

# PLANT SCIENCES

## College of Agricultural & Environmental Sciences

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## Department Office

Advising Center (<https://www.plantsciences.ucdavis.edu/undergraduate/>) is located in 1220 Plant & Environmental Sciences. For more information, see Plant Sciences (<https://www.plantsciences.ucdavis.edu/undergraduate/>).

## Major Programs

- Biotechnology (<https://catalog.ucdavis.edu/departments-programs-degrees/plant-sciences/biotechnology-bs/>)
- International Agricultural Development (<https://catalog.ucdavis.edu/departments-programs-degrees/plant-sciences/international-agricultural-development-bs/>)
- Plant Sciences (<https://catalog.ucdavis.edu/departments-programs-degrees/plant-sciences/plant-science-bs/>)

## Related Courses

See the Biotechnology (BIT) (<https://catalog.ucdavis.edu/courses-subject-code/bit/>), Environmental Horticulture (ENH) (<https://catalog.ucdavis.edu/courses-subject-code/enh/>), Horticulture (HRT) (<https://catalog.ucdavis.edu/courses-subject-code/hrt/>), International Agricultural Development (IAD) (<https://catalog.ucdavis.edu/courses-subject-code/iad/>), and Plant Sciences (PLS) (<https://catalog.ucdavis.edu/courses-subject-code/pls/>) course listings.

## Graduate Study

For related graduate study, see the M.S. degree program in International Agricultural Development, the M.S. and Ph.D. degree programs in the graduate groups of Horticulture & Agronomy, Plant Biology, Ecology, Genetics, Geography, and Soils & Biogeochemistry.

- Agricultural Systems & Environment, Minor (<https://catalog.ucdavis.edu/departments-programs-degrees/plant-sciences/agricultural-systems-environment-minor/>)
- Biotechnology, Bachelor of Science (<https://catalog.ucdavis.edu/departments-programs-degrees/plant-sciences/biotechnology-bs/>)
- Ecological Management & Restoration, Bachelor of Science (<https://catalog.ucdavis.edu/departments-programs-degrees/plant-sciences/ecological-management-restoration-bs/>)
- Environmental Horticulture & Urban Forestry, Bachelor of Science (<https://catalog.ucdavis.edu/departments-programs-degrees/plant-sciences/environmental-horticulture-urban-forestry-bs/>)
- Environmental Horticulture, Minor (<https://catalog.ucdavis.edu/departments-programs-degrees/plant-sciences/environmental-horticulture-minor/>)
- International Agricultural Development, Bachelor of Science (<https://catalog.ucdavis.edu/departments-programs-degrees/plant-sciences/international-agricultural-development-bs/>)
- International Agricultural Development, Minor (<https://catalog.ucdavis.edu/departments-programs-degrees/plant-sciences/international-agricultural-development-minor/>)

- Landscape Restoration, Minor (<https://catalog.ucdavis.edu/departments-programs-degrees/plant-sciences/landscape-restoration-minor/>)
- Plant Sciences, Bachelor of Science (<https://catalog.ucdavis.edu/departments-programs-degrees/plant-sciences/plant-science-bs/>)

## Biotechnology (BIT)

### BIT 001Y – Introduction to Biotechnology (4 units)

*Course Description:* Principles and technologies of biotechnology as applied to agriculture, the environment, and medicine. Business plans and presentation pitches for new biotechnology products. Bioinformatics approaches exploring genomic databases and DNA manipulations in silica.

*Learning Activities:* Lecture 2 hour(s), Web Virtual Lecture 1 hour(s), Discussion 1 hour(s).

*Grade Mode:* Letter.

*General Education:* Science & Engineering (SE).

### BIT 091 – Undergraduate Seminars in Biotechnology (1 unit)

*Course Description:* Undergraduate oriented seminar series focused on biotechnology research and product development. Speakers from campus and the private sectors discuss ongoing research, product development and biotechnology careers.

*Learning Activities:* Seminar 1 hour(s).

*Grade Mode:* Pass/No Pass only.

### BIT 092 – Internship in Biotechnology (1-12 units)

*Course Description:* Work experience on or off campus in subject area pertaining to biotechnology or in a business, industry or agency associated with biotechnology. Internship supervised by faculty member in the animal or plant sciences.

*Prerequisite(s):* Consent of instructor.

*Learning Activities:* Internship 3-36 hour(s).

*Grade Mode:* Pass/No Pass only.

### BIT 098 – Directed Group Study (1-5 units)

*Course Description:* Directed group study.

*Prerequisite(s):* Consent of instructor.

*Learning Activities:* Variable 1-15 hour(s).

*Repeat Credit:* May be repeated.

*Grade Mode:* Pass/No Pass only.

*General Education:* Science & Engineering (SE).

### BIT 099 – Special Study for Undergraduates (1-5 units)

*Course Description:* Special study for undergraduates.

*Prerequisite(s):* Consent of instructor.

*Learning Activities:* Independent Study 3-15 hour(s).

*Grade Mode:* Pass/No Pass only.

**BIT 150 – Applied Bioinformatics (4 units)**

*Course Description:* Concepts and programs needed to apply bioinformatics in biotechnology research. Sequence analysis and annotation and use of plant and animal databases for students in biological and agricultural sciences.

*Prerequisite(s):* BIS 101; (ECS 010 or ECS 015 or PLS 021 or PLS 021V); (PLS 120 or STA 013 or STA 013Y or STA 100); or consent of instructor.

*Learning Activities:* Lecture 2 hour(s), Discussion/Laboratory 2 hour(s).

*Enrollment Restriction(s):* Limited enrollment.

*Credit Limitation(s):* Only 2 units of credit for students who have completed ECS 124.

*Grade Mode:* Letter.

*General Education:* Science & Engineering (SE); Visual Literacy (VL).

**BIT 160 – Principles of Plant Biotechnology (3 units)**

*Course Description:* Principles and concepts of plant biotechnology including recombinant DNA technology, molecular biology, genomics, cell and tissue culture, gene transfer and crop improvement strategies using transgenic crops.

*Prerequisite(s):* (BIS 001A or BIS 002A); (BIS 101 or PLS 152).

*Learning Activities:* Lecture 3 hour(s).

*Credit Limitation(s):* Not open for credit to students who have completed PLB 160. (Former PLB 160.)

*Grade Mode:* Letter.

*General Education:* Science & Engineering (SE).

**BIT 161A – Genetics & Biotechnology Laboratory (6 units)**

*Course Description:* Techniques of genetic analysis at the molecular level including recombinant DNA, gene mapping and basic computational biology.

*Prerequisite(s):* PLS 152 or BIS 101; and consent of instructor.

*Learning Activities:* Lecture 3 hour(s), Laboratory 9 hour(s).

*Credit Limitation(s):* Not open for credit to students who have completed PLB 161A.

*Grade Mode:* Letter.

*General Education:* Science & Engineering (SE).

**BIT 161B – Plant Genetics & Biotechnology Laboratory (4 units)**

*Course Description:* Advanced techniques of genetic analysis at the molecular and cellular levels, including transformation, gene expression and analysis of transgenic plants.

*Prerequisite(s):* PLS 152 or BIS 101; and consent of instructor.

*Learning Activities:* Lecture 1 hour(s), Laboratory 8 hour(s).

*Credit Limitation(s):* Not open for credit to students who have taken PLB 161B. (Former PLB 161B.)

*Grade Mode:* Letter.

*General Education:* Science & Engineering (SE); Scientific Literacy (SL).

**BIT 171 – Professionalism & Ethics in Genomics & Biotechnology (3 units)**

*Course Description:* Real and hypothetical case studies to illustrate ethical issues in genomics and biotechnology. Training and practice in difficult ethical situations and evaluating personal and social consequences.

*Prerequisite(s):* Upper division standing in a natural science major.

*Learning Activities:* Lecture 1 hour(s), Discussion 2 hour(s).

*Grade Mode:* Letter.

*General Education:* Science & Engineering (SE); Scientific Literacy (SL); Writing Experience (WE).

**BIT 188 – Undergraduate Research Proposal (3 units)**

*Course Description:* Preparation and review of a scientific proposal. Problem definition, identification of objectives, literature survey, hypothesis generation, design of experiments, data analysis planning, proposal outline and preparation.

*Prerequisite(s):* Upper division standing.

*Learning Activities:* Lecture/Discussion 3 hour(s).

*Cross Listing:* PLS 188.

*Grade Mode:* Letter.

*General Education:* Science & Engineering (SE); Writing Experience (WE).

**BIT 189L – Laboratory Research in Genomics & Biotechnology (2-5 units)**

*Course Description:* Formulating experimental approaches to current questions in biotechnology; performance of proposed experiments.

*Prerequisite(s):* BIT 188; and consent of instructor.

*Learning Activities:* Laboratory 3-12 hour(s), Discussion 1 hour(s).

*Repeat Credit:* May be repeated 12 unit(s).

*Grade Mode:* Pass/No Pass only.

**BIT 192 – Internship in Biotechnology (1-12 units)**

*Course Description:* Work experience on or off campus in a subject area pertaining to biotechnology or in a business, industry or agency associated with biotechnology. Internship supervised by faculty member in the animal or plant sciences.

*Prerequisite(s):* Consent of instructor.

*Learning Activities:* Internship 3-36 hour(s).

*Grade Mode:* Pass/No Pass only.

**BIT 194H – Honors Thesis in Biotechnology (1-2 units)**

*Course Description:* Independent study of selected topics under the direction of a member or members of the staff. Completion will involve the writing of a senior thesis.

*Prerequisite(s):* BIT 188; BIT 189L; consent of instructor; senior standing in Biotechnology with 3.250 GPA or higher.

*Learning Activities:* Independent Study 3-6 hour(s).

*Grade Mode:* Pass/No Pass only.

