

DEPARTMENT OF ENVIRONMENTAL SCIENCE AND ECOLOGY

The Department of Environmental Science and Ecology offers a Bachelor of Science degree in Environmental Science, a Bachelor of Arts in Environmental Studies, and a Bachelor of Science degree in Multidisciplinary Science. The Bachelor degree in Environmental Science degree aims to provide students with both basic and advanced science training in the field of Environmental Science. The Bachelor of Arts is designed to provide students with a multidisciplinary educational approach regarding environmental issues and foster system-thinking skills. The Multidisciplinary Science degree is designed for future secondary science teachers.

- B.S. degree in Environmental Science (p. 1)
- B.A. degree in Environmental Studies (p. 4)
- B.S. degree in Multidisciplinary Science (p. 6)

Bachelor of Science Degree in Environmental Science

The Bachelor of Science (B.S.) degree in Environmental Science aims to provide students in the program with both basic and advanced training in the field of Environmental Science. Students will develop skills in how to monitor environmental conditions as well as analyze environmental problems. The main areas of study will include conservation and restoration ecology, environmental management, or natural resources and wildlife management. Today's environmental problems call for scientists who are educated in more than one discipline, highly trained in technical skills, and aware of the political and social dimensions of environmental problems and how to make decisions with regard to these situations. Coursework includes a variety of interdisciplinary topics ranging from fundamentals of Geographic Information Systems, environmental systems, soil, water, global change, environmental law, and environmental assessment. Students will gain hands-on experience with many of the instrumental techniques used in environmental analysis and have the opportunity to engage in teamwork for field studies, excursions and laboratory studies. There is a strong emphasis on producing graduates with well-developed oral and written communication skills who are capable of complex problem solving.

The minimum number of semester credit hours required for this degree, including the Core Curriculum requirements, is 120, at least 39 of which must be at the upper-division level.

All major and support work courses must be completed with a grade of "C-" or better.

All candidates seeking this degree must fulfill the Core Curriculum requirements and the degree requirements, which are listed below.

Core Curriculum Requirements (42 semester credit hours)

Students seeking the B.S. degree in Environmental Science must fulfill University Core Curriculum requirements in the same manner as other students. If courses are taken to satisfy both degree requirements and Core Curriculum requirements, then students may need to take additional

courses in order to meet the minimum number of semester credit hours required for this degree.

Core Curriculum Component Area Requirements (<http://catalog.utsa.edu/undergraduate/bachelorsdegreeregulations/degreerequirements/corecurriculumcomponentarearequirements/>)

First Year Experience Requirement	3
Communication	6
Mathematics	3
Life and Physical Sciences	6
Language, Philosophy and Culture	3
Creative Arts	3
American History	6
Government-Political Science	6
Social and Behavioral Sciences	3
Component Area Option	3
Total Credit Hours	42

Gateway Courses

Students pursuing the B.S. degree in Environmental Science must successfully complete each of the following Gateway Courses with a grade of "C-" or better in no more than two attempts. A student who is unable to successfully complete these courses within two attempts, including dropping a course with a grade of "W" or taking an equivalent course at another institution, will be required to change his or her major.

CHE 1083	Introduction to the Molecular Structure of Matter	3
CHE 1093	Introduction to Molecular Transformations	3
MAT 1093	Precalculus	3

Degree Requirements

A. Required environmental science courses (54 hours of which 6 are in the core)

Must be completed with a grade of "C-" or better		
ES 1113 & ES 1111	Environmental Botany and Environmental Botany Laboratory	4
ES 1123 & ES 1121	Environmental Zoology and Environmental Zoology Laboratory	4
ES 1213 & ES 1211	Environmental Geology and Environmental Geology Laboratory	4
ES 1314	Environmental Statistics	4
ES 2013 & ES 2021	Introduction to Environmental Science I and Introduction to Environmental Science I Laboratory	4
ES 2023 & ES 2031	Introduction to Environmental Science II and Introduction to Environmental Science II Laboratory	4
ES 2113	Fundamentals of Geographic Information Systems (GIS)	3
ES 3033 & ES 3042	Environmental Ecology and Environmental Ecology Laboratory	5
ES 3123 & ES 3121	Introduction to Soils and Introduction to Soils Laboratory	4
ES 3143 & ES 3141	Watershed Processes and Watershed Processes Laboratory	4
ES 3203	Environmental Law	3
ES 4103	Global Change	3

ES 4203	Environmental Assessment	3
ES 4212	Senior Seminar	2
ES 4253	Sources, Fate, and Transport of Chemicals in the Environment	3

B. Required support courses (15 hours of which 6 are in the core)

Must be completed with a grade of "C-" or better

CHE 1083	Introduction to the Molecular Structure of Matter	3
CHE 1093	Introduction to Molecular Transformations	3
COM 2113	Public Speaking	3
ENG 2413	Technical Writing	3
MAT 1093	Precalculus	3

C. Area of Study courses 21

Upper-division environmental science courses completed with a grade of "C-" or better

Twenty one (21) semester credit hours of additional environmental science courses are required of which 15 hours must be upper division. While the degree is a general degree in environmental science, four areas of study have been identified within the B.S. degree program for students interested in conservation and restoration ecology, environmental management, natural resources and wildlife management, or aquatic sciences. Depending on their area of interest, students must select courses from the following areas of study:

Conservation and Restoration Ecology

Required Courses:

ES 4213	Conservation Biology
ES 4233	Restoration Ecology

Select five courses from the following:

ES 3053	Environmental Remediation
ES 3103	Environmental Microbiology
ES 3113	Ichthyology
ES 3133	Oceanography
ES 3153	Environmental Chemistry
ES 3163	Ornithology
ES 3173	Mammalogy
ES 3183	Entomology
ES 3193	Herpetology
ES 3213	Biology of Flowering Plants
ES 3223	Woody Plants
ES 3953	Topics in Environmental Science
ES 4023	Aquatic Ecology
ES 4113	Field Biology
ES 4123	Desert Biology
ES 4133	Natural Resource Policy and Administration
ES 4163	Renewable Energy
ES 4183	Environmental Toxicology
ES 4243	Wildlife Management
ES 4913	Independent Study
ES 4953	Special Studies in Environmental Science

Environmental Management

Required Courses:

ES 3053	Environmental Remediation
ES 3103	Environmental Microbiology
ES 4183	Environmental Toxicology

Select four courses from the following:

ES 3113	Ichthyology
ES 3133	Oceanography
ES 3153	Environmental Chemistry
ES 3953	Topics in Environmental Science
ES 4023	Aquatic Ecology
ES 4153	Introduction to Sustainability
ES 4163	Renewable Energy
ES 4173	Waste Water Treatment
ES 4243	Wildlife Management
ES 4913	Independent Study
ES 4953	Special Studies in Environmental Science

