PLANT AND ENVIRONMENTAL SCIENCES

Undergraduate Program Information

The undergraduate program in Plant and Environmental Science prepares you for a variety of careers in agriculture and related fields. Accordingly, a flexible curriculum has been designed that will allow specific programs to be developed in consultation with your academic advisor. Programs may also be developed if you wish to prepare for advanced studies in graduate school. In addition to the courses listed for each major, 35 credits must be taken in the College of Agricultural, Consumer and Environmental Sciences, and the university general education requirements must be met.

The minors require a minimum of 18 credits of which at least 9 hours must be at the 300 or higher level. Specific coursework requirements apply. See advisor for course requirements and scheduling.

Graduate Program Information

More than ever, we are linked in an interconnected world: both in agriculture and sustainability of environmental systems. The department has programs in

- plant sciences,
- environmental science,
- soil science,
- water management,
- natural resources management and
- turf management.

Students trained in these areas are in demand for U.S. and international positions. This demand is at all levels of training—BS, MS, and Ph.D. Therefore, the course work and original research in Plant and Environmental Sciences leading to the Master of Science and Doctor of Philosophy are designed for and have proven to be successful in preparing students for commercial companies, educational institutions, governmental agencies and private production enterprises.

The student may emphasize study in several discipline areas described in the following pages.

- The agronomy section emphasizes sustainable crop production, plant-pest/disease/weed interactions, soil-water-plant relations, crop physiology, and breeding and genetics of cotton, alfalfa, maize and peanuts.
- The genetics section places special emphasis on genetic basis of agronomic or horticultural traits, applied bioinformatics, gene regulation and genomics.
- The environmental and soil science sections emphasize environmental quality and ecosystem services, bioremediation, recycling of organic wastes and wastewater, water use efficiency, soil-plant relations, soil-geomorphology and desert ecology, and the fertility, chemistry, physics, and microbiology of soils, including forest soils.
- The horticulture section emphasizes the creative use of plants by humans, and studies on the technical advancements in the husbandry of most economic commodity groups of fruits, vegetables, or ornamentals as well as managed turf. Emphasis may be in breeding and genetics of chile or onions, plant growth and development, nutrition, dormancy and cold hardiness, plant stress (water and/or salinity) response, fruit and vegetable physiology, forestry, and turfgrass.

Most students will be expected to complete a thesis. The research detailed in a thesis should be of a scope and quality to merit publication in a refereed journal. Depending on prior training and experience, a non-thesis option is available subject to approval by a departmental committee. The non-thesis option requires completion of a research project and paper of limited scope. In both the thesis and non-thesis options, suitability of the research project and resulting thesis or paper will be judged by the student's graduate committee. A minor is recommended and may be taken in chemistry, biology, molecular biology, environmental management, applied statistics, toxicology or other areas.

Prerequisite to major graduate work is completion of a curriculum essentially equivalent to that required by the department for the BS degree at New Mexico State University.

Degrees for the Department

Bachelor Degree(s)

- Agronomy - Bachelor of Science in Agriculture (https://catalogs.nmsu.edu/nmsu/agricultural-consumer-environmental-sciences/plant-environmental-sciences/agronomy-bachelor-science-agriculture/)
- Environmental Science - Bachelor of Science in Environmental Science (https://catalogs.nmsu.edu/nmsu/agricultural-consumer-environmental-sciences/plant-environmental-sciences/environmental-science-bachelor-science-environmental-science/)
- Genetics and Biotechnology - Bachelor of Science in Genetics (https://catalogs.nmsu.edu/nmsu/agricultural-consumer-environmental-sciences/plant-environmental-sciences/genetics-biotechnology-bachelor-science-genetics/)
- Horticulture (Turfgrass Science and Management) - Bachelor of Science in Agriculture (https://catalogs.nmsu.edu/nmsu/agricultural-consumer-environmental-sciences/plant-environmental-sciences/horticulture-turfgrass-science-management-bsag/)
- Horticulture - Bachelor of Science in Agriculture (https://catalogs.nmsu.edu/nmsu/agricultural-consumer-environmental-sciences/plant-environmental-sciences/horticulture-bachelor-science-agriculture/)
- Soil Science (Environment and Resource Management) - Bachelor of Science in Agriculture (https://catalogs.nmsu.edu/nmsu/agricultural-consumer-environmental-sciences/plant-environmental-sciences/soil-science-environment-resource-management-bachelor-science-agriculture/)
- Soil Science (Soil and Water Science) - Bachelor of Science in Agriculture (https://catalogs.nmsu.edu/nmsu/agricultural-consumer-environmental-sciences/plant-environmental-sciences/soil-science-soil-water-science-bachelor-science-agriculture/)
- Soil Science (Soils) - Bachelor of Science in Agriculture (https://catalogs.nmsu.edu/nmsu/agricultural-consumer-environmental-sciences/plant-environmental-sciences/soil-science-soils-bachelor-science-agriculture/)

Master Degree(s)

- Horticulture - Master of Science (https://catalogs.nmsu.edu/nmsu/graduate-school/horticulture-master-science/)

- Plant and Environmental Science - Master of Science (https://catalogs.nmsu.edu/nmsu/graduate-school/plant-environmental-science-master-science/)

Doctoral Degree(s)

- Plant and Environmental Science - Doctor of Philosophy (https://catalogs.nmsu.edu/nmsu/graduate-school/plant-environmental-science-doctor-philosophy/)

Certificate(s)

- Sustainability - Graduate Certificate (https://catalogs.nmsu.edu/nmsu/graduate-school/sustainability-graduate-certificate/)

Minors for the Department

- Agronomy - Undergraduate Minor (https://catalogs.nmsu.edu/nmsu/agricultural-consumer-environmental-sciences/plant-environmental-sciences/agronomy-undergraduate-minor/)
- Environmental Science - Undergraduate Minor (https://catalogs.nmsu.edu/nmsu/agricultural-consumer-environmental-sciences/plant-environmental-sciences/environmental-science-undergraduate-minor/)
- Genetics and Biotechnology - Undergraduate Minor (https://catalogs.nmsu.edu/nmsu/agricultural-consumer-environmental-sciences/plant-environmental-sciences/genetics-biotechnology-undergraduate-minor/)
- Horticulture - Undergraduate Minor (https://catalogs.nmsu.edu/nmsu/agricultural-consumer-environmental-sciences/plant-environmental-sciences/horticulture-undergraduate-minor/)
- Soil Science - Undergraduate Minor (https://catalogs.nmsu.edu/nmsu/agricultural-consumer-environmental-sciences/plant-environmental-sciences/soil-science-undergraduate-minor/)

Anowar Islam, Department Head

Professors Angadi, Burney, Carroll, Cramer, Goss, Hanan, Heerema, Idowu, Islam, Leinauer, Lombard, Marsalis, Pratt, Ulery, Walker, Yao; ***Associate Professors*** Brungard, Darapuneni, Djaman, Ghimire, Grover, Guzman, Holguin, Salmasi; ***Assistant Professors*** Chavez, Li, Lozada, Thompson; ***College Professors*** Lauriault, Puppala, Stringam; ***College Associate Professors*** DuBois, Gioannini, Steele; ***Research Assistant Professors*** Anchang, Edwards, Kahiu, Rodriguez-Uribe; ***Emeriti*** Bosland, Guldan, Mexal, Monger, O'Connell, O'Neill, Picchioni, Ray, Sengupta-Gopalan, St. Hillaire; ***Affiliate faculty*** Kahn, Pietrasiak, Rucker, Schooley, Webb

A. Islam Department Head, Ph.D. (University of Sydney, Australia)–forage agroecology; J. Anchang, Ph.D. (University of South Florida)-remote sensing and dryland ecology; S. Angadi, Ph.D. (University of Manitoba, Canada)–crop physiology; C. Brungard, Ph.D. (Utah State University, Logan)–pedology; O. Burney, Ph.D. (Purdue University, West Lafayette)–silviculture and forest biology; K.C. Carroll, Ph.D. (University of Arizona)–hydrology and water resources; M.Y. Chavez, Ph.D. (Colorado State University)-agroecology and agrovoltaics; C.S. Cramer, Ph.D. (North Carolina State University)–onion breeding and horticulture; M. Darapuneni, Ph.D. (Texas A&M, College Station)–Agronomy and semi-arid crop rotations; K. Djaman, Ph.D. (University of Nebraska-Lincoln)-soil & water resources and irrigation engineering; D. DuBois, Ph.D. (University of Nevada)–atmospheric science; B. Edwards, Ph.D. (Louisiana State University)-geomorphology, aeolian processes; R. Ghimire, Ph.D. (University of Wyoming, Laramie)–soil & crop management; R. Gioannini, M.S. (New Mexico State University)-ornamental horticulture, landscape design; R.M. Goss, Ph.D. (University of Nebraska, Lincoln)–turf science; K. Grover, Ph.D. (Pennsylvania State University)–agronomy; I. Guzman, Ph.D. (New Mexico State University)–horticulture; N.P. Hanan, Assistant Department Head, Ph.D. (Queen Mary College, UK)–dryland ecology; R.J. Heerema, Ph.D. (University of California, Davis)–pecans; F.O. Holguin, Ph.D. (New Mexico State University)–biochemical analysis; J. Idowu, Ph.D. (Cranfield University, United Kingdom)–agronomy and land management; M.N. Kahiu, Ph.D. (South Dakota State University)-savannah ecology and remote sensing; M. Kahn, PhD. (CA Institute of Technology)-molecular biology; B. Leinauer, Ph.D. (Hohenheim University, Germany)–turfgrass; X. Li, Ph.D. (Oklahoma State University)-soil microbiology, fertility, and soil health; K. Lombard, Ph.D. (New Mexico State University)–horticulture; D. Lozada Ph.D. (University of Arkansas, Fayetteville)-cell and molecular biology; M. Marsalis, Ph.D. (Texas Tech University)–forages; N. Pietrasiak, Ph.D. (University of California, Riverside)–soil and water sciences; R. Pratt, Ph.D. (Purdue University)–plant breeding and genetics; N. Puppala, Ph.D. (New Mexico State University)–plant breeding and genetics; L. Rodriguez-Uribe. Ph.D. (New Mexico State University)-molecular genetics; D. Rucker, Ph.D. (University of Arizona)–hydrogeophysics; S.Z. Salmasi, Ph.D. (University of Tabriz, Iran)-sustainable crop management; R. Schooley, PhD. (Colorado State University)-wildlife ecology and management; B. Stringam, Ph.D. (Utah State University)–biological and agricultural engineering; C. Steele, Ph.D. (King's College, University of London, United Kingdom)–range soils; M. Thompson, Ph.D. (New Mexico State University)–horticulture; A.L. Ulery, Ph.D. (University of California, Riverside)–environmental soil chemistry; S. J. Walker, Ph.D. (New Mexico State University)–horticulture; N. Webb Ph.D. (University of Queensland, Australia)-aeolian process, land degradation processes and rangeland management; S. Yao, Ph.D. (Cornell University)–pomology/horticulture.

