Environmental Science Graduate Program Curriculum Revision

Dear Dean Stromberger,

As Co-Directors of the Environmental Science Graduate Program (ESGP), we are writing to alert you to a change in our graduate curriculum. ESGP underwent an External Review in 2018, and all curriculum recommendations made by these reviewers have been addressed.

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Mary Gardiner and Nick Basta
ESGP Co-Directors

Subject: RE: Approval of Environmental Science Graduate Program Curriculum Revision
Date: Friday, March 24, 2023 at 3:27:11 PM Eastern Daylight Time
From: Bisesi, Michael
To: Gardiner, Mary, Stiner-Jones, LaTonia, Pierzynski, Gary M., Orefice, Brian, Malone, Kelly, Basta, Nicholas
CC: Adetona, Olorunfemi T., Hood, Darryl B. Hood, Weir, Mark
Attachments: image001.png

On behalf of the College of Public Health and the ESGP MS-ES and PhD-ES degree programs with specialization in Environmental Public Health, we accept these changes to the foundational curriculum as described.

THE OHIO STATE UNIVERSITY

Michael S. Bisesi, MS, PhD, REHS, CIH
Vice Dean, Academic Affairs & Academic Administration
Professor & Chair, Environmental Health Sciences
College of Public Health
Senior Strategic Advisor, OSU Global One Health initiative (GOHi)
Administrative Chair, Sustainability Education and Learning Committee
Fellow AIHA
Phone: (614) 247-8290 Email: bisesi.12@osu.edu
(Administrative Assistant Samantha Hicks (614) 688-3822 hicks.598@osu.edu)
(EHS Division Coordinator Joy Snow snow.256@osu.edu)

From: Gardiner, Mary <gardiner.29@osu.edu>
Sent: Friday, March 24, 2023 8:54 AM
To: Stiner-Jones, LaTonia <stiner-jones.1@osu.edu>; Bisesi, Michael <bisesi.12@osu.edu>; Pierzynski, Gary M. <pierzynski.3@osu.edu>; Orefice, Brian <orefice.1@osu.edu>; Malone, Kelly <malone.381@osu.edu>; Basta, Nicholas <basta.4@osu.edu>
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To: Stiner-Jones, LaTonia <stiner-jones.1@osu.edu>, Bisesi, Michael <bisesi.12@osu.edu>, Pierzynski, Gary M. <pierzynski.3@osu.edu>, Orefice, Brian <orefice.1@osu.edu>, Malone, Kelly <malone.381@osu.edu>, Basta, Nicholas <basta.4@osu.edu>
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Thank you so much for your time and support of ESGP. Please reach out with any questions.

Sincerely,

Mary Gardiner and Nick Basta
ESGP Co-Directors

Appendix 2

Sustainability and the Circular Economy

ENVSCI 5170
Spring 202X

Course Information

- **Mode of delivery:** In-Person
- **Course times:** TBD
- **Course location:** TBD
- **Credit hours:** 3

Instructor

- **Name:** Daniel B. Gingerich, Ph.D. (he/him/his)
- **Email:** gingerich.62@osu.edu
- **Office hours:** TBD
- **Preferred means of communication:**
  - My preferred method of communication for questions is **email.** When emailing me, please put "ENVSCI 5170" in the subject line.
  - My class-wide communications will be sent through the Announcements tool in CarmenCanvas. Please check your notification preferences (go.osu.edu/canvas-notifications) to be sure you receive these messages.

Course Prerequisites

For undergraduate students, the prerequisite for this course is ENVENG 3200 (Fundamentals of Environmental Engineering). There are no prerequisites for this course for graduate students.

Catalog Description

An introduction to life-cycle thinking and the circular economy with emphasis on quantitative sustainability assessment and decision-making.

Course Description

This course covers two of the Grand Challenges facing environmental engineers in the 21st century and is designed to equip you with the tools to address them as you start your career.

The first of these is Grand Challenge #3: Designing a Future Without Pollution or Waste. Ninety-four percent of the materials that we extract from the Earth end up as waste: in landfills, in water, or in air. A key role of engineers in society is to reduce this amount of wastage. To that end, in this class, we will discuss frameworks to improve the material efficiency of society

(*the circular economy* and *resource recovery*) and measure the environmental consequences of our resource usage and wastage (*environmental life-cycle assessment*).

The second of these is Grand Challenge #5: Fostering Informed Decisions and Actions. As stewards of – and experts in – society's built and natural environments, environmental and civil engineers have an obligation to support societal decision making. To that end, in this class, we will discuss approaches to interacting with stakeholders (*community engagement*), formal approaches to evaluate trade-offs in environmental decision making (*multi-criteria decision making* and *multi-objective optimization*), and other policy frameworks.

Course Goals and Learning Outcomes

By the end of this course, students should successfully be able to:

1. Model components and performance of solid waste infrastructure systems;
    a. Describe the life cycle of solid waste
    b. Size components of the solid waste infrastructure system, including collection, transportation, and disposal steps
    c. Implement economic analysis to perform screening of material recovery
    d. Implement circular economy metrics to assess the performance of materials systems
2. Use life-cycle thinking and life-cycle assessment in order to quantitatively assess the impacts of a product or system from cradle-to-grave;
    a. Create life-cycle diagrams showing a product's life cycle from cradle-to-grave
    b. Describe the steps of a life-cycle assessment and life-cycle impact assessment (based on the ISO 14040 standards)
    c. Describe the three different types of LCA (process-based, EIO, hybrid) and identify their differences
    d. Execute the calculations used in simple process-based, EIO, and hybrid LCA studies
3. Apply life-cycle assessment to messy, real-world sustainability assessment problems;
    a. Appropriately define the goal and scope of a life-cycle assessment based on real-world conditions and the goals of a client
    b. Identify appropriate secondary data to use in a life-cycle assessment
    c. Characterize the uncertainty underlying secondary data using appropriate frameworks
    d. Design and perform appropriate uncertainty and sensitivity assessment
    e. Use LCA software and databases to perform a life-cycle assessment.
4. Support sustainability decision making by leveraging decision science and sustainability assessment;
    a. Describe the values that underlie real-world sustainability decisions
    b. Apply multi-attribute utility theory approaches to a sustainability problem to make recommendations to a client
    c. Design appropriate figures to communicate the results of an LCA study
    d. Communicate the results of an LCA study in a way that is appropriate and useful to a client
5. Define and explain a personal definition of sustainability with frameworks drawn from engineering, natural science, social science, and the humanities.
        a. Identify cultural narratives of the environment and how they have changed throughout Western history
        b. Describe the Grand Challenges for Environmental Engineering
        c. Develop examples of how to apply the principles of Green Engineering to design problems
        d. Understand how different Engineering Ethics frameworks treat the environment

    e. Apply a personal definition of sustainability to analyze a problem with impacts for the environment.
6. Understand the role of environmental life-cycle assessment in technology development and research activities. **(GRADUATE STUDENTS ONLY)**
    a. Be able to situate relevant elements of the technosphere to research activities within the broader eco- and technosphere.
    b. Describe methods for performing LCA and the potential broader impacts of LCA work in a format suitable for funding agencies.
    c. Develop research plans in which LCA is integrated with other research activities for fields in a student's home and closely related disciplines.

In addition to course goal #6, this course is also closely connected to the Environmental Sciences Graduate Program (ESGP) and touches on the three ESGP foundations to show how they can be integrated to advance sustainable social, environmental, and technical systems. As examples:

- **Biological Sciences –** Impact assessment methodologies draw on an understanding of the mechanisms by which pollution impacts living organisms (2b, 2d) while industrial ecosystems and the circular economy are biomimetic approaches to creating sustainable systems that are inspired by natural ecosystems and processes (1d).
- **Physical Sciences & Engineering –** In several places in this course, concepts from physics, chemistry, and engineering sciences are used to assess the sustainability of human-designed processes (e.g., atom economy in 5b and 5c; mass and energy balances in LCA in 2, 3, and 4). This course also discusses the design of elements of the technosphere to help students understand how solid waste is managed (1a, 1b, 1c).
- **Social Sciences –** In the beginning and end of the course, students are taught how values influence social and scientific understandings of the environment (4a, 5a, 5b, 5d) and approaches from the decision sciences that can leverage LCA results to inform make decisions consistent with individually and communally held values (4a, 4b, 4d).

