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| **California State University, Fresno****Jordan College of Agriculture****Plant Science, Masters of Science Program****Plant Science Graduate Program Assessment Coordinator [i]: Sharon Benes** |
| **Student Outcomes Assessment Plan (SOAP)Version 5; February 25, 2021** |
| Mission Statement |
| The mission of the Plant Science Graduate Program is to provide our students with the theoretical and applied knowledge necessary for advanced careers in agricultural sciences. The program builds upon the knowledge and experiences obtained by students in their baccalaureate study in Plant Science or related disciplines. The program provides mentoring by graduate faculty from a wide range of disciplines, with access to modern research equipment and facilities, and an agricultural farm laboratory for field studies. |

## Institutional, Program, and Student Learning Outcomes [a,b,c]

* 1. The Plant Science Graduate Program adheres to the Institutional Learning Outcomes (ILOs) of California State University, Fresno. Fresno State ILO’s are posted on the following webpage: <http://fresnostate.edu/academics/oie/assessment/fresno-state-assessment.html>
	2. Program Learning Outcomes (PLOs) & Student Learning Outcomes
	**PLO 1: Students will be provided fundamental knowledge in plant growth, development, and physiology. This will enable students to:**

**SLO 1.1:** describe the environment of plants and its influence on their growth and development
**SLO 1.2:** integrate theoretical concepts from basic sciences into crop production and agro-ecosystem management.

**SLO 1.3:** conduct scholarly review of primary literature and develop competency in interpreting existing data from scientific papers

**PLO 2: Students will formulate a scientific hypothesis and conduct research to verify the hypothesis using an appropriate experimental design and sampling scheme. This will enable students to:**

**SLO 2.1:** plan and design experiments to test a specific hypothesis

**SLO 2.2:** conduct statistical analyses, interpret the statistical output, and draw valid conclusions

**PLO 3: Students will have knowledge of and familiarity with advanced equipment and analytical techniques. This will enable students to:**

**SLO 3.1:**  evaluate appropriate methods for sampling, sample processing and laboratory analysis demonstrating knowledge of quality control procedures

**PLO 4: Students will enhance their communication skills and be able to:**

**SLO 4.1:** communicate experimental procedures, results, and their conclusions in written format

**SLO 4.2:**  present research findings in a scholarly manner through oral or poster presentation and be able to respond to questions integrating scholarly knowledge into the response.

## Curriculum Map [d]: Courses in which SLO’s are addressed and evaluated

|  | **SLO 1.1** | **SLO 1.2** | **SLO 1.3** | **SLO 2.1** | **SLO 2.2** | **SLO 3.1** | **SLO 4.1** | **SLO 4.2** |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **Core Course** |  |  |  |  |  |  |  |  |
| AGRI 200 |  |  |  | I | I |  |  |  |
| AGRI 201 |  |  |  |  |  | **I** |  |  |
| AGRI 220 |  | I | I |  |  | I | I |  |
| PLANT 257 | I | I | I |  |  | I |  |  |
| PLANT 270 | I | I | I |  |  |  | I | I |
| **Electives** |  |  |  |  |  |  |  |  |
| PLANT 251 | D | D | D |  |  | D | D | D |
| PLANT 261 | D | D | D |  |  | D | D | D |
| PLANT 252 | D | D | D |  |  | D | D | D |
| PLANT 255 | D | D | D |  |  | D | D | D |
| PLANT 250T | D | D | D |  |  | D | D | D |
| **Thesis** |  |  |  |  |  |  |  |  |
| PLANT 299 | M | M | M | M | M | M | M | M |
| **I = Introduced** | **D = Developed** | **M=Mastered** |  |

## SLO’s Mapped to Assessment Measures and Methods [e]

| **Assessment Measure** | **Evaluation****Method** | **SLO****1.1** | **SLO****1.2** | **SLO****1.3** | **SLO****2.1** | **SLO****2.2** | **SLO****3.1** | **SLO****4.1** | **SLO****4.2** |
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| 1. PLANT 257 - Literature Review | DIRECT | X |  | X |  |  |  |  |  |
| 2. PLANT 257 - Article Critique | DIRECT | X |  |  |  |  |  |  |  |
| 3. PLANT 257 - Exam Questions | DIRECT | X | X |  |  |  |  |  |  |
| 4. AGRI 200 – Final Project | DIRECT |  |  |  | X | X |  |  |  |
| 5. AGRI 201 – Final Project | DIRECT |  |  |  |  |  | X |  |  |
| 6. Thesis Proposal  | DIRECT | X | X | X | X |  | X | X |  |
| 7. Thesis Proposal Defense | DIRECT | X | X | X | X |  | X |  | X |
| 8. Thesis Exit Seminar | DIRECT | X | X | X |  | X | X |  | X |
| 9. Written Thesis  | DIRECT | X | X | X | X | X | X | X |  |
| 10. Exit Survey | INDIRECT | X | X | X | X | X | X | X | X |

## Assessment Measures: Description of Assignment and Method (rubric, criteria, etc.) used to evaluate the assignment [f]

* 1. *Direct Measures*
		1. **PLANT 257 Literature Review: 1.1, 1.3**

Students choose a topic of their choice and perform a literature review from the primary literature on a range of physiological topics.
Assessment based on grading rubric used within PLANT 257

