

ANIMAL AND RANGE SCIENCES

Undergraduate Program Information

The Department of Animal and Range Sciences provides opportunities for you to follow a variety of interests in modern scientific agriculture. The animal science curriculum provides a background for many phases of the food animal industry, from farm animal production on rangelands to management positions in the food processing industry to highly technical careers in research and companion animal management. The range science curriculum provides you with knowledge and skills necessary to sustainably manage rangelands for multiple uses. These curricula allow you to acquire the background necessary to adjust easily to variations in specific job opportunities. If you are majoring in either animal science or range science, you must meet general education requirements, have a minimum of 48 credits of upper-division courses (numbered 300 and above), and complete a minimum of 35 credits in courses in the College Agricultural, Consumer and Environmental Sciences.

Graduate Program Information

The Department of Animal and Range Sciences offers graduate work leading to the Master of Science and the Doctor of Philosophy degrees with majors in animal science and range science. The Doctor of Philosophy degree in animal science is only in the areas of reproductive physiology or ruminant nutrition.

Prerequisite for admission as a regular graduate student in the department is the completion of a curriculum, substantially equivalent to that required of undergraduate students in animal or range science at this institution, 3.0 GPA, and three letters of reference.

For the Master of Science degree, a minimum of 30 semester credits of graduate work in the major and related subjects will be required, together with a thesis for most majors. A non-thesis option is available for certain students.

For the Master of Agriculture with specialization in Domestic Animal Biology, students must complete 32 credit hours of graduate courses which include 2 credits of ANSC 598 Special Research Programs for the creative component.

The Doctor of Philosophy student must demonstrate proficiency in a foreign language or research tool, such as experimental statistics, philosophy of science, computer science, or mathematics. Choice of the research tool will remain the option of the student subject to approval by the student's graduate committee. Demonstration of proficiency may be accomplished by satisfactory completion of courses or by other suitable evidence acceptable to the student's committee. In addition, doctoral students are required to complete advanced courses in a field of study closely related to animal science or range science. The number of courses to be completed in the related area will be determined by the student's committee. Related areas of study often are biology, chemistry, or experimental statistics.

The Department of Animal and Range Sciences is a sponsoring department in the recently approved interdisciplinary graduate degree program that offers both a MS and Ph.D. degree in Water Science Management. The degree program is being handled through the College of Agricultural, Consumer and Environmental Sciences (ACES), and the program description, including application guidelines, classes involved,

and topic areas being supported can be found in the catalog under the section describing ACES Programs. Interested students are encouraged to contact the Department Head of Animal and Range Sciences, Shanna Ivey at (575) 646-2515 for more information.

Graduate work in the department is designed to prepare the student for work in the fields of research, extension, teaching, production, and conservation.

Facilities available to graduate students include herds and flocks of the major livestock species, animal nutrition laboratories, physiology laboratories, meats laboratory, small animal laboratory, 25,000-specimen herbarium, two ranches of approximately 92,000 acres, and a 1,000-head experimental feedlot. Active cooperation is maintained with federal research agencies located on and off the campus.

A number of graduate assistantships will be available each year. Inquiries should be addressed to the head of the department.

Degrees for the Department

Bachelor Degree(s)

- Animal Science (Animal Industry) - Bachelor of Science in Agriculture (<https://catalogs.nmsu.edu/nmsu/agricultural-consumer-environmental-sciences/animal-range-sciences/animal-science-animal-industry-bachelor-science-agriculture/>)
- Animal Science (Science) - Bachelor of Science in Agriculture (<https://catalogs.nmsu.edu/nmsu/agricultural-consumer-environmental-sciences/animal-range-sciences/animal-science-science-bachelor-science-agriculture/>)
- Range Science - Bachelor of Science in Agriculture (<https://catalogs.nmsu.edu/nmsu/agricultural-consumer-environmental-sciences/animal-range-sciences/range-science-bachelor-science-agriculture/>)

Master Degree(s)

- Agriculture (Domestic Animal Biology) - Master of Agriculture (<https://catalogs.nmsu.edu/nmsu/graduate-school/agriculture-domestic-animal-biology-ma-agriculture/>)
- Agriculture (Domestic Animal Biology) - Master of Agriculture (Online) (<https://catalogs.nmsu.edu/global/nmsu-global/agriculture-domestic-animal-biology-master-agriculture-online/>)
- Animal Science - Master of Science (<https://catalogs.nmsu.edu/nmsu/graduate-school/animal-science-ma-science/>)
- Range Science - Master of Science (<https://catalogs.nmsu.edu/nmsu/graduate-school/range-science-master-science/>)

Doctoral Degree(s)

- Animal Science - Doctor of Philosophy (<https://catalogs.nmsu.edu/nmsu/graduate-school/animal-science-doctor-philosophy/>)
- Range Science - Doctor of Philosophy (<https://catalogs.nmsu.edu/nmsu/graduate-school/range-science-doctor-philosophy/>)

Minors for the Department

- Animal Science - Graduate Minor (<https://catalogs.nmsu.edu/nmsu/graduate-school/animal-science-graduate-minor/>)
- Dairy Science - Undergraduate Minor (<https://catalogs.nmsu.edu/nmsu/agricultural-consumer-environmental-sciences/animal-range-sciences/dairy-science-undergraduate-minor/>)

- Horse Management - Undergraduate Minor (<https://catalogs.nmsu.edu/nmsu/agricultural-consumer-environmental-sciences/animal-range-sciences/horse-management-undergraduate-minor/>)
- Human Animal Interaction - Undergraduate Minor (<https://catalogs.nmsu.edu/nmsu/agricultural-consumer-environmental-sciences/animal-range-sciences/human-animal-interaction-undergraduate-minor/>)
- Livestock Production - Undergraduate Minor (<https://catalogs.nmsu.edu/nmsu/agricultural-consumer-environmental-sciences/animal-range-sciences/livestock-production-undergraduate-minor/>)
- Ranch Management - Undergraduate Minor (<https://catalogs.nmsu.edu/nmsu/agricultural-consumer-environmental-sciences/animal-range-sciences/ranch-mgt-undergraduate-minor/>)
- Range Science - Graduate Minor (<https://catalogs.nmsu.edu/nmsu/graduate-school/range-science-graduate-minor/>)
- Range Science - Undergraduate Minor (<https://catalogs.nmsu.edu/nmsu/agricultural-consumer-environmental-sciences/animal-range-sciences/range-science-undergraduate-minor/>)