How to Succeed In This Class

When I taught this class last year, I asked the top students to let me know what they did in the class to succeed. Here's what they told me:

- "The thing that helped me succeed the most was doing all of the practice questions before the quiz every week. These were very good review of what we did and it helped me immensely. I also made a small study guide before every quiz and made a large study guide (aside from the cheat sheet) for the exams. Also doing all extra credit helped!"
- "(1) As you said in the syllabus, attendance is key. You can explain it more clearly than any textbook can; (2) The days immediately following lecture, I would retake my own notes based off of yours, so I saw that material another time and was forced to engage with it in another medium. I would then attempt the relevant practice problems, that way I would have enough time to ask questions if needed. (3) Leading up to the exams, I would study a module a day that way I could get I could focus on it in depth and prepare my note sheet. (4) In terms of the project, just starting ahead of time that way you do not feel rushed if problems arise! None of these are groundbreaking practices but I hope it helps a little."
- "I'd say the main factor in my success was the focus I put on quizzes. I made sure each week to spend adequate time on doing all the practice problems for the quizzes. This allowed me to do well on the quizzes and minimize studying on the midterms. For the midterms, I started studying about a week before, but the studying was relaxed, and I only did an hour or so a day max. This way, I was

very familiar with the material and was able to go through the test smoothly. To be quite honest, I did not read after the first few weeks as my schedule got quite busy. So, while reading can be helpful, it might not be required for success. For the project, my group was in very consistent contact with you and asked for help, which made sure we had a thorough and complete project by the end of the semester."

- "I think the thing that helped me succeed the most in class this year was really just showing up, paying attention every class period, and doing the assigned work. I know that kind of sounds like the bare minimum, but paying attention the entire lecture and then checking my understanding after really solidified a lot of the information and I found a lot of the material making sense intuitively. I also felt that as long as I understood all of the example problems in the class notes, I would be able to do fine on any of the quizzes or exams. I really felt that the "On-your-own" examples gave me a good chance to double check and make sure I really understood the problems before moving on. I think it is really easy to take lecture based classes and kind of mail-in just showing up and writing down notes, so to me it was actively participating and checking with myself that I understood the material after every class session that I think helped me succeed. I also felt like you provided a lot of opportunities for us to check that understanding (TopHat, Quizzes, Practice Problems, etc.) so my advice again would really just be to do the work presented and make sure you understand it."
- "My advice to future students would be to dedicate a specific time each week to work on the practice problems and take the quiz. By getting into a routine of working out the practice problems followed by completing the quiz, I was able to make sure I grasped the content before being evaluated on it."

I want to highlight three common features of these responses, because these students that did well picked up on key elements of how I designed this class and the assessments for it.

First, they completed the **practice problems** every week, often right after the class session in which I assigned them. I design the practice problems with two goals in mind. First, they are designed to give you additional practice for the concepts that we cover in a particular topic so that you can continue to refine and extend the skills and approaches we cover in class. Second, they are designed to give you information on how well you understand the concepts. That information is extremely valuable to you as a student, because it tells you what you need to study more and it tells you what you need to get help on. *When you struggle with practice problems, that is a sign to ask for help from me or a classmate.* I want to know what you're struggling with on the practice problems, so I can help you and I can help your classmates with because it is almost certain that someone else is struggling with it too. I *do not* give out solutions to the practice problems, because I want you to understand a solution – not memorize it and memorization is what students tend to do if they are given a solution to a problem they do not understand. Practice questions are not graded assessments, so I encourage collaboration on them! I will also have a discussion board set-up for each practice problem set, so that you can ask for help there and discuss solutions. I will monitor discussion boards and step in to answer questions or correct misperceptions in answers at least twice a week.

Second, they prepared well for **weekly quizzes**. There is a large body of literature that shows the value of spaced studying rather than cramming for exams. Quizzes are my attempt to get you to do that. Take quizzes seriously and use them as incentives to space your preparation for exams. I also would encourage you to shift your thinking about quizzes away from an "assessment of what you *already* know" towards an "assessment of what you *don't yet* know". Quizzes are another way for you to understand if there is material that you haven't mastered and should get more help from. This is especially true once we start discussing life-cycle assessment as from that point on things start building off

of each other rapidly. So if you struggle with an early topic, you are going to struggle with later topics if you do not ask for help.

Third, they start the **group project** early. That gives you time to respond to things that come up with plenty of time and to ask for help when you need it. The project is an opportunity for you to apply what you're learning in the class to a real-world problem; it is not meant for you to get frustrated with what you're learning in class. I also received feedback last year in the student evaluations that students wanted more check-ins with me about the project. As a result, this year, I've added an intermediate deliverable between the proposal and the final project so that you can get more early feedback.

Fundamentally, I design classes where you have plenty of no-stake and low-stake opportunities to learn what you do not yet know. Students that do well understand this interpretation of these opportunities and use that information to do well in this class.

Course Topics & Schedule

Topics for what will be covered in class on a given day are tentative and may shift. Exam dates, however, will not change.

Week	Class Session	Topics
1	1	The History and Future of Sustainability
	2	Engineering for Sustainability
2	n/a	NO CLASS – Martin Luther King, Jr. Day
	3	Introduction to LCA
3	4	Goals, Scopes, and Data for LCA*
	5	Process-Based LCA I
4	6	Process-Based LCA II* **Team Contract Due for Project**
	7	EIOLCA
5	8	Software & Tools for LCA*
	9	Hybrid LCA & Interpreting LCAs
6	10	Uncertainty Analysis for LCA I*
	11	Uncertainty Analysis for LCA II & Impact Assessment **Project Proposal Due**
7	12	Performing Impact Assessment
	13	Exam #1
8	14	Introduction to Solid Waste
	15	Solid Waste Generation, Collection, and Transportation
9	16	Solid Waste Treatment and Disposal*
	17	Guest Speaker – Jeffrey Snyder, Rumpke **Intermediate Project Deliverables Due**
10	n/a	NO CLASS – Spring Break
	n/a	
11	18	Resource Recovery
	19	Theory of the Circular Economy
12	20	Environmental Justice I*
	21	Environmental Justice II
13	22	Exam 2
	23	Value-Focused Decision Making **Final Project Deliverable Due**
14	24	Utility Theory and Environmental Decision Making*
	25	Multi-Attribute Utility Theory I
15	26	Values and Weights in Decision Making*
	27	Policy & Sustainability
16	28	Professional Responsibilities and Ethics for Sustainability
17	TBD	Exam 3

* Indicates a quiz will be held in class on that day.

Project reflections will be due by 11:59pm on Saturdays following component due date

Grading and Faculty Response

How Your Grade is Calculated

Your grade for the course will come from in-class work, quizzes, and exams.

Assignment Category	Points
In-Class Engagement	10
Weekly Quizzes	20
Amid Term Exams	30
Project	40

Letter grades will be assigned as follows based on net weighted grade (NWG).

NWG	Letter Grade	NWG	Letter Grade
		0.7700 ≤ NWG < 0.8000	C+
0.9300 ≤ NWG	A	0.7300 ≤ NWG < 0.7700	C
0.9000 ≤ NWG < 0.9300	A-	0.7000 ≤ NWG < 0.7300	C-
0.8700 ≤ NWG < 0.9000	B+	0.6700 ≤ NWG < 0.7000	D+
0.8300 ≤ NWG < 0.8700	B	0.6000 ≤ NWG < 0.6700	D
0.8000 ≤ NWG < 0.8300	B-	NWG < 0.6000	E

Descriptions of Major Course Assignments

In-Class Engagement (10% of grade)

Description: These assessments are designed to keep you engaged in class. These assessments will be TopHat quizzes in which you will make a prediction or submit results of calculations you have just made. They are designed to follow best pedagogical practices to keep you engaged in class and to provide me with real-time information that would allow me to adjust mid-lecture. As a result, their usefulness is specific to the session in which they take place. Given that life happens and sometimes you may miss a class or two, I will automatically subtract three times the average number of points per day from the total number of points available, and set this as the maximum number of points available. As it is the maximum amount available, you will not be able to get more points than this. This will allow you to miss roughly three days of class without penalty or need to do make-up work. If you miss more than three days of class, I strongly encourage you to reach out to me to discuss alternate arrangements.

Weekly Quizzes (20% of grade)

Description: There will be nine graded, open-notes quizzes administered in class on Mondays. These quizzes are designed to assess your knowledge of course content and to help you keep pace with the class as we move forward. Make-up quizzes will be offered, but only if I am informed at least one hour before class (3:10pm) on quiz days.

In addition to these nine quizzes, there will be an optional Quiz #0 administered via Carmen in the first week of the class, that will be graded on a participation basis. This quiz will allow you to self-assess how well you remember some of the mathematics and engineering principles that you'll use in this class. If you complete this quiz, it will replace your lowest quiz score.

