NATURAL RESOURCE ECOLOGY AND MANAGEMENT

Faculty in the Department of Natural Resource Ecology and Management (NREM) have expertise in conducting interdisciplinary instruction, research and extension education which focus on the natural resources of fisheries, forests, rangeland and wildlife within and beyond the boundaries of Oklahoma. Increased public understanding of the ecology and management of these natural resources which are important in agriculture, hunting and fishing, ecotourism, forest production and use, as well as the conservation of wildlife habitat is an important goal of the faculty in NREM.

The NREM faculty support undergraduate and graduate programs in the general areas of fisheries, forestry, rangeland and wildlife. The NREM curriculum prepares students to plan, implement and research the management, protection and sustainable use of natural resources within Oklahoma and throughout the world. The department provides an integrated education in renewable natural resource management, conservation and utilization, as well as a valuable perspective for understanding and solving critical contemporary environmental problems at local, regional and global scales.


Natural Resource Ecology and Management Undergraduate Degree Options

**Fisheries and Aquatic Ecology** is an option designed for students with interest in the management of fish populations and habitats. Courses offer research techniques and methodology in fisheries science, including sampling design, habitat measurements, sampling techniques and abundance estimation, age and growth analysis, recreational surveys, data analysis and report writing.

**Forest Ecology and Management** emphasizes the science-based conservation and management of forest lands, ecosystems and related natural resources. Students gain the skills that are necessary for the measurement, assessment and valuation of natural resources and the evaluation of management strategies for forest and related wildlands. Successful completion of the curriculum will provide competency in the general areas of basic science, forest biology, forest mensuration, forest plant species identification, forest economics, natural resource policy, decision-making and problem-solving, and communications. The option is accredited by the Society of American Foresters (SAF), the specialized accrediting body for forestry programs in the U.S. Requirements for this option include the successful completion of two three-week field camps in May, which are scheduled to follow the sophomore and junior years, and are held annually in diverse forest settings. Field forestry skills, forest ecology, integrated natural resource management, state-of-the-art operations and resource economics are emphasized at camp and integrated in the senior-level capstone course.

**Rangeland Ecology and Management** program emphasizes understanding management of grasslands, shrub lands, and forests for forage and habitat production. This includes the effects of livestock grazing, fire, invasive species and other disturbances on biotic and abiotic processes. The importance of prescribed fire as rangeland restoration tool, and the identification and value of native grass species for livestock forage and for other uses are emphasized. Students learn to integrate their knowledge of soil, water and vegetation attributes and natural resource policies into management of public or private wild lands for multiple uses.

**Wildlife Ecology and Management** option provides insight into the biological basis for management of wildlife populations and habitats, with emphasis on current management problems. This option combines research techniques, including aging and sexing, wildlife and vegetation sampling, and wildlife population and habitat analysis with the methodology of wildlife science.

**Wildlife Biology and Preveterinary Science** option provides ecological background and training in natural wildlife science and population dynamics in addition to the basic sciences necessary to prepare students for graduate education in wildlife biology or veterinary medicine. The option combines research and management training in population ecology with basic biology and chemistry.

Students entering the NREM department are encouraged to join and become active members of one of the many student organizations: Society of American Foresters, Society for Range Management, The Wildlife Society and the American Fisheries Society. Participation in one or more of these organizations provides students the opportunity to attend state, regional or national meetings where they will gain valuable advantages through networking, student competitions and interacting with various career-related activities.

Courses

NREM 1012 Introduction to Natural Resource Ecology and Management

**Description:** Introduction to the wide variety of natural resources found globally with a focus on Oklahoma ecoregions. Overview of the ecology and management of natural resources in the pine-hardwood forest, the Cross Timbers, and the tallgrass, mixed-grass and shortgrass prairies. Academic and career options presented through guest speakers.

**Credit hours:** 2

**Contact hours:** Lecture: 2

**Levels:** Undergraduate

**Schedule types:** Lecture

**Department/School:** Natural Res Eco & Mgmt
NREM 1014 Introduction to Natural History (LN)
Description: The study of living organisms especially their origins, life histories, behaviors, conservation, and unique adaptations for reproducing and relating to their environment. Laboratory emphasis is on observation and investigation of the diversity and adaptations of living organisms.
Credit hours: 4
Contact hours: Lecture: 3 Lab: 2
Levels: Undergraduate
Schedule types: Lab, Lecture, Combined lecture and lab
Department/School: Natural Res Eco & Mgmt
General Education and other Course Attributes: Scientific Investigation, Natural Sciences

NREM 1113 Elements of Forestry
Description: Survey of forestry as an art, science and profession including forestry and natural resource management theory, forest distribution and ownership, history of forest resource policy development, forest protection, wildlife interactions, forest ecosystem process, current issues, and career opportunities. Previously offered as NREM 1114. Additional flat fee of $24.00 applies.
Credit hours: 3
Contact hours: Lecture: 3 Lab: 0
Levels: Undergraduate
Schedule types: Lab, Lecture, Combined lecture and lab
Department/School: Natural Res Eco & Mgmt

NREM 1213 Introduction to Wood Properties and Products
Description: Anatomical, physical and mechanical properties of solid wood and wood products. Macroscopic and microscopic identification of wood. Principles of manufacture of lumber, plywood and wood composites. Biological deterioration of wood and main wood preservation techniques. One weekend field trip required. Previously offered as NREM 1214.
Credit hours: 3
Contact hours: Lecture: 2 Lab: 2
Levels: Undergraduate
Schedule types: Lab, Lecture, Combined lecture and lab
Department/School: Natural Res Eco & Mgmt

NREM 2013 Ecology of Natural Resources
Prerequisites: BIOL 1114 or PLNT 1213.
Description: Introductory focus on understanding and applying general ecological principles to agricultural and natural ecosystems. Emphasis on relationships between climate, soils, agricultural, and natural ecosystems. Topics include nutrient cycles, energy flow, species interactions, biological diversity, productivity, sustainability, and landscape and ecosystem management. Previously offered as RLEM 2913.
Credit hours: 3
Contact hours: Lecture: 3
Levels: Undergraduate
Schedule types: Lecture
Department/School: Natural Res Eco & Mgmt

