

**Proposal for  
Department of Animal and Range Sciences  
College of Agriculture  
Montana State University - Bozeman**

**PROPOSAL:**

The Animal and Range Sciences Department in the College of Agriculture at Montana State University requests permission to re-title a B.S. degree, and the number and names of options offered under that degree. The current and re-titled names are:

	<u>Current</u>	<u>Re-title</u>
Degree Name	Range Science	Natural Resources and Rangeland Ecology
Options	Range Science	Rangeland Ecology and Management Wildlife Habitat Ecology and Management

**OBJECTIVES AND NEEDS:**

**Why change the title from “Range Science” to “Natural Resources and Rangeland Ecology”?**

Research and education programs of the Department represented by the current Range Science degree are better described by the name “Natural Resources and Rangeland Ecology.” Urban high school students have a poor understanding of the word “range”, thinking of “range” as a verb or associating the word solely with the cattle industry. In truth, range science is the study of the natural resource ecology and management of “rangelands” (i.e., a descriptive term for landscapes), encompassing many inter-related disciplines addressing wildlife habitats. Rangeland management continues to be extremely important to the livestock industry, yet livestock grazing is just a part of the study of ecology and management of rangelands. The term “Natural Resources” is a more contemporary and recognizable term than Range Science that better reflects the integration of research and education activities in the Department – i.e., multiple landscapes that include grasslands, shrub communities, forests, riparian and upland habitats, multiple wild rangeland species including elk, deer, antelope, prairie dogs and other wild rodents, a myriad of plant species, and the study of habitat ecology and management for ungulates, rodents, fish, and birds. “Rangeland” more accurately identifies a resource rather than an activity or grazing livestock. “Ecology” reflects the central scientific element of range science, which is *applied ecology*.

Natural Resources and Rangeland Ecology is an integrative and multi disciplinary program of applied ecology. Students integrate and apply concepts and principles of plant ecology, animal nutrition, fish and wildlife biology, botany, plant physiology, livestock production, nutrient cycling, soil development and classification, hydrology, watershed management, geology, and weed science. They develop a holistic approach to understanding the interrelationships among ecosystem components, and integrate and apply ecological and socioeconomic knowledge to conserve, restore, preserve, and manage natural resources in ways that are ecologically sustainable, socially acceptable and economically viable. A degree in Natural Resources and Rangeland Ecology prepares students to help society derive a wealth of important environmental, social, and economic values from rangeland and forest ecosystems, including diverse wildlife habitats, clean and plentiful water, nutritious and productive livestock forage, open space, and scenic beauty. Potential occupations include managing and rehabilitating wildlife habitat, controlling noxious weed invasions, managing livestock grazing systems, conducting prescribed burns, managing wild horses and burros, restoring degraded sites, and mitigating non-point source pollutants.

Careers for our majors are among the few where a graduate can expect to work outdoors in a natural environment. Our graduates manage natural resources that are the focal points for some of the most important ecological, economic, social and contentious issues of our generation. This new descriptive title will help recruit high school students from an agricultural and an even broader base, especially urban students, from throughout Montana and the West. Terms in the title will be recognizable by high school students and their parents. Internet searches will lead students to the Department.

### **Why add options to the Natural Resources and Rangeland Ecology degree, and why these options?**

First, natural resource sciences are broad, integrative, multi disciplinary fields. The options give students opportunity to match their interests and professional goals with their educational experiences. Second, research results as well as the experiences of peer institutions indicate that adding diversity and (or) specialization within a degree improves recruiting effectiveness. Third, excellent newly added courses in the Department as well as supporting courses are available from other departments on campus. These have been incorporated as electives into each degree option (see the attached curricula).

Each option title includes the words "Ecology and Management." These words accurately reflect the subject matter addressed, and emphasize strengths in teaching and research programs of the Department. Managing natural resources is a central theme to our academic programs, and requires the application of ecological concepts and principles.

"Rangeland Ecology and Management" emphasizes the interactions between natural resource ecology and rangeland livestock production. This option serves students interested in rangeland livestock management as well as those desiring a broader approach on issues associated with rangeland management in the West. This option provides a strong link to more traditional degree programs in rangeland management and more directly prepares students for employment with natural resource agencies where diverse skills and knowledge are expected. "Wildlife Habitat Ecology and Management" emphasizes issues associated with habitat management of numerous wildlife species in the West. Habitat management is one of the primary tools of wildlife management and conservation. Agencies are looking for wildlife professionals with an applied education in habitat evaluation, manipulation and management. This option also allows study of the numerous issues associated with riparian habitats in the West, and the critical roles riparian areas play in ecosystem function and management.