Amid-Term Exams (30% of grade)

Description: Throughout the course of the semester, there will be two exams, the dates of which are included in the course schedule. Exam #1 will cover solid waste management and industrial ecology and will be worth 11% of your grade. Exam #2 will cover life-cycle assessment and will be worth 11% of your grade. Exam #3 will cover decision analysis, ethics of sustainability, and policy analysis for sustainability and will be worth 8% of your grade.

Project (40% of grade, breakdown below)

Description: Over the course of the semester, you will work as part of a group on a project to develop a life-cycle assessment of a product or service of your choice. Instructions on the project will be posted to Carmen and discussed in class and tentative due dates can be found in the schedule above. This project will be broken down into many different pieces throughout the course of the semester:

- Project Proposal (10% of grade). With your team you will submit a two-page description of the product or system you will be analyzing with sufficient detail on the scope, goal, and data sources for your analysis to allow me to provide feedback and address issues that may come up. You will also discuss what your final deliverable will look like.
- Intermediate Project Deliverables (10% of grade). Over the course of the semester you will need to submit a group contract (2% of grade) laying out expectations for how your group will work together, a team evaluation (3% of grade) for how you all met the expectations laid out in the contract, and your life-cycle inventory results with sample calculation (5% of your grade).
- Final Project Deliverable (15% of grade). At the end of the semester, you will need to submit a final deliverable that presents the results of your team's analysis. There are multiple forms that this project deliverable can take with more details put on Carmen.
- Reflections (5% of grade): Over the course of the semester, I will have you write a series of journal reflections to get you to think about the process of doing life-cycle assessment and engaging with decision makers. These reflection assignments will be posted and submitted through Carmen.

By default, the grade for the final project deliverable will be shared by all members of the group. If a team member does not contribute, please reach out to me to discuss next steps.

Expectations for Graduate Students: While graduate students will also perform a life-cycle assessment as part of the course project, they will work individually or in smaller teams (no more than two individuals). The final deliverable for the project will be in the form of a National Science Foundation preliminary proposal to conduct and use a full-scale life-cycle assessment as part of a larger research project. The final deliverable will include preliminary analysis created as part of the Intermediate Project Deliverable. Graduate students will not have to submit a team contract or evaluation. Instead, intermediate results will be worth the entire 10% of the intermediate project deliverable category.

The goal of this structure is to help graduate students in the Environmental Science and Civil Engineering programs understand how LCA fits into other research activities that a student may perform in their career. While a student may end up going into a career in industrial ecology where performing life-cycle assessment will be their major focus, I do not expect this to be the case for many students in these programs. Therefore, this assessment is designed to help you understand how LCA can fit into your broader academic and professional career. This is also related to course goal #6.

Late Policy for Project Components: I will accept project components submitted within 24 hours of the posted deadline without penalty. Project components submitted 24-72 hours after a deadline will be accepted, but at a 50% penalty. Components submitted more than 72 hours after the deadline will be accepted and feedback will be provided but will not be graded.

Attendance and Missed Assignments

Because their goal is to provide you and I with real-time information, I do not allow make-up work for in-class engagement and activities points except in extremely limited circumstances in which I am notified of in advance. As there will be many of these assessments throughout the semester, you should not worry if you miss a day or two of class. You will be fine. For longer absences, I strongly encourage you to talk to me so that we can develop a plan for how you can keep up with the class.

If I am notified in advance, make-up quizzes and exams for Exam #1 and #2 may be provided for excused absences (following University definitions). Students will have five business days (i.e., before the next quiz) to make-up a quiz or exam. However, make-up quizzes or exams may be different in form and structure (e.g., may include an oral exam component) than the in-class component.

Instructor Feedback and Response Time

I am providing the following list to give you an idea of my intended availability throughout the course. Remember you can call 614-688-4357 (HELP) 24/7 if you have a technical problem.

- **Preferred contact method:** If you have a question, please contact me first through my Ohio State email address. I will reply to emails within **24 hours on days when class is in session at the university**. I will respond to emails sent between 5:00pm on Friday and 8:00am on Monday by Tuesday at 8:00am
- **Class announcements:** I will send all important class-wide messages through the Announcements tool in CarmenCanvas. Please check your notification preferences (go.osu.edu/canvas-notifications) to ensure you receive these messages.
- **Discussion board:** I will check and reply to messages in the discussion boards once mid-week on Wednesday at 9:00am and once at the end of the week on Friday at 4:00pm.
- **Grading and feedback:** For the quizzes, you can generally expect feedback within **two class sessions**. For projects and exams, you can generally expect feedback within **three class sessions**.

Course Materials, Fees, and Technologies

Course Materials

There are several recommended, optional textbooks for the course. I will often provide readings from these books that you may find helpful to know more about the concepts discussed in class or as a resource to refer to while you study for this course. The first of these textbooks are available online, free of charge at the website.

- Matthews, Hendrickson, and Matthews (2014). Life Cycle Assessment: Quantitative Approaches for Decisions That Matter. Open access textbook, retrieved from https://www.lcatextbook.com/.

Electronic versions of these books are all available through the OSU library or online. Instructions on how to access them are on Carmen.

- Chang and Pires (2015). Sustainable Solid Waste Management: A Systems Engineering Approach. Wiley-IEEE Press, ISBN 1118456912.
- Morgan (2017). Theory and Practice in Policy Analysis: Including Applications in Science and Technology. Cambridge University Press, ISBN 978-1-316-88266-5 (eBook).

Finally, we will use the following pieces of software:

- **TopHat.** TopHat is an app for phones and certain tablets that I use for in-class polling, to assess your engagement, and to share my powerpoint slides. You have a free account through TopHat as an Ohio State University student and should be able to download it through the Apple AppStore or the Google PlayStore.
- **OpenLCA.** OpenLCA is open-access software that is used to do LCA and available for Windows, Mac, and Linux Operating Systems. You may download it on your personal computer here. It is installed on the machines in the 4th floor Bolz computer lab, and we will spend at least one class day in the computer lab to walk through the software.

CarmenCanvas Access

You will need to use BuckeyePass (buckeyepass.osu.edu) multi-factor authentication to access your courses in Carmen. To ensure that you are able to connect to Carmen at all times, it is recommended that you do each of the following:

- Register multiple devices in case something happens to your primary device. Visit the BuckeyePass - Adding a Device (go.osu.edu/add-device) help article for step-by-step instructions.
- Request passcodes to keep as a backup authentication option. When you see the Duo login screen on your computer, click **Enter a Passcode** and then click the **Text me new codes** button that appears. This will text you ten passcodes good for 365 days that can each be used once.
- Install the Duo Mobile application (go.osu.edu/install-duo) on all of your registered devices for the ability to generate one-time codes in the event that you lose cell, data, or Wi-Fi service.

If none of these options will meet the needs of your situation, you can contact the IT Service Desk at 614-688-4357 (HELP) and IT support staff will work out a solution with you.

Technology Skills Needed for This Course

- Basic computer and web-browsing skills
- Navigating CarmenCanvas (go.osu.edu/canvasstudent)
- CarmenZoom virtual meetings (go.osu.edu/zoom-meetings)

Technology Support

For help with your password, university email, CarmenCanvas, or any other technology issues, or requests, contact the IT Service Desk, which offers 24-hour support, seven days a week.

- **Self Service and Chat**: go.osu.edu/it
- **Phone:** 614-688-4357 (HELP)
- **Email:** servicedesk@osu.edu

Other Course Policies

Discussion and Communication Guidelines

The following are my expectations for how we should communicate as a class on Carmen's discussion boards. Above all, please remember to be respectful and thoughtful.

- **Writing style**: While there is no need to participate in class discussions as if you were writing a research paper, you should remember to write using good grammar, spelling, and punctuation. A more conversational tone is fine for non-academic topics.
- **Tone and civility**: Let's maintain a supportive learning community where everyone feels safe and where people can disagree amicably. Remember that sarcasm doesn't always come across online.
- **Citing your sources**: When we have academic discussions, please cite your sources to back up what you say. For the textbook or other course materials, list at least the title and page numbers. For online sources, include a link.
- **Backing up your work**: Consider composing your academic posts in a word processor, where you can save your work, and then copying into the Carmen discussion.

Academic Integrity Policy

See Descriptions of Major Course Assignments for specific guidelines about collaboration and academic integrity in the context of this class.

Ohio State's Academic Integrity Policy

Academic integrity is essential to maintaining an environment that fosters excellence in teaching, research, and other educational and scholarly activities. Thus, The Ohio State University and the Committee on Academic Misconduct (COAM) expect that all students have read and understand the university's Code of Student Conduct (studentconduct.osu.edu), and that all students will complete all academic and scholarly assignments with fairness and honesty. Students must recognize that failure to follow the rules and guidelines established in the university's *Code of Student Conduct* and this syllabus may constitute "Academic Misconduct."

