

2010-2011 Course Catalog

The University Of Montana

Forestry

Bachelor of Science in Forestry

*See addendum for changes to the course descriptions of Forestry 271N, 365, 444, 445 and 494 that were made after the catalog was published.

Forest Operations and Applied Restoration Option

In addition to special degree requirements listed previously, the students selecting the Forest Operations and Applied Restoration option must complete the following required courses or their equivalent, if transferred from another college or university. Transference and equivalency will be determined by the University and College of Forestry and Conservation. Electives may be taken at any time, keeping in mind these requirements as well as the University's General Education requirements for graduation.

First Year	Credits
CHMY 121N (CHEM 151N) Introduction to General Chemistry	3
WRIT 101 (ENEX 101) College Writing I	3
M 151 (MATH 121) Precalculus	4
BIOO 105N (BIOL 120N) Introduction to Botany	3
M 162 (MATH 150) Applied Calculus	4
PHSX 205N and 206N (PHYS 111N and PHYS 113N) College Physics I and Lab	5
ECNS 201S (ECON 111S) Introduction to Microeconomics	3
FOR 180 Careers in Natural Resources or RSCN 121 Nature of Montana	2
FOR 200 Natural Resources Measurements Camp	2
Electives and General Education	4
Second Year	Credits
FOR 235 Problem Solving for Forest Operations	4
FOR 201 Forest Biometrics	3
FOR 210N Introductory Soils	3
WRIT 222 (FOR 220) Technical Approaches to Writing	2
FOR 241 Dendrology	3

FOR 250 Geographic Information System Practicum	2
FOR 265 Elements of Ecological Restoration	3
Nature and Society Elective	3
Electives and General Education	3

Third and Fourth Years

Credits

FOR 302 Forest Mensuration	3
FOR 320 Forest Economics	3
FOR 330 Forest Ecology	3
FOR 385 Watershed Hydrology	3
FOR 340 Forest Products Manufacturing	2
FOR 341 Timber Harvesting and Forest Roads	3
FOR 347 Multiple Resource Silviculture	3
FOR 351 Photogrammetry and Remote Sensing	3
FOR 422 Natural Resources Policy & Administration	3
FOR 434 Advanced Forest Roads	2
FOR 435 Advanced Timber Harvesting	2
FOR 436 Forest Operations Evaluation and Project Planning	3
FOR 437 Forest Operations and Applied Restoration Capstone	3
FOR 455 Riparian Ecology and Management	3
Electives and General Education	22

The following courses satisfy the nature and society elective requirement:

EVST 167H Nature and Society	3
EVST 225 Community and Environment	3
EVST 327E Environmental Ethics I	3

Forest Resources Management Option

In addition to special degree requirements listed previously, the students selecting the Forest Resources Management option must complete the following required courses or their equivalent, if transferred from another college or university. Transference and equivalency will be determined by the University and College of Forestry and Conservation. Electives may be taken at any time, keeping in mind these requirements as well as the University's General Education requirements for graduation.

First Year

Credits

BIOO 105N (BIOL 120N) Introduction to Botany	3
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CHMY 121N (CHEM 151N) Introduction to General Chemistry	3	
COMM 111A Introduction to Public Speaking or THTR 120A (DRAM 111A) Acting for Non-Majors	3	
ECNS 201S (ECON 111S) Introduction to Microeconomics	3	
WRIT 101 (ENEX) 101 Composition	3	
M 151 (MATH 121) Precalculus	4	
M 162 (MATH 150) Applied Calculus	4	
Electives and General Education	5	
Second Year		Credit
FOR 201 Forest Biometrics	3	
WRIT 222 (FOR 220) Technical Approaches to Writing	2	
FOR 210N Introductory Soils	3	
FOR 240 Tree Biology	2	
FOR 241N Dendrology	3	
FOR 250 Geographic Information System Practicum	2	
Social Science Restricted Elective(Select one course from the following list)		
SOCI/EVST 225 Community and Environment	3	
EVST 167 nature and Society	3	
RSCN 370 Wildland Conservation Policy and Governance	3	
Management Applications Restricted Elective (Select at least five credits from the following list)		
FOR 230 Fire Management	2	
FOR 232 Forest Insects and Diseases	2	
FOR 360 Range Management	3	
RECM 217S Wildland Recreation Management	3	
FOR 275 Wildlife Conservation	2	
Electives and General Education	4	
Third and Fourth Years		Credits
FOR 302 Forest Mensuration	3	
FOR 320 Forest Economics	3	
FOR 330 Forest Ecology	3	
FOR 340 Forest Products Manufacturing	2	

