

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, Hanan, Heerema, Idowu, Islam, Leinauer, Lombard, Marsalis, Picchioni, Pratt, Shukla, Ulery, Walker, Yao, Zhang; **Associate Professors** Brungard, Darapuneni, Djaman, Flynn, Ghimire, Goss, Grover, Guzman, Holguin, Salmasi; **Assistant Professors** Li, Lozada, Thompson; **College Professors** Lauriault, Puppala, Stringam; **College Associate Professor** DuBois, Steele; **College Assistant Professors** Giannini; **Research Assistant Professors** Anchang, Edwards, Kahiu, Rodriguez-Urbe; **Emeriti** Bosland, Guldán, Mexal, Monger, O'Connell, O'Neill, Ray, Sengupta-Gopalan, St. Hilaire; **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; 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. Flynn, Ph.D. (Auburn University)–soil and water quality; R. Ghimire, Ph.D. (University of Wyoming, Laramie)–soil & crop management; R. Giannini, 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, Ph.D. (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; G.A. Picchioni, Ph.D. (Texas A&M University)–plant-mineral relations; 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-Urbe, 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, Ph.D. (Colorado State University)–wildlife ecology and management; M.K. Shukla, Ph.D. (University of Agricultural Sciences Vienna, Austria)–environmental soil physics; 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; J. Zhang, Ph.D. (University of Arkansas, Fayetteville)–cotton breeding, genetics, and genomics

Emeriti

P.W. Bosland, Ph.D. (University of Wisconsin, Madison)–chile breeding and genetics; S.J. Guldán, 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; 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.

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 (4)

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. Same EPWS 311.

Prerequisite: CHEM 1215G and BIOL 2110G.

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.

Crosslisted with: HORT 365

Prerequisite(s): AGRO 1110G/HORT 1115G, CHEM 1215G or equivalent and MATH 1215 or equivalent.

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

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: HORT 447, ENVS 447 and SOIL 447.

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. May be repeated up to 3 credits.

Prerequisite(s): ANSC/AGRO/BIOL/HORT/GENE 305 or GENE 315 and GENE 320.

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. May be repeated up to 3 credits.

Prerequisite/Corequisite: EPWS 314/BIOL 314, or concurrent enrollment, or consent of instructor.

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. Identify and analyze issues in agriculture and their possible causes.
2. Identify principles of sustainable agriculture and contrast with conventional agriculture.
3. Evaluate application of principles of sustainable agriculture.
4. Define clearly what sustainable agriculture is and its importance for conserving natural resources.
5. Evaluate role of different crop management practices such as GMO's or organic agriculture and make unbiased inferences based on scientific evidence.
6. Gain experience in sustainable crop production through experiential learning.
7. Observe, analyze, and critique real-world examples of sustainable agriculture and conventional agriculture models.
8. Collaborate with peers and engage in team-based learning.
9. Present and write well on topics in sustainable crops. 1
10. Learn about advances in agricultural technology and its role in sustainable crop production.

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.

AGRO 511. Introduction to Weed Science (f)**4 Credits (4)**

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. Same as EPWS 511.

Prerequisites: CHEM 1215G or BIOL 2110G, or consent of 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 masters 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: CHEM 1215G and 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

- 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

- List typical analyses commonly performed to evaluate physical, chemical, and microbiological parameters used to describe water quality.
- Follow experimental procedures listed in the class laboratory manual, or other publications such as Standards Methods, to perform common water quality analyses.
- 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. Same as E T 312 and WERC 312.

Prerequisite: consent of instructor.

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. Crosslisted with: TOX 361. May be repeated up to 3 credits.

Prerequisite: CHEM 1120G or CHEM 1225G and BIOL 2610G or BIOL 2110G.

Learning Outcomes

- Learn how toxins are absorbed, distributed, metabolized, and excreted from living systems.
- Demonstrate how metabolism can appreciably alter the toxicity of compounds as well as dictate the resultant toxicity with an emphasis on target organ(s).
- Explain the specific mechanism(s) of actions of toxins targeting the liver, lung, kidney, and nervous systems.
- Delineate how certain toxins induce cancer and/or promote the development of cancer.
- 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.

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

- Describe and explain the solid, liquid, and gas phases of the environment and how they interact.
- Understand the chemical reactions and processes that occur between various phases of the environment.
- 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.

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

4 Credits (3+2P)

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.

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(s): PHYS 1310G, CHEM 1225G, MATH 1511G.

