

BACHELOR OF SCIENCE IN NATURAL RESOURCES AND ENVIRONMENTAL SCIENCE

The program in Natural Resources and Environmental Science is designed to provide students with the knowledge and skills needed for a career in the rapidly growing fields of environmental science, natural resource management, and environmental policy. With global climate change and an inter-connected world economy, the conservation and management of our natural resources and sustainability of our natural environment is becoming an issue for all societies. This curriculum provides students with exposure to a broad array of disciplines that are essential in approaching issues of natural resources, environmental quality, and environmental sustainability. Experiential learning is a key component in the curriculum. As a result, graduates have the capacity to integrate perspectives and diverse bodies of knowledge in dealing with environmental resource management problems.

All students in the program take a common core of major requirements which is designed to provide exposure to technical and socioeconomic dimensions of natural resource management and policy. Important components of the core requirements are a required three-week summer camp, a pre-professional internship or research experience, and a senior capstone course that is problem based. In addition to the core requirements, all students must complete nine hours of course work in both an Analytical Skill Development Area (ASD) and an Environmental System Emphasis Area (ESEA). This allows students to match analytical skills to an area of particular interest in conservation biology, natural resource planning, environmental soil science, water resources, forestry, wildlife management, agricultural sustainability, geological processes, or related areas. Courses completed for the ASD and ESEA are selected from a list of choices in each area. Students are required to complete an off-campus internship or a research experience that is related to their ESEA and/or ASD. NRES majors have completed internships in several foreign countries, although most are conducted within the U.S. with organizations such as the National Park Service, the U.S. Forest Service, with local nature preserves, an Alaskan salmon recovery program, a national laboratory, environmental consulting firms, private corporations, and both state and local governments. All seniors apply their course work and experiential learning to the senior capstone course which focuses on a well-defined natural resource issue, requires group collaboration and problem-solving, and involves actual stakeholders.

Graduates of the Natural Resources and Environmental Science degree program move on to graduate work or careers. Many graduates continue their studies in Masters or Ph.D. programs or go on to law school. Most graduates begin careers as aspiring environmental professionals in both the public and private sector. Additional employment opportunities exist in environmental education, journalism, and work with nonprofit organizations which have environmental concerns.

Graduation Requirements

To earn a Bachelor of Science in Natural Resources and Environmental Science, a student must complete at least 120 semester hours of credit with at least a 2.0 cumulative grade-point average. A minimum of 45 credits must be from upper division courses (300-level and above). Remedial courses may **not** be counted toward the total degree hours. In addition to the UK Core requirements, students must complete College requirements, premajor and major requirements, and complete an internship or research experience. With advisor approval, students select and Analytical Skill Development and an Environmental System Emphasis Area which focuses course work in a student's area of interest.

UK Core Requirements

See the *UK Core* section of this Bulletin for the complete **UK Core requirements**. The courses listed below are (a) recommended by the college, or (b) required courses that also fulfill UK Core areas. Students should work closely with their advisor to complete the UK Core requirements.

I. Intellectual Inquiry in Arts and Creativity

Choose one course from approved list 3

II. Intellectual Inquiry in the Humanities

Choose one course from approved list 3

III. Intellectual Inquiry in the Social Sciences

Choose one course from approved list 3

IV. Intellectual Inquiry in the Natural, Physical, and Mathematical Sciences

CHE 105 General College Chemistry I 4

CHE 111 General Chemistry I Laboratory 1

V. Composition and Communication I

CIS/WRD 110 Composition and Communication I 3

VI. Composition and Communication II

CIS/WRD 111 Composition and Communication II 3

VII. Quantitative Foundations

MA 123 Elementary Calculus and Its Applications

or

MA 113 Calculus I

or

MA 137 Calculus I With Life Sciences Applications 4

VIII. Statistical Inferential Reasoning

STA 296 Statistical Methods and Motivations 3

IX. Community, Culture and Citizenship in the USA

GEN 100 Issues in Agriculture, Food and Environment 3

X. Global Dynamics

Choose one course from approved list 3

UK Core hours 33

Graduation Composition and Communication Requirement (GCCR)