FOR 341 Timber Harvesting and Forest Roads	3
FOR 347 Multiple Resource Silviculture	3
FOR 351 Photogrammetry and Remote Sensing	3
FOR 385 Watershed Hydrology	3
FOR 422 Natural Resource Policy	3
FOR 440 Timber Management I	3
FOR 481 Forest Planning	3
Professional Electives	15
Electives and General Education	26
Professional Electives: Students must select at least five courses among the three areas of emphasis listed below so that at least 15 total professional elective credits are included in the degree program.	
Biophysical Sciences (select at least one course)	
WBIO 373 Wildlife Techniques	2
WBIO 370 Wildlife Habitat Conservation & Management	3
FOR 332 Forest Entomology	3
FOR 342 Wood Anatomy, Properties and Identification	3
BIOO 320 (BIOL 316) Plant Form and Function	5
BIOO 335 (BIOL 350) Rocky Mountain Flora	3
BIOO 433 (BIOL 444) Plant Physiology	4
BIOB 275 (BIOL 223) General Genetics	4
PHSX 205N and 206N (PHYS 111N and PHYS 113N) College Physics I and Lab	5
FOR 430 Forest Meteorology	3
FOR 350 Geographic Information Systems and Applications	3
Management Applications (select at least one course)	
FOR 230 Fire Management*	2
FOR 360 Range Management*	3
RECM 217S Wildland Recreation Management*	3
FOR 455 Riparian Ecology and Management	3

FOR 307 Forest Vegetation Management Models	3
FOR 447 Advanced Silviculture	3
FOR 331 Wildland Fuel Management	3
FOR 485 Watershed Management	3
FOR 441 Timber Management II	3
FOR 480 Forest and Rangeland Area Planning and Design	3
RECM 310 Natural Resources Interpretation	3
Policy and Social Sciences (select at least one course)	
SOC/EVST 225 Community and Environment*	3
EVST 167 Nature and Society*	3
FOR 423 Montana Wilderness Policy and Politics	3
FOR 424 Community Forestry and Conservation	3
FOR 379 Collaboration in Natural Resources Decisions	3
FOR 475 Sociology of the Environment and Development	3
FOR 425 natural Resource and Environmental Economics	3
RSCN 370 Wildland Conservation Policy and Governance*	3
RECM 481 Recreation Behavior	3
RECM 482W Wilderness and Protected Area Management	3
RECM 485 Recreation Planning	3

*If these courses are selected as restricted electives they may not be used to fulfill professional electives

Range Resources Management Option

In addition to special degree requirements listed previously, students electing the range resources management option must complete the following required courses, or their equivalent if transferred from another college or university. Transference and equivalency will be determined by the University and College of Forestry and Conservation. Electives may be taken at appropriate times, keeping in mind these requirements as well as the University's General Education requirements for graduation.

First Year	Credits
BIOO 105N (BIOL 120N) Introduction to Botany	3

CHMY 121N (CHEM 151) Introduction to General Chemistry	3	
COMM 111A Introduction to Public Speaking	3	
ECNS 201S (ECON 111S) Introduction to Microeconomics	3	
WRIT 101 (ENEX 101) Composition	3	
GPHY 111N (GEOG 102N) Introduction to Physical Geography	3	
M 151 (MATH 121) Precalculus	4	
M 162 (MATH 150) Applied Calculus	4	
Summer		Credits
FOR 200 Natural Resources Measurements Camp	2	
Second Year		Credits
BIOO 335 (BIOL 350) Rocky Mountain Flora	3	
FOR 201 Forest Biometrics	3	
FOR 210N Introductory Soils	3	
WRIT 222 (FOR 220) Technical Approaches to Writing	2	
FOR 230 Forest Fire Management	2	
FOR 275 Wildlife Conservation	2	
Electives and General Education	10-16	
Third and Fourth Years: FOR 320, 330, 351, 360, 361, 362, 385, 410, 455, 460, 461, 462, 463, 480.		

Courses

U = for undergraduate credit only, UG = for undergraduate or graduate credit, G = for graduate credit. R after the credit indicates the course may be repeated for credit to the maximum indicated after the R. Credits beyond this maximum do not count toward a degree.

Forestry (FOR)

U 140 Introduction to Urban Forestry 2 cr. Offered spring. An introduction to urban forestry principles and practices. Benefits of the urban forest. Topics covered include plant species selection, site design, site assessment, planting, watering, fertilization, insects and diseases, pruning and tree care, inventory of property values, and community forestry development.

U 180 Careers in Natural Resources 2 cr. Offered autumn and spring. Same as WBIO 180 and RECM 180. Subject matter and fields of study within natural resources management. Topics include forestry, wildlife biology, range, water, recreation management, forest products production, and other opportunities for careers in natural resources.

U 195 Special Topics Variable cr. (R-6) Offered intermittently. Experimental offerings of visiting professors, experimental offerings of new courses, or one-time offerings of current topics.

U 196 Independent Study Variable cr. (R-3) Offered every term. Prereq., consent of instr. Problems course designed to allow individual research at the undergraduate level.