*General Education:* Science & Engineering (SE); Writing Experience (WE).

**BIT 198 – Directed Group Study (1-5 units)**

*Course Description:* Directed group study.

*Prerequisite(s):* Consent of instructor.

*Learning Activities:* Variable 1-15 hour(s).

*Repeat Credit:* May be repeated.

*Grade Mode:* Pass/No Pass only.

*General Education:* Science & Engineering (SE).

**BIT 199 – Special Study for Advanced Undergraduates (1-5 units)**

*Course Description:* Special study for advanced undergraduates.

*Prerequisite(s):* Consent of instructor.

*Learning Activities:* Independent Study 3-15 hour(s).

*Grade Mode:* Pass/No Pass only.

## Environmental Horticulture (ENH)

### ENH 006 – Introduction to Environmental Plants (4 units)

*Course Description:* Classification, nomenclature and variation of environmental plants. The use of floral and vegetative characteristics and terminology to key unknown plants. Characteristics of plant groups and basics of climate, soils and plant selection. Identification of 150 common landscape plants.

*Learning Activities:* Lecture 1 hour(s), Discussion 2 hour(s), Laboratory 3 hour(s).

*Grade Mode:* Letter.

*General Education:* Science & Engineering (SE); Visual Literacy (VL).

### ENH 100 – Urban Forestry (4 units)

This version has ended; see updated course, below.

*Course Description:* Principles and practices of planning and managing urban vegetation. Basics of tree appraisal, natural resource inventory, and development of long term urban forest management plans.

*Prerequisite(s):* ENH 001 or PLS 002 or BIS 002B.

*Learning Activities:* Lecture 2 hour(s), Laboratory 3 hour(s), Term Paper.

*Grade Mode:* Letter.

*General Education:* Science & Engineering (SE).

### ENH 100 – Urban Forests are Nature-Based Solutions (4 units)

*Course Description:* Principles and practices of planning and managing urban vegetation, forests, green infrastructures and nature-based solutions. Basics of tree/site monitoring, natural resource inventory, and development of long term urban forest management plans at both local and landscape scales.

*Prerequisite(s):* PLS 002 or BIS 002B or LDA 001.

*Learning Activities:* Lecture 2 hour(s), Laboratory 3 hour(s).

*Grade Mode:* Letter.

*General Education:* Science & Engineering (SE).

This course version is effective from, and including: Winter Quarter 2024.

### ENH 101 – Trees of the Urban Forest (2 units)

*Course Description:* Identification and evaluation of 200 tree species of the urban forest on campus, in the Arboretum, and in the city of Davis; appraised and aesthetic values, condition, and branch structure; contribution of trees to this ecosystem. Bicycle required.

*Prerequisite(s):* ENH 006; or consent of instructor.

*Learning Activities:* Lecture 1 hour(s), Laboratory 2 hour(s).

*Grade Mode:* Letter.

*General Education:* Science & Engineering (SE); Visual Literacy (VL).

### ENH 102 – Physiological Principles in Environmental Horticulture (4 units)

Starting Fall Quarter 2023, this course is no longer offered.

*Course Description:* Physiological principles and processes essential to floriculture, nursery crop production, turf culture and landscape horticulture. Emphasis on the control of vegetative and reproductive development for a broad species range in greenhouse and extensive landscape environments.

*Prerequisite(s):* BIS 001C.

*Learning Activities:* Lecture 3 hour(s), Discussion 1 hour(s).

*Grade Mode:* Letter.

*General Education:* Science & Engineering (SE).

### ENH 105 – Taxonomy & Ecology of Environmental Plant Families (4 units)

*Course Description:* Classification and identification of introduced and native species used in urban forests, with emphasis on floral and vegetative characteristics of the prominent families of angiosperms and gymnosperms, adaptations to environmental variations in western landscapes, and horticultural classification.

*Prerequisite(s):* ENH 006; or consent of instructor.

*Learning Activities:* Lecture 2 hour(s), Laboratory 6 hour(s).

*Grade Mode:* Letter.

*General Education:* Science & Engineering (SE); Visual Literacy (VL).

### ENH 120 – Management of Container Media (3 units)

*Course Description:* Principles of soil science and practices related to management of container media are taught, emphasizing appropriate use of soils and amendments, irrigation, and fertilizers. Physical and chemical properties are tested and effects of management on crops are evaluated in the laboratory.

*Prerequisite(s):* SSC 010 or SSC 100.

*Learning Activities:* Lecture 2 hour(s), Laboratory 3 hour(s).

*Grade Mode:* Letter.

*General Education:* Science & Engineering (SE); Quantitative Literacy (QL); Writing Experience (WE).

### ENH 125 – Greenhouse & Nursery Crop Production (5 units)

*Course Description:* Principles and techniques for the production of ornamental greenhouse and nursery crops. Hands-on experience producing greenhouse crops. Optional weekend field trip.

*Prerequisite(s):* PLS 002.

*Learning Activities:* Lecture 3 hour(s), Discussion 1 hour(s), Laboratory 3 hour(s).

*Grade Mode:* Letter.

*General Education:* Science & Engineering (SE); Writing Experience (WE).

### ENH 133 – Woody Plants in the Landscape: Growth, Ecology & Management (4 units)

*Course Description:* Principles and practices of managing trees and shrubs in the urban landscape and other managed environments. Topics include woody plant form; growth response and adaptation; tree management in relation to soil, moisture, climate; plant problems.

*Prerequisite(s):* PLS 002 or BIS 002C.

*Learning Activities:* Lecture 3 hour(s), Laboratory 2 hour(s), Discussion 1 hour(s).

*Grade Mode:* Letter.

*General Education:* Science & Engineering (SE).

### ENH 150 – Genetics & Plant Conservation: The Biodiversity Crisis (3 units)

*Course Description:* Conservation of genetic diversity, measurement of diversity, threats to diversity and reasons for protection, the process of extinction, distribution of diversity, determination of what to conserve and means of conservation. Examples drawn largely from forest tree species.

*Prerequisite(s):* BIS 001C; or the equivalent.

*Learning Activities:* Lecture/Discussion 3 hour(s).

*Grade Mode:* Letter.

*General Education:* Science & Engineering (SE); Scientific Literacy (SL).

**ENH 160 – Restoration Ecology (4 units)**

*Course Description:* Broad, interdisciplinary approach to effective restoration. Design and implementation of restoration projects based on principles of physiology, population, community, ecosystem and landscape ecology.

*Prerequisite(s):* SSC 112 C or better or ESP 100 C or better or ESM 144 C or better or PLS 162 C or better or PLS 163 C or better or PLS 130 C or better or PLS 144 C or better or PLS 147 C or better or PLS 160 C or better or ESP 121 C or better or ESP 127 C or better or ESP 155 C or better or EVE 101 C or better or EVE 104 C or better or EVE 117 C or better or EVE 119 C or better or EVE 181 C or better or PLB 117 C or better or ECL 200AN C or better or ECL 200BN C or better; or consent of instructor; or equivalent course in ecology/plant ecology.

*Learning Activities:* Lecture/Discussion 3 hour(s), Project.

*Grade Mode:* Letter.

*General Education:* Science & Engineering (SE); Scientific Literacy (SL).

**ENH 160L – Restoration Ecology Laboratory (1 unit)**

This version has ended; see updated course, below.

*Course Description:* Companion field course to ENH 160. Series of part-day and all day visits to various field sites, involving site evaluations, guest field presentations by local restorationists, and actual restoration activities.

*Prerequisite(s):* ENH 160 (can be concurrent); consent of instructor.

*Learning Activities:* Discussion/Laboratory 3 hour(s).

*Credit Limitation(s):* Not open for credit to students who completed ENH 160 prior to spring 2004.

*Grade Mode:* Letter.

*General Education:* Science & Engineering (SE); Scientific Literacy (SL).

**ENH 160L – Restoration Ecology Laboratory (1 units)**

*Course Description:* Companion field course to ENH 160. Design, implementation, and analysis of ecological monitoring of a site, followed by design of a restoration project for the site through work in ENH 160. Weekly field trips and classroom training on monitoring design and analysis.

*Prerequisite(s):* ENH 160 (can be concurrent); consent of instructor.

*Learning Activities:* Discussion/Laboratory 3 hour(s).

*Grade Mode:* Letter.

*General Education:* Science & Engineering (SE); Scientific Literacy (SL).

This course version is effective from, and including: Winter Quarter 2024.

**International Agricultural (IAD)****IAD 010 – Introduction to International Agricultural Development (4 units)**

*Course Description:* Theories, practices and institutions relating to agricultural development; the interaction of changing social, cultural and economic organization through successive stages of economic development; impact of new agricultural technology on underdeveloped regions.

*Learning Activities:* Lecture 3 hour(s), Discussion 1 hour(s).

*Grade Mode:* Letter.

*General Education:* Social Sciences (SS); World Cultures (WC); Writing Experience (WE).

**IAD 092 – Internship (1-12 units)**

*Course Description:* Supervised internship, off and on campus, in community and institutional settings.

*Prerequisite(s):* Consent of instructor.

*Learning Activities:* Internship 3-36 hour(s).

*Grade Mode:* Pass/No Pass only.

**IAD 103 – Social Change & Agricultural Development (4 units)**

*Course Description:* How social and cultural factors influence technological change in agriculture; theories of diffusion of innovations; social impact analysis and technology assessment.

*Prerequisite(s):* Introductory social science course (Anthropology (ANT), Sociology (SOC), Economics (ECN), International Agricultural Development (IAD)).

*Learning Activities:* Lecture/Discussion 4 hour(s).

*Grade Mode:* Letter.

*General Education:* Social Sciences (SS); Writing Experience (WE).