NRE 400 Professional NRES

Composition and Communication 2

Graduation Composition and Communication Requirement hours (GCCR) 2

Premajor Requirements Hours

BIO 148 Introductory Biology I 3

BIO 152 Principles of Biology II 3

CHE 105 General College Chemistry I 4

CHE 111 General Chemistry I Laboratory 1

ECO 201 Principles of Economics I 3

EES 220 Principles of Physical Geology 4

MA 123 Elementary Calculus and Its Applications

or

MA 113 Calculus I

or

MA 137 Calculus I With Life Sciences Applications 4

STA 296 Statistical Methods and Motivations 3

Subtotal: Premajor hours 25

Major Requirements Hours

AEC 326 Principles of Environmental Law 3

AEC 445G Introduction to Resource and Environmental Economics 3

FOR 435 Conservation Biology 3

FOR 240 Forestry and Natural Resource Ethics

or

PHI 336 Environmental Ethics 2-3

FOR 325 Economic Botany:

Plants and Human Affairs 3

FOR 340 Forest Ecology 4

FOR 460 Forest Hydrology and Watershed Management

or

EES 385 Hydrology and Water Resources 3

NRE 201 Natural Resources and Environmental Science 3

*NRE 320 Natural Resource and Environmental Analysis 3

NRE 355/LA 355 Introductory Geospatial Applications for Land Analysis 3

NRE 381 Natural Resource and Environmental Policy Analysis 3

†NRE 395 Research in Natural Resources and Environmental Science

or

†NRE 399 Experiential Education in Natural Resources and Environmental Science 1-3

NRE 400 Professional NRES

Composition and Communication 2

NRE 471 Senior Problem in Natural Resources and Environmental Science 4

PLS 366 Fundamentals of Soil Science 4

*NRE 320 is a three-week summer camp field data collection experience. The student will attend this camp after the sophomore or junior year. This camp exposes the student to a wide range of natural resource techniques and concepts, including aquatic ecology, soil and plant sciences, wildlife and forestry, and waste management.

†Requires approved (Advisor and Coordinator) Learning Contract as a condition of registration and prior to starting the learning experience.

Subtotal: Major hours 44-47

Analytical Skill Development (ASD) and Environmental System Emphasis Areas (ESEA)

Students must select one area within Analytical Skill Development and one Environmental System Emphasis Area and complete nine hours of course work in each area from the list of courses provided below. Students must select from the courses listed under each ASD and ESEA but may request one (1) substitute course per ASD and ESEA, subject to approval by both their academic advisor and the DUS. For the 18 hours of ASD and ESEA course work, all classes must be 200-level or above and at least twelve (12) credit hours must be in 300-level or above courses. Classes taken to complete the ASD requirement may not count towards the ESEA course requirement and vice versa. Research experiences, internships, or apprenticeships cannot be used to satisfy the ASD and ESEA requirements, including individualized options.

Analytical Skill Development Areas

1. Economic and Policy Analysis

Economic and Policy Analysis – The economic and policy analysis skill development area will provide students with the theoretical and analytical tools necessary to evaluate the economic and social effects of resource and environmental issues. The policy courses will help students understand how environmental policy is made, the public agencies that manage resources, and how policies are evaluated for impact on humans and the environment.

AEC 309 International Agriculture, World Food Needs and U.S. Trade in Agricultural Products.....	3
AEC 483 Regional Economics	3
AEC 532 Agricultural and Food Policy.....	3
AEC/NRE 545 Resource and Environmental Economics.....	3
CLD/SOC 360 Environmental Sociology	3
ECO 473G Economic Development	3
FOR 320 Forest Valuation and Economics	3
FOR 400 Human Dimensions of Forestry and Natural Resources	3
GEO 235 Environmental Management and Policy	3
GEO 316 Environment and Development	3
GEO 431 Political Ecology	3

2. Field and Laboratory Analysis of Ecosystems

Students will learn the theory and application of sample data collection and techniques, field and laboratory analysis, statistical analysis, and data interpretation required to evaluate the quality of water, soil, and ecosystem resources. This analytical skill development area is geared towards students pursuing careers as environmental science and protection scientists/technicians and forest and conservation scientists/technicians.

ENT/BIO 300 General Entomology	3
BIO 325 Ecology	4
BIO 351 Plant Kingdom	3
BIO/NRE 420G Taxonomy of Vascular Plants	4
BIO 559 Ornithology	4
EES 230 Fundamentals of Geology I.....	3
ENT/FOR 502 Forest Entomology	3
FOR 219 Dendrology	4
FOR 221 Winter Dendrology	1
FOR 510 Herpetology.....	4
FOR 520 Mammals of the Eastern United States.....	4
PLS 396 Soil Judging	1-2
PLS 468G Soil Use and Management	3
PLS 514 Grass Taxonomy and Identification	3
PLS 573 Soil Morphology and Classification	3
PLS 581 Chemical Analysis of Soils and Plants	4

3. Geospatial Analysis

Geospatial technologies are often used in conjunction with traditional natural resource and environmental scientist job requirements. This development area will provide students with enhanced skills beyond the major requirements in the use of geospatial software, approaches, and products. Students will learn the theory and application required to address a variety of environmental conditions. This analytical skill development area is geared towards students wishing to pursue careers that depend on extensively applying geospatial technologies to natural resources and environmental science issues or advanced study in geospatial science.