The Ohio State University's *Code of Student Conduct* (Section 3335-23-04) defines academic misconduct as: "Any activity that tends to compromise the academic integrity of the university or subvert the educational process." Examples of academic misconduct include (but are not limited to) plagiarism, collusion (unauthorized collaboration), copying the work of another student, and possession of unauthorized materials during an examination. Ignorance of the university's *Code of Student Conduct* is never considered an excuse for academic misconduct, so I recommend that you review the *Code of Student Conduct* and, specifically, the sections dealing with academic misconduct.

If I suspect that a student has committed academic misconduct in this course, I am obligated by university rules to report my suspicions to the Committee on Academic Misconduct. I believe that the COAM process is the best way to ensure that you receive due process in resolving allegations of academic misconduct. As a result, I will spend the time necessary to work with COAM in getting academic misconduct issues resolved. In my office I have a paleontology textbook because I really enjoy dinosaurs. If you send me a picture of a dinosaur by January 13th at 5:00pm, I will give you 2.5 percentage points of extra credit on Exam I. To protect the secrecy of the process, don't discuss this opportunity with your classmates. If COAM determines that you have violated the university's Code of Student Conduct (i.e., committed academic misconduct), the sanctions for the misconduct could include a failing grade in this course and suspension or dismissal from the university.

If you have any questions about the above policy or what constitutes academic misconduct in this course, please contact me.

Other sources of information on academic misconduct (integrity) to which you can refer include:

- Committee on Academic Misconduct (go.osu.edu/coam)
- Ten Suggestions for Preserving Academic Integrity (go.osu.edu/ten-suggestions)
- Eight Cardinal Rules of Academic Integrity (go.osu.edu/cardinal-rules)

Copyright for Instructional Materials

The materials used in connection with this course may be subject to copyright protection and are only for the use of students officially enrolled in the course for the educational purposes associated with the course. This does include materials developed by the instructor for the class (e.g., practice problems, quizzes, exams). Copyright law must be considered before copying, retaining, or disseminating materials outside of the course.

Statement on Title IX

All students and employees at Ohio State have the right to work and learn in an environment free from harassment and discrimination based on sex or gender, and the university can arrange interim measures, provide support resources, and explain investigation options, including referral to confidential resources.

If you or someone you know has been harassed or discriminated against based on your sex or gender, including sexual harassment, sexual assault, relationship violence, stalking, or sexual exploitation, you may find information about your rights and options on Ohio State's Title IX website (titleix.osu.edu) or by contacting the Ohio State Title IX Coordinator at titleix@osu.edu. Title IX is part of the Office of Institutional Equity (OIE) at Ohio State, which responds to all bias-motivated incidents of harassment and discrimination, such as race, religion, national origin and disability. For more information, visit the OIE website (equity.osu.edu) or email equity@osu.edu.

Commitment to a Diverse and Inclusive Learning Environment

The Ohio State University affirms the importance and value of diversity in the student body. Our programs and curricula reflect our multicultural society and global economy and seek to provide opportunities for students to learn more about persons who are different from them. We are committed to maintaining a community that recognizes and values the inherent worth and dignity of every person; fosters sensitivity, understanding, and mutual respect among each member of our community; and encourages each individual to strive to reach their own potential. Discrimination against any individual based upon protected status, which is defined as age, color, disability, gender identity or expression, national origin, race, religion, sex, sexual orientation, or veteran status, is prohibited.

Your Mental Health

As a student you may experience a range of issues that can cause barriers to learning, such as strained relationships, increased anxiety, alcohol/drug problems, feeling down, difficulty concentrating and/or lack of motivation. These mental health concerns or stressful events may lead to diminished academic performance or reduce a student's ability to participate in daily activities. No matter where you are engaged in distance learning, The Ohio State University's Student Life Counseling and Consultation Service (CCS) is here to support you. If you find yourself feeling isolated, anxious or overwhelmed, on-demand mental health resources (go.osu.edu/ccsondemand) are available. You can reach an on-call counselor when CCS is closed at 614- 292-5766**. 24-hour emergency help** is available through the National Suicide Prevention Lifeline website (suicidepreventionlifeline.org) or by calling 1-800-273-8255(TALK). The Ohio State Wellness app (go.osu.edu/wellnessapp) is also a great resource.

Requesting Accommodations

The university strives to make all learning experiences as accessible as possible. In light of the current pandemic, students seeking to request COVID-related accommodations may do so through the university's request process, managed by Student Life Disability Services. If you anticipate or experience academic barriers based on your disability including mental health, chronic or temporary medical conditions, please let me know immediately so that we can privately discuss options. To establish reasonable accommodations, I may request that you register with Student Life Disability Services (SLDS). After registration, make arrangements with me as soon as possible to discuss your accommodations so that they may be implemented in a timely fashion. SLDS can be contacted by phone (614-292-3307), through their website (slds.osu.edu), by email (slds@osu.edu), or in person (Baker Hall 098, 113 W. 12th Avenue).

This course requires use of CarmenCanvas (Ohio State's learning management system) and other online communication and multimedia tools. If you need additional services to use these technologies, please request accommodations with your instructor.

Appendix 3: Data analysis courses approved by the ESGP GSC.

Course Number	Credit Hours	Additional Info	Instructor	Syllabus? Y/N
ENR 8780	3	Quantitative Methods for Natural Resources	Robert Gates	Y
Geography 8102	3	Advanced Spatial Data Analysis	Elisabeth Root	Y
HCS 5887	3	Introduction to Experimental Design	David Barker	y
Microbiology 5161	3	Bioinformatics and Geonomics	Igor Jouline	Y
Microbiology 8161	3	Microbiome Informatics	Matt Sullivan	Y
PUBHBIO 7225	3	Survey Sampling	Stanley Lemeshow	Y
ENTMLGY	3	Entomological Techniques and Data Analysis	Kayla Perry and Sam Ward	Y

Appendix 4

SYLLABUS
ENTMLGY 7920

Presentation Skills for Scientists

Spring 2023 (full term)

2 credit hours
Online, 3-5 pm Monday and Wednesday

COURSE OVERVIEW

Department of Entomology

Location:

Columbus Campus: 245 Kottman Hall

Wooster Campus: 300 Wooster Science Building

Co-Instructors

Instructor: Dr. Kelley Tilmon
Email address: Tilmon.1@osu.edu (email is preferred contact method, Office Phone: 330-202-3529)
Office hours: virtual, by appointment

Instructor: Dr. Mary Gardiner

Email address: Gardiner.29@osu.edu (preferred contact method, no office phone, Columbus Department Main Office: 614-292-8209)

Office hours: virtual, by appointment (Campus office 251 Kottman Hall)

Prerequisites

Graduate standing or successful petition status (https://gradsch.osu.edu/sites/default/files/resources/pdfs/SeniorPetitionFORM.pdf)

Course description

This course is a seminar for graduate students in STEM fields who are interested in developing and improving their written and graphical communication skills. We focus on designing and communicating research presentations that are understandable to interdisciplinary audiences.

Course learning outcomes

By the end of this course, students should successfully demonstrate the communication skills needed to communicate effectively in poster and oral presentation formats.

HOW THIS ONLINE COURSE WORKS

Mode of delivery: This course is a hybrid format. The course will meet at scheduled course times either online via zoom or in person in (add room) (3-5 on Monday and Wednesday).

Pace of online activities: This course is divided into **weekly modules**. Students are expected to attend all class sessions and complete homework activities as described in the modules.

Credit hours and work expectations: This is a **2-credit-hour course**. According to Ohio State policy (go.osu.edu/credithours), students should expect around 4 hours per week of time spent on direct instruction (instructor content and Carmen activities, for example) in addition to 4 hours of homework (reading and assignment preparation, for example) to receive a grade of (C) average.

Attendance and participation requirements: Students are expected to attend class and participate as presenters and peer-reviewers.

- **We will make exceptions to our attendance policy in cases of illness or emergency**. Students must alert the instructors, and provide either a doctor's note documenting their illness or describe the emergency faced as soon as possible prior to or following their absence.

COURSE MATERIALS AND TECHNOLOGIES

Textbooks

- No textbook is required

Course technology

Technology support

For help with your password, university email, Carmen, or any other technology issues, questions, or requests, contact the Ohio State IT Service Desk. Standard support hours are available at ocio.osu.edu/help/hours, and support for urgent issues is available 24/7.

