DOCTOR OF PHILOSOPHY (PH.D.), MAJOR IN AQUATIC RESOURCES

Ph.D. Program
Sustainable freshwater resources provide a foundation for aquatic and terrestrial ecosystems, as well as human use and economic development. However, inadequate understanding of aquatic resources and a prevailing inability to properly integrate scientific, technical, and socioeconomic elements continues to seriously hinder the goal of providing sustainable aquatic resources, not only in Texas but across the nation and around the world.

Educational Goal
The doctoral program emphasizes original research and is designed to provide depth and breadth of knowledge in the field of aquatic resources and related disciplines, including basic and applied research, management, and policy. Students will work, both independently and with other specialists, in a multidisciplinary environment to identify and solve complex problems and issues relevant to the sustainable use of aquatic resources.

Admission Policy
For information regarding admission application requirements and deadlines, please visit The Graduate College website at http://www.gradcollege.txstate.edu/aqrp.html.

Department Policies
Each doctoral student will develop a program of research and study in consultation with their Ph.D. advisor and the doctoral program director and approved by the dean of The Graduate College. This program will include a set of core courses and an appropriate selection of elective courses necessary to provide the student with the scientific expertise and knowledge to work independently and with others in a multidisciplinary environment to address the range of issues constituting sustainable aquatic resources.

Prospective students must contact doctoral faculty members to identify an individual willing to serve as their major advisor prior to submitting their application to the graduate program. A list of faculty and their research areas is available at http://www.bio.txstate.edu/Graduate-Programs/Ph-D--Aquatic-Resources.html.

Financial Assistance
Assistantships and scholarships are available to qualified applicants. The Department of Biology offers doctoral instructional assistantships and teaching assistantships on a competitive basis to full-time students enrolled in the aquatic resources Ph.D. program. Detailed information on the department’s assistantship policy is included in the Department’s Graduate Guide. The office of The Graduate College can provide further information regarding scholarships.

Course Work

Degree Audit
Each Ph.D. student is issued a preliminary degree audit by The Graduate College that should be used to plan the student’s course of study. In the first term of enrollment, students should review the degree audit in consultation with their supervising professor and the program director.

With admission into the doctoral program, it is expected that students will pursue their course work and research activities in an efficient and timely manner. If it is determined that a student is not making adequate progress toward completion of the doctoral degree requirements, consultations will be undertaken between the student, their Ph.D. advisor, the program director, and the department graduate committee to develop a remediation plan, which may include revising a student’s program of study or research. Failure to successfully remedy documented deficiencies will result in termination of the student’s enrollment in the doctoral program at the discretion of the graduate committee. Students removed from the doctoral program in this manner may appeal to the dean of The Graduate College for reinstatement in the program.

Course Work Requirements
For students entering the program with a master’s degree, the Ph.D. in aquatic resources requires the completion of 21 hours of core courses and 40 hours of elective courses and dissertation (including a minimum of 15 hours of dissertation credit). For students entering the program with a bachelor’s degree, the Ph.D. in aquatic resources requires the completion of 28 hours of core courses and 63 hours of elective courses and dissertation (including a minimum of 15 hours of dissertation credit). The selection of core courses should be made in consultation with the student’s Ph.D. advisor and the program director. With approval of the program director, a core course beyond the minimum required hours can be counted as an elective course toward the total hours required for the degree.

Entering with a Master’s Degree

Core Courses
- BIO 7102 Seminar in Aquatic Resources (Taken twice) 2
- BIO 7303 Research (Taken three times) 9
- BIO 7405 or BIO 7406 Statistics and Experimental Design I 4
- BIO 7312 Government Policy and Aquatic Resources 3
- PHIL 7323 Environmental Ethics and Sustainable Aquatic Resources 3

Electives
Select 25 hours from the following:

<table>
<thead>
<tr>
<th>Course</th>
<th>Title</th>
<th>Hours</th>
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<tbody>
<tr>
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<td>Agriculture and Sustainable Aquatic Resources</td>
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<td>BIO 7114</td>
<td>Collaborative Research</td>
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<td>BIO 7120</td>
<td>Population Biology Seminar</td>
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<td>BIO 7214</td>
<td>Collaborative Research</td>
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<td>BIO 7308</td>
<td>History of Vegetation and Climate</td>
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<td>Collaborative Research</td>
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<td>BIO 7324</td>
<td>Natural History and Conservation of Large Mammals</td>
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<td>Wildlife and Recreation: Impact, Policy, and Management</td>
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<td>Integrated Waterbird Management</td>
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<td>Aquatic Resources Economics</td>
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<td>BIO 7350</td>
<td>Aquatic Resources Law</td>
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<tr>
<td>BIO 7353</td>
<td>Biogeography</td>
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<td>BIO 7355</td>
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<td>Course Code</td>
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<tr>
<td>BIO 7356</td>
<td>Pollution of Aquatic Ecosystems</td>
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<td>BIO 7360A</td>
<td>Industry and Sustainable Aquatic Resources</td>
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<td>BIO 7360B</td>
<td>Environmental Linkages and Sustainable Aquatic Resources</td>
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<td>BIO 7360C</td>
<td>Role of State and Federal Courts in Protection and Maintenance of Aquatic Resources</td>
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<td>BIO 7360D</td>
<td>Evolutionary Ecology</td>
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<td>BIO 7360E</td>
<td>Advances in Water Quality Investigations</td>
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<td>BIO 7360F</td>
<td>Approaches to Aquatic Resource Modeling</td>
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<td>BIO 7360G</td>
<td>Molecular Techniques in Microbial Ecology</td>
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<tr>
<td>BIO 7360H</td>
<td>Parasites and Diseases of Fishes and Other Aquatic Animals</td>
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<tr>
<td>BIO 7360I</td>
<td>Bayesian Statistics for Biology</td>
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<tr>
<td>BIO 7360K</td>
<td>Evolution</td>
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<tr>
<td>BIO 7360L</td>
<td>Landscape and Biogeography of Texas</td>
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<td>BIO 7360M</td>
<td>Wetland Ecology</td>
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<td>BIO 7360N</td>
<td>Behavioral Ecology</td>
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<td>BIO 7360P</td>
<td>Regulation of Plant Growth and Development</td>
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<td>BIO 7360Q</td>
<td>Spatial Ecology of Animals</td>
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<td>BIO 7360R</td>
<td>Community and Ecosystem Ecology</td>
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<td>BIO 7360S</td>
<td>Soil Biology</td>
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<td>BIO 7360T</td>
<td>Karst Hydrogeology and Geomorphology</td>
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<tr>
<td>BIO 7360U</td>
<td>Sustainability in a Changing World</td>
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<td>BIO 7360V</td>
<td>Techniques in Aquatic Biology</td>
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<td>BIO 7366</td>
<td>Integrated Water Resources Management</td>
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<td>BIO 7367</td>
<td>Behavioral Ecology</td>
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<td>BIO 7407</td>
<td>Instrumentation for Water Quality Analysis</td>
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<td>BIO 7408</td>
<td>Fish Ecology and Conservation</td>
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<td>BIO 7410</td>
<td>Aquatic Microbial Ecology</td>
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<td>BIO 7412</td>
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<td>BIO 7421</td>
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<td>Wetlands Ecology</td>
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<td>BIO 7424</td>
<td>Phycology</td>
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<td>BIO 7426</td>
<td>Ecology and Management of Aquatic Macrophytes</td>
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<td>BIO 7427</td>
<td>Principles of Population Biology I</td>
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<td>BIO 7428</td>
<td>Principles of Population Biology II</td>
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<td>BIO 7433</td>
<td>Population Genetics</td>
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<td>BIO 7434</td>
<td>Herpetology</td>
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<td>BIO 7440</td>
<td>Aquatic Toxicology</td>
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<td>BIO 7447</td>
<td>Microbial Physiology and Genetics</td>
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<td>BIO 7469</td>
<td>Introduction to Ecological Modeling</td>
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<td>BIO 7470</td>
<td>Limnology</td>
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<td>BIO 7471</td>
<td>Reservoir Ecology</td>
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<td>BIO 7475</td>
<td>Restoration of Polluted Aquatic Resources</td>
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<tr>
<td>CHEM 7330</td>
<td>Environmental Chemistry</td>
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<td>ENG 7314</td>
<td>Specializations in Professional and Technical Communication Topics</td>
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<tr>
<td>GEO 7316</td>
<td>Remote Sensing and the Environment</td>
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<tr>
<td>GEO 7318</td>
<td>GIS and Geospatial Environment</td>
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**Dissertation**

Select a minimum of 15 hours from the following:  

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<tr>
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<th>Course Title</th>
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<tbody>
<tr>
<td>BIO 7199A</td>
<td>Dissertation</td>
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</table>