NREM 2103 Forest Measurements I
Prerequisites: NREM 1113; MATH 1715 or (MATH 1513 and MATH 1613); STAT 2013 (or concurrent).
Description: An introduction to the measurements of forests, forest products, standing trees, growth, and the application of mensurational techniques to timber valuation and analysis. Measurement techniques of non-timber components of forest resources. Previously offered as FOR 2003.
Credit hours: 3
Contact hours: Lecture: 2 Lab: 2
Levels: Undergraduate
Schedule types: Lab, Lecture, Combined lecture and lab
Department/School: Natural Res Eco & Mgmt

NREM 2112 Timber Harvesting
Description: Theory and strategies of planning and management of timber harvesting. Harvesting techniques including felling, bucking, skidding operations, and cable yarding. Timber harvest cost analysis, safety aspects of harvesting, and principles of forest road building. Field practices in road design and surveying. Field trips to industrial timber harvesting operations. Previously offered as NREM 2113, FOR 2113, and FOR 2002.
Credit hours: 2
Contact hours: Lecture: 1 Lab: 3
Levels: Undergraduate
Schedule types: Lab, Lecture, Combined lecture and lab
Department/School: Natural Res Eco & Mgmt

NREM 2134 Dendrology
Description: Identification, taxonomy and distribution of forest trees and shrubs of the United States; their environmental requirements and utilization. Additional flat fee of $24.00 applies. Previously offered as FOR 2134.
Credit hours: 2
Contact hours: Lecture: 2 Lab: 4
Levels: Undergraduate
Schedule types: Lab, Lecture, Combined lecture and lab
Department/School: Natural Res Eco & Mgmt

NREM 3012 Applied Ecology Laboratory
Prerequisites: NREM 3013 or concurrent.
Description: Field experience aimed at navigating and working effectively and safely in the natural environment. Identification, measurement and interpretation of abiotic and biotic components to understand and describe ecosystem function and current natural resource management tools and issues. Focus on representative forest, grassland and aquatic ecosystems.
Credit hours: 2
Contact hours: Lab: 4
Levels: Undergraduate
Schedule types: Lab
Department/School: Natural Res Eco & Mgmt
NREM 3013 Applied Ecology and Conservation
Prerequisites: BIOL 1114 or BIOL 1604 or PBIO 1404; Sophomore, Junior, or Senior class standing; SOIL 2124 preferred.
Description: Development of critical thinking for conservation and land management through the application of ecological concepts and theory. Principles of population, community, ecosystem and landscape ecology, with applications to management of wildlife, fisheries, forest and rangeland resources. Application of scientific method and literature to natural resource ecology and management.
Credit hours: 3
Contact hours: Lecture: 3
Levels: Undergraduate
Schedule types: Lecture
Department/School: Natural Res Eco & Mgmt

NREM 3063 Natural Resource Biometrics
Prerequisites: STAT 2013, and MATH 1513 or MATH 1483.
Description: Application of statistical concepts to problems in natural resource sampling and estimation including simple random sampling, stratified sampling, regression analysis, double sampling and ratio and regression estimation. Statistical analysis using spreadsheets. Applications to forest, range and wildlife management. Previously offered as NREM 3363.
Credit hours: 3
Contact hours: Lecture: 2 Lab: 2
Levels: Undergraduate
Schedule types: Lab, Lecture, Combined lecture and lab
Department/School: Natural Res Eco & Mgmt

NREM 3083 Geospatial Technologies for Natural Resources
Prerequisites: MATH 1483 or MATH 1493 or MATH 1513.
Description: Principles and application of geospatial technologies for natural resource ecology and management including remote sensing (aerial photography and satellite data), geographic information systems (GIS) and global positioning system (GPS) technologies. Previously offered as FOR 3883.
Credit hours: 3
Contact hours: Lecture: 2 Lab: 2
Levels: Undergraduate
Schedule types: Lab, Lecture, Combined lecture and lab
Department/School: Natural Res Eco & Mgmt

NREM 3101 Forest Resource Field Studies
Prerequisites: NREM 2134 and BOT 1404 and SOIL 2124.
Description: One-week summer presession field experience at an off-campus site. Field study in the dynamics of forest ecosystems and related components including trees, soils, water, fauna, and associated flora as they relate to site productivity and the production of resource outputs, products, and services. Previously offered as NREM 3112.
Credit hours: 1
Contact hours: Lab: 2
Levels: Undergraduate
Schedule types: Lab
Department/School: Natural Res Eco & Mgmt

NREM 3102 Forest Measurements II
Prerequisites: NREM 2103.
Description: Two-week summer presession field experience at an off-campus site. Land, tree, stand and forest-level measurements, and the use and care of measurement equipment. Emphasis on statistical and tactical design of forest inventory methods, and their implementation in the field. Previously offered as FOR 3102.
Credit hours: 2
Contact hours: Lab: 4
Levels: Undergraduate
Schedule types: Lab
Department/School: Natural Res Eco & Mgmt

NREM 3111 Natural Resource Field Studies
Description: One-week summer presession field experience at off-campus site. Field study, analysis, and assessment of natural resource ecosystems at multiple scales with application to integrated management of forest, wildlife, range, water, soil, and recreation resources to sustain a broad array of uses and values, and to understand associated ecological, social, policy, and ethical issues. Includes visits to private and public natural resource lands and projects. Previously offered as FOR 3103 and NREM 3103.
Credit hours: 1
Contact hours: Lecture: 3 Lab: 2
Levels: Undergraduate
Schedule types: Lab, Lecture, Combined lecture and lab
Department/School: Natural Res Eco & Mgmt

NREM 3224 Silviculture
Prerequisites: NREM 2013, or NREM 3012 and NREM 3013, or BIOL 3034.
Description: Theory and practice of controlling forest establishment, composition, structure, and growth to meet multiple objectives. Principles and techniques of natural and artificial regeneration, intermediate cultural treatments, and silvicultural systems applicable in various forest cover types. Two-day field trip is required. Previously offered as NREM 3223.
Credit hours: 4
Contact hours: Lecture: 3 Lab: 2
Levels: Undergraduate
Schedule types: Lab, Lecture, Combined lecture and lab
Department/School: Natural Res Eco & Mgmt

NREM 3502 Wildlife Law Enforcement
Prerequisites: Junior standing and consent of instructor.
Description: Survey of state and federal wildlife laws with emphasis on Oklahoma statutory and regulatory laws pertaining to wildlife. Lectures, guest lectures, videotapes and field exercises. Previously offered as COSC 3502 and ZOOL 3502.
Credit hours: 2
Contact hours: Lecture: 2
Levels: Undergraduate
Schedule types: Lecture
Department/School: Natural Res Eco & Mgmt