U 200 Natural Resources Measurements Camp 2 cr. Offered summer. Intensive two-week resident camp at the Lubrecht Experimental Forest. Introduction to the common measurements and skills used in identifying, quantifying, and understanding natural resources.

U 201 Forest Biometrics 3 cr. Offered autumn. Prereq., M 115 (MATH 117) or M 151 (MATH 121) or equivalent. Introduction to probability and statistical methods for forestry and environmental sciences covering natural resource applications of common probability distributions, data analysis, hypothesis testing, and regression.

U 210N Introductory Soils 3 cr. Offered autumn and spring. Prereq., CHMY 121N (CHEM 151N). An introduction to the chemical, physical, biological and morphological properties of soils.

U WRIT 222 (FOR 220) Technical Approaches to Writing 2 cr. Offered every term. Emphasis on strategy, style and tone in effective technical prose. Traditions of technical writing and how to adopt a wide range of tones and styles in writing various technical documents to diverse audiences. Focus on more effective technical sentences, paragraphs and larger writing components. Assignments include analyses, summaries, employment documents, research reports, case studies and editing/revision exercises.

U 230 Forest Fire Management 2 cr. Offered spring. Presuppression and suppression of fire and the uses of fire in management practices. Fire weather, the measurement of fire weather, the factors that influence fire behavior, and fire management decisions.

U 232 Forest Insects and Diseases 2 cr. Offered spring. Identification, significance of and remedies for insect infestations and infectious and non-infectious diseases of forests and forest products.

U235 Problem Solving for Forest Operations 4 cr. Offered autumn. Prereq., M 162 (MATH 150), GEO 101N (GEOS 100N) strongly recommended. Introduction to problem solving including the fundamentals of statics and mechanics of materials presented in the context of forest operations.

U 240 Tree Biology 2 cr. Offered autumn and spring. Suggested coreq., FOR 241N. The physical and biological requirements for the growth and development of trees. Discussions of: identification, classification, range, and economic importance of the major tree species of North America.

U 241N Dendrology 3 cr. Offered autumn and spring. Prereq., BIOO 105N (BIOL 120N); suggested coreq., FOR 240. Methods and techniques for identifying the major families of North American trees, based on gross morphological and anatomical features. Building and use of identification keys.

U 250 Geographic Information System Practicum 2 cr. Offered every term. A practical introduction to the use of geographic information systems for storing, retrieving, analyzing and displaying spatial data.

U 265 Elements of Ecological Restoration 3 cr. Offered autumn. Prereq., one course in the ecological or biological sciences. Overview of the natural and social science elements of ecological restoration, including the ecological foundations of

restoration, restoration, restoration goals and practices in terrestrial and aquatic habitats, philosophical and ethical challenges involved, and current restoration initiatives in Montana and the United States. Includes Saturday field trips.

U 275 Wildlife Conservation 2 cr. Offered spring. Prereq., sophomore standing or consent of instr. Principles of animal ecology and framework of wildlife administration as a basis for the conservation of wild birds and animals, and biodiversity. For non-wildlife biology majors.

U 295 Special Topics Variable cr. (R-6) Offered intermittently. Experimental offerings of visiting professors; new courses or one-time offerings of current topics.

U 296 Independent Study Variable cr. (R-3) Offered every term. Prereq., consent of instr. Individual research at the undergraduate level.

U 302 Forest Mensuration 3 cr. Offered spring. Prereq., FOR 201. The theory and practice of timber inventory and growth projection, including field measurements, sampling procedures, statistical methods, inventory compilation, and stand growth simulation under specified management prescriptions. Stand growth under specified management prescriptions.

UG 307 Forest Vegetation Management Models 3 cr. (R-6) Offered autumn. Prereq., FOR 202 or consent of instr. Hands on experience in applying the common simulation models used by forest managers in forecasting the development of forest vegetation. Includes elements of model building and evaluation.

U 311 Field Studies in Ecological and Human Communities 2-3 cr. (R-12) Offered every term. Prereq., consent of instr. Via extended backcountry travel, experiential examination of the structure and function of the ecosystems occurring within the course area. Also investigates the relationship of those ecosystems with the people that manage, live, and work in the area. Offered by the Wild Rockies Field Institute.

UG 320 Forest and Environmental Economics 3 cr. Offered autumn and spring. Prereq., M 162 (MATH 150); ECNS 201S (ECON 111S). Economic techniques to support decision making about the allocation of scarce resources, and management of forests for timber and other ecosystem services.

UG 330 Forest Ecology 3 cr. Offered autumn and spring. Same as RSCN 330. Prereq., BIOO 105N or BIOB 170N/171N (BIOL 120N or BIOL 108N, 109N); prereq. or coreq., FOR 210N. Examination of physical and biological factors affecting forest structure, composition, and function, including biodiversity, disturbance, and nutrient cycling. Field labs throughout Northern Rockies including developing skills in field observation, data interpretation and problem solving.