**Total Hours**: 61

**Entering with a Bachelor's Degree**

**Core Courses**

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<tr>
<td>BIO 7102</td>
<td>Seminar in Aquatic Resources (Taken twice)</td>
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<tr>
<td>BIO 7303</td>
<td>Research (Taken three times)</td>
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<tr>
<td>BIO 7405</td>
<td>Statistics and Experimental Design I</td>
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<tr>
<td>or BIO 7406</td>
<td>Statistics and Experimental Design II</td>
</tr>
<tr>
<td>BIO 7312</td>
<td>Government Policy and Aquatic Resources</td>
</tr>
<tr>
<td>BIO 7310</td>
<td>Global Aquatic Resources</td>
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<tr>
<td>PHI 7323</td>
<td>Environmental Ethics and Sustainable Aquatic Resources</td>
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</table>

**Elective Courses**

Select 48 hours from the following:  

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<td>Advances in Water Quality Investigations</td>
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<td>BIO 7360F</td>
<td>Approaches to Aquatic Resource Modeling</td>
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<td>GEO 7334</td>
<td>Geographic Aspects of Water</td>
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<td>GEO 7417</td>
<td>Geographic Information Systems</td>
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<td>HR 7375</td>
<td>Aquatic Health Ecology and Human Disease</td>
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<tr>
<td>POSI 7310</td>
<td>Resolution of Disputes Involving Aquatic Resources</td>
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Select a minimum of 15 hours from the following:  
- BIO 7199A  Dissertation  
- BIO 7299A  Dissertation  
- BIO 7399A  Dissertation  
- BIO 7599A  Dissertation  
- BIO 7699A  Dissertation  
- BIO 7999A  Dissertation  

Total Hours 91

### Advancement to Candidacy

#### Application for Advancement to Candidacy

Students can download the “Application for Advancement to Candidacy” from The Graduate College website or they can obtain a copy from the program director. The student should complete and sign the upper portion of the form and return it to the program director. When all requirements for admission to candidacy have been met (completion of core course work, submission of an approved dissertation proposal, and completion of the comprehensive examination), the program director will forward the Application for Advancement to Candidacy form to the dean of The Graduate College for review and approval.

#### Advancement to Candidacy Time Limit

- Students entering the doctoral program in aquatic resources with a master's degree and receiving departmental support are expected to take the Advancement to Candidacy Comprehensive Examination by the end of their second year in the program; students entering with a bachelor’s degree and receiving departmental support are expected to take the examination by the end of their third year. All students are expected to have passed the Advancement to Candidacy Comprehensive Examination within one calendar year of completing the core course work required by their degree audit. This expectation holds for both full-time and part-time students. Requests for a time extension must be submitted to the program director by the student’s Ph.D. advisor and approved by the graduate committee.

- No credit will be applied toward a student’s doctoral degree for course work completed more than four years before the date on which the student is admitted to candidacy. This time limit applies to course credit earned at Texas State, as well as course credit transferred to Texas State from other accredited institutions.

#### Grade-Point Requirements for Advancement to Candidacy

A minimum GPA of 3.0 on all course work undertaken as a graduate student in the aquatic resources doctoral program is required for admission to candidacy. No grade below “B” on any graduate course work may apply toward a Ph.D. degree in aquatic resources at Texas State.

Incomplete grades must be cleared through the office of The Graduate College at least ten days before approval for advancement to candidacy will be granted.

#### Advancement to Candidacy Comprehensive Examination

Students in the aquatic resources doctoral program are required to pass a comprehensive examination that will assess the student’s preparedness to carry out the proposed plan of dissertation research. Students taking the Advancement to Candidacy Comprehensive Examination must have completed all required core and background...
courses as prescribed in their degree audit. Detailed information on the examination procedure can be found in the Department of Biology’s Guide to Graduate Study or obtained from the program director.

The Advancement to Candidacy Comprehensive Examination will consist of both written and oral components. The written component of the examination will consist of questions submitted by the dissertation committee members and will be administered by the program director. Successfully passing the written component of the examination requires positive votes from all members of the dissertation committee.

Successful completion of the written portion of the candidacy exam must be followed within thirty days by an oral presentation and defense of the dissertation proposal. The oral component of the Advancement to Candidacy Comprehensive Examination will entail a public seminar presentation of the student’s dissertation proposal, followed immediately by a closed defense of the proposal attended only by the student and his or her dissertation committee. Both the presentation and defense must take place on the same day. Successfully passing the oral examination requires positive votes from all members of the student’s dissertation committee.

Dissertation Proposal
A dissertation proposal prepared by the student and approved by the student’s Ph.D. advisor and all other members of the dissertation committee is a requirement for advancement to candidacy status. The proposal must outline the substance and scope of the dissertation research, present the methodology to be used, and survey the relevant literature. The student’s Ph.D. advisor and other dissertation committee members must indicate approval of the dissertation proposal on the “Dissertation Proposal form” which can be downloaded from The Graduate College website or obtained from the program director. A final copy of the dissertation proposal, accompanied by the signed approval form, must be turned in to the program director, who will forward it to the dean of The Graduate College for review and final approval.

Recommendation for Advancement to Candidacy
The dissertation committee recommends the applicant for advancement to candidacy after completing the “Doctoral Comprehensive Examination Report” which can be downloaded from The Graduate College website or obtained from the program director. The results of the Advancement to Candidacy Comprehensive Examination and the Application for Advancement to Candidacy must be filed in the office of The Graduate College before the dean of The Graduate College gives final approval to candidacy. The program director is responsible for submitting these forms to the office of The Graduate College.

Dissertation Research and Writing
All doctoral students are required to complete a dissertation. The dissertation must represent an original contribution to scholarship based on independent investigation. Preparation of the dissertation should follow the guidelines in the current edition of the CBE (Council of Biology Editors) Style Manual or in an appropriate professional journal in the designated field, as deemed acceptable by the dissertation committee.

Dissertation Enrollment Requirements
After being admitted to candidacy, students must be continuously enrolled for dissertation hours each term until the defense of their dissertation. If a student is receiving supervision on the dissertation during the summer or the student is graduating during the summer, the student must be enrolled in dissertation hours for the summer. All candidates for graduation must be enrolled in dissertation hours during the term in which the degree is to be conferred. Students must complete a minimum of 15 semester hours of dissertation research and writing credit.

Dissertation Time Limit
Students are expected to complete the dissertation within three years of advancement to candidacy. Successful completion of the dissertation defense must occur within ten years of the student’s entry into the Ph.D. program. Any exceptions to these time limits require the approval of the program director and the dean of The Graduate College. The dissertation committee and the program director will review each student annually to ascertain his or her progress in pursuing the degree, and will consult with the student’s Ph.D. advisor and dissertation committee on this matter as appropriate.

Dissertation Committee
The dissertation committee is responsible for the Advancement to Candidacy Comprehensive Examination and will oversee the research progress of a doctoral student and the writing of the student’s dissertation. The committee will consist of at least five members, including the student’s Ph.D. advisor, two other Texas State biology doctoral faculty members, and two external doctoral-level members, at least one of whom must be from an institution other than Texas State. The student’s Ph.D. advisor will chair the committee and will normally be from the major department. The student, program director, department chair, and the dean of The Graduate College will approve the composition of the dissertation committee. The student is responsible for obtaining committee members’ signatures on the “Dissertation/Research Advisor Assignment form” and the “Dissertation Committee Request form,” which can be downloaded from The Graduate College website.

Committee Changes
Any changes to the dissertation committee must be submitted for approval to the dissertation committee chair, the doctoral program director, the department chair, and the dean of The Graduate College. Changes must be submitted no less than sixty days before the dissertation defense. The “Dissertation Advisor/Committee Member Change Request form” may be downloaded from The Graduate College website.

Dissertation Defense
The dissertation defense will consist of two parts. The first part is an oral presentation of the dissertation research as a public seminar that should be given as part of the department’s weekly seminar series. The second part of the defense is restricted to the student’s dissertation committee and will entail an oral examination over the dissertation research.

The oral examination over the dissertation research may not be scheduled until all other academic and program requirements have been fulfilled. A complete draft of the dissertation must be given to the members of the dissertation committee at least 65 days before the date of commencement during the semester in which the student intends to graduate. After committee members have reviewed the draft with the student and provided comments, the student, in consultation with the Ph.D. advisor, will incorporate the recommended changes into a second draft of the dissertation. When each committee member is satisfied that the draft dissertation is defendable, the oral examination may be scheduled. The full committee, including all external members, must be present. Approval of the dissertation requires positive votes
from all members of the dissertation committee. At the conclusion of the defense, a "Dissertation Defense Report form" — which can be downloaded from The Graduate College website — must be completed, signed by all committee members, and submitted to the program director, who will forward it to the dean of The Graduate College for review and final approval. Specific information on the examination procedure can be found in the Department of Biology's Guide to Graduate Study or obtained from the program director.

