

2021-2022 Yearly Assessment Report for the Bachelor of Science in Environmental Science & Minor in Environmental Science

Name of Program: B.S. in Environmental Science, Minor in Environmental Science

Type of Program: Major & Minor

College of Arts and Sciences

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Mission Statement for the BS in ENVS

The mission of the Department of Environmental Science is to provide an interdisciplinary and integrated science curriculum in order to develop skills for solving environmental problems in a socially just manner. The program prepares students for careers and graduate study and to be good stewards of the environment.

This mission statement was approved by the department in a general meeting on 24 April, 2015.

Mission Statement for the Minor in ENVS

A minor in Environmental Science provides a science-based interdisciplinary introduction to the field of Environmental Science. Students will gain an understanding of environmental systems and will be able to apply this knowledge to promote sustainability and social justice.

This mission statement was approved by the department in a general meeting on 4 October, 2019.

Program Goals

- Provide an interdisciplinary and integrated science curriculum to develop skills for solving environmental problems.
- Prepare students for careers and graduate study in environmental fields.
- Ground our students in social justice to be good stewards of the environment for future generations.

These program goals were approved by the department in a general meeting on 24 April, 2015.

Program Learning Outcomes for BS in ENVS

Students who complete the degree requirements will be able to:

- PLO 1 – Explain the interdisciplinary nature and complexities of environmental issues.
- PLO 2 – Apply the scientific method to environmental issues.
- PLO 3 – Skillfully communicate knowledge of environmental science.
- PLO 4 – Demonstrate knowledge of environmental conditions so as to promote active participation and social justice.

These program learning outcomes were approved by the department in a general meeting on 24 April, 2015.

Program Learning Outcomes for Minor in ENVS

Students who complete the Minor in ENVS requirements will be able to:

- PLO 1 – Demonstrate and communicate an understanding of basic concepts in Environmental Science.
- PLO 2 – Demonstrate knowledge of the interdisciplinary nature and complexities of key environmental issues.
- PLO 3 – Develop skills in applying the scientific method to environmental issues.

These program learning outcomes for the minor in ENVS were approved by the department in a general meeting on 4 October, 2019. As such, no assessment has yet occurred with these revised PLOs.

Curricular maps for the major and minor are shown in Tables 1 and 2. Table 3 illustrates how PLOs support USF institutional learning outcomes. These maps are unchanged from previous reports.

Table 1. The curricular map for B.S. in ENVS degree, approved by the department on 24 April 2015. I = Introduced, D = Developed, M = Mastered

| | PLO 1 – Explain the interdisciplinary nature and complexities of environmental issues. | PLO 2 – Apply the scientific method to environmental issues. | PLO 3 – Skillfully communicate knowledge of environmental science. | PLO 4 – Demonstrate knowledge of environmental conditions so as to promote active participation and social justice. |
|---|--|--|--|---|
| 110-Introduction to Environmental Science (LAB) | I | I | I | I |
| 210-Ecology & Human Impacts (LAB) | D | D | I | I |
| 212-Air & Water (LAB) | D | D | I | |
| 250-Environmental Data Analysis | I | D | I | |
| 410-Methods of Environmental Monitoring (FIELD/LAB) | M | M | M | M |
| 311-Environmental Chemistry | D | | D | |
| 320-Restoration Ecology (FIELD/LAB) | D | D | D | I |
| 321-Wetland Ecology (FIELD/LAB) | D | D | D | I |
| 325-California Ecosystems (LAB) | D | D | D | D |
| 330-Environment & Ecosystem Health | M | | M | I |
| 335-Marine Environments (LAB) | D | D | D | |
| 350-Energy & Environment | D | D | D | D |
| 360-Climate Change: Science & Policy | D | D | D | D |
| 366-Environmental Policy | M | D | D | D |
| 371-Fundamentals of Ecosystem Science | D | D | M | D |
| 380-Environmental Engineering | I | | D | |
| 392- Wildfire Ecology and Management | D | D | M | D |
| 392 - Water and Wastewater Treatment | D | D | D | D |