Natural Resources and Wildlife Management

Required courses:

ES 4133	Natural Resource Policy and Administration
ES 4243	Wildlife Management

Select five courses from the following:

ES 3053	Environmental Remediation
ES 3103	Environmental Microbiology
ES 3113	Ichthyology
ES 3133	Oceanography
ES 3153	Environmental Chemistry
ES 3163	Ornithology
ES 3173	Mammalogy
ES 3183	Entomology
ES 3193	Herpetology
ES 3213	Biology of Flowering Plants
ES 3223	Woody Plants
ES 3953	Topics in Environmental Science
ES 4023	Aquatic Ecology
ES 4113	Field Biology
ES 4123	Desert Biology
ES 4153	Introduction to Sustainability
ES 4163	Renewable Energy
ES 4173	Waste Water Treatment
ES 4183	Environmental Toxicology
ES 4213	Conservation Biology
ES 4233	Restoration Ecology
ES 4913	Independent Study
ES 4953	Special Studies in Environmental Science

Aquatic Sciences

Required Courses:

ES 3113	Ichthyology
ES 3133	Oceanography
ES 4023	Aquatic Ecology

Select four courses from the following:

ES 3053	Environmental Remediation
ES 3103	Environmental Microbiology
ES 3153	Environmental Chemistry
ES 3163	Ornithology
ES 3173	Mammalogy
ES 3183	Entomology

ES 3193	Herpetology	
ES 3213	Biology of Flowering Plants	
ES 3223	Woody Plants	
ES 3953	Topics in Environmental Science	
ES 4113	Field Biology	
ES 4123	Desert Biology	
ES 4133	Natural Resource Policy and Administration	
ES 4153	Introduction to Sustainability	
ES 4163	Renewable Energy	
ES 4183	Environmental Toxicology	
ES 4243	Wildlife Management	
ES 4913	Independent Study	
ES 4953	Special Studies in Environmental Science	
Total Credit Hours		90

Course Sequence Guide for B.S. Degree in Environmental Science

This course sequence guide is designed to assist students in completing their UTSA undergraduate Environmental Science degree requirements. *This is merely a guide and students must satisfy other requirements of this catalog and meet with their academic advisor for individualized degree plans.* Progress within this guide depends upon such factors as course availability, individual student academic preparation, student time management, work obligations, and individual financial considerations. Students may choose to take courses during Summer terms to reduce course loads during long semesters.

B.S. in Environmental Science – Recommended Four-Year Academic Plan

First Year

		Credit Hours
Fall		
AIS 1203	Academic Inquiry and Scholarship (core)	3
ES 1123	Environmental Zoology (core and major)	3
ES 1121	Environmental Zoology Laboratory (major)	1
MAT 1093	Precalculus (core and support work)	3
WRC 1013	Freshman Composition I (core)	3
Creative Arts core		3
Credit Hours		16

Spring

COM 2113	Public Speaking (core and support work)	3
ES 1113	Environmental Botany (core and major)	3
ES 1111	Environmental Botany Laboratory (major)	1
ES 1314	Environmental Statistics (major)	4
WRC 1023	Freshman Composition II (core)	3
Credit Hours		14

Second Year

Fall		
ES 2013	Introduction to Environmental Science I (major)	3

ES 2021	Introduction to Environmental Science I Laboratory (major)	1
ES 2113	Fundamentals of Geographic Information Systems (GIS) (major)	3
CHE 1083	Introduction to the Molecular Structure of Matter (support work)	3
POL 1013	Introduction to American Politics (core)	3
American History core		3
Credit Hours		16

Spring

ES 2023	Introduction to Environmental Science II (major)	3
ES 2031	Introduction to Environmental Science II Laboratory (major)	1
ES 1213	Environmental Geology (major)	3
ES 1211	Environmental Geology Laboratory (major)	1
CHE 1093	Introduction to Molecular Transformations (support work)	3
ENG 2413	Technical Writing (support work)	3
Credit Hours		14

Third Year

Fall

ES 3123	Introduction to Soils (major)	3
ES 3121	Introduction to Soils Laboratory (major)	1
ES 3033	Environmental Ecology (major)	3
ES 3042	Environmental Ecology Laboratory (major)	2
POL 1133	Texas Politics and Society (core)	3
ES Area of Study Required (major)		3
Credit Hours		15

Spring

ES 3143	Watershed Processes (major)	3
ES 3141	Watershed Processes Laboratory (major)	1
ES 4253	Sources, Fate, and Transport of Chemicals in the Environment (major)	3
ES Area of Study Required (major)		3
ES Area of Study Elective (major)		3
American History core		3
Credit Hours		16

Fourth Year

Fall

ES 4103	Global Change (major)	3
ES 3203	Environmental Law (major)	3
ES Area of Study Elective (major) ²		3
ES Area of Study Elective (major)		3
Language, Philosophy & Culture core		3
Credit Hours		15

Spring

ES 4203	Environmental Assessment (major)	3
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ES 4212	Senior Seminar (major)	2
ES Area of Study Elective (major)		3
ES Area of Study Elective (major)		3
Social and Behavioral Science core		3
Credit Hours		14
Total Credit Hours		120

- ¹ These laboratory courses include a lecture component as indicated on the University Schedule of Classes. (Note: The prerequisite for CHE 1131 General Chemistry II Laboratory is CHE 1121 General Chemistry I Laboratory.)
- ² For Environmental Management and Aquatic Studies, this is the third required Area of Study course.

Note: Some courses are only offered once a year: Fall or Spring. Check with the Environmental Science Academic Programs department for scheduling of courses.

Bachelor of Arts Degree in Environmental Studies

The Bachelor of Arts in Environmental Studies degree is designed to provide students with a multidisciplinary educational approach regarding environmental issues, and fosters system-thinking skills. The curriculum focuses on the interfaces between human and natural systems; includes key concepts from the natural sciences, social sciences, applied sciences and the humanities; and promotes understanding of both the sociopolitical and natural aspects of environmental problems. A large and increasing portion of environmental jobs are based in non-science, environmentally related fields - such as legal or consulting positions and a wide range of management and government position - that include a significant social or human relations component. This program is designed to prepare students to acquire the knowledge and skills needed to establish successful careers by becoming sustainability-oriented problem solvers through scholarship, practice, and informed citizenship.

Core Curriculum Requirements (42 semester credit hours)

Students seeking the B.A. degree in Environmental Studies must fulfill University Core Curriculum requirements in the same manner as other students. If courses are taken to satisfy both degree requirements and Core Curriculum requirements, then students may need to take additional courses in order to meet the minimum number of semester credit hours required for this degree.