Emeriti

P.W. Bosland, Ph.D. (University of Wisconsin, Madison)–chile breeding and genetics; S.J. Guldan, Ph.D. (University of Minnesota)–sustainable agriculture; J.G. Mexal, Ph.D. (Colorado State University)-plant physiology; C.H. Monger, Ph.D. (New Mexico State University)-soil genesis and classification; M.A. O'Connell, Ph.D. (Cornell University)–plant biochemistry and molecular genetics; M. O'Neill, Ph.D. (University of Arizona, Tucson)-agronomy and crop physiology; G.A. Picchioni, Ph.D. (Texas A&M University)-plant-mineral relations; I.M. Ray, Ph.D. (University of Wisconsin-Madison)–alfalfa breeding and genetics; C. Sengupta-Gopalan, Ph.D. (Ohio State University)–biochemical genetics; R. St. Hilaire, Ph.D. (Iowa State University)-plant stress physiology and landscape horticulture.

Agronomy Courses

AGRO 1110G. Introduction to Plant Science (Lecture & Lab)
4 Credits (3+2P)
This is an introductory course for understanding plant science. Basic biological, chemical, and physical principles of various plants are covered. The focus of this course is on plants/crops used in agriculture production of food and fiber as well as pasture and range plants. Plant taxonomy and soil properties will also be discussed. Same as HORT 1115G.

Learning Outcomes

1. Describe the basic structure of plants including growth and function.
2. Define photosynthesis, respiration, and translocation
3. Utilize plant taxonomy techniques to identify various plants.
4. Classify soils based on their chemical and physical properties.
5. Explain how different soil properties affect plant growth and sustainability.

AGRO 2160. Plant Propagation
3 Credits (2+2P)
Practical methods of propagating horticultural plants by seed, cuttings, layering, grafting, division and tissue culture. Examination of relevant physiological processes involved with successful plant propagation techniques. Crosslisted with HORT 2160.
Learning Outcomes
1. Practical methods of propagating plants by seed, cuttings, layering, grafting, division, and tissue culture through experiential, "hands-on" laboratories.
2. Relevant physiological principles involved in propagating horticultural plants through lecture discussions and readings.

AGRO 2996. Special Topics
1-4 Credits (1-4)
Specific subjects and credits to be announced in the Schedule of Classes. Maximum of 4 credits per semester. No more than 9 credits toward a degree. May be repeated up to 9 credits. Consent of Instructor required.
Learning Outcomes
1. Varies

AGRO 300. Special Topics
1-4 Credits (1-4)
Specific subjects and credits to be announced in the Schedule of Classes. Maximum of 4 credits per semester. No more than 9 credits toward a degree. May be repeated up to 9 credits. Consent of Instructor required. Restricted to Las Cruces campus only.

AGRO 303V. Genetics and Society
3 Credits (3)
Relates the science of genetics with social ramifications. Ways in which genetics and evolution interact with social, political, and economic issues. Includes genetic engineering, gene therapy, DNA finger-printing, ancient DNA, plant and animal improvement, and future prospects. Students required to formulate value judgments on contemporary biological issues that will impact society. Crosslisted with: GENE 303V.
Learning Outcomes
1. Explain foundational genetic concepts and modern biotechnological techniques, including whole genome sequencing and genetic variation.
2. Analyze the implications of genetic technologies, such as cloning, gene therapy, genetic testing, and DNA forensics, to society.
3. Evaluate ethical issues surrounding genetic applications, including genetic discrimination, eugenics, and ownership of genetic information.
4. Develop and defend informed arguments about controversial topics in genetics (cloning and stem cells), using scientific evidence and ethical reasoning.
5. Collaborate on a group project (a term paper) to research and present real-world genetics-related issues and their impact on society.

AGRO 305. Principles of Genetics
3 Credits (3)
Covers fundamental principles of reproduction, variation, and heredity in plants and animals. May be repeated up to 3 credits.
Prerequisite: (BIOL 2610G and BIOL 2110G, or BIOL 2110G and BCHE 140, and either CHEM 1215G or CHEM 1216).
Learning Outcomes
1. To provide an introduction to the basic concepts, methods, and terminology of genetics. Introduction to genomics and bioinformatics.
2. To develop a working understanding of genetics and heredity
3. To understand in some depth, the mechanism of DNA replication, transcription and protein synthesis. To understand the regulation of gene expression.
4. To examine the impact of genetics on both basic and applied aspects of the biological sciences, as well as its effects on our everyday lives.

AGRO 311. Introduction to Weed Science
4 Credits (3+2P)
Principles of weed science, with emphasis on characteristics of invasive plants, methods of integrated weed management, and current issues impacting weed management. Identification of local weeds. Taught with AGRO 311. May be repeated up to 4 credits.
Prerequisite: CHEM 1215G, and BIOL 2110G.
Learning Outcomes
1. Describe the environmental conditions and inherent traits that promote the growth and persistence of weed populations in managed and natural ecosystems.
2. Predict causes and consequences of weed management failures in agricultural and natural ecosystems.
3. Apply knowledge of herbicidal, mechanical and cultural weed control to develop integrated strategies for weed problems.
4. Classify herbicides based on injury symptoms, mode of action, site of action, translocation, selectivity, potential uses and potential dangers.
5. Identify common weeds found in southern New Mexico by providing correctly spelled botanical and common names, as well as lifecycles.
6. Demonstrate the ability to safely apply herbicide solutions including: perform the activities and calculations to ensure that a sprayer delivers the appropriate amount of solution over the sprayed area, interpret herbicide labels to identify guidelines for safety, dosage and application procedures, and perform the calculations necessary for determining appropriate amounts of herbicide, carrier and adjuvant to add to a spray tank.

AGRO 365. Principles of Crop Production
4 Credits (3+3P)
Basic principles of crop production including environmental and physiological factors limiting production, plant nutrition and soil science, soil-water management, cropping systems and management, pest management, and economic factors influencing crop production. Taught with HORT 365. May be repeated up to 4 credits.
Prerequisite: AGRO 1110G/HORT 1115G, CHEM 1215G or equivalent and MATH 1215 or equivalent.
Learning Outcomes
1. Analyze and apply core principles of crop production, including environmental, physiological, and climatic factors, to optimize plant growth, yield, and overall production efficiency.
2. Demonstrate understanding of plant biology by identifying structures, growth stages, and functions across the plant life cycle.
3. Evaluate plant propagation and reproduction methods by distinguishing between sexual and asexual techniques, explaining pollination and fertilization processes, and discussing their impact on genetic improvement and crop uniformity.
4. Demonstrate proficiency in seed and equipment technologies, including identification and calibration of farm implements, calculation of seed rates, and evaluation of certified seed quality and planting operations.
5. Apply experiential learning methods to design, manage, and assess crop production systems using real-world data and reflection-based decision-making models (Kolb's learning cycle).

AGRO 377. Introduction to Turfgrass Management
4 Credits (3+3P)
Establishment and maintenance of turfgrass with emphasis on seeding methods, soil and water management, mowing, disease, insects and turfgrass varieties. Consent of instructor required. Crosslisted with: HORT 377
Learning Outcomes
1. Identify the general morphology of grass plants and the characteristics of cool- and warm-season grasses.
2. Explain various turf establishment techniques and procedures.
3. Demonstrate understanding of basic soil science, soil testing, amendments, and fertilization regarding cultural and maintenance procedures as well as seasonal projects to maintain healthy turf.
4. Recognize and identify common turf disturbances including weed, pest, and disease identification.
5. Communicate turf conditions and the rationale for different maintenance processes on the course or field.

AGRO 391. Internship
1-6 Credits
Professional work experience under the joint supervision of the employer and a faculty member. A written report is required. No more than 6 credits toward a degree. Consent of Instructor required. Graded: S/U Grading (S/U, Audit).
Prerequisite(s): Consent of instructor.

AGRO 447. Seminar
1 Credit (1)
Organization, preparation, and presentation of current topics in agronomy, environmental sciences, horticulture, and soil science. Crosslisted with: SOIL 447, HORT 447 and ENVS 447.
Learning Outcomes
1. Develop professional communication skills through teamwork, case study preparation and presentation, data interpretation, and role-playing in mock interviews.
2. Prepare a professional resume, personal statement of goals for graduate school or permanent employment and make a Case Study presentation to faculty and peers.