Table 2. Curricular map for the Minor in ENVS, approved by the department on 4 October 2019.
I = Introduced, D = Developed, M = Mastered

| | PLO 1 - Demonstrate and communicate an understanding of basic concepts in Environmental Science | PLO 2 - Demonstrate knowledge of the interdisciplinary nature and complexities of key environmental issues | PLO 3 - Develop skills in applying the scientific method to environmental issues |
|--|---|--|---|
| ENVS-100 Understanding our Environment w/Lab (Core B2) | I | I | I |
| ENVS-110 Intro to Environmental Science w/Lab (Core B2) | I | I | I |
| ENVS-195 First Year Seminar w/Lab (Core B2) | I | I | I |
| ENVS-210 Ecology & Human Impacts w/Lab | D | D | D |
| ENVS-212 Air & Water w/Lab | D | D | I |
| ENVS-250 Environmental Data Analysis (Core B1) | I | I | I |
| ENVS-311 Environmental Chemistry | D | D | |
| ENVS-315 Hydrology w/Lab | D | D | D |
| ENVS-320 Restoration Ecology w/Lab | D | D | D |
| ENVS-321 Wetland Ecology w/Lab | D | D | D |
| ENVS-325 Field Botany w/Lab | D | D | D |
| ENVS-330 Environment & Ecosystem Health | M | D | I |
| ENVS-335 Marine Environments | D | D | D |
| ENVS-340 Environmental Geology w/Lab | D | D | D |

| | | | |
|--|---|---|---|
| ENVS-350 Energy & Environment | D | D | D |
| ENVS-360 Climate Change: Science & Policy | D | D | D |
| ENVS-366 Environmental Policy | D | M | D |
| ENVS-371 Fundamentals of Ecosystem Science | D | D | D |
| ENVS-375 Intro to Geospatial Technology w/Lab | D | D | D |
| ENVS-380 Environmental Engineering | D | D | D |
| ENVS-390 Undergraduate Special Topics w/Lab | D | D | D |
| ENVS-392 Undergraduate Special Topics | D | D | D |
| ENVS-410 Methods of Environmental Monitoring w/Lab | M | M | M |
| Natural Science Electives * | I | I | I |
| Interdisciplinary Electives ** | | D | |

* Natural Science Electives include: BIOL-100, Science of Life, BIOL-105, General Biology-I, BIOL-106, General Biology II, CHEM-111 & 112, General chemistry I w/ Lab, CHEM-113 & 114, General CHEM II w/ Lab, PHYS 100, Introductory Phys. I

** Interdisciplinary Electives include: ARCD-312 Environmental Control Systems, ARCD-320 Sustainable Design, ECON-230 Environmental Economics, ENVA-363 Environmental Law, ENVS-366 Environmental Policy, ENVA-367 Environmental Justice, ENVA-109 Environment and Society, ENVA-310 Commons: Land, Water and Air, ENVA-319 Health and Environment, BIAS-360/POLS-360 Global Environmental Politics, ENVA-396 Community Internships, PHIL-244 Environmental Ethics, THRS-404 Environmental Ethics, THRS-361 Religion and the Environment, MS-301 Green Media, MS-302 Communication for Change, COMS-344 Environmental Communication.

Table 3. The curricular map below describes when and how each program learning outcomes for the B.S. in ENVS degree maps onto the Institutional Learning Outcomes (ILOs) for the University of San Francisco, approved by the department on 24 April 2015.

| Program Learning Outcomes / Institutional Learning Outcomes | PLO 1 – Explain the interdisciplinary nature and complexities of environmental issues. | PLO 2 – Apply the scientific method to environmental issues. | PLO 3 – Skillfully communicate knowledge of environmental science. | PLO 4 – Demonstrate knowledge of environmental conditions so as to promote active participation and social justice. |
|--|--|--|--|---|
| ILO 1 – Students reflect on and analyze their attitudes, beliefs, values, and assumptions about diverse communities and cultures and contribute to the common good. | | | | ✓ |
| ILO 2 – Students explain and apply disciplinary concepts, practices, and ethics of their chosen academic discipline in diverse communities. | ✓ | ✓ | | ✓ |
| ILO 3 – Students construct, interpret, analyze, and evaluate information and ideas derived from a multitude of sources. | ✓ | ✓ | | |
| ILO 4 – Students communicate effectively in written and oral forms to interact within their personal and professional communities. | | | ✓ | |
| ILO 5 – Students use technology to access and communicate information in their personal and professional lives. | | | ✓ | |
| ILO 6 – Students use multiple methods of inquiry and research processes to answer questions and solve problems. | | ✓ | | |
| ILO 7 – Students describe, analyze, and evaluate global interconnectedness in social, economic, environmental and political systems that shape diverse groups within the San Francisco Bay Area and the world. | | | | ✓ |