Core Curriculum Component Area Requirements (<http://catalog.utsa.edu/undergraduate/bachelorsdegreeregulations/degreerequirements/corecurriculumcomponentarearequirements/>)

First Year Experience Requirement	3
Communication	6
Mathematics	3
Life and Physical Sciences	6
Language, Philosophy and Culture	3
Creative Arts	3
American History	6
Government-Political Science	6
Social and Behavioral Sciences	3

Component Area Option	3
Total Credit Hours	42

Degree Requirements

A. Required courses (72 hours of which 12 are in the core)

Must be completed with a grade of "C-" or better		
ES 1003	Survey Topics in Environmental Studies	3
ES 1113	Environmental Botany	3
ES 1123	Environmental Zoology	3
ES 1213	Environmental Geology	3
ES 1314	Environmental Statistics	4
ES 2013 & ES 2021	Introduction to Environmental Science I and Introduction to Environmental Science I Laboratory	4
ES 2023 & ES 2031	Introduction to Environmental Science II and Introduction to Environmental Science II Laboratory	4
ES 2113	Fundamentals of Geographic Information Systems (GIS)	3
ES 3203	Environmental Law	3
ES 4133	Natural Resource Policy and Administration	3
ES 4153	Introduction to Sustainability	3
ES 4163	Renewable Energy	3
ES 4203	Environmental Assessment	3
CHE 1083	Introduction to the Molecular Structure of Matter	3
COM 2113	Public Speaking	3
ENG 2413	Technical Writing	3
ENG 3383	Writing in Public and Professional Contexts	3
GES 3753	Climate Change	3
ANT 2053	Introduction to Cultural Anthropology	3
ECO 2003	Economic Principles and Issues	3
MS 4333	Project Management	3
PAD 3043	Public and Nonprofit Financial Management	3
PAD 3143	Urban and Regional Planning	3

B. Choose four (4) of the following courses 12

Twelve (12) semester credit hours of additional elective hours from the following list:

ANT 3223	Anthropology and the Environment
ANT 3333	Human Adaptability
ANT 3873	Food, Culture, and Society
ES 4213	Conservation Biology
ANT 4303	Water, Sustainability, and Health
ANT 4333	Ecology and Evolution of Human Diseases
COM 3023	Foundations of Communication
COM 3243	Persuasion
ES 3033	Environmental Ecology
ES 3123	Introduction to Soils
ES 3143	Watershed Processes
ES 3163	Ornithology
ES 3173	Mammalogy
ES 3183	Entomology
ES 3193	Herpetology
ES 3213	Biology of Flowering Plants

ES 3223	Woody Plants	
GES 3613	Conservation of Resources	
GES 3713	Weather and Climate	
GES 3723	Physiography	
GES 3743	Biogeography	
HIS 4223	Environmental History of the United States	
HTH 4543	Environmental Health and Safety	
PAD 3003	Fundraising in Nonprofit Agencies	
PAD 3023	Introduction to Urban Management and Policy	
PAD 3033	Introduction to Nonprofit Agencies	
PAD 3053	Urban Economic Development	
PAD 3113	Managing Nonprofit Organizations	
PAD 3123	Strategic Planning in the Public and Nonprofit Sectors	
SOC 3223	Population Dynamics and Demographic Techniques	
C. Choose two of the following courses		6
ES 4953	Special Studies in Environmental Science	
ES 4963	Internship	
ES 4113	Field Biology	
ES 4123	Desert Biology	
Total Credit Hours		90

Course Sequence Guide for B.A. Degree in Environmental Studies

This course sequence guide is designed to assist students in completing their UTSA undergraduate Environmental Studies degree requirements. *This is merely a guide and students must satisfy other requirements of this catalog and meet with their academic advisor for individualized degree plans.* Progress within this guide depends upon such factors as course availability, individual student academic preparation, student time management, work obligations, and individual financial considerations. Students may choose to take courses during Summer terms to reduce course loads during long semesters.

B.A. in Environmental Studies – Recommended Four-Year Academic Plan

First Year

Fall		Credit Hours
AIS 1203	Academic Inquiry and Scholarship (core)	3
ES 1123	Environmental Zoology (Required)	3
ES 1003	Survey Topics in Environmental Studies	3
WRC 1013	Freshman Composition I (core)	3
Math Core		3
Credit Hours		15

Spring

CHE 1083	Introduction to the Molecular Structure of Matter	3
ES 1113	Environmental Botany (core and major)	3
POL 1013	Introduction to American Politics	3
WRC 1023	Freshman Composition II (core)	3

Language, Philosophy, & Culture	3
Credit Hours	15

Second Year

Fall

ENG 2413	Technical Writing (Required and core)	3
ES 2013	Introduction to Environmental Science I (Required and science core)	3
ES 2021	Introduction to Environmental Science I Laboratory	1
ES 1314	Environmental Statistics	4
American History		3
Credit Hours		14

Spring

COM 2113	Public Speaking (Required and Core)	3
ECO 2003	Economic Principles and Issues	3
ES 2023	Introduction to Environmental Science II (major)	3
ES 2031	Introduction to Environmental Science II Laboratory (major)	1
ES 1213	Environmental Geology (major)	3
POL 1133	Texas Politics and Society (Core)	3
Credit Hours		16

Third Year

Fall

ANT 2053	Introduction to Cultural Anthropology (Required)	3
ENG 3383	Writing in Public and Professional Contexts (Required)	3
ES 3203	Environmental Law (Required)	3
American History		3
Creative Arts		3
Credit Hours		15

Spring

ES 4163	Renewable Energy (Required)	3
MS 4333	Project Management	3
PAD 3043	Public and Nonprofit Financial Management (Required)	3
Elective		3
Elective		3
Credit Hours		15

Fourth Year

Fall

PAD 3143	Urban and Regional Planning	3
ES 2113	Fundamentals of Geographic Information Systems (GIS)	3
GES 3753	Climate Change	3
Elective		3
Internship, Ind. Study, Field Course		3
Credit Hours		15

Spring

ES 4203	Environmental Assessment (major)	3
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ES 4153	Introduction to Sustainability	3
ES 4133	Natural Resource Policy and Administration	3
Elective		3
Internship, Ind. Study, Field Course		3
Credit Hours		15
Total Credit Hours		120

Bachelor of Science Degree in Multidisciplinary Science

The Bachelor of Science (B.S.) degree in Multidisciplinary Science (MDS) is designed for future secondary science teachers and gives students broad training across the sciences. The MDS degree offers a composite science certification track through the College of Education and Human Development (COEHD), which is designed to prepare students for a career in teaching secondary school science. Students seeking teacher certification should contact the Interdisciplinary Education Advising and Certification Center as early in their educational program as possible, but no later than their fourth semester of study, for information about certificate requirements and admission procedures. Undergraduates seeking elementary teacher certification must complete the Interdisciplinary Studies degree.