NREM 3503 Principles of Wildlife Ecology and Management
Prerequisites: NREM 3012 and NREM 3013, or BIOL 3034 or concurrent.
Description: An introduction to the biological basis of the management of wildlife habitats and populations. Previously offered as NREM 4513, ZOOL 4513, WLDL 4513, and COSC 4513.
Credit hours: 3
Contact hours: Lecture: 3
Levels: Undergraduate
Schedule types: Lecture
Department/School: Natural Res Eco & Mgmt
NREM 3523 Fish and Wildlife Population Biology
Prerequisites: NREM 3012 and NREM 3013, or BIOL 3034 or concurrent enrollment.
Credit hours: 3
Contact hours: Lecture: 3
Levels: Undergraduate
Schedule types: Lecture
Department/School: Natural Res Eco & Mgmt

NREM 3613 Principles of Rangeland Management
Description: Overview of the science of applying ecological principles to managing rangeland resources, including rangeland characteristics; goods and services provided by rangelands; primary threats to rangelands; North American rangeland resources; principles of grazing management and current topics in range management. Previously offered as RLEM 3913.
Credit hours: 3
Contact hours: Lecture: 3
Levels: Undergraduate
Schedule types: Lecture
Department/School: Natural Res Eco & Mgmt

NREM 3713 Wildland Fire Ecology and Management
Prerequisites: NREM 3012 and NREM 3013, or BIOL 1114.
Description: Fundamentals of wildland fire including chemistry and physics of fire, fuel and weather influences on fire behavior, ecological effects of fire, interaction of fire and vegetation, history of humans and fire, management and suppression, and prescribed fire.
Credit hours: 3
Contact hours: Lecture: 3
Levels: Undergraduate
Schedule types: Lecture
Department/School: Natural Res Eco & Mgmt

NREM 4001 Issues In Global Change
Prerequisites: (NREM 3012 and NREM 3013) or BIOL 3034.
Description: Student led discussion to learn the causes and consequences of global change and practical implications for natural resource ecology and management.
Credit hours: 1
Contact hours: Other: 1
Levels: Undergraduate
Schedule types: Discussion
Department/School: Natural Res Eco & Mgmt

NREM 4023 Restoration Ecology
Prerequisites: NREM 3013 or NREM 3012 and NREM 3013, or BIOL 3034.
Description: Application of ecological theory to the practice of ecological restoration to improve populations, communities, and ecosystems degraded directly or indirectly by human activities.
Credit hours: 3
Contact hours: Lecture: 3
Levels: Undergraduate
Schedule types: Lecture
Department/School: Natural Res Eco & Mgmt

NREM 4033 Ecology Of Invasive Species
Prerequisites: BIOL 1114, and BOT 1404 and BIOL 1604 recommended.
Description: Ecological principles and their application to invasive species. Population level characteristics; community and ecosystem level effects of a wide variety of taxa including microbial, fungal, plant, invertebrate, and vertebrate examples. Global consequences and governmental policies/programs designed to limit the spread of invasives.
Credit hours: 3
Contact hours: Lecture: 3
Levels: Undergraduate
Schedule types: Lecture
Department/School: Natural Res Eco & Mgmt

NREM 4043 Natural Resource Administration and Policy
Prerequisites: Senior standing.
Description: Natural resource policy and legislation; ethics relating to natural resources; natural resource organizations and how they function to include structure, supervision, and financing of federal, state, and private natural resource enterprises. Previously offered as NREM 4343 and FOR 4443.
Credit hours: 3
Contact hours: Lecture: 3
Levels: Graduate, Undergraduate
Schedule types: Lecture
Department/School: Natural Res Eco & Mgmt

NREM 4053 Natural Resource Recreation
Description: Ecological, historical, social and policy basis for recreational use and management of natural resources, including an analysis of planning, management, and administrative frameworks for providing a diversity of recreational opportunities, benefits, and resource values. Previously offered as NREM 4353 and FOR 4553.
Credit hours: 3
Contact hours: Lecture: 3
Levels: Graduate, Undergraduate
Schedule types: Lecture
Department/School: Natural Res Eco & Mgmt

NREM 4093 Natural Resource Administration and Policy
Prerequisites: BIOL 1114; and BOT 1404 and BIOL 1604 recommended.
Description: Ecological principles and their application to invasive species. Population level characteristics; community and ecosystem level effects of a wide variety of taxa including microbial, fungal, plant, invertebrate, and vertebrate examples. Global consequences and governmental policies/programs designed to limit the spread of invasives.
Credit hours: 3
Contact hours: Lecture: 3
Levels: Undergraduate
Schedule types: Lecture
Department/School: Natural Res Eco & Mgmt

NREM 4093 Natural Resources, People and Sustainable Development (I)
Description: Relationship between people, the land, and associated natural resources in the developing world, including the ecological and cultural basis for resource use and development. Examines issues of traditional agriculture and deforestation, and explores sustainable strategies for land use, resource management, and community development. Includes two-week study abroad component. Previously offered as NREM 4393.
Credit hours: 3
Contact hours: Lecture: 3
Levels: Undergraduate
Schedule types: Lecture
Department/School: Natural Res Eco & Mgmt

General Education and other Course Attributes: International Dimension
### NREM 4213 Forest Biology
**Prerequisites:** BOT 1404.
**Description:** The response of trees and forest ecosystems to environmental, cultural and genetic factors. Application of physiological and ecological principles in predicting the effects of biotic and abiotic factors on tree growth and community interactions. Previously offered as FOR 4563.
**Credit hours:** 3
**Contact hours:** Lecture: 3
**Levels:** Undergraduate
**Schedule types:** Lecture
**Department/School:** Natural Res Eco & Mgmt

### NREM 4234 Forest Management and Economics
**Prerequisites:** NREM 3224 and AGEC 1113.
**Description:** Regulation of forest growing stock to meet financial and biological management objectives; stand level optimization; linear programming principles in harvest scheduling; timberland taxation; timberland investment criteria; risk and uncertainty in timberland investment; economics of non-market goods. Previously offered as NREM 4323.
**Credit hours:** 4
**Contact hours:** Lecture: 3 Lab: 2
**Levels:** Graduate, Undergraduate
**Schedule types:** Lab, Lecture, Combined lecture and lab
**Department/School:** Natural Res Eco & Mgmt