FOR 200 Basics of Geospatial Technology	3
FOR 570 Landscape Ecology for Natural Resources	3
GEO 305 Elements of Cartography.....	3
GEO 409 Advanced GIS	3
GEO 415 Map Interpretation	3
GEO 419 Introduction to Remote Sensing	3
GEO 509 Workshop in Geospatial Technologies.....	3
LA/NRE 556 Contemporary Geospatial Applications for Land Analysis	3

4. Environmental Education and Communication

The environmental education and communication area will introduce you to the concepts of Environmental Education (in NRE 365) and then provide you with the background necessary to apply your environmental systems knowledge in an educational (formal and non-formal) setting or through other avenues of communication.

AED/FCS 583 Designing Curriculum and Assessment in Career and Technical Education.....	3
CLD 230 Intrapersonal Leadership	3
CLD/SOC 360 Environmental Sociology	3
CLD/EDL 402 Principles of Leadership	3
CLD/EDL 403 Leadership and Communication.....	3
COM 281 Communication in Small Groups	3
COM 287 Persuasive Speaking	3
COM 315 Understanding Workplace Communication in a Diverse U.S. Society	3
ECO 499 Seminar in Economics (Subtitle required)	3
EDP 202 Human Development and Learning.....	3
ENG 425 Environmental Writing	3
NRE 360 Environmental Communication	3
NRE 365 Environmental Education.....	3

5. Individualized Analytical Skill Development

With advisor approval, a student may submit a request for an individualized ASD. The written proposal must include a memo explaining the rationale, a list of proposed courses for the ASD, an explanation of how those courses meet the intent of the ASD, and a copy of the student's Plan of Study which includes the proposed course work. The written proposal must be submitted to the DUS for Steering Committee approval.

Environmental System Emphasis Areas

1. Conservation Biology

The conservation biology emphasis area will provide students with knowledge of the ecological underpinnings and organismal biology of conservation biology. Depending on the courses chosen, students will: (1) gain a solid foundation in field botany by learning tree identification and by developing a taxonomic framework for plant identification; (2) become familiar with the mammals, birds, reptiles and amphibians of Kentucky and surrounding states; (3) gain an introduction to the vegetation, flora and forests of Kentucky and surrounding states; and (4) develop an understanding of ecosystem pattern and process. Students who choose courses in this environmental systems emphasis area may be qualified

to pursue careers with organizations dedicated to the preservation, conservation, and management of habitat, and related rare species preservation. Other opportunities include nature preserve manager, natural resource educator, naturalist, biological inventories and assessment, and environmental consulting. This emphasis area also prepares students for graduate studies in ecology, evolutionary biology, zoology, or botany.

ABT/BIO/ENT/FOR 461G Introduction to

Population Genetics	3
BIO/PLS 210 The Life Processes of Plants.....	3
BIO 303 Introduction to Evolution.....	4
BIO 325 Ecology.....	4
BIO 375 Behavioral Ecology and Sociobiology.....	3
BIO/NRE 420G Taxonomy of Vascular Plants.....	4
BIO/GEO 530 Biogeography and Conservation	3
FOR 219 Dendrology.....	4
FOR 370 Wildlife Biology and Management	4
FOR 510 Herpetology	4
FOR 520 Mammals of the Eastern United States	4
FOR 530 Freshwater Ecology.....	3
FOR 540 Urban Ecology.....	3
FOR/GEO 570 Landscape Ecology for Natural Resources	3
NRE/PLS 455G Wetland Delineation	3

2. Forestry

The forestry emphasis area provides students with knowledge in dendrology (the study of trees) and silviculture (the cultivation, growing, and management of trees). In dendrology students will learn basic concepts of botany of woody species, and their use, along with basic soil and site characteristics used in the identification of trees and forest vegetation. In silviculture students will learn the basics of ecologically-based management of forest ecosystems to achieve a desired objective. Students who choose this emphasis area may be qualified to pursue careers in natural resource management with an emphasis on forest systems. *[Note: Students with a B.S. in Forestry from a Society of American Foresters (SAF) accredited forestry program may be more competitive for certain forestry jobs. The NRES program is not an SAF accredited program.]*