Assessment Schedule

Table 4 lists past and planned assessment activities for the department of Environmental Science. Note that from 2015-2018 we assessed PLOs 1-3 with a single rubric. Starting in AY 2021-2022, we will shift our assessment strategy to focus on assessing each PLO individually.

Table 4. Summary of PLOs assessed since last APR in spring 2015 as well as plans for future assessment.

| Academic Year | PLO | Assessment method |
|----------------------|---|--|
| 2015-2016 | PLO 1-3 | Single rubric for final presentations in ENVS 212 and 410. |
| 2016-2017 | PLO 1-3 | Single rubric for final presentations in ENVS 212 and 410. |
| 2017-2018 | PLO 1-3 | Single rubric for final presentations in ENVS 212 and 410. |
| 2018-2019 | PLO 4 | Reflection essay in ENVS 410 |
| 2019-2020 | COVID Alternative Assessment | |
| 2020-2021 | Year of Reflection | |
| 2021-2022 | PLO 2-Develop performance indicators | |
| 2022-2023 | Assess PLO2, Develop performance indicators for PLO 3 | Collect data from ENVS212, ENVS392 and ENVS410 |
| 2023-2024 | Assess PLO3, modify PLO4 and develop performance indicators | |
| 2024-2025 | Assess PLO 4 and Minor PLO 1 | |
| 2025-2026 | Academic Program Review | |

Assessment Methodology

Developing performance indicators

In AY 2020-2021, the Department of Environmental Science took the year to reflect on the results of our previous assessment efforts. In general, faculty were not satisfied with the process used to assess the PLOs the first time through the process. Faculty discussed overall goals for the assessment process and how we can adjust our assessment strategies to yield more actionable information about our curriculum. Moving forward we decided to make two changes. First, we decided to begin to assess PLOs individually, and second to establish performance indicators for each PLO, beginning with PLO2.

As a starting point, we reviewed the use of performance indicators for PLO assessment in the Engineering program. We agreed to adopt the following definitions for developing our own performance indicators:

Performance indicators are specific measurable endpoints for each PLO, and provide a common agreement as to what specific performances should be expected from students around each of the outcomes, which allows temporal comparisons and program-level assessment.

Performance indicators specifications:

- Assessed on a 1-4 scale (3: competence)
 - 1 - Student work is below expectations, at an introductory level.
 - 2 - Student work is developing towards meeting expectations
 - 3 - Student work meets expectations
 - 4 - Student work exceeds expectations.
- Varied in terms of cognitive learning
- Should be directly measurable (no ambiguity)
- Should reflect the program's priorities and values
- Are broad enough to be used in more than one class.
- Result in a map that sufficiently covers what the students should achieve by the end of the degree.

Once a working definition for the key performance indicators (KPIs) was discussed and agreed upon, the department had several brainstorming sessions over the course of the year to propose and refine a list of potential KPIs for PLO2.

The following KPIs were adopted by the department in May 2022.

PLO2 performance indicators

1. Collect, record and report appropriate data to answer given question
2. Read and understand applications of the scientific method in the literature
3. Understand and apply appropriate method for measurement and analysis, considering uncertainty
4. Interpret results and draw conclusions given the context of the question
5. Explain experimental results in broader context of key environmental science issues
6. Develop and answer question and hypothesis, considering variability (beginning to end)

Faculty were then tasked with reviewing their courses to determine assignments and/or activities that specifically addressed any of the PLO2 KPIs. They were asked to populate a spreadsheet with assignments and/or activities that could be used to assess the specific KPIs. A summary table for the results of that effort is shown below (Table 5).