- **Self-Service and Chat support:** ocio.osu.edu/help
- **Phone:** 614-688-4357(HELP)
- **Email:** servicedesk@osu.edu
- **TDD:** 614-688-8743

Technology skills needed for this course

- Basic computer (e.g., presentation and word processing software), and web-browsing skills
- Navigating Carmen (go.osu.edu/canvasstudent)
- CarmenZoom virtual meetings (go.osu.edu/zoom-meetings). You must log in to Zoom sessions using the OSU system and your OSU login, as your login will be linked to grading.

Required equipment

- Computer: current Mac (MacOs) or PC (Windows 10) with high-speed internet connection
- Webcam: built-in or external webcam, fully installed and tested
- Microphone: built-in laptop or tablet mic or external microphone
- Other: a mobile device (smartphone or tablet) to use for BuckeyePass authentication

Required software

- Microsoft Office 365: All Ohio State students are now eligible for free Microsoft Office 365. Full instructions for downloading and installation can be found at go.osu.edu/office365help.

Carmen access

You will need to use BuckeyePass (buckeyepass.osu.edu) multi-factor authentication to access your courses in Carmen. To ensure that you are able to connect to Carmen at all times, it is recommended that you take the following steps:

- Register multiple devices in case something happens to your primary device. Visit the BuckeyePass - Adding a Device help article for step-by-step instructions (go.osu.edu/add-device).
- Request passcodes to keep as a backup authentication option. When you see the Duo login screen on your computer, click **Enter a Passcode** and then click the **Text me new codes** button that appears. This will text you ten passcodes good for 365 days that can each be used once.
- Download the Duo Mobile application (go.osu.edu/install-duo) to all of your registered devices for the ability to generate one-time codes in the event that you lose cell, data, or Wi-Fi service

If none of these options will meet the needs of your situation, you can contact the IT Service Desk at 614-688-4357(HELP) and IT support staff will work out a solution with you.

GRADING AND FACULTY RESPONSE

How your grade is calculated

ASSIGNMENT CATEGORY	PERCENTAGE
3-Minute Elevator Speech	10%
Introduction	20%
10-Minute Presentation	35%
Poster	35%
Total	**100%**

See course schedule below for due dates.

Descriptions of major course assignments

3 Minute Elevator Speech

Description: The purpose of this assignment is to gain skills distilling a research-related subject (such as your thesis or dissertation topic) into a brief, succinct oral communication without visual aids, that can be understood by a general audience. See course schedule for timeline details.

Academic integrity: This assignment is to be original work on your part, with feedback from instructors and peers on an early practice draft before the graded version. You are expected to behave with academic integrity in the performance of this assignment.

Introduction

Description: In some ways the Introduction of a scientific talk is the most important part of the presentation, where you set the stage for your subject, convince the audience of its relevance, and secure their interest in your topic. This semester you will work on a 10-minute scientific talk. Because of the importance of the Introduction we will spend time on this segment of the talk first, with a practice/feedback session and later a graded session. Ultimately this Introduction will be incorporated into your full 10-minute talk. See course schedule for timeline details.

Academic integrity: This assignment is to be original work on your part, with feedback from instructors and peers on an early practice draft before the graded version. You are expected to behave with academic integrity in the performance of this assignment.

10 Minute Presentation

Description: You will produce a 10-minute scientific talk, preferentially based on your own research, with practice sessions and instructor/peer feedback before the graded version. See course schedule for timeline details.

Academic integrity: This assignment is to be original work on your part, with feedback from instructors and peers on an early practice draft before the graded version. You are expected to behave with academic integrity in the performance of this assignment.

Poster

Description: You will produce a scientific poster, preferentially based on your own research, with practice drafts and instructor/peer feedback before the graded version. See course schedule for timeline details.

Academic integrity: This assignment is to be original work on your part, with feedback from instructors and peers on an early practice draft before the graded version. You are expected to behave with academic integrity in the performance of this assignment.

Late assignments

Because the 3-minute elevator speech, Introduction and 10-Minute Presentation will be delivered during class, late presentations will not be accepted. Late posters will receive a penalty of one letter grade per 24 h. For example, an A poster turned in late but within 24 h of the due date will receive a B, within 48 a C and so forth. Exceptions will be made for ALL assignments due to illness, with a doctor's note, or emergency (validity of emergencies evaluated on a case-by-case basis). If possible, students should alert instructors to their inability to meet a deadline prior to the deadline, but we understand with some emergencies this will not be possible. Please refer to the course schedule for due dates.

Grading scale

93–100: A
90–92.9: A-
87–89.9: B+
83–86.9: B
80–82.9: B-
77–79.9: C+
73–76.9: C
70–72.9: C-
67–69.9: D+
60–66.9: D
Below 60: E

Instructor feedback and response time

Instructors may be reached by email at gardiner.29@osu.edu and tilmon.1@osu.edu. Instructors will attempt to respond within 48 hours during the instructional week.

Instructors will attempt to return assignments in a timely manner following the due date.

You can call **614-688-4357(HELP)** at any time if you have a technical problem.

OTHER COURSE POLICIES

Discussion and communication guidelines

The following are the expectations for how we should communicate as a class. Above all, please remember to be respectful and thoughtful.

- **Writing style**: For presentations and posters, you should use good grammar, check spelling, and use appropriate punctuation.
- **Tone and civility**: We will maintain a supportive learning community where everyone feels safe and comfortable working on improving their presentation skills. Remember that sarcasm doesn't always come across online.

Academic integrity policy

See **Descriptions of major course assignments**, above, for specific guidelines about collaboration and academic integrity in the context of this online class.

Ohio State's academic integrity policy

Academic integrity is essential to maintaining an environment that fosters excellence in teaching, research, and other educational and scholarly activities. Thus, The Ohio State University and the Committee on Academic Misconduct (COAM) expect that all students have read and understand the university's *Code of Student Conduct* (studentconduct.osu.edu), and that all students will complete all academic and scholarly assignments with fairness and honesty. Students must recognize that failure to follow the rules and guidelines established in the university's *Code of Student Conduct* and this syllabus may constitute "Academic Misconduct."

The Ohio State University's *Code of Student Conduct* (Section 3335-23-04) defines academic misconduct as: "Any activity that tends to compromise the academic integrity of the university or subvert the educational process." Examples of academic misconduct include (but are not limited to) plagiarism, collusion (unauthorized collaboration), copying the work of another student, and possession of unauthorized materials during an examination. Ignorance of the university's *Code of Student Conduct* is never considered an excuse for academic misconduct, so I recommend that you review the *Code of Student Conduct* and, specifically, the sections dealing with academic misconduct.

If I suspect that a student has committed academic misconduct in this course, I am obligated by university rules to report my suspicions to the Committee on Academic Misconduct. If COAM determines that you have violated the university's *Code of Student Conduct* (i.e., committed academic misconduct), the sanctions for the misconduct could include a failing grade in this course and suspension or dismissal from the university.

If you have any questions about the above policy or what constitutes academic misconduct in this course, please contact the instructors.

Other sources of information on academic misconduct (integrity) to which you can refer include:

- Committee on Academic Misconduct web page (go.osu.edu/coam)
- Ten Suggestions for Preserving Academic Integrity (go.osu.edu/ten-suggestions)
- Eight Cardinal Rules of Academic Integrity (go.osu.edu/cardinal-rules)

Copyright for instructional materials

The materials used in connection with this course may be subject to copyright protection and are only for the use of students officially enrolled in the course for the educational purposes associated with the course. Copyright law must be considered before copying, retaining, or disseminating materials outside of the course.

Safe and Healthy Buckeyes

Health and safety requirements: All students, faculty and staff are required to comply with and stay up to date on all university safety and health guidance (https://safeandhealthy.osu.edu), which includes wearing a face mask in any indoor space and maintaining a safe physical distance at all times. Non-compliance will result in a warning first, and disciplinary actions will be taken for repeated offenses.

Creating an environment free from harassment, discrimination, and sexual misconduct

The Ohio State University is committed to building and maintaining a community to reflect diversity and to improve opportunities for all. All Buckeyes have the right to be free from harassment, discrimination, and sexual misconduct. Ohio State does not discriminate on the basis of age, ancestry, color, disability, ethnicity, gender, gender identity or expression, genetic information, HIV/AIDS status, military status, national origin, pregnancy (childbirth, false pregnancy, termination of pregnancy, or recovery therefrom), race, religion, sex, sexual orientation, or protected veteran status, or any other bases under the law, in its activities, academic programs, admission, and employment. Members of the university community also

have the right to be free from all forms of sexual misconduct: sexual harassment, sexual assault, relationship violence, stalking, and sexual exploitation.