AGRO 449. Special Problems
1-3 Credits (1-3)
Research problem, experience training, or other special study approved by a faculty adviser. Maximum of 3 credits per semester and a grand total of 6 credits. May be repeated up to 6 credits. Consent of Instructor required.

AGRO 450. Special Topics
1-4 Credits (1-4)
Specific subjects to be announced in the Schedule of Classes. Maximum of 4 credits per semester and a total of 9 credits toward a degree. May be repeated up to 9 credits. Consent of Instructor required.

AGRO 462. Plant Breeding
3 Credits (3)
Principles and practices involved with the genetic improvement of plants.
Prerequisite: ANSC/AGRO/BIOL/HORT/GENE 305, or GENE 320.
Learning Outcomes
1. Determine important plant traits and develop means to obtain trait variation for any plant species.
2. Create a plan for obtaining plant germplasm for any plant species.
3. Synthesize 3-5 breeding objectives that are obtainable for the breeding of any plant species.
4. Propose different breeding methods for use to develop cultivars for any plant species.
5. Work as a team with other students to produce a comprehensive breeding plan to develop cultivars for any plant species.

AGRO 471. Plant Mineral Nutrition
3 Credits (3)
Basic and applied aspects of plant requirements for soil-derived minerals and the processes whereby minerals are acquired, absorbed, translocated, and utilized throughout the plant. Same as HORT 471 and EPWS 471.
Prerequisite/Corequisite: EPWS 314/BIOL 314, or concurrent enrollment, or consent of instructor.
Learning Outcomes
1. Describe essential plant minerals, how each plant mineral is acquired, the function of each plant mineral, and how plants regulate internal mineral content.
2. Diagnose plant mineral disorders and stress.
3. Demonstrate ability to understand plant nutrient analyses, this includes: 1) perform the activities and conversions to understand the analyses and 2) make recommendations based on analyses.
4. Develop and present a fifteen-minute presentation describing aspects of a specific crop including information on 1) fertilizer needs and rates, leaf nutrient values, and nutrient disorders 2) roles and function of a minimum of one specific mineral used by selected plant, and 3) environmental and sustainability issues with managing the fertilization chosen crop.

AGRO 483. Advanced Sustainable Crop Production
4 Credits (3+3P)
Characteristics and objectives of sustainable agricultural systems with application to the production, utilization, and improvement of agronomic and vegetable crops.
Prerequisite: AGRO 365 or HORT 365.
Learning Outcomes
1. Design and evaluate sustainable cropping systems by integrating principles of crop diversification, crop rotation, no-till, and organic practices, and assessing their advantages, challenges, and impact on long-term agricultural sustainability.
2. Analyze and apply crop and soil management strategies using holistic and integrated approaches, including mycorrhizal fungi use in arid environments, IPM (Integrated Pest Management), and the "many little hammers" approach to weed control.
3. Select and recommend crop cultivars and management practices for specific agronomic and horticultural crops using tools such as growing degree days, variety test reports, and region-specific criteria (for New Mexico).
4. Critically review and communicate sustainable agricultural research and practices by analyzing case studies, scientific literature, and peer presentations to evaluate the effectiveness of sustainability-focused strategies.
5. Identify and engage with agricultural support systems and sustainability networks, including agencies like Western SARE, to explore resources for funding, research, and application of sustainable agriculture practices.

AGRO 492. Diagnosing Plant Disorders
3 Credits (2+3P)
Systematic diagnosis of the physiological, pathological, and entomological causes of plant disorders. Same as EPWS 492 and HORT 492.

Prerequisites: EPWS 303 and EPWS 310.

AGRO 500. Special Topics
1-4 Credits
Specific subjects and credits to be announced in the Schedule of Classes. Maximum of 4 credits per semester. No more than 9 credits toward a degree.

AGRO 505. Research Orientation
4 Credits (3+2P)
Training in writing research proposals, presentation of research results, and interpretation of research results. Crosslisted with: HORT 505, SOIL 505 and ENVS 505.

Learning Outcomes

1. Gain insight into the nature of scientific research and skills vital for graduate research and future careers in science.
2. Navigate graduate school processes and protocols.
3. Demonstrate critical thinking.
4. Generate a scientific hypothesis.
5. Communicate science effectively in written and oral formats, including drafting a proposal for thesis or dissertation research.

AGRO 511. Introduction to Weed Science (f)
4 Credits (3+2P)
Covers the principles of weed science with emphasis on characteristics of invasive plants, methods of integrated weed management, and current issues impacting weed management. Includes identification of local weeds. Research paper required for graduate credit. Taught with AGRO 511. May be repeated up to 4 credits.
Prerequisite: CHEM 1215G and BIOL 2110G.

Learning Outcomes

1. Describe the environmental conditions and inherent traits that promote the growth and persistence of weed populations in managed and natural ecosystems.
2. Predict causes and consequences of weed management failures in agricultural and natural ecosystems.
3. Apply knowledge of herbicidal, mechanical and cultural weed control to develop integrated strategies for weed problems.
4. Classify herbicides based on injury symptoms, mode of action, site of action, translocation, selectivity, potential uses and potential dangers.
5. Identify common weeds found in southern New Mexico by providing correctly spelled botanical and common names, as well as lifecycles.
6. Demonstrate the ability to safely apply herbicide solutions includes: perform the activities and calculations to ensure that a sprayer delivers the appropriate amount of solution over the sprayed area, interpret herbicide labels to identify guidelines for safety, dosage and application procedures, and perform the calculations necessary for determining appropriate amounts of herbicide, carrier and adjuvant to add to a spray tank.

AGRO 513. Introduction to Scientific Writing
3 Credits (3)
Students will learn how to communicate, through written format, to both the scientific community and diverse audiences. Students will be introduced to new technologies and new genres of scientific writing. Students will also learn basic reviewing and writing skills that underlie efficient preparation of literature reviews, scientific manuscripts, project reports, blog-posts, opinion or perspective pieces for more popular venues, advocacy articles for legislators, and descriptive pieces for popular venues such as newspapers, magazines, and broadcast media. Emphasis will be on the communication of experimental findings in peer-reviewed scientific journals.

Learning Outcomes

1. Students will review the basics of rhetoric and the technology of language.
2. Students will learn how to overcome writing barriers and gain confidence in their writing skills.
3. Students will improve their writing skills so that manuscript preparation becomes more efficient and productive.
4. Students will learn professional standards for the conduct of ethical reporting of scientific results.
5. Students will learn to recognize structural and stylistic elements in scientific articles that help researchers achieve certain communication goals.
6. Students will learn the basics of table, figure, diagram, and image presentation in manuscripts.
7. Literature reviews, framed so that they answer an important question in the field, and lead to peer-reviewed publication, may also be prepared. (With permission of the instructor.)

AGRO 516. Molecular Analysis of Complex Traits
3 Credits (3)
Provide a comprehensive overview of molecular genetic analysis of complex phenotypes, including case histories/experiments in plants, animals and humans. Emphasize technological developments in DNA marker technologies and their application to molecular quantitative genetics. Explore the efficient application of these technologies in the future to complex genetic systems, breeding, and other areas of life sciences. Same as HORT 516.
Prerequisite: AGRO 305 or consent of instructor.

AGRO 525. Scientific Writing- How to be a Productive and Effective Writer
1-3 Credits (1-3)
Students will learn to improve their writing skills so that their manuscript preparation process is more efficient and productive. Students will also gain experience in peer-review. Crosslisted with: HORT 525, EPWS 525, SOIL 525, AGRO 625, HORT 625 and SOIL 625.

AGRO 590. Graduate Seminar
1 Credit (1)
Current research discussions presented by masters level graduate students. Not more than one credit toward the degree. Same as HORT/SOIL 590. Crosslisted with: HORT 590 and SOIL 590.

AGRO 595. Internship
1-6 Credits
Supervised professional on-the-job learning experience. Limited to Master of Agriculture candidates. Not more than 6 credits toward the degree.

AGRO 596. Masters Proposal
1 Credit (1)
Current research proposal written by maters level graduate students. Consent of Instructor required. Crosslisted with: ENVS 596, GENE 596, HORT 596 and SOIL 596. Restricted to: Masters HORT; Masters PLEN majors.
Prerequisite(s): Master level graduate students.

AGRO 597. University Teaching Experience
1-3 Credits (1-3)
Certain graduate students will be permitted to teach up to one-third of one AGRO/HORT/SOIL/ENVS course. The student will prepare and deliver lectures and will prepare, administer, and grade at least one examination. The professor in charge of the course will attend and evaluate the student's lectures.

AGRO 598. Special Research Programs
1-6 Credits

Individual investigations, either analytical or experimental. Maximum of 6 credits per semester. No more than 9 credits towards degree. Same as SOIL 598.

AGRO 599. Master's Thesis
15 Credits
Thesis.

Environmental Science Courses

ENVS 1110G. Environmental Science I
4 Credits (3+2P)
Introduction to environmental science as related to the protection, remediation, and sustainability of land, air, water, and food resources. Emphasis on the use of the scientific method and critical thinking skills in understanding environmental issues.
Learning Outcomes
1. Students will learn to critically analyze cause-and-effect relationships in the environment
2. Students will integrate and synthesize knowledge and draw appropriate conclusions based on the scientific method

ENVS 2111. Environmental Engineering and Science
3 Credits (3)
Principles in environmental engineering and science: physical chemical systems and biological processes as applied to pollution control. Crosslisted with: C E 256.
Prerequisite: (C- or better grade in CHEM 1215G) and (C- or better grade in MATH 1511G or ENGR 190).
Learning Outcomes
1. To understand the nature of water quality parameters in the context of Civil Engineering and Environmental Science (Water Treatment/ Wastewater Treatment/Environmental Science).
2. To learn to apply engineering and scientific solutions to water quality problems.
3. To understand environmental regulations and their consequences on the design of pollution control systems.

