Master of Science Animal and Range Sciences

Animal Science Emphasis

Graduate students in the Animal Science emphasis receive broad-based training resulting in experiences that qualify them for many agricultural jobs. Areas of emphasis include nutrition, breeding and genetics, physiology, production systems, and meat science/muscle growth. Research problems may involve beef cattle, sheep and biochemical or other properties of agricultural products. Supporting course work may be taken from Animal Science, Range Science, Biology, Wildlife Management, Biochemistry, Statistics, Plant Sciences, Land Resources and Environmental Sciences, and Economics.

Research laboratories are available in the department and specialized equipment is also available through cooperation with other departments.

The department conducts cooperative research with the U.S. Livestock and Range Research Station at Miles City, Montana, and the U.S. Sheep Experiment Station at Dubois, Idaho. Facilities for the maintenance of beef cattle and sheep are available at the Red Bluff Research Ranch, 30 miles west of Bozeman, the Fort Ellis Research Center, near Bozeman, and the Northern Agricultural Research Center at Havre. The main station has facilities for sheep, horses and beef cattle (a cattle feedlot and nutrition laboratory). A wool laboratory is located on campus.

Range Science Emphasis

Research and training opportunities in the Range Science programs are diverse, and students with a wide variety of backgrounds, goals, and educational needs are accepted. Major areas of study are range ecology, habitat management, watershed management, grazing management, monitoring, riparian ecosystems, measurements, and plant-animal (livestock and wildlife) interactions. A graduate degree with the range science emphasis prepares students for careers in rangeland management, wildlife management, habitat management, natural resource conservation and restoration, research, land-use planning, and consultation. Research facilities include the Red Bluff Research Ranch, several research centers of the Montana Agricultural Experiment Station, U.S. Livestock and Range Research Station at Miles City, Montana, and the U.S. Sheep Experiment Station at Dubois, Idaho. Cooperative projects with ranchers and federal and state agencies are also conducted. Supporting courses at the graduate level include botany, wildlife biology and management, soils, animal science, earth science, plant science, statistics and biochemistry.

Biology Emphasis

Graduate students in the Biology emphasis receive training directed toward the basic biological functions as they relate to animal production, meat science/meat food safety or entomology. Research projects may involve beef cattle, sheep and biochemical or other properties of agricultural products. Supporting course work may be taken from Animal Science, Range Science, Biology, Wildlife Management, Biochemistry, Statistics and Plant Sciences.

Minimum Requirements for a M.S. in Animal & Range Sciences

• At least one upper level (400 or 500) course in statistics.
• Two semesters of ARNR 507 Research Methods.
• Students must declare either the Animal Science, Range Science or Biology Emphasis:
• Course requirements for students in the Animal Science Emphasis:
  • At least two courses from the Graduate Animal Science block (must be 500 level course)
• Course requirements for students in the Range Science Emphasis:
  • At least two courses from the Graduate Range Science block (must be 500 level course)
• Course requirements for students in the Biology Emphasis:
  • At least two biology-related 500-level courses in their area of emphasis

Graduate Animal Science Block
ARNR 520 Nutrient Metabolism 3
ARNR 521 Adv Ruminant Nutrition 3
ARNR 523 Adv Physiology of Reproduction 3
ARNR 524 Adv Animal Breeding 3
ARNR 525 Muscle Growth & Biology 3

Graduate Range Science Block
ARNR 541 Range Ecophysiology 3
ARNR 543 Riparian Process & Function 3
ARNR 544 Adv Grazing Mgmt & Ecology 3

Students must meet the proficiency requirements for their emphasis area (see Proficiencies below).

Proficiency Requirements for Animal Science Emphasis

By the time a student completes a M.S. or Ph.D. in Animal & Range Sciences (Animal Science Emphasis), he/she must have successfully completed undergraduate or graduate coursework in three of the four areas listed below. Examples of MSU courses that fulfill these requirements are given. Students who have successfully completed an equivalent course may apply that course toward the proficiency requirements, subject to the approval of the student’s Graduate Committee. Undergraduate courses in these categories are not intended to comprise a substantial portion of a student’s graduate curriculum. These courses should be taken in addition to, not in lieu of, other courses in a graduate program. While some courses may apply toward requirements for the M.S. in Animal & Range Sciences and proficiency requirements, the student’s Graduate Committee must not allow the need to meet proficiency requirements detract from a student completing a rigorous graduate degree program.

• Breeding/Genetics (ANSC 322 Principles of Animal Breeding and Genetics or BIOB 375 General Genetics)
• Physiology/Reproduction (ANSC 321 Physiology of Animal Reproduction)
• Nutrition (ANSC 320 Animal Nutrition)
• Production/Management (ANSC 434R Beef Cattle Management)

Proficiency Requirements for Range Science Emphasis

By the time a student finishes the M.S. degree in Animal & Range Sciences (Range Science Emphasis), he/she must have successfully completed undergraduate or graduate coursework in four of the five areas listed below. Examples of MSU courses that fulfill these requirements are given. Students
who have successfully completed an equivalent course may apply that course toward the proficiency requirements, subject to the approval of the student’s Graduate Committee. Undergraduate courses in these categories are not intended to comprise a substantial portion of a student’s graduate curriculum. These courses should be taken in addition to, not in lieu of, other courses in a graduate program. While some courses may apply toward requirements for the M.S. in Animal & Range Sciences and proficiency requirements, the student’s Graduate Committee must not allow the need to meet proficiency requirements detract from a student completing a rigorous graduate degree program.

- Grazing Management (NRSM 353 Grazing Ecology and Management)
- Plant Ecology (NRSM 240 Natural Resource Ecology or BIOE 370 General Ecology (equiv to 270) or BIOE 534 Vegetation Ecology)
- Plant Identification (NRSM 350 Veg of Western Wildlands or AGSC 454 Agrostology)
- Plant Physiology (BIOO 433 Plant Physiology or ARNR 541 Range Ecophysiology)
- Vegetation Measurements (NRSM 453 Habitat Inventory and Analysis)

**Proficiency Requirements for Biological Science Emphasis**

By the time a student finishes the M.S. degree in Animal & Range Sciences (Biological Science Emphasis), he/she must have successfully completed a minimum of 15 credit hours in the biological sciences with at least 9 credit hours in upper division course work which may include: biological sciences, chemistry, microbiology, food science, entomology, and ecology. Examples of MSU courses that fulfill these requirements are given. Students who have successfully completed an equivalent course may apply that course toward the proficiency requirements, subject to the approval of the student’s Graduate Committee. Undergraduate courses in these categories are not intended to comprise a substantial portion of a student’s graduate curriculum. These courses should be taken in addition to, not in lieu of, other courses in a graduate program. While some courses may apply toward requirements for the M.S. in Animal & Range Sciences and proficiency requirements, the student’s Graduate Committee must not allow the need to meet proficiency requirements detract from a student completing a rigorous graduate degree program.

- Biology (BIOB 160 Principles of Living Systems, BIOB 170IN Principles of Biological Diversity, BIOB 260 Cellular and Molecular Biology)
- Ecology (BIOE 370 General Ecology (equiv to 270); BIOE 405 Behavioral and Evolutionary Ecology)
- Chemistry (CHMY 141 College Chemistry I, CHMY 143 College Chemistry II, CHMY 211 Elements of Organic Chemistry; CHMY 311 Fundamental Analytical Chem, CHMY 321 Organic Chemistry I)
- Biochemistry (BCH 380 Biochemistry)
- Entomology (BIOO 262IN Introduction to Entomology)
- Food Science / Meat Science (Introductory Food Science or upper division food science or food safety course)