Department Head Shanna L. Ivey

Professors Ashley, Duff, Fassenko, Fernald, Hernandez Gifford, Ivey, Löest, Scholljegerdes, Soto

Associate Professors Fuentes-Soriano, Geli, Utsumi

Assistant Professors Garbowksi, Mezzomo Giotto

College Track Associate Professors Campbell

College Track Assistant Professor Smythe

Instructors Bilovesky, Painter, Priest

Co-operators (USDA) Estell, Herrick, Peters

Emeritus Faculty Allred, Bailey, Cibils, Holechek, McDaniel, Ross, Thomas

S. L. Ivey, Department Head, Ph.D. (New Mexico State University)- ruminant nutrition/microbiology; K. W. Allred, Ph.D. (emeritus, Texas A&M University)- plant taxonomy; R.L. Ashley, Ph.D. (Colorado State University)- physiology of reproduction; D.W. Bailey, Ph.D. (emeritus, Colorado State University)- rangeland management; J.W. Campbell, Ph.D. (New Mexico State University)- reproductive physiology; A.F. Cibils, Ph.D. (emeritus, Colorado State University)- grazing management and ecology; G.C. Duff, Ph.D. (New Mexico State University)-animal nutrition; G.M. Fassenko, Ph.D. (North Carolina State University)- companion animal management; A. G. Fernald, Ph.D. (Colorado State University)- land use hydrology and water quality hydrology; S. Fuentes-Soriano, Ph.D. (University of Missouri-Saint Louis)- biology in plant systematics and evolution; M. Garbowksi, Ph.D. (Colorado State University) - restorative ecology; H. M. E. Geli, Ph.D. (Utah State University)-landscape hydrology; C. Gifford, Ph. D. (University of Idaho)- animal science; J. Hernandez-Gifford, Ph.D. (Washington State University)- reproductive physiology; J. L. Holechek, Ph.D. (emeritus, Oregon State)- range ecology; C. A. Löest, Ph.D. (Kansas State University)- ruminant nutrition; K. C. McDaniel, Ph.D. (emeritus, Texas A&M University)- brush management; F. Mezzomo Giotto, Ph. D. (University of Nevada, Reno) - meat science and food safety; L. Prihodko, Ph.D. (Colorado State University)- range ecology; T. T. Ross, Ph.D. (emeritus, North Carolina State University)- physiology of reproduction and sheep production; E.J. Scholljegerdes, Ph.D. (University of Wyoming)- ruminant nutrition; B.G. Smythe, Ph.D. (New Mexico

State University)- veterinary entomology; S.A. Soto-Navarro, Ph.D. (New Mexico State University)- ruminant nutrition; J. D. Thomas, Ph.D. (emeritus, University of Missouri-Columbia)- meat science; S. Utsumi, Ph. D. (New Mexico State University) - range ecology

Adjunct faculty: C. D. Allison, Ph.D. (Texas A&M University)- range management; R.A. Cushman, Ph.D. (North Carolina State University)- physiology of reproduction; A. Faist, Ph. D. (University Colorado Boulder) - range ecology; K. M. Harvstad, Ph.D. (Utah State University)- range animal nutrition; J.E. Herrick, Ph.D. (Ohio State University)- soils; M.R. Levi, Ph. D. (University of Arizona)-soil morphology/classification; T.J. Nagaraja, Ph.D. (Kansas State University)-rumen microbiology; D.P. Peters, Ph.D. (Colorado State University)- landscape ecology; S. Spiegel, Ph.D. (University of California Berkeley)-range management; M. Steele, Ph.D. (University of Guelph)- ruminant nutrition; A.F. Summers, Ph.D. (University of Nebraska)- physiology of reproduction.

Cooperative Extension Service: D. Cram, Ph.D. (New Mexico State University)- range science; R. Hagevoort, Ph. D. (Texas A&M University) - dairy science; R. Salleneve, Ph.D (University of Guelph)-aquatic ecology; S. Smallidge, Ph.D. (New Mexico State University) - wildlife; C. Spackman, Ph.D. (Utah State University)- range science; J. L. Turner, Ph.D. (Kansas State University)- equine immunology and physiology; M. Ward, Ph.D. (North Dakota State University)- ruminant nutrition;

Animal Science Courses

ANSC 1110. Animal Science Careers

1 Credit (1)

Introduction to scientific disciplines and career options in animal-agriculture career skill development, including resume preparation, networking, importance of internships, and leadership experiences in animal agriculture.

Learning Outcomes

1. Increasing the understanding of career opportunities in animal agriculture.
2. Gain a broad experience in the development of creative thinking about the career choices available in animal agriculture.
3. Apply the increased knowledge of career development in the career path and internship directions for each student.
4. Gain leadership experience that will be impactful for the student in their pursuit of a career in animal agriculture.

ANSC 1120. Introduction to Animal Science

3 Credits (3)

Survey of the livestock industry throughout the world. Basic management practices will be covered, including livestock selection, nutrition, reproduction, anatomy and marketing to the consumer. This course will also discuss animal behavior and welfare.

Learning Outcomes

1. Understand the role of farm animals in a global setting.
2. Describe the role of nutrition, breeding, behavior, welfare, and physiology of livestock in the world.
3. Explain the structure and organization of livestock industries.
4. Discuss concepts and terminology of the livestock industries as they relate to the global perspective.
5. Classify the overall management, care, marketing of animals, represented in the various livestock industries.

ANSC 1120H. Introduction to Animal Science Honors

3 Credits (3)

This course is designed to provide an introduction to nutrients and their function in livestock animals. Basic feed identification, evaluation, and diet formulation will be discussed. The anatomy of the digestive tract of animals and their ability to utilize feedstuffs is presented. Classification, digestion, absorption, transport and metabolism of major nutrients required by animals are studied. Additional course work will be required. Restricted to Las Cruces campus only.