ENVS 2111L. Environmental Science Laboratory
1 Credit (1)
Laboratory experiments associated with the material presented in ENVS 2111. Same as C E 256 L.
Corequisite(s): ENVS 2111.
Learning Outcomes
1. List typical analyses commonly performed to evaluate physical, chemical, and microbiological parameters used to describe water quality.
2. Follow experimental procedures listed in the class laboratory manual, or other publications such as Standards Methods, to perform common water quality analyses.
3. Evaluate, analyze, and discuss experimental results and present the conclusions in the form of a professional report

ENVS 300. Special Topics
1-4 Credits
Special subjects and credits to be announced in the Schedule of Classes. Consent of instructor required. Maximum of 4 credits per semester. Restricted to majors.

ENVS 301. Principles of Ecology
3 Credits (3)
A survey of ecology including general theory, the adaptations of organisms, population dynamics, species interactions, and the structure and function of natural communities and ecosystems. Crosslisted with: BIOL 301
Prerequisite(s): BIOL 2610G, A ST 311, and grade of C or better in MATH 1511G or Math Placement Exam score adequate to enroll in mathematics courses beyond MATH 1511G.

ENVS 312. Emergency Response to Hazardous Material Incidents
2 Credits (2)
EPA approved Environmental Response Training Program Course 165.15. In compliance with OSHA 29 CFR 1910.120. Normally taken during last year of study.
Prerequisite: Same as E T 312 and WERC 312.
Learning Outcomes
1. Satisfy OSHA training requirements for members of hazardous materials response teams and for environmental personnel requiring access to superfund sites.
2. Recognize, evaluate, and safely control an incident involving the release or potential release of hazardous materials.
3. Participate in mock scenarios using self-contained breathing apparatus, fully encapsulated suits, and a variety of equipment to test hazardous levels.

ENVS 361. Basic Toxicology
3 Credits (3)
Introduction to the principles of toxicology, discussion of toxic agents, environmental problems, testing procedures, and regulations. Prior course work in biology and chemistry recommended.
Prerequisite: CHEM 2120 or CHEM 313 or ANSC 1170 and BIOL 2610G or BIOL 2110G.
Learning Outcomes
1. Learn how toxins are absorbed, distributed, metabolized, and excreted from living systems.
2. Demonstrate how metabolism can appreciably alter the toxicity of compounds as well as dictate the resultant toxicity with an emphasis on target organ(s).
3. Explain the specific mechanism(s) of actions of toxins targeting the liver, lung, kidney, and nervous systems.
4. Delineate how certain toxins induce cancer and/or promote the development of cancer.
5. Understand how and why certain plants and animals are poisonous and venomous, specifically linking discreet chemicals or complex mixtures to the resultant toxic manifestation.

ENVS 370. Environmental Soil Science
3 Credits (3)
Continuation of SOIL 2110 that emphasizes soil properties and processes that directly relate to environmental pollution problems. Same as SOIL 370.
Prerequisite: SOIL 2110.
Learning Outcomes
1. Connect soil science to the environment.
2. Describe several contaminants and their methods of remediation.
3. Design a remediation plan based on environmental transport mechanisms.
4. Demonstrate a clear understanding of the direct and indirect costs (consequences) associated with poor soil and water management.

ENVS 391. Internship
3 Credits (3)
Professional work experience under the joint supervision of the employer and a faculty member. A written report is required. Maximum of 3 credits

toward a degree. Consent of Instructor required. Graded: S/U Grading (S/U, Audit).

ENVS 422. Environmental Chemistry
3 Credits (3)
Chemistry of organic and metal ion pollutants in the environment and principles important to their remediation including bioremediation. Restricted to: Main campus only. Crosslisted with: CHEM 422
Prerequisite(s): CHEM 1225G and either CHEM 2120 or CHEM 313.
Learning Outcomes
1. Describe and explain the solid, liquid, and gas phases of the environment and how they interact.
2. Understand the chemical reactions and processes that occur between various phases of the environment.
3. Learn how the chemical processes can be managed to promote environmental remediation, including the techniques and calculations used.

ENVS 447. Seminar
1 Credit (1)
Organization, preparation, and presentation of current topics in agronomy, environmental sciences, horticulture, and soil science. Crosslisted with: AGRO 447, HORT 447 and SOIL 447.
Learning Outcomes
1. Develop professional communication skills through teamwork, case study preparation and presentation, data interpretation, and role-playing in mock interviews.
2. Prepare a professional resume, personal statement of goals for graduate school or permanent employment and make a Case Study presentation to faculty and peers.

ENVS 449. Special Problems
1-3 Credits
Research problem, experience training, or other special study approved by a faculty adviser. Maximum of 3 credits per semester and 6 credits toward a degree. May be repeated up to 6 credits. Consent of Instructor required. Restricted to: E S majors.

ENVS 451. Special Topics
1-4 Credits (1-4)
Specific subjects and credits to be announced in the Schedule of Classes. Maximum of 4 credits per semester and a total of 9 credits toward a degree. May be repeated up to 9 credits. Consent of Instructor required.

ENVS 452. Geohydrology
3-4 Credits (3+1P)
Origin, occurrence, and movement of fluids in porous media and assessment of aquifer characteristics. Development and conservation of ground water resources, design of well fields. Crosslisted with: C E 452 and GEOL 452.
Learning Outcomes
1. An understanding of the movement of water in porous media and its effects on aquifers.
2. An understanding of the development and conservation of ground water resources.

ENVS 457. Water Measurement
3 Credits (3)
The fundamentals of measuring water will be covered. Participants will learn about measurement techniques that are used to estimate evapotranspiration as well as commonly used water measurement structures to estimate water use. The benefits and problems that are associated with using each measurement will be discussed. Students will also learn about the principles of how to use water measurement as a management tool.
Prerequisite(s): MATH 1215 or higher, or consent of Instructor.

ENVS 460. Introduction to Air Pollution
3 Credits (3)
An introduction to the physics and chemistry of tropospheric air pollution including sources of air pollution, local and long-range transport, instrumentation, regulatory requirements, control technology.
Prerequisite: PHYS 1310G, CHEM 1225G, MATH 1511G.
Learning Outcomes
1. Gain experience in critical thinking and assessment and presenting the results in a clear and concise manner.
2. Describe and communicate air pollution issues.
3. Develop skills for approaching air quality problems and calculating air quality data analysis.
4. Gain practical experience in operating air pollution instrumentation and sample collection.
5. Communicate science using social media.

ENVS 462. Sampling and Analysis of Environmental Contaminants
3 Credits (1+6P)
Theory, application, methodology, and instrumentation used in the sampling and analysis of environmental contaminants. May be repeated up to 3 credits. Same as ENVE 462.
Prerequisite: ENVS 2111 or C E 256.
Learning Outcomes
1. Plan and execute the collection of relevant and useful data for environmental projects based on procedures outlined by the EPA, DOD, and DOE.
2. Understand the importance of careful planning, implementation, and assessment of environmental chemical data collection.
3. Work in teams to master the scientific method, including originating a question, collecting and analyzing samples, and presenting the findings orally and in professionally written reports.

ENVS 470. Environmental Impacts of Land Use and Contaminant Remediation
3 Credits (3)
The course will cover the integrated assessment of soil erosion, contaminant transport in soil and water, and contaminant remediation from site scale to watershed scales. Understanding of the controlling factors for each type land use impact will be gained through the use of risk assessment, case studies, and computer modeling. Case studies will illustrate the processes under various environmental applications. This course will also cover the application of solute transport principles and methods for the remediation of contaminated soil and groundwater. It will also discuss the contaminated site characterization, monitoring, and remediation design. Discussions of innovative methodologies will be supported with case studies.
Learning Outcomes
1. Apply knowledge of mathematics, science, and engineering to identify, formulate, and solve environmental problems.
2. Function on multidisciplinary teams and exhibit professional and ethical responsibility and communicate findings effectively.
3. Recognize the need for, and an ability to engage in, life-long learning.
4. Describe contemporary land-use impact and cleanup issues.
5. Use the techniques, skills, and modern environmental science and engineering tools necessary for current industry practice.

ENVS 505. Research Orientation
4 Credits (3+2P)
Training in writing research proposals, presentation of research results, and interpretation of research results. Crosslisted with: HORT 505, SOIL 505 and AGRO 505.
Learning Outcomes
1. Gain insight into the nature of scientific research and skills vital for graduate research and future careers in science.
2. Navigate graduate school processes and protocols.
3. Demonstrate critical thinking.
4. Generate a scientific hypothesis.
5. Communicate science effectively in written and oral formats, including drafting a proposal for thesis or dissertation research.

ENVS 596. Master's Proposal
1 Credit (1)
Current research proposal written by masters level graduate students. Consent of Instructor required. Crosslisted with: AGRO 596, HORT 596, GENE 596 and SOIL 596. Restricted to: Masters HORT; Masters PLEN majors.
Prerequisite: Master level graduate students.
Learning Outcomes
1. Student will review academic literature and draft a research proposal.

ENVS 599. Master's Thesis
1-15 Credits
Thesis Graded: Thesis/Disertation.