Approval and Submission of the Dissertation

Following approval and signing of the dissertation by the members of the dissertation committee and submission of the "Dissertation Defense Report form", the student must submit one copy of the dissertation and the signed "Thesis/Dissertation Committee Approval" form to The Graduate College. Specific guidelines for approval and submission of the dissertation can be obtained from The Graduate College.

Fee Reduction

A master's or doctoral degree candidate for graduation may be eligible for a one-time fee reduction under V.T.C.A. Education Code, Section 54.054. Please refer to the section titled Fee Reduction in the Additional Fees and Expenses chapter of this catalog for more information.

Doctoral courses in Biology (and other related departments): AG (p. 5), BIO (p. 5), CHEM (p. 14), ENG (p. 14), GEO (p. 21), HR (p. 21), PHI (p. 21), POSI (p. 21)

Courses Offered

Agriculture (AG)

AG 7310. Agriculture and Sustainable Aquatic Resources.
Study of the impacts of agricultural on aquatic resources, including agricultural water requirements for various types of crops and soils, impacts of agricultural chemicals on aquatic ecosystems, efficiency of alternative irrigation practices, and means for altering or mitigating current practices that can adversely affect aquatic resources. Must be enrolled in all AG courses.

3 Credit Hours. 3 Lecture Contact Hours. 0 Lab Contact Hours.
Grade Mode: Standard Letter
about Agriculture and Sustainable Aquatic Resources

Biology (BIO)

BIO 7100. Professional Development.
This course is seminar-based and covers topics related to teaching, research, and employment responsibilities. Completion of the course is required as a condition of employment for graduate assistants. This course does not earn graduate degree credit. Repeatable with different emphasis. Graded on a credit (CR), no-credit (F) basis.

1 Credit Hour. 1 Lecture Contact Hour. 0 Lab Contact Hours.
Course Attribute(s): Leveling/Assistantships
Grade Mode: Leveling/Assistantships
about Professional Development

BIO 7102. Seminar in Aquatic Resources.
Interactive discussion of timely issues and problems, designed to introduce students to the range of scientific, socioeconomic and policy issues likely to be encountered within the field of aquatic resources. All students seeking a doctoral degree in Aquatic Resources must enroll in BIO 7102 at least twice.

1 Credit Hour. 1 Lecture Contact Hour. 0 Lab Contact Hours.
Course Attribute(s): Exclude from 3-peat Processing
Grade Mode: Standard Letter
about Seminar in Aquatic Resources

BIO 7103A. Ecology and Society.
Interactive discussion on relationships between society and the life-supporting ecosystems on which humans depend. Topics include roles of natural systems in social systems; effects of social, economic and political institutions on ecological systems and services; and the means by which humans develop and sustain desired ecological and social states.

1 Credit Hour. 1 Lecture Contact Hour. 0 Lab Contact Hours.
Course Attribute(s): Topics
Grade Mode: Standard Letter
about Ecology and Society

BIO 7103B. Aquaculture.
The course comprises a survey of aquaculture production throughout the world. It also examines and discusses the impacts of aquaculture on nutrition, fisheries and the economy.

1 Credit Hour. 1 Lecture Contact Hour. 0 Lab Contact Hours.
Course Attribute(s): Topics
Grade Mode: Standard Letter
about Aquaculture

BIO 7103C. Aquatic Toxicology.
An introduction to the principles, concepts and mechanisms of aquatic toxicology, and the implications of this issue regarding environmental and ecosystem quality and sustainability.

1 Credit Hour. 1 Lecture Contact Hour. 0 Lab Contact Hours.
Course Attribute(s): Topics
Grade Mode: Standard Letter
about Aquatic Toxicology

BIO 7103D. Molecular Biology of the Cell.
Interactive discussion of current literature on molecular biology of the cell. The course is designed to discuss concepts and their applications and methodology associated with the structure and function of the cell at cellular and molecular level.

1 Credit Hour. 1 Lecture Contact Hour. 0 Lab Contact Hours.
Course Attribute(s): Topics
Grade Mode: Standard Letter
about Molecular Biology of the Cell
BIO 7103E. Contemporary Problems in Ecology.
This course is an interactive discussion of the theoretical foundations and empirical basis for controversial topics in ecology, designed to develop critical thinking skills, and the ability to evaluate and integrate the biological, chemical and physical factors that affect the structure, functions, and interactions characterizing communities and ecosystems. 

Grade Mode: Standard Letter
Course Attribute(s): Topics

BIO 7103F. Molecular Genetics of Plant Development.
The study of plant development is rapidly changing as plant genome projects discover a multitude of new genes, and their expression and interaction patterns are understood. This course is designed to discuss concepts in plant development, and developmental processes as pathways of gene regulatory activities.

Grade Mode: Standard Letter
Course Attribute(s): Topics

BIO 7103G. Ecohydrology.
A review of the concept of ecohydrology, its scientific foundation, and its ecological-hydrological linkages. Current topics in ecohydrology in the literature will be discussed, including manipulation of biota and hydrology interactions in a landscape, and the possibility of augmenting the resilience of ecosystems to anthropogenic changes.

Grade Mode: Standard Letter
Course Attribute(s): Topics

BIO 7103H. Integrated Waterbird Management.
This course focuses on the ecology and management of waterbirds, with an emphasis on the inland and coastal waterbirds of Texas. The basic ecology of waterbirds, waterbird management techniques, and waterbird habitat management will be discussed.

Grade Mode: Standard Letter
Course Attribute(s): Topics

BIO 7103I. Avian Ecology and Evolution.
This course is an interactive discussion of avian ecology and evolution, providing students with a critical examination of theories, hypotheses, and lab and field-based data that support or refute their hypotheses. This course also discusses peerreviewed literature that challenges some paradigms in avian ecology and evolution.

Grade Mode: Standard Letter

BIO 7114. Collaborative Research.
This course (concurrent enrollment allowed) allows Ph.D. level graduate students to initiate, conduct, and participate in collaborative research with graduate faculty of the Department of Biology that is in addition to research conducted under BIO 7303, BIO 7399A, or BIO 7699A. This course recognizes the collaborative nature of scientific investigation.

Grade Mode: Standard Letter
Course Attribute(s): Topics

This course facilitates exploration of current topics in population and conservation biology through reading and discussion of contemporary primary and secondary literature.

Grade Mode: Standard Letter
Course Attribute(s): Topics

BIO 7199A. Dissertation.
Original research and writing in Aquatic Resources, to be accomplished under direct supervision of the dissertation advisor. While conducting dissertation research and writing, students must be continuously enrolled each long semester. Graded on a credit (CR), non-credit (F) basis.

Grade Mode: Credit/No Credit

BIO 7214. Collaborative Research.
This course (concurrent enrollment allowed) allows Ph.D. level graduate students to initiate, conduct, and participate in collaborative research with graduate faculty of the Department of Biology that is in addition to research conducted under BIO 7303, BIO 7399A, or BIO 7699A. This course recognizes the collaborative nature of scientific investigation.

Grade Mode: Standard Letter
Course Attribute(s): Topics

BIO 7299A. Dissertation.
Original research and writing in Aquatic Resources, to be accomplished under direct supervision of the dissertation advisor. While conducting dissertation research and writing, students must be continuously enrolled each long semester. Graded on a credit (CR), non-credit (F) basis.

Grade Mode: Credit/No Credit

BIO 7302. Problems in Aquatic Resources.
Individual study on specific state, national, or international aquatic resources issues, under direct supervision of a doctoral or associate faculty member. Students may not enroll in BIO 7302 more than twice for doctoral credit without the approval of the Graduate Program Director.

Grade Mode: Standard Letter
Course Attribute(s): Topics

BIO 7399A. Dissertation.
Original research and writing in Aquatic Resources, to be accomplished under direct supervision of the dissertation advisor. While conducting dissertation research and writing, students must be continuously enrolled each long semester. Graded on a credit (CR), non-credit (F) basis.

Grade Mode: Credit/No Credit

BIO 7699A. Dissertation.
Original research and writing in Aquatic Resources, to be accomplished under direct supervision of the dissertation advisor. While conducting dissertation research and writing, students must be continuously enrolled each long semester. Graded on a credit (CR), non-credit (F) basis.

Grade Mode: Credit/No Credit

BIO 7103E. Contemporary Problems in Ecology.
This course is an interactive discussion of the theoretical foundations and empirical basis for controversial topics in ecology, designed to develop critical thinking skills, and the ability to evaluate and integrate the biological, chemical and physical factors that affect the structure, functions, and interactions characterizing communities and ecosystems.

Grade Mode: Standard Letter
Course Attribute(s): Topics

1 Credit Hour. 1 Lecture Contact Hour. 0 Lab Contact Hours.

BIO 7103F. Molecular Genetics of Plant Development.
The study of plant development is rapidly changing as plant genome projects discover a multitude of new genes, and their expression and interaction patterns are understood. This course is designed to discuss concepts in plant development, and developmental processes as pathways of gene regulatory activities.