**IAD 142 – Equipment & Technology for Small Farms (2 units)**

*Course Description:* Types and characteristics of agricultural equipment and technologies appropriate for small commercial farming. Adjustment and calibration of equipment. Selection of and budgeting for equipment.

*Learning Activities:* Lecture 1 hour(s), Laboratory 3 hour(s).

*Cross Listing:* ABT 142.

*Grade Mode:* Letter.

*General Education:* Science & Engineering (SE); Quantitative Literacy (QL); Visual Literacy (VL).

**IAD 160 – Agroforestry: Global & Local Perspectives (3 units)**

*Course Description:* Traditional and evolving use of trees in agricultural ecosystems; their multiple roles in environmental stabilization and production of food, fuel, and fiber; and socioeconomic barriers to the adoption and implementation of agroforestry practices.

*Prerequisite(s):* PLS 002 or BIS 001C or BIS 002C; (PLS 142 or PLS 150 or BIS 002B); or general ecology course in lieu of PLS 142 or PLS 150 or BIS 002B.

*Learning Activities:* Lecture/Discussion 3 hour(s).

*Credit Limitation(s):* Not open for credit to students who have taken previously taken AMR 160. (Former AMR 160.)

*Cross Listing:* PLS 160.

*Grade Mode:* Letter.

*General Education:* Science & Engineering (SE).

**IAD 170 – Program Development for International Agriculture (4 units)**

*Course Description:* Principles of leadership and management for international agricultural development. Organizations and organizational behavior, and the implications for planning and administering organizations involved in the global development effort.

*Prerequisite(s):* IAD 010.

*Learning Activities:* Lecture/Discussion 4 hour(s).

*Grade Mode:* Letter.

### **IAD 190 – Proseminar in International Agricultural Development (1 unit)**

*Course Description:* Presentation and discussion of current topics in international agricultural development by visiting lecturers, staff and students.

*Learning Activities:* Seminar 1 hour(s).

*Repeat Credit:* May be repeated.

*Grade Mode:* Pass/No Pass only.

### **IAD 192 – Internship (1-12 units)**

*Course Description:* Supervised internship, off and on campus, in community and institutional settings.

*Prerequisite(s):* Consent of instructor.

*Learning Activities:* Internship 3-36 hour(s).

*Repeat Credit:* May be repeated.

*Grade Mode:* Pass/No Pass only.

### **IAD 198 – Directed Group Study (1-5 units)**

*Course Description:* Directed group study.

*Prerequisite(s):* Consent of instructor.

*Learning Activities:* Variable 1-5 hour(s).

*Repeat Credit:* May be repeated.

*Grade Mode:* Pass/No Pass only.

### **IAD 199 – Special Study for Advanced Undergraduates (1-5 units)**

*Course Description:* Special study for advanced undergraduates.

*Prerequisite(s):* Consent of instructor.

*Learning Activities:* Variable 1-5 hour(s).

*Repeat Credit:* May be repeated.

*Grade Mode:* Pass/No Pass only.

### **IAD 200N – Philosophy & Practice of Agricultural Development (5 units)**

*Course Description:* Introduces key elements of philosophy and practice of agricultural development in less developed countries; major paradigms of development; historical context within which these paradigms operate; various development techniques and initiatives emerging from agricultural production to institutional capacity building and management.

*Learning Activities:* Lecture/Discussion 5 hour(s), Term Paper.

*Credit Limitation(s):* Not open for credit to students who have completed former IAD 202.

*Grade Mode:* Letter.

### **IAD 201 – Economics of Small Farms & Farming Systems (4 units)**

*Course Description:* Economic perspective on small farm development.

Establishes a basis for predicting farmers' responses to changes in the economic environment, and for proposing government policies to increase small farm production and improve farmer and national welfare.

*Prerequisite(s):* ARE 100A or ECN 100; or the equivalent.

*Learning Activities:* Lecture 3 hour(s), Discussion 1 hour(s).

*Grade Mode:* Letter.

### **IAD 202N – Analysis & Determinants of Farming Systems (4 units)**

*Course Description:* Unifying concepts of cropping systems in temperate and tropical climatic zones; agroecosystems stability, diversity and sustainability; management strategies, resource use efficiency and their interactions; role of animals, their impact on energy use efficiency, nutrient cycling, and providing food and power.

*Prerequisite(s):* PLS 110C or PLS 111; or the equivalent.

*Learning Activities:* Lecture 3 hour(s), Discussion 1 hour(s).

*Credit Limitation(s):* Not open for credit to students who have completed former IAD 200.

*Grade Mode:* Letter.

### **IAD 203N – Project Planning & Evaluation (4 units)**

*Course Description:* Interdisciplinary setting for application of student skills and specialization to a "real world" development project. Focus on team-building and effective interdisciplinary problem-solving methods, with the objective of producing a project document and presentation within a specified deadline.

*Prerequisite(s):* IAD 200N; or consent of instructor.

*Learning Activities:* Discussion 1 hour(s), Workshop 3 hour(s).

*Credit Limitation(s):* Not open for credit to students who have completed former IAD 203.

*Grade Mode:* Letter.

### **IAD 290 – Seminar in International Agricultural Development (1-2 units)**

*Course Description:* Discussion and critical evaluation of advanced topics and issues in international agricultural development.

*Prerequisite(s):* Consent of instructor.

*Learning Activities:* Seminar 1-2 hour(s).

*Repeat Credit:* May be repeated.

*Grade Mode:* Satisfactory/Unsatisfactory only.

### **IAD 291 – Topics in International Agricultural Development (1-3 units)**

*Course Description:* Selected topics dealing with current issues in agricultural development in lesser developed nations. Variable content.

*Prerequisite(s):* Consent of instructor.

*Learning Activities:* Lecture/Discussion 1-3 hour(s).

*Repeat Credit:* May be repeated 1 time(s).

*Grade Mode:* Letter.

### **IAD 292 – Graduate Internship (1-12 units)**

*Course Description:* Individually designed supervised internship, off or on campus, in community, business or institutional setting. Developed with advice of faculty mentor and Humphrey Coordinator.

*Prerequisite(s):* Participation in H. Humphrey Fellow Program or consent of instructor.

*Learning Activities:* Internship 3-36 hour(s).

*Repeat Credit:* May be repeated.

*Grade Mode:* Satisfactory/Unsatisfactory only.

### **IAD 298 – Directed Group Study (1-5 units)**

*Course Description:* Directed group study.

*Prerequisite(s):* Consent of instructor.

*Learning Activities:* Variable 1-5 hour(s).

*Repeat Credit:* May be repeated.

*Grade Mode:* Satisfactory/Unsatisfactory only.

**IAD 299 – Research (1-12 units)**

*Course Description:* Research.

*Prerequisite(s):* Consent of instructor.

*Learning Activities:* Variable 1-12 hour(s).

*Repeat Credit:* May be repeated.

*Grade Mode:* Satisfactory/Unsatisfactory only.

**IAD 396 – Teaching Assistant Training Practicum (1-4 units)**

*Course Description:* Teaching assistant training practicum.

*Prerequisite(s):* Graduate standing.

*Learning Activities:* Variable 3-12 hour(s).

*Repeat Credit:* May be repeated.

*Grade Mode:* Satisfactory/Unsatisfactory only.

**Plant Sciences (PLS)****PLS 001 – Agriculture, Nature & Society (3 units)**

*Course Description:* Multiple perspectives and connections between natural sciences, social sciences, and agriculture. Emphasizes agriculture's central position between nature and society and its key role in our search for a productive, lasting and hospitable environment. Several full-period field trips provide hands-on learning.

*Learning Activities:* Lecture 2 hour(s), Discussion/Laboratory 1 hour(s).

*Credit Limitation(s):* Not open for credit to students who have completed AMR 001. (Former AMR 001.)

*Grade Mode:* Letter.

*General Education:* Science & Engineering (SE).

**PLS 002 – Botany & Physiology of Cultivated Plants (4 units)**

*Course Description:* Holistic introduction to the underlying botanical and physiological principles of cultivated plants and their response to the environment. Includes concepts behind plant selection, cultivation, and utilization. Laboratories include discussion and interactive demonstrations.

*Prerequisite(s):* High school course in biology and chemistry recommended.

*Learning Activities:* Lecture 3 hour(s), Discussion/Laboratory 3 hour(s).

*Credit Limitation(s):* Not open for credit to students who have complete AMR 002. (Former AMR 002.)

*Grade Mode:* Letter.

*General Education:* Science & Engineering (SE); Scientific Literacy (SL).

**PLS 003 – Seminar: Overview of the Plant Sciences Major (1 unit)**

*Course Description:* Introduction to topics covered in the core courses and areas of specialization within the Plant Sciences major. Research and internship opportunities and potential career paths in plant breeding, crop management and ecology, horticulture, precision agriculture, crop quality and safety, ecosystem management and restoration, and related fields.

*Learning Activities:* Seminar 1.5 hour(s).

*Grade Mode:* Pass/Not Passed only.

**PLS 006 – Flower Power; Art & Science of Flowers & Their Uses (2 units)**

*Course Description:* Introduction to the art and science of using and growing flowers to harness the power that is represented by their aesthetic beauty. Handling, production, arranging, breeding and marketing of flowers. Emphasis on potted plants and cut-flowers.

*Prerequisite(s):* High school biology.

*Learning Activities:* Lecture/Discussion 2 hour(s).

*Grade Mode:* Pass/No Pass only.

**PLS 006V – Flower Power; Art & Science of Flowers & Their Uses (2 units)**

*Course Description:* Introduction to the art and science of using and growing flowers to harness the power that is represented by their aesthetic beauty. Handling, production, arranging, breeding and marketing of flowers. Emphasis on potted plants and cut-flowers.

*Prerequisite(s):* High school biology.

*Learning Activities:* Web Virtual Lecture 1 hour(s), Web Electronic Discussion 1 hour(s).