The minimum number of semester credit hours required for this degree, including the Core Curriculum requirements, is 120 hours, at least 39 of which must be at the upper-division level. All major and support work must be completed with a grade of "C-" or better.

All candidates seeking this degree must fulfill the Core Curriculum requirements and the degree requirements, which are listed below.

Core Curriculum Requirements (42 semester credit hours)

Students seeking the B.S. degree in Multidisciplinary Science must fulfill University Core Curriculum requirements in the same manner as other students. If courses are taken to satisfy both degree requirements and Core Curriculum requirements, then students may need to take additional courses in order to meet the minimum number of semester credit hours required for this degree.

Core Curriculum Component Area Requirements (<http://catalog.utsa.edu/undergraduate/bachelorsdegreeregulations/degree/requirements/corecurriculumcomponentarearequirements/>)

First Year Experience Requirement	3
Communication	6
Mathematics	3
Life and Physical Sciences	6
Language, Philosophy and Culture	3
Creative Arts	3
American History	6
Government-Political Science	6
Social and Behavioral Sciences	3
Component Area Option	3
Total Credit Hours	42

Gateway Course

Students pursuing the B.S. degree in Multidisciplinary Science must successfully complete the following Gateway Course with a grade of

"C-" or better in no more than two attempts. A student who is unable to successfully complete the course within two attempts, including dropping a course with a grade of "W" or taking an equivalent course at another institution, will be required to change his or her major.

BIO 1414 Biosciences II

Degree Requirements

A. Required science and mathematics courses

AST 1033	Exploration of the Solar System	3
BIO 1404	Biosciences I	4
BIO 1414	Biosciences II	4
BIO 2313	Genetics	3
BIO 3413	Physiology	3
CHE 1103 & CHE 1121	General Chemistry I and General Chemistry I Laboratory	4
CHE 1113 & CHE 1131	General Chemistry II and General Chemistry II Laboratory	4
ES 2013 & ES 2021	Introduction to Environmental Science I and Introduction to Environmental Science I Laboratory	4
ES 2023	Introduction to Environmental Science II	3
ES 3033	Environmental Ecology	3
ES 3133	Oceanography	3
GEO 1103 & GEO 1111	Physical Geology and Physical Geology Laboratory	4
GEO 3004	Rocks, Fossils, and Global Tectonics	4
MAT 1193 or STA 1053	Calculus for the Biosciences or Basic Statistics	3
Select one of the following options:		8
Option 1		
PHY 1603 & PHY 1611	Algebra-based Physics I and Algebra-based Physics I Laboratory	
PHY 1623 & PHY 1631	Algebra-based Physics II and Algebra-based Physics II Laboratory	
Option 2		
PHY 1943 & PHY 1951	Physics for Scientists and Engineers I and Physics for Scientists and Engineers I Laboratory ¹	
PHY 1963 & PHY 1971	Physics for Scientists and Engineers II and Physics for Scientists and Engineers II Laboratory ¹	
Total Credit Hours		57

¹ Note that the prerequisites for Physics for Scientists are Calculus I and II (MAT 1214 and MAT 1224). These can be included among the elective courses in sciences and mathematics.

Certification Requirements (composite science emphasis)

B. Electives to satisfy certification requirements

CI 4646	Clinical Teaching: Grades 7–12	6
ESL 3083	Second Language Teaching and Learning for Grades 7-12	3
LTED 3773	Reading and Writing Across the Disciplines-Grades 7–12	3

UTE 1111	Introduction to STEM Teaching Step 1	1
UTE 1122	Introduction to STEM Teaching Step 2	2
UTE 3023	Perspectives on Science and Mathematics	3
UTE 3043	UTeachSA Research Methods	3
UTE 3203	Knowing and Learning in Mathematics and Science	3
UTE 3213	Classroom Interactions	3
UTE 4203	Project-Based Instruction	3
Total Credit Hours		30

Students seeking an MDS degree as preparation for a graduate degree in science should follow as closely as possible the degree requirements of their chosen science as those courses are most likely to be required by graduate schools in that field. It is possible through careful planning to achieve a double major in MDS and another science. All MDS students should create a four-year plan through an undergraduate academic advisor as early as possible in their course of study, and continue to check in on a course-by-course basis should those plans change.

B.S. in Multidisciplinary Science with Grades 7–12 Teaching Certification – Recommended Four-Year Academic Plan

First Year

Fall		Credit Hours
AIS 1203	Academic Inquiry and Scholarship (core)	3
BIO 1404	Biosciences I (core and major)	4
WRC 1013	Freshman Composition I (core)	3
UTE 1111	Introduction to STEM Teaching Step 1	1
American History core		3
Credit Hours		14

Spring

BIO 1414	Biosciences II (core and major)	4
MAT 1193 or STA 1053	Calculus for the Biosciences (core and major) or Basic Statistics	3
WRC 1023	Freshman Composition II (core)	3
UTE 1122	Introduction to STEM Teaching Step 2	2
American History core		3
Credit Hours		15

Summer

CS 1173	Data Analysis and Visualization (core)	3
PSY 1013	Introduction to Psychology (core)	3
Government-Political Science core		3
Language, Philosophy & Culture core		3
Credit Hours		12

Second Year

Fall		
CHE 1103	General Chemistry I	3
CHE 1121	General Chemistry I Laboratory ¹	1
ES 2013	Introduction to Environmental Science I	3
ES 2021	Introduction to Environmental Science I Laboratory	1

UTE 3203	Knowing and Learning in Mathematics and Science	3
Creative Arts core		3
Credit Hours		14

Spring

CHE 1113	General Chemistry II	3
CHE 1131	General Chemistry II Laboratory ¹	1
GEO 1103	Physical Geology	3
GEO 1111	Physical Geology Laboratory	1
UTE 3213	Classroom Interactions	3
Government-Political Science core		3
Credit Hours		14

Third Year

Fall

BIO 3413	Physiology	3
ES 2023	Introduction to Environmental Science II	3
UTE 3023	Perspectives on Science and Mathematics	3
Select one of the following:		4
PHY 1603 & PHY 1611	Algebra-based Physics I and Algebra-based Physics I Laboratory	
PHY 1943 & PHY 1951	Physics for Scientists and Engineers I and Physics for Scientists and Engineers I Laboratory	
Credit Hours		13

Spring

ES 3033	Environmental Ecology	3
GEO 3004	Rocks, Fossils, and Global Tectonics	4
UTE 3043	UTeachSA Research Methods	3
UTE 4203	Project-Based Instruction	3
Select one of the following:		4
PHY 1623 & PHY 1631	Algebra-based Physics II and Algebra-based Physics II Laboratory	
PHY 1963 & PHY 1971	Physics for Scientists and Engineers II and Physics for Scientists and Engineers II Laboratory	
Credit Hours		17

Fourth Year

Fall

AST 1033	Exploration of the Solar System	3
BIO 2313	Genetics	3
ES 3133	Oceanography	3
ESL 3083	Second Language Teaching and Learning for Grades 7-12	3
LTED 3773	Reading and Writing Across the Disciplines-Grades 7–12	3
Credit Hours		15

Spring		
CI 4646	Clinical Teaching: Grades 7–12	6
	Credit Hours	6
	Total Credit Hours	120

¹ These laboratory courses include a lecture component as indicated on the University Schedule of Classes.