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. Same as ENVE 462.

Prerequisites: ENVS 2111.

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. May be repeated up to 3 credits. Crosslisted with: WSAM 470.

Prerequisite(s): ENVS 2111, ENVS 370, ENVS 452, ENVS 462.

ENVS 505. Research Orientation**4 Credits (4)**

Training in writing research proposals, presentation of research results, and interpretation of research results. Crosslisted with: AGRO 505, HORT 505 and SOIL 505.

ENVS 596. Masters Proposal**1 Credit (1)**

Current research proposal written by masters level graduate students. Consent of Instructor required. Crosslisted with: AGRO 596, GENE 596, HORT 596 and SOIL 596. Restricted to: Masters HORT; Masters PLEN majors.

Prerequisite(s): Master level graduate students.

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 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(s): CHEM 1215G & BIOL 2110G.

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. Consent of instructor required.

Prerequisite(s): Seniors only; GENE 315 & GENE 320.

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.

Prerequisites: AGRO/ANSC/BIOL/HORT 305 or GENE 315 and GENE 320, and BCHE 341, or BCHE 395.

GENE 486. Genes and Genomes

3 Credits (3)

Extensive coverage of nuclear and organelle genome structure in plants and animals, genome restructuring including duplication, aneuploidy, 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. Given 35 ornamental plants selected from the course's plant list, 100% of students will be expected to correctly identify the genus, species, and common names of the plants with 70% accuracy.
2. Given plants selected from the course's plant list, 100% students will be expected to identify to landscape use of those plants with 85% accuracy.

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. Given 35 ornamental plants selected from the course's plant list, 100% of students will be expected to correctly identify the genus, species, and common names of the plants with 70% accuracy.
2. Given plants selected from the course's plant list, 100% students will be expected to identify to landscape use of those plants with 85% accuracy.

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.

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.

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 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.

Crosslisted with: AGRO 365

Prerequisite(s): AGRO 1110G/HORT 1115G, CHEM 1215G or equivalent and MATH 1215 or equivalent.

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. Crosslisted with: AGRO 377

HORT 378. Turfgrass Science**4 Credits (3+3P)**

Introduction to the scientific fundamentals for turfgrass management cultural practices, pest management, rootzone construction and ecology.

Prerequisite(s): HORT 377 or consent of instructor.

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, ENVS 447 and SOIL 447.

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. May be repeated up to 3 credits.

Prerequisite(s): ANSC/AGRO/BIOL/HORT/GENE 305 or GENE 315 and GENE 320.

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. May be repeated up to 3 credits.

Prerequisite/Corequisite: EPWS/BIOL 314, or concurrent enrollment, or consent of instructor.

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.

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. Identify and analyze issues in agriculture and their possible causes.
2. Identify principles of sustainable agriculture and contrast with conventional agriculture.
3. Evaluate application of principles of sustainable agriculture.
4. Define clearly what sustainable agriculture is and its importance for conserving natural resources.
5. Evaluate role of different crop management practices such as GMO's or organic agriculture and make unbiased inferences based on scientific evidence.
6. Gain experience in sustainable crop production through experiential learning.
7. Observe, analyze, and critique real-world examples of sustainable agriculture and conventional agriculture models.
8. Collaborate with peers and engage in team-based learning.
9. Present and write well on topics in sustainable crops. 1

10. Learn about advances in agricultural technology and its role in sustainable crop production.

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(s): HORT/AGRO 365 or consent of instructor.

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.

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. 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 SOIL 596. Restricted to: Masters HORT; Masters PLEN majors.

Prerequisite(s): Master level graduate students.

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(s): SOIL 2110.

Corequisite(s): SOIL 312L.

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(s): SOIL 2110.

Corequisite(s): SOIL 312.

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(s): SOIL 2110L or CHEM 1215G and CHEM 1225G.

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.

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.

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.

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(s): SOIL 2110L or CHEM 1215G and CHEM 1225G.

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.

SOIL 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, HORT 525, HORT 625, SOIL 625 and EPWS 525.

SOIL 590. Graduate Seminar
1 Credit (1)

Current research discussions presented by master level graduate students. Not more than one credit toward the degree. Same as AGRO/HORT 590. Crosslisted with: AGRO 590 and HORT 590.

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.

SOIL 625. 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.

Office Location: Skeen Hall room N127

Phone: (575) 646-3405

Website: <http://aces.nmsu.edu/academics/pes/>