Genetics Courses

GENE 1110. Experimental Systems in Genetics
1 Credit (1)
Survey of molecular, biochemical, organismal, and computer science based approaches to investigate how genes determine important traits. Historical development and topics of current interest will be discussed.
Learning Outcomes
1. To give the students a historical perspective on the field of genetics.
2. To familiarize the students to introductory concepts and vocabulary to the field of genetics.
3. Introduce experimental systems within the field of genetics and to give perspective to current genetic research.
4. As this course is designed for beginning students as an overview of faculty and research labs on campus. The students majoring in genetics are encouraged to meet with faculty and to explore opportunities available to them on campus

GENE 303V. Genetics and Society
3 Credits (3)
Relates the science of genetics with social ramifications. Ways in which genetics and evolution interact with social, political, and economic issues. Includes genetic engineering, gene therapy, DNA finger-printing, ancient DNA, plant and animal improvement, and future prospects. Students required to formulate value judgments on contemporary biological issues that will impact society. Crosslisted with: AGRO 303V.
Learning Outcomes
1. Explain foundational genetic concepts and modern biotechnological techniques, including whole genome sequencing and genetic variation.
2. Analyze the implications of genetic technologies, such as cloning, gene therapy, genetic testing, and DNA forensics, to society.
3. Evaluate ethical issues surrounding genetic applications, including genetic discrimination, eugenics, and ownership of genetic information.
4. Develop and defend informed arguments about controversial topics in genetics (cloning and stem cells), using scientific evidence and ethical reasoning.
5. Collaborate on a group project (a term paper) to research and present real-world genetics-related issues and their impact on society.

GENE 305. Principles of Genetics
3 Credits (3)
Covers fundamental principles of reproduction, variation, and heredity in plants and animals. May be repeated up to 3 credits.
Prerequisite: (BIOL 2610G and BIOL 2110G, or BIOL 2110G and BCHE 140, and either CHEM 1215G or CHEM 1216).
Learning Outcomes
1. To provide an introduction to the basic concepts, methods, and terminology of genetics. Introduction to genomics and bioinformatics.
2. To develop a working understanding of genetics and heredity
3. To understand in some depth, the mechanism of DNA replication, transcription and protein synthesis. To understand the regulation of gene expression.
4. To examine the impact of genetics on both basic and applied aspects of the biological sciences, as well as its effects on our everyday lives.

GENE 305 L. Genetic Techniques
1 Credit (3P)
Experimental procedures used in genetic research including: sexual transmission genetics, eukaryotic DNA isolation, DNA marker development and genotyping, polymerase chain reaction, and cytogenetics.
Prerequisite(s)/Corequisite(s): GENE 315, or AGRO/ANSC/BIOL/HORT 305.

GENE 315. Molecular Genetics
3 Credits (3)
Covers fundamental principles of DNA structure and replication, transcription, translation, gene regulation, recombinant DNA technology, and a survey of genomics and bioinformatics. Recommend CHEM 313.
Prerequisite(s): CHEM 1225G and BIOL 2110G.

GENE 320. Hereditary and Population Genetics
3 Credits (3)
Covers fundamental principles of reproduction, variation, and heredity in plants and animals including: Mendelian inheritance, mitosis, meiosis, genetic linkage, random mating, genetic drift, natural selection, inbreeding, migration, mutation, interrelationships between individuals, populations and communities and the environment.
Prerequisite: CHEM 1215G & BIOL 2110G.
Learning Outcomes
1. Deduce correctly how a trait is being inherited from one generation to another in any species.
2. Explain correctly concepts associated with Mendelian, quantitative, and population genetics.
3. Solve numerical problems correctly associated with Mendelian inheritance of traits, gene linkage and recombination, quantitative inheritance of traits, and population genetics.

GENE 391. Genetics Internship
1-6 Credits (1-6)

Professional work experience in genetics under the joint supervision of an employer and a faculty member. Documentation of proposed internship activities must be submitted prior to the start of the internship. A written report is required after the internship is completed. No more than 6 credits toward a degree. May be repeated up to 6 credits. Graded: S/U Grading (S/U, Audit).

GENE 440. Genetics Seminar
1 Credit (1)
Organization, preparation, and presentation of genetic studies in model microorganism, plant, or animal systems that have been used to solve problems in molecular, cellular, and developmental biology.
Prerequisite: Seniors only; GENE 315 & GENE 320.
Learning Outcomes
1. Evaluate and discuss scientific literature associated with the use of a genetic model (microorganism, plant, or animal).
2. Identify several types of peer-reviewed journal articles.
3. Lead a discussion of a peer-reviewed journal article in genetics.
4. Develop and present a three-minute "lightning talk".
5. Organize, develop, and deliver a presentation on a topic in genetics.

GENE 449. Special Problems
1-3 Credits (1-3)
Research problem, experience training, or other special study approved by a faculty adviser. Maximum of 3 credits per semester and a grand total of 3 credits toward a degree. Consent of instructor required.

GENE 450. Special Topics
1-3 Credits (1-3)
Specific subjects to be announced in the schedule of classes. Maximum of 3 credits per semester and a total of 3 credits toward a degree. Consent of instructor required.

GENE 452. Applied Bioinformatics
3 Credits (3)
Survey and application of publicly available bioinformatic tools that treat genomic DNA, cDNA, and protein sequences, RNA abundance, as well as tools that allow inference based on phylogenetic relationships.
Prerequisite: AGRO/ANSC/BIOL/HORT 305 or GENE 315 and GENE 320, and BCHE 341, or BCHE 395.
Learning Outcomes
1. Define bioinformatics and its relevance in different fields or disciplines.
2. Interpret gene sequence and expression information derived from genomic and transcriptomic databases.
3. Identify the importance of sequencing the genomes of organisms and determine the relationships of sequence to the structure, function, and diversity of DNA, RNA, and proteins.
4. Implement information derived from bioinformatics to solve specific biological problems (disease resistance in animals and plants).
5. Organize a round-table discussion of a peer-reviewed journal demonstrating the application of bioinformatics software/program(s) or databases to study (a) gene expression, (b) multiple sequence alignments, or (c) genomics and develop a presentation and research project proposal related to bioinformatics.

GENE 486. Genes and Genomes
3 Credits (3)
Extensive coverage of nuclear and organelle genome structure in plants and animals, genome restructuring including duplication, anueploidy, chromosome translocations and inversions, comparative genomics, and molecular systematics.
Prerequisites: AGRO/ANSC/BIOL/HORT 305 or GENE 315, and GENE 320.

Horticulture Courses

HORT 1115G. Introductory Plant Science
4 Credits (3+2P)
Introduction to the physical, biological, and chemical principles underlying plant growth and development in managed ecosystems. In the laboratory portion of the class, students perform experiments demonstrating the principles covered in lecture. The course uses economic plants and agriculturally relevant ecosystems to demonstrate basic principles. Appropriate for nonscience majors. Same as AGRO 1110G.
Learning Outcomes
1. Describe the role plants play in everyday lives
2. Introduce career opportunities in plant and soil sciences, and related fields
3. Define plants through the concepts of plant structure and anatomy
4. Introduce the wide variety of plants cultivated throughout the world
5. Describe how plants work (growth, reproduction, physiology, and soil)
6. Describe how plants are manipulated to feed, clothe and entertain the world

HORT 2110. Ornamental Plants I
4 Credits (2+3P)
Covers identification, botanical characteristics, culture, and landscape uses of woody plants. Emphasis on deciduous trees, native shrubs, and evergreens.
Learning Outcomes
1. Identify landscape plants by scientific names, including family, genus and specific epithet.
2. Use scientific terminology to accurately describe landscape plant morphology.
3. Illustrate plant family relationships at the family and genus level.
4. Apply landscape design principles and knowledge of plant requirements to arrange plants in a landscape.

HORT 2120. Ornamental Plants II
4 Credits (2+3P)
Identification, botanical characteristics, culture, and landscape uses of woody plants. Emphasis on flowering trees, cacti, and members of the pea and rose families.
Learning Outcomes
1. Identify landscape plants by scientific names, including family, genus and specific epithet.
2. Use scientific terminology to accurately describe landscape plant morphology.
3. Illustrate plant family relationships at the family and genus level.
4. Apply landscape design principles and knowledge of plant requirements to arrange plants in a landscape.

HORT 2130. Floral Quality Evaluation and Design
2 Credits (1+2P)
Critical hands-on evaluation of the quality of cut and potted floral and tropical foliage crops, their specific merits and faults, and fundamentals of floral design.
Learning Outcomes
1. Identify common floriculture crops, or know resourcing to help identify the crop.

2. Evaluate quality (merit and fault) of common floriculture crops, based on industry standards and merit. Pi Alpha Xi and American Floral Endowment standards will be used for the purpose of this class.
3. Have a basic understanding of the floriculture industry, and identify career pathways within the industry.
4. Know, understand, creatively interpret, and execute basic principles of design in regards to floral design.
5. Use interpersonal communication, problem solving, basic math, and marketing during cash and carry "lab" time (flower sales) in developing job ready skills in floristry.
6. Layer principles of design, marketing, sales, and time management to create floral art in real-world scenarios.

HORT 2160. Plant Propagation
3 Credits (2+2P)
Practical methods of propagating horticultural plants by seed, cuttings, layering, grafting, division and tissue culture. Examination of relevant physiological processes involved with successful plant propagation techniques. Same as AGRO 2160.
Learning Outcomes
1. Practical methods of propagating plants by seed, cuttings, layering, grafting, division, and tissue culture through experiential, “hands-on” laboratories.
2. Relevant physiological principles involved in propagating horticultural plants through lecture discussions and readings.