Because wildlife and their habitat are an integral part of rangeland ecosystems, Range Science curricula have included various wildlife biology courses since the late 1940s. With its strong focus on plant community ecology, soil-plant interaction and the effect of herbivory on plant growth and reproduction, Range Science instruction and research has consistently addressed the interaction between the recruitment and survival of native grass and shrub species and grazing/browsing by a wide variety of native and domestic herbivores. At the same time, many range management professionals have also been actively engaged in the development of reseeding techniques and the identification of native grass/shrub germplasm for the rehabilitation of rangelands degraded by extensive overgrazing and wildfires or drastically altered by coal, oil and gas development. One of the primary goals of range improvement and disturbed land rehabilitation efforts has been the re-establishment of grass, forb and shrub species important as cover and forage for wildlife species. The knowledge gained from extensive efforts to rehabilitate wildlife habitat on disturbed lands has added considerable detail to the rangeland ecology and management courses taught

today. Consequently, the creation of an area of emphasis on the management and restoration of wildlife habitat within the proposed Natural Resources and Rangeland Ecology degree is a natural outgrowth of efforts by current MSU College of Agriculture faculty and their colleagues throughout the West.

### **What new courses will be offered?**

Several new courses have been developed in the Department over the past several years. Three new courses taught by Department faculty are proposed as part of the Rangeland Ecology and Management and Wildlife Habitat Ecology and Management Options. These courses provide subject matter not available in currently offered courses and provide alternatives to lessen potential impacts on currently offered high demand courses. The courses are to be taught by faculty in the Department of Animal and Range Sciences. These faculty are qualified by their advanced degree and/or teaching and research experiences. The courses proposed are: Wildlife-Livestock Habitat Restoration; Wildlife-Livestock Range Nutrition; and Contemporary Topics in Wildlife-Livestock Habitat Management. The options proposed also integrate courses from several departments across campus (see below).

### **What are the career opportunities for graduates in the Natural Resources and Rangeland Ecology B.S. Degree?**

- Careers:
  - Land/natural resource management
  - Wildlife habitat management
  - Ranch management
  - Land use planning
  - Resource conservation/restoration
  - Consulting
- Application areas:
  - Livestock production
  - Wildlife habitat
  - Water quality and use
  - Native plant communities

### **How does the Natural Resources and Rangeland Ecology program relate to the mission of MSU?**

Our faculty, staff and resources position us to deliver a unique program that utilizes a multi-disciplinary scientific approach to the dynamic interactions between livestock production/marketing systems and natural resource management, and prepares leaders to address some of the most critical issues facing livestock production, wildlife habitat and natural resource management in Montana and the West. The Department's teaching, research and Extension Service programs mirror key components of Montana's economy, culture, and natural resources.

Important strengths of the Department include the genuine integration of science and management and the integration of academic programs with research and Extension Service programs. Our extension specialists also teach undergraduate courses. Our applied research and Extension Service projects include industry and agency partners and connect us with the diverse problems faced by rangeland and natural resource users and managers. The Department has several advisory committees composed of ranchers, natural resource managers, and other stakeholders. These committees strengthen the connection of the Department to the resource management issues, policies, and opportunities in Montana. Discussions with these committees and students have refined and strengthened our vision.

Rangelands comprise 70% of Montana's land area and help support Montana's \$1.5 billion per year livestock industry. Montana's rangelands also provide wildlife habitat, clean water and unparalleled aesthetic beauty. The location of the MSU campus within the Greater Yellowstone Ecosystem further immerses the Department in science and policy issues of regional, national and international importance.

### **ADEQUACY, ACCREDITATION, AND ASSESSMENT ISSUES:**

The changes requested pertain to an existing degree program. Present faculty, facilities, equipment, and library holdings are all adequate to support the program. No special accreditation will be required. A revised assessment plan was developed last spring. No changes in the assessment plan will be required.

### **IMPACT ON FACULTY, FACILITIES, COSTS, STUDENTS, AND OTHER DEPARTMENTS AND CAMPUSES:**

#### **What are the expected impacts on faculty?**

The changes requested pertain to an existing degree program. Any increase in load will result from increased recruiting effectiveness. Faculty course-loads will not change significantly, though we expect student/faculty ratios to increase. Faculty advising loads will increase, but should remain within manageable levels for the near future, enabling us to maintain quality in the classroom.

