

RGSC-RANGE SCIENCE

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.

Learning Outcomes

1. Demonstrate comprehension of basic plant physiology.
2. Analyze various inputs and environmental factors that affect trees and forests.
3. Identify forest biomes based on plant morphology and environmental characteristics.
4. Categorize different types of forest products and harvesting methods.
5. Compare and contrast various forest management practices in the US and worldwide.

6. Evaluate climate and ecological issues as they relate to society.
7. Develop an awareness of the interconnection of nature and society.

RGSC 316. Rangeland Plants

3 Credits (2+3P)

Identification, classification, cultural uses, and economic importance of native and introduced rangeland plants. May be repeated up to 3 credits.

Learning Outcomes

1. Describe the physical characteristics of plants within key Representative Rangeland Plant Groups.
2. Explain the scientific classification system and accurately place plants within the correct taxonomic hierarchy (kingdom to species).
3. Apply plant morphology and classification knowledge to identify rangeland plants using field guides, dichotomous keys, and other botanical tools.
4. Demonstrate proficiency in field methods through plant surveys and specimen collection, connecting practical skills with theoretical concepts.
5. Analyze selected rangeland plant species for their unique traits, ecological roles, and potential uses in land management or restoration.

RGSC 317. Rangeland Communities

3 Credits (3)

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

Learning Outcomes

1. Identify and distinguish the major rangeland associations and plant communities found across different regions of the United States.
2. Explain the ecological and geographical characteristics (ecogeographic) of rangeland communities and evaluate the primary management challenges associated with each.
3. Recognize and describe key plant and wildlife species that characterize each rangeland community, highlighting their ecological roles and interactions.

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. May be repeated up to 3 credits.

Learning Outcomes

1. Understand impacts of land use on water quantity and quality.
2. Quantify components of the hydrologic cycle.
3. Learn watershed management techniques and practices.
4. Apply scientific principles to evaluate current issues in watershed management.

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: Sophomore standing or consent of instructor.

Learning Outcomes

1. Use fundamental knowledge of plants, soils, and climate to explain how changes in the structure and function of ecological systems can

cause ecological degradation, and how management actions can implement changes to facilitate ecological restoration.

2. Compare and contrast the four major plant control methods (mechanical, chemical, fire, and biological) in terms of their effects on vegetation and soils and demonstrate how this knowledge informs management decisions.
3. Describe the biotic and abiotic factors that must be considered to design and implement feasible revegetation and restoration plans and explain the importance of these factors in an ecological context.
4. Apply the concepts and principles learned in this course to predict the effect of vegetation management activities on common North American rangeland plant communities.
5. Effectively communicate understanding of land degradation and restoration practices via writing and oral presentations.

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. May be repeated up to 3 credits.

Learning Outcomes

1. Use terminology to describe and identify grasses.
2. Apply dichotomous keys to unknown grass species so they can be identified.
3. Recognize numerous important rangeland grasses.
4. Understand the taxonomic classification of grasses.
5. Describe the important characteristics of grasses for disciplines related to range science, wildlife management, and natural history.

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. May be repeated up to 3 credits.

Learning Outcomes

1. Apply foundational knowledge of rangeland science to practical field and management settings.
2. Gain firsthand experience working with professionals in the rangeland ecology and management field and develop key workplace skills such as communication, collaboration, and time management.
3. Describe the goals, roles, and daily operations of the host agency or organization, and reflect on how the internship experience informs their career interests and personal development.
4. Through documentation and final reporting, students will demonstrate an ability to communicate the value of their internship work and articulate how it connects to broader concepts in rangeland ecology and management.

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.

Learning Outcomes

1. Students who complete this course will have a better understanding of mechanisms that determine how rangeland plant communities and ecosystems respond to natural and human-induced disturbance regimes.

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. Corequisite(s): RGSC 440. May be repeated up to 1 credit.

Learning Outcomes

1. Students who complete this course will gain a comprehensive understanding of the interplay between abiotic and biotic factors in shaping rangeland plant communities.
2. Learn how rangeland ecosystems adapt and respond to both natural and human-induced disturbances and change.
3. Students will apply field measurement techniques and remote sensing to develop and evaluate rangeland monitoring assessment plans.

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. May be repeated up to 4 credits.

Prerequisite: RGSC 294 and A ST 311.

Learning Outcomes

1. Choose from many available tools and methods for measuring and quantifying vegetation.
2. Design appropriate sampling protocols to meet monitoring objectives in various types of vegetation.
3. Measure vegetation cover, density, frequency, species inventory and production on rangelands.
4. Estimate utilization of forage.
5. Explain advantages and disadvantages of different sampling and measurement methods.
6. Use standard approaches to land classification and evaluation to interpret results in the context of resource management decisions.
7. Clearly communicate results through graphics as well as writing.

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. May be repeated up to 4 credits.

Prerequisite: Senior or graduate student standing.

Learning Outcomes

1. Apply previous course work and skills to evaluate approaches to rangeland management issues.
2. Prepare a proposal for a practitioner-scientist research and management project which will include a comprehensive literature review of a specific topic, a directed research and project objective, partnerships among stakeholders, a project budget and timeline, and a monitoring and evaluation plan.

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.

Learning Outcomes

1. Identify sources of and obtain land cover GIS data.
2. Handle GIS data in different formats.
3. Extract meaningful information.
4. Development of qualitative reasoning and analytical thinking skills to address research questions related to natural resources.

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

Experimental design and statistical analysis of experimental results.