HORT 2990. Floriculture Field Practicum
1 Credit (1)
Participation as team member in the National Intercollegiate Floral Quality Evaluation and Design Competition. Intensive week-long travel for competition, networking with industry, academia, and floriculture tours. May be repeated for a maximum of 3 credits.
Prerequisite(s): HORT 2130 or consent of instructor.
Learning Outcomes
1. Varies

HORT 2996. Special Topics
1-4 Credits
Specific subjects and credits as announced. Maximum of 4 credits per semester and a grand total of 9 credits. May be repeated up to 9 credits. Consent of Instructor required.
Learning Outcomes
1. Varies

HORT 300. Special Topics
1-4 Credits
Specific subjects as announced in the Schedule of Classes. Maximum of 4 credits per semester and a grand total of 9 credits. May be repeated up to 9 credits. Consent of Instructor required. Restricted to Las Cruces campus only.

HORT 302V. Forestry and Society
3 Credits (3)
Global study of the development and use of forest resources for production of wood, fuel, fiber, and food products. Climatic, edaphic, cultural, and economic influences on forests of the world evaluated. Same as RGSC 302V.
Learning Outcomes
1. Demonstrate comprehension of basic plant physiology.
2. Analyze various inputs and environmental factors that affect trees and forests.
3. Identify forest biomes based on plant morphology and environmental characteristics.
4. Categorize different types of forest products and harvesting methods.
5. Compare and contrast various forest management practices in the US and worldwide.
6. Evaluate climate and ecological issues as they relate to society.
7. Develop an awareness of the interconnection of nature and society.

HORT 304. Hydroponics
4 Credits (4)
This course will introduce students to the basics of the different soil-less growing systems: hydroponics, aeroponics and aquaponics. Topics will include growing systems and environments, crop management, business aspects of hydroponic growing, integrated pest management, commercial and restaurant systems, and plant nutrition. Labs will reinforce lecture topics and give students practical experience growing different types of crops in different types of systems.
Prerequisite: AGRO 1110G or HORT 1115G.
Learning Outcomes
1. Discuss the benefits and constraints of different hydroponic systems.
2. Evaluate different crops for each type of system.
3. Identify the components and calculate costs of different systems.
4. Demonstrate how to build and maintain each type of system.
5. Discuss how soilless growing relates to sustainability and local food production.

HORT 305. Principles of Genetics
3 Credits (3)
Covers fundamental principles of reproduction, variation, and heredity in plants and animals. May be repeated up to 3 credits.
Prerequisite: (BIOL 2610G and BIOL 2110G, or BIOL 2110G and BCHE 140, and either CHEM 1215G or CHEM 1216).
Learning Outcomes
1. To provide an introduction to the basic concepts, methods, and terminology of genetics. Introduction to genomics and bioinformatics.
2. To develop a working understanding of genetics and heredity
3. To understand in some depth, the mechanism of DNA replication, transcription and protein synthesis. To understand the regulation of gene expression.
4. To examine the impact of genetics on both basic and applied aspects of the biological sciences, as well as its effects on our everyday lives.

HORT 307. Landscape Design
4 Credits (3+3P)
Design elements, the design process, and contemporary planting design used in the design of residential and small commercial landscapes. Basic drafting, drawing, and landscape plan presentation techniques.
Prerequisite: HORT 2110 or HORT 2120 or consent of instructor.
Learning Outcomes
1. Access a residential site for landscape design.
2. Create a landscape plan that addresses and solves a client's needs and wishes.
3. Incorporate ideas into the landscape plan that reflects the region.
4. Incorporate sustainable ideas into a landscape plan.
5. Analyze a landscape plan for aesthetics and functionality.
6. Verbally and visually present a landscape plan in a professional manner.

HORT 310. Medicinal Herbs
3 Credits (3)
Introduction to ethnobotany, including plant cultivation, extraction methods, and analysis of active chemistries.
Learning Outcomes
1. Describe relationships between people and plants.
2. Identify cultural uses of plants by peoples across the world.
3. Discuss the westernized use of plants and regulations associated with medicinal plant products.
4. Discuss the scientific methods employed to study medicinal plant compounds.
5. Identify medicinal plant chemical structures.
6. List medicinal plant tincture preparation methods.
7. Discuss analytical chemistry instrumentation used to identify plant compounds.

HORT 318V. Urban Water Issues and Society
3 Credits (3)
Global study of water science, development, law, and use for agriculture, manufacturing, landscaping, home use, and other urban uses. This course allows students to become familiar with important issues concerning the interaction between water use and humans. Topics include the water cycle, water chemistry, human-water relations, plant-water relations, water users, water-dependent population placement and growth, water regulation, and the future of water.
Learning Outcomes
1. Define and describe Earth's water sources and the water cycle.
2. Describe the chemical processes associated with water and analyze the composition of several water sources.
3. Summarize the interactions of water with the human body.
4. Explain the use of water in agricultural and other plants on both a regional scale and cellular level.
5. Identify, explain, and compare all water users and categorize their demand and availability for water.
6. Analyze the interconnection of the human societies and water while discussing locations of civilizations and communities.
7. Analyze, from a historical perspective, the interrelationships of all water users and all water decision makers. Describe the history of US and world water regulation and analyze its success rate.
8. Predict and recommend how water will be used and distributed in the future.

HORT 340. Greenhouse Retailing
2 Credits (1+1P)
A hands-on experience in weekly organizing, management, propagation and sale of greenhouse crops. This course is to learn how to propagate crops to achieve the fastest finished products, maintain the stock plant, and create opportunities for sales. Students will work 2 hours a week in the greenhouse with instructor, and choose one day a week to maintain and check on the greenhouse throughout the semester. May be repeated up to 4 credits.
Learning Outcomes
1. Identification and propagation of common greenhouse plants.
2. Create care sheets and propagation manuals for potential buyers of greenhouse crops.
3. Propagate, maintain, water, schedule and sell greenhouse products.
4. Practice team communication and support to create an equitable division of labor during the semester.
5. Learn to maintain labor and sales records.

HORT 365. Principles of Crop Production
4 Credits (3+3P)
Basic principles of crop production including environmental and physiological factors limiting production, plant nutrition and soil science, soil-water management, cropping systems and management, pest management, and economic factors influencing crop production. Taught with AGRO 365. May be repeated up to 4 credits.
Prerequisite: AGRO 1110G/HORT 1115G, CHEM 1215G or equivalent and MATH 1215 or equivalent.
Learning Outcomes
1. Analyze and apply core principles of crop production, including environmental, physiological, and climatic factors, to optimize plant growth, yield, and overall production efficiency.
2. Demonstrate understanding of plant biology by identifying structures, growth stages, and functions across the plant life cycle.
3. Evaluate plant propagation and reproduction methods by distinguishing between sexual and asexual techniques, explaining pollination and fertilization processes, and discussing their impact on genetic improvement and crop uniformity.
4. Demonstrate proficiency in seed and equipment technologies, including identification and calibration of farm implements, calculation of seed rates, and evaluation of certified seed quality and planting operations.
5. Apply experiential learning methods to design, manage, and assess crop production systems using real-world data and reflection-based decision-making models (Kolb's learning cycle).

HORT 377. Introduction to Turfgrass Management
4 Credits (3+3P)
Establishment and maintenance of turfgrass with emphasis on seeding methods, soil and water management, mowing, disease, insects and turfgrass varieties. Consent of instructor required. Crosslisted with: AGRO 377
Learning Outcomes
1. Identify the general morphology of grass plants and the characteristics of cool- and warm-season grasses.
2. Explain various turf establishment techniques and procedures.
3. Demonstrate understanding of basic soil science, soil testing, amendments, and fertilization regarding cultural and maintenance procedures as well as seasonal projects to maintain healthy turf.
4. Recognize and identify common turf disturbances including weed, pest, and disease identification.
5. Communicate turf conditions and the rationale for different maintenance processes on the course or field.

HORT 378. Turfgrass Science
4 Credits (3+3P)
Introduction to the scientific fundamentals for turfgrass management cultural practices, pest management, rootzone construction and ecology. May be repeated up to 4 credits.
Prerequisite: HORT 377 or consent of instructor.
Learning Outcomes
1. Explain the benefits and history of turfgrass.
2. Apply basic plant physiological knowledge to turfgrass adaptation, growth and function.

3. Demonstrate ability to identify known and unknown turfgrasses and appraise how, when and why specific turfgrasses are used in certain environments.
4. Examine the basic principles of turfgrass soils, turfgrass establishment and major turfgrass management practices (mowing, fertility, irrigation, cultivation, secondary cultural practices).
5. Examine basic turfgrass pest management principles and practices in order to be able to identify, analyze and implement solutions.
6. Calculate common turfgrass math calculations and perform equipment calibrations.
7. Analyze how the environment influences turfgrass growth and management.
8. Prepare a consulting appraisal and specific turfgrass management plan using learned turfgrass knowledge.

HORT 391. Internship
1-6 Credits
Professional work experience under the joint supervision of the employer and a faculty member. A written report is required. No more than 6 credits toward a degree. Consent of instructor required. Graded: S/U. Crosslisted with: AGRO 391 and SOIL 391

HORT 447. Seminar
1 Credit (1)
Organization, preparation, and presentation of current topics in agronomy, environmental sciences, horticulture, and soil science. Crosslisted with: AGRO 447, SOIL 447 and ENVS 447.
Learning Outcomes
1. Develop professional communication skills through teamwork, case study preparation and presentation, data interpretation, and role-playing in mock interviews.
2. Prepare a professional resume, personal statement of goals for graduate school or permanent employment and make a Case Study presentation to faculty and peers.

HORT 449. Special Problems
1-3 Credits
Research problem, experience training, or other special study approved by a faculty adviser. Maximum of 3 credits per semester and a grand total of 6 credits. May be repeated up to 6 credits. Consent of Instructor required.