#### **What are the expected impacts on facilities?**

Library resources are adequate to deliver the program. Impacts on facilities will not be changed. Current classrooms are large enough to handle anticipated short-term growth. New facilities, including state-of-the-art classrooms and labs, are currently being planned, and fundraising efforts are underway. New facilities will complement recruitment and support additional growth.

#### **What are the expected impacts on expenses?**

Costs to deliver the degrees should not change above inflation common to all programs. No additional faculty positions are included in this request. Several courses have lab fees that cover most costs associated with delivering labs (transportation and consumables).

#### **What are the expected impacts on students?**

Over twenty students were asked their opinion about the new proposed revisions. Students represented Range Science and other majors in the College of Agriculture. Their responses were universally enthusiastic; especially if the option name would appear on their transcript and most importantly new courses were added.

We expect these changes to impact students in several positive ways: increased enrollment, richer classroom experiences with more non-resident students, increased student satisfaction, and expanded career opportunities.

#### **How do the proposed degree options relate to other natural resource and environmental degree programs at MSU and UM?**

The changes proposed better communicate to potential students the opportunities available through the academic programs delivered by the unit. The proposed revisions do not represent a change in direction for the Department.

Montana State University departments that offer supporting courses may experience increased enrollment. The proposed curriculum balances the value of the subject matter of specific courses taught by different departments with the learning objectives of the options with the potential availability of those courses to students in the option. Desirable, but high demand courses were utilized in restricted electives blocks

rather than made absolute required courses. The University of Montana campus should not be impacted. At the University of Montana, there is a Range Resources Management Option within the Forest Resources B.S. Degree. Historically, UM has emphasized forested landscapes, whereas MSU has emphasized non-forested landscapes. This unique difference will remain.

Range Science traditionally integrates several disciplines into management systems in a wide variety of landscapes. The proposed new structure continues to reflect this approach. Hence, the degree complements degrees and options offered by other departments. For example, related degrees offered by the Department of Land Resources and Environmental Sciences reflect faculty strengths and emphasize science related to soils, cultivated and native plants, rehabilitation of drastically disturbed lands, and basic microbe-plant-soil-water environmental sciences. Our degree emphasizes the interaction of vegetation, livestock enterprises, wildlife habitat and associated management applications in agricultural and wildland systems. Related degrees offered by the Ecology Department reflect faculty strengths and emphasize fish and wildlife ecology. Our degree options place the emphasis on habitat management.

### **How do the proposed degree options integrate coursework offered from other MSU departments?**

- Courses used in required, option and choice blocks from other MSU departments.
  - AGEC 210 – Economics of Ag Bus
  - BCHM 122 – Organic & Biochem Prin
  - BIOL 101 – Biology of Organisms
  - BIOL 230 – Identification of Seed Plants
  - BIOL 303 – Prin Ecology
  - BIOL 405 – Advanced Animal Ecology
  - BIOL 418 – Mammology
  - BIOL 419 – Ornithology
  - BIOL 439 – Stream Ecology
  - BUS 201 – Managerial Communication
  - CHEM 121 – Intro General Chemistry
  - ECON 101 – Economic Way of Thinking
  - ENGL 221 – College Writing II
  - ENGL 223 – Technical Writing
  - ESCI 112 – Physical Geography
  - ESCI 432 – Surface-Water Resources
  - F&WL 301 – Principles of F&WL Mgt
  - GEOG 305 – Intro to Geographic Information Systems
  - LRES 201 – Soil Resource
  - LRES 357 – GPS Fundamentals & Appl. in Mapping
  - LRES 443 – Weed Ecology and Management
  - LRES 444 – Watershed Hydrology
  - LRES 454 – Pedology
  - LRES 460 – Soil Remediation
  - LRES 461 – Restoration Ecology
  - MATH 160 – Pre-Calculus
  - MATH 170 – Survey of Calculus
  - PHYS 205 – College Physics I
  - PSPP 318 – Biometry
  - PSPP 342 – Forages
  - PSPP 450 – Plant Physiology
  - PSPP 454 – Agrostology

- PSPP 456 – Plant Systematics
- STAT 216 – Elementary Statistics
- See attached curricula.

### **PROCESS LEADING TO SUBMISSION OF PROPOSAL:**

The scope of work in the Department of Animal and Range Sciences has broadened, reflecting the expertise of our faculty and changes in private and public natural resource management and in society. The Department needs to better communicate to students and other clientele the scope of its programs.