Note: Some courses are only offered once a year: Fall or Spring. Check with the Department of Environmental Science and Ecology for scheduling of courses.

Minor in Environmental Science

The Minor in Environmental Science is open to all majors in the University. To declare a Minor in Environmental Science or obtain advice, students should consult with an undergraduate or Environmental Science advisor. All students pursuing the Minor in Environmental Science must complete 22 semester credit hours of Environmental Science courses including a minimum of 6 hours of upper-division courses. All coursework must be completed with a grade of "C-" or better.

A. 16 semester credit hours of required courses:	16
ES 2013	Introduction to Environmental Science I
ES 2021	Introduction to Environmental Science I Laboratory
ES 2023	Introduction to Environmental Science II
ES 2031	Introduction to Environmental Science II Laboratory
ES 3033	Environmental Ecology
ES 3042	Environmental Ecology Laboratory
ES 3203	Environmental Law
B. 6 additional semester credit hours from the following courses:	6
ES 3123	Introduction to Soils
ES 3143	Watershed Processes
ES 4133	Natural Resource Policy and Administration
ES 4163	Renewable Energy
ES 4203	Environmental Assessment
ES 4213	Conservation Biology
ES 4233	Restoration Ecology
Total Credit Hours	22

Environmental Sciences (ES) Courses

ES 1003. Survey Topics in Environmental Studies. (3-0) 3 Credit Hours.
A broad based survey course intended to provide a comprehensive introduction to the multidisciplinary field of environmental studies. This course examines the ecological, social and political-economic aspects of contemporary environmental issues from an interdisciplinary perspective. Course Fees: LRS1 \$45; STSI \$21.

ES 1111. Environmental Botany Laboratory. (0-3) 1 Credit Hour. (TCCN = BIOL 1111)
Laboratory studies to accompany Environmental Botany Lecture. Selected laboratories pertaining to the structure and function of plants. Course Fees: IUS1 \$15; L001 \$20; LRS1 \$15; STSI \$7.

ES 1113. Environmental Botany. (3-0) 3 Credit Hours. (TCCN = BIOL 1311)
Study of structure and function of plant cells, tissues, and organs. Includes an evolutionary survey and life histories of the following representative groups: algae, fungi, mosses, liverworts, ferns, and seed producing organisms. Plant reproductive and functional interactions with their environment and with humans. May apply toward the Core Curriculum requirement in Life and Physical Sciences. Course Fees: IUS1 \$15; LRC1 \$12; LRS1 \$45; STSI \$21.

ES 1121. Environmental Zoology Laboratory. (0-3) 1 Credit Hour. (TCCN = BIOL 1113)
Laboratory studies to accompany Environmental Zoology Lecture. Selected laboratories pertaining to the taxonomy, molecular biology, and ecology of animals. Course Fees: IUS1 \$15; L001 \$30; LRS1 \$15; STSI \$7.

ES 1123. Environmental Zoology. (3-0) 3 Credit Hours. (TCCN = BIOL 1313)
Study of the principles of taxonomy, molecular biology, and ecology as they relate to animal form and function, diversity, behavior, and evolution. May apply toward the Core Curriculum requirement in Life and Physical Sciences. Course Fees: LRC1 \$12; LRS1 \$45; STSI \$21.

ES 1211. Environmental Geology Laboratory. (0-3) 1 Credit Hour. (TCCN = GEOL 1105)
Laboratory studies to accompany Environmental Geology Lecture. Selected laboratories pertaining to urban and regional land use planning. Course Fees: IUS1 \$15; L001 \$30; LRS1 \$15; STFE \$40; STSI \$7.

ES 1213. Environmental Geology. (3-0) 3 Credit Hours. (TCCN = GEOL 1305)
The earth as a habitat. Interrelationships between humans and the environment. Geologic factors in urban and regional land use planning. May apply toward the Core Curriculum requirement in Life and Physical Sciences. Course Fees: LRC1 \$12; LRS1 \$45; STSI \$21.

ES 1314. Environmental Statistics. (3-3) 4 Credit Hours. (TCCN = MATH 1442)
Collection, analysis, presentation and interpretation of environmental data, and probability. Analysis includes descriptive statistics, correlation and regression, confidence intervals and hypothesis testing. Use of appropriate technology, including statistical software. Course Fees: IUS1 \$15; LRS1 \$60; STSI \$28.

ES 2013. Introduction to Environmental Science I. (3-0) 3 Credit Hours. (TCCN = ENVR 1301)
An introduction to the scientific principles, concepts, and methodologies needed to understand the interactions of the biotic component of the natural world, to identify and analyze environmental problems within the biotic component of natural world, risk assessment of these environmental problems, and to examine alternate solutions. General attention is given to the biotic concepts of growth, processes, and changes occurring in ecosystems and social structures. May apply toward the Core Curriculum requirement in Life and Physical Sciences. Generally offered: Fall, Spring. Course Fees: DL01 \$75; LRC1 \$12; LRS1 \$45; STSI \$21.

ES 2021. Introduction to Environmental Science I Laboratory. (0-3) 1 Credit Hour.
Concurrent enrollment in ES 2013 is recommended. Qualitative and quantitative methods in the study of biotic environmental systems. Generally offered: Fall, Spring. Course Fees: IUS1 \$15; L001 \$30; LRS1 \$15; STSI \$7.

ES 2023. Introduction to Environmental Science II. (3-0) 3 Credit Hours. (TCCN = ENVR 1302)

An introduction to the scientific principles, concepts, and methodologies needed to understand the interactions of the abiotic component of the natural world, to identify and analyze environmental problems within the abiotic component of the natural world, risk assessment of these environmental problems, and to promote environmental sustainability. General attention is given to the abiotic environmental factors including natural hazards, pollution processes, energy resources, sustainability, and changes occurring in ecosystems. May apply toward the Core Curriculum requirement in Life and Physical Sciences. Generally offered: Fall, Spring. Course Fees: LRC1 \$12; LRS1 \$45; STSI \$21.

ES 2031. Introduction to Environmental Science II Laboratory. (0-3) 1 Credit Hour.

Concurrent enrollment in ES 2023 is recommended. Qualitative and quantitative methods in the study of abiotic environmental systems. Generally offered: Fall, Spring. Course Fees: IUS1 \$15; L001 \$30; LRS1 \$15; STSI \$7.