To report harassment, discrimination, sexual misconduct, or retaliation and/or seek confidential and non-confidential resources and supportive measures, contact the Office of Institutional Equity:

1. Online reporting form at equity.osu.edu,
2. Call 614-247-5838 or TTY 614-688-8605,
3. Or Email equity@osu.edu

The university is committed to stopping sexual misconduct, preventing its recurrence, eliminating any hostile environment, and remedying its discriminatory effects. All university employees have reporting responsibilities to the Office of Institutional Equity to ensure the university can take appropriate action:

- All university employees, except those exempted by legal privilege of confidentiality or expressly identified as a confidential reporter, have an obligation to report incidents of sexual assault immediately.

- The following employees have an obligation to report all other forms of sexual misconduct as soon as practicable but at most within five workdays of becoming aware of such information: 1. Any human resource professional (HRP); 2. Anyone who supervises faculty, staff, students, or volunteers; 3. Chair/director; and 4. Faculty member.

This course adheres to The Principles of Community adopted by the College of Food, Agricultural, and Environmental Sciences. These principles are located on the Carmen site for this course; and can also be found at https://go.osu.edu/principlesofcommunity. For additional information on Diversity, Equity, and Inclusion in CFAES, contact the CFAES Office for Diversity, Equity, and Inclusion (https://equityandinclusion.cfaes.ohio-state.edu/). If you have been a victim of or a witness to a bias incident, you can report it online and anonymously (if you choose) at https://studentlife.osu.edu/bias/report-a-bias-incident.aspx.

Your mental health: Counseling and Consultation Services

As a student you may experience a range of issues that can cause barriers to learning, such as strained relationships, increased anxiety, alcohol/drug problems, feeling down, difficulty concentrating and/or lack of motivation. These mental health concerns or stressful events may lead to diminished academic performance or reduce a student's ability to participate in daily activities. The Ohio State University offers services to assist you with addressing these and other concerns you may be experiencing. If you or someone you know are suffering from any of the aforementioned conditions, you can learn more about the broad range of confidential mental health services available on campus via the Office of Student Life Counseling and

Consultation Services (CCS) by visiting ccs.osu.edu or calling (614) 292- 5766. CCS is located on the 4th Floor of the Younkin Success Center and 10th Floor of Lincoln Tower. You can reach an on-call counselor when CCS is closed at (614) 292-5766 and 24 hour emergency help is also available through the 24/7 National Suicide Prevention Hotline at 1-(800)-273-TALK or at suicidepreventionlifeline.org.

Requesting disability accommodations

The university strives to make all learning experiences as accessible as possible. In light of the current pandemic, students seeking to request COVID-related accommodations may do so through the university's request process, managed by Student Life Disability Services. If you anticipate or experience academic barriers based on your disability (including mental health, chronic, or temporary medical conditions), please let me know immediately so that we can privately discuss options. To establish reasonable accommodations, I may request that you register with Student Life Disability Services. After registration, make arrangements with me as soon as possible to discuss your accommodations so that they may be implemented in a timely fashion. SLDS contact information: slds@osu.edu; 614-292-3307; slds.osu.edu; 098 Baker Hall, 113 W. 12th Avenue.

Accessibility of course technology

This online course requires use of CarmenCanvas (Ohio State's learning management system) and other online communication and multimedia tools. If you need additional services to use these technologies, please request accommodations with your instructor.

- Canvas accessibility (go.osu.edu/canvas-accessibility)
- Streaming audio and video
- CarmenZoom accessibility (go.osu.edu/zoom-accessibility)
- Collaborative course tools

COURSE SCHEDULE

Refer to the Carmen course for up-to-date assignment due dates.

Week	Dates	Location	Topics, Readings, Assignments, Deadlines
1	January 9	In Person	Introductions and Course Information, Elevator Speeches (Gardiner, Peer Group Activity)
	January 11	Zoom	Slide Design Basics (Gardiner Lecture)
2	January 16		*Martin Luther King Jr. Day – No Class*
	January 18	Zoom	Preparing a Scientific 10-Minute Talk (Gardiner Lecture)
3	January 23	In Person	Deliver Elevator Speeches (Class Presentation for Feedback)
	January 25	In Person	Deliver Elevator Speeches (Class Presentation for Feedback)
4	January 30	In Person	Deliver Elevator Speeches (Class Presentation for Feedback)
	February 1	Zoom	Creating Effective Posters (Tilmon Lecture)
5	February 6	Zoom	Speaking to the Extension Audiences (Tilmon Lecture)
	February 8	In Person	Deliver Elevator Speeches (Class Presentation for Grade)
6	February 13		No class, presentation worktime
	February 15	In Person	Presentation of 10 Minute Talk Introduction (Class Feedback)
7	February 20	In Person	Presentation of 10 Minute Talk Introduction (Class Feedback)
	February 22	In Person	Presentation of 10 Minute Talk Introduction (Class Feedback)
8	February 27	Zoom	Effective Communication in Teaching (Guest Lecture)
	March 1		No class, presentation worktime
9	March 6	Zoom	Academic Use of Social Media (Guest Lecture)
	March 8	Zoom or In Person	Meet with Peer, Practice Session of 10 Minute Talk
10	March 13		Spring Break
	March 15		Spring Break
11	March 20	In Person	Presentation of Full 10 Minute Talk (Introduction Graded, Class Feedback on Full Presentation)
	March 22	In Person	Presentation of Full 10 Minute Talk (Introduction Graded, Class Feedback on Full Presentation)

Week	Dates	Location	Topics, Readings, Assignments, Deadlines
12	March 27	In Person	Presentation of Full 10 Minute Talk (Introduction Graded, Class Feedback on Full Presentation)
	March 29	In Person	Presentation of Full 10 Minute Talk (Introduction Graded, Class Feedback on Full Presentation)
13	April 3	Zoom	Poster Rough Draft for Workshop (Projected Class Activity)
	April 5	In Person	Presentation of Full 10 Minute Talk (Graded)
14	April 10	In Person	Presentation of Full 10 Minute Talk (Graded)
	April 12	In Person	Presentation of Full 10 Minute Talk (Graded)
15	April 17		No class, poster worktime
	April 19		No class, poster worktime
16	April 24	In Person	Poster Second Draft for Workshop (Printed Class Activity)
	April 28 (4:00-5:45 pm)	In Person	FINAL EXAM: Poster Mixer (With Invited Guests, Submit Posters for Grade)

Appendix 5. Grant Writing Corse Choices Approved by the ESGP GSC.

Course Number	Credit Hours	Additional Info	Instructor
Animal Science 6100	1	AU (half semester course)	Chanhee Lee
Anthropology 8828	3	Writing Research proposals	Mark Moritz
BSGP 7070 (Biomedical Sciences Graduate Program)	4	Fundamentals of Grant Writing	Multiple Instructors
CRPLAN 6610/PUBAFRS 7501	3	Grant Writing in the Public Sector	Gretchen Hammond
Educational Studies 5765	3	Grant Writing	Tzu-Jung Lin
EEOB6620/EEOB 6630	3	The first part focuses on paper writing and the second part focuses on grant writing	Stu Ludsin
Entomology 7930	2	Scientific Writing and Grant Proposal Development	Mary Gardiner
Microbiology 6790/Chemistry 6790	2	Special Topics: Scientific Writing	Karin Musier-Forsyth, Michael Ibba, Susan M. Lang
PUBHHBP 8899.02	1	Specifically for NIH F31; Students are expected to take the course in the fall and spring of the same academic year – it spans the semesters. It is one credit for each semester	Kathy Lancaster

Appendix 6: ESGP Graduate Program: M.S.

All M.S. students are required to complete a total of 30 credit hours to earn the M.S. These credit hours must be a combination of required ESGP courses, approved elective courses, and research hours taken in the advisor's home department.