Enrollment in the Range Science B.S. program has remained flat, while job opportunities increase. Many other universities and relevant professional societies have experienced this same trend. Historically, the majority of students entering the Range Program have come from agricultural families and families employed by government resource management agencies. Many were introduced to Range Science through FFA or 4-H. These potential students had prior experience with Range Science, so they understood Range Science as a discipline and as a profession. This historical recruiting base is decreasing as the number of agricultural families decreases and as some of these individuals choose careers in other fields. Universities that have failed to change have lost their programs (e.g., Washington State University), while those that have made changes to better market their degrees are thriving (e.g., North Dakota State University).

Urban high school students have a poor understanding of the scope and breadth of Range Science as a discipline and a profession. Such students with no agricultural experience or no exposure to Range Science think of “range” as a verb (i.e., something animals do), rather than a noun (i.e., a resource or a field of study). Further, many urban high school students assume that Range Science is strictly a “production ag” degree that is only associated with livestock grazing. We need to market and deliver our degree program in a way that accurately communicates the true breadth and content of the program and the opportunities afforded its graduates. Research results and the experiences of peer institutions indicate that changes we propose will be successful in attracting students.<sup>1</sup>

Career opportunities for our majors are excellent. Our graduates find employment in many sources including: USDA Forest Service, USDA Natural Resources Conservation Service, USDI Bureau of Land Management, USDI National Park Service, MT Department of Fish, Wildlife, and Parks (and corresponding agencies in other western states), private resource management and consulting firms, private ranches, and university extension. Natural resource management issues are of increasing importance, especially in the West. MSU is located near the center of more natural resource issues than any land grant university in America. Some students continue their education in graduate school before joining the workforce. Federal agencies have traditionally employed many of our Range Science graduates. These agencies have increased the number of rangeland management hires in the last five years and anticipate high rates of retirement in the near future<sup>2</sup>. For example, the Forest Service has started interviewing students and making on-the-spot job offers to Range Science students at the Society for Range Management annual meetings.

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<sup>1</sup> References:

McClaran, M. P. 2000. History of the Range Curriculum: Are there new trails? *Rangelands* 22(1):23-27.  
Range Science Education Symposium, 2002 Society for Range Management Annual Meeting, Kansas City.  
Heitschmidt, R. 2003. President, Society for Range Management. (paper in preparation).  
Wildman, M. L., and R. M. Torres. 2002. Factors influencing choice of major in agriculture. *NACTA Journal*, Sept:4-7.

<sup>2</sup> USDI (BLM, BIA, NPS, FWS), USDA-USFS. Data provided by Society for Range Management.

We have shared our plans with Departmental advisory groups and clientele and they have encouraged us to proceed. They understand the need for this change and support it. We have met with representatives of the Bureau of Land Management, the Natural Resources Conservation Service, and the U.S. Forest Service regarding educational requirements for federal employment. Because many of our current graduates find careers with these agencies, and these agencies anticipate many job openings in the near future, we asked for their input on curricula. Each option under the Natural Resource and Rangeland Ecology B.S. degree has been tailored to qualify graduates for positions with these agencies.

The proposal was created by Range Science faculty. With support of the Dean of the College of Agriculture, the proposal was presented to the University Undergraduate Studies Committee and was approved. Since the proposed degree would potentially impact courses in departments outside the College of Agriculture (especially Ecology), the proposal was reviewed and the Provost requested modest changes to the proposal to address some concerns that were raised. The department responded to these concerns resulting in the current proposal.

**06-08 Catalog  
9/30/05**

**Montana State University  
COLLEGE OF AGRICULTURE  
ANIMAL AND RANGE SCIENCES DEPARTMENT**

**B.S. in Natural Resources and Rangeland Ecology  
PROPOSAL**

Name: \_\_\_\_\_ ID#: \_\_\_\_\_ Date: \_\_\_\_\_

A minimum of 120 credits is required to graduate, 42 must be 300 level or above.