ES 2113. Fundamentals of Geographic Information Systems (GIS). (2-2) 3 Credit Hours.

This course will serve as a basic introduction to the concepts and techniques of utilizing a Geographic Information System (GIS) to study and model environmental issues. In lecture and laboratory, students will study methods of querying, analyzing, creating and displaying GIS data utilizing industry standard software. Students will also be introduced to using the Global Positioning System (GPS) as a means for creating GIS data. (Credit cannot be earned for both ES 2113 and GEO 2113.) Course Fees: IUS1 \$15; LRS1 \$45; STSI \$21.

ES 3033. Environmental Ecology. (3-0) 3 Credit Hours.

Prerequisites: ES 2013 and ES 2023, or equivalents. Examination of the interactions of biotic and abiotic systems, including interactions of plants, animals, and the environment. (Formerly ES 3034. Credit cannot be earned for more than one of the following: ES 3033, ES 3034 or BIO 3283.) Generally offered: Fall, Spring. Differential Tuition: \$150.

ES 3042. Environmental Ecology Laboratory. (0-6) 2 Credit Hours.

Prerequisites: ES 2013, ES 2021, ES 2023 and ES 2031, or equivalents. Concurrent enrollment in ES 3033 is recommended. A field-oriented course emphasizing modern ecological techniques, including examinations of plant and animal populations and measurement of selected chemical and physical parameters. (Credit cannot be earned for both ES 3042 and BIO 3292.) Generally offered: Fall, Spring. Differential Tuition: \$100. Course Fees: IUS1 \$15; L001 \$30; STFE \$40.

ES 3053. Environmental Remediation. (3-0) 3 Credit Hours.

Prerequisites: CHE 1083, CHE 1093, ES 2013, and ES 2023, or equivalents. This course will focus on the fundamentals associated with environmental remediation in relation to the overall environmental quality and protection. Topics covered include contaminant fate and transport; physical, chemical, and biological processes/characteristics of the air, soil, and water; remediation/restoration methods; environmental monitoring; environmental assessments; environmental regulations; and water/wastewater treatment. (Formerly ES 3054. Credit cannot be earned for both ES 3053 and ES 3054.) Generally offered: Spring. Differential Tuition: \$150.

ES 3061. Environmental Remediation Laboratory. (0-3) 1 Credit Hour.

Prerequisites: CHE 1083, CHE 1093, ES 2013, and ES 2023, or equivalents. Concurrent enrollment in ES 3053 is recommended. This laboratory and field-based course will provide hands-on experience in environmental remediation that will focus on regulatory aspects of assessing environmental contamination, technologies/strategies used to remediate, and current literature research investigations into remediation. Generally offered: Spring. Differential Tuition: \$50. Course Fee: IUS1 \$15.

ES 3103. Environmental Microbiology. (3-0) 3 Credit Hours.

Prerequisites: CHE 1083, CHE 1093, ES 2013, and ES 2023, or equivalents; or consent of instructor. This course will survey environmental microbiology and will emphasize microbial interactions in terrestrial and aquatic environments as well as the fate of microbial pathogens. Topics covered include microbial environments, detection of bacteria and their activities in the environment, microbial biogeochemical cycling, bioremediation of organic and inorganic pollutants, and water quality. (Formerly ES 3104. Credit cannot be earned for more than one of the following: ES 3103, ES 3104 or BIO 3713.) Differential Tuition: \$150.

ES 3113. Ichthyology. (3-0) 3 Credit Hours.

Prerequisites: ES 2013, ES 2021, ES 2023, and ES 2031, or equivalents. Study of fishes, and includes a wide range of topics including taxonomy, systematics, and biogeography, anatomy and physiology, and behavior and ecology. This course will focus on form and function, behavior, life history, ecology, and key taxonomic characteristics of most of the orders of fishes. Field trips may be required. Differential Tuition: \$150. Course Fees: IUS1 \$15; STFE \$40.

ES 3121. Introduction to Soils Laboratory. (0-3) 1 Credit Hour.

Prerequisites: CHE 1083 and CHE 1093, or equivalents. Laboratory exercise and field trips designed to develop student competency in soil description, analysis, and assessment. Course Fees: Differential Tuition: \$50. Course Fees: IUS1 \$15; L001 \$30.

ES 3123. Introduction to Soils. (3-0) 3 Credit Hours.

Prerequisites: CHE 1083 and CHE 1093, or equivalents. A study of soil properties and processes and relationships to land use, plant growth, environmental quality, and society. Differential Tuition: \$150.

ES 3133. Oceanography. (3-0) 3 Credit Hours.

Prerequisite: ES 1213 or equivalent. Description of the oceans. Emphasis on relations of biology, chemistry, geology, and physics in marine environments. Examination of relationships and interactions at macro and micro scales in the ocean. Field trips may be required. (Credit cannot be earned for both ES 3133 and GEO 3163.) Differential Tuition: \$150.

ES 3141. Watershed Processes Laboratory. (0-3) 1 Credit Hour.

Prerequisites: ES 2013, ES 2023, ES 1213, and ES 2113, or equivalents. Laboratory exercises and field trips designed to develop an understanding of watershed processes, watershed assessment, and watershed management. Differential Tuition: \$50. Course Fees: IUS1 \$15; L001 \$30; STFE \$40.

ES 3143. Watershed Processes. (3-0) 3 Credit Hours.

Prerequisites: ES 2013, ES 2023, ES 1213, and ES 2113, or equivalents. This course focuses on watershed processes, watershed assessment, and watershed management. Differential Tuition: \$150. Course Fee: STFE \$40.

ES 3153. Environmental Chemistry. (3-0) 3 Credit Hours.

Prerequisites: CHE 1083, CHE 1093, ES 2013, and ES 2023, or equivalents. This course explores the chemistry of the environment, the chemistry underlying environmental problems and solutions to environmental problems. Emphasis is placed on thermodynamics and kinetics of reaction cycles; sources, sinks and transport of chemical species; and quantitation of chemical species. Examples are selected from the chemistry of natural and contaminated air, water, and soil. (Same as CE 4613. Credit cannot be earned for both ES 3153 and CE 4613.) Differential Tuition: \$150.

ES 3163. Ornithology. (3-0) 3 Credit Hours.

Prerequisite: ES 3033 or BIO 3283, or equivalents. A course covering various aspects of the biology of birds, including anatomy, physiology, systematics, evolution, behavior, ecology, and biogeography. Field trips may be required. (Same as BIO 4063. Credit cannot be earned for both ES 3163 and BIO 4063.) Course Fees: Differential Tuition: \$150. Course Fee: IUS1 \$15.

ES 3173. Mammalogy. (3-0) 3 Credit Hours.