UG 331 Wildland Fuel Management 3 cr. Offered autumn. Prereq., FOR 230 or equiv. Fire ecology, western vegetation types; planning for prescribed use of fire; fuel management objectives and techniques: mechanical, chemical, prescribed fire; smoke management considerations.

UG 332 Forest Entomology 3 cr. Offered intermittently. Prereq., FOR 232. Classification, identification, life cycles, and control of insects which injure forests and forest products.

U 335 Environmental Entomology 3 cr. Offered autumn. Prereq., BIOB 170N (BIOL 108N) or equivalent. An introduction to the importance of insects in ecosystem function and process, and their use in ecological monitoring as indicators of ecological change, degradation, and the efficacy of ecological restoration efforts. Will also cover effects of

climate change and biological invasions in the context of both pest and beneficial insect species.

UG 340 Forest Products Manufacturing 2 cr. Offered autumn. Prereq., junior standing or consent of instr. Survey of the manufacture of wood-based products generated from timber harvest. Laboratory field trips to several local manufacturing facilities.

U 341 Timber Harvesting and Forest Roads 3 cr. Offered spring. Prereq., FOR 200. An overview of harvesting system capabilities and selection for multiple resource objectives. Fundamentals of forest road management. Best management practices as they apply to forest operations in Montana and the western United States.

UG 342 Wood Anatomy, Properties and Identification 3 cr. Offered spring. Prereq., BIOO 105N (BIOL 120N) or FOR 240, 241N. Lecture and laboratory investigation of the structure, identification and physical and mechanical properties of the commercial tree species of North America.

U 345 Sustaining Human Society and the Natural Environment 3-6 cr. Offered Winter and Summer. Same as RECM 345. These field-based, experiential classes focus on the environmental and conservation concerns, as well as the modern and traditional cultures, of Australia, New Zealand, or Fiji.

UG 347 Multiple Resource Silviculture 3 cr. Offered autumn and spring. Prereq., FOR 330 or BIOE 370 (BIOL 340) or equiv. An introduction to the concepts and application of silvicultural techniques to forest ecosystems to meet multiple resource objectives.

U350 Geographic Information Systems and Applications 3 cr. Offered autumn. Prereq. or coreq., FOR 250. Introduction to the basic concepts and techniques of computerized spatial data management and analysis systems and application to natural resource management.

UG 351 Photogrammetry and Remote Sensing 3 cr. Offered spring. Prereq., M 151 (MATH 121). The theory and application of photo- and electro-optical remote sensing for mapping resources and developing information systems.

U 352 Himalayan Environment and development 3 cr. Offered summer only. Coreq., RECM/FOR/GPHY 353. Same as RECM/GPHY 352. This course covers the contentious issues surrounding environment and development in the Himalaya using the Garhwal region of India as the example.

U 353 Tourism, Livelihoods and Sustainability in the Himalaya 3 cr. Offered summer only. Coreq. RECM/FOR/GPHY 352. Same as RECM/GPHY 353. In this course we will explore the opportunities and challenges of development with particular reference to nature-based tourism and sustainability in an isolated but rapidly globalizing region of the Himalaya. Students will learn through extensive readings, class discussions, direct field experience (including living in a remote mountain village), meetings with development officials, sustainability activists and stakeholders in the region.

UG 360 Range Management 3 cr. Offered autumn and spring. Same as RSCN 360. Prereq., junior standing or consent of instr. An introduction to rangelands and their management, grazing influences, class of animal, grazing capacity, control of livestock distribution, improvements, competition and interrelationships with wildlife. Laboratory exercises to gain on-site experience on topics and concepts presented in lectures.

U 361 Range Forage Plants 3 cr. Offered autumn. Same as RSCN 361. Prereq., FOR 360 and BIOL 165N. Description, identification, forage value and ecology of forage

plants of the western United States; important weed species, management of grazing lands, and the relationship of ecophysiology and morphology to grazing response.

U 362 Range Livestock Production 3 cr. Offered spring odd numbered years. Same as RSCN 362. Prereq., FOR 360 or consent of instr. An introduction to livestock production in natural systems and the role of livestock production in the world food situation; emphasizes selection, production and management principles of beef cattle systems.

U 365 Foundations of Restoration Ecology 3 cr. Primary ecological theories that inform the practice of ecological restoration. Topics include the dynamic nature of ecological systems, ecophysiological constraints on plant responses, biodiversity and ecosystem functioning, population dynamics and metapopulation theory, and statistical issues and study design.

UG 379 Collaboration in Natural Resources Decisions 3 cr. Offered intermittently. Same as EVST and RSCN 379. Political and social processes affecting natural resource decisions. Examination of cases of multi-party collaboration in forestry, range, and watershed management issues..

U 385 Watershed Hydrology 3 cr. Offered autumn and spring. Same as RSCN 385. An introduction to physical and biological controls over water movement and storage in the environment, and how those controls are affected by land management practices.

