

# 2020-2021 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
370-Intro to Landscape Ecology & GIS	D	D	M	D
380-Environmental Engineering	I		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-370 Intro to Landscape Ecology & GIS w/Lab	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. Summary of PLOs assessed since last APR in spring 2015 as well as plans for future assessment.

<b>Academic Year</b>	<b>PLO</b>
2015-2016	PLO 1-3
2016-2017	PLO 1-3
2017-2018	PLO 1-3
2018-2019	PLO 4
2019-2020	COVID Alternative Assessment
<b>2020-2021</b>	<b>Year of Reflection</b>
2021-2022	PLO 2
2022-2023	PLO 3
2023-2024	PLO 4
2024-2025	Minor PLO 1
2025-2026	Academic Program Review

## Year of Reflection for BS and Minor in ENVS

In AY 2020-2021 the department of environmental science took the year to reflect on the results of our previous assessment efforts (summarized in Table 5).

Table 5. Summary of assessment activities for the BS in Environmental Science for academic years ending in 2015-2019. During the 2019-2020 academic year standard assessment efforts were suspended due to Covid-19.

Program Learning Outcome	Assessment Method
PLO 1 – Explain the interdisciplinary nature and complexities of environmental issues.	Final project presentations in ENVS 212 (Air and Water) and ENVS 410 (Methods in Environmental Monitoring) were assessed using the same rubric. A broad group of faculty assessed students in both classes. (AY 2015-2016, 2016-2017, 2017-2018)
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.	A student reflection essay in ENVS 410 (Methods in Environmental Monitoring) was assessed using a rubric developed for PLO 4. Assessment was conducted by the course instructors. (AY 2018-2019)

## Summary of Past Assessment Methods and Results

A detailed description of methods and results is included in past reports. Here we present a high level summary to provide context for our assessment reflection. For three consecutive years (AY 2015-2016, 2016-2017, 2017-2018) the ENVS department assessed PLOs 1-3 by evaluating student performance during final project presentations in two courses: ENVS 212 (Air and Water) and ENVS 410 (Methods in Environmental Monitoring). ENVS majors typically take ENVS 212 in their second year and ENVS 410 in their senior year so evaluation of students in these two courses should illustrate student progress toward program learning outcomes. The same rubric (Table 6) was used to evaluate presentations in both courses. In AY 2018-2019 the ENVS department evaluated PLO 4 using a student reflection essay in ENVS 410. The rubric used to evaluate student reflections is shown in Table 7.



Table 6. Rubric used to evaluation PLO 1-3 during final project presentations in ENVS 212 and ENVS 410.

<b>Program Learning Outcome</b>	<b>Mastery of Knowledge Score = 4</b>	<b>Developing Knowledge Score = 3</b>	<b>Introductory Knowledge Score = 2</b>	<b>Inadequate Knowledge Score = 1</b>
<b>PLO 1 – Explain the interdisciplinary nature and complexities of environmental issues</b>	Relationship between the study conducted and complexities of environmental issues are well explained. Student uses anecdotal evidence & examples in a robust and meaningful way.	Student has a solid understanding of the complexities of environmental issues. Explanations of interdisciplinary connections are at a basic level and are relevant to the topic.	Student has a limited understanding of how their topic relates to other environmental issues. They are not able to describe meaningful interdisciplinary connections.	Student has a little to no understanding of how their topic relates to other environmental issues. When asked how their presentation relates to other environmental topics they are not able to respond.
<b>PLO 2 – Apply the scientific method to environmental issues</b>	Student utilizes the scientific method associated with their presentation in a clear and logical fashion.	Student correctly utilizes the scientific method at a basic level or higher. Explains aspects of the scientific method that relate to the project.	Understands the elements associated with the scientific method and a rudimentary understanding of how those elements are connected.	Understands some but not all of the elements associated with the scientific method and lacks a rudimentary understanding of how those elements are connected.
<b>PLO 3 – Skillfully communicate knowledge of environmental science</b>	Student fully understands the scientific context and implications of the material presented. They are able to highlight examples of their project with anecdotal evidence & examples in a robust and meaningful way.	Student presents a problem statement and solution. Knowledge expands upon the information in the presentation with multiple external examples. Level of knowledge exceeds a basic level.	Student presents a problem statement and solution. Knowledge is limited to the information in the presentation with few external examples and in limited context. Level of knowledge exceeds a basic level.	Student fails to clearly present a problem statement and result. Knowledge is limited and some information presented is not understood.