### NREM 4333 Forest Resource Management: Planning and Decision-Making
**Prerequisites:** NREM 4323.
**Description:** Integrated problem solving, to apply biological, quantitative, economic, political, and administrative principles in solving forest resource management problems. Previously offered as FOR 4333.
**Credit hours:** 3
**Contact hours:** Lecture: 2 Lab: 2
**Levels:** Graduate, Undergraduate
**Schedule types:** Lab, Lecture, Combined lecture and lab
**Department/School:** Natural Res Eco & Mgmt

### NREM 4360 Ecotourism and Wilderness
**Credit hours:** 3
**Contact hours:** Lecture: 3
**Levels:** Undergraduate
**Schedule types:** Lecture
**Department/School:** Natural Res Eco & Mgmt

### NREM 4403 Wetland Ecology and Management
**Prerequisites:** NREM 3012 and NREM 3013, or BIOL 3034 or consent of instructor.
**Description:** Ecology, classification, restoration, and management of wetlands. Adaptations of wetland plants and animals, structure and function of wetlands, field identification of wetland plants, restoration techniques, wetland classification systems, management and conservation of wetlands, and regulatory processes. Previously offered as COSC 4403 and ZOOL 4403.
**Credit hours:** 3
**Contact hours:** Lecture: 2 Lab: 3
**Levels:** Undergraduate
**Schedule types:** Lab, Lecture, Combined lecture and lab
**Department/School:** Natural Res Eco & Mgmt

### NREM 4414 Fisheries Management
**Prerequisites:** NREM 3012 and NREM 3013, or BIOL 3034.
**Description:** Techniques and principles involved in management of fishes. Field trip fee required. Previously offered as COSC 4414, ZOOL 4414, and ZOOL 4524.
**Credit hours:** 4
**Contact hours:** Lecture: 2 Lab: 4
**Levels:** Graduate, Undergraduate
**Schedule types:** Lab, Lecture, Combined lecture and lab
**Department/School:** Natural Res Eco & Mgmt

### NREM 4424 Fisheries Techniques
**Prerequisites:** NREM 4414.
**Description:** Research techniques and methodology in fisheries science, including sampling design, habitat measurements, sampling gears and abundance estimation, age and growth analysis, recreational surveys, data analysis, and report writing. No credit for students with credit in NREM 5424. Previously offered as COSC 4424.
**Credit hours:** 4
**Contact hours:** Lecture: 3 Lab: 3
**Levels:** Undergraduate
**Schedule types:** Lab, Lecture, Combined lecture and lab
**Department/School:** Natural Res Eco & Mgmt

### NREM 4443 Watershed Hydrology and Water Quality
**Description:** Processes that comprise the hydrologic cycle and how land use affects those processes and the quantity and quality of water from watersheds, focusing on surface water from forest, range and agricultural watersheds. Measurement and evaluation of water quantity and quality. Additional flat fee of $22.00 applies. Previously offered as NREM 4413 and FOR 4813.
**Credit hours:** 3
**Contact hours:** Lecture: 2 Lab: 2
**Levels:** Graduate, Undergraduate
**Schedule types:** Lab, Lecture, Combined lecture and lab
**Department/School:** Natural Res Eco & Mgmt

### NREM 4452 Pond Management
**Prerequisites:** BIOL 1114.
**Description:** Principles and practice of aquatic plant management, pond construction, and maintenance, fish population management, and human factors associated with pond ownership and management. No credit for students with credit in NREM 5452.
**Credit hours:** 2
**Contact hours:** Lecture: 2
**Levels:** Undergraduate
**Schedule types:** Lecture
**Department/School:** Natural Res Eco & Mgmt

### NREM 4453 Aquaculture
**Prerequisites:** BIOL 1114.
**Description:** Introduction to the principles of freshwater finfish production with an emphasis on warm water species. No credit for student having completed NREM 5453.
**Credit hours:** 3
**Contact hours:** Lecture: 3
**Levels:** Undergraduate
**Schedule types:** Lecture
**Department/School:** Natural Res Eco & Mgmt
NREM 4463 Ornithology
Prerequisites: BIOL 1601.
Description: Classification, evolution, distribution, identification, life histories, and morphological, ecological, and behavioral adaptations of birds. Two weekend field trips required. Same course as BIOL 4464. May not be used for degree credit with BIOL 5464, NREM 5564.
Credit hours: 4
Contact hours: Lecture: 2 Lab: 3
Levels: Undergraduate
Schedule types: Lab, Lecture, Combined lecture and lab
Department/School: Natural Res Eco & Mgmt

NREM 4524 Wildlife Management Techniques
Prerequisites: NREM 3503. ENGL 3323 strongly recommended.
Description: Research techniques and methodology in wildlife science. Experimental design, wildlife population and habitat analysis, wildlife and vegetation sampling techniques, aging and sexing techniques, and report preparation and presentation. Previously offered as COSC 4524, COSC 4523, WLDL 4523, and ZOOL 4523.
Credit hours: 4
Contact hours: Lecture: 2 Lab: 4
Levels: Undergraduate
Schedule types: Lab, Lecture, Combined lecture and lab
Department/School: Natural Res Eco & Mgmt

NREM 4533 Wildlife Management for Game Species
Prerequisites: NREM 3012 and NREM 3013, or BIOL 3034; and NREM 3503.
Description: Life history attributes and habitat relationships of game species relative to life history strategies; conservation and management strategies for game species; and federal and state policies influencing game species management.
Credit hours: 3
Contact hours: Lecture: 3
Levels: Undergraduate
Schedule types: Lecture
Department/School: Natural Res Eco & Mgmt

NREM 4543 Wildlife Management for Biodiversity
Prerequisites: NREM 3013 and NREM 3503 recommended.
Description: Identification, life history, and conservation management issues affecting non-game species in North America, stressing rare, threatened, and endangered species occurring in Oklahoma. Principles of landscape ecology, wildlife management, and conservation biology applied to management scenarios aimed at recovery of rare species and biodiversity conservation at broad scales. Previously offered as COSC 4543 and ZOOL 4543.
Credit hours: 3
Contact hours: Lecture: 3
Levels: Undergraduate
Schedule types: Lecture
Department/School: Natural Res Eco & Mgmt

NREM 4603 Rangeland and Pasture Utilization
Prerequisites: NREM 3613.
Description: Investigation of livestock and forage interactions that impact productivity in the utilization of rangeland and improved pastures. Same course as ANSI 4203.
Credit hours: 3
Contact hours: Lecture: 2 Lab: 2
Levels: Undergraduate
Schedule types: Lab, Lecture, Combined lecture and lab
Department/School: Natural Res Eco & Mgmt