HORT 450. Special Topics
1-4 Credits
Specific subjects as announced in the Schedule of Classes. Maximum of 4 credits per semester and a grand total of 9 credits. May be repeated up to 9 credits. Consent of Instructor required.

HORT 462. Plant Breeding
3 Credits (3)
Principles and practices involved with the genetic improvement of plants.
Prerequisite: ANSC/AGRO/BIOL/HORT/GENE 305 or GENE 320.
Learning Outcomes
1. Learn the principles and practices involved in plant genetic improvement.
2. Be able to apply principles and practices in real life scenarios.

HORT 471. Plant Mineral Nutrition
3 Credits (3)
Basic and applied aspects of plant requirements for soil-derived minerals and the processes whereby minerals are acquired, absorbed, translocated, and utilized throughout the plant. Same as AGRO/EPWS 471.
Prerequisite/Corequisite: EPWS/BIOL 314, or concurrent enrollment, or consent of instructor.
Learning Outcomes
1. Describe how minerals function in plants, including uptake, transport and heritability factors.
2. Explain how plants regulate internal mineral content.
3. Compare different crop nutrient management practices.
4. Identify plant mineral disorders and stressors.
5. Prepare and present information on crop mineral nutrition.

HORT 479. Advanced Turfgrass Science
3 Credits (3)
Extensive reviews of turfgrass sciences including ecology, physiology, entomology, pathology, weed science, and soil science.
Prerequisite: HORT 378 or consent of instructor.
Learning Outcomes
1. Discuss the fundamentals of turfgrass management practices including mowing, fertilization, irrigation, cultural practices and pest management, and use these practices to plan an integrated turfgrass management plan.
2. Identify common and unique turfgrass problems and situations and formulate a solution based on prior knowledge learned.
3. Analyze how stresses, construction and turfgrass management practices affect growth, development, and physiology of turfgrasses.
4. Ascertain how environmentally sound management practices can be modified to promote optimal turfgrass health under stress conditions.
5. Critically evaluate scientifically based literature on turfgrass management.

HORT 483. Advanced Sustainable Crop Production
4 Credits (3+3P)
Characteristics and objectives of sustainable agricultural systems with application to the production, utilization, and improvement of agronomic and vegetable crops.
Prerequisite: AGRO 365 or HORT 365.
Learning Outcomes
1. Design and evaluate sustainable cropping systems by integrating principles of crop diversification, crop rotation, no-till, and organic practices, and assessing their advantages, challenges, and impact on long-term agricultural sustainability.
2. Analyze and apply crop and soil management strategies using holistic and integrated approaches, including mycorrhizal fungi use in arid environments, IPM (Integrated Pest Management), and the "many little hammers" approach to weed control.
3. Select and recommend crop cultivars and management practices for specific agronomic and horticultural crops using tools such as growing degree days, variety test reports, and region-specific criteria (for New Mexico).
4. Critically review and communicate sustainable agricultural research and practices by analyzing case studies, scientific literature, and peer presentations to evaluate the effectiveness of sustainability-focused strategies.
5. Identify and engage with agricultural support systems and sustainability networks, including agencies like Western SARE, to explore resources for funding, research, and application of sustainable agriculture practices.

HORT 488. Greenhouse Management
4 Credits (3+3P)

Principles and practices involved in greenhouse structures and construction, site considerations, heating and cooling systems, greenhouse crop production techniques, sustainability practices. May be repeated up to 4 credits.
Prerequisite: HORT/AGRO 365 or consent of instructor.
Learning Outcomes

1. Establish, operate, and maintain a greenhouse.
2. Demonstrate greenhouse business and marketing skills, horticulture techniques.
3. Practice "hands-on" greenhouse production.
4. Describe greenhouse sustainability issues.
5. Identify emerging trends in the greenhouse industry.

HORT 492. Diagnosing Plant Disorders
3 Credits (2+3P)
Systematic diagnosis of the physiological, pathological, and entomological causes of plant disorders. Same as EPWS 492 and AGRO 492.
Prerequisites: EPWS 303 and EPWS 310.

HORT 500. Special Topics
1-4 Credits
Specific subjects and credits to be announced in the Schedule of Classes . Maximum of 4 credits per semester. No more than 9 credits toward a degree.

HORT 505. Research Orientation
4 Credits (3+2P)
Training in writing research proposals, presentation of research results, and interpretation of research results. Crosslisted with: AGRO 505, SOIL 505 and ENVS 505.
Learning Outcomes

1. Gain insight into the nature of scientific research and skills vital for graduate research and future careers in science.
2. Navigate graduate school processes and protocols.
3. Demonstrate critical thinking.
4. Generate a scientific hypothesis.
5. Communicate science effectively in written and oral formats, including drafting a proposal for thesis or dissertation research.

HORT 513. Introduction to Scientific Writing
3 Credits (3)
Students will learn how to communicate, through written format, to both the scientific community and diverse audiences. Students will be introduced to new technologies and new genres of scientific writing. Students will also learn basic reviewing and writing skills that underlie efficient preparation of literature reviews, scientific manuscripts, project reports, blog-posts, opinion or perspective pieces for more popular venues, advocacy articles for legislators, and descriptive pieces for popular venues such as newspapers, magazines, and broadcast media. Emphasis will be on the communication of experimental findings in peer-reviewed scientific journals.
Learning Outcomes

1. Students will review the basics of rhetoric and the technology of language.
2. Students will learn how to overcome writing barriers and gain confidence in their writing skills.
3. Students will improve their writing skills so that manuscript preparation becomes more efficient and productive.
4. Students will learn professional standards for the conduct of ethical reporting of scientific results.
5. Students will learn to recognize structural and stylistic elements in scientific articles that help researchers achieve certain communication goals.
6. Students will learn the basics of table, figure, diagram, and image presentation in manuscripts.
7. Literature reviews, framed so that they answer an important question in the field, and lead to peer-reviewed publication, may also be prepared. (With permission of the instructor.)

HORT 525. Scientific Writing How to be a Productive and Effective Writer
1-3 Credits (1-3)
Students will learn to improve their writing skills so that their manuscript preparation process is more efficient and productive. Students will also gain experience in peer-review Crosslisted with: AGRO 525, AGRO 625, EPWS 525, SOIL 625 and SOIL 525.

HORT 590. Graduate Seminar
1 Credit (1)
Current research discussions presented by masters level graduate students. Not more than one credit toward the degree. Same as AGRO/SOIL 590. Crosslisted with: AGRO 590 and SOIL 590.

HORT 595. Internship
1-6 Credits
Supervised professional on-the-job learning experience. Limited to Master of Horticulture or Plant & Environmental Science candidates. Not more than 6 credits toward the degree.

HORT 596. Master's Proposal
1 Credit (1)
Current research proposal written by masters level graduate students. Consent of Instructor required. Crosslisted with: AGRO 596, ENVS 596, GENE 596 and SOIL 596. Restricted to: Masters HORT; Masters PLEN majors.
Prerequisite: Master level graduate students.
Learning Outcomes

1. Student will review academic literature and draft a research proposal.

HORT 598. Special Research Programs
1-6 Credits
Individual investigations, either analytical or experimental. Maximum of 6 credits per semester. No more than 9 credits toward a degree.
Prerequisite: consent of instructor.

HORT 599. Master's Thesis
15 Credits
Thesis.

Soil Courses

SOIL 2110. Introduction to Soil Science
3 Credits (3)
An overview of fundamental concepts in soil science and soils as a natural resource. Students will be introduced to the physical, chemical, and biological properties as it relates to soil management in environmental science, conservation, and agronomy. May be repeated up to 3 credits.
Prerequisite: (CHEM 1120G and MATH 1215 or higher) or CHEM 1215G.
Learning Outcomes

1. Understand and use the technical terminology associated with the use and management of soils.
2. Understand the classification of soils and the processes leading to their formation.
3. Identify key physical, chemical, and biological properties of soils.

4. Explain the impact of land use and management decisions as it relates to soil degradation and environmental problems.

SOIL 2110L. Introduction to Soil Science Laboratory
1 Credit (1)
Morphological, chemical, physical and biological properties of soil in the laboratory and field.
Corequisite(s): SOIL 2110.
Learning Outcomes
1. Learn techniques for sampling and characterizing soils in the region.
2. Understand how soils are formed and the processes that occur within the soil profile.
3. Gain fundamental knowledge on soil physical, chemical, and biological properties and how each can influence the overall function of a particular soil.
4. Develop critical thinking and analytical skills within laboratory and field settings.
5. Encourage collaboration, inclusiveness and critical thinking.

SOIL 2996. Special Topics
1-4 Credits
Specific subjects and credits to be announced in the Schedule of Classes. Maximum of 4 credits per semester. No more than 9 credits toward a degree. May be repeated up to 9 credits. Consent of Instructor required.
Learning Outcomes
1. Varies

SOIL 300. Special Topics
1-4 Credits
Specific subjects and credits announced in the Schedule of Classes. Maximum of 4 credits per semester. No more than 9 credits toward a degree. May be repeated up to 9 credits. Consent of Instructor required. Restricted to Las Cruces campus only.

SOIL 312. Soil Management and Fertility
3 Credits (3)
Management, conservation, and fertility of soils; physical conditions affecting growth, nutrition, and plant production.
Prerequisite: SOIL 2110.
Corequisite: SOIL 312L.
Learning Outcomes
1. Explain the elements affecting soil productivity.
2. Determine what factors influence fertilizer use and needs.
3. Identify factors affecting soil pH and summarize materials used for pH modification.
4. Recognize typical nutrient deficiency symptoms and their general location on the plant.
5. Calculate soil amendment amounts needed for field applications.