*Grade Mode:* P/NP only.

*General Education:* Arts & Humanities (AH) or Science & Engineering (SE).

**PLS 007 – Just Coffee: The Biology, Ecology & Socioeconomic Impacts of the World's Favorite Drink (4 units)**

*Course Description:* Coffee used as a case study to examine biological, ecological and social factors influencing sustainability of farming systems and how food production systems impact human well-being.

*Learning Activities:* Lecture 3 hour(s), Discussion 1 hour(s).

*Grade Mode:* Letter.

*General Education:* Science & Engineering (SE) or Social Sciences (SS); Writing Experience (WE).

**PLS 007V – Just Coffee: The Biology, Ecology & Socioeconomic Impacts of the World's Favorite Drink (4 units)**

*Course Description:* Coffee used as a case study to examine biological, ecological and social factors influencing sustainability of farming systems and how food production systems impact human well-being.

*Learning Activities:* Web Virtual Lecture 3 hour(s), Web Electronic Discussion 1 hour(s).

*Grade Mode:* Letter.

*General Education:* Science & Engineering (SE) or Social Sciences (SS); Writing Experience (WE).

**PLS 012 – Plants & Society (4 units)**

*Course Description:* Dependence of human societies on plant and plant products. Plants as resources for food, fiber, health, enjoyment and environmental services. Sustainable uses of plants for food production, raw materials, bioenergy, and environmental conservation. Global population growth and future food supplies.

*Prerequisite(s):* High school biology.

*Learning Activities:* Lecture 3 hour(s), Extensive Writing 3 hour(s).

*Credit Limitation(s):* Not open for credit to students who have complete PLB 012. (Former PLB 012.)

*Cross Listing:* SAS 012.

*Grade Mode:* Letter.

*General Education:* Science & Engineering (SE) or Social Sciences (SS); Writing Experience (WE).

### PLS 013 – Chocolate, Covered: The Past, Present, & Future of Cacao (3 units)

*Course Description:* Multidisciplinary perspectives on the crop that gives us chocolate. History, genetics, agronomy, sensory science, and economics of cacao production.

*Prerequisite(s):* High school biology.

*Learning Activities:* Lecture 2 hour(s), Discussion 1 hour(s).

*Grade Mode:* Letter.

*General Education:* Science & Engineering (SE); Scientific Literacy (SL).

### PLS 015 – Introduction to Sustainable Agriculture (4 units)

*Course Description:* Multidisciplinary introduction to agricultural sustainability with a natural sciences emphasis. Sustainability concepts and perspectives. Agricultural evolution, history, resources and functions. Diverse agricultural systems and practices and their relative sustainability. Laboratories provide direct experience with selected agricultural practices and systems.

*Learning Activities:* Lecture 3 hour(s), Laboratory 3 hour(s).

*Grade Mode:* Letter.

*General Education:* Science & Engineering (SE).

### PLS 021 – Application of Computers in Technology (3 units)

*Course Description:* Concepts of computing and applications using personal computers, spreadsheets, database management, word processing and communications.

*Prerequisite(s):* High school algebra.

*Learning Activities:* Lecture 2 hour(s), Discussion/Laboratory 2 hour(s).

*Enrollment Restriction(s):* Not open for students who have completed PLS 021V or AMR 021. (Former AMR 021.)

*Grade Mode:* Letter.

*General Education:* Science & Engineering (SE); Visual Literacy (VL).

### PLS 021V – Application of Computers in Technology (3 units)

*Course Description:* Concepts of computing and applications using personal computers, spreadsheets, database management, word processing and communications.

*Prerequisite(s):* High school algebra.

*Learning Activities:* Web Virtual Lecture 2 hour(s), Web Electronic Discussion 2 hour(s).

*Enrollment Restriction(s):* Not open for students who have taken PLS 021.

*Grade Mode:* Letter.

*General Education:* Science & Engineering (SE); Visual Literacy (VL).

### PLS 049 – Organic Crop Production Practices (3 units)

*Course Description:* Principles and practices of organic production of annual crops. Including organic crops, soil, and pest management, cover cropping, composting, seeding, transplanting, irrigation, harvesting and marketing.

*Learning Activities:* Lecture 1 hour(s), Discussion 1 hour(s), Laboratory 3 hour(s).

*Credit Limitation(s):* Not open for credit to students who have completed AMR 049. (Former AMR 049.)

*Grade Mode:* Pass/No Pass only.

*General Education:* Science & Engineering (SE).

### PLS 092 – Internship (1-12 units)

*Course Description:* Work experience on or off campus in subject areas pertaining to plant and environmental sciences. Internship supervised by a faculty member.

*Learning Activities:* Internship 3-36 hour(s).

*Repeat Credit:* May be repeated.

*Grade Mode:* Pass/No Pass only.

### PLS 098 – Directed Group Study (1-5 units)

*Course Description:* Directed group study.

*Prerequisite(s):* Consent of instructor; primarily for lower division students.

*Learning Activities:* Variable 3-15 hour(s).

*Repeat Credit:* May be repeated.

*Grade Mode:* Pass/No Pass only.

### PLS 099 – Special Study for Undergraduates (1-5 units)

*Course Description:* Special study for undergraduates.

*Prerequisite(s):* Consent of instructor; primarily for lower division students.

*Learning Activities:* Variable 3-15 hour(s).

*Grade Mode:* Pass/No Pass only.

### PLS 100A – Metabolic Processes of Cultivated Plants (3 units)

*Course Description:* Principles of energy capture and photosynthesis, water use, and nutrient cycling. Conversion of these resources into products (carbohydrates, proteins, lipids, and other chemicals) by plants. Emphasis on the relationships between environmental resources, plant metabolism and plant growth.

*Prerequisite(s):* PLS 002 or BIS 002C; or consent of instructor.

*Learning Activities:* Lecture 3 hour(s).

*Grade Mode:* Letter.

*General Education:* Science & Engineering (SE).

### PLS 100AL – Metabolic Processes of Cultivated Plants Laboratory (2 units)

*Course Description:* Techniques and instruments used to study plant metabolic processes, including water relations, respiration, photosynthesis, enzyme kinetics, microscopy, immunochemistry, and nitrogen fixation. Quantitative methods, problem solving, and practical applications are emphasized.

*Prerequisite(s):* PLS 100A (can be concurrent); or the equivalent.

*Learning Activities:* Discussion/Laboratory 3 hour(s).

*Grade Mode:* Letter.

*General Education:* Science & Engineering (SE).

### PLS 100B – Growth & Yield of Cultivated Plants (3 units)

*Course Description:* Principles of the cellular mechanisms and hormonal regulation underlying plant growth, development, and reproduction. Emphasis on how these processes contribute to the harvestable yield of cultivated plants and can be managed to increase crop productivity and quality.

*Prerequisite(s):* PLS 100A; or the equivalent of PLS 100A.

*Learning Activities:* Lecture 3 hour(s).

*Grade Mode:* Letter.

*General Education:* Science & Engineering (SE).

### **PLS 100BL – Growth & Yield of Cultivated Plants Laboratory (2 units)**

*Course Description:* Laboratory exercises in plant growth and development and their regulation, including photomorphogenesis, plant growth regulators, plant anatomy, seed germination, fruit ripening and senescence. Includes field trips to illustrate relationships to cropping and marketing systems.

*Prerequisite(s):* PLS 100B (can be concurrent); or equivalent.

*Learning Activities:* Discussion/Laboratory 3 hour(s).

*Grade Mode:* Letter.

*General Education:* Science & Engineering (SE).

### **PLS 100C – Environmental Interactions of Cultivated Plants (3 units)**

*Course Description:* Principles of plant interactions with their physical and biological environments and their acquisition of the resources needed for growth and reproduction. Emphasis on how management practices and environmental conditions affect crop productivity.

*Prerequisite(s):* PLS 100A; or the equivalent of PLS 100A.

*Learning Activities:* Lecture 3 hour(s).

*Grade Mode:* Letter.

*General Education:* Science & Engineering (SE).

### **PLS 100CL – Environmental Interactions of Cultivated Plants Laboratory (2 units)**

*Course Description:* Techniques and instruments used to study plant interactions with their physical and biological environments, including light responses, transpiration, microclimatology, nutrient availability and utilization, biomass accumulation. Quantitative methods and modeling are emphasized.

*Prerequisite(s):* PLS 100C (can be concurrent).

*Learning Activities:* Discussion/Laboratory 3 hour(s).

*Grade Mode:* Letter.

*General Education:* Science & Engineering (SE).

### **PLS 101 – Agriculture & the Environment (3 units)**

*Course Description:* Focus on the interaction between agriculture and the environment to address the principles required to analyze conflict and develop solutions to complex problems facing society.

*Prerequisite(s):* PLS 002; or consent of instructor.

*Learning Activities:* Lecture 3 hour(s).

*Credit Limitation(s):* Not open for credit to students who have completed AMR 101. (Former AMR 101.)

*Grade Mode:* Letter.

*General Education:* Science & Engineering (SE); Scientific Literacy (SL).

### **PLS 102 – California Floristics (5 units)**

Starting Winter Quarter 2024, this course is no longer offered.

*Course Description:* Survey of the California flora, emphasizing recognition of important plant families and genera and use of taxonomic keys to identify species. Phylogenetic relationships among families. Principles of systematics and taxonomy. Two Saturday field trips.

*Prerequisite(s):* PLS 002 or BIS 002C; or equivalent course in Plant Science.

*Learning Activities:* Lecture 2 hour(s), Laboratory 5 hour(s), Fieldwork.

*Cross Listing:* PLB 102.

*Grade Mode:* Letter.

*General Education:* Science & Engineering (SE); Visual Literacy (VL).