Prerequisite: A ST 505 or consent of instructor.

Learning Outcomes

1. Define and articulate problems related to rangeland resources with clarity and relevance.
2. Formulate researchable questions based on clearly defined problems.
3. Identify and justify key variables relevant to addressing specific research questions.
4. Develop testable hypotheses and clearly defined research objectives.
5. Evaluate and compare alternative sampling methods for rangeland data collection.
6. Assess the strengths and limitations of various experimental designs in rangeland research.
7. Use statistical software tools, including Excel and SAS, to organize, analyze, and interpret data.

8. Critically analyze research publications and ongoing projects, including those of peers and professionals, for methodological rigor and scientific validity.

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: RGSC 440 or equivalent.

Learning Outcomes

1. Define rangelands and describe their global distribution, ecological characteristics, and historical context within the field of natural resource management.
2. Explain key ecological principles and functional traits (morphology and physiology) that influence rangeland ecosystem structure, function, and response to disturbance.
3. Apply foundational methods for rangeland inventory, monitoring, and assessment, including techniques for evaluating vegetation, soil condition, and ecosystem health.
4. Evaluate strategies for sustainable rangeland management, including livestock grazing systems, vegetation management, restoration practices, and watershed/riparian area protection.

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.

Learning Outcomes

1. Gain a better understanding of the basic science underlying the management of semi-arid and arid range lands.
2. Have an increased appreciation of relevant topics, seminal papers, as well as key researchers in each of the areas of arid land management mentioned above.
3. Become familiarized with the history, academic traditions, and current issues in arid land management in the western United States.

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.

Learning Outcomes

1. Understand impacts of land use on water quantity and quality.
2. Quantify components of the hydrologic cycle.
3. Learn watershed management techniques and practices.
4. Apply scientific principles to evaluate current issues in watershed management.

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.

Learning Outcomes

1. To develop a holistic systems thinking and problem-solving approach to understanding plant and animal interrelationships, as well as addressing issues relevant to both managed and natural ecosystems.
2. Students who complete this course will develop a comprehensive understanding of these dynamics and be equipped with the skills to apply this knowledge in practical scenarios.
3. Students will deepen their understanding of how to read, review, and present scientific literature, and conduct scientific paper annotations.
4. Develop a first draft of a scientific paper reporting either experimental results, a meta-analysis of existing data, or an in-depth literature review on a topic related to the student's dissertation.

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.

Learning Outcomes

1. Use fundamental knowledge of plants, soils, and climate to explain how changes in the structure and function of ecological systems can cause ecological degradation, and how management actions can implement changes to facilitate ecological restoration.
2. Compare and contrast the four major plant control methods (mechanical, chemical, fire, and biological) in terms of their effects on vegetation and soils and demonstrate how this knowledge informs management decisions.
3. Describe the biotic and abiotic factors that must be considered to design and implement feasible revegetation and restoration plans and explain the importance of these factors in an ecological context.
4. Apply the concepts and principles learned in this course to predict the effect of vegetation management activities on common North American rangeland plant communities.
5. Effectively communicate understanding of land degradation and restoration practices via writing and oral presentations.

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.

Learning Outcomes

1. Identify, retrieve, and visualize earth observation datasets that are relevant to individual research activities.
2. Understand the nature and formats of earth observation data.

3. Handle, process, and conduct quantitative analysis of earth observation datasets using python, MATLAB, and cloud computing (GEE).
4. Development of qualitative reasoning and analytical thinking skills to address research questions related to earth observation datasets.

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. May be repeated up to 3 credits.

Learning Outcomes

1. Use terminology to describe and identify grasses.
2. Apply dichotomous keys to unknown grass species so they can be identified.
3. Recognize numerous important rangeland grasses.
4. Understand the taxonomic classification of grasses.
5. Describe the important characteristics of grasses for disciplines related to range science, wildlife management, and natural history.

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.

Learning Outcomes

1. Know, identify, and interrogate Earth's climate observation datasets.
2. Evaluate and understand Earth's climate systems.
3. Conduct meaningful investigations, prediction, and inferencing.
4. Critical thinking about climate change impacts on human and natural resources.

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.

Learning Outcomes

1. Identify sources of and obtain land cover GIS data.
2. Handle GIS data in different formats.
3. Extract meaningful information.
4. Development of qualitative reasoning and analytical thinking skills to address research questions related to natural resources.

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.

Learning Outcomes

1. Identify the different components of a landscape scale hydrologic system and quantitatively evaluate the associated physical processes including precipitation, runoff, streamflow, infiltration, evapotranspiration.
2. Retrieve and visualize a hydrologic system data along with the associated datasets.
3. Be able to model hydrological processes within a watershed and understand the streamflow generation process and the effect of vegetation and topography on streamflow generation.
4. Gain knowledge about, and be able to use, some of the available tools that can be used in spatial and temporal hydrological process modeling.

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.

Learning Outcomes

1. To develop a holistic systems thinking and problem-solving approach to understanding plant and animal interrelationships, as well as addressing issues relevant to both managed and natural ecosystems.
2. Students will deepen their understanding of how to read, review, and present scientific literature, and conduct scientific paper annotations.
3. Develop a first draft of a scientific paper reporting either experimental results, a meta-analysis of existing data, or an in-depth literature review on a topic related to the student's dissertation.
4. Students who complete this course will develop a comprehensive understanding of these dynamics and be equipped with the skills to apply this knowledge in practical scenarios.

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.