<b>DEPARTMENTAL REQUIREMENTS FOR THIS DEGREE</b>					
<b>CREDITS: 93</b>					
<b>Dept/#</b>	<b>Course Title</b>	<b>Credits</b>	<b>Class/Sem</b>	<b>Year</b>	<b>Sub/Transfer</b>
ARNR 100	Intro Animal Science	3	FR	S	
ARNR 101	Natural Resource Conservation	3	FR	F	
ARNR 102	Principles of Rangeland Mgmt Lab	1	FR	F	
ARNR 230	Range Livestock Production	3	SO	F	
ARNR 235	Rangeland Monitoring	1	SO	F	
ARNR 240	Natural Resource Ecology	3	SO	F	
ARNR 345	Riparian Ecology & Management	3	JR	S	
ARNR 350	Vegetation of Western Wildlands	3	JR	S	
ARNR 351	Biomes of Western Wildlands	2	JR	S	
ARNR 353	Grazing Ecology & Management	3	JR	S	
ARNR 354	Fire Ecology & Management	3	JR	F	
ARNR 401	Planning and Program Analysis I	1	SR	F	
ARNR 402	Planning and Program Analysis II	1	SR	S	
ARNR 438	Wildlife Habitat Ecology	3	SR	S	
ARNR 453	Habitat Inventory & Analysis	3	SR	F	
ARNR 456	Conflict Resolution Natrl Res Mgmt	1	SR	F	
AGED 251US OR COM110 US	Leadership Dev for Ag	3	FR	FS(S)	
	Public Communication	3	FR	FS(S)	
BCHM 122	Organic & Biochemical Principles	4	FR	FSSu (S)	
BIOL 101N	Biology of Organisms	4	FR	FS (F)	
BIOL 230	Identification of Seed Plants	4	SO	S	
BIOL 303	Principles of Ecology	3	SR	S	
BIOL 430	Plant Physiology	3	SR	S	
BIOL 434 OR BIOL 436	Agrostology (Alt Yrs 2005)	3	JR	F	
	Plant Systematics (Alt Yrs 2006)	3	JR	F	
BUS 201 OR ENGL 221 OR ENGL 223	Managerial Communication	3	SO	FSSu (F)	
	College Writing II	3	SO	FS (F)	
	Technical Writing	3	SO	S	
CHEM 121N	Intro General Chemistry	4	FR	FSSu (F)	
ECON 101 IS	Economic Way of Thinking	3	FR	FSSu (F)	
ENGL 121W	College Writing I	3	FR	FSSu (F)	
F&WL 301	Principles of F&WL Mgt	3	JR	S	
GEOG 305 OR LRES 357	Intro to Geographic Information Syst	3	JR	F	
	GPS Fundamentals & Appl in Mapping	3	JR	F	
LRES 201	Soil Resource	3	SO	F	
LRES 454	Pedology	3	SR	F	
MATH 160Q OR MATH 170Q	Pre-Calculus	4	FR	FSSu (S)	
	Survey of Calculus	4	FR	FSSu (S)	

PS 318 OR STAT 216Q	Biometry Elementary Statistics	3 3	SO SO	F S		
<b>CHOOSE ONE OPTION BELOW TO COMPLETE</b>						
<b>RANGELAND ECOLOGY AND MANAGEMENT OPTION</b>						
<b>CREDITS REQUIRED: 14-16</b>						
ARNR 4XX	Wildlife-Livestock Range Nutrition	3		S		
MGMT 473	Modern Management of Western Resources	3		F		
PS 342	Forages	3		F		
<b>CHOOSE at least TWO OF THE FOLLOWING:</b>						
AGEC 210	Economics of Ag Business	3		S		
ARNR 320	Animal Nutrition	4		F		
ARNR 410	Veterinary Entomology	2		S		
ARNR 432 OR ARNR 434	Sheep Management Beef Cattle Management	3 4		S F		
BIOL 439	Stream Ecology	3		F		
LRES 443	Weed Ecology and Management	3				
LRES 444 Or ESCI 432	Watershed Hydrology Surface Water Resources	3 3		F F		
LRES 460	Soil Remediation	3		S		
LRES 461	Restoration Ecology	3		F		
<b>WILDLIFE HABITAT ECOLOGY AND MANAGEMENT OPTION</b>						
<b>CREDITS REQUIRED: 14-15</b>						
ARNR 355	Wildlife-Livestock Habitat Restoration	3		F		
ARNR 4XX	Wildlife-Livestock Range Nutrition	3		S		
ARNR 4XX	Contemporary Topics in Wildlife-Livestock Habitat Mgmt	3		FS		
<b>CHOOSE at least TWO OF THE FOLLOWING</b>						
ARNR 480Z	Yellowstone Range Ecology	2		Su		
BIOL 405	Advanced Animal Ecology	3		S		
BIOL 415	Ichthyology	3		S		
BIOL 418	Mammalogy	3		F		
BIOL 419	Ornithology	3		S		
BIOL 439	Stream Ecology	3		F		
LRES 444 Or ESCI 432	Watershed Hydrology Surface Water Resources	3 3		F F		
BIOL 310 Or VTMB 271	Comparative Vertebrate Anatomy Functional Anatomy of Domestic Animals	4 4		S S		
<b>FREE ELECTIVES</b>						
<b>CREDITS REQUIRED 0-1</b>						

CORE 2.0 Not Included in curriculum – 12 credits