### **PLS 105 – Concepts in Pest Management (3 units)**

*Course Description:* Introduction to the ecological principles of integrated pest management, biology of different classes of pests and the types of losses they cause, population assessment, evaluation of advantages and disadvantages of different techniques used for pest management, IPM programs.

*Prerequisite(s):* CHE 008B; (PLS 002 or BIS 002B or BIS 002C).

*Learning Activities:* Lecture 2 hour(s), Discussion/Laboratory 3 hour(s).

*Credit Limitation(s):* Not open for credit to students who have completed AMR 105. (Former AMR 105.)

*Grade Mode:* Letter.

*General Education:* Science & Engineering (SE).

### **PLS 110 – Crop Management Systems for Vegetable Production (4 units)**

*Course Description:* Horticultural principles applied to production and management systems for vegetable crops. Laboratory and discussion illustrate efficient field management and resource use practices.

*Prerequisite(s):* PLS 002 or (BIS 002A, BIS 002B, BIS 002C).

*Learning Activities:* Lecture 2 hour(s), Discussion 1 hour(s), Laboratory 3 hour(s).

*Credit Limitation(s):* Not open for credit to students who have completed PLS 110C. (Former PLS 110C.)

*Grade Mode:* Letter.

*General Education:* Science & Engineering (SE).

### **PLS 111 – Principles of Agronomic Crop Production Systems (4 units)**

*Course Description:* Principles, practices and technologies of agronomic cropping systems, including crop systematics, physiology, agroecology, equipment, and management. Cropping systems analysis and integration of economic and ecological decision-making considerations involved in crop production. One weekend field trip required.

*Prerequisite(s):* PLS 002 or (BIS 002A, BIS 002B, BIS 002C).

*Learning Activities:* Lecture 3 hour(s), Laboratory 3 hour(s).

*Credit Limitation(s):* Not open for credit to students who have completed PLS 110A. (Former PLS 110A.)

*Grade Mode:* Letter.

*General Education:* Science & Engineering (SE).

### **PLS 112 – Forage Crop Production (3 units)**

*Course Description:* Forages as a world resource in food production. Ecological principles governing the adaptation, establishment, growth and management of perennial and annual forages, including pastures, rangelands and hay; aspects of forage quality which affect feeding value to livestock.

*Prerequisite(s):* PLS 002 or BIS 001C or BIS 002C; or consent of instructor.

*Learning Activities:* Lecture 3 hour(s).

*Credit Limitation(s):* Not open for credit to students who have completed AMR 112. (Former AMR 112.)

*Grade Mode:* Letter.

*General Education:* Science & Engineering (SE).



### PLS 113 – Biological Applications in Fruit Tree Management (2 units)

*Course Description:* Physiology, growth, development and environmental requirements of fruit trees and the cultural practices used to maintain them. Emphasis on the application of biological principles in the culture of commercially important temperate zone fruit tree species.

*Prerequisite(s):* PLS 002 or BIS 001C or BIS 002C; or equivalent.

*Learning Activities:* Lecture 1 hour(s), Laboratory 3 hour(s).

*Credit Limitation(s):* Not open for credit to students that have completed PLB 173. (Former PLB 173.)

*Grade Mode:* Letter.

*General Education:* Science & Engineering (SE).

### PLS 114 – Biological Applications in Fruit Production (2 units)

*Course Description:* Reproductive biology of tree crop species. Biological principles of fruit production, tree nutrition and orchard management for optimizing cropping. Laboratories emphasize hands-on work with orchard tree systems that are done specifically to produce the crop.

*Prerequisite(s):* PLS 002 or BIS 001C or BIS 002C; PLS 113 recommended.

*Learning Activities:* Lecture 1 hour(s), Laboratory 3 hour(s).

*Credit Limitation(s):* Not open for credit to students who have completed PLB 174. (Former PLB 174.)

*Grade Mode:* Letter.

*General Education:* Science & Engineering (SE).

### PLS 116 – Plant Morphology & Evolution (5 units)

This version has ended; see updated course, below.

*Course Description:* Introduction to the form, development, and evolution of vascular plants. Emphasis given to the form and development of reproductive structures in ferns and seed-producing plants as a basis for determining evolutionary relationships.

*Prerequisite(s):* Introductory Plant Biology; e.g., BIS 002C, PLS 002.

*Learning Activities:* Lecture 3 hour(s), Laboratory 4 hour(s).

*Credit Limitation(s):* Not open for credit to students who have completed PLB 116.

*Cross Listing:* PLB 116.

*Grade Mode:* Letter.

*General Education:* Science & Engineering (SE).

### PLS 116 – Plant Morphology & Evolution (5 units)

*Course Description:* Structure and evolution of terrestrial plants.

Evolutionary and developmental origins and adaptive significance of both reproductive and vegetative structures, in the context of current understanding of phylogenetic relationships.

*Prerequisite(s):* Introductory Plant Biology; e.g., BIS 002C, PLS 002.

*Learning Activities:* Lecture 3 hour(s), Laboratory 4 hour(s).

*Credit Limitation(s):* Not open for credit to students who have completed PLB 116.

*Cross Listing:* PLB 116.

*Grade Mode:* Letter.

*General Education:* Science & Engineering (SE).

This course version is effective from, and including: Winter Quarter 2024.

### PLS 120 – Applied Statistics in Agricultural Sciences (4 units)

*Course Description:* Application of statistical methods to design and analysis of research trials for plant, animal, behavioral, nutritional, and consumer sciences. Basic concepts and statistical methods are presented in lectures, laboratories emphasize data processing techniques, problem solving, and interpretation in specialized fields.

*Prerequisite(s):* Upper division standing.

*Learning Activities:* Lecture 3 hour(s), Discussion/Laboratory 3 hour(s).

*Credit Limitation(s):* Not open for credit for students who have completed AMR 120. (Former AMR 120.)

*Grade Mode:* Letter.

*General Education:* Quantitative Literacy (QL).

### PLS 123 – Introduction to Plant & Crop Systems Modeling (3 units)

*Course Description:* Modeling approaches commonly used in plant and crop applications. Fundamentals of how plant/crop models are developed and considerations regarding their limitations. Example model applications include degree-day and radiation-use-efficiency models of growth and yield, phenological models, and crop coefficients.

*Prerequisite(s):* college algebra/precalculus college physics recommended.

*Learning Activities:* Lecture 3 hour(s).

*Enrollment Restriction(s):* Restricted to upper division and graduate students.

*Grade Mode:* Letter.

*General Education:* Quantitative Literacy (QL).

### PLS 124 – Introduction to Digital Agriculture (3 units)

*Course Description:* Introduction to quantitative approaches for collecting, analyzing, and interpreting environmental data used in plant sciences research. Remote sensing data for estimating plant structure, function and water status, spatial and temporal aspects of data, data science and machine learning, synthesizing complex, high-dimensional data.

*Prerequisite(s):* PLS 021 C or better (can be concurrent) or PLS 021 C or better (can be concurrent); PLS 120 C or better; PHY 007A; PHY 007B; PHY 007C; or consent of instructor.

*Learning Activities:* Lecture/Discussion 2 hour(s); Project.

*Grade Mode:* Letter.

*General Education:* Science & Engineering (SE).

### PLS 125 – Proximal & Remote Sensing of Plants (3 units)

*Course Description:* Quantitative approaches for collecting, analyzing and interpreting remote sensing data at scales from the leaf to the satellite in plant sciences research. Hands-on experience collecting, processing, and analyzing leaf and canopy-level remote sensing data.

*Prerequisite(s):* PLS 124 C or better (can be concurrent); PLS 021 C or better (can be concurrent or PLS 021V C or better (can be concurrent)); PHY 007A; PHY 007B; PHY 007C; PLS 120 C or better; or consent of instructor.

*Learning Activities:* Lecture 1 hour(s); Laboratory 3 hour(s).

*Grade Mode:* Letter.

*General Education:* Science & Engineering (SE).

**PLS 127 – Systematics of Vascular Plants (5 units)**

*Course Description:* Diversity, phylogeny, and taxonomy of lycophytes, ferns, and seed plants (gymnosperms and angiosperms), emphasizing relationships and distinguishing characteristics of families and genera represented in the California flora. Principles and methods of phylogeny reconstruction, classification, and plant nomenclature. Practice identifying plants to species using taxonomic keys.

*Prerequisite(s):* BIS 002C or PLS 002; or consent of instructor.

*Learning Activities:* Lecture 3 hour(s), Laboratory 6 hour(s).

*Credit Limitation(s):* No credit if student has taken PLB/PLS 102 or EVE/PLB 108.

*Cross Listing:* EVE 127, PLB 127.

*Grade Mode:* Letter.

*General Education:* Science & Engineering (SE); Visual Literacy (VL).

**PLS 130 – Grassland Ecology (3 units)**

*Course Description:* Comprehensive survey of grassland ecology including distributions of major grassland types; systematics; morphology, physiology, and diversity of grassland species; population, community, and ecosystem processes occurring in grasslands; the role of grazing, fire, and drought in grasslands; management and conservation.

*Prerequisite(s):* PLS 002 or BIS 002B or BIS 002C; or consent of instructor; upper division standing.

*Learning Activities:* Lecture 3 hour(s).

*Grade Mode:* Letter.

*General Education:* Science & Engineering (SE).

**PLS 135 – Ecology & Community Structure of Grassland & Savannah Herbivores (3 units)**

Starting Winter Quarter 2024, this course is no longer offered.

*Course Description:* Feeding ecology of grassland herbivores and its importance in evolution of herbivore communities and social systems. Optimal foraging, interspecific interactions, and primary productivity are considered as factors structuring natural and managed grassland and savannah systems.

*Prerequisite(s):* (BIS 001A or BIS 001B); (PLS 002 or BIS 001C); General ecology course (ESP 100) recommended.