NREM 4613 Rangeland Resources Planning
Prerequisites: NREM 3613.
Description: Inventory of ranch resources, survey and evaluation of ranch practices, and economic analysis. Development of a comprehensive ranch management plan. Managing rangeland and ranch resources in a social context. Written and oral reports. Field trips required. Same course as ANSI 4973. Previously offered as RLEM 4973 and AGRN 4973.
Credit hours: 3
Contact hours: Lecture: 3
Levels: Undergraduate
Schedule types: Lecture
Department/School: Natural Res Eco & Mgmt

NREM 4741 Wildland Firefighter Training
Description: Training for Type 2 (FFT2) wildland firefighting positions with US government agencies. Provides qualifications to participate in prescribed fire and other wildland fire operations including: ignition, control, mop-up, suppression, and monitoring.
Credit hours: 1
Contact hours: Lecture: 3
Levels: Undergraduate
Schedule types: Lecture
Department/School: Natural Res Eco & Mgmt

NREM 4783 Prescribed Fire
Prerequisites: NREM 3613.
Description: When to use prescribed fire and how to use prescribed fire to accomplish specific land management objectives. Writing prescribed fire plans, policy and laws, weather, equipment, conducting burns, and post-burn mop-up. Previously offered as RLEM 4983.
Credit hours: 3
Contact hours: Lecture: 3
Levels: Undergraduate
Schedule types: Lecture
Department/School: Natural Res Eco & Mgmt

NREM 4793 Advanced Prescribed Fire
Prerequisites: NREM 4783 or consent of instructor.
Description: Preparing fire plans and executing prescribed fires as the fireboss. No credit for both NREM 4793 and NREM 5793. Previously offered as RLEM 4993.
Credit hours: 3
Contact hours: Lecture: 2 Lab: 3
Levels: Undergraduate
Schedule types: Lab, Lecture, Combined lecture and lab
Department/School: Natural Res Eco & Mgmt

NREM 4960 Undergraduate Internship
Prerequisites: Consent of instructor.
Description: Supervised internship with an approved natural resource business, government agency, or nongovernment organization, including a diversity of learning opportunities in a work environment. For every hour of credit, 45 hours of work are required. Offered for variable credit, 1-6 credit hours, maximum of 6 credit hours.
Credit hours: 1-6
Contact hours: Other: 1
Levels: Undergraduate
Schedule types: Independent Study
Department/School: Natural Res Eco & Mgmt
NREM 4980 Undergraduate Research
Prerequisites: Upper-division standing, GPA of 2.50 or better and consent of instructor.
Description: Participation in faculty research or execution of a research problem formulated by the student. Previously offered as RLEM 4990. Offered for variable credit, 1-3 credit hours, maximum of 3 credit hours.
Credit hours: 1-3
Contact hours: Lecture: 1
Levels: Undergraduate
Schedule types: Lecture
Department/School: Natural Res Eco & Mgmt

NREM 4990 Special Topics in Natural Resource Ecology and Management
Description: Advanced topics and new developments in natural resource ecology and management. Previously offered as RLEM 4990. Offered for variable credit, 1-3 credit hours, maximum of 12 credit hours.
Credit hours: 1-3
Contact hours: Lecture: 1
Levels: Graduate, Undergraduate
Schedule types: Lecture
Department/School: Natural Res Eco & Mgmt

NREM 5000 Master's Thesis Report
Description: Independent research planned, conducted and reported in consultation with a major professor. Previously offered as RLEM 5000. Offered for variable credit, 1-12 credit hours, max 12 (Thesis) 4 (Report).
Credit hours: 1-12
Contact hours: Lecture: 1
Levels: Graduate
Schedule types: Lecture
Department/School: Natural Res Eco & Mgmt

NREM 5020 Graduate Seminar
Description: Special topics in Natural Resource Ecology and Management; philosophy, methods and interpretation of research. Previously offered as RLEM 5020. Offered for fixed credit, 1 credit hour, maximum of 10 credit hours.
Credit hours: 1
Contact hours: Lecture: 1
Levels: Graduate
Schedule types: Lecture
Department/School: Natural Res Eco & Mgmt

NREM 5023 Restoration Ecology
Description: Application of ecological theory to ecological restoration with the goal of improving populations, communities and ecosystems degraded directly or indirectly by human activities. Case studies and applications of ecological principles to restorations across circumstances and systems will be discussed. May not be used for degree credit with NREM 4023.
Credit hours: 3
Contact hours: Lecture: 3
Levels: Graduate
Schedule types: Lecture
Department/School: Natural Res Eco & Mgmt

NREM 5030 Special Problems in Natural Resource Ecology and Management
Description: Special problems in areas of natural resource ecology and management other than those covered in the student's thesis research. Previously offered as FOR 5030. Offered for variable credit, 1-9 credit hours, maximum of 9 credit hours.
Credit hours: 1-9
Contact hours: Lecture: 1
Levels: Graduate
Schedule types: Lecture
Department/School: Natural Res Eco & Mgmt

NREM 5033 Ecology of Invasive Species
Description: Ecological principles and their application to invasive species. Discussion of population level characteristics and community and ecosystem level effects of a wide variety of taxa including invasive microbial, fungal, plant, invertebrate, and vertebrate examples. Current global consequences and governmental policies/programs designed to limit the spread of invasives. No credit for students having completed NREM 4033.
Credit hours: 3
Contact hours: Lecture: 3
Levels: Graduate
Schedule types: Lecture
Department/School: Natural Res Eco & Mgmt

NREM 5043 Ecology and Evolution of Symbiosis
Description: Ecology and evolution of symbiotic and mutualistic interactions in different ecosystems. Theory, current questions, and general patterns involving biotic interactions of plants and animals with other plants, animals, or microbes.
Credit hours: 3
Contact hours: Lecture: 3
Levels: Graduate
Schedule types: Lecture
Department/School: Natural Res Eco & Mgmt

NREM 5053 Global Ecology and Biogeochemistry
Description: Examines key nutrient pools and transformations in the atmosphere, soils, and hydrosphere, with an emphasis on the role of living organisms in nutrient transformations and fluxes. Emphasis placed on processes relevant to biogeochemical cycles at ecosystem and global scales in reference to aspects of global change.
Credit hours: 3
Contact hours: Lecture: 3
Levels: Graduate
Schedule types: Lecture
Department/School: Natural Res Eco & Mgmt