Prerequisite(s): Eligibility for membership in honors college.

Learning Outcomes

1. Identify conventional and non-conventional feedstuffs that are fed to livestock animals.
2. Describe various methods for feed processing and storage.
3. Assess the nutritional value of a ration or feed ingredients.
4. Interpret the NRC (Nutrient Requirement Council) guidelines for feeding livestock.
5. List the basic digestive anatomy for all classes of livestock.
6. Describe nutritional deficiencies and digestive disorders common to livestock animals

ANSC 1120L. Introduction to Animal Science Lab

1 Credit (2P)

Students will observe and participate in activities related to farm animal management and will include areas of livestock selection, nutrition, reproductive physiology, animal ID and animal health. This lab is required for animal science majors.

Prerequisite(s)/Corequisite(s): ANSC 1120.

Learning Outcomes

1. To provide the students with an understanding of the principles, concepts and terminology of today's livestock industry

ANSC 1125. Equestrian Team Competition

1 Credit (1)

Basic principles of equestrian team competition, including care and management of the riding horse, equitation equipment, and development of riding skills. Emphasis will be placed competition within the Intercollegiate Horse Show Association. Consent of Instructor required. May be repeated up to 8 credits.

Learning Outcomes

1. Have a general knowledge of horses and basic horsemanship/equitation position.
2. Explain and demonstrate basic techniques of balance, control, and safety skills while being in contact and mounted on a horse.
3. Explain and demonstrate proper handling and safety around horses and the proper care of the stable and tack.
4. Be able to ride unassisted at the walk, jog, and lope in either English or Western tack.
5. Apply general knowledge of horsemanship and equitation to competitive equine events in a safe manner including equitation on the flat, equitation over fences, horsemanship, ranch riding and reining.

ANSC 1130. Western Equitation I

2 Credits (4P)

Basic principles of Western riding, including care and management of the riding horse, equitation equipment, and development of riding skills.

ANSC 1140. Introduction to Dairy Science

3 Credits (3)

Introduction to the basic aspects of dairy science and how to apply key concepts to the practical feeding and management of dairy cattle

and production of dairy products. Students should also obtain an appreciation for the size and diversity of the dairy industry.

Prerequisite(s)/Corequisite(s): ANSC 1120. Restricted to Las Cruces campus only.

Learning Outcomes

1. Learn key concepts in dairy production and management
2. Be familiar with terms used in production of milk and milk products

ANSC 1160. Introductory Horse Science

3 Credits (2+2P)

The light horse industry; breeds; introduction to feeding, breeding, marketing and management; handling and selecting horses for breeding and performance.

Learning Outcomes

1. Describe and identify breeds of horses, their characteristics and their uses.
2. Demonstrate knowledge of basic physiology of horses by recalling parts of the horse, including bones, muscle, tendons and ligaments. Also, by ageing horses via teeth, body condition scoring and taking vital signs.
3. Demonstrate safe and proper handling of horses.
4. Demonstrate comprehension of basic nutrition and feedstuffs by formulating/correcting diets in clinical and non-clinical situations.
5. Recall aspects of basic reproduction by calculating a stallion book and recalling appropriate procedures for breeding.
6. Create informative articles that seek to educate the lay horse person about a topic covered in class.

ANSC 1170. Introduction to Animal Metabolism

3 Credits (3)

Principles underlying the mechanisms of animal metabolism as they relate to production, maintenance, and health of animals.

Prerequisite: CHEM 1215G.

Learning Outcomes

1. This course provides an introduction to the study of the physiology of life.
2. The first part of the course covers acids and bases and the chemical nature of organic compounds.
3. The second part of the course relates to the chemistry of biomolecules (nutrients) and summarizes the chemical reactions of life (metabolism).

ANSC 1180. Companion Animal in Society

3 Credits (3)

Examination of the historical, current, and potential future roles of companion animals in human society. Topics include animal domestication, breeds, exotic companion animals, the companion animal industry, and competitions and sports involving companion animals. Emphasis is on canine and feline species. May be repeated up to 3 credits. Restricted to Las Cruces campus only.

Learning Outcomes

1. Discuss the theories regarding why, how, and when companion animals became domesticated.
2. Describe how selective breeding has optimized certain physiological and behavioral traits of companion animals in order to fulfill the needs of individual people and society.
3. Explain the concept of human-companion animal interaction (HAI) and the influence this bond has on human behavior, health, society, and government policy/laws.

- Understand the breadth and economic impact of the rapidly expanding companion animal industry and the recent expenditure trends of pet owners.
- Discuss the past and present uses of companion animals and theorize regarding the future uses of companion animals in society
- Be effective in searching for, and critically evaluating, scientific based resources.

ANSC 2120. Equine Management

3 Credits (3)

Introduction and application of the business skills necessary to effectively manage the equine operation. Students will learn how to use strategic thinking and sound business management practices to succeed in the demanding equine industry.

Prerequisite: ANSC 1160.

Learning Outcomes

- Develop a working knowledge of the business principles needed to operate a successful entrepreneurial enterprise.
- Increase the awareness of the need for business principles in the aggregate function of an equine operation.
- Gain a greater perspective of accounting, economic and financial principles in an equine business operation.

ANSC 2130. Western Equitation II

2 Credits (4P)

Intermediate principles of Western riding, including reading horse behavior, limbering-up exercises, and developing riding skills. Introduction to rollbacks, turnarounds and stops.

Prerequisite: consent of instructor.

Learning Outcomes

- Increasing the understanding of the student relative to equitation practices
- Increase the students' ability to apply principles of Western Equitation to applied settings across a broad spectrum of outlets
- Prepare the student to engage equine in a professional manner

ANSC 2140. Introduction to Companion Animal Science

3 Credits (3)

Introduction to the care of common companion animal species. Species specific housing and nutrition are covered in the context of maximizing animal health and well-being and reducing disease. May be repeated up to 3 credits.

Learning Outcomes

- Accurately use scientific terminology common to the companion animal discipline.
- Compare and contrast the physiological similarities and differences between the various companion animal species studied in class.
- Create dietary plans based on the nutritional needs of different companion animal species to optimize animal health and lifespan.
- Identify symptoms of disease/injury at the early stages of illness in order to obtain Veterinary care and treatment as quickly as possible.
- Design and construct species specific cages/vivariums to maximize animal well-being and health.
- Educate others regarding providing the best possible care for a variety of companion animal species.