U 386 Watershed Hydrology Laboratory 1 cr. Offered autumn and spring. Coreq., FOR 385 or consent of instr. An introduction to basic watershed measurement and analysis techniques. Lab exercises designed around the use of spreadsheets and computer graphics.

U 395 Special Topics Variable cr. (R-12) Offered intermittently. Experimental offerings of visiting professors, experimental offerings of new courses, or one-time offerings of current topics.

U 396 Independent Study 1-3 cr. (R-10) Offered every term. Prereq., consent of instr. Individual study or research problems.

U 398 Internship Variable cr. Offered every term. Prereq., consent of department. Extended classroom experience that provides practical application of classroom learning during placements off campus. Prior approval must be obtained from the faculty supervisor and the Internship Services office. A maximum of 6 credits of Internship (198, 298, 398, 498) may count toward graduation.

U 404 Wilderness in the American Context 4 cr. Same as RECM 404. An expansive treatment of the history of the wilderness preservation movement in the United States. Introduction to the successive influences of philosophy, science, art and politics on society's relationship with wilderness. Discussion of the Wilderness Act of 1964.

U 405 Management of the Wilderness Resource 4 cr. Same as RECM 405. An ecology-based treatment of wilderness management. Brief overview of fundamental ecological principles followed by an examination of their specific and often unique applications to wilderness ecosystems. Presentation of basic wilderness management principles and guidelines. Discussion of nonconforming wilderness uses.

U 406 Wilderness Management Planning 3 cr. Same as RECM 406. Exploration of basic planning theory, concepts, effective plan writing, and the characteristics of successful planning and implementation. In-depth treatment of the Limits of Acceptable Change planning framework. Comparison and evaluation of the different planning approaches used by the four wilderness managing agencies.

U 407 Managing Recreation Resources in Wilderness 3 cr. Same as RECM 407. Examination of strategies to management recreation in a wilderness setting. Addresses management of visitor use and experiences, measuring and monitoring biophysical and social impacts, effective education and interpretation, and law enforcement.

UG 408 Global Biogeochemical Cycles 3 cr. Offered spring odd numbered years. Same as BIOL/GEO/CCS 407. Exploration of how variations in the availability or utilization of critical Earth elements influences the atmosphere, the oceans, and the terrestrial biosphere including the natural and agricultural ecosystems on which we depend.

UG 410 Soil Morphology, Genesis and Classification 3 cr. Offered spring odd-numbered years. Prereq., FOR 210N. The morphological characteristics of soils, how the horizons formed and an introduction to the Soil Taxonomy classification system used in this country. Field trips will be included.

UG 415 Environmental Soil Science 3 cr. Offered intermittently. Prereq., FOR 210N. A detailed analysis of how natural and anthropogenic disturbances influence soil processes and how those processes in turn influence our environment. Specific topic areas include nutrient cycling, water quality, xenobiotic compounds, metal contamination, and the remediation of contaminated soils.

UG 422 Natural Resources Policy and Administration 3 cr. Offered autumn and spring. Same as RSCN 422. Policy formation in the United States and a survey of the major resource policies interpreted in their historical and political contexts.

UG 424 Community Forestry and Conservation 3 cr. Offered spring. Same as SOCI 424 (SOC 424) and RSCN 424. A review of agroforestry, community forestry, and opportunities and constraints to the use of trees in rural development and protected areas management.

UG 425 Natural Resource and Environmental Economics 3 cr. Offered spring. Prereq., M 162 (Math 150), and at least one of ECNS 201S (ECON 111S), FOR 225, and FOR 320. Introduction to analytical approaches for economic analysis of management of non-renewable resources, fisheries, forests, threatened and endangered species, and the atmosphere.

UG 430 Forest Meteorology 3 cr. Offered autumn odd numbered years. Prereq., Consent of instr. A brief introduction to synoptic and mesoscale meteorology, followed by more intense study of physics in the forest environment: transfers of heat, light and momentum and their influences on plant structure, function, productivity and survival.

UG 434 Advanced Forest Roads 2 cr. Offered autumn. Prereqs., FOR 235, 340, 351. The purpose of this course is to help students understand the principles and skills of forest road design and the concepts of forest transportation planning. The course will cover the basic topics of road location, design, construction, and maintenance and provide students with techniques to identify the combination of roads, facilities, and transport systems which minimize costs or maximize revenue for primary and secondary road systems.

UG 435 Advanced Timber Harvesting 2 cr. Offered autumn. Prereqs., FOR 235, 347, 340, 351. This course covers the fundamentals of logging feasibility and cost analyses of various timber harvesting systems including the characteristics and performance of ground vehicles, cable and aerial systems; cost factors and cost analysis procedures; safety issues; and environmental impacts of harvesting systems .