Grade Mode: Standard Letter
Course Attribute(s): Topics

1 Credit Hour. 1 Lecture Contact Hour. 0 Lab Contact Hours.

BIO 7103G. Ecohydrology.
A review of the concept of ecohydrology, its scientific foundation, and its ecological-hydrological linkages. Current topics in ecohydrology in the literature will be discussed, including manipulation of biota and hydrology interactions in a landscape, and the possibility of augmenting the resilience of ecosystems to anthropogenic changes.

Grade Mode: Standard Letter
Course Attribute(s): Topics

1 Credit Hour. 1 Lecture Contact Hour. 0 Lab Contact Hours.

BIO 7103H. Integrated Waterbird Management.
This course focuses on the ecology and management of waterbirds, with an emphasis on the inland and coastal waterbirds of Texas. The basic ecology of waterbirds, waterbird management techniques, and waterbird habitat management will be discussed.

Grade Mode: Standard Letter
Course Attribute(s): Topics

1 Credit Hour. 1 Lecture Contact Hour. 0 Lab Contact Hours.

BIO 7103I. Avian Ecology and Evolution.
This course is an interactive discussion of avian ecology and evolution, providing students with a critical examination of theories, hypotheses, and lab and field-based data that support or refute their hypotheses. This course also discusses peerreviewed literature that challenges some paradigms in avian ecology and evolution.

Grade Mode: Standard Letter
Course Attribute(s): Topics

1 Credit Hour. 1 Lecture Contact Hour. 0 Lab Contact Hours.

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Doctor of Philosophy (Ph.D.), Major in Aquatic Resources
BIO 7303. Research. Research course for students who have not yet passed their Candidacy Exam, typically under direction of research-dissertation supervisor. Pre-candidacy students must enroll in course every semester until admission to Candidacy, although it may not be taken more than three times for doctoral credit without the approval of Graduate Program Director. about Research

3 Credit Hours. 3 Lecture Contact Hours. 3 Lab Contact Hours. Grade Mode: Standard Letter about Research

BIO 7308. History of Vegetation and Climate. An overview of past vegetation and its relationship to changing climate. Topics include principles of paleovegetation analysis, paleoclimatology, the rise of flowering plants, vegetation during the age of dinosaurs, the rise of the grasslands, and the Quaternary Ice Age. Prerequisites: Consent of instructor. about History of Vegetation and Climate

3 Credit Hours. 3 Lecture Contact Hours. 1 Lab Contact Hour. Grade Mode: Standard Letter about History of Vegetation and Climate

BIO 7310. Global Aquatic Resources. Introduction to global, national, and regional aquatic resource issues, including scientific, environmental policy and socioeconomic components and perspectives. Water quantity and quality issues and their root causes in different regions of the world are examined, with an emphasis on case studies. about Global Aquatic Resources

3 Credit Hours. 3 Lecture Contact Hours. 0 Lab Contact Hours. Grade Mode: Standard Letter about Global Aquatic Resources

BIO 7312. Government Policy and Aquatic Resources. Examination of aquatic resource issues in federal, state, or local governments, including examination of goals and relations of different governmental entities to each other. Relevant international treaties, and federal and state statutes in which these policies are embodied, are examined. about Government Policy and Aquatic Resources

3 Credit Hours. 3 Lecture Contact Hours. 0 Lab Contact Hours. Grade Mode: Standard Letter about Government Policy and Aquatic Resources

BIO 7314. Collaborative Research. This course (concurrent enrollment allowed) allows Ph.D. level graduate students to initiate, conduct, and participate in collaborative research with graduate faculty of the Department of Biology that is in addition to research conducted under BIO 7303, BIO 7399A, or BIO 7699A. This course recognizes the collaborative nature of scientific investigation. about Collaborative Research

3 Credit Hours. 3 Lecture Contact Hours. 3 Lab Contact Hours. Grade Mode: Standard Letter about Collaborative Research

BIO 7322. Scientific Method and Aquatic Resources. Analysis of the scientific method applied to ecological research, focusing on aquatic ecosystems. Topics include methods of reasoning and statistical inferences in research, strategies of scientific research in aquatic ecology, and scientific research as a social process. about Scientific Method and Aquatic Resources

3 Credit Hours. 3 Lecture Contact Hours. 0 Lab Contact Hours. Grade Mode: Standard Letter about Scientific Method and Aquatic Resources

BIO 7324. Natural History and Conservation of Large Mammals. This course will introduce students to advanced details of natural history, research, and conservation of large mammals. Topics considered will include natural history, range and population status (historic and current), importance to and interaction with humans, research design and analysis, and the development of conservation and management plans. about Natural History and Conservation of Large Mammals

3 Credit Hours. 3 Lecture Contact Hours. 0 Lab Contact Hours. Grade Mode: Standard Letter about Natural History and Conservation of Large Mammals

BIO 7325. Wildlife and Recreation: Impact, Policy, and Management. Students will be introduced to the impact human recreational activities have on wildlife habitats and populations. Management practices to enhance human-wildlife encounters or to minimize detrimental effects on wildlife populations will be presented. Prerequisite: BIO 4416. about Wildlife and Recreation: Impact, Policy, and Management

3 Credit Hours. 3 Lecture Contact Hours. 0 Lab Contact Hours. Grade Mode: Standard Letter about Wildlife and Recreation: Impact, Policy, and Management

BIO 7328. Integrated Waterbird Management. This course examines the principles and practical methodology of integrated waterbird conservation and management, including overview of waterbird ecology, techniques in monitoring and data collection related to population dynamics, and habitat parameters of waterbird species. Field trips may be required. about Integrated Waterbird Management

3 Credit Hours. 3 Lecture Contact Hours. 3 Lab Contact Hours. Course Attribute(s): Lab Required Grade Mode: Standard Letter about Integrated Waterbird Management

BIO 7336. Evolutionary Ecology. This course will use an evolutionary perspective to explore questions provided by natural selection and sexual selection through assessment of current theory and research related to topics such as competition, coevolution, and phenotypic plasticity. Students will achieve comprehension and familiarity with the field through discussions and writing. about Evolutionary Ecology

3 Credit Hours. 3 Lecture Contact Hours. 0 Lab Contact Hours. Grade Mode: Standard Letter about Evolutionary Ecology
BIO 7346. Conservation Biology.
Examination of the alteration of habitats and associated biological changes threatening the continued existence of species and basic ecosystems. Topics include conservation ethics, working paradigms, levels and loss of global biodiversity, conservation at population and ecosystem levels, restoration ecology, endangered species biology and conservation laws. Recent Advances are stressed.

Grade Mode: Standard Letter

3 Credit Hours. 3 Lecture Contact Hours. 0 Lab Contact Hours.

about Conservation Biology

BIO 7348. Aquatic Resources Economics.
Examination of economic and related social issues for facilitation of sustainable aquatic resources for competing beneficial human uses and ecosystem maintenance, including valuation of aquatic ecosystem services. Prerequisite: BIO 7312 or consent of instructor.

Grade Mode: Standard Letter

3 Credit Hours. 3 Lecture Contact Hours. 0 Lab Contact Hours.

about Aquatic Resources Economics

BIO 7350. Aquatic Resources Law.
Examination of treaties, state and federal laws, and regional and local regulations, affecting freshwater and coastal aquatic resources. The focus is on aquatic ecosystems, water quantity and quality and environmental conditions, including the availability, storage, use, and protection of aquatic resources. Prerequisite: BIO 7312 or consent of instructor.

Grade Mode: Standard Letter

about Aquatic Resources Law

3 Credit Hours. 3 Lecture Contact Hours. 0 Lab Contact Hours.

BIO 7353. Biogeography.
Examines historical and ecological explanations of the geographic distribution of organisms including the role of geologic, climatic, and biologic changes. Emphasizes the historical and philosophical development of the science and modern methods of analysis. Prerequisites: Undergraduate evolution and ecology courses, or consent of instructor.

Grade Mode: Standard Letter

about Biogeography

3 Credit Hours. 3 Lecture Contact Hours. 1 Lab Contact Hour.

BIO 7355. Plant-Water Relations.
Examination of the physiology and ecology of water use in higher plants, including the uptake, utilization, and movement of water, transpiration and adaptation to variable water availability including drought, and the ecological role of water in structuring plant communities. Prerequisite: BIO 3465 or equivalent, or consent of instructor.

Grade Mode: Standard Letter

about Plant-Water Relations

3 Credit Hours. 3 Lecture Contact Hours. 0 Lab Contact Hours.

BIO 7356. Pollution of Aquatic Ecosystems.
Overview of the water quality degradation of aquatic ecosystems (rivers, lakes, wetlands, groundwater aquifers) and their living resources from point and nonpoint pollutant sources. Topics will include aquatic ecosystem pollution and impacts attributable to nutrients, heavy metals, organic chemicals, sediment, salinization, and acid rain. Field trips may be required.