ANSC 2150. Management of Equine Operations

3 Credits (3)

Introduction and application of business skills necessary to effectively manage the equine operation. Students will learn how to use strategic

thinking and sound business management practices to succeed in the demanding equine industry.

Prerequisite(s): ANSC 1160.

Learning Outcomes

- Acquire a working knowledge of different sectors of the equine industry, including business practices, management and marketing skills.

ANSC 2310. Introduction to Meat Science

3 Credits (2+3P)

Fundamental aspects of the red meat industry. Lecture topics and laboratory exercises include the nutrient value of meat, meat preservation, meat safety, muscle structure and contraction, slaughter and processing of beef, lamb and pork, sausage manufacture, meat curing, meat cookery, and muscle and bone anatomy.

Learning Outcomes

- Increasing the understanding of meat science applications across animal agriculture.
- Increase the students' ability to apply principles of production to the industry perspective.
- Apply the increased knowledge of meat science in a global situation.
- Gain an understanding of the components involved in the development and processing of the red meat industry.

ANSC 2330. Animal Production

3 Credits (2+2P)

Production and utilization of beef cattle, sheep, and swine; emphasis on feeding, breeding, management problems and marketing; selection of animals for breeding and market

Learning Outcomes

- Increasing the understanding of meat animal production.
- Increase the students' ability to apply principles of production to the industry perspective.
- Apply the increased knowledge of meat animal production to global situations.
- Gain a broader understanding of the importance of meat animals in the global food system.

ANSC 2340. Genetics in Animal Science

3 Credits (3)

Introduction to genetics and inheritance relative to livestock production. Introduction to procedures for collection and use of performance information in livestock improvement programs.

Prerequisites: BIOL 2610G.

Learning Outcomes

- Gain a broader understanding of the role genetic impacts in the livestock industry.
- Employ an increased knowledge of impact of genetics in the food animal industry and the production and economic principles that apply.
- Recognition of the global impacts of genetics in the food animal industry in a global setting.

ANSC 2996. Special Topics

1-4 Credits

Specific subjects and credits to be announced in the Schedule of Classes. Maximum of 4 credits per semester. No more than 9 credits toward a degree.

Learning Outcomes

- Varies

ANSC 301. Animal and Carcass Evaluation**3 Credits (2+2P)**

Determination of the market value of meat animals by relating live animal and carcass traits. Topics include the identification of economically important traits, grading, growth and development, wholesale and retail pricing, and futures and options markets.

ANSC 303. Livestock, Meat and Wool Evaluation**4 Credits (3+2P)**

Selection, classification, grading, and judging of livestock, meat, and wool.

ANSC 304. Feeds and Feeding**3 Credits (2+2P)**

Digestibility of feeds, their nutritive values, grades, and classes, principles of ration formulation and computer ration formulations, and practical feeding of farm animals. Prerequisite(s): CHEM 1215G

ANSC 305. Principles of Genetics**3 Credits (3)**

Covers fundamental principles of reproduction, variation, and heredity in plants and animals. May be repeated up to 3 credits.

Prerequisite: (BIOL 2610G and BIOL 2110G, or BIOL 2110G and BCHE 140, and either CHEM 1215G or CHEM 1216).

Learning Outcomes

1. To provide an introduction to the basic concepts, methods, and terminology of genetics. Introduction to genomics and bioinformatics.
2. To develop a working understanding of genetics and heredity
3. To understand in some depth, the mechanism of DNA replication, transcription and protein synthesis. To understand the regulation of gene expression.
4. To examine the impact of genetics on both basic and applied aspects of the biological sciences, as well as its effects on our everyday lives.

ANSC 308. Horse Evaluation**4 Credits (2+4P)**

Students will acquire a working knowledge of selection and classification of horses, learn criteria for evaluation and selection of breeding and show animals, gain a broad understanding of judging conformation and performance in the horse, and learn effective oral and written communication skills through defense of class placings. This course is considered an introduction to the NMSU Horse Judging Team.

ANSC 310. Exhibiting Livestock**3 Credits (1+4P)**

Fitting and showing beef cattle, dairy cattle, sheep and swine.

ANSC 312V. Companion Animals and the Human- Animal Interaction**3 Credits (3)**

The science behind human-animal interactions (HAI). An examination of the interactions between humans and companion animals and the effects on human and animal health and wellness. Cultural differences in HAI will be explored. Topics will include Animal Assisted Activity (AAA), Animal Assisted Therapy (AAT), and service animals. Emerging and future uses of companion animals in HAI will be discussed.

ANSC 320. Equine Behavior and Training**3 Credits (6P)**

Basic principles, methods and philosophies of handling, breaking and training the two-year-old Western horse. May be repeated up to 6 credits.

Prerequisite(s): ANSC 2130 or consent of instructor.

ANSC 321. Advanced Equine Behavior and Training**3 Credits (6P)**

Continuation of ANSC 320. Further development of skills required to advance the training of the two-year-old Western horse. Emphasis will be placed on lateral work, lead changes, turn-arounds, obstacles, and making the horse accustomed to ranch and trail riding situations.

Prerequisite(s): ANSC 320 or consent of instructor.

ANSC 350. Special Topics**1-4 Credits**

Specific subjects and credits to be announced in the Schedule of Classes. Maximum of 4 credits per semester. No more than 9 credits toward a degree.

ANSC 351V. Agricultural Animals of the World**3 Credits (3)**

Global study of the development and use of animals for production of food and nonfood products. Climatic, cultural, and economic influences on systems of livestock production and species and breeds of livestock utilized will be evaluated.

ANSC 360. Meat and Muscle Biology**3 Credits (3)**

Course will explore in depth the antemortem and postmortem factors that influence the properties of meat.

Prerequisite: BIOL 2610G.

Learning Outcomes

1. Identify major structural components of the animal muscular.
2. Understand the processes of muscle contraction and relaxation.
3. Gain knowledge about meat quality attributes.
4. Understand the conversion of muscle into meat.