SOIL 312 L. Soil Management and Fertility Lab
1 Credit (1)
Hands-on experience. Includes field trips, videos, calculations, visiting lecturers and other lab activities as possible.
Prerequisite: SOIL 2110.
Corequisite: SOIL 312.
Learning Outcomes
1. Use proper procedures to collect soil samples and prepare them for analyses including documentation, pretreatment, and storage.
2. Extract various nutrients from soil and interpret/convey the results in written reports.
3. Explain the difference between total and plant-available nutrients.
4. Observe lab analytical procedures and field practices common in soil fertility and management.
5. Calculate the amounts of nutrients in soil samples and convert to field scale.

SOIL 370. Environmental Soil Science
3 Credits (3)
Continuation of SOIL 2110 that emphasizes soil properties and processes that directly relate to environmental pollution problems. Same as ENVS 370.
Prerequisite: SOIL 2110.

SOIL 391. Internship
1-6 Credits (1-6)
Professional work experience under the joint supervision of the employer and a faculty member. A written report is required. No more than 6 credits toward a degree. Consent of Instructor required. Graded: S/U Grading (S/U, Audit).

SOIL 424. Soil Chemistry
3 Credits (3)
Basic elements of soil chemistry including clay mineralogy, cation and anion exchange and the chemistry of problem (acid, saline and flooded) soils. Credit not given for both SOIL 424 and SOIL 479.
Prerequisite: SOIL 2110L or CHEM 1215G and CHEM 1225G.
Learning Outcomes
1. Explain the solid and liquid phases of soil.
2. Describe the chemical reactions and processes that occur between various soil phases.
3. Describe the techniques used to promote plant productivity and land remediation.
4. Calculate nutrient and contaminant concentrations in soil samples and convert to field scale.
5. Calculate soil chemical properties including CEC, pH, EC, SAR, nitrate, and convert them between old and new units.

SOIL 447. Seminar
1 Credit (1)
Organization, preparation, and presentation of current topics in agronomy, environmental sciences, horticulture, and soil science. Crosslisted with: AGRO 447, HORT 447 and ENVS 447.
Learning Outcomes
1. Develop professional communication skills through teamwork, case study preparation and presentation, data interpretation, and role-playing in mock interviews.
2. Prepare a professional resume, personal statement of goals for graduate school or permanent employment and make a Case Study presentation to faculty and peers.

SOIL 449. Special Problems
1-3 Credits
Research problem, experience training, or other special study approved by a faculty adviser. Maximum of 3 credits per semester and a grand total of 6 credits. May be repeated up to 6 credits. Consent of Instructor required.

SOIL 450. Special Topics
1-4 Credits
Specific subjects to be announced in the Schedule of Classes. Maximum of 4 credits per semester and a total of 9 credits towards a degree. May be repeated up to 9 credits. Consent of Instructor required.

SOIL 456. Irrigation and Drainage
3 Credits (3)

Principles and practices required for irrigation to exist as a permanent economy. Equipment and methods for measurement and control of water.

SOIL 472. Soil Morphology and Classification
4 Credits (2+2P)
Same as SOIL 472. Crosslisted with: SOIL 472.
Learning Outcomes
1. Describe soil profile morphology at a competitive level.
2. Understand the processes that drive soil formation and use this knowledge to identify common landforms.
3. Classify soils using Soil Taxonomy.
4. Interpret available soil mapping products to infer soil use and management conditions.

SOIL 476. Soil Microbiology
3 Credits (3)
Nature and physiology of soil microorganisms, how they affect plant growth and recycle nutrients. Land farming, bioremediation and other environmental problems as influenced by soil microorganisms. SOIL 2110 and BIOL 311 recommended. Same as BIOL 476.
Learning Outcomes
1. Explain foundational concepts of the soil environment and soil microbiology, including the soil habitat, the rhizosphere, microbial taxonomy, and microbial cell structure and function.
2. Analyze the diversity, physiology, and ecological functions of soil microorganisms—such as bacteria, archaea, fungi, micro-algae, and micro-fauna—and evaluate their interactions with plants and the soil environment.
3. Apply core soil microbiological techniques—including culturing, inoculation, microscopy, and DNA sequencing—to isolate, identify, and characterize soil microorganisms.
4. Evaluate real-world applications of soil microbiology in areas such as organic matter decomposition, nutrient cycling, integrated disease management, bioremediation, and wastewater treatment.
5. Effectively Communicate evidence-based strategies for enhancing soil microbial diversity and soil health through practices like soil amendments, cover cropping, crop rotation, and conservation tillage.

SOIL 476 L. Soil Microbiology Laboratory
1 Credit (3P)
Enumeration of soil microorganisms, their activities, and transformations they mediate. May be repeated up to 1 credit.
Corequisite: SOIL 476.
Learning Outcomes
1. Collect, store, and characterize soil samples using appropriate and sterile techniques of soil microbiology.
2. Observe, describe, and recognize major groups of microbial organisms
3. Develop skills in basic microscopy, isolation and culturing of soil microbes
4. Acquire basic DNA-based molecular skills in soil microbiology.
5. Compare and evaluate soil samples from different microhabitats regarding their soil microbiota.
6. Apply the scientific method including the following steps: developing a research question, constructing a testable hypothesis, design a research study to test the hypothesis, perform the experiment and collect data, analyze the results, evaluate the results and support/reject the hypothesis, and report the results.

SOIL 477. Environmental Soil Physics
3 Credits (3)
A description of the physical characteristics of porous media including soil. Examination of processes describing the transport of water, chemicals, heat and gases through porous media with application to environmental quality, waste management, and crop production.

SOIL 477 L. Environmental Soil Physics Laboratory
1 Credit (1)
Concurrent enrollment with SOIL 477 recommended. Hands on experience with techniques for characterizing soil physical properties such as particle size distribution, bulk density, water retention, hydraulic conductivity and solute transport. Demonstrations of field and laboratory techniques for measuring moisture content, soil water potential, gas/air flow and thermal conductivity.
Prerequisite(s): SOIL 2110.

SOIL 479. Environmental Soil Chemistry
3 Credits (3)
Basic elements of soil chemistry including discussion of clay mineralogy, cation and anion exchange and the chemistry of problem (acid, saline and flooded) soils. Credit not given for both SOIL 424 and SOIL 479.
Prerequisite: SOIL 2110L or CHEM 1215G and CHEM 1225G.
Learning Outcomes
1. Describe and explain the solid and liquid phases of soil.
2. Explain the chemical reactions and processes that occur between soil phases.
3. Use soil chemistry processes and properties to promote plant productivity and land remediation.
4. Calculate nutrient and contaminant concentrations in soil samples and convert to field scale.
5. Calculate soil chemical properties including CEC, pH, EC, SAR, nitrate, and convert them between old and new units.

SOIL 500. Special Topics
1-4 Credits
Specific subjects and credits to be announced in the Schedule of Classes. Maximum of 4 credits per semester. No more than 9 credits toward a degree.

SOIL 505. Research Orientation
4 Credits (3+2P)
Training in writing research proposals, presentation of research results, and interpretation of research results. Crosslisted with: HORT 505, AGRO 505 and ENVS 505.
Learning Outcomes
1. Gain insight into the nature of scientific research and skills vital for graduate research and future careers in science.
2. Navigate graduate school processes and protocols.
3. Demonstrate critical thinking.
4. Generate a scientific hypothesis.
5. Communicate science effectively in written and oral formats, including drafting a proposal for thesis or dissertation research.

SOIL 513. Introduction to Scientific Writing
3 Credits (3)
Students will learn how to communicate, through written format, to both the scientific community and diverse audiences. Students will be introduced to new technologies and new genres of scientific writing. Students will also learn basic reviewing and writing skills that underlie efficient preparation of literature reviews, scientific manuscripts, project reports, blog-posts, opinion or perspective pieces for more popular venues, advocacy articles for legislators, and descriptive pieces for popular venues such as newspapers, magazines, and broadcast media.

Emphasis will be on the communication of experimental findings in peer-reviewed scientific journals.

Learning Outcomes

1. Students will review the basics of rhetoric and the technology of language.
2. Students will learn how to overcome writing barriers and gain confidence in their writing skills.
3. Students will improve their writing skills so that manuscript preparation becomes more efficient and productive.
4. Students will learn professional standards for the conduct of ethical reporting of scientific results.
5. Students will learn to recognize structural and stylistic elements in scientific articles that help researchers achieve certain communication goals.
6. Students will learn the basics of table, figure, diagram, and image presentation in manuscripts.
7. Literature reviews, framed so that they answer an important question in the field, and lead to peer-reviewed publication, may also be prepared. (With permission of the instructor.)

SOIL 525. Scientific Writing- How to be a Productive and Effective Writer
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Students will learn to improve their writing skills so that their manuscript preparation process is more efficient and productive. Students will also gain experience in peer-review Crosslisted with: AGRO 525, AGRO 625, HORT 525, HORT 625, SOIL 625 and EPWS 525.

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SOIL 596. Masters Proposal
1 Credit (1)
Current research proposal written by masters level graduate students. Consent of Instructor required. Crosslisted with: AGRO 596, ENVS 596, GENE 596 and HORT 596. Students must be a Master level graduate student to enroll in this course. Restricted to: Masters HORT; Masters PLEN majors.

SOIL 597. University Teaching Experience
1-3 Credits (1-3)
Certain graduate students will be permitted to teach up to one-third of one AGRO/HORT/SOIL/ENVS course. The student will prepare and deliver lectures and will prepare, administer, and grade at least one examination. The professor in charge of the course will attend and evaluate the student's lectures.

SOIL 598. Special Research Programs
1-6 Credits
Individual investigations, either analytical or experimental. Maximum of 6 credits per semester. No more than 9 credits toward a degree.

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