UG 436 Forest Operations Evaluation and Project Planning 3 cr. Offered autumn. Prereq., FOR 320. Coreq., FOR 436. This course introduces sensitivity analysis; break-even analysis; risk analysis; multistage sequential analysis; multiattribute analysis; project planning; and contracting.

UG 437 Forest Operations and Applied Restoration Capstone 3 cr. Offered spring. Prereq., FOR 385, 435, EVST 167. FOR 230 and 360 strongly recommended. Principles of ecological restoration and techniques for implementing restoration strategies for terrestrial and aquatic systems.

UG 440 Timber Management I 3 cr. Offered autumn. Prereq., FOR 302, 336, 341. The management and manipulation of the timber resource on private lands to reach multiple objectives, with a focus on the planning of forest operations.

UG 441 Timber Management II 3 cr. Offered spring. Prereq., FOR 440 the immediately preceding autumn semester. The management and manipulation of the timber resource on private lands to reach multiple objectives, with a focus on the administration of forest operations.

UG 442 Technical Processing of Wood Products 5 cr. Offered spring. Prereq., FOR 340 and 342. Lecture, discussion, laboratory manufacture, and evaluation of solid and composite wood products. Exercises include lumber manufacture and drying at College's sawmill; plywood, laminated beam manufacture and strength testing; particle board and flakeboard manufacture and testing.

U 444 Integrative Ecology Restoration 3 cr. Lectures and field trips address key aspects of restoration planning on terrestrial sites (including use of native plant materials and plant-soil bioregulation) and in aquatic systems (including hydrologic and geomorphic components of project design and fish and invertebrate monitoring). Students are required to develop and submit a restoration plan for their final project.

U 445 Ecological Restoration Practicum 3-6 cr. Real-world experience in the practice of ecological restoration. Students will design and implement aspects of a restoration plan for a CFC-maintained property, private entity, nonprofit group, management agency, or other sponsor.

UG 447 Advanced Silviculture 3 cr. Offered autumn. Prereq., FOR 347. Examination of silvicultural topics such as regeneration practices, thinning/stand density concepts, and silvicultural systems at an advanced level.

UG 455 Riparian Ecology and Management 3 cr. Offered spring. Same as RSCN 455. Coreq. or prereq., FOR 385 and one introductory ecology course or consent of instr.. Importance of riparian/wetland areas and the complexities associated with their management for short and long term benefits.

UG 460 Range Inventory and Analysis 3 cr. Offered autumn. Same as RSCN 460. Prereq., FOR 360 and one course in statistics. Methods of measuring range and shrub-land vegetation at individual and community level for determining plant composition, changes following treatments, and carrying capacity of range livestock and native ungulates.

UG 461 Animal Nutrition 3 cr. Offered spring. Prereq., FOR 360 or consent of instr. Elements of animal nutrition, physiology of ruminant nutrition, nutritional characteristics of forage plants related to nutrition requirements of livestock and wildlife, and nutritional strategies of free-roaming animals.

UG 462 Range Ecology 3 cr. Offered spring. Same as RSCN 462. Prereq., FOR 360 and one course in plant ecology. Applied ecology of rangeland uses by various biota, synecological response to grazing, fire, herbicides, fertilizers and mechanical treatments, structural and functional responses of grassland systems to disturbance.

UG 463 Range Improvement 3 cr. Offered autumn. Same as RSCN 463. Prereq., FOR 360. Methods of improving rangelands, including grazing systems, control of weeds, controlled burning, seeding, fertilization and mechanical soil treatments.

UG 465 Restoration Ecology 3 cr. Offered spring. Prereq., senior standing and a course in ecology. Same as EVST 465. Philosophy and practice of restoring damaged ecosystems. Restoration planning including improvement of degraded soils, site preparation for revegetation, and case studies.

UG 475 Sociology of Environment and Development 3 cr. Offered annually. Same as RSCN 475. Examines key social forces that influence how individuals, groups and nation-states understand and live within their bio-physical environments, especially policies and processes relating to development, corporate capitalism, globalization, culture, class and other forms of power and social relations. Pays close attention to ways both indigenous and introduced resource use and management practices (including conservation) variably impact people of different races, classes, genders, cultures and livelihood practices.

U 476 Managing Recreation Resources in Wilderness 3 cr. Same as RECM 476. Examination of strategies to management recreation in a wilderness setting. Addresses management of visitor use and experiences, measuring and monitoring biophysical and social impacts, effective education and interpretation, and law enforcement.

UG 480 Forest and Rangeland Area Planning and Design 3 cr. Offered autumn. Prereq., senior standing, WBIO 370, RECM 310, FOR 347 or FOR 360; senior or graduate standing; or consent of instr. A multidisciplinary planning team approach to developing detailed, site-specific resource management planning for units of forest and rangeland at the area or watershed level. Includes use of geographic information systems, computer modeling, and linear programming.