Table 5: Curriculum map specific to PLO2 performance indicators. PLO2-1 through 6 are the specific KPIs for PLO2. Check marks indicate an assignment or activity in a class which addresses the KPI. The last column indicates the developmental level that the activities target as per our curriculum map (I: introductory, D: developing, M: Mastery).

| | PLO2-1 | PLO2-2 | PLO2-3 | PLO2-4 | PLO2-5 | PLO2-6 | Cur.map PLO2 |
|---|--------|--------|--------|--------|--------|--------|--------------|
| ENVS110 Intro to Env Science | ✓ | | | ✓ | | ✓ | I |
| CHEM151 Gen Chem II Eng and Sci ** | ✓ | | ✓ | ✓ | | ✓ | I |
| ENVS210 (Ecology) | ✓ | ✓ | | ✓ | ✓ | ✓ | D |
| ENVS212 (Air & Water) | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | D |
| ENVS250 (Data Analysis) | | | ✓ | ✓ | | | D |
| ENVS315-Hydrology | ✓ | | ✓ | ✓ | | | D |
| ENVS 320 (Restoration ecology) | | ✓ | | ✓ | | ✓ | D |
| ENVS 321 (Wetland ecology) | | ✓ | | ✓ | | ✓ | D |
| ENVS325 CA Ecosystems | ✓ | ✓ | | | | ✓ | D |
| ENVS330 (Env and Ecosystem Health) | ✓ | ✓ | ✓ | ✓ | | ✓ | D |
| ENVS335 (Marine Environments) | ✓ | ✓ | ✓ | ✓ | | ✓ | D |
| ENVS340- Environmental Geology | | | | ✓ | | ✓ | D |
| ENVS350 (Energy & Environment) | | ✓ | ✓ | ✓ | | ✓ | D |

| | | | | | | | |
|--------------------------------------|---|---|---|---|---|---|---|
| ENVS360 Clim Chng: Science & Policy | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | D |
| ENVS366 (Environmental Policy) | ✓ | ✓ | | | | ✓ | D |
| ENVS 370 (Ecosystem science) | | ✓ | | ✓ | ✓ | ✓ | D |
| ENVS375 GISI | ✓ | | ✓ | ✓ | | ✓ | D |
| ENVS 380 Environmental Engineering | | | | | | | |
| ENVS392 (Water/wastewater treatment) | | ✓ | ✓ | ✓ | | | D |
| ENVS392 (Wildfire Ecology and Mgm) | | ✓ | | ✓ | | ✓ | D |
| ENVS410-Methods | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | M |

Results and Findings

The department assessment process and plan benefited from taking time to reflect on our past assessment efforts and results during the 2020-2021 academic year (Table 4). The department concluded that we needed to both streamline our efforts and develop more measurable metrics. Thus, during the 2021-2022 academic year the department engaged in a process to develop KPIs for PLO2. The department now has an initial set of KPIs identified and will spend the next academic year applying those KPIs to student work products in order to evaluate the efficacy of using this approach for PLO assessment.

Findings based on discussion related to developing PLO2 indicators

The process of developing KPIs was straightforward and relatively efficient for PLO2. Every faculty member provided input and feedback. The process worked because faculty were able to contribute to the development of KPIs in several different ways and to a degree that made sense for their courses. Thus it was a truly collaborative effort which created a sense of ownership and buy-in for our new assessment process.

Development of future assessment protocol

This academic year we will use the KPIs developed for PLO2 for assessment in a minimum of 3 courses: ENVS 212, ENVS 410 and at least 1 upper division elective. In addition, we will develop KPIs for an additional PLO which has yet to be determined. Knowledge and insight gained from application of PLO2 KPIs in this academic year will be used to inform development of the next set of KPIs.

Findings based on preliminary data collection

Not Applicable, no data collected during this assessment period

Sharing of results

Not applicable, no data collected during this assessment period

Feedback from Previous Report

Feedback from our previous report was very positive and did not include any actionable items.

Summary and Future Plans

Our department focused our assessment activities on developing performance indicators for PLO2. In the coming academic year AY 2022/2023 we intend to complete two tasks:

- Develop performance indicators for one or more of the remaining three PLOs
- Collect data from courses currently running in F22 and S23 on multiple indicators for PLO2.