# Doctoral Programs in Agriculture and Natural Resources

## Horticulture, Cooperative Ph.D.

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The Department of Agriculture, Agribusiness and Environmental Sciences offers a cooperative Ph.D. program in Horticulture, through partnership with the Department of Horticultural Sciences at Texas A&M University in College Station. The degree is awarded by Texas A&M University; however, much of the course work, research and graduate advising can be completed at Texas A&M University-Kingsville and/or the Texas A&M University-Kingsville Citrus Center. Graduate studies leading to this degree can include any aspect of horticulture. Students in the program are highly encouraged to spend at least two semesters in residence at Texas A&M University in College Station, and to work under the direction of an advisory committee comprised of members of both university faculties with one committee co-chair from each of the two universities. The committee chairperson must be a faculty member with a faculty appointment from Texas A&M University.

### Entrance Requirements

Students seeking admission to the cooperative doctoral program should apply through Texas A&M University and specify that they wish to participate in the cooperative program. A committee of five faculty members representing both universities will evaluate each application. Admission requirements are set by Texas A&M University. Current requirements can be found in the Texas A&M University Graduate Catalog, or obtained from the Texas A&M University Department of Horticultural Sciences.

### Other Policies

All current rules and policies at Texas A&M University, including those regarding residency, course load, course longevity, admission to candidacy and grade point requirements, govern the administration of this degree. Students should consult the Texas A&M University Graduate Catalog and Handbook (http://catalog.tamu.edu/graduate/).

## Wildlife and Rangeland Sciences, Ph.D.

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The Department of Rangeland and Wildlife Sciences offers the Doctor of Philosophy in Wildlife and Rangeland Sciences. Ph.D. students will prepare for research, teaching and administrative careers in natural resources. As humans increasingly impact the environment, scientists educated in natural resource areas like wildlife science will become increasingly important. Ph.D. students educated under this program will be amply prepared to confront these challenges. Detailed guidelines for the program are available from the administrative assistant or chair of the Department of Rangeland and Wildlife Sciences.

### Entrance Requirements

Students must hold the Master of Science degree and an acceptable combination of GRE scores, TOEFL score or intensive English language training course (international students) and grade point average. Contact the Chair, Department of Rangeland and Wildlife Sciences, for details. Students must also have the agreement of a faculty member at Texas A&M University-Kingsville to direct the dissertation research.

### Graduate Committee

Students develop a committee of at least four members in consultation with their major adviser. Make-up of the committee generally is based on faculty expertise in subjects relevant to the dissertation research. In addition, a Graduate Council representative to serve on the doctoral committee will be appointed.

### Admission to Candidacy

Ph.D. students may be admitted to candidacy upon successful completion of preliminary examinations. Preliminary examinations typically are administered when the student has completed all but six hours of formal course work on the degree plan. Candidates for the Ph.D. degree must obtain clearance and complete a Degree Candidacy form at the Graduate Office. Clearance to graduate follows recommendation by the official graduate adviser to the Graduate Dean.

## Course Longevity

A student must complete all requirements for the doctoral degree within four years of completion of the preliminary examinations, and the dissertation must be completed within ten consecutive years of initial registration. Graduate credits older than ten years are not applicable toward a doctoral degree without written approval of the Graduate Dean.

All post-master, doctoral course work (including the dissertation), must be satisfactorily completed by the doctoral student in a maximum of 99 semester credit hours. If the Graduate Dean approves in writing that a student may proceed beyond the 99 credit hour limit, the student will be assessed out-of-state tuition.

## Dissertation

A dissertation must be written and defended before the graduate committee.

## Normal Course Load

A normal course load at Texas A&M University-Kingsville is nine hours during long semesters and three hours during summer sessions. The latter also constitutes a full-time status course load. Ph.D. students must register for a normal course load when they are in residence at Texas A&M University-Kingsville.

## Registration

Students are required to be continuously registered at Texas A&M University-Kingsville.