ANSC 370. System Physiology of Farm Animals**4 Credits (3+2P)**

Structure and function of the animal body. Includes studies of the horse, cow, sheep, pig, and comparisons with the human body. May be repeated up to 4 credits.

Prerequisite: CHEM 1215G and BIOL 2610G or BIOL 2110G.

Learning Outcomes

1. The objective of this course is to introduce the basic terminology and concepts of animal anatomy and physiology.
2. The course will stress the understanding of the functions of the entire body.
3. The interaction of different systems and the effect of environmental factors will be emphasized.

ANSC 383. Equine Reproductive Management**3 Credits (1+4P)**

Anatomy, physiology, and endocrinology of reproduction of the mare and stallion; training in modern reproductive techniques employed in the horse industry.

Prerequisites: ANSC 1160, ANSC 2150, and ANSC 370.

ANSC 390. Internship**1-3 Credits**

Professional work experience under the joint supervision of the employer and a faculty member. A written report is required. No more than 3 credits toward a degree. Graded S/U.

Prerequisite: consent of instructor.

ANSC 391. Undergraduate Research Experience**1-3 Credits (1-3)**

Formal laboratory, library, or field study of problems related to animal sciences, emphasizing hypothesis development, testing, and reporting results. Projects are preplanned, reviewed, and approved. Students

submit periodic written reports and final written and oral reports. May be repeated for a maximum of three credits. Consent of Instructor required.

ANSC 392. Animal Sciences Teaching/Extension Experience
1-3 Credits (1-3)

: Formal teaching experience related to animal sciences supervised by a faculty member. May involve classroom instruction, educational material development, and/or student evaluation and assessment. Students may also be involved in development, implementation, or assessment of adult or youth educational programs related to animal sciences, supervised by a faculty member. Students submit periodic written reports and a final written and oral report. May be repeated for a maximum of three credits. Consent of Instructor required.

ANSC 402. Animal Science Seminar
1 Credit (1)

A seminar course designed to inform students of the career opportunities, develop their interviewing and other interpersonal skills may also include reading, discussions, written reports, and seminar presentations of current relevant literature.

ANSC 402 H. Animal Science Seminar
1 Credit (1)

Taught with ANSC 402 with additional work.

Prerequisite(s): Meets Honors eligibility and/or Crimson Scholar status.

ANSC 411. Canine and Feline Behavior and Training
3 Credits (3)

The influence of domestication, breeds, genetics, and physiology on the behavior of canine and feline species. Training methods and modification of problem behaviors are examined. The impact of the pet parent on their animal's behavior is addressed. May be repeated up to 3 credits.

Prerequisite(s): Junior or Senior status or consent of the instructor.

ANSC 412. Canine and Feline Health and Diseases
3 Credits (3)

A review of common infectious and non-infectious diseases and the basics of the immune response. Pathophysiology and treatment of these diseases and the role the pet parent plays in pre-disposing their animals to disease. May be repeated up to 3 credits.

Prerequisite(s): ANSC 2140 or consent of instructor.

ANSC 421. Physiology of Reproduction
4 Credits (3+2P)

Fertility and the role of hormones, nutrition, selection, management and environment in the maintenance of high reproductive rate.

Prerequisite(s): ANSC 370.

ANSC 422. Animal Nutrition
3 Credits (3)

Nutrient utilization and measurement and nutrient requirements for the various body functions. May be repeated up to 3 credits.

Prerequisite: CHEM 313 or ANSC 1170.

Learning Outcomes

1. Compare digestion, absorption and metabolism of nutrients between ruminants and non-ruminants.
2. Demonstrate how animal physiology drives nutrient usage in the body.
3. Integrate animal nutrition concepts to better understand efficient animal production and health.

ANSC 423. Animal Breeding
3 Credits (2+2P)

Mating systems, and selection procedures; calculation of inbreeding coefficients, genetic relationships, and gene frequency.

Prerequisite(s): ANSC 2340 or 305.

ANSC 424. Swine Production
3 Credits (2+2P)

Breeding, feeding, and care of swine.

Prerequisite(s): ANSC 304.

ANSC 425. Horse Science and Management
3 Credits (2+2P)

Senior level course requiring students to apply basic knowledge acquired in the previous courses to solve typical problems encountered in the horse industry. Specific topics include genetics and animal breeding, business and legal issues, reproduction, health, nutrition and exercise physiology.

Prerequisite(s): ANSC 304 and ANSC 370 or concurrent registration.

ANSC 426. Beef Production: Cow-Calf Management
3 Credits (2+2P)

Senior level course examining management practices for the cow-calf producers. Specifically focusing on nutrition, reproduction, genetics, marketing, and health. May be repeated up to 3 credits.

Prerequisite(s): ANSC 304 and (ANSC 2340 or ANSC 305) or concurrent registration.

ANSC 427. Dairy Production
3 Credits (2+2P)

Breeding, nutrition, physiology and management of dairy cattle.

Prerequisite(s): ANSC 304 and (ANSC 2340 or ANSC 305) or concurrent registration.

ANSC 428. Sheep and Wool Production
3 Credits (2+2P)

Genetics, nutrition, physiology and management of sheep. Wool grading, shearing, and disease control. May be repeated up to 3 credits.

Prerequisite: ANSC 304, ANSC 370.

Learning Outcomes

1. Enhance knowledge and understanding of the different systems utilized to produce a sheep and wool. Topics discussed will include breeding, nutrition, reproduction, management and marketing strategies

ANSC 429. Beef Production: Feedlot Management
3 Credits (2P)

Senior level course in feedlot management of beef cattle. Topics of interest include cattle handling and processing, health and nutrition, intake management, and growth. Feed mill operation, marketing strategies, and regulatory concerns associated with finishing cattle production may also be discussed.

Prerequisite(s): ANSC 304 or Consent of Instructor.

ANSC 448. Problems
1-4 Credits

Individual investigation in a specific area of animal science. Maximum of 4 credits per semester. No more than 6 credits toward a degree. Consent of Instructor required.