Grade Mode: Standard Letter

3 Credit Hours. 3 Lecture Contact Hours. 0 Lab Contact Hours.

BIO 7360A. Industry and Sustainable Aquatic Resources.
Examination of industrial water needs and uses, the types and quantities of water pollutants produced by different industries, problems faced by industry regarding process water for different manufacturing activities, and the possibilities for industry to contribute to the goal of sustainable aquatic resources.

Grade Mode: Standard Letter

3 Credit Hours. 3 Lecture Contact Hours. 0 Lab Contact Hours.

BIO 7360B. Environmental Linkages and Sustainable Aquatic Resources.
Introduction to the environmental relationships between humans and other living beings and the ecological systems in which they exist. Emphasis will be on the potential for individual environmental problems to have serious impacts on other environmental components, as well as the nature of these impacts.

Grade Mode: Standard Letter

3 Credit Hours. 3 Lecture Contact Hours. 0 Lab Contact Hours.

BIO 7360C. Role of State and Federal Courts in Protection and Maintenance of Aquatic Resources.
Examination of current or emerging state, national and international aquatic resources issues, including root causes and their human and ecosystem interactions. The course may be repeated for credit, depending on the topic. No more than six hours can be counted for doctoral credit without the approval of the Program Director.

Grade Mode: Standard Letter

3 Credit Hours. 3 Lecture Contact Hours. 0 Lab Contact Hours.

BIO 7360D. Role of State and Federal Courts in Protection and Maintenance of Aquatic Resources.
Examination of current or emerging state, national and international aquatic resources issues, including root causes and their human and ecosystem interactions. The course may be repeated for credit, depending on the topic. No more than six hours can be counted for doctoral credit without the approval of the Program Director.

Grade Mode: Standard Letter

3 Credit Hours. 3 Lecture Contact Hours. 0 Lab Contact Hours.
BIO 7360D. Evolutionary Ecology.
Examination of current or emerging state, national and international aquatic resources issues, including root causes and their human and ecosystem interactions. The course may be repeated for credit, depending on the topic. No more than six hours can be counted for doctoral credit without the approval of the Program Director.

3 Credit Hours. 3 Lecture Contact Hours. 0 Lab Contact Hours.
Course Attribute(s): Topics
Grade Mode: Standard Letter
about Evolutionary Ecology

BIO 7360E. Advances in Water Quality Investigations.
Examination of current or emerging state, national and international aquatic resources issues, including root causes and their human and ecosystem interactions. The course may be repeated for credit, depending on the topic. No more than six hours can be counted for doctoral credit without the approval of the Program Director.

3 Credit Hours. 3 Lecture Contact Hours. 0 Lab Contact Hours.
Course Attribute(s): Topics
Grade Mode: Standard Letter
about Advances in Water Quality Investigations

BIO 7360F. Approaches to Aquatic Resource Modeling.
Examination of current or emerging state, national and international aquatic resources issues, including root causes and their human and ecosystem interactions. The course may be repeated for credit, depending on the topic. No more than six hours can be counted for doctoral credit without the approval of the Program Director.

3 Credit Hours. 3 Lecture Contact Hours. 0 Lab Contact Hours.
Course Attribute(s): Topics
Grade Mode: Standard Letter
about Approaches to Aquatic Resource Modeling

BIO 7360G. Molecular Techniques in Microbial Ecology.
Lectures on molecular techniques used to analyze structure and function of uncultured microbial communities in the environment with selected examples of applications. Prerequisites: None.

3 Credit Hours. 3 Lecture Contact Hours. 0 Lab Contact Hours.
Course Attribute(s): Topics
Grade Mode: Standard Letter
about Molecular Techniques in Microbial Ecology

BIO 7360H. Parasites and Diseases fo Fishes and Other Aquatic Animals.
Examination of current or emerging state, national and international aquatic resources issues, including root causes and their human and ecosystem interactions. Prerequisites: Ichthyology.

3 Credit Hours. 3 Lecture Contact Hours. 3 Lab Contact Hours.
Course Attribute(s): Lab Required|Topics
Grade Mode: Standard Letter
about Parasites and Diseases fo Fishes and Other Aquatic Animals

BIO 7360I. Bayesian Statistics for Biology.
This course examines the theory and mathematical foundations of Bayesian statistics and provides instruction and experience conducting Bayesian analyses using computer-based procedures. The course emphasizes practical applications for Bayesian statistical procedures for problems in biological sciences.

3 Credit Hours. 3 Lecture Contact Hours. 0 Lab Contact Hours.
Course Attribute(s): Topics
Grade Mode: Standard Letter
about Bayesian Statistics for Biology

BIO 7360K. Evolution.
Examination of current or emerging state, national and international aquatic resources issues, including root causes and their human and ecosystem interactions. The course may be repeated for credit, depending on the topic. No more than six hours can be counted for doctoral credit without the approval of the Program Director.

3 Credit Hours. 3 Lecture Contact Hours. 0 Lab Contact Hours.
Course Attribute(s): Topics
Grade Mode: Standard Letter
about Evolution

BIO 7360L. Landscape and Biogeography of Texas.
Examination of current or emerging state, national and international aquatic resources issues, including root causes and their human and ecosystem interactions. The course may be repeated for credit, depending on the topic. No more than six hours can be counted for doctoral credit without the approval of the Program Director.

3 Credit Hours. 3 Lecture Contact Hours. 0 Lab Contact Hours.
Course Attribute(s): Topics
Grade Mode: Standard Letter
about Landscape and Biogeography of Texas

BIO 7360M. Wetland Ecology.
Examination of current or emerging state, national and international aquatic resources issues, including root causes and their human and ecosystem interactions. The course may be repeated for credit, depending on the topic. No more than six hours can be counted for doctoral credit without the approval of the Program Director.

3 Credit Hours. 3 Lecture Contact Hours. 0 Lab Contact Hours.
Course Attribute(s): Topics
Grade Mode: Standard Letter
about Wetland Ecology

BIO 7360N. Behavioral Ecology.
Examination of evolutionary implications of behavioral interactions through the assessment of current theory and research related to cooperation and conflict, mating and parental conflict and sexual selection. Class will consist of lectures, discussions of recent primary literature, and scientific writing.

3 Credit Hours. 3 Lecture Contact Hours. 0 Lab Contact Hours.
Course Attribute(s): Topics
Grade Mode: Standard Letter
about Behavioral Ecology
BIO 7360P. Regulation of Plant Growth and Development.
Examination of current or emerging state, national and international aquatic resources issues, including root causes and their human and ecosystem interactions. The course may be repeated for credit, depending on the topic. No more than six hours can be counted for doctoral credit without the approval of the Program Director.

Grade Mode: Standard Letter
Course Attribute(s): Topics
3 Credit Hours. 3 Lecture Contact Hours. 0 Lab Contact Hours.

about Regulation of Plant Growth and Development

BIO 7360Q. Spatial Ecology of Animals.
Examination of current or emerging state, national and international aquatic resources issues, including root causes and their human and ecosystem interactions. The course may be repeated for credit, depending on the topic. No more than six hours can be counted for doctoral credit without the approval of the Program Director.

Grade Mode: Standard Letter
Course Attribute(s): Topics
3 Credit Hours. 3 Lecture Contact Hours. 0 Lab Contact Hours.

about Spatial Ecology of Animals

BIO 7360R. Community and Ecosystem Ecology.
Examination of current or emerging state, national and international aquatic resources issues, including root causes and their human and ecosystem interactions. The course may be repeated for credit, depending on the topic. No more than six hours can be counted for doctoral credit without the approval of the Program Director.

Grade Mode: Standard Letter
Course Attribute(s): Topics
3 Credit Hours. 3 Lecture Contact Hours. 0 Lab Contact Hours.

about Community and Ecosystem Ecology

BIO 7360S. Soil Biology.
An introduction to the biology of soil systems, including the roles of biota in forming and maintaining soils, and the interactions between biotic and abiotic components in soils.

Grade Mode: Standard Letter
Course Attribute(s): Topics
3 Credit Hours. 3 Lecture Contact Hours. 0 Lab Contact Hours.

about Soil Biology

BIO 7360T. Karst Hydrogeology and Geomorphology.
An introduction to, and advanced understanding of, karst hydrogeology, geology, and geomorphology, with emphasis on field and theoretical applications of this information to the study of karst systems, and recognition and understanding of karst landforms at the surface and their relationships with subsurface processes. Pre-requisite: Graduate status and instructor's approval.