Prerequisite: ES 3033 or BIO 3283, or equivalents. A course covering various aspects of the biology of mammals, including anatomy, physiology, systematics, evolution, behavior, ecology, and biogeography. Field trips may be required. Differential Tuition: \$150. Course Fee: IUS1 \$15.

ES 3183. Entomology. (3-0) 3 Credit Hours.

Prerequisite: ES 3033 or BIO 3283, or equivalents. A course covering various aspects of the biology of insects, including anatomy, physiology, systematics, evolution, behavior, ecology, and biogeography. Field trips may be required. Differential Tuition: \$150.

ES 3193. Herpetology. (3-0) 3 Credit Hours.

Prerequisite: ES 3033 or BIO 3283, or equivalents. A course covering various aspects of the biology of amphibians and reptiles, including anatomy, physiology, systematics, evolution, behavior, ecology, and biogeography. Field trips may be required. Differential Tuition: \$150. Course Fee: IUS1 \$15.

ES 3203. Environmental Law. (3-0) 3 Credit Hours.

Present-day environmental enabling acts and regulations will be covered, with emphasis on federal acts, such as the National Environmental Policy Act, Clean Water Act, Resource Conservation and Recovery Act, and associated regulations. Generally offered: Spring. Differential Tuition: \$150.

ES 3213. Biology of Flowering Plants. (2-3) 3 Credit Hours.

Prerequisite: Junior or senior status; a minimum of 60 semester credit hours. A study of the wildflowers of Texas emphasizing identification of the more common wildflowers, as well as family characteristics, flower anatomy, plant morphology, and plant-collecting techniques will be included. Lecture, laboratory, and fieldwork will be included as part of the course. (Same as BIO 3273. Credit can only be earned for ES 3213 or BIO 3273.) Differential Tuition: \$150. Course Fees: L001 \$30; STFE \$40.

ES 3223. Woody Plants. (2-3) 3 Credit Hours.

Prerequisite: Junior or senior status; a minimum of 60 semester credit hours. A study of the woody plants emphasizing the characteristics of family, genus, and species. Includes identification of the common woody plants. Leaf, stem, and flower morphology, anatomy, and collecting techniques. Lecture, laboratory, and fieldwork will be included as part of the course. (Same as BIO 3263. Credit can only be earned for ES 3223 or BIO 3263.) Differential Tuition: \$150. Course Fees: L001 \$30; STFE \$40.

ES 3313. Advanced Geographic Information Systems (GIS). (3-0) 3 Credit Hours.

Prerequisite: ES 2113 or equivalent. This course is an undergraduate level course directed at developing more advanced Geographic Information Systems skills. The class is not introductory and students will begin using more advanced analysis tools in ESRI GIS software (ArcGIS 10.3). Applications of the technology for scientific discovery and exploration will be used as case study examples. Differential Tuition: \$150.

ES 3953. Topics in Environmental Science. (3-0) 3 Credit Hours.

Prerequisite: Consent of instructor. An organized course offering the opportunity for specialized study not normally or not often available as part of the regular course offerings. Field trips may be required. May be repeated for credit when topics vary. Differential Tuition: \$150.

ES 4023. Aquatic Ecology. (3-0) 3 Credit Hours.

Prerequisites: ES 2013, ES 2021, ES 2023, and ES 2031, or equivalents. Study of aquatic ecosystems including streams, wetlands, and lakes. Topics include watershed processes, biological communities, physical habitats, nutrient cycling, energy flow, and management issues. The course culminates with individual research projects focused on local watersheds. Field trips may be required. Course Fees: Differential Tuition: \$150. Course Fee: STFE \$40.

ES 4033. Plant Physiological Ecology. (3-0) 3 Credit Hours.

Prerequisites: ES 3033 and ES 3042, or equivalents. A survey of physiological approaches to understanding plant-environment interactions from the functional perspective. Differential Tuition: \$150.

ES 4103. Global Change. (3-0) 3 Credit Hours.

Prerequisites: CHE 1083, CHE 1093, ES 2013, and ES 2023, or equivalents; and junior or senior status. Changes in the global distribution of plants and animals and the causes of the changes will be examined. Factors that are apparently coupled to changes in these distributions will be examined including, but not limited to, atmospheric composition change and temperature change. Additionally, examination of the impact of humans and their activities on the environment: their effect on aquatic, marine, and terrestrial plant, animal, and human resources. (Formerly ES 4104. Credit cannot be earned for both ES 4103 and ES 4104.) Generally offered: Fall. Differential Tuition: \$150.

ES 4111. Field Biology Laboratory. (0-3) 1 Credit Hour.

Prerequisite: Junior or senior status: a minimum of 60 semester credit hours, or consent of instructor. Concurrent enrollment in ES 4113 is recommended. A field-oriented course offering the opportunity for practical experience observing, collecting, and identifying Texas plants and animals. (Same as BIO 4241. Credit cannot be earned for both ES 4111 and BIO 4241.) Differential Tuition: \$50. Course Fee: IUS1 \$15.

ES 4113. Field Biology. (3-0) 3 Credit Hours.

Prerequisite: Junior or senior status: a minimum of 60 semester credit hours, or consent of instructor. Concurrent enrollment in ES 4111 is recommended. A study of the natural history of plants and animals in their native environment. Techniques for the identification of birds, mammals, reptiles, amphibians, insects, and the dominant flowering plants will be discussed. (Same as BIO 4233. Credit cannot be earned for both ES 4113 and BIO 4233.) Differential Tuition: \$150. Course Fee: IUS1 \$15.

ES 4123. Desert Biology. (3-0) 3 Credit Hours.

Prerequisite: Junior or senior status: a minimum of 60 semester credit hours, or consent of instructor. An introduction to wildlife biology and management including ecological principles dealing with ecosystems, natural communities, and populations. The importance of animal behavior, the availability of food, cover, wildlife diseases, predators, hunting, and trapping will be included. Field studies will allow students to observe and apply classroom topics. Differential Tuition: \$150. Course Fee: IUS1 \$15.

ES 4133. Natural Resource Policy and Administration. (3-0) 3 Credit Hours.

Prerequisite: Junior or senior status. Factors in evolution of forest, range, wildlife and related natural resources administration and policies in the United States; policy components; policy formation implementation, administration and change processes; introduction to criteria for evaluating effectiveness of policies and administration. Differential Tuition: \$150.

ES 4153. Introduction to Sustainability. (3-0) 3 Credit Hours.

Prerequisites: ES 2023 and junior or senior status: a minimum of 60 semester credit hours, or consent of instructor. This course will examine the major environmental issues and trends happening in modern society from a scientific and practical perspective, including biodiversity, population, food and water resources, climate change, energy, public health, and the overall forecast for the environment for the next several decades. Differential Tuition: \$150.