*Learning Activities:* Lecture 3 hour(s).

*Credit Limitation(s):* Not open for credit to students who have completed AMR 135. (Former AMR 135.)

*Grade Mode:* Letter.

**PLS 141 – Ethnobotany (4 units)**

*Course Description:* Relationships and interactions between plants and people, including human perceptions, management, and uses of plants, influences of plants on human cultures, and effects of human activity on plant ecology and evolution. Concepts, questions, methods, and ethical considerations in ethnobotanical research.

*Prerequisite(s):* PLS 002 or BIS 001C or BIS 002C.

*Learning Activities:* Lecture 3 hour(s), Discussion/Laboratory 2 hour(s).

*Credit Limitation(s):* Not open for credit to students who have completed PLB 141. (Former PLB 141.)

*Grade Mode:* Letter.

*General Education:* Science & Engineering (SE) or Social Sciences (SS); Oral Skills (OL); Writing Experience (WE).

**PLS 144 – Trees & Forests (4 units)**

*Course Description:* Biological structure and function of trees as organisms; understanding of forests as communities and as ecosystems; use of forests by humans; tree phenology, photosynthesis, respiration, soil processes, life histories, dormancy, forest biodiversity, and agroforestry.

*Prerequisite(s):* PLS 002 or BIS 001C or BIS 002C.

*Learning Activities:* Lecture 3 hour(s), Discussion 1 hour(s).

*Credit Limitation(s):* Not open for credit to students who have completed PLB 144 or ENH 144 or ERS 144. (Formerly PLB 144, ENH 144, ERS 144.)

*Cross Listing:* ESM 144.

*Grade Mode:* Letter.

*General Education:* Science & Engineering (SE); Visual Literacy (VL).

**PLS 147 – California Plant Communities (3 units)**

*Course Description:* Ecology, distribution, and species of California's plant communities. Environmental forces that determine these communities, the threats they face, and their conservation and restoration opportunities.

*Prerequisite(s):* PLS 002 or BIS 002C.

*Learning Activities:* Lecture/Discussion 3 hour(s).

*Credit Limitation(s):* Not open for credit to students who have completed PLB 147. (Former PLB 147.)

*Grade Mode:* Letter.

*General Education:* Science & Engineering (SE); Visual Literacy (VL).

**PLS 147L – California Plant Communities Field Study (1 unit)**

*Course Description:* Visits to many of northern California's plant communities, from the north coast to the Central Valley to the Sierras. Discussion of community ecology and hands-on identification of species. Two Saturday and two three-day field trips required.

*Prerequisite(s):* (PLS 002 or BIS 002C); concurrent or previous enrollment in PLS 147.

*Learning Activities:* Discussion/Laboratory 3 hour(s).

*Credit Limitation(s):* Not open for credit to students who have completed PLB 147. (Former PLB 147.)

*Grade Mode:* Letter.

*General Education:* Science & Engineering (SE); Visual Literacy (VL).

**PLS 148 – Field Course: Flora of Northern California's Mountains (3 units)**

*Course Description:* Diversity, taxonomy, ecology, evolution, and traditional cultural importance of the flora of the Cascade and Klamath mountain ranges. Conservation and management issues. Legal and ethical responsibilities of field botanists. Hands-on botanical field methods including plant identification, characterization of vegetation types, and rare plant surveys. Field course offered the last two weeks of July, based at Lassen Volcanic National Park.

*Prerequisite(s):* Consent of instructor.

*Learning Activities:* Lecture/Discussion 5 hour(s), Laboratory 5 hour(s), Fieldwork 25 hour(s).

*Grade Mode:* Letter.

### PLS 150 – Sustainability & Agroecosystem Management (4 units)

*Course Description:* Interdisciplinary analysis of agricultural production and food systems with primary emphasis on biophysical processes.

General concepts governing the functioning of temperate and tropical agroecosystems in relation to resource availability, ecological sustainability, and socio-economic viability. Comparative ecological analyses of agroecosystems.

*Prerequisite(s):* SSC 010; CHE 002A; (PLS 002 or BIS 001C or BIS 002C).

*Learning Activities:* Lecture 3 hour(s), Laboratory 3 hour(s).

*Credit Limitation(s):* Not open for credit to students who have completed AMR 150. (Former AMR 150.)

*Grade Mode:* Letter.

*General Education:* Science & Engineering (SE); Oral Skills (OL); Scientific Literacy (SL).

### PLS 152 – Plant Genetics (4 units)

*Course Description:* Basic principles of transmission genetics, cytogenetics, population and quantitative genetics, and molecular genetics. Practical aspects of genetic crosses and analysis of segregating populations.

*Prerequisite(s):* BIS 001A or BIS 002A; or consent of instructor.

*Learning Activities:* Lecture 3 hour(s), Discussion/Laboratory 1 hour(s).

*Credit Limitation(s):* Not open to students who have completed PLB 152. (Former PLB 152.)

*Grade Mode:* Letter.

*General Education:* Science & Engineering (SE).

### PLS 153 – Plant, Cell, Tissue & Organ Culture (4 units)

*Course Description:* Basic and applied aspects of plant tissue culture including media preparation, micropropagation, organogenesis, embryogenesis, anther culture, protoplast culture and transformation.

*Prerequisite(s):* PLS 002 or BIS 001C or BIS 002C.

*Learning Activities:* Lecture 2 hour(s), Discussion 1 hour(s), Laboratory 3 hour(s).

*Credit Limitation(s):* Not open for credit to students who have completed PLB 153. (Former PLB 153.)

*Grade Mode:* Letter.

*General Education:* Science & Engineering (SE).

### PLS 154 – Introduction to Plant Breeding (4 units)

*Course Description:* Principles, methods and applications of plant breeding and genetics to the improvement of crop plants. Illustration of how plant breeding is a dynamic, multidisciplinary, constantly-evolving science. Laboratory emphasizes hands-on experience in the basics of breeding through experiments.

*Prerequisite(s):* PLS 152 or BIS 101; or consent of instructor.

*Learning Activities:* Lecture 3 hour(s), Laboratory 3 hour(s).

*Credit Limitation(s):* Not open for credit to students who have completed PLB 154. (Former PLB 154.)

*Grade Mode:* Letter.

*General Education:* Science & Engineering (SE).

### PLS 157 – Physiology of Environmental Stresses in Plants (4 units)

*Course Description:* Stress concepts and principles; molecular, physiological, developmental and morphological characteristics enabling plants to avoid or tolerate environmental stresses; stress acclimation and adaptation processes; responses of wild and cultivated species to drought, flooding, nutrient deficiencies, salinity, toxic ions, extreme temperatures, etc.

*Prerequisite(s):* PLS 100C or PLB 111 or PLB 112 or ENH 102 or VEN 110.

*Learning Activities:* Lecture 2 hour(s), Discussion 2 hour(s).

*Credit Limitation(s):* Not open for credit to students who have completed PLB 157. (Former PLB 157.)

*Grade Mode:* Letter.

*General Education:* Science & Engineering (SE).

### PLS 158 – Mineral Nutrition of Plants (4 units)

*Course Description:* Evolution and scope of plant nutrition; essential elements; mechanisms of absorption and membrane transporters; translocation and allocation processes; mineral metabolism; deficiencies and toxicities; genetic variation in plant nutrition; applications to management and understanding ecological effects of nutrient availability or deficiency.

*Prerequisite(s):* PLS 100A or PLB 111 or ENH 102 or VEN 110.

*Learning Activities:* Lecture 3 hour(s), Laboratory 3 hour(s).

*Credit Limitation(s):* Not open for credit to students who have completed PLB 158. (Former PLB 158.)

*Grade Mode:* Letter.

*General Education:* Science & Engineering (SE).

### PLS 160 – Agroforestry: Global & Local Perspectives (3 units)

*Course Description:* Traditional and evolving use of trees in agricultural ecosystems; their multiple roles in environmental stabilization and production of food, fuel, and fiber; and socioeconomic barriers to the adoption and implementation of agroforestry practices.

*Prerequisite(s):* (PLS 002 or BIS 001C or BIS 002C); (PLS 142 or PLS 150 or BIS 002B); or general ecology course in lieu of PLS 142 or PLS 150 or BIS 002B.

*Learning Activities:* Lecture/Discussion 3 hour(s).

*Credit Limitation(s):* Not open for credit to students who have previously taken AMR 160. (Former AMR 160.)

*Cross Listing:* IAD 160.

*Grade Mode:* Letter.

*General Education:* Science & Engineering (SE).

### PLS 162 – Urban Ecology (3 units)

*Course Description:* Application of fundamental concepts and approaches in landscape and ecosystem ecology to urban ecosystems. Ecological and social drivers and responses. Landscape heterogeneity, nutrient dynamics, invasive species, altered hydrology and climate, and pollution. Discussion of primary literature.

*Prerequisite(s):* ECL 200AN C- or better or ECL 200BN C- or better or ENH 160 C- or better or ESM 144 C- or better or ESP 100 C- or better or ESP 110 C- or better or ESP 121 C- or better or EVE 101 C- or better or EVE 104 C- or better or EVE 117 C- or better or EVE 120 C- or better or EVE 181 C- or better or PLB 117 C- or better or PLS 130 C- or better or PLS 144 C- or better or PLS 163 C- or better or SSC 112 C- or better; or consent of instructor.

*Learning Activities:* Lecture/Discussion 3 hour(s).

*Grade Mode:* Letter.

*General Education:* Science & Engineering (SE); Scientific Literacy (SL).

**PLS 163 – Ecosystem & Landscape Ecology (4 units)**

This version has ended; see updated course, below.

*Course Description:* Integration of concepts to understand and manage ecosystems in a complex and changing world. Emphasis on interactions among biotic, abiotic & human factors and changes over space/ time. Local to global controls over water, carbon and nutrients across ecosystems/landscapes.