Grade Mode: Standard Letter
Course Attribute(s): Topics
3 Credit Hours. 3 Lecture Contact Hours. 0 Lab Contact Hours.

about Karst Hydrogeology and Geomorphology

BIO 7360U. Sustainability in a Changing World.
Understanding the ecological-social interface, including policies, product development and actions towards sustainability, with emphasis on integrating and implementing theories and methods across disciplines, and improving the knowledge and experience base for public policy and decision-making regarding human-environment linkages within the context of sustainable development. Prerequisite: Instructor approval.

Grade Mode: Standard Letter
Course Attribute(s): Topics
3 Credit Hours. 3 Lecture Contact Hours. 0 Lab Contact Hours.

about Sustainability in a Changing World

BIO 7360V. Techniques in Aquatic Biology.
The course will provide hands on experience with a suite of physical, chemical, and biological sampling techniques and gear used in applied river studies. Students will be exposed to the fundamentals of data quality objectives, accuracy, precision, detection limits, data visualization, exploratory analysis, univariate and multivariate statistics.

Grade Mode: Standard Letter
Course Attribute(s): Topics
3 Credit Hours. 3 Lecture Contact Hours. 0 Lab Contact Hours.

about Techniques in Aquatic Biology

BIO 7360W. Mycology.
This course provides an introduction to the organisms in the Kingdom Fungi and to fungus-like organisms, their ecology and evolution, and their role in industry and disease. Special emphasis will be placed on morphology, culturing, and using laboratory techniques for identification.

Grade Mode: Standard Letter
Course Attribute(s): Exclude from 3-peat ProcessingTopics
3 Credit Hours. 3 Lecture Contact Hours. 0 Lab Contact Hours.

about Mycology

BIO 7360X. Communicating Science.
This course explores how to successfully disseminate science through visualizations, oral presentations, and written works to multiple audiences. Special emphasis will be placed on communicating with the general public, media and granting agencies.

Grade Mode: Standard Letter
Course Attribute(s): Exclude from 3-peat ProcessingTopics
3 Credit Hours. 3 Lecture Contact Hours. 0 Lab Contact Hours.

about Communicating Science

BIO 7360Y. Applied Bioinformatics.
This course provides an introduction to scripting and other computational techniques used for visualizing and analyzing large biological datasets. Computational techniques include sequence and structural alignment, data mining, phylogenetic tree construction, and data clustering using UNIX, Python, and R. Students will gain a solid foundation in broadly applicable bioinformatics skills.

Grade Mode: Standard Letter
Course Attribute(s): Topics
3 Credit Hours. 3 Lecture Contact Hours. 0 Lab Contact Hours.

about Applied Bioinformatics
Examination of government regulations regarding environmental impact, content of environmental impact statements, procedure for impact studies, application of ecological principles to impact studies, and the review process for environmental impact statements, focusing on aquatic resources.
about Environmental Impact Analysis
3 Credit Hours. 3 Lecture Contact Hours. 0 Lab Contact Hours.
Grade Mode: Standard Letter
about Environmental Impact Analysis

BIO 7366. Integrated Water Resources Management.
Study of principles for integrated management of aquatic ecosystems, including drainage basin, regional, and transboundary dimensions. Other global issues (climate change, biodiversity, etc.) also are discussed as components of integrative approach for multi-functional programs for sustainable use of aquatic ecosystems. Prerequisites: BIO 7310 and BIO 7412 or consent of instructor.
about Integrated Water Resources Management
3 Credit Hours. 3 Lecture Contact Hours. 0 Lab Contact Hours.
Grade Mode: Standard Letter
about Integrated Water Resources Management

Examination of the evolutionary implications of behavioral interactions through the assessment of current theory and research related to social behavior, sexual selection and sexual conflict, and mechanisms of behavior. Students will achieve comprehension and familiarity with the historical development of the field of behavioral ecology through discussions and writing.
about Behavioral Ecology
3 Credit Hours. 3 Lecture Contact Hours. 0 Lab Contact Hours.
Grade Mode: Standard Letter
about Behavioral Ecology

BIO 7399A. Dissertation.
Original research and writing in Aquatic Resources, to be accomplished under direct supervision of the dissertation advisor. While conducting dissertation research and writing, students must be continuously enrolled each semester (including summer) for at least three dissertation hours. Graded on a credit (CR), progress (PR), no–credit (F) basis.
about Dissertation
3 Credit Hours. 3 Lecture Contact Hours. 5 Lab Contact Hours.
Grade Mode: Credit/No Credit
about Dissertation

BIO 7401. Assessment Techniques for Aquatic Resources.
The rationale for designing and implementing monitoring and sampling programs for aquatic resources is examined. General field and laboratory methods for assessing water quantity, water quality and the status of aquatic ecosystems and their living resources, will be introduced. Field trips will be required.
about Assessment Techniques for Aquatic Resources
4 Credit Hours. 3 Lecture Contact Hours. 3 Lab Contact Hours.
Course Attribute(s): Lab Required
Grade Mode: Standard Letter
about Assessment Techniques for Aquatic Resources

BIO 7402. Molecular Field Techniques.
The application of molecular tools for identifying, quantifying, and interpreting biological diversity assessments in aquatic systems. The course focuses on micro organismal identification and vertebrate model systems.
about Molecular Field Techniques
4 Credit Hours. 2 Lecture Contact Hours. 3 Lab Contact Hours.
Course Attribute(s): Lab Required
Grade Mode: Standard Letter
about Molecular Field Techniques

BIO 7405. Statistics and Experimental Design I.
Introduction to inferential statistics, including exploratory and confirmatory data analysis, estimation and hypothesis testing, analysis of variance and regression, and non-parametric techniques, as applied to aquatic resource issues. Computer applications emphasized.
about Statistics and Experimental Design I
4 Credit Hours. 3 Lecture Contact Hours. 3 Lab Contact Hours.
Course Attribute(s): Lab Required
Grade Mode: Standard Letter
about Statistics and Experimental Design I

BIO 7406. Statistics and Experimental Design II.
Introduction to the principles of experimental design, including randomization, replication, sample-size determination, completely randomized and randomized block design, factorial design, repeated measure design, and analysis of variance and covariance, as applied to aquatic resource issues. Computer applications emphasized.
Prerequisite: BIO 7405 or consent of instructor.
about Statistics and Experimental Design II
4 Credit Hours. 3 Lecture Contact Hours. 3 Lab Contact Hours.
Course Attribute(s): Lab Required
Grade Mode: Standard Letter
about Statistics and Experimental Design II

BIO 7407. Instrumentation for Water Quality Analysis.
An introduction to the theory and application of laboratory and field instrumentation and techniques for analysis of water quality. Prerequisite: CHEM 3410 or consent of instructor.
about Instrumentation for Water Quality Analysis
4 Credit Hours. 3 Lecture Contact Hours. 3 Lab Contact Hours.
Course Attribute(s): Lab Required
Grade Mode: Standard Letter
about Instrumentation for Water Quality Analysis

BIO 7408. Fish Ecology and Conservation.
Examination of the linkages and interactions between fish assemblages and communities and their population ecology. Issues related to flowing and pooled water systems and fisheries conservation also are discussed. Field trips may be required.
about Fish Ecology and Conservation
4 Credit Hours. 3 Lecture Contact Hours. 3 Lab Contact Hours.
Course Attribute(s): Lab Required
Grade Mode: Standard Letter
about Fish Ecology and Conservation
BIO 7410. Aquatic Microbial Ecology.  
Examination of microbial organisms, communities, and interactions affecting the form, structure, and functional aspects of aquatic ecosystems. Field trips may be required. Prerequisite: BIO 2400. BIO 3440 (Microbiology) or consent of instructor.  
4 Credit Hours. 3 Lecture Contact Hours. 3 Lab Contact Hours.  
Course Attribute(s): Lab Required  
Grade Mode: Standard Letter  
about Aquatic Microbial Ecology

BIO 7412. Environmental Hydrology.  
Overview of the properties, distribution, and movement of water over and under the land surface and its relation to sustainable aquatic ecosystems, including quantitative methods to assess cumulative impacts of human activities on such systems. Field trips may be required. Knowledge of calculus recommended.  
4 Credit Hours. 3 Lecture Contact Hours. 3 Lab Contact Hours.  
Course Attribute(s): Lab Required  
Grade Mode: Standard Letter  
about Environmental Hydrology

BIO 7415. Ichthyology.  
An introduction to the morphology, taxonomy, natural history, and evolution of fishes. Field trips will be made to collect specimens, and laboratory periods will be devoted to morphological and systematic analyses. Prerequisite: Biology undergraduate zoology course or consent of instructor.  
4 Credit Hours. 3 Lecture Contact Hours. 3 Lab Contact Hours.  
Course Attribute(s): Lab Required  
Grade Mode: Standard Letter  
about Ichthyology