* + 1. **PLANT 257 Article Critiques: 1.1**Students read and prepare critical reviews of selected primary literature each week for use in class discussions.
		Assessment based on grading rubric used within PLANT 257
		2. **PLANT 257 Exam Questions: 1.1, 1.2**Students complete essay style questions as part of two exams in PLANT 257. Exam 1 addresses theoretical concepts of crop production (SLO 1.2), while exam 2 addresses interactions between plants and the environment (SLO 1.1).
		Assessed by the graduate committee using an internal rubric
		3. **AGRI 200 Final Project: 2.1, 2.2** Students find a data set, analyze it, and interpret the outcome
		Assessment based on grading rubric used within AGRI 220
		4. **AGRI 201 Final Project: 3.1**Students select a laboratory technique, perform analysis, and summarize outcomes to class in writing
		Assessment based on grading rubric used within AGRI 201
		5. **Thesis proposal: 1.1, 1.2, 1.3, 2.1, 3.1, 4.1**Students write a proposal for their thesis research consisting of 1) an introduction with literature review, 2) a statement of research hypothesis and 3) a Materials & Methods section describing their experimental design, measurements and sampling, analytical procedures. Approx. 12 pages.

Assessed using a standardized departmental rubric that combines both the oral defense and written proposal completed by the thesis committee.

* + 1. **Thesis proposal defense: 1.1, 1.2, 1.3, 2.1, 3.1, 4.2**Students present their thesis proposal to the thesis committee and respond to questions related to the proposal and areas of Plant Science related to their thesis research. Students are given either a pass, conditional pass, or fail
		Assessed using a standardized departmental rubric that combines both the oral defense and written proposal completed by the thesis committee.
		2. **Thesis Exit Seminar: 1.1, 1.2, 1.3, 2.2, 3.1, 4.2**Students present their thesis research to the department (faculty, fellow graduate students, and outside visitors). 45 min. presentation covering the sections of the thesis listed above. An evaluation sheet is provided to faculty and any research scientists attending. Average scores will be tabulated.
		3. **Written thesis: 1.1, 1.2, 1.3, 2.1, 2.2, 3.1, 4.1**

The written thesis is the capstone assignment of the master’s degree providing a thorough overview of the student’s thesis research. Formats vary by discipline, but include a literature review along with sections describing experimental design, data analysis, results, and a discussion of how results integrate into the existing literature.
Assessed using a standardized departmental rubric completed by the thesis committee.

* 1. *Indirect Measures*
		1. **Exit Survey: 1.1, 1.2, 1.3, 2.1, 2.2, 3.1, 4.1, 4.2**Written survey sent to alumni having graduated at least 3 years prior. Questions will address whether the listed learning outcomes were fulfilled and the degree of preparation for their agricultural career. Evaluated by the graduate committee following an internal rubric.

## Assessment Schedule/Timeline [g]

| Academic Year | Assessment Measure | SLOs Assessed |
| --- | --- | --- |
| 2020-2021 | Thesis proposal and defense (A6/A7) | 1.3, 2.1, 4.1, 4.2 |
| 2021-2022 | Exit Survey (B1) | 1.2, 2.2 |
| 2022-2023 | PLANT 257 – Literature Review (A1) | 1.1 |
| 2023-2024 | AGRI 201 – Final Project (A5) | 3.1 |
| 2024-2025 | AGRI 200 – Final project (A4) or Thesis (A9) | 2.2 |
| 2025-2026 | PLANT 257 – Exam Questions (A3) | 1.2 |

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| Closing the Loop [h,j,k]  |
| **Fresno State Closing the Loop process is described immediately below.** |
| An assessment report, which focuses on assessment activities carried out the previous academic year, is submitted in September of each academic year and evaluated by the Learning Assessment Team and Director of Assessment at Fresno State. |
| The Plant Science Graduate faculty will continue to refine the thesis proposal and defense process and align core classes in the curriculum, in particular AGRI 220 (Research Communications) and AGRI 201 (Lab Techniques) to improve student performance on the LO’s related to these assessment activities. The most recent assessment (AY2018-2019) directly assessed SLOs 2.1 and 2.2 through a review of written theses from the previous 5 years. It should be noted that these outcomes underwent a revision in this most recent SOAP update. At the time of that review they were written as follows: **Outcome 2.1:** formulate a research hypothesis and plan and design experiments to test that hypothesis. **Outcome 2.2:** conduct statistical analyses, interpret the statistical output, and make valid conclusionsOur Review found that while students are performing strongly in statistical analyses and descriptions of findings (2.2), many failed to clearly define a research hypothesis (2.1). The reasons for this were identified as a lack of emphasis on hypothesis formulation in core courses. Additionally it was discovered that many of our theses are not hypothesis-focused; rather they emphasize the development of new techniques or technologies, and therefore do not require a research hypothesis. To address this, the committee suggested 1) adding a hypothesis formulation lesson to AGRI 220 (Research Communications), and 2) include a hypothesis criteria to the thesis proposal rubric in order to incentivize inclusion of hypothesis statements.Moving forward, the graduate faculty will pursue a six-year assessment schedule which will allow for the review of progress in all eight SLOs listed in this document. This will begin with the review of SLOs 1.3, 2.1, 4.1, and 4.2 this AY (2020-2021) using the combined thesis proposal and defense rubric. In all other years two or fewer SLOs will be assessed. The data-rich nature of the proposal defense rubric allows for the assessment of multiple SLOs. In AY 2021-2022, SLOs 1.2 and 2.2 will be assessed in tandem through assessment of the literature reviews produced in PLANT 257.  |