NREM 5063 Production Ecology
Prerequisites: NREM 3012 and NREM 3013, or BIOL 3034.
Description: Mechanisms driving the growth and productivity of terrestrial ecosystems in response to resource availability, genetics, disturbance, and climate. Factors affecting the distribution and productivity of biomes, relationship between leaf area and productivity, effects of diversity on productivity, the proximal causes of increased growth associated with resource additions, and using process models to predict growth. Previously offered as NREM 4103.
Credit hours: 3
Contact hours: Lecture: 3
Levels: Graduate
Schedule types: Lecture
Department/School: Natural Res Eco & Mgmt
NREM 5073 Sampling and Modeling Ecological Populations
Prerequisites: Basic understanding of population ecology and statistics strongly encouraged.
Description: Experimental design issues relevant to population sampling; Introduction to population modeling and forecasting. No prior modeling experience is expected.
Credit hours: 3
Contact hours: Lecture: 3
Levels: Graduate
Schedule types: Lecture
Department/School: Natural Res Eco & Mgmt

NREM 5083 Applied Landscape Ecology
Description: Advanced ecology and management of grasslands, shrublands, and forests. Understanding the effects of grazing, fire and other disturbances on biotic and abiotic processes. Vegetation dynamics, wildlife habitat evaluation, woody plant encroachment, rangeland monitoring, and landscape ecology. Field trips required at additional cost to students. Previously offered as NREM 5054.
Credit hours: 3
Contact hours: Lecture: 3
Levels: Graduate
Schedule types: Lecture
Department/School: Natural Res Eco & Mgmt

NREM 5093 Community Natural Resource Management
Prerequisites: Graduate standing.
Description: Theoretical frameworks, methodological investigation and applied practices to enhance the ability of community development professionals to work with their communities to plan, develop, and monitor the development of natural resources with multiple functions. Course available online only through distance education.
Credit hours: 3
Contact hours: Lecture: 3
Levels: Graduate
Schedule types: Lecture
Department/School: Natural Res Eco & Mgmt

NREM 5130 Topics in Forestry
Description: Advanced study on special topics in forestry. Offered for variable credit, 1-3 credit hours, maximum of 9 credit hours.
Credit hours: 1-3
Contact hours: Other: 1
Levels: Graduate
Schedule types: Independent Study
Department/School: Natural Res Eco & Mgmt

NREM 5133 Advanced Topics in Forest Biometrics
Prerequisites: NREM 3063 or equivalent; STAT 5013 concurrently or equivalent.
Description: Quantitative description of forest populations and methods for modeling forest growth and development. Sampling techniques for forest populations. Previously offered as FOR 5053.
Credit hours: 3
Contact hours: Lecture: 3
Levels: Graduate
Schedule types: Lecture
Department/School: Natural Res Eco & Mgmt

NREM 5193 Spatial and Non-Spatial Database Management
Prerequisites: One course in statistics and programming experience.
Description: Methods of acquiring, managing and analyzing spatial data using geographic information systems. Management of non-spatial data using relational database managers. Development of applications using these tools for evaluating and managing natural resources. Previously offered as SOIL 5193.
Credit hours: 3
Contact hours: Lecture: 3
Levels: Graduate
Schedule types: Lecture
Department/School: Natural Res Eco & Mgmt

NREM 5424 Fisheries Techniques
Prerequisites: NREM 4414.
Description: Research techniques and methodology in fisheries science, including sampling design, habitat measurements, sampling gears and abundance estimation, age and growth analysis, recreational surveys, data analysis and report writing. No credit for students with credit in NREM 4424. Previously offered as COSC 5424.
Credit hours: 4
Contact hours: Lecture: 2 Lab: 4
Levels: Graduate
Schedule types: Lab, Lecture, Combined lecture and lab
Department/School: Natural Res Eco & Mgmt

NREM 5430 Special Topics in Fisheries
Prerequisites: Consent of instructor.
Description: Advanced study on special topics in fisheries. Offered for variable credit, 1-3 credit hours, maximum of 9 credit hours.
Credit hours: 1-3
Contact hours: Lecture: 1
Levels: Graduate
Schedule types: Lecture
Department/School: Natural Res Eco & Mgmt

NREM 5433 Fisheries Science
Prerequisites: NREM 4414 or equivalent or consent of instructor.
Description: Principles of fisheries science as they relate to fish and aquatic biota, their habitats, and the humans who utilize them. Previously offered as COSC 5433.
Credit hours: 3
Contact hours: Lecture: 3
Levels: Graduate
Schedule types: Lecture
Department/School: Natural Res Eco & Mgmt

NREM 5443 Watershed Hydrology and Water Quality
Description: Processes that comprise the hydrologic cycle and how land use affects those processes and the quantity and quality of water from watersheds, focusing on surface water from forest, range and agricultural watersheds. Measurement and evaluation of water quantity and quality. Intended for graduate students new to the water resources field. No credit for students having completed NREM 4443.
Credit hours: 3
Contact hours: Lecture: 2 Lab: 2
Levels: Graduate
Schedule types: Lab, Lecture, Combined lecture and lab
Department/School: Natural Res Eco & Mgmt
NREM 5452 Pond Management
Prerequisites: BIOL 1114.
Description: Principles and practice of aquatic plant management, pond construction and maintenance, fish population management, and human factors associated with pond ownership and management. No credit for students with degree credit in NREM 4452.
Credit hours: 2
Contact hours: Lecture: 2
Levels: Graduate
Schedule types: Lecture
Department/School: Natural Res Eco & Mgmt

NREM 5453 Aquaculture
Prerequisites: BIOL 1114.
Description: Introduction to the principles of freshwater finfish production with an emphasis on warm water species. No credit for student having completed NREM 4453.
Credit hours: 3
Contact hours: Lecture: 3
Levels: Graduate
Schedule types: Lecture
Department/School: Natural Res Eco & Mgmt

NREM 5463 Stream Restoration and Management
Description: Streams and associated riparian areas and their functions in maintaining water quantity and quality and providing aquatic habitat. Fluvial geomorphology, stream assessment and classification, riparian area functions and management, and concepts and comparison of methods of stream restoration. Field measurements of stream and riparian characteristics. Two overnight field trips required. No credit for students having completed NREM 4463.
Credit hours: 3
Contact hours: Lecture: 2 Lab: 2
Levels: Graduate
Schedule types: Lab, Lecture, Combined lecture and lab
Department/School: Natural Res Eco & Mgmt