Study of ecological theories, concepts, and processes occurring at the population, community, and ecosystem levels of organization in running water. Laboratory includes sampling methods, descriptive and comparative studies, experiments, and critical discussion of literature. Field trips may be required.  
4 Credit Hours. 3 Lecture Contact Hours. 3 Lab Contact Hours.  
Course Attribute(s): Lab Required  
Grade Mode: Standard Letter  
about Stream Ecology

BIO 7421. Landscape Dynamics.  
Study of processes influencing energy and material flows, interactions and cycling in aquatic ecosystems, including system and spatial analysis of landscapes, aquatic ecosystems, land use characteristics, and associated human impacts. Field trips may be required. Knowledge of calculus recommended. Prerequisite: BIO 7412 or consent of instructor.  
4 Credit Hours. 3 Lecture Contact Hours. 3 Lab Contact Hours.  
Course Attribute(s): Lab Required  
Grade Mode: Standard Letter  
about Landscape Dynamics

BIO 7422. Wetlands Ecology.  
Study of the characteristics, classification, conservation and management of marshes and other periodically-inundated ecosystems, emphasizing the interactions of physical, chemical and biological factors. Field trips may be required. Prerequisite: BIO 4416 or consent of instructor.  
4 Credit Hours. 3 Lecture Contact Hours. 3 Lab Contact Hours.  
Course Attribute(s): Lab Required  
Grade Mode: Standard Letter  
about Wetlands Ecology

BIO 7424. Phycology.  
Examination of algae (phytoplankton, periphyton) and their structure, taxonomy, ecology and distribution.  
4 Credit Hours. 3 Lecture Contact Hours. 3 Lab Contact Hours.  
Course Attribute(s): Lab Required  
Grade Mode: Standard Letter  
about Phycology

BIO 7426. Ecology and Management of Aquatic Macrophytes.  
Examination of aquatic macrophytes and their ecology, taxonomy, distribution and management. Field trips may be required.  
4 Credit Hours. 3 Lecture Contact Hours. 3 Lab Contact Hours.  
Grade Mode: Standard Letter  
about Ecology and Management of Aquatic Macrophytes

Provides a foundation in theory and mathematics of basic population biology. The course is divided into modular components including defining evolutionary significant units, ecology of populations, genetics of populations, and evolutionary genetics. Prerequisites: BIO 4416 and BIO 2450, or permission of instructor.  
4 Credit Hours. 3 Lecture Contact Hours. 3 Lab Contact Hours.  
Course Attribute(s): Lab Required  
Grade Mode: Standard Letter  
about Principles of Population Biology I

BIO 7428. Principles of Population Biology II.  
Provides a foundation in theory and mathematics of basic population biology. The course is divided into modular components which include: 1) Ecology of Communities, 2) Evolution of Behavior, 3) Phylogenetic Methods, and 4) Biological Diversity and Conservation Biology. Prerequisite: BIO 7427 or permission of instructor.  
4 Credit Hours. 3 Lecture Contact Hours. 3 Lab Contact Hours.  
Course Attribute(s): Lab Required  
Grade Mode: Standard Letter  
about Principles of Population Biology II
This course examines the theoretical foundations of population genetics, including the description of population genetic structure and the forces creating it. The course emphasizes application of principles to a wide range of current problems in evolution, systematics and ecology. Molecular methods, data interpretation and computer-based data analysis are emphasized.  
4 Credit Hours. 3 Lecture Contact Hours. 2 Lab Contact Hours.  
Course Attribute(s): Lab Required  
Grade Mode: Standard Letter  
about Population Genetics

BIO 7434. Herpetology.  
A course treating the origin and evolution of amphibians and reptiles; their reproductive and physiological tactics; taxonomy/systematics; and population biology. While cosmopolitan in scope, emphasis will be placed on North American species and those groups inhabiting Texas.  
4 Credit Hours. 3 Lecture Contact Hours. 3 Lab Contact Hours.  
Course Attribute(s): Lab Required  
Grade Mode: Standard Letter  
about Herpetology

BIO 7440. Aquatic Toxicology.  
Introduction to principles for identifying and assessing the adverse effects of chemicals and other compounds and mixtures on aquatic organisms and ecosystems. Completion of BIO 7402 is recommended prior to enrollment in BIO 7440.  
4 Credit Hours. 3 Lecture Contact Hours. 3 Lab Contact Hours.  
Course Attribute(s): Lab Required  
Grade Mode: Standard Letter  
about Aquatic Toxicology

BIO 7447. Microbial Physiology and Genetics.  
Prokaryotes, including bacteria and archaea, are the most diverse group of organisms on earth. Many prokaryotes live in environments which are inhospitable to other life forms. This course covers major aspects of prokaryotic physiology and genetics that permit them to be so successful. Prerequisites: BIO 2400 and BIO 2450 or equivalents.  
4 Credit Hours. 3 Lecture Contact Hours. 3 Lab Contact Hours.  
Course Attribute(s): Lab Required  
Grade Mode: Standard Letter  
about Microbial Physiology and Genetics

BIO 7466. Phylogenetics.  
Study of the use of phylogenetic methodologies in aquatic research, including practical data collection, management, and analysis in the reconstruction of phylogenies. Laboratory exercises will introduce phylogenetic and DNA analysis software. Prerequisite: BIO 2450, BIO 4369 and BIO 5466, or consent of instructor.  
4 Credit Hours. 2 Lecture Contact Hours. 3 Lab Contact Hours.  
Course Attribute(s): Lab Required  
Grade Mode: Standard Letter  
about Phylogenetics

BIO 7468. Groundwater Resources.  
Study of the geological, physical, chemical and biological factors influencing sustainable groundwater resources, including hydrologic linkages and interactions with surface aquatic resources. Emphasis will be on the karst aquifer systems of Central Texas, and other groundwater aquifer systems of the United States.  
4 Credit Hours. 3 Lecture Contact Hours. 3 Lab Contact Hours.  
Course Attribute(s): Lab Required  
Grade Mode: Standard Letter  
about Groundwater Resources

BIO 7469. Introduction to Ecological Modeling.  
Mathematical models range from simple conceptual models to complex mechanistic models for mimicking behavior of natural systems. This course provides a broad overview of modeling objectives, techniques and assumptions, as well as the practical skills needed to conduct modeling projects. Computer applications emphasized. Prerequisite: MATH 2471 or equivalent or consent of instructor.  
4 Credit Hours. 2 Lecture Contact Hours. 2 Lab Contact Hours.  
Grade Mode: Standard Letter  
about Introduction to Ecological Modeling

BIO 7470. Limnology.  
Physical, chemical, and biological factors affecting productivity in lakes, ponds, and streams. Limnology sampling methods, chemical and biological analysis of samples, and hydrographic surveying are included in the laboratory. Prerequisite: One year of chemistry or consent of instructor.  
4 Credit Hours. 3 Lecture Contact Hours. 3 Lab Contact Hours.  
Course Attribute(s): Lab Required  
Grade Mode: Standard Letter  
about Limnology

BIO 7471. Reservoir Ecology.  
Study of the physical, geological, chemical, and biological factors that influence and form structural and functional aspects of reservoir ecosystems. Lab focuses on field, laboratory, and mathematical approaches to quantifying and managing these important ecosystems. Field trips may be required. Prerequisite: BIO 4470 or BIO 5470 or consent of instructor.  
4 Credit Hours. 3 Lecture Contact Hours. 3 Lab Contact Hours.  
Course Attribute(s): Lab Required  
Grade Mode: Standard Letter  
about Reservoir Ecology

BIO 7475. Restoration of Polluted Aquatic Resources.  
Overview of methods for treating or restoring aquatic resources degraded by pollution and related anthropogenic impacts. Topics include point and nonpoint source pollution of surface waters and groundwater aquifers, pollution from storage and waste disposal sites, aquatic habitat rehabilitation, and on-site methods. Field trips may be required. Prerequisite: BIO 7356 or consent of instructor.  
4 Credit Hours. 3 Lecture Contact Hours. 3 Lab Contact Hours.  
Course Attribute(s): Lab Required  
Grade Mode: Standard Letter  
about Restoration of Polluted Aquatic Resources
BIO 7599A. Dissertation.
Original research and writing in Aquatic Resources, to be accomplished under direct supervision of the dissertation advisor. While conducting dissertation research and writing, students must be continuously enrolled each long semester. Graded on a credit (CR), non-credit (F) basis.

Grade Mode: Credit/Non-Credit

BIO 7699A. Dissertation.
Original research and writing in Aquatic Resources, to be accomplished under direct supervision of the dissertation advisor. While conducting dissertation research and writing, students must be continuously enrolled each semester (including summer) for at least three dissertation hours. Graded on a credit (CR), progress (PR), no-credit (F) basis.

Grade Mode: Credit/Non-Credit

BIO 7999A. Dissertation.
Original research and writing in Aquatic Resources, to be accomplished under direct supervision of the dissertation advisor. While conducting dissertation research and writing, students must be continuously enrolled each long semester. Graded on a credit (CR), non-credit (F) basis.