UG 481 Forest Planning 3 cr. Offered spring. Prereq., FOR 422 or consent of instr. Integrated multiple use planning at the forest-wide level: defining multi-resource management goals, generating management alternatives, projecting outcomes, assessing environmental impacts, and implementing preferred option.

UG 485 Watershed Management 3 cr. Offered autumn. Same as RSCN 485. Prereq., FOR 385 or consent of instr. Effects of land management practices on water and sediment yields from wildland watersheds. Introduction to statistical methods in hydrology. Introduction to water yield and sediment modeling techniques.

U 494 Seminar in Ecological Restoration 1 cr. This seminar provides a forum for students to share the results of restoration projects conducted through FOR 445, Ecological Restoration Practicum. Each student will lead at least one seminar during the semester.

UG 495 Special Topics Variable cr. (R-12) Offered intermittently. Experimental offerings of visiting professors, experimental offerings of new courses, or one-time offerings of current topics.

U 496 Independent Study 1-3 cr. (R-10) Offered every term. Prereq., consent of instr. Individual study or research problems.

U 497 Senior Thesis 3 cr. Offered autumn and spring. Prereq., senior standing and consent of instr. Preparation of a major paper based on study or research in a field selected according to the needs and objectives of the student.

UG 498 Internship Variable cr. Offered every term. Prereq., consent of instr. Extended classroom experience which provides practical application of classroom learning during placements off-campus. Prior approval must be obtained from faculty advisor and Internship Services office. A maximum of 6 credits of Internship (198, 298, 398, 498) may count toward graduation.

G 500 Forest Growth and Yield 3 cr. Offered spring. Prereq., FOR 202 or consent of instr. Offered alternate years. Theory and methods for projecting quantitative measures of tree and stand growth over time; includes analysis of computer growth and yield models used in the region.

G 501 Research Methods 3 cr. Offered autumn. Prereq., a course in statistics or consent of instr. The nature of scientific research, planning research projects, organization and presentation of research results. Emphasis on the development of study plans for specific research projects.

G 503 GIS: Methods and Applications I 3 cr. Offered autumn. Prereq., consent of instr. Introduction to the theory and development of statistical gradient and predictive distribution models in the resource and conservation sciences. Course will develop climatic, edaphic, biophysical, and inventory data sources for use in predictive distribution modeling. Survey of multiple modeling approaches, limitations and assumptions, and applications in the resource and conservation fields. Emphasis on the integration of GIS and raster analysis methods with spatial and non-spatial statistical techniques.

G 504 GIS: Methods and Applications II 3 cr. Offered spring. Prereq., FOR 503. Continuation of 503.

UG 505 Sampling Methods 3 cr. Offered spring. Prereq., FOR 201 or equiv.; consent of instr. Fundamentals of statistical sampling emphasizing natural and environmental resource applications. Principles of inferences and alternative estimators are studied in the context of simple random, systematic, unequal probability, stratified, and 3P/Poisson designs. Variable radius plot sampling, line intersect sampling, and other probability proportional to size designs used in forest and ecological inventories are also covered.

G 508 Modeling Forest Dynamics 3 cr. Offered autumn odd numbered years. Prereq., FOR 500 and some experience with statistical methods and a programming language. Introduction to the construction of simulation models for forecasting change in forest vegetation. Survey of alternative modeling approaches followed by construction of a simulator. Includes specification of conceptual model, statistical analysis of data, and programming a working simulator.

G 511 Soil Chemistry 3 cr. Offered spring odd-numbered years. Prereq., FOR 210N, 330. A series of lectures on soil chemistry in the beginning of the semester, emphasizing water and nutrient movement, followed by a series of laboratory and lecture classes on soil chemistry, emphasizing data interpretation and problem solving.

G 513 Foundations of Natural Resources Conflict Resolution 3 cr. Offered spring. Same as LAW 613 and EVST 513. Provides a conceptual framework for understanding the history of ideas that have shaped the policies, institutions, and strategies used to resolve natural resource and other public policy conflicts in the American West. Focus on natural resource and environmental dispute resolution.

G 520 Forest Resource Economics 3 cr. Offered autumn. Prereq., FOR 320 or equiv., an upper-division or graduate level course in microeconomics, and consent of instr. The demand for, and supply of, commodity products from the forest, including characteristics of demand for stumpage, logs and processed products, forest management and harvesting decisions, and the supply of stumpage, intermediate and processed products.

G 532 Forest Ecosystem Analysis 3 cr. Offered autumn. Prereq., FOR 330 or equiv. Current research on important processes in forest ecosystems, including carbon, water and nutrient cycles, with emphasis on recent computer simulation models.

G 533 Use of Fire in Wildland Management 3 cr. Offered autumn even-numbered years. Prereq., consent of instr. Western fire ecology and the planned use of fire. Wildlife, range and forestry applications of prescribed fire. Seminars and discussions; research applications.