ANSC 458. Livestock Behavior, Welfare and Handling
3 Credits (2+3P)

Principles of animal behavior and evaluation of management practices on animal welfare in confined and rangeland livestock operations. Low stress livestock handling techniques. Design of livestock handling facilities. Crosslisted with: RGSC 458

Prerequisite(s): RGSC 2110 or ANSC 1120.

ANSC 462. Parasitology
3 Credits (3)

Same as EPWS 462.

ANSC 468. Advanced Dairy Herd Management**3 Credits (3)**

The course is offered through the Southern Great Plains Dairy Consortium in Clovis, NM, and will include breeding, nutrition, physiology, health and management of large herd dairies of the Southwest. Students must apply for the course through the Consortium, and can take it more than once, as topics vary. Consent of instructor required.

Prerequisite(s): ANSC 304.**ANSC 480. Environmental Physiology of Domestic Animals****3 Credits (3)**

Influence of environmental factors on physiological processes of domestic animals.

Prerequisite: ANSC 370.**ANSC 484. Ruminant Nutrition****3 Credits (3)**

Energy, nitrogen, and mineral nutrition of ruminants with special emphasis on digestive physiology and metabolism of nonprotein nitrogen compounds.

Prerequisite: ANSC 422.**ANSC 501. Advanced Animal Nutrition (so)****3 Credits (3)**

Emphasis on digestive physiology and metabolism. Basic mechanisms involved in the intake, digestion, and absorption of nutrients studied. May be repeated up to 3 credits.

ANSC 507. Laboratory Techniques in Nutrition (f)**4 Credits (2+6P)**

Methodology and experimental procedures in measuring nutrient requirements and value of diets.

Prerequisites: ANSC 422 or consent of instructor.**ANSC 509. Endocrinology of Domestic Animals (f)****3 Credits (3)**

The role of hormones in growth, development, metabolism, temperature regulation, lactation, and reproduction of domestic animals, including commercial applications.

ANSC 510. Range Nutrition Techniques (se)**3 Credits (3)**

Animal and plant methods of determining quantity and quality of range forage. Same as RGSC 510.

Prerequisite: ANSC 484 or consent of instructor.**ANSC 512. Research Methods in Animal Science (s)****4 Credits (3+2P)**

Procedures used in animal science research, including planning and conduct of investigations and interpretation of results.

ANSC 515. Graduate Seminar**1 Credit (1)**

Current topics.

ANSC 520. Advanced Nutritional Management I: Feedlot (se)**3 Credits (3)**

Emphasis on feeding systems for beef cattle from weaning to slaughter. Primary focus on feedlot nutrition and management.

Prerequisite: ANSC 484 or consent of instructor.**ANSC 521. Advanced Nutritional Management II: Cow Calf/Stocker (so)****3 Credits (3)**

Emphasis on nutritional management for cow-calf and stocker operations. Primary focus on applications to range animal nutrition and management.

Prerequisite: ANSC 484 or consent of instructor.**ANSC 522. Animal Nutrition (f)****3 Credits (3)**

Nutrient utilization and measurement; nutrient requirements for the various body functions. Taught with ANSC 422 with additional requirements for graduate students. Recommended for nonmajors. May be repeated up to 3 credits.

Learning Outcomes

1. Compare digestion, absorption and metabolism of nutrients between ruminants and non-ruminants.
2. Demonstrate how animal physiology drives nutrient usage in the body.
3. Integrate animal nutrition concepts to better understand efficient animal production and health.

ANSC 560. Rumen Microbiology (so)**3 Credits (3)**

Issues in ruminal and gastrointestinal microbiology. Includes physiological and genetic mechanisms in carbohydrate and nitrogen utilization. Same as FSTE 560.

Prerequisites: ANSC 501.**ANSC 580. Environmental Physiology of Domestic Animals****3 Credits (3)**

Influence of environmental factors on physiological processes of domestic animals. Specific focus on fetal and developmental programming, heat and cold stress.

ANSC 598. Special Research Programs**1-4 Credits (1-4)**

Individual investigations, either analytical or experimental. Maximum of 4 credits per semester. No more than 6 credits toward a degree. Consent of Instructor required.

ANSC 599. Master's Thesis**1-15 Credits (1-15)**

Thesis. Consent of Instructor required. Thesis/Dissertation Grading. May be repeated up to 88 credits.

Learning Outcomes

1. Various

ANSC 600. Research**1-15 Credits**

This course is for Ph.D. students before they have completed qualifiers. Consent of Instructor required. Thesis/Dissertation Grading.

Prerequisite(s): ANSC 421 or consent of instructor.**ANSC 602. Advanced Reproductive Physiology (fo)****3 Credits (3)**

Mechanisms of reproductive function; research methodology.

Prerequisite(s): ANSC 421 or consent of instructor.**ANSC 604. Hypothalamo-Hypophyseal-Pineal Endocrinology (fe)****1 Credit (1)**

Hormones and other neurochemicals synthesized and secreted by the hypothalamus, pituitary, and pineal glands. Neuroendocrinology of the hypothalamo-hypophyseal axis.

Prerequisite: ANSC 509.**ANSC 605. Gonadal and Uterine Endocrinology (fe)****1 Credit (1)**

Endocrinology of mammalian ovaries, testes, and uteri including developing trophoblasts.

Prerequisite: ANSC 509.**ANSC 606. Endocrinology of Pregnancy, Parturition, and Lactation (fe)****1 Credit (1)**

Hormones and other chemical messengers involved in maintenance of pregnancy, control of parturition, and initiation and maintenance of lactation in farm animals.

Prerequisite: ANSC 509.

ANSC 621. Metabolic Functions and Dysfunctions (fe)

3 Credits (3)

Physiological chemistry of ruminants and other domestic animals, with attention to metabolic dysfunctions and nutritional toxicology.

Prerequisites: CHEM 345 and ANSC 501.

ANSC 625. Nutrient Metabolism I: Mineral, Vitamin, and Nitrogen Metabolism (fo)

4 Credits (4)

Cellular metabolism, physiological function(s), toxicities, and deficiencies of minerals, vitamins and nitrogen in ruminants and nonruminants.

Prerequisite: ANSC 501.