NREM 5473 Stream Ecology
Prerequisites: Course in ecology strongly recommended.
Description: Ecology of streams and rivers, physical and chemical properties, biotic assemblages and interactions, ecosystem processes and theories and human impact. Two day field trip required at additional costs to students. Previously offered as NREM 5464.
Credit hours: 3
Contact hours: Lecture: 3
Levels: Graduate, Undergraduate
Schedule types: Lecture
Department/School: Natural Res Eco & Mgmt

NREM 5483 Ecohydrology
Prerequisites: Ecology course strongly recommended.
Description: Concepts, framework and challenges in ecohydrology. Soil water control on vegetation structure, function and distribution. Vegetation feedback on water budget in water limited ecosystems. Ecological and hydrological interaction associated with land use, land cover change and climate variability.
Credit hours: 3
Contact hours: Lecture: 3
Levels: Graduate
Schedule types: Lecture
Department/School: Natural Res Eco & Mgmt

NREM 5493 Social Dimensions in Aquatic Ecology
Prerequisites: Consent of instructor.
Description: Role of humans as implementers of policy, as users of resources, and as scientists in aquatic ecology.
Credit hours: 3
Contact hours: Lecture: 3
Levels: Graduate
Schedule types: Lecture
Department/School: Natural Res Eco & Mgmt

NREM 5513 Applied Wildlife Behavior
Description: Importance of wildlife behavior to individual survival, reproduction, and implications for population ecology, community ecology, conservation, and management. Wildlife is broadly defined in this class; topics include habitat selection, dispersal, & migration.
Credit hours: 3
Contact hours: Lecture: 2 Other: 2
Levels: Graduate
Schedule types: Discussion, Combined lecture & discussion, Lecture
Department/School: Natural Res Eco & Mgmt

NREM 5523 Population Ecology
Prerequisites: BIOL 3034, MATH 1513.
Description: Theory and principles of predicting and analyzing population abundance and dynamics. Life history theory, foraging theory, habitat selection, population genetics, and species interactions. Same course as BIOL 5523.
Credit hours: 3
Contact hours: Lecture: 2 Lab: 2
Levels: Graduate
Schedule types: Lab, Lecture, Combined lecture and lab
Department/School: Natural Res Eco & Mgmt

NREM 5530 Special Topics in Wildlife
Prerequisites: Consent of instructor.
Description: Advanced study on special topics in Wildlife. Offered for variable credit, 1-3 credit hours, maximum of 9 credit hours.
Credit hours: 1-3
Contact hours: Lecture: 1
Levels: Graduate
Schedule types: Lecture
Department/School: Natural Res Eco & Mgmt

NREM 5563 Forest Wildlife Ecology
Prerequisites: Course in ecology strongly recommended.
Description: Vertebrate species diversity in the world's woodland and forested biomes. Changes imposed by land clearing and development and their effects upon wildlife diversity and populations. Options for wildlife conservation, from strict nature reserves to integrating wildlife habitat management into land use practices. Field trip required. Previously offered as COSC 5563.
Credit hours: 3
Contact hours: Lecture: 3
Levels: Graduate
Schedule types: Lecture
Department/School: Natural Res Eco & Mgmt
NREM 5564 Ornithology
Description: Classification, evolution, distribution, identification, life histories, and morphological, ecological, and behavioral adaptations of birds. Two weekend field trips required. May not be used for degree credit with BIOL 4464, NREM 4464. Previously offered as BIOL 5464.
Credit hours: 4
Contact hours: Lecture: 3 Lab: 3
Levels: Graduate
Schedule types: Lab, Lecture, Combined lecture and lab
Department/School: Natural Res Eco & Mgmt

NREM 5573 Grassland and Desert Wildlife Ecology
Prerequisites: Course in ecology strongly recommended.
Description: Ecology of grasslands and deserts with emphasis on vertebrate species diversity, adaptations to semi-arid and arid ecosystems, and management problems associated with such habitats. Previously offered as COSC 5573.
Credit hours: 3
Contact hours: Lecture: 3
Levels: Graduate
Schedule types: Lecture
Department/School: Natural Res Eco & Mgmt

NREM 5583 Wetland Wildlife Ecology
Prerequisites: A course in wildlife ecology or wetland management recommended
Description: Ecology and management of wetland dependent wildlife species with an emphasis on the autecology, adaptations for inhabiting wetland systems, and management problems associated with these taxa. Previously offered as COSC 5583.
Credit hours: 3
Contact hours: Lecture: 3
Levels: Graduate
Schedule types: Lecture
Department/School: Natural Res Eco & Mgmt

NREM 5603 Rangeland and Pasture Utilization
Prerequisites: NREM 3613 or equivalent.
Description: Investigation of livestock and forage interactions that impact productivity in the utilization of rangeland and improved pastures. May not be used for degree credit with ANSI 4203 or NREM 4603.
Credit hours: 3
Contact hours: Lecture: 2 Lab: 2
Levels: Graduate
Schedule types: Lab, Lecture, Combined lecture and lab
Department/School: Natural Res Eco & Mgmt

NREM 5630 Special Topics in Rangeland Science
Prerequisites: Consent of instructor.
Description: Advanced study on special topics in rangeland science. Previously offered as NREM 5660. Offered for variable credit, 1-3 credit hours, maximum of 9 hours.
Credit hours: 1-3
Contact hours: Lecture: 1
Levels: Graduate
Schedule types: Lecture
Department/School: Natural Res Eco & Mgmt

NREM 5673 Rangeland Resources Watershed Management
Description: Management of anthropogenic activities and physical/biological functions or processes on water and rangeland watersheds. Emphasizes preventative and restorative strategies in a natural resource rangeland setting. Course available online only through distance education.
Credit hours: 3
Contact hours: Lecture: 3
Levels: Graduate
Schedule types: Lecture
Department/School: Natural Res Eco & Mgmt

NREM 5682 Grassld Plant Identification
Prerequisites: Consent of instructor.
Description: Study and identification of plants that have ecological and/or agricultural importance in the Great Plains. Grassland ecosystems and plant characteristics including forage value, palatability, and utilization by both domestic livestock and wildlife. Cultural and historical uses of grassland. Course available online only through distance education.
Credit hours: 2
Contact hours: Lecture: 2
Levels: Graduate
Schedule types: Lecture
Department/School: Natural Res Eco & Mgmt