# Plant and Soil Science (PLSS)

**PLSS 6185** Seminar **1 SCH (0-1)**
Student reports and discussion of recent literature and current investigations. May be repeated up to three times.

**PLSS 6326** Soil Chemistry **3 SCH (3-0)**
Advanced study of the chemistry of soils, including properties, processes and applications.

**PLSS 6344** Crop Protection **3 SCH (3-0)**
Advanced study of principles and practical aspects of control in the field vertebrate and insect pests, weeds and diseases caused by pathogens such as viruses, bacteria, fungi and nematodes of all major cultivated crops. Economic and environmental considerations of crop protection including developments in biotechnological and integrated pest managements will be covered.

**PLSS 6345** Phytochem to Imprve Humn Helth **3 SCH (3-0)**
Update the research information on the phytochemicals and describe their role in human diet. Understand the toxic effects and sources of phytochemicals. Prerequisite: approval of instructor.

**PLSS 6346** Citrus & Subtrop Fruit Crops **3 SCH (3-0)**
Encompasses various types of citrus, including oranges, lemons, limes, grapefruit and mandarins as well as avocados and olives. Covers identification, culture, processing, marketing, post-harvest aspects, phytochemicals and economic future. Other crops will be covered in brief. Prerequisite: approval of instructor.

**PLSS 6377** Genetics of Crop Improvement **3 SCH (3-0)**
Critical study of scientific literature and current research concerning principles of plant genetics and their applications to conventional breeding and genetic engineering methods for the improvement of cultivated crops.

**PLSS 6379** Posthar Physiol of Hort Crops **3 SCH (3-0)**
Study of biochemical and physiological processes affecting maturity, quality and conditions of horticultural crops (fruits, vegetables and flowers). Selection and use of handling, storage and transportation facilities will be discussed.

**PLSS 6390** Adv Studies in Horticulture **1-3 SCH (1-3-0)**
Material offered will be determined by the needs of the students. Laboratory and lecture will vary according to the subject. May be repeated under a different topic.

**PLSS 6395** Adv Probs in Horticulture **1-3 SCH (1-3)**
Independent work. Variable credit depending upon the problem. Requires approval of faculty to supervise the problem.

**PLSS 6397** Dissertation Research **3-9 SCH (3-9)**
Research for dissertation.

# Animal Science (ANSC)

**ANSC 6335** Quantitative Genetics **3 SCH (3-0)**
Quantitative methodologies for altering the genetic properties and/or achieving genetic progress in domesticated and natural animal and plant populations. Application of genetic software packages.

# Wildlife Science (WSCI)

**WSCI 6302** Biopolitics, PR & Wildlife Law **3 SCH (3-0)**
Course explores contemporary issues that affect wildlife and conservation from various perspectives, provides a basis of laws that shape the United States, and provides linkages between what wildlife needs and what humans want. This is a writing intensive class. It also expects discussion of topics and issues presented by every student, so students are expected to research topics outside of classroom and come prepared with opinions. The course is an applied, hands-on course.

**WSCI 6310** Teach & Comm Method Scientists **3 SCH (3-0)**
Material in this course includes an introduction to pedagogy (instructional theory), *public speaking and educational outreach techniques for grade school, university, and layperson audiences, an introduction to the duties and requirements of a professor, and an introduction to research techniques in education and human dimensions. Prerequisite: Graduate student status. *Public speaking aspect might make it applicable to the Communications hours required for TWS certification.

**WSCI 6315** Landscape Ecology **3 SCH (3-0)**
The objective of the course is to teach graduate students the principles and approaches of landscape ecology. This includes the concepts of patches, matrix, and corridors. It also includes concepts and examples of fragmentation, spatial heterogeneity, point pattern analysis, spatial aggregation, and animal movement. By the end of the course students should be able to integrate these concepts into their research where applicable. At the end of the course, students are expected to know the relationship between pattern and process and they should be able to distinguish the metrics that describe landscape composition from those that describe landscape configuration. This is not a GIS course.

**WSCI 6320** Prescribed Burning **3 SCH (3-0)**
Provides a foundation for students wishing to include prescribed burning in their careers. The purpose of the course is to introduce students to the science and art of prescribed burning, review the science and ecology concepts basic to prescribed burning, and management aspects such as firing techniques, fire weather, fireline safety, smoke management, etc. This will provide a basis for understanding the problems facing prescribed burning managers, help students gain an understanding of the scientific and technological developments in prescribed burning, and gain necessary burning skills and experience. The course is an applied course in which we will learn to use prescribed burning as a management tool by conducting prescribed fires together as a crew. There is classroom work in addition to fieldwork. The course covers: Using hand tools, drip torches, radios and the pumper truck; writing a burn plan; prescribed fire weather, and how weather impacts fires; various fuels and their characteristics; how topography influences fire behavior; fire behavior, intensity and severity; various firing techniques and prescriptions; fire effects on vegetation in Texas; fire and wildlife management; prescribed fire laws; managing escapes; and smoke management.

**WSCI 6325** Fire Ecology **3 SCH (3-0)**
The purpose of the course is to introduce students to the science of fire ecology and behavior in major North American ecosystems. Historic and current fire regimes in North America, vegetative adaptations to fire, effects of fire on vegetation and wildlife, effects of fire suppression on ecosystems, wildland fire policy, history of wildland fire management in North America, present and future issues in wildland fire ecology. It is a theory-based course. The course covers: Role of fire in North American forest and grassland biomes, anthropogenic changes in historic fire regimes; vegetation adaptations to and impacts of fire; wildlife species dependent on fire or threatened by fire; large wildfire impacts; mimicking natural fires with prescribed fire; future implications for wildland fire in North America; policy and human dimensions of wildland fire; climate changes impacts on wildland fire.

**WSCI 6330** Remote Sensing for Wildlife St **3 SCH (3-0)**
The purpose of this course is to introduce students to the basic principles of remote sensing and remote sensing techniques that are useful in habitat and wildlife studies. The class will cover basic physical principles of remote sensing, history of remote sensing, image classification techniques: unsupervised classification, supervised classification, object oriented analysis, sub-pixel analysis, data fusion, and GIS and remote sensing data integration. This is a hands-on course which is expected to be 40% theory and 60% hands on work.

**WSCI 6345** Restoration Ecology **3 SCH (3-0)**
The purpose of the course is to introduce students to concepts and practices in restoration ecology, ecological foundations (spatial, trophic, interspecific and intraspecific interactions), restoration of dry grasslands, wetlands, forests and other terrestrial ecosystems of North America, and present and future challenges in restoration ecology. It is a combination of theory and application. It is very much theoretical, but we always do a restoration project as part of the class. The course covers: Assembly rules and their relevance to restoration; reference sites; assessments; successional theory and state and transition models; scale issues; island biogeography; assisted migration; grazing; pollinators; invasive species; soil microbes; Indigenous people and human dimensions of restoration.

**WSCI 6371** Wildlife Nutrition **3 SCH (3-0)**
Role of nutrition in wildlife management, wildlife nutrient requirements, digestion and nutrient metabolism, evaluation of nutritional status and nutrient regulation of wildlife populations.

**WSCI 6372** Wildlife Conservation Biol **3 SCH (3)**
Conservation biology is a multi-disciplinary science that deals with the crisis confronting biological diversity and the biology of rare or isolated populations. Topics include environmental ethics, patterns of species diversity, biology and management of small populations, conservation genetics, population viability analysis, landscape ecology and fragmentation issues, and the application of wildlife management techniques and strategies for species conservation. The course will 1) provide an in-depth understanding of the tenets, concepts, and scope of conservation biology; 2) develop critical insight into the strengths and weaknesses of this discipline; 3) examine a variety of conservation projects and programs that will enable the student to have a realistic understanding of the role of conservation biology; and 4) further develop the following student skills: writing, speaking, group interaction, and critical thinking. The course is a combination of theoretical and applied concepts.

**WSCI 6374** WildlifeResearch Methods **3 SCH (0-3)**
The course is designed to foster an understanding and appreciation of the process of science and research; present theory and application of analytical methods; provide broad exposure to the scientific literature, foster a skeptical attitude, encourage creativity and cross-discipline thinking; and provide instruction on real-world skills important to research in the natural resources field, including scientific writing and reviewing, grant writing and oral presentations.

**WSCI 6381** Wildlife Population Ecology **3 SCH (3-0)**
This course is designed to provide students a foundation in population ecology via both theory and application. The course is quantitative by nature and encompasses the fundamentals of how populations grow, the processes that influence them (e.g., carrying capacity, density dependence, etc.), and their interactions with the biotic community (e.g., competition, predation, etc.). The ecological processes that influence population dynamics are explored via population-modeling software to provide a practical application of theory.

**WSCI 6382** Waterfowl Ecology & Management **3 SCH (2-2)**
Discussion and lecture course that covers the ecology and management of waterfowl. Topics include taxonomy of the World's waterfowl, reproductive strategies that allow species to be successful in different environments, feeding ecology and energetics, vital rates that regulate populations, migration strategies, and contemporary management issues. Broad coverage of the North American Waterfowl Management Plan and updates, Joint Ventures, and the role of regional habitat planning.

**WSCI 6387** Wildlife Habitat Mgmt **3 SCH (3-0)**
Concepts pertaining to the effects of habitat loss and degradation on wildlife including cumulative, time lag and legacy effects. Overview of terminology used in habitat management. Key ecological concepts in managing habitat including succession theory and patch dynamic theory. Overview of methods of applied habitat management including brush management, livestock grazing, and habitat restoration. Students prepare and present results of literature reviews on pertinent topics and participate in class debates.

**WSCI 6390** Adv Studies Range and Nat Res **1-3 SCH (1-3-0)**
Material offered will be determined by the needs of the students. Laboratory and lecture will vary according to the subject needs. May be repeated under a different topic.

**WSCI 6391** Ecosys Function and Management **3 SCH (3-0)**
Discussion class covering (1) classic scientific literature that forms the basis of modern ecological theories and (2) applications of these theories as a basis for contemporary ecosystem management.

**WSCI 6392** Wildlife & Nat Resource Sci **3 SCH (3-0)**
Discussion and lecture class that covers background theory and assumptions of many kinds of models used in wildlife science, including but not limited to applications of qualitative conceptual and logic models, as well as quantitative models such as frequentist statistics, regression, information theoretic, multivariate, population estimation, and systems analysis models.

**WSCI 6394** Grazing Management **3 SCH (3-0)**
The course provides basic understanding of the physiological processes, morphological development, nutritional qualities, and palatability of range plants as a basis for grazing management strategies for domestic and wild animals. Additionally, the impacts of the grazing strategies on vegetation, livestock, and wildlife are provided and discussed. The course also provides information to direct students in the decision making process to optimize plant communities integrity, animal performance and profitability of production systems. The course includes some theoretical bases to understand the effects of defoliation on plant recovery and animal performance with a heavy content of practical (hands on) information.

**WSCI 6395** Probs in Range and Wldlfe Mgt **1-3 SCH (1-3-0)**
Independent work which may include a laboratory or field problem. Variable credit dependent upon the problem; may be repeated for a total of 6 semester hours. Prerequisite: approval of a staff member who will supervise the problem.

**WSCI 6396** Avian Community Ecology **3 SCH (3-0)**
A discussion-based course that focuses on evolutionary concepts that shape avian communities. Course provides broad exposure to the ornithological literature, promotes creativity and critical thinking, and provides opportunity for problem solving. Topics include mating systems, reproductive strategies, avian community structure, foraging adaptations, brood parasitism, responses to predation, competition, and the influences of climate change.

**WSCI 6397** Wildlife Diseases **3 SCH (3-0)**
Course is an introductory level course since most students have had little or no academic training in wildlife diseases. Infectious and noninfectious diseases of wildlife, epizootiology, and theoretical disease ecology as it relates to individuals and populations, wildlife management strategies, and human-wildlife interactions. A successful student in WSCI 6397 will be able to demonstrate the following competencies: 1) Define, select, and recognize basic terms used in the wildlife disease profession; 2) Describe, compare, and classify wildlife disease concepts; 3) Effectively formulate and express thoughts and ideas, verbally and in writing.

**WSCI 6401** Experimental Design & Analysis **4 SCH (3-2)**
The purpose of the course is to teach the student the basic principles and practices associated with experimental designs and analyses, and interpretation of data; and to introduce students to software (e.g., SAS, R, SPSS) and programming used in data analysis. This course is a combination of practice and theory: students will learn not only how to design an experimental appropriately to satisfy the needs of their research, but they will also learn why these principles are important. There is a strong emphasis on interpretation of statistical results with practical examples (frequently based on students' actual research projects). Topics include single- and multiple-factor experiments in completely randomized, randomized block, and Latin square settings, including repeated measures analyses, longitudinal studies, and analysis of covariance, with a strong emphasis on tests of assumptions. This course will prepare students to be able to more effectively design experiments, more completely analyze data, and more thoroughly interpret results especially as they are applied in wildlife, range, and natural resources areas of research. In addition, a laboratory session will focus on learning how to use various software packages to analyze and to present experimental results. Provides a solid background before enrolling in next level of statistical courses.

**WSCI 6402** Applied Regression Analysis **4 SCH (3-2)**
The purpose of the course is to teach the student the basic principles and practices associated with regression analyses and associated interpretation of data; and to introduce students to proper use of software (e.g., SAS, R, SPSS) and programming used in regression analyses. This course is a combination of practice and theory: students will learn not only how to use regression-based models appropriately to satisfy the needs of their research, but they will also learn why these principles are important. Topics include simple and multiple regression with linear and nonlinear models (including general and generalized linear models) as well as nonparametric approaches. There is a strong emphasis on interpretation of statistical results with practical examples (frequently based on students' actual research projects). In addition, a laboratory session will focus on learning how to use various software packages to analyze and to present regression results. This course will prepare students to be able to more effectively understand and apply regression analyses especially as they are applied in wildlife, range, and natural resources areas of research.

**WSCI 6403** Practical Non-Parametric Stats **4 SCH (3-2)**
The purpose of this course is to teach the student basic principles and practices associated with nonparametric statistics and their interpretation; and to introduce students to proper use of software (e.g., SAS, R, SPSS) programming used in nonparametric statistics. This course is a combination of practice and theory: students will learn not only how to use nonparametric statistics appropriately to satisfy the needs of their research, but they will also learn why these methods are important and how they compare to parametric statistics. Topics include a wide variety of tests based on the binomial distribution; two-way (and higher-dimensional) contingency tables; methods based on ranks; regression-related techniques; statistics of the Kolgomorov-Smirov type; and permutation-based methods; and all of these topics are embedded in an experimental design or regression perspective. There is a strong emphasis on interpretation of statistical results with practical examples (frequently based on students' actual research projects). In addition, a laboratory session will focus on learning how to use various software packages to analyze and to present nonparametric statistical analyses. This course will prepare students to be able to more effectively understand and apply nonparametric statistical analyses, especially as they are applied in wildlife, range, and natural resources areas of research.

**WSCI 6404** Applied Multivariate Analysis **4 SCH (3-2)**
The purpose of this course is to teach the student the basic principles and practices associated with multivariate analyses and associated interpretation of data; and to introduce students to proper use of software (e.g., SAS, R, SPSS) programming used in multivariate analyses. This course is a combination of practice and theory: students will learn not only how to use multivariate statistics appropriately to satisfy the needs of their research, but they will also learn why these methods are important and how they differ from and complement univariate analyses. Topics include methods based on the multivariate normal distribution (including tests of equality of mean multivariate vectors and variance-covariance matrices); ordination-based analyses (including principal components analysis and related methods and non-metric multidimensional scaling), and discriminant analysis. In addition, a laboratory session will focus on learning how to use various software packages to analyze and to present multivariate statistical tests. This course will prepare students to be able to more effectively understand and apply multivariate analyses, especially as they are applied in wildlife, range, and natural resources areas of research. Typically the last statistical course in the series; best to take Experimental Design and Regression as statistical background for this course.