All M.S. students are required to take one course in biological foundational science which can be chosen from the following list (3 credits):

Course	Title	Credits
ASM 5786	Environmental Issues in East Asia	3
ENR 5250.01/ENR 5250.02	Wetland Ecology Restoration/Wetland Field Laboratory	3/1
ENR 5263	Biology of Soil Ecosystems	3
ENR 5270	Soil Fertility	3
ENR 5560	Rehabilitation/Restoration of Ecosystems	3
ENR 7333	Successional Dynamics of Forests	3
ENTMLGY 6410	Insect Ecology and Evolutionary Processes	3
ENVENG 5217	Applied Mathematical Ecology	3
PUBHEHS 5315	Principles of Toxicology	3
PUBHEHS 5335	Ecology of Infectious Diseases	3
PUBHEHS 6320	Global Health and Environmental Microbiology	3
PUBHEHS 7360	Water Contamination: Sources and Health Impact	3
PUBHEHS 7365	Environmental and Human Health Risk Assessment	3
PUBHEHS 7375	Quantitative Microbial Risk Analysis Modeling	3
EEOB 5420	Aquatic Ecosystems – Ecology of Inland Waters	1.5 – 4
EEOB 5470	Community and Ecosystem Ecology	3
EEOB 6210	Ecotoxicology	3
MICRO 5155	Environmental Microbiology	3
MICRO 6155	Microbial Ecology	3
HCS 5602	The Ecology of Agriculture	3

All M.S. students are required to take one course in the physical foundational science which can be chosen from the following list (3 credits):

Course	Title	Credits
CBE 5771	Air Pollution	3
CHEM 6550	Atmospheric Chemistry	3
ENR 5310/FABENG 5310	Ecological Engineering and Science	3
ENR 5260	Soil Landscapes: Morphology, Genesis and Classification	3
ENR 5261	Environmental Soil Physics	3
ENR 5262	Environmental Soil Chemistry and Remediation	3
ENR 5268	Soils and Climate Change	2
ENR 5273	Environment Fate and Impact of Contaminants in Soil and Water	3
FABENG 5550	Sustainable Waste Management Systems	3
GEOG 5900	Climatology: Weather, Climate, and Global Warming	3
EARTHSCI 5621	Introduction to Geochemistry	3
EARTHSCI 5651	Hydrogeology	4
EARTHSCI 5718	Aquatic Geochemistry	3
CIVENV 5130	Applied Hydrology	3
ENVENG 5110	Environmental Engineering and Bioprocesses	3
ENVENG 5120	Bioremediation of Groundwater and Soil	3
ENVENG 5140	Air Quality Engineering	3
ENVENG 5195/ PUBHEHS 5395	Engineering Design for Environmental Health	3
ENVENG 5140	Hazardous Waste Management and Remediation	2
ENVENG 5210	Advanced Physical Chemical Treatment Processes	3
ENVENG 6100	Environmental Engineering Analytical Methods	3
ENVENG 6200	Fundamentals of Environmental Engineering	3
ENVENG 6218	Measurement and Modeling of Climate Change	3

ENVENG 6220	Data Analysis in Environmental Engineering	3
ENVENG 6400	Integrated Environmental Chemical Fate and Transport	3
FABENG 5760	Design of Urban Stormwater Control Measures	3
PUBHEHS 6330	Environmental Epigenetics	3

All M.S. students are required to take one course in the social and policy foundational science which can be chosen from the following list (3 credits):

Course	Title	Credits
AEDCON 6300	Environmental and Resources Economics	3
AEDCON 6330	Benefit-Cost Analysis	3
ANTH 7004/ENR 7004	Social-Ecological Systems	3
ANTH 5614	Ethnobotany	3
CRPLAN 6300	Law and Planning I: Land Use	3
CRPLAN 6310	Law and Planning II: Environment and Society	3
CRPLAN 6400	Site Planning and Development	4
CRPLAN 6410	Planning for Sustainable Development	3
CRPLAN 6750	Resolving Social Conflict	3
ENVENG 5600/PUBAFRS 5600	Science, Engineering, and Public Policy	3
ENVENG 6600	Assessment for Human Rights and Sustainability	3
ENR 5325	Forest and Public Lands Policy	3
ENR 5451	Water Policy and Governance	3
ENR 7400	Communicating Environmental Risk	3
ENR 7520	Environmental Science and Law	3
ENR 7380	Climate and Society	3
ENR 8150	Advanced Environmental Risk and Decision Making	3
ISE 5830	Decision Analysis	3
LAW 8309	Environmental Law	2 -4
LAW 8311	Climate Change Law	3
PUBAFRS 6000	Public Policy Formulation and Implementation	4
PUBAFRS 6080	Concepts and Methods of Program Evaluation	4
RURLSOC 5530	Sociology of Agriculture and Food Systems	3
RURLSOC 7550	Rural Community Development in Theory and Practice	3
RURLSOC 7560	Environmental Sociology	3

All M.S. students are required to take one course in the data analysis methods which can be chosen from the following list (3 credits):

Course	Title	Credits
ENR 8780	Quantitative Methods for Natural Resources	3
GEOG 8102	Advanced Spatial Data Analysis	3
HCS 5887	Introduction to Experimental Design	3
MICRO 5161	Bioinformatics and Genomics	3
MICRO 8161	Microbiome Informatics	3
PUBHBIO 7225	Survey Sampling	3

All M.S. students are required to take all the following supplemental training courses, to instill an understanding of the breadth of interdisciplinary research (8 credits, plus research credits):

Course	Title	Credits
ENVENG/ENVSIC 5170	Sustainability and Pollution Prevention Practices	3
ENTMLGY 7920/ENVSCI 7920	Presentation Skills for Interdisciplinary Scientists	2
ENVSCI 7899	Issues in Environmental Science[a]	3[b]
(various; see Appendix 1)	Approved Elective Course(s)	3+

[a] Students are encouraged to enroll in ESGP Seminar once during their first year.

[b] Students are required to take 3 credits of ESGP seminar over three semesters.

Note that petitions to the Graduate Studies Committee can be made to exclude or replace any required course if the student can provide evidence of a similar course taken at OSU or elsewhere.

The minimum total number of semester credit hours required for the ESGP M.S. is 30
Total number of required course credits, excluding research credits is 20
Number of credit hours for research and electives is 10

Guidelines for number of credit hours per term:

Position	Term	Minimum required by Graduate School
Graduate Associate, 50%	autumn or spring	8
	summer	4
Graduate Associate, 25%	autumn or spring	4
	summer	2
Graduate Fellow	autumn or spring	12
	summer	6

Appendix I: List of ESGP Preferred Elective Courses

Course	Title	Credits
ANTH 8891.05	Research Design and Ethnographic Methods	
ENR 5262	Environmental Soil Chemistry and Remediation	3
ENR 5600	Sustainable Agriculture and Food Systems	3
ENR 7530	Soils and Carbon: Stabilization and Permanence	3
ENR 7580	Root and Rhizosphere Ecology	2
HCS 5097.03	Chile Study Abroad: Pre-Departure	1
MICRO 5155	Environmental Microbiology	3
MICRO 6155	Microbial Ecology	3
MICRO 8161	Microbiome Informatics	3
PLNTPTH 5040	The Science of Fungi: Mycology	3
PUBHEHS 5320	Climate Change and Human Health	3
PUBHEHS 5340	Air Contaminants and Public Health	3
PUBHEHS 5345	Infections Disease Modeling in Humans and Animals	3
PUBHEHS 6390	Major Human Diseases in Global Public Health	3
PUBHEHS 7380	Exposure Science Modeling Techniques	3
PUBHEPI 7411	Environmental Epidemiology	3
PUBHEHS 8340	Molecule Techniques for Environmental Health Sciences	3

Appendix 7: ESGP Graduate Program: Ph.D.

All Ph.D. students are required to complete a total of 80 credit hours to earn the Ph.D. These credit hours must be a combination of required ESGP courses, approved elective courses, and pre- and post-candidacy research hours taken in the advisor's home department.

All Ph.D. students are required to take two courses in biological foundational science which can be chosen from the following list (6 credits):

Course	Title	Credits
ASM 5786	Environmental Issues in East Asia	3
ENR 5250.01/ENR 5250.02	Wetland Ecology Restoration/Wetland Field Laboratory	3/1
ENR 5263	Biology of Soil Ecosystems	3
ENR 5270	Soil Fertility	3
ENR 5560	Rehabilitation/Restoration of Ecosystems	3
ENR 7333	Successional Dynamics of Forests	3
ENTMLGY 6410	Insect Ecology and Evolutionary Processes	3
ENVENG 5217	Applied Mathematical Ecology	3
PUBHEHS 5315	Principles of Toxicology	3
PUBHEHS 5335	Ecology of Infectious Diseases	3
PUBHEHS 6320	Global Health and Environmental Microbiology	3
PUBHEHS 7360	Water Contamination: Sources and Health Impact	3
PUBHEHS 7365	Environmental and Human Health Risk Assessment	3
PUBHEHS 7375	Quantitative Microbial Risk Analysis Modeling	3
EEOB 5420	Aquatic Ecosystems – Ecology of Inland Waters	1.5 – 4
EEOB 5470	Community and Ecosystem Ecology	3
EEOB 6210	Ecotoxicology	3
MICRO 5155	Environmental Microbiology	3
MICRO 6155	Microbial Ecology	3
HCS 5602	The Ecology of Agriculture	3