*Prerequisite(s):* (ESP 100 C- or better) or (SSC 112 C- or better) or (EVE 117 C- or better) or (PLB 117 C- or better) or (PLS 144 C- or better) or (ESM 144 C- or better) or (PLS 162 C- or better) or (ENH 160 C- or better) or (EVE 101 C- or better); or similar class with consent of instructor.

*Learning Activities:* Lecture/Discussion 3 hour(s), Project 1 hour(s).

*Credit Limitation(s):* Not open for credit to students who have completed ECL 201.

*Grade Mode:* Letter.

**PLS 163 – Ecosystem & Landscape Ecology (4 units)**

*Course Description:* Integration of concepts to understand and manage ecosystems in a complex and changing world. Emphasis on interactions among biotic, abiotic & human factors and changes over space/ time. Local to global controls over water, carbon and nutrients across ecosystems/landscapes.

*Prerequisite(s):* ENH 160 C- or better or ESM 144 C- or better or ESP 100 C- or better or ESP 155 C- or better or EVE 101 C- or better or EVE 117 C- or better or PLB 117 C- or better or PLS 130 C- or better or PLS 144 C- or better or PLS 147 C- or better or PLS 150 C- or better or PLS 162 C- or better or SSC 100 C- or better or SSC 102 C- or better or SSC 109 C- or better or SSC 112 C- or better or HYD 124 C- or better or ECL 200AN C- or better or ECL 200BN (can be concurrent); or similar class with consent of instructor.

*Learning Activities:* Lecture/Discussion 3 hour(s), Project 1 hour(s).

*Credit Limitation(s):* Not open for credit to students who have completed ECL 201.

*Grade Mode:* Letter.

This course version is effective from, and including: Fall Quarter 2023.

**PLS 170A – Fruit & Nut Cropping Systems (2 units)**

*Course Description:* Overview of production and handling systems of major pomological crops, analysis of current cultural and harvesting problems and concerns associated with commercial fruit growing.

*Prerequisite(s):* PLS 002 or BIS 002C; or consent of instructor.

*Learning Activities:* Lecture 1 hour(s), Laboratory 3 hour(s).

*Credit Limitation(s):* Not open for credit to students who have completed AMR 170A. (Former AMR 170A.)

*Grade Mode:* Letter.

*General Education:* Science & Engineering (SE).

**PLS 170B – Fruit & Nut Cropping Systems (2 units)**

*Course Description:* Overview of production and handling systems of major pomological crops, including analysis of current cultural and harvesting problems and concerns associated with commercial fruit growing.

*Prerequisite(s):* PLS 002 or BIS 002C; or consent of instructor.

*Learning Activities:* Lecture 1 hour(s), Laboratory 3 hour(s).

*Credit Limitation(s):* Not open for credit to students who have completed AMR 170B. (Former AMR 170B.)

*Grade Mode:* Letter.

*General Education:* Science & Engineering (SE).

**PLS 171 – Principles & Practices of Plant Propagation (4 units)**

*Course Description:* Principles and practices of propagating plants covering anatomical, physiological, and practical aspects.

*Prerequisite(s):* PLS 002 or BIS 001C or BIS 002C.

*Learning Activities:* Lecture 2 hour(s), Discussion 1 hour(s), Laboratory 3 hour(s).

*Credit Limitation(s):* Not open for credit to students who have completed PLB 171. (Former PLB 171.)

*Grade Mode:* Letter.

*General Education:* Science & Engineering (SE).

**PLS 172 – Biology and Quality of Harvested Crops (4 units)**

*Course Description:* Overview of physiological and molecular processes related to the quality and safety of harvested crop products. Targeted approaches and technologies to improve/maintain crop quality and limit crop losses after harvest. Socioeconomic aspects of crop losses and food waste.

*Prerequisite(s):* BIS 002A; PLS 002; or consent of instructor.

*Learning Activities:* Lecture 3 hour(s), Discussion/Laboratory 2 hour(s).

*Grade Mode:* Letter.

*General Education:* Science & Engineering (SE).

**PLS 173 – Molecular & Cellular Aspects of Postharvest Biology (3 units)**

Starting Winter Quarter 2024, this course is no longer offered.

*Course Description:* Basic concepts and current knowledge of issues relevant to postharvest biology. Mechanisms of fruit ripening, senescence, programmed cell death. Metabolism and functions of phytohormones, carbohydrates, lipids, pigments, flavor compounds, and phytonutrients at molecular and cellular levels.

*Prerequisite(s):* PLS 002 or BIS 001C or BIS 002C; or equivalent.

*Learning Activities:* Lecture/Discussion 3 hour(s).

*Grade Mode:* Letter.

*General Education:* Science & Engineering (SE).

**PLS 174 – Microbiology & Safety of Fresh Fruits & Vegetables (3 units)**

*Course Description:* Overview of microorganisms on fresh produce, pre- and postharvest factors influencing risk of microbial contamination, attachment of microorganisms to produce, multiplication during postharvest handling and storage, and methods of detection. Mock outbreak trial and presentation of science-based forensic discovery.

*Prerequisite(s):* PLS 002 or BIS 001C or BIS 002C; or equivalent.

*Learning Activities:* Lecture 3 hour(s).

*Grade Mode:* Letter.

*General Education:* Science & Engineering (SE).

**PLS 176 – Introduction to Weed Science (4 units)**

*Course Description:* Weed biology and ecology, methods of weed management, biological control, herbicides and herbicide resistance. Weed control in managed and natural ecosystems; invasive species. Laws and regulations. Application of herbicides. Sight and software-assisted identification of common weeds.

*Prerequisite(s):* PLS 002 or BIS 001C or BIS 002C.

*Learning Activities:* Lecture 2 hour(s), Discussion/Laboratory 4 hour(s).

*Credit Limitation(s):* Not open for credit to students who have completed PLB 176. (Former PLB 176.)

*Grade Mode:* Letter.

*General Education:* Science & Engineering (SE); Visual Literacy (VL).

**PLS 178 – Biology & Management of Aquatic Plants (3 units)**

*Course Description:* Brief survey of common and invasive fresh water plants and macroalgae, their reproductive modes, physiology, growth (photosynthesis, nutrient utilization), development (hormonal interactions), ecology, modes and impacts of invasion, and management. Two Saturday field trips required.

*Prerequisite(s):* (PLS 002 or BIS 001C or BIS 002C); (CHE 008B or CHE 118B); PLS 100C, PLB 111, ENH 102, or HYD 122 recommended.

*Learning Activities:* Lecture 3 hour(s).

*Credit Limitation(s):* Not open for credit to students who have completed former PLB 178. (Former PLB 178.)

*Grade Mode:* Letter.

*General Education:* Science & Engineering (SE).

**PLS 188 – Undergraduate Research Proposal (3 units)**

*Course Description:* Preparation and review of a scientific proposal. Problem definition, identification of objectives, literature survey, hypothesis generation, design of experiments, data analysis planning, proposal outline and preparation.

*Prerequisite(s):* Upper division standing.

*Learning Activities:* Lecture/Discussion 3 hour(s).

*Cross Listing:* BIT 188.

*Grade Mode:* Letter.

*General Education:* Science & Engineering (SE); Writing Experience (WE).

**PLS 189L – Laboratory Research in Plant Sciences (2-5 units)**

*Course Description:* Formulating experimental approaches to current questions in plant science; performance of proposed experiments.

*Prerequisite(s):* PLS 188; and consent of instructor.

*Learning Activities:* Laboratory 3-12 hour(s), Discussion 1 hour(s).

*Repeat Credit:* May be repeated 12 unit(s).

*Grade Mode:* Pass/No Pass only.

**PLS 190 – Seminar on Alternatives in Agriculture (2 units)**

*Course Description:* Seminar on topics related to alternative theories, practices and systems of agriculture and the relationship of agriculture to the environment and society. Scientific, technological, social, political and economic perspectives.

*Prerequisite(s):* Upper division standing or consent of instructor.

*Learning Activities:* Seminar 1 hour(s), Discussion 1 hour(s).

*Repeat Credit:* May be repeated 2 time(s) for a total of three times.

*Grade Mode:* Pass/No Pass only.

*General Education:* Science & Engineering (SE).

**PLS 190C – Research Group Conference (1 unit)**

*Course Description:* Weekly conference on research problems, progress and techniques in the plant sciences.

*Prerequisite(s):* Consent of instructor; advanced standing.

*Learning Activities:* Discussion 1 hour(s).

*Repeat Credit:* May be repeated.

*Grade Mode:* Pass/No Pass only.

**PLS 192 – Internship (1-12 units)**

*Course Description:* Work experience on or off campus in subject areas pertaining to plant and environmental sciences. Internship supervised by a faculty member.

*Prerequisite(s):* Consent of instructor; completion of 84 units.

*Learning Activities:* Internship 3-36 hour(s).

*Repeat Credit:* May be repeated.

*Grade Mode:* Pass/No Pass only.

**PLS 193 – Garden & Farm-Based Experiential Education Methods (2 units)**

*Course Description:* Methods of teaching children and youth about fruit and vegetable production and consumption. Lesson and activity planning for garden and farm field trips. Basic biology, ecology, plant science, and crop management practices. Mentorship in experiential learning.

Preparation of garden site.

*Prerequisite(s):* Upper division standing or consent of instructor.

*Learning Activities:* Lecture 1 hour(s), Laboratory 3 hour(s).

*Grade Mode:* Pass/No Pass only.

*General Education:* Science & Engineering (SE); Oral Skills (OL).

**PLS 194H – Senior Honors Thesis (1-2 units)**

*Course Description:* Independent study of selected topics under the direction of a member or members of the staff. Completion will involve the writing of a senior thesis.