**PLO #4 of the Bachelor of Science in Environmental Science (ENVS) states:** Demonstrate knowledge of environmental conditions so as to promote active participation and social justice.

**Question used to evaluate student learning of PLO #4:** Think of one example of how the Environmental Science degree has developed your knowledge of environmental conditions so as to promote active participation and social justice. Now reflecting on that example, take 10 minutes to...

- Share the specific example you are reflecting on.
- Explain how you actively participated with regards to your example.
- Explain how you will use or have used your degree to promote social justice.

Criteria	Below Expectations (= 1)	Minimal Expectations are Met (= 2)	Meets Expectations (= 3)	Exceeds Expectations (= 4)
Student clearly lists one relevant example of how their ENVS degree has promoted active participation and social justice.	The example stated is <u>poorly explained and/or</u> has only <u>marginal relationship</u> to demonstrating understanding of PLO #4.	The example is <u>nominally stated and/or</u> demonstrates only a <u>moderate</u> relationship to understanding of PLO #4.	The example is <u>reasonably stated and/or</u> demonstrates a <u>reasonable</u> relationship to understanding of PLO #4.	The example is <u>clearly stated and patently demonstrates</u> that the student has understood PLO #4.
Student explains how their degree promoted active participation with regards to their example.	The student provides <u>little or no</u> explanation of how they actively participated in some activity with regards to their example.	The student provides a <u>minimal</u> explanation of how they actively participated in some activity with regards to their example.	The student provides an <u>appropriate</u> explanation of how they actively participated in some activity with regards to their example.	The student provides a <u>clear and convincing</u> explanation of how they actively participated in some activity with regards to their example.
Student explains how their degree has or allows them to promote social justice with regards to their example.	The student provides <u>little or no</u> explanation of how they have or will promote social justice in an activity with regards to their example.	The student provides a <u>minimal</u> explanation of how they have or will promote social justice in an activity with regards to their example.	The student provides an <u>appropriate</u> explanation of how they have or will promote social justice in an activity with regards to their example.	The student provides a <u>clear and convincing</u> explanation of how they have or will promote social justice in an activity with regards to their example.
<b>Total Score</b>	<b>/12 points</b>			

Student Evaluated: \_\_\_\_\_

Faculty Evaluator: \_\_\_\_\_

Overall, the results of our assessments in previous years have been encouraging. For PLOs 1-3 we see substantial improvement between ENVS 212 and ENVS 410, and a high level of achievement overall for students in ENVS 410 (Figure 1). For PLO 4 we found that nearly 100% of our students met or exceeded our expectations for mastery of that PLO (Table 8).

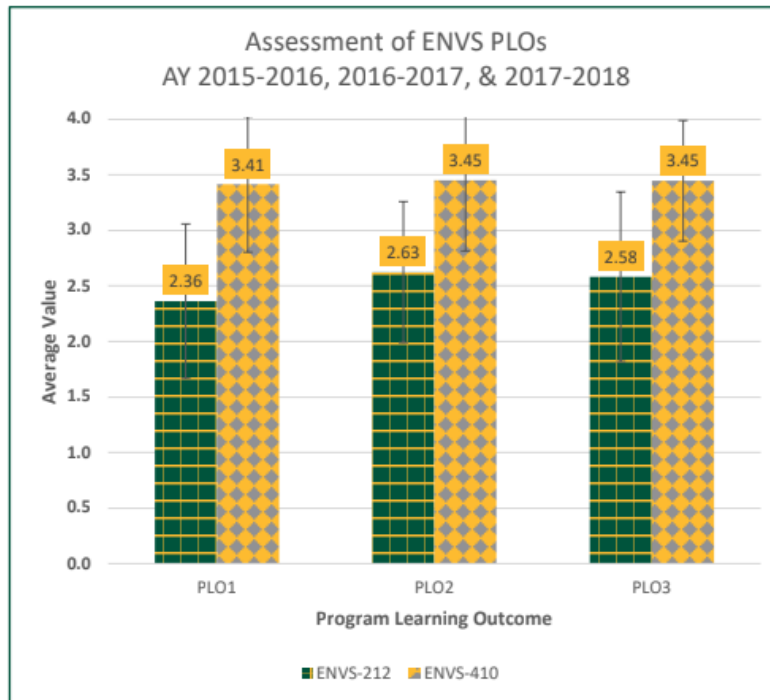


Figure 1. Results from assessment of PLO 1-3 over three academic years using final presentations in two classes (ENVS 212, and ENVS 410). Column heights represent mean values, bars represent one standard deviation from the mean.