**WSCI 6999** Dissertation Research **3-9 SCH (0-0-3-9)**
To be taken by students who receive a stipend while working on their research. Designed to be student-specific to meet each student's individual needs and to enhance their graduate education.

## Wildlife and Rangeland Science, Ph.D.

| Code | Title | Semester Credit Hours |
|---|---|---|
| **Major Elective Courses** | | **15-24 credits** |
| WSCI Elective – Electives from graduate-level courses in rangeland and wildlife sciences. List of courses to take is under recommendation with major advisor; see list of potential doctoral course shown below. | | |
| **Free Elective Courses** | | **0-9 credits** |
| Free Elective – Electives from graduate-level coursework in biology, geography/GIS, animal science, wildlife and rangeland sciences, plant and soil science, ranch management, and statistics. | | |

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|---|---|---|
| **Major Research** | | **40 credits** |
| WSCI 6999 | Dissertation Research | |
| Dissertation research hours in WSCI program permit graduate students to remain full time enrolled while working on research project and maintain graduate research assistantship support. | | |
| **TOTAL** | | **64 credits** |

## List of Major Elective Course Options

| Code | Title | Semester Credit Hours |
|---|---|---|
| WSCI 6302 | Biopolitics, PR & Wildlife Law | 3 |
| WSCI 6310 | Teach & Comm Method Scientists | 3 |
| WSCI 6315 | Landscape Ecology | 3 |
| WSCI 6320 | Prescribed Burning | 3 |
| WSCI 6325 | Fire Ecology | 3 |
| WSCI 6330 | Remote Sensing for Wildlife St | 3 |
| WSCI 6345 | Restoration Ecology | 3 |
| WSCI 6371 | Wildlife Nutrition | 3 |
| WSCI 6372 | Wildlife Conservation Biol | 3 |
| WSCI 6374 | WildlifeResearch Methods | 3 |
| WSCI 6382 | Waterfowl Ecology & Management | 3 |
| WSCI 6387 | Wildlife Habitat Mgmt | 3 |
| WSCI 6390 | Adv Studies Range and Nat Res | 1-3 |
| WSCI 6391 | Ecosys Function and Management | 3 |
| WSCI 6392 | Wildlife & Nat Resource Sci | 3 |
| WSCI 6394 | Grazing Management | 3 |
| WSCI 6395 | Probs in Range and Wldlfe Mgt | 1-3 |
| WSCI 6396 | Avian Community Ecology | 3 |
| WSCI 6397 | Wildlife Diseases | 3 |
| WSCI 6401 | Experimental Design & Analysis | 4 |
| WSCI 6402 | Applied Regression Analysis | 4 |
| WSCI 6403 | Practical Non-Parametric Stats | 4 |
| WSCI 6404 | Applied Multivariate Analysis | 4 |
| WSCI 6381 | Wildlife Population Ecology | 3 |

# Horticulture, Cooperative Ph.D.

## Degree Plan and Course Requirements

Students develop a degree plan in consultation with their advisers. The plan must be filed before registering for the fifth semester. Students must complete at least 64 credit hours of course work beyond the master's degree (or, in rare cases, 96 credit hours beyond the bachelor's degree). Of the 64 credit hours, approximately half should come from organized courses and half from dissertation research and advanced problems. Students must complete courses at both universities. Courses at Texas A&M University-Kingsville can be chosen from the Plant and Soil Science courses listed below or from selected other courses. All courses used towards the degree must be approved by the students' advisers.