ANSC 626. Nutrient Metabolism II: Carbohydrates, Lipids, and Energetics (se)

4 Credits (4)

Basic principles of carbohydrate, lipid, and energy metabolism; integration of metabolism with emphasis on nutritional and biochemical processes related to efficiency of nutrient use.

Prerequisite: ANSC 501.

ANSC 698. Special Research Programs

1-4 Credits

Advanced individual investigations, either analytical or experimental. Maximum of 4 credits per semester. No more than 6 credits toward a degree. Consent of Instructor required.

ANSC 700. Doctoral Dissertation

15 Credits

Dissertation. Consent of Instructor required. Thesis/Dissertation Grading.

Range Science Courses

RGSC 1110. The Range Science Profession

1 Credit (1)

Introduction to scientific disciplines and career opportunities in rangeland science and management.

Learning Outcomes

1. To introduce students to the Range Science program and to a variety of career opportunities in Range Science.
2. To develop an individualized course curriculum that prepares the student to achieve their career goals.
3. To examine opportunities to gain practical work experience through internships and cooperative employment.

RGSC 2110. Introduction to Rangeland Management

3 Credits (3)

This course covers the principles of managing and understanding pasture and rangelands. Plant physiology and ecology, plant communities and rangeland sustainability and how they relate to livestock production and wildlife management will be discussed. Restricted to: Main campus only.

Learning Outcomes

1. Understand rangeland management operations.
2. Identify rangeland plants.
3. Gain a perspective of watershed management.
4. Discuss the management of rangeland resources.
5. Understand the process of rangeland evaluation through a broad understanding of monitoring and production of these rangelands.

6. Gain a perspective of the correlation of rangelands and the economic principles guiding resource management.
7. Understand the process of rangeland condition.
8. Understand the concepts of stocking rates and usage of rangelands.
9. Gain a broad perspective of different classes of land ownership; Tribal, federal, private and state. 1
10. Recognize vegetative communities, ecological sites, plant physiology and application to rangeland management considerations.

RGSC 2996. Special Topics

1-4 Credits

Specific subjects and credits announced in the Schedule of Classes. Maximum of 4 credits per semester and a grand total of 9 credits.

Learning Outcomes

1. Varies

RGSC 302V. Forestry and Society

3 Credits (3)

Global study of the development and use of forest resources for production of wood, fuel, fiber, and food products. Climatic, edaphic, cultural, and economic influences on forests of the world evaluated. Same as HORT 302V.

RGSC 316. Rangeland Plants

3 Credits (2+3P)

Identification, classification, cultural uses, and economic importance of native and introduced rangeland plants.

RGSC 317. Rangeland Communities

3 Credits (3)

Rangeland associations and communities, their plant species composition, and ecological factors affecting management of communities.

RGSC 318. Watershed Management

3 Credits (2+2P)

Management of rangeland and forest watersheds with emphasis on hydrologic cycle and land use effects on runoff and water quality.

RGSC 325. Rangeland Restoration Ecology

3 Credits (3)

Principles and practices of vegetation management and ecological restoration. Course emphasizes problems associated with rangeland degradation, and implementation of rangeland restoration and improvements.

Prerequisite(s): Sophomore standing or consent of instructor.

RGSC 350. Special Topics

1-4 Credits

Specific subjects and credits announced in the Schedule of Classes. Maximum of 4 credits per semester and a grand total of 9 credits.

RGSC 357. Grass Taxonomy and Identification

3 Credits (1+4P)

Taxonomy of grasses; grass anatomy, variation in reproductive structures, and identification of grasses by sight and through the use of dichotomous keys. Students must be Junior standing to enroll in this course.

RGSC 390. Internship

1-3 Credits

Professional work experience under the joint supervision of the employer and a faculty member. A written report is required. No more than 3 credits toward a degree. Graded S/U.

Prerequisite: consent of instructor.

RGSC 402. Seminar**1 Credit (1)**

A seminar course designed to inform students of the career opportunities, develop their interviewing and other interpersonal skills may also include reading, discussions, written reports, and seminar presentations of current relevant literature.

Prerequisite(s): Senior standing.

RGSC 402 H. Range Science Seminar**1 Credit (1)**

Taught with RGSC 402 with additional work.

Prerequisite(s): Meets Honors eligibility and/or Crimson Scholar status and senior standing.

RGSC 440. Rangeland Resource Ecology**3 Credits (3)**

Plant adaptations to arid environments. Life histories of arid land plants. Biotic interactions among rangeland organisms. Arid land plant communities: their physiognomy, diversity, productivity, and response to disturbance. Arid land ecosystem dynamics.

Prerequisite(s): Senior standing.

RGSC 440 L. Rangeland Resource Ecology Lab**1 Credit (2P)**

Living and nonliving factors of the range environment, the life forms and role of range plants and animals on succession and interactions in range ecosystems. Corerequisite(s): RGSC 440.

RGSC 448. Problems**1-4 Credits (1-4)**

Individual investigation in a specific area of range science. Maximum of 4 credits per semester and a grand total of 6 credits. Consent of Instructor required.

RGSC 452. Vegetation Measurements for Rangeland Assessment**4 Credits (2+4P)**

Sampling principles, sampling design, and measurement methods used to quantify vegetation attributes and to assess the structure and function of rangeland ecosystems. Laboratory emphasizes practical field techniques, quantitative analysis, and interpretation of results.

Prerequisite(s): RGSC 294 and A ST 311.

RGSC 458. Livestock Behavior, Welfare and Handling**3 Credits (2+3P)**

Principles of animal behavior and evaluation of management practices on animal welfare in confined and rangeland livestock operations. Low stress livestock handling techniques. Design of livestock handling facilities. Crosslisted with: ANSC 458

Prerequisite(s): RGSC 2110 or ANSC 1120.

RGSC 460. Rangeland and Natural Resource Planning and Management**4 Credits (3+3P)**

Planning and problem solving in rangeland and natural resource management. Public land planning and policy. Application of land management principles to resolve rangeland, riparian and habitat issues.

Prerequisite(s): Senior or graduate student standing.

