

## Plant and Wildlife Sciences Graduate Course Descriptions

<b>PWS 470</b>	<p><b>Analysis of Genetic and Genomic Data</b> (2 Cr) (Fall odd years) (prereq BIO 165 &amp; MMBIO 240 &amp; PWS 340; Bio/MMBio/PWS 468 or concurrent enrollment)</p> <p>The purpose of this course is to provide practical training in computational analysis of genetics and genomic data to accompany the theoretical training in Bio/MMBio/PWS 468.</p>
<b>PWS 505</b>	<p><b>Aquatic and Terrestrial Biogeochemistry</b> (3 Cr.) (Fall odd years) An in-depth treatment of global biogeochemical cycles, focusing on cycles of carbon, oxygen, nitrogen, phosphorus, and sulfur in the atmosphere, hydrosphere, and lithosphere. Special attention will be given to the microbial mediated transformations and the impact of human disturbances in terrestrial and aquatic environments.</p>
<b>PWS 512</b>	<p><b>Rangeland Landscape Ecology and Geographic Information Systems</b> (3 Cr.) (Fall odd years) (Recommended: PWS 215, Geog 212) Rangeland Landscape Ecology and Geographic Information Systems</p>
<b>PWS 513</b>	<p><b>Environmental Field Instrumentation</b> (4 Cr.) (Fall odd years) (Prereq Phcs 105 and PWS 282; or equivalents) Hands-on course and lab teaching students how to use instrumentation in the field and in controlled settings to measure key environmental parameters. Learning the physical principles underlying sensors.</p>
<b>PWS 540</b>	<p><b>Plant Response to the Environment</b> (3 cr) (Fall even years) (Prereq: PWS 440 or equivalent; PWS 494R or concurrent enrollment) Advanced plant physiological ecology principles.</p>
<b>PWS 547</b>	<p><b>Ungulate Conservation and Management</b> (2 Cr) (Winter even years) (Preq: PWS or Bio 350; and Bio 447; or equivalents) Integrating principles of natural history, population ecology, behavior, and conservation biology of North</p>
<b>PWS 551</b>	<p><b>Quantitative Ecology</b> (3 Cr.) (Winter even years) (Prereq: Bio 350 or equivalent; Stat 121 or 511 or concurrent enrollment) Quantitative methods for ecological sampling and data analysis.</p>
<b>PWS 553</b>	<p><b>Restoration Ecology</b> (3 Cr.) (Winter odd years) (Prereq: PWS 282, 416; Bio 350; or equivalents) Nature of ecosystem disturbance and plant succession; developing science and practice of ecological restoration; case studies of applied restoration.</p>
<b>PWS 554</b>	<p><b>Wildlife Behavioral Ecology</b> (3 Cr.) (Fall even years) (Prereq: Bio 100, 350; or equivalents) (Note: Field trips required) Integrating principles of ethology, sociobiology, and behavioral ecology using examples from wildlife resources; behavioral sampling methods.</p>

<b>PWS 560</b>	<b>Quantitative Environmental Chemistry</b> (2 Cr.) (Winter even years) (Preq: Chem 105, 106, 107; or equivalent) (Recommended: Chem 223 and/or PWS 283, 306, 405, 406) Laboratory chemical analysis of soils and plant materials in soil and plant research.
<b>PWS 575</b>	<b>Plant Pathology</b> (3 Cr.) (Fall odd years) (Prereq: PWS 100 or equivalent) Concepts associated with symptoms, development, control, and classification of plant diseases. Identification and classification of plant fungi, bacteria, and viruses.
<b>PWS 586</b>	<b>Plant Cell Biology</b> (3 Cr.) (Fall even years) (Prereq: PDBio 360, PWS 340, 440; or equivalents) Molecular aspects of the structural and functional characteristics of plant cells, emphasizing characteristics of plant cells setting them apart from animal cells.
<b>PWS 588</b>	<b>Metagenomics</b> (3 Cr.) (Winter odd years) (Prereq: Introductory coding and command-line experience (e.g. Bio 664 for grad students or seek instructor's consent); strongly recommend Bio/MMBio/PWS 468 or corresponding graduate sections.) Introduction to comparative and functional analysis of genomic and metagenomic datasets, including microbial functions that affect host health. Analyzing existing and novel datasets with field-standard techniques.
<b>PWS 598R</b>	<b>Advanced Topics in Plant and Wildlife Sciences</b> (1-3 Cr.) Give students a specific topic to increase their understanding of the scientific method as it relates to focused research objectives.
<b>PWS 629</b>	<b>Conservation of Mega and Meso Carnivores</b> (3 Cr.) (Fall odd years) Life histories of representative carnivores with political, popular, and managerial problems surrounding their existing and proposed conservation.
<b>PWS 633</b>	<b>Biometry and Experimental Design</b> (3 Cr.) (Fall) (Stat 121 or 510 or equivalent) The design, analysis, and interpretation of biological research using modern analytical tools and relevant software.
<b>PWS 634</b>	<b>Analysis and Management of Plant and Animal Populations</b> (3 Cr.) (Winter odd years) Exposure to common tools for analysis and management of plant and animal populations. Program mark, program distance, movement and home range analysis, point pattern analysis, etc.