Grade Mode: Credit/Non-Credit

Chemistry (CHEM)

CHEM 7330. Environmental Chemistry.
An introduction to environmental chemistry, with an emphasis on aquatic resources. Basic principles of geochemistry and atmospheric chemistry, as they relate to pollutant impacts on aquatic ecosystems, will be examined. Prerequisites: CHEM 1341/CHEM 1141, CHEM 1342/CHEM 1142, CHEM 2341/CHEM 2141, CHEM 2342/CHEM 2142 and CHEM 3410, or consent of instructor.

Grade Mode: Credit/Non-Credit

English (ENG)

ENG 7300. Language Problems in a Multicultural Environment.
An introduction to the study of multicultural language and linguistics with descriptive, psychological, social, and semantic emphases.

Grade Mode: Standard Letter

ENG 7314. Specializations in Professional and Technical Communication Topics.
Provides theoretical and practical information for specialized types of technical and professional communication.

Grade Mode: Standard Letter

ENG 7316. Foundations in Rhetoric and Composition.
A course providing students with theoretical, pedagogical, and/or methodological foundations in the field of rhetoric and composition. Emphases vary but may include Contemporary Composition Pedagogy, Basic Writing Theory and Practice, and Writing Assessment. Repeatable with different emphases for up to nine hours of English credit.

Grade Mode: Standard Letter

ENG 7317. Specializations in Rhetoric and Composition.
A course providing theoretical, pedagogical, methodological, and/or administrative grounding in specialized areas of rhetoric and composition. Emphases vary but may include Writing Across the Curriculum, Service Learning, Writing Center Theory and Practice, Computers and Writing, Literacy. Repeatable with different emphases for up to nine hours of English credit.

Grade Mode: Standard Letter

ENG 7326. Contemporary Composition Theory.
Introduces students to the history of writing instruction in the university and to the theories of writing and composing that inform contemporary composition studies and the teaching of writing.

Grade Mode: Standard Letter

ENG 7383. Studies in Rhetorical Theory.
An introduction to classical and rhetorical theory in various areas of English studies. Recent emphases include Teaching of Composition and Technical Communication. Repeatable with different emphases for up to nine hours of English credit.

Grade Mode: Standard Letter
Geography (GEO)

GEO 7190. Independent Study.
Research in geography under the direction of a supervising professor. Repeatable once for additional credit with a different topic.
Grade Mode: Standard Letter
about Independent Study
1 Credit Hour. 1 Lecture Contact Hour. 0 Lab Contact Hours.

GEO 7199A. Dissertation in Geography-Environmental Geography.
Original research and writing in Geography-Environmental Geography to be accomplished under direct supervision of the dissertation advisor. While conducting dissertation research and writing, students must be continuously enrolled each long semester. Graded on a credit (CR), no-credit (F) basis.
Grade Mode: Credit/No Credit
about Dissertation in Geography-Environmental Geography
1 Credit Hour. 1 Lecture Contact Hour. 0 Lab Contact Hours.

GEO 7199B. Dissertation in Geography-Geographic Education.
Original research and writing in Geography-Geographic Education to be accomplished under direct supervision of the dissertation advisor. While conducting dissertation research and writing, students must be continuously enrolled each long semester. Graded on a credit (CR), no-credit (F) basis.
Grade Mode: Credit/No Credit
about Dissertation in Geography-Geographic Education
1 Credit Hour. 1 Lecture Contact Hour. 0 Lab Contact Hours.

GEO 7199C. Dissertation in Geography-Geographic Information Science.
Original research and writing in Geography-Geographic Information Science to be accomplished under direct supervision of the dissertation advisor. While conducting dissertation research and writing, students must be continuously enrolled each long semester. Graded on a credit (CR), no-credit (F) basis.
Grade Mode: Credit/No Credit
about Dissertation in Geography-Geographic Information Science
1 Credit Hour. 1 Lecture Contact Hour. 0 Lab Contact Hours.

GEO 7250. Practicum in Teaching Geography.
An introduction to key concepts and practices in the teaching of college Geography. Provides regular in-service training and planned periodic evaluations of instructional responsibilities. Required for first-year teaching and instructional assistants in the Geography Department. This course does not earn graduate degree credit. Graded on a credit (CR), no-credit (F) basis.
Grade Mode: Leveling/Assistantships
about Practicum in Teaching Geography
2 Credit Hours. 2 Lecture Contact Hours. 0 Lab Contact Hours.
Course Attribute(s): Graduate Assistantship|Exclude from Graduate GPA

GEO 7290. Independent Study.
This course is designed to provide a student with credit while conducting independent research in consultation with his or her research advisor. Repeatable once for additional credit with a different topic.
Grade Mode: Standard Letter
about Independent Study
2 Credit Hours. 2 Lecture Contact Hours. 0 Lab Contact Hours.

GEO 7299A. Dissertation in Geography-Environmental Geography.
Original research and writing in Geography-Environmental Geography to be accomplished under direct supervision of the dissertation advisor. While conducting dissertation research and writing, students must be continuously enrolled each long semester. Graded on a credit (CR), no-credit (F) basis.
Grade Mode: Credit/No Credit
about Dissertation in Geography-Environmental Geography
2 Credit Hours. 2 Lecture Contact Hours. 0 Lab Contact Hours.

GEO 7299B. Dissertation in Geography-Geographic Education.
Original research and writing in Geography-Geographic Education to be accomplished under direct supervision of the dissertation advisor. While conducting dissertation research and writing, students must be continuously enrolled each long semester. Graded on a credit (CR), no-credit (F) basis.
Grade Mode: Credit/No Credit
about Dissertation in Geography-Geographic Education
2 Credit Hours. 2 Lecture Contact Hours. 0 Lab Contact Hours.

GEO 7299C. Dissertation in Geography-Geographic Information Science.
Original research and writing in Geography-Geographic Information Science to be accomplished under direct supervision of the dissertation advisor. While conducting dissertation research and writing, students must be continuously enrolled each long semester. Graded on a credit (CR), no-credit (F) basis.
Grade Mode: Credit/No Credit
about Dissertation in Geography-Geographic Information Science
2 Credit Hours. 2 Lecture Contact Hours. 0 Lab Contact Hours.
GEO 7300. Advanced Geographic Research Design.
The purpose of this course is to develop an appreciation for the process of research as practiced by contemporary professional geographers. Topics covered include formulating research problems, reviewing and critiquing published literature, developing and executing a research design, and completing a research project.

3 Credit Hours. 3 Lecture Contact Hours. 0 Lab Contact Hours.
Grade Mode: Standard Letter

GEO 7301. Advanced Quantitative Methods in Geography.
How to mathematically and statistically model geographic problems is the focus of this course. The application of multivariate statistical techniques to geographic problems and the problems that spatial data create in the application of statistical and other quantitative techniques are central issues.

3 Credit Hours. 3 Lecture Contact Hours. 0 Lab Contact Hours.
Grade Mode: Standard Letter

This course is a critical analysis of the historical development of geographic thought: its roots, its present status, and future directions.

3 Credit Hours. 3 Lecture Contact Hours. 0 Lab Contact Hours.
Grade Mode: Standard Letter

GEO 7303. Historical Geography of the American Environment.
This course examines the spatial evolution of environmental problems in the United States using the techniques and analytical perspectives of historical geography. Special emphasis is given to the emergence of environmental problems in the context of urbanization and industrialism. The course will expose students to the most significant work by geographers in this area to date, and to the historical development of environmental geographic analysis in the U.S.

3 Credit Hours. 3 Lecture Contact Hours. 0 Lab Contact Hours.
Grade Mode: Standard Letter

GEO 7305. Advanced Regional Field Studies.
Advanced study of geographic phenomena during field excursions to a particular site or region. Course includes preparation of site inventory, site guides, and on-site presentations. Repeatable once for additional credit with a different site or region.

3 Credit Hours. 1 Lecture Contact Hour. 4 Lab Contact Hours.
Grade Mode: Standard Letter

GEO 7306. Environmental Systems Analysis.
Theories and concepts involved in environmental systems will be examined. Tools and research issues relevant to their analysis will also be explored. Basic principles, as well as specific research questions and techniques, will be proposed to give students a foundation for analysis of current issues involving environmental systems.

3 Credit Hours. 3 Lecture Contact Hours. 0 Lab Contact Hours.
Grade Mode: Standard Letter

GEO 7307. Environmental Geography of Resource Development.
The purpose of this course is to develop an appreciation for the process of research as practiced by contemporary professional geographers. Topics covered include formulating research problems, reviewing and critiquing published literature, developing and executing a research design, and completing a research project.

3 Credit Hours. 3 Lecture Contact Hours. 0 Lab Contact Hours.
Grade Mode: