

## **ASSETT 2017 Faculty Fellows Final Report**

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**Title:** Stimulating Evaluation and Transformation of the ENVS Undergraduate Curriculum

**Description:** My ASSETT Faculty Fellows project had two parts: (1) create a committee in ENVS focused on mapping learning goals across the introductory series (1000/1001) for the undergraduate major during Fall 2017, and (2) create a Faculty Learning Community (FLC) to define and map learning goals across the ENVS curriculum (introductory series, intermediate natural sciences course, intermediate social sciences course, cornerstone, capstone, and honors thesis/senior thesis) during Spring 2018. My motivation to pursue these efforts began while developing the second part of the introductory series, ENVS-1001, with support from a TRESTLE grant. This effort (and the TRESTLE community) primed me to think about learning goals and how this new, important course would fit into the rest of the ENVS curriculum. I became interested in working with my ENVS colleagues to think more about defining and mapping learning goals across our major, but I was not sure if there was broad interest. As an ASSETT Fellow and member of the TRESTLE network, I learned more about how to initiate change within my department. Armed with new approaches and tools, as well as the support of a cross-department community, I started to talk more with my colleagues in ENVS. I found, much to my surprise, that there was quite a bit of interest in doing this type of work. So, we began.

The following sections describe the progress that I made with my colleagues in the ENVS Introductory Series 1000/1001 Committee and FLC during AY2017-2018. One of the great outcomes of these efforts is that they have taken root, and will continue. Lisa Dilling, an ASSETT Fellow in the 2018 cohort, will lead the FLC in AY2018-2019 to continue where our group left off this spring. The next phase of this work will be the subject of her ASSETT project.

### **1. Fall 2017: ENVS Introductory Series 1000/1001 Committee**

**Members:** Eve-Lyn Hinckley (Chair), Jason Neff (Co-Chair), Atreyee Bhattacharya, Max Boykoff, Sharon Collinge, Marianne Holbert, Joel Singley, and Victoria Stout

**Dates Active:** September-December 2017

#### **1.1 Goals of the Committee**

The ENVS Introductory Series 1000/1001 Committee convened during Fall 2017 with the goals of (1) building a community of faculty who teach the introductory courses, (2) mapping the learning goals of the two courses, and (3) establishing a plan for consistent instruction of ENVS 1000 across semesters. The committee formed following Summer 2017 when Joel Singley created a tool for ENVS to track learning goals, supported by a TRESTLE award to Jason Neff (Co-PI) and me (PI).

#### **1.2 Progress by the Committee**

The following sections describe the progress to date on each of the stated goals.

### *1.2.1 Building a community of faculty teaching the introductory courses*

The Committee identified that improvement of resources for teaching the introductory courses—mentorship and a sense of community from experienced faculty, as well as standardized course materials—would help those teaching the series to feel more supported. Convening this committee served to initiate a sense of community among faculty, instructors, and lead teaching assistants (TAs) by providing a forum to share ideas and ask questions. While the Committee will not continue in its present configuration, we recommend that **ENVS maintain a forum for continuing development of the intro series and support of faculty and TAs** (see Next Steps).

The Committee also identified that **faculty mentorship of new instructors** is helpful. For example, Max Boykoff (teaching 1000 in Fall 2017) meets regularly with Atreyee Bhattacharya (teaching 1000 in Spring 2018) to discuss plans and best practices. Similarly, Andy Martin (EBIO) and Jason Neff have provided feedback to me during development of 1001. In lieu of team-teaching the intro courses, mentorship prior to and during one’s first semester teaching 1000 or 1001 is beneficial.

Finally, as new faculty begin teaching these courses, the Committee identified that having **standardized course materials with consistent learning goals** will help provide additional support to instructors (and be beneficial to students). While there is interest in maintaining the flexibility for faculty to put their “spin” on lectures, etc., they should not have to re-create the introductory course materials, nor should the TAs be creating recitation materials anew each semester. We describe this standardization in section 2.3.

### *1.2.2 Mapping the learning goals of 1000 and 1001*

While the process- or skills-based learning goals for 1001 were established at the start of the course, course learning goals for 1000 have not been formalized as clearly, and, if present, have shifted each semester. The Committee agreed that it is critical to identify, communicate, and maintain consistent learning goals for 1000 that map to the overarching ENVS programmatic goals, as well as to higher level (e.g., 3000) courses in the major. Identifying the learning goals for the intro series provides a foundation for a comprehensive mapping effort across courses in the major, as well as for assessing student learning outcomes regularly and systematically.

Joel Singley provided a draft of potential overarching, as well as assessable learning goals for 1000. His draft was based on 1000 learning objectives articulated by Jason Neff and Max Boykoff, as well as the ENVS Program learning goals. This exercise, and subsequent Committee discussions, pointed to the need for students to demonstrate a conceptual understanding of environmental issues (introduced in lectures and readings, assessed in the textbook and exams), and to build quantitative and critical thinking skills through recitations and textbook assessments. Skills include calculations, data exploration, graph interpretation, critical thinking, and complex systems thinking. These skills are picked up in 1001, and subsequent courses.

The Committee spent significant time discussing three important points related to 1000 learning goals:

- (1) Using Excel (and other analysis/graphing platforms) will not occur in 1000; this will be introduced in 1001 and then picked up in higher-level courses.

- (2) Writing will be de-emphasized in 1000; students are already required to take writing courses for the major.
- (3) Ability to think in a complex systems framework—or thinking across science, policy, values—is very difficult to assess. The Committee discussed using case studies and debates to test integration, but this merits more thought/exploration.

### *1.2.3 Establishing a plan for consistent instruction of ENVS-1000 across semesters*

I developed ENVS 1001 to be taught consistently across semesters, and to be transferrable to other instructors. All materials are in a Dropbox, including lectures with annotations, in-class exercises, recitation exercises, exams and keys. A written log describes every class, including its learning goals, what worked and did not, etc. Readings and assessments are assigned from Jason Neff's textbook, *A Changing Planet*; supplementary readings are in the Dropbox with accompanying assessments currently on Canvas. I tested the transferability of these materials in Summer 2017 by giving Joel Singley access to the Dropbox and asking him to make sense of the course without input.

The Committee discussed how to standardize the course materials for 1000 similarly, and identified the following plan:

- (1) **Lectures** will generally expand on content introduced in the textbook and/or introduce material that is not covered in the text depending on instructor interests. Lectures also may be used to create linkages across topics and through the semester that distinctly absent from the (modular and foundational) textbook. To promote active learning in the classroom, instructors can incorporate Clicker questions and in-class exercises may be included depending on instructor preferences regarding student- vs. instructor-centered learning. Previous instructors have identified 10-12 themes (e.g., climate change, poverty and consumption, renewable energy) that are taught as an overview each semester; these will be consistent year-to-year. Instructors will have flexibility with the lectures, in terms of order and presentation (e.g., could present as case studies)
- (2) **Readings** and accompanying assessments in *A Changing Planet* (by Jason Neff) will be used to introduce content and some skills (e.g., graphing). Readings assessments will be assigned for credit to build a common content-oriented framework for students.
- (3) **Recitations** will consist of in-class exercises explored in small groups. There is now a library of recitations that can be used by instructors and this committee recommends moving, over the course of the next three semesters, toward a standard set of recitations that are used consistently and which include a core set of process-based learning goals that will provide a foundation for ENVS 1001 and take a step a more deliberate scaffolding of process/skill oriented learning objectives throughout the ENVS major.

### **1.3 Next Steps**

The Committee identified several action items to address, regarding continued development of 1000 and 1001, as well as mapping the learning goals across courses in the ENVS major. These include:

- (1) Discussion of all aforementioned ideas with the Undergraduate Curriculum Committee (January 2018).

- (2) Development of a mentoring plan and community building for intro series instructors.
- (3) Development of a mentoring plan and community building for the teaching assistants working on the courses.
- (4) Regular and systematic assessment of student learning outcomes and attitudes starting at the intro level and carried throughout the major. We have a Qualtrics survey focused on student attitudes (modified from the Colorado Learning Attitudes toward Science Survey from physics) that was last administered across the ENVS population in 2012. We recommend making this survey a regular component of ENVS 1000. We also suggest the development of a formal pre and post-assessment that focuses on higher-level conceptual learning goals and which provides a baseline assessment of ENVS oriented critical thinking skills. Such a survey will require resources and time to develop and will need to be closely aligned with overall program goals.
- (5) The CLASS survey should be implemented every semester starting in Fall 2018. A well-designed content and process oriented pre/post assessment should be a goal for use starting in Fall 2019.
- (6) Development of a Faculty Learning Community (FLC) in Spring 2018, to begin mapping learning goals across courses in the major.

## **2. Spring: ENVS FLC to Define and Map Learning Goals Across the Major**

**Members:** Eve-Lyn Hinckley (Chair), Amanda Carrico, David Ciplet, Lisa Dilling, and Carrie Vodehnal

**Dates Active:** January 2018 – present

### **2.1 Goals of the FLC**

The ENVS FLC convened six times during Spring 2018 with the goals of (1) beginning to look comprehensively at learning goals across the ENVS major, (2) creating a strategy for including other ENVS faculty in the process of defining learning goals and assessing student outcomes, and (3) defining a plan for implementing change in the undergraduate curriculum. The committee formed following Fall 2017 when I chaired the ENVS Introductory Series 1000/1001 Committee to define learning goals for the foundation of the major.

### **2.2 Progress by the Committee**

The following sections describe the progress to date on each of the stated goals.

#### *2.2.1 Beginning to look comprehensively at learning goals across the ENVS major*

The FLC decided that the best approach was to examine closely each of the major components of the ENVS degree: introductory courses, intermediate natural sciences course, intermediate social sciences course, cornerstone, capstone, and honors thesis/senior thesis. During Spring 2018, the FLC finalized the learning goals for 1000/1001 (drafted by the Fall 2017 Committee) and presented the draft to the larger faculty (see Appendix A). In addition, they drafted a proposal for a revised honors thesis and senior thesis in the major. The latter will be

reviewed and voted on in Fall 2018 (this proposal is not attached, as it has not yet been reviewed/approved by ENVS). Guiding these discussions was a document that maps the program level learning goals across the major, prepared by Jason Neff and the ENVS Undergraduate Curriculum Committee.

### *2.2.2 Creating a strategy for including other ENVS faculty in the process of defining learning goals and assessing student outcomes*

The members of the FLC are committed to stimulating change in the ENVS curriculum, but recognize the importance of getting broader buy-in from the ENVS faculty. Thus, part of the discussions was devoted to how these efforts would scale and be inclusive to set the unit up for long-term adoption. The FLC determined that the next phase of efforts should include interviews with individual faculty to determine how they are currently teaching their courses that fit into the major components of the ENVS degree (see above). Lisa Dilling will conduct these interviews in Fall 2018, to inform how the department should discuss creating standardized learning goals for each component. Following the interviews, the FLC envisions holding a half-day retreat during which the survey data are presented, and then small groups of faculty work together to discuss best practices and define learning goals for each of the major components of the ENVS degree (e.g., those involved with teaching the intermediate natural sciences course will meet at this time, and those teaching the intermediate social sciences course will meet).

### *2.2.3 Defining a plan for implementing change in the undergraduate curriculum*

During Spring 2019, the FLC will digest the results of the half-day retreat and create a timeline/plan for implementation in the department. Faculty members outside of ENVS whose departments have conducted similar transformation efforts will review this timeline/plan, and it will be presented to the ENVS Director and core/affiliated ENVS faculty at the end of the semester.

## Appendix A. Learning Goals for the ENVS Introductory Series

### ENVS-1000 Learning Goals

#### *Overarching:*

- Understand the fundamentals of Earth and environmental science, challenges of inequality, and approaches to developing environmental policy, as described in *A Changing Planet* by Jason Neff and supplementary materials
- Explain how various biological, physical, social and political systems function and are interconnected
- Apply critical thinking skills to address the multiple dimensions of environmental issues

#### *Assessable Learning Goals:*

Demonstrate a basic understanding of foundations and coupled human-environment problems discussed in the course

Describe and distinguish between the multiple dimensions (e.g., science, policy, and values) of complex environmental solutions

Describe and distinguish between empirical (data, measurement) and normative (“should,” value, tradeoffs) claims

Identify and compare who has a stake in an environmental problem, how stakes in an environmental problem may differ according to gender, race, socioeconomic, class, geography and other characteristics, what each stakeholder’s goals and values are, and how their different perspectives influence acceptable solutions

Develop, justify, and apply criteria by which policy effectiveness is judged

Integrate evidence from multiple case studies to explain and evaluate how systems thinking (interconnectedness of biological, physical, social and political systems) is applied to develop environmental solutions

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### ENVS-1001 Learning Goals

#### *Assessable Learning Goals:*

Demonstrate ability to use evidence as the basis for developing decisions about environmental issues

Demonstrate ability to convert between units, and set up unit conversion problems

Demonstrate ability to approach, execute, and complete word problems

Differentiate between evidence and evidence-based claims; demonstrate ability to craft evidence-based claims

Demonstrate ability to conduct exploratory data analysis and visualization

Demonstrate ability to access and analyze long-term data (third-party)

Work effectively in small groups to develop a solution to a complex environmental issue