G 545 Silviculture Research 1 cr. (R-6) Offered intermittently. Prereq., graduate standing and consent of instr.; prereq. or coreq., FOR 347 or equiv. Reading and discussion of scientific literature related to silvicultural practice and science. Different topic each semester. Students become familiar with silviculture literature, develop skills for scrutinizing scientific literature, and examine silvicultural topics in detail.

G 547 Forest Vegetation Dynamics 3 cr. Offered autumn. Prereq., consent of instr. Role of disturbances, plant interactions, tree architecture, and structure on forest stand development. Laboratory provides experience with vegetation development reconstruction. Discusses even-aged, uneven-aged, single- and mixed-species stand development as well as landscape linkages.

G 548 Forest Stand Dynamics and Culture 1 cr. Offered intermittently. Prereq., FOR 347 or equiv. One-week continuing education course designed to present emerging concepts in stand dynamics and stand culture to practicing silviculturists. Topics include even- and uneven-aged stand dynamics and density control, fire management, fertilization, and stand health.

G 551 Digital Image Processing 4 cr. Offered autumn even numbered years. Prereq., FOR 351 or equiv. and consent of instr. Fundamentals of electro-optical digital remote sensors, data compilation, preprocessing, and pattern recognition.

G 560 American Wilderness Philosophy and Policy 4 cr. Same as RECM 560. History of the American Wilderness idea and associated policies, including the Wilderness Act and implementing regulations. Current management challenges also covered.

G 561 Managing Wilderness Ecosystems 4 cr. Same as RECM 562. Current research, theory, and management approaches to recreation management in wilderness, including monitoring and management of visitor impacts and experiences.

G 562 Managing Recreation Resources in Wilderness Settings 3 cr. Same as RECM 562. Current research, theory, and management approaches to recreation management in wilderness, including monitoring and management of visitor impacts and experiences.

G 563 Wilderness Planning: Theory, Management Frameworks, and Application 4 cr. Same as RECM 563. Planning theory and effective plan development, including principles and practices of public involvement. Includes examination of primary planning frameworks.

G 565 Advanced Problems in Restoration Ecology 3 cr. Offered autumn. Same as RSCN 565. Prereq., graduate standing and consent of instructor. This is a student-driven course that explores current topics in the theory and practice of restoration. Students will develop and implement a collaborative research project related to a current problem in restoration ecology or ecological restoration.

G 570 Political Ecology 3 cr. Same as RSCN 570. Graduate seminar on key theories, issues and literature in the subfield of Political Ecology, an interdisciplinary environmental social science approach which integrates how political, economic, cultural and ecological processes interact and shape society nature relations. Case examples are drawn from both the North and South.

G 571 International Conservation and Development 1-3 cr. (R-2) Offered fall and spring. Prereq., graduate standing and consent of instructor. Critical review of selected international natural resource development, conservation and management approaches and experiences.

G 579 Practicum in Natural Resources Conflict Resolution 3 cr. (R-4) Offered autumn. Same as EVST 579 and LAW 679. Prereq., FOR 513 or consent of instr. Current topics in theory and practice. Development and discussion of research topics. Topics vary.

G 582 Tropical Ecosystems and Management 3 cr. Offered spring. Prereq., graduate standing or consent of instr. Introduction to tropical forests and agroecosystems, and a critical examination of their management and conservation within the context of ecological, socioeconomic and political change.

G 586 Snow Hydrology 3 cr. Offered spring. Prereq., graduate standing or consent of instr. The physics of snow formation, distribution and ablation. Snow and forest management in the subalpine zone.

G 594 Graduate Seminar in Forestry 1 cr. (R-3) Offered autumn and spring. Prereq., graduate standing. Presentation by students, staff and visitors of issues and topics in their fields.

G 595 Special Topics Variable cr. (R-12) Offered intermittently. Experimental offerings of visiting professors, experimental offerings of new courses, or one-time offerings of current topics.

G 596 Independent Study 1-3 cr. (R-10) Offered every term. Prereq., consent of instr. Individual study or research problems.

G 598 Internship Variable cr. (R-15) Offered every term. Prereq., consent of instr. Extended classroom experience which provides practical application of classroom learning during placements off campus. Prior approval must be obtained from the faculty supervisor and the Internship Services office.

G 599 Professional Paper Variable cr. (R-15) Offered autumn and spring. Preparation of Master of Ecosystem Management professional paper.

G 622 Advanced Problems in Environmental Policy 3 cr. Offered Spring even-number years. Examines environmental policy problems and contemporary issues in environmental policy, law, and administration. Policy tools, concepts and research resources introduced. Numerous problems, themes, and issues in environmental policy analyzed. Readings-based seminar; students lead most reviews and discussions.

G 697 Graduate Research Variable cr. (R-15) Offered every term. Independent graduate research in forest management, wood science, soils, wildlife management, silviculture, recreation and other topic areas.

G 699 Thesis Variable cr. (R-15) Offered every term. Preparation of thesis/dissertation.