ES 4163. Renewable Energy. (3-0) 3 Credit Hours.

Prerequisites: ES 2023 and junior or senior status: a minimum of 60 semester credit hours, or consent of instructor. This course is an introduction to energy systems and renewable energy resources, with a scientific examination of the energy field and an emphasis on alternate energy sources and their technology and application. Differential Tuition: \$150.

ES 4173. Waste Water Treatment. (2-3) 3 Credit Hours.

Prerequisite: ES 2023 and junior or senior status: a minimum of 60 semester credit hours, or consent of instructor. The application of chemical, biochemical, and physical processes to water treatment, wastewater treatment, and pollution control. Differential Tuition: \$150. Course Fees: IUS1 \$15; STFE \$40.

ES 4183. Environmental Toxicology. (3-0) 3 Credit Hours.

Prerequisites: CHE 1083, CHE 1093, ES 2013, and ES 2023, or equivalents. Examination of advanced or specialized hazardous or toxic waste treatment methods. Emphasis will be on physical, chemical, and biological processes in treatment and processing of hazardous wastes materials. (Same as ES 4003. Credit cannot be earned for both ES 4183 and ES 4003.) Differential Tuition: \$150.

ES 4193. Planning and Response to Environmental Disasters. (3-0) 3 Credit Hours.

Prerequisites: CHE 1083, CHE 1093, ES 2013, and ES 2023, or equivalents. Mitigation of preparation for, response to, and recovery from environmental disasters. Differential Tuition: \$150.

ES 4203. Environmental Assessment. (3-0) 3 Credit Hours.

Prerequisites: ES 2013 and ES 2023, or equivalents. This course evaluates the framework of an impact assessment and details regarding the environment (air, water, soil), its pollutants (atmospheric, noise, water, solid waste), their impacts (physical, social, economic), relevant regulations, and pollution minimization or management strategies. Students use this information to review and comment on an existing Environmental Impact Statement (EIS). Generally offered: Spring. Differential Tuition: \$150.

ES 4211. Senior Seminar. (1-0) 1 Credit Hour.

Prerequisite: Senior status: Environmental Science majors and a minimum of 90 credit hours. The techniques of seminar presentation will be studied by preparing and presenting individual seminars on topics of interest. Enrollment for credit is limited to, and required of, all senior students majoring in environmental studies. Differential Tuition: \$50.

ES 4212. Senior Seminar. (2-0) 2 Credit Hours.

Prerequisite: Senior status: Environmental Science majors and a minimum of 90 credit hours. The techniques of seminar presentation will be studied by preparing and presenting individual seminars on topics of interest. Enrollment for credit is limited to, and required of, all senior students majoring in environmental studies. (Formerly ES 4211. Credit cannot be earned for both ES 4212 and ES 4211). Differential Tuition: \$100.

ES 4213. Conservation Biology. (3-0) 3 Credit Hours.

Prerequisite: ES 3033 or BIO 3283, or equivalents. The class topics will include studying the nature of the biosphere, threats to its integrity, and ecologically sound responses to these threats. Also included will be the origin and preservation of biotic diversity, how the rich variety of plant and animal life around us arose, how it has been maintained by natural processes, and how we can prevent its destruction. (Same as BIO 4033. Credit cannot be earned for both ES 4213 and BIO 4033.) Differential Tuition: \$150.

ES 4223. Urban Wildlife Ecology. (3-0) 3 Credit Hours.

Prerequisites: ES 3033 and ES 3042, or equivalents. Fundamentals of urban ecology, field methods including urban wildlife and human surveys, and urban wildlife management and conservation strategies. Differential Tuition: \$150.

ES 4233. Restoration Ecology. (3-0) 3 Credit Hours.

Prerequisite: ES 3033 or BIO 3283, or equivalents. Applies ecological principles to the restoration of disturbed terrestrial, wetland, and aquatic ecosystems. Includes the restoration of soils and waterways, of flora and fauna, and of natural ecological processes such as plant succession and nutrient cycling. Differential Tuition: \$150.

ES 4243. Wildlife Management. (3-0) 3 Credit Hours.

Prerequisite: ES 3033 or BIO 3283, or equivalents. An introduction to wildlife biology and management including ecological principles dealing with ecosystems, natural communities, and populations. The importance of animal behavior, the availability of food, cover, wildlife diseases, predators, hunting, and trapping will be included. Field studies will allow students to observe and apply classroom. (Same as BIO 4053. Credit cannot be earned for both ES 4243 and BIO 4053.) Differential Tuition: \$150.

ES 4253. Sources, Fate, and Transport of Chemicals in the Environment. (3-0) 3 Credit Hours.

Prerequisites: ES 2013, ES 2023, and MAT 1093, or equivalents. Sources of chemicals in the environment. Processes regulating fate and transport of metals, organics, nutrients, salts, pathogens, and radionuclides in the environment. Differential Tuition: \$150.

ES 4911. Independent Study. (0-0) 1 Credit Hour.

Prerequisites: Permission in writing (form available) of the instructor, the student's advisor, the Department Chair, and Dean of the College in which the course is offered. Independent reading, research, discussion, and/or writing under the direction of a faculty member. May be repeated for credit, but not more than 6 semester credit hours, regardless of discipline, will apply to a bachelor's degree. Differential Tuition: \$50.

ES 4912. Independent Study. (0-0) 2 Credit Hours.

Prerequisites: Permission in writing (form available) of the instructor, the student's advisor, the Department Chair, and Dean of the College in which the course is offered. Independent reading, research, discussion, and/or writing under the direction of a faculty member. May be repeated for credit, but not more than 6 semester credit hours, regardless of discipline, will apply to a bachelor's degree. Differential Tuition: \$100.

ES 4913. Independent Study. (0-0) 3 Credit Hours.

Prerequisites: Permission in writing (form available) of the instructor, the student's advisor, the Department Chair, and Dean of the College in which the course is offered. Independent reading, research, discussion, and/or writing under the direction of a faculty member. May be repeated for credit, but not more than 6 semester credit hours, regardless of discipline, will apply to a bachelor's degree. Differential Tuition: \$150.

ES 4953. Special Studies in Environmental Science. (3-0) 3 Credit Hours.

Prerequisite: Consent of instructor. An organized course offering the opportunity for specialized study not normally or not often available as part of the regular course offerings. Special Studies may be repeated for credit when the topics vary, but not more than 6 semester credit hours, regardless of discipline, will apply to a bachelor's degree. Differential Tuition: \$150.

ES 4963. Internship. (0-0) 3 Credit Hours.

Prerequisite: Consent of the Undergraduate Advisor of Record. An opportunity for students to work in a setting that permits them to apply what they have learned in the formal instruction part of the program. Course Fees: Differential Tuition: \$150.