RGSC 485. Land Cover Analysis for Natural Resources**3 Credits (3)**

This course is designed to help students understand, manipulate and extract Earth Observation (EO) data and to conduct land cover analysis related to natural resources including water and vegetation. The course provides and highlights means to identify and access EO data in different formats, extract meaningful information, and to help students developing critical thinking skills. The course introduces tools such as python and ArcGIS Pro to handle different data formats (e.g. hdf) efficiently; develop and present creative maps. The course provides basic information

about how to conduct land use, land cover change analysis, mapping vegetation, water related variables and plant and animal distribution analysis.

RGSC 509. Approaches to Rangeland Research**3 Credits (3)**

Experimental design and statistical analysis of experimental results.

Prerequisite(s): A ST 505 or consent of instructor.

RGSC 513. Advanced Rangeland Ecology**3 Credits (3)**

Overview of the current state of knowledge in selected areas of rangeland ecology, with emphasis on currently developing ideas and issues relevant to rangeland management.

Prerequisite(s): RGSC 440 or equivalent.

RGSC 515. Graduate Seminar**1 Credit (1)**

Current topics. Graded S/U.

RGSC 516. Arid Land Management**3 Credits (3)**

Survey of seminal and current literature dealing with management of arid and semiarid lands including soil-plant-animal interactions, plant community ecology, arid land assessment methods, and arid land hydrology.

RGSC 518. Watershed Methods and Management**3 Credits (3)**

Management of rangeland and forest watersheds with emphasis on the hydrologic cycle and land use effects on runoff and water quality. Hydrologic monitoring methods problem sets required for graduate credit.

RGSC 520. Arid Land Plant Herbivore Interactions**3 Credits (3)**

Survey of seminal and current literature dealing with plant- and animal-related factors that influence herbivory patterns in arid landscapes. Although ungulate herbivory is a central focus of the course, the role of plant defenses in deterring both vertebrate and invertebrate herbivores is discussed in detail.

RGSC 525. Advanced Rangeland Restoration Ecology**3 Credits (3)**

Theory and application of restoration ecology and the principles and practices of ecological restoration. Course emphasizes problems associated with rangeland degradation and highlights current restoration management actions. May be repeated up to 3 credits.

RGSC 550. Special Topics**1-4 Credits**

Specific subjects to be announced in the Schedule of Classes. Maximum of 4 credits per semester. No more than 9 credits toward a degree.

RGSC 551. Earth Data Retrieval**3 Credits (3)**

This course covers topics related to identifying sources, preprocessing, utilizing earth data that can be used to monitor some hydrological and water related variables, vegetation growth and related biophysical properties. The course focuses on developing students' skills on how to handle and analyze high-level large amounts of research data in different formats (i.e. .hdf). The course highlights the use of remote sensing and land surface models-based (NLDAS) earth observation datasets (e.g. NDVI, LST, Ta, and ET). The course uses some open-source tools including Python, API as well as MATLAB. Crosslisted with: WSAM 551.

RGSC 557. Advanced Grass Taxonomy and Identification**3 Credits (1+4P)**

Taxonomy of grasses; grass anatomy, variation in reproductive structures, and identification of grasses by sight and through the use of dichotomous keys. Additional writing and grass identification assignments are required for graduate credit.

RGSC 575. Climate Studies, Water and Society
3 Credits (3)

The course provides a brief description of the Earth's climate system, an in-depth review and methodologies used to investigate climate change and variability, evidence of climate change on natural systems (water availability) vulnerability of human systems (e.g. agriculture) to climate change, and mitigation and adaptation strategies. Crosslisted with: WSAM 575.

RGSC 585. Land Cover Analysis for Natural Resources
3 Credits (3)

This course is designed to help students understand, manipulate and extract Earth Observation (EO) data and to conduct land cover analysis related to natural resources including water and vegetation. The course provides and highlights means to identify and access EO data in different formats, extract meaningful information, and to help students developing critical thinking skills. The course introduces tools such as python and ArcGIS Pro to handle different data formats (e.g. hdf) efficiently; develop and present creative maps. The course provides basic information about how to conduct land use, land cover change analysis, mapping vegetation, water related variables and plant and animal distribution analysis. Crosslisted with: WSAM 585.

RGSC 589. Landscape Hydrology Modeling
3 Credits (3)

The course "Landscape Hydrology Modeling" offers topics related to the physical hydrological processes that occur at different spatial and temporal scales in terms of understanding, quantitative evaluation, modeling, and visualization. It addresses precipitation, runoff, infiltration, and evaporation, as well as understanding impact of land use change on these processes. The course highlights and provide training on the use of hydrological modeling tools including WMS software, HydroVIS and ArcGIS software to help students understand, model, manipulate, and visualize hydrological data processes. The course offers hands-on learning experience on the use of these tools. Consent of Instructor required. Crosslisted with: WSAM 589.

RGSC 598. Special Research Program
1-4 Credits

Individual investigations, either analytical or experimental. Maximum of 4 credits per semester. No more than 6 credits toward a degree. Consent of Instructor required.

RGSC 599. Master's Thesis
15 Credits

Thesis. Consent of Instructor required. Thesis/Dissertation Grading.

RGSC 600. Doctoral Research
1-15 Credits

Research. Consent of Instructor required. Thesis/Dissertation Grading.

RGSC 616. Advanced Arid Land Management
3 Credits (3)

In depth discussion of seminal and current literature dealing with management of arid and semiarid lands including land tenure systems, soil-plant-animal interactions (emphasis on livestock grazing), plant community ecology and assessment methods, and arid land hydrology.

RGSC 620. Advanced Arid Land Plant-Herbivore Interactions
3 Credits (3)

In depth discussion of seminal work dealing with plant- and animal-related factors that influence herbivory patterns in arid landscapes.

Although ungulate herbivory is a central focus of the course, the role of plant defenses in deterring both vertebrate and invertebrate herbivores is discussed in detail.

RGSC 698. Special Research Programs
1-4 Credits (1-4)

Advanced individual investigations, either analytical or experimental. Maximum of 4 credits per semester. No more than 6 credits toward a degree. Consent of Instructor required.

RGSC 700. Doctoral Dissertation
15 Credits

Dissertation. Consent of Instructor required. Thesis/Dissertation Grading.

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