All Ph.D. students are required to take two courses in the physical foundational science which can be chosen from the following list (6 credits):

Course	Title	Credits
CBE 5771	Air Pollution	3
CHEM 6550	Atmospheric Chemistry	3
ENR 5310/FABENG 5310	Ecological Engineering and Science	3
ENR 5260	Soil Landscapes: Morphology, Genesis and Classification	3
ENR 5261	Environmental Soil Physics	3
ENR 5262	Environmental Soil Chemistry and Remediation	3
ENR 5268	Soils and Climate Change	2
ENR 5273	Environment Fate and Impact of Contaminants in Soil and Water	3
FABENG 5550	Sustainable Waste Management Systems	3
GEOG 5900	Climatology: Weather, Climate, and Global Warming	3
EARTHSCI 5621	Introduction to Geochemistry	3
EARTHSCI 5651	Hydrogeology	4
EARTHSCI 5718	Aquatic Geochemistry	3
CIVENV 5130	Applied Hydrology	3
ENVENG 5110	Environmental Engineering and Bioprocesses	3
ENVENG 5120	Bioremediation of Groundwater and Soil	3
ENVENG 5140	Air Quality Engineering	3
ENVENG 5195/ PUBHEHS 5395	Engineering Design for Environmental Health	3
ENVENG 5140	Hazardous Waste Management and Remediation	2
ENVENG 5210	Advanced Physical Chemical Treatment Processes	3
ENVENG 6100	Environmental Engineering Analytical Methods	3
ENVENG 6200	Fundamentals of Environmental Engineering	3
ENVENG 6218	Measurement and Modeling of Climate Change	3

ENVENG 6220	Data Analysis in Environmental Engineering	3
ENVENG 6400	Integrated Environmental Chemical Fate and Transport	3
FABENG 5760	Design of Urban Stormwater Control Measures	3
PUBHEHS 6330	Environmental Epigenetics	3

All Ph.D. students are required to take two courses in the social and policy foundational science which can be chosen from the following list (6 credits):

Course	Title	Credits
AEDCON 6300	Environmental and Resources Economics	3
AEDCON 6330	Benefit-Cost Analysis	3
ANTH 7004/ENR 7004	Social-Ecological Systems	3
ANTH 5614	Ethnobotany	3
CRPLAN 6300	Law and Planning I: Land Use	3
CRPLAN 6310	Law and Planning II: Environment and Society	3
CRPLAN 6400	Site Planning and Development	4
CRPLAN 6410	Planning for Sustainable Development	3
CRPLAN 6750	Resolving Social Conflict	3
ENVENG 5600/PUBAFRS 5600	Science, Engineering, and Public Policy	3
ENVENG 6600	Assessment for Human Rights and Sustainability	3
ENR 5325	Forest and Public Lands Policy	3
ENR 5451	Water Policy and Governance	3
ENR 7400	Communicating Environmental Risk	3
ENR 7520	Environmental Science and Law	3
ENR 7380	Climate and Society	3
ENR 8150	Advanced Environmental Risk and Decision Making	3
ISE 5830	Decision Analysis	3
LAW 8309	Environmental Law	2 -4
LAW 8311	Climate Change Law	3
PUBAFRS 6000	Public Policy Formulation and Implementation	4
PUBAFRS 6080	Concepts and Methods of Program Evaluation	4
RURLSOC 5530	Sociology of Agriculture and Food Systems	3
RURLSOC 7550	Rural Community Development in Theory and Practice	3
RURLSOC 7560	Environmental Sociology	3

All Ph.D. students are required to take one course in grant writing which can be chosen from the following list (1-3 credits):

Course	Title	Credits
ANIMSCI 6100	Research Methods and Writing in Animal Sciences[a]	1
ANTH 8828	Writing Research Proposals in Anthropology	3
BSGP 7070	Fundamentals of Grant Writing	4
CRPLAN 6610/PUBAFRS 7501	Grant Writing in the Public Sector	3
EDUCST 5765	Grant Writing	3
EEOB 6620/EEOB 6630	Scientific Writing in Evolution & Ecology: Manuscripts & Proposals[b]	3
ENTMLGY 7930	Scientific Writing and Grant Proposal Development	2
MICRO 6790/CHEM 6790	Special Topics: Scientific Writing	2
PUBHHBP 8899.02	Seminar for Health Behavior and Health Promotion[c]	1

[a] This course is only half a semester long.

[b] EEOB 6620 focuses on paper writing and EEOB 6630 focuses on grant writing. This is a two part course that takes place over one semester, and each part is 1.5 credits hours.

[c] This course is specifically for NIH F31 and students are expected to take the course in the fall and spring of the same academic year. This course takes places over both semesters and is one credit for each semester.

All Ph.D. students are required to take one course in the data analysis methods which can be chosen from the following list (3 credits):

Course	Title	Credits
ENR 8780	Quantitative Methods for Natural Resources	3
GEOG 8102	Advanced Spatial Data Analysis	3
HCS 5887	Introduction to Experimental Design	3
MICRO 5161	Bioinformatics and Genomics	3

MICRO 8161	Microbiome Informatics	3
PUBHBIO 7225	Survey Sampling	3

All Ph.D. students are required to take all the following supplemental training courses, to instill an understanding of the breadth of interdisciplinary research (8 credits, plus research credits):

Course	Title	Credits
ENVENG/ENVSIC 5170	Sustainability and Pollution Prevention Practices	3
ENTMLGY 7920/ENVSCI 7920	Presentation Skills for Interdisciplinary Scientists	2
ENVSCI 7899	Issues in Environmental Science[a]	3[b]
(various; see Appendix 1)	Approved Elective Course(s)	3+

[a] Students are encouraged to enroll in ESGP Seminar once during their first year.

[b] Students are required to take 3 credits of ESGP seminar over three semesters.

Note that petitions to the Graduate Studies Committee can be made to exclude or replace any required course if the student can provide evidence of a similar course taken at OSU or elsewhere.

The minimum total number of semester credit hours required for the ESGP Ph.D. is 80
Total number of required course credits, excluding research credits is 30
Number of credit hours for research and electives is 50

Guidelines for number of credit hours per term:

Position	Term	Minimum required by Graduate School
Graduate Associate, 50%	autumn or spring	8
	summer	4
Graduate Associate, 25%	autumn or spring	4
	summer	2
Graduate Fellow	autumn or spring	12
	summer	6
Ph.D. Post-Candidacy	autumn or spring	3
	summer	3

Appendix I: List of ESGP Preferred Elective Courses

Course	Title	Credits
ANTH 8891.05	Research Design and Ethnographic Methods	
ENR 5262	Environmental Soil Chemistry and Remediation	3
ENR 5600	Sustainable Agriculture and Food Systems	3
ENR 7530	Soils and Carbon: Stabilization and Permanence	3
ENR 7580	Root and Rhizosphere Ecology	2
HCS 5097.03	Chile Study Abroad: Pre-Departure	1
MICRO 5155	Environmental Microbiology	3
MICRO 6155	Microbial Ecology	3
MICRO 8161	Microbiome Informatics	3
PLNTPTH 5040	The Science of Fungi: Mycology	3
PUBHEHS 5320	Climate Change and Human Health	3
PUBHEHS 5340	Air Contaminants and Public Health	3
PUBHEHS 5345	Infections Disease Modeling in Humans and Animals	3
PUBHEHS 6390	Major Human Diseases in Global Public Health	3
PUBHEHS 7380	Exposure Science Modeling Techniques	3
PUBHEPI 7411	Environmental Epidemiology	3
PUBHEHS 8340	Molecule Techniques for Environmental Health Sciences	3

Appendix 8: Degree Milestones with New Milestones as Track Changes

Formation & Notification of PhD Committee: Before the end of year 1

Plan of study must be submitted by the end of year 1

Approval of 3-page Interdisciplinary Project Proposal by the graduate studies committee by end of year 2

Course Checklist: prior to scheduling candidacy

Candidacy: Once all course requirements have been met: at least one semester before desired graduation semester. Oral is held at least one week after the completion of the written portion and within a month of the written portion.

Dissertation Proposal Form: Must be completed before dissertation. Usually at direction of committee

Application to graduate: must be submitted and approved by the deadline set by graduate school semester of graduation (usually 3rd Friday of the semester student applies).

PhD Course Checklist: Due at time of graduation application

Interdisciplinary Project Dissertation Chapter completion form approved by graduate studied committee 3 weeks prior to semester deadline for submission of dissertation.

Dissertation defense and oral
Exam form: Must be completed and approved by published grad school deadlines each semester.