Table 8. Results of assessment of PLO 4 in AY 2018-2019.

Criterion	Percentage of Student Evaluations Meeting or Exceeding Minimal Expectations
Student clearly lists one relevant example of how their ENVS degree has promoted active participation and social justice.	100%
Student explains how their degree promoted active participation with regards to their example.	100%
Student explains how their degree has or allows them to promote social justice with regards to their example.	97%

## Reflection

To reflect on our assessment efforts and determine if changes should be made to the assessment plan we engaged in two conversations as a department. The first conversation focused on summarizing our past reports and the feedback we received to determine if we had “closed the loop” in previous years. The second conversation focused on how we might adjust our assessment strategy in the future to gain greater insight into how we can improve our curriculum.

### *Closing the Loop*

A brief summary of the feedback we received and the actions we took to address the feedback is shown in Table 9. In our department meeting on 10/15/2021 the ENVIS faculty revisited this feedback and reflected on our responses. The department felt that while it had been helpful to collect multiple years of data on PLO 1-3 without changing our methods, we now feel ready to create more granular rubrics, which can be used to assess each PLO individually. Another important insight from this activity was that PLO 4, as currently written, is very hard to assess. Given the subjective nature of this PLO, we chose to assess a reflection essay by students enrolled in ENVIS 410 (Methods of Environmental Monitoring). The department agreed with feedback that a reflection essay is not an ideal product to assess. The department concluded that we would like to both revise PLO 4 and select a new product to assess this PLO in the future.

Table 9. Summary of feedback and actions taken following past assessment reports.

<b>Feedback</b>	<b>Actions Taken</b>
Reviewer suggested that our PLO 1-3 rubric is too high level. Suggest unpacking the components of each PLO and assess each individually through a more specific rubric	The general strategy and rubric for PLO 1-3 was discussed at multiple department meetings. Department decided not to change our rubric before using it to collect multiple years of data using the same method. We wanted to get a larger sample size of students and gain more assessment experience before making changes to assessment strategy.
Reviewer suggested that PLO's for major and minor should be different.	New PLOs were created for the minor.
Reviewer suggested changes to our curricular map- unclear how all courses can address PLO 1 and 3.	The circular map was discussed at a faculty meeting. And the department decided not to change the map. We do strive to address PLOs 1- 3 in all classes. Because not all students take all of the courses we need to be sure that content is present across the entire curriculum.
Rubric for PLO 4 could be more granular. Self reflection can be biased, would be better to move toward assessment of a work product	The department discussed PLO 4 and the reflection assignment and has decided to revise the PLO in AY 2021-2022. We will select a new work product to assess in future years.

In addition to the actions taken in response to feedback on assessment reports. Faculty reflected on the changes they made to their courses following assessment discussions over the past several years. For example, the faculty that teach lower division core courses met to discuss assignments and alignment of learning outcomes in ENVS 110, 210, and 212, and 250. Additionally some faculty added new components to their courses based on departmental discussions about the need to improve skills between ENVS 212 and ENVS 410. For example, a faculty member added new components to their upper division electives designed to reinforce the use of Excel and data analysis. Other faculty members added a group project to their upper division electives to prepare students for group work in ENVS 410.

### *Future Assessment Planning*

In our department meeting on 10/29/2021 the 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 the department would like to establish performance indicators for each PLO. 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:

- Assessed on a 1-4 scale (3: competence)
- 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

In AY 2021-2022 the department plans to develop performance indicators to assess PLO 2. To allow some continuity with previous assessment efforts we will continue to assess the same work products: final project presentations in ENVS 212 and ENVS 410. Our second goal for AY 2021-2022 is to work on revising PLO 4. We don't plan to assess PLO 4 again until AY 2023-2024, so this gives us plenty of time to work on the PLO and consider how it fits into the curriculum.

## Summary

The Environmental Science Department used AY 2020-2021 to reflect on past assessment results. We reviewed 5 years of assessment reports and feedback from 2015-2020 and decided to make three changes to our assessment strategy. The first change is to assess each PLO individually. The second change is to develop specific performance indicators to assess each PLO. Lastly we plan to revise PLO 4 to make it more easily measurable. We are hopeful that these adjustments will yield the kind of detailed information needed to continuously improve our curriculum to better achieve the goals of our program.