NREM 5683 Grazing Ecology and Management
Prerequisites: Graduate standing.
Description: Ecological principles of livestock grazing and applications to grazing land management for production and conservation.
Credit hours: 3
Contact hours: Lecture: 3
Levels: Graduate
Schedule types: Lecture
Department/School: Natural Res Eco & Mgmt

NREM 5692 Grassland Monitoring and Assessment.
Description: Vegetation sampling theory and plot selection. Quantitative measures used in vegetation analysis, root growth, and utilization. Use of the similarity index, and plant community health and trends for grassland. Course available online only through distance education.
Credit hours: 2
Contact hours: Lecture: 2
Levels: Graduate
Schedule types: Lecture
Department/School: Natural Res Eco & Mgmt

NREM 5693 Principles of Forage Quality and Evaluation to Ruminant
Prerequisites: Consent of instructor.
Description: Chemical characteristics of forage components and the laboratory procedures used to evaluate forages for grazing livestock. Interactions with ruminant physiology and digestion that influence forage feeding value. Students should have a strong background in the basic principles of chemistry, ruminant nutrition, and plant physiology. Course available online only through distance education.
Credit hours: 3
Contact hours: Lecture: 3
Levels: Graduate
Schedule types: Lecture
Department/School: Natural Res Eco & Mgmt
NREM 5713 Grassland Fire Ecology
Description: Ecological effects of fire on grassland ecosystems. Examination of the history of fire, societal use of fire, fire behavior in relation to fuel and weather, and conducting and safety of prescribed burns. Course available online only through distance education.
Credit hours: 3
Contact hours: Lecture: 3
Levels: Graduate
Schedule types: Lecture
Department/School: Natural Res Eco & Mgmt

NREM 5723 Ecol Fire Dependent Ecosystems
Prerequisites: Any ecology course.
Description: Role of fire and the interactions with land use, weather, and climate change in fire-dependent ecosystems. Responses of species composition, diversity, annual net primary productivity, nutrient cycling, and ecosystem management in diverse ecosystems.
Credit hours: 3
Contact hours: Lecture: 3
Levels: Graduate
Schedule types: Lecture
Department/School: Natural Res Eco & Mgmt

NREM 5783 Prescribed Fire
Description: When to use prescribed fire and how to use prescribed fire to accomplish specific land management objectives. Writing prescribed fire plans, policy and laws, weather, equipment, conducting burns, and post-burn mop-up. Field trips required. Previously offered as RLEM 5983.
Credit hours: 3
Contact hours: Lecture: 3
Levels: Graduate
Schedule types: Lecture
Department/School: Natural Res Eco & Mgmt

NREM 5793 Advanced Prescribed Fire
Prerequisites: NREM 4783 or consent of instructor.
Description: Preparing fire plans and executing prescribed fires as the fireboss. No credit for both NREM 4793 and NREM 5793. Previously offered as RLEM 5993.
Credit hours: 3
Contact hours: Lecture: 2 Lab: 3
Levels: Graduate
Schedule types: Lab, Lecture, Combined lecture and lab
Department/School: Natural Res Eco & Mgmt

NREM 6000 Doctoral Dissertation
Description: Independent research planned, conducted and reported in consultation with major professor. Previously offered as RLEM 6000. Offered for variable credit, 1-15 credit hours, maximum of 45 credit hours.
Credit hours: 1-15
Contact hours: Other: 1
Levels: Graduate
Schedule types: Independent Study
Department/School: Natural Res Eco & Mgmt

NREM 6010 Advanced Topics and Conference
Prerequisites: MS degree.
Description: Supervised study of advanced topics. A reading and conference course designed to acquaint the advanced student with fields not covered in other courses. Previously offered as RLEM 6010. Offered for variable credit, 1-6 credit hours, maximum of 6 credit hours.
Credit hours: 1-6
Contact hours: Lecture: 1
Levels: Graduate
Schedule types: Lecture
Department/School: Natural Res Eco & Mgmt

Undergraduate Programs
• Fisheries and Aquatic Ecology (FAEC), Minor (http://catalog.okstate.edu/agricultural-sciences-natural-resources/natural-resource-ecology-management/fisheries-aquatic-ecology-minor)
• Forestry (FOR), Minor (http://catalog.okstate.edu/agricultural-sciences-natural-resources/natural-resource-ecology-management/forestry-minor)

Graduate Programs
The Department offers MS and PhD degrees in Natural Resource Ecology and Management with specializations in Fisheries and Aquatic Ecology, Forest Resources, Rangeland Ecology and Management, and Wildlife Ecology and Management. In addition, students may work toward the MS and PhD degrees in the Environmental Science Graduate Program and the
PhD degree in the Plant Science Graduate Program with faculty members from the Department.

The overall goals of the Department’s graduate program are to provide high-quality advanced training and instruction in the application of the scientific method to problems in natural resource ecology and management. This includes problem analysis and identification, research methods, synthesis of results and communication of findings through publications and presentations. The Department strives to develop the capability for original and creative work under the guidance of established professionals and scientists. Graduate instruction is a critical component of the research, instruction and Extension missions of the Department.

Students work directly with a member of the faculty to design a program of study to serve individual career goals. The prerequisite for graduate study in the Department is a bachelor’s degree in an area aligned with the student’s research interests with a minimum overall GPA of 3.00. Please refer to the website nrem.okstate.edu for a full description of the application process. A student must be accepted by a member of the Department’s faculty prior to official admission to the program.

**Faculty**

Robert J. (Jim) Ansley Jr., PhD—Professor and Head

**Regents Professor:** Samuel D. Fuhlendorf, PhD

**Professors:** Craig A. Davis, PhD; R. Dwayne Elmore, PhD; Karen R. Hickman, PhD; Salim Hiziroglu, PhD; Thomas Kuzmic, PhD; Rodney E. Will, Jr., PhD; Gail W.T. Wilson, PhD

**Associate Professors:** Timothy J. O’Connell, PhD; Daniel E. Shoup, PhD; Chris Zou, PhD

**Assistant Professors:** W. Sue Fairbanks, PhD; Laura E. Goodman, PhD; Omkar Joshi, PhD; Scott R. Loss, PhD; Bryan D. Murray, PhD

**Adjunct Associate Professors:** Shannon Brewer, PhD; James Long, PhD

**Non-tenure Track Faculty:** Marley Beem, PhD; John R. Weir, MS