<b>PWS 670</b>	<b>Analysis of Complex Genomes</b> (3 Cr.) (Fall odd years) (Prereq:PWS 340 or equivalent) Genetic analysis of quantitative traits in plants and animals.
<b>PWS 672</b>	<b>Comparative Genomics</b> (3 Cr.) (Winter even years) (Prereq: PWS 670) Analysis and interpretation of eukaryotic genomes in a comparative context. Theory behind commonly used methods for comparing whole genomes, such as read alignment, whole genome alignment, orthology prediction, variant calling, detection of positive selection, and phylogenomic analysis. Second of a two-course series.
<b>PWS 673R</b>	<b>Cytogenetics</b> (3 Cr.) (Winter even years) (Prereq: PWS 340, 485; or equivalents) Chromosome structure and function; classical and molecular cytological methods of chromosome and genome analysis.
<b>PWS 673R</b>	<b>Plant Cytogenetics</b> (3 Cr.) (Winter even years) (Prereq: PWS 340, 485; or equivalents) Chromosome structure and function; classical and molecular cytological methods of chromosome and genome analysis.
<b>PWS 694R</b>	<b>Seminar</b> (1 Cr.) (Fall, Winter) Display fluency in the vocabulary and current research techniques in the four focal areas of the PWS Department: Environmental Science; Genetics and Biotechnology; and Wildlife and Wildlands Conservation. Explain the importance of cross-discipline research for comprehensive scholarship and the importance of Gospel-centered stewardship and sustainability.
<b>PWS 697R</b>	<b>Research</b> (1 -9 Cr.) Graduate students will use scientific principles to answer objectives associated with their individual research projects. Skills and techniques acquired in class and through advisors will be applied to research projects that will be evaluated by peers.
<b>PWS 699R</b>	<b>Master's Thesis</b> (1-9 Cr.) Students will be able to apply research principles to practical problems to alleviate concerns. Graduates will understand scientific principles and methods and be able to present research for peer evaluation.
<b>PWS 799R</b>	<b>Doctoral Dissertation</b> (1-9 Cr.) Students will be able to apply research principles to practical problems to alleviate concerns. Graduates will understand scientific principles and methods and be able to present research for peer evaluation.

## Courses Currently Not Offered

<b>PWS 511</b>	<b>Environmental Biophysics: Soil and Plant Water Relations</b> (4 Cr.) (prereq:Phscs 105 and PWS 282; or equivalents)Integrating biological, physical, and chemical processes of water and solute movements through the soil-plant-atmosphere continuum.
<b>PWS 514</b>	<b>Soil Microbiology</b> (2 Cr) (prereq:Chem 105 and 106; or equivalents) Ecology and role of soil microorganisms in biogeochemical cycles, decomposition of organic matter and waste materials, and bioremediation of contaminated soils and water.
<b>PWS 520</b>	<b>Saline and Sodic Soils</b> (3 Cr) (prereq: PWS 305, Chem 105, 106, 107; or equivalents) Physical and chemical properties of saline and sodic soils and irrigation waters--their diagnosis, reclamation, and management for sustainable crop production.
<b>PWS 559</b>	<b>Molecular Plant Breeding</b> (3 Cr.) (Prereq: PWS 265, 340, 485, 586, PDBio 360; or equivalents; PWS 494R or concurrent enrollment) Molecular genetics methods applied to improvement of economically important plants. Theory and methods of plant transformations.
<b>PWS 660</b>	<b>Environmental Site Evaluation and Analysis</b> (2 Cr.) (Prereq: PWS 282 & 283; PWS 405 or 406; or equivalents) (Recommended Chem 223; PWS 560) Sampling, analyzing, and interpretation of plant, water, and soil matrixes in native, agricultural, and urban sites. Emphasis on completing Environmental Site Assessments.
<b>PWS 698R</b>	<b>Master's Project</b> (1-6 Cr.) (Note: For project option only) Master's students will address specific objectives associated with their research interests.Application of skills to a specific research project related to a master's student area of emphasis.