FOR 200 Basics of Geospatial Technology	3
*FOR 219 Dendrology.....	4
FOR 221 Winter Dendrology.....	1
FOR 255 Forest Fire	1
FOR 260 Forest Products and Wood Science	4
FOR 320 Forest Valuation and Economics	3
*FOR 350 Silviculture.....	4
FOR 400 Human Dimensions of Forestry and Natural Resources.....	3
FOR 425 Forest Management.....	4
ENT/FOR 502 Forest Entomology.....	3

**Students are strongly encouraged to take these key courses.*

3. Human Dimensions and Natural Resource Planning

The human dimensions and natural resource planning emphasis area will provide students with an understanding of the interaction between society and natural systems and provide students with the skills and knowledge for tomorrow's effective conservation leaders. This emphasis area does this by building upon the core NRES curriculum with course work and internship experience focused on land planning, legal aspects of land and water, landscape ecology, biogeography, and geospatial technologies. Private foundations and government entities are funding land conservation efforts, and increasingly, real estate developers and their consultants are incorporating land conservation into their development projects. There is a professional community working in a variety of capacities for conservation organizations globally and there is the opportunity for advanced study in a variety of graduate programs.

BIO/GEO 530 Biogeography and Conservation	3
CLD/SOC 340 Community Interaction	3
CLD/SOC 360 Environmental Sociology	3
CLD/SOC 420 Sociology of Communities	3
CLD/SOC 440 Community Processes and Communication	3
CLD/SOC 517 Rural Sociology	3
ENG 425 Environmental Writing	3
FOR 400 Human Dimensions of Forestry and Natural Resources	3
FOR 540 Urban Ecology	3
GEO 220 U.S. Cities (UK Core)	3
GEO 222 Cities of the World (UK Core)	3
GEO 285 Introduction to Planning	3
GEO 422 Urban Geography	3
GEO 431 Political Ecology	3
GEO 485G Urban Planning and Sustainability	3
GEO 490G American Landscapes	3
GEO/BIO 530 Biogeography and Conservation	3
GEO 531 Landscape Ecology	3
GEO 550 Sustainable Resource Development and Environmental Management	3
LA 307 Cultural Landscape Preservation	3
LA 308 Regional Land Use Planning Systems	3
SOC 363 Environmental Justice	3

4. Soil Science

Students choosing this emphasis area will learn about the dynamic and interrelated processes taking place within the thin skin of the Earth (i.e., Critical Zone) and the services provided by these processes to ensure adequate and sustainable feed, fuel and fiber production, clean air and water, and healthy habitats. Topics covered include bioremediation, phytoremediation, soil fertility, microbiology, soil chemistry, biogeochemistry, etc. Students completing this emphasis area will be equipped to evaluate soils for a range of management options, and be eligible for positions with public and private agencies (e.g., the Natural Resource Conservation Service, Environmental Protection Agency, U.S. Department of Agriculture, Environmental Consulting Firms, etc.)

PLS 396 Soil Judging	3
PLS 406 Advanced Soil Judging	1
PLS/NRE 455G Wetland Delineation	3
PLS 468G Soil Use and Management	3
PLS/NRE 470G Soil Nutrient Management	3
PLS 566 Soil Microbiology	3
PLS 573 Soil Morphology and Classification	3
PLS 575 Soil Physics	3
GEO 351 Physical Landscapes	3
EES 530 Low Temperature Geochemistry	3

5. Water Resources

The water resources emphasis area will provide students with a fundamental understanding of the hydrologic cycle so that students understand how climate, soils, vegetation, and land-use affect the amount, timing and quality of water. Use of this information is important in natural resource management so that one may determine where water resource management objectives are compatible and where they conflict with other resource management objectives. Ultimately, students will gain an understanding of the role of watershed management and multiple use in planning and implementing natural resource programs while becoming familiar with current issues in watershed management and water resources.