*Prerequisite(s):* Senior standing; overall GPA of 3.250 or higher and consent of master advisor.

*Learning Activities:* Independent Study 3-6 hour(s).

*Grade Mode:* Pass/No Pass only.

*General Education:* Science & Engineering (SE); Writing Experience (WE).

**PLS 196 – Postharvest Technology of Horticultural Crops (3 units)**

Starting Spring Quarter 2024, this course is no longer offered.

*Course Description:* Intensive study of postharvest considerations and current procedures and challenges in postharvest handling for fruits, nuts, vegetables, and ornamentals in California. Scheduled first two weeks immediately following last day of spring quarter.

*Prerequisite(s):* Upper division or graduate student standing.

*Learning Activities:* Lecture/Discussion 45 hour(s), Fieldwork 45 hour(s).

*Credit Limitation(s):* Not open for credit to students who have completed PLB 196. (Former PLB 196.)

*Grade Mode:* Pass/No Pass only.

*General Education:* Science & Engineering (SE).

**PLS 197T – Tutoring in Plant Sciences (1-5 units)**

*Course Description:* Leading small voluntary discussion or lab groups affiliated with one of the department's regular courses.

*Prerequisite(s):* Consent of instructor; upper division standing, completion of course being tutored or the equivalent.

*Learning Activities:* Tutorial 1-5 hour(s).

*Repeat Credit:* May be repeated 8 unit(s).

*Grade Mode:* Pass/No Pass only.

**PLS 198 – Directed Group Study (1-5 units)**

*Course Description:* Directed group study.

*Learning Activities:* Variable 3-15 hour(s).

*Repeat Credit:* May be repeated.

*Grade Mode:* Pass/No Pass only.

**PLS 199 – Special Study for Advanced Undergraduates (1-5 units)**

*Course Description:* Special study for advanced undergraduates.

*Learning Activities:* Variable 3-15 hour(s).

*Repeat Credit:* May be repeated.

*Grade Mode:* Pass/No Pass only.

**PLS 205 – Experimental Design & Analysis (5 units)**

*Course Description:* Introduction to the research process and statistical methods to plan, conduct and interpret experiments.

*Prerequisite(s):* PLS 120; or equivalent.

*Learning Activities:* Lecture 3 hour(s), Discussion/Laboratory 2 hour(s).

*Credit Limitation(s):* Not open for credit to students who have completed AGR 205. (Former AGR 205.)

*Grade Mode:* Letter.

**PLS 206 – Applied Multivariate Modeling in Agricultural & Environmental Sciences (4 units)**

*Course Description:* Multivariate linear and nonlinear models. Model selection and parameter estimation. Analysis of manipulative and observational agroecological experiments. Discriminant, principal component, and path analyses. Logistic and biased regression. Bootstrapping. Exercises based on actual research by UC Davis students.

*Prerequisite(s):* PLS 120; (STA 106 or STA 108 or PLS 205).

*Learning Activities:* Lecture 3 hour(s), Discussion 1 hour(s).

*Credit Limitation(s):* Not open for credit to students who have complete AGR 206. (Former AGR 206.)

*Grade Mode:* Letter.

**PLS 207 – Applied Statistical Modeling for the Environmental Sciences (3 units)**

*Course Description:* Introduction to building statistical models in classical and Bayesian frameworks, model fitting methods, introduction to hierarchical Bayes, regularization and priors, applications of hierarchical Bayesian models to important kinds of problems of environmental data analysis.

*Prerequisite(s):* PLS 205 (can be concurrent); PLS 206 (can be concurrent); or consent of instructor.

*Learning Activities:* Lecture 3 hour(s).

*Grade Mode:* Letter.

**PLS 212 – Postharvest Biology & Biotechnology of Fruits & Nuts (3 units)**

*Course Description:* Review of postharvest biology of fruits and nuts and biotechnological approaches to address postharvest challenges. Morphology, biology and postharvest handling of fruits and nuts are presented along with current research, including biotechnology, and discussion of future research needs and approaches.

*Prerequisite(s):* PLS 172.

*Learning Activities:* Lecture 3 hour(s).

*Credit Limitation(s):* Not open for credit to students who have completed POM 212.

*Grade Mode:* Letter.

**PLS 213 – Postharvest Physiology of Vegetables (3 units)**

*Course Description:* Comparative physiology of harvest vegetables; emphasis on maturation, senescence, compositional changes, physiological disorders and effects of environmental factors. Concepts and research procedures.

*Prerequisite(s):* PLS 172 or PLS 100B or PLB 112.

*Learning Activities:* Lecture 2 hour(s), Discussion 1 hour(s).

*Credit Limitation(s):* Not open for credit to students who have completed VCR 212. (Former VCR 212.)

*Grade Mode:* Letter.

**PLS 217 – Field Techniques in Plant Physiology (3 units)**

*Course Description:* Hands-on practice applying a wide range of field-oriented plant physiology equipment and techniques. Use of water relations techniques, gas exchange devices, and image analysis, with extensive focus on dataloggers and sensing. Training in field-based plant physiology techniques intended to help students design research projects and appreciate the value and limitations of new equipment.

*Prerequisite(s):* Prior coursework in plant physiology such as PLS 100A, PLS 100CL, PLS 157, PLS 210, PLB 111 or similar.

*Learning Activities:* Discussion/Laboratory 2.50 hour(s), Extensive Problem Solving 1 hour(s).

*Grade Mode:* Letter.

**PLS 220 – Genomics & Biotechnology of Plant Improvement (3 units)**

*Course Description:* Integration of modern biotechnology and classical plant breeding including the impact of structural, comparative and functional genomics on gene discovery, characterization and exploitation. Covers molecular markers, plant transformation, hybrid production, disease resistance, and novel output traits.

*Prerequisite(s):* BIS 101; or the equivalent.

*Learning Activities:* Lecture 3 hour(s).

*Credit Limitation(s):* Not open for credit to students who have completed VCR 220. (Former VCR 220.)

*Cross Listing:* GGG 220.

*Grade Mode:* Letter.

**PLS 221 – Genomics & Breeding of Vegetable Crops (3 units)**

*Course Description:* Preview of genome structure, mapping, gene tagging and development of other genetic resources applied to improvement of major vegetables. For graduate students contemplating a career in modern vegetable breeding and biotechnology.

*Prerequisite(s):* BIS 101; or equivalent.

*Learning Activities:* Lecture 3 hour(s).

*Credit Limitation(s):* Not open for credit to students who have completed VCR 221. (Former VCR 221.)

*Grade Mode:* Letter.

**PLS 222 – Advanced Plant Breeding (4 units)**

*Course Description:* Philosophy, methods, and problems in developing improved plant species. Topics include: inbreeding, heterosis, progeny testing, breeding methodology, index selection, germplasm conservation, and breeding for stress resistance. Laboratories include tours of breeding facilities and calculation and interpretation of quantitative data.

*Prerequisite(s):* PLS 154; PLS 205; GGG 201D or ANG 107 recommended.

*Learning Activities:* Lecture 3 hour(s), Laboratory 3 hour(s).

*Grade Mode:* Letter.

**PLS 225 – Quantitative Genetics (4 units)**

*Course Description:* Introduction to the principles of quantitative genetics including the study and analysis of quantitative variation, concepts of heritability and genetic gain from artificial selection, and application of classic and genome-informed approaches in breeding.

*Prerequisite(s):* PLS 205; GGG 201D; or consent of instructor; graduate standing.

*Learning Activities:* Lecture 3 hour(s), Discussion 1 hour(s).

*Grade Mode:* Letter.

**PLS 240 – Extension Education, Outreach & Science Communication (4 units)**

*Course Description:* History, theory, and current practice of extension education. Role and skills needed of the extension educator. Pluralistic nature of extension education. Development of skills to create lasting change through outreach and communication in an extension education program.

*Prerequisite(s):* Graduate standing; or consent of instructor.

*Learning Activities:* Lecture 3 hour(s); Discussion 1 hour(s).

*Enrollment Restriction(s):* Open to graduate students only.

*Grade Mode:* Letter.

**PLS 290 – Seminar (1-2 units)**

*Course Description:* Topics of current interest related to Plant Sciences.

*Learning Activities:* Seminar 1-2 hour(s).

*Grade Mode:* Satisfactory/Unsatisfactory only.

**PLS 290C – Research Conference (1 unit)**

*Course Description:* Research conference.

*Prerequisite(s):* Consent of instructor.

*Learning Activities:* Discussion 1 hour(s).

*Repeat Credit:* May be repeated.

*Grade Mode:* Satisfactory/Unsatisfactory only.

**PLS 297T – Tutoring in Plant Sciences (1-5 units)**

*Course Description:* Designed for graduate students who desire teaching experience but are not teaching assistants.

*Prerequisite(s):* Consent of instructor; graduate standing; completion of course to be tutored or the equivalent.

*Learning Activities:* Tutorial 1-5 hour(s).

*Repeat Credit:* May be repeated 5 unit(s) and same course may not be tutored more than once.

*Grade Mode:* Satisfactory/Unsatisfactory only.

**PLS 298 – Group Study (1-5 units)**

*Course Description:* Group study.

*Learning Activities:* Variable.

*Grade Mode:* Letter.

**PLS 299 – Research (1-12 units)**

*Course Description:* Research.

*Learning Activities:* Variable 3-36 hour(s).

*Repeat Credit:* May be repeated.

*Grade Mode:* Satisfactory/Unsatisfactory only.

**PLS 396 – Teaching Assistant Training Practicum (1-4 units)**

*Course Description:* Teaching assistant training.

*Prerequisite(s):* Consent of instructor; graduate standing.

*Learning Activities:* Variable 3-12 hour(s).

*Repeat Credit:* May be repeated.

*Grade Mode:* Satisfactory/Unsatisfactory only.