# Plant and Wildlife Sciences Department

## Graduate Course Offerings By Semester

Fall Even Years	Winter Even Years
540 Plant Response to the Environment 554 Wildlife Behavioral Ecology 586 Plant Cell Biology 598R ADV Topics in PWS 633 Biometry and Experimental Design 694R Seminar 699R Master's Thesis 799R Doctoral Dissertation	547 Ungulate Conservation and Management 551 Quantitative Ecology 560 Quantitative Environmental Chemistry 598R ADV Topics in PWS 672 Comparative Genomics 673R Cytogenetics 694R Seminar 699R Master's Thesis 799R Doctoral Dissertation
Fall Odd Years	Winter Odd Years
472 Conservation Genomics 505 Aquatic and Terrestrial Biochemistry 512 Rangeland Landscape Ecology and GIS 513 Environmental Field Instrumentation 575 Plant Pathology 598R ADV Topics in PWS 629 Conservation of Carnivores 633 Biometry and Experimental Design 670 Analysis of Complex Genomes 694R Seminar 699R Master's Thesis 799R Doctoral Dissertation	553 Restoration Ecology 588 Metagenomics 598R ADV Topics in PWS 634 Analysis and Management of Plant and Animal Populations 694R Seminar 699R Master's Thesis 799R Doctoral Dissertation

# Plant and Wildlife Sciences Department

## Graduate Course Offerings

### Environmental Science MS

Fall Even Years	Winter Even Years
540 Plant Response to the Environment 633 Biometry and Experimental Design	551 Quantitative Ecology 560 Quantitative Environmental Chemistry
Fall Odd Years	Winter Odd Years
511 Environmental Biophysics: Soil and Plant Water Relations 512 Rangeland Landscape Ecology and GIS 513 Environmental Field Instrumentation 575 Plant Pathology 633 Biometry and Experimental Design	514 Soil Microbiology 553 Restoration Ecology

#### Graduate courses from other departments that are commonly taken by students in this program

Biology	Other
430 Plant Classification and Identification 503 Research Orientation 505 Aquatic and Terrestrial Biogeochemistry 517 Publishing in Peer-Reviewed Journals 664 Bioinformatics and Data Analysis 1 665 Bioinformatics and Data Analysis 2	STAT 511 Statistical Methods for Research 1 GEOL 535 Contaminant Hydrogeology CE EN 414 Engineering Applications of GIS
Geography	MM BIO
495R Mentored Research 503 Geographic Information Systems	468 Genomics 661 Molecular Genetics in Practice

# Plant and Wildlife Sciences Department

## Graduate Course Offerings

### Genetics, Genomics, and Biotechnology MS

Fall Even Years	Winter Even Years
540 Plant Response to the Environment 586 Plant Cell Biology	672 Comparative Genomics 673R Cytogenetics / Plant Cytogenetics
Fall Odd Years	Winter Odd Years
575 Plant Pathology 670 Analysis of Complex Genomes	588 Metagenomics 634 Analysis and Management of Plant and Animal Populations

#### Graduate courses from other departments that are commonly taken by students in this program

Biology	
420 Evolutionary Biology 463 Genetics of Human Disease 465 Capstone in Bioinformatics 468 Genomics 475 Plant Developmental Biology 503 Research Orientation	517 Publishing in Peer-Reviewed Journals 559R Tropical Biology 581 Biological Applications in Electron Microscopy 640 Evolutionary Ecology 664 Bioinformatics and Data Analysis 1 665 Bioinformatics and Data Analysis 2
MM BIO	Statistics
441 Advanced Molecular Biology 465 Virology 522 Flow Cytometry 661 Molecular Genetics in Practice 665 Genomics	511 Statistical Methods for Research 1 512 Statistical Methods for Research 2

# Plant and Wildlife Sciences Department

## Graduate Course Offerings

### Wildlife and Wildlands Conservation MS, PhD

Fall Even Years	Winter Even Years
554 Wildlife Behavioral Ecology 633 Biometry and Experimental Design	547 Ungulate Conservation and Management 551 Quantitative Ecology
Fall Odd Years	Winter Odd Years
472 Conservation Genomics 511 Environmental Biophysics: Soil and Plant Water Relations 512 Rangeland Landscape Ecology and GIS 513 Environmental Field Instrumentation 629 Conservation of Mega and Meso Carnivores 633 Biometry and Experimental Design	553 Restoration Ecology 634 Analysis and Management of Plant and Animal Populations

#### Graduate courses from other departments that are commonly taken by students in this program

Biology	Other
503 Research Orientation 512 Angiosperm Phylogeny 517 Publishing in Peer-Reviewed Journals 555 Evolutionary and Ecological Modeling 559R Advanced Ecology 560 Population Genetics 652 Evolutionary Ecology 653 Community and Ecosystem Ecology 654 Speciation and Phylogeography	Anthropology 535 Southwest Seminar CE EN 555 Environmental Chemistry CE EN 594R Selected Problems in Civil and Environmental Engineering CHEM 586 Advanced Biochemistry Methods 2 GEOL 636 Hydrogeochemistry MM BIO 661 Molecular Genetics in Practice MM BIO 663 Articulating Science MM BIO 665 Genomics
Geography	Statistics
212 Introduction to Geographic Information Systems (No credit received on Program of Study since it is a "200" level class) 412 Advanced Geographic Information Systems 503 Geographic Information Systems	511 Statistical Methods for Research 1 512 Statistical Methods for Research 2