AEN 461G Biometeorology	3
BAE 532/CE 542 Introduction to Stream Restoration	3
BAE 538 GIS Applications for Water Resources	3
BAE/CE 547 Watershed Sedimentation	3
BIO/GEO 530 Biogeography and Conservation	3
CHE 565 Environmental Chemistry	3
EES 530 Low Temperature Geochemistry	3
EES 585 Hydrogeology	3

FOR 530 Freshwater Ecology	3
GEO 230 Weather and Climate	3
GEO 451G Fluvial Forms and Processes	3
LA 531 Water in Urbanizing Environments	3
NRE/LA 556 Contemporary Geospatial Applications for Land Analysis	3
PLS/NRE 455G Wetland Delineation	3
PLS 573 Soil Morphology and Classification	3
PLS 575 Soil Physics	3

6. Wildlife Ecology and Management

This emphasis area will provide opportunities for students to gain knowledge and experience, understand fundamental concepts, and develop basic skills in the area of wildlife ecology and management. The curriculum provides students with the option to meet certification requirements to become a registered Associate Wildlife Biologist with The Wildlife Society. To do this, students will need to complete additional course work. For more information visit: <http://wildlife.org/learn/professionaldevelopment-certification/certificationprograms/>

ASC 325 Animal Physiology	3
BIO/ENT 300 General Entomology	3
BIO 303 Introduction to Evolution	4
BIO 304 Principles of Genetics	4
BIO 325 Ecology	4
BIO 350 Animal Physiology	4
BIO 375 Behavioral Ecology and Sociobiology	3
BIO 559 Ornithology	4
BIO/ENT 568 Insect Behavior	3
FOR 370 Wildlife Biology and Management	4
FOR/ENT 502 Forest Entomology	3
FOR 510 Herpetology	4
FOR 520 Mammals of the Eastern United States	4
FOR 530 Freshwater Ecology	3
FOR 540 Urban Ecology	3
FOR 550 U.S. Biodiversity Hotspots	3
FOR/GEO 570 Landscape Ecology for Natural Resources	3

7. Global Sustainable Food Systems

Students who choose this area will be exposed to basic principles in sustainable agriculture, issues in global food systems (e.g., food security) and the ecology of agricultural systems, emphasizing the overlap and complementarities between systems emphasized through NRES major requirements and food production systems. Some students choosing this ESEA may want to obtain the minor in Sustainable Agriculture, which requires the selection of SAG 210 (not listed below because all 9 credits must be 200 or above), in addition to SAG 310 and 386.

AEC 309 International Agriculture, World Food Needs and U.S. Trade in Agricultural Products	3
AEC 532 Agricultural and Food Policy	3
CLD/SOC 360 Environmental Sociology	3
DHN 318 Hunger, Food Behavior, and the Environment	3
ENT/BIO 300 General Entomology	3
ENT 310 Insect Pests of Field Crops	3
PLS 404 Integrated Weed Management	4
SAG 310 Cultural Perspectives on Sustainability	3
SAG/PLS 386 Plant Production Systems	4
SAG 390 Agroecology	3

8. Earth System Sciences

The Earth Systems Science emphasis area will provide context for understanding the processes that operate within and at the interface between Earth's lithosphere, biosphere, hydrosphere, and atmosphere, i.e., the environments in which bedrock, soil, organisms, water, and air interact. Students pursuing this area of emphasis may choose to pursue the minor in Geological Sciences, which can be partly satisfied with NRES required courses EES 220 and PLS 366, plus EES 230 and 235, and an additional 5 credits at the 300

level or higher in Earth and Environmental Sciences (EES) or a related field. All courses listed below at the 300+ level would count toward the minor. Students who take EES 385 among their NRES major requirements may also count this course toward the minor.

EES 230 Fundamentals of Geology I	3
EES 235 Fundamentals of Geology II	3
EES 323 Field Work in Regional Geology	6
EES 345 Paleoclimatology: The Science	3
EES 360 Mineralogy	4
EES 450G Sedimentary Geology	4
EES 530 Low Temperature Geochemistry	3
EES 550 Fundamental Geophysics	3
EES 585 Hydrogeology	3
GEO 331 Global Environmental Change	3
GEO 351 Physical Landscapes	3
PLS 450G Biogeochemistry	3

9. Individualized System Emphasis Area

With advisor approval, a student may submit a request for an individualized ESEA. The written proposal must include a memo explaining the rationale, a list of proposed courses for the ESEA, an explanation of how those courses meet the intent of the ESEA, and a copy of the student's Plan of Study which includes the proposed course work. The written proposal must be submitted to the DUS for Steering Committee approval.

Subtotal: Analytical Skill Development and Environmental System Emphasis Areas

18

Electives

Free elective courses should be selected by the student to lead to the minimum total of 120 hours required for graduation.

Subtotal: Electives

7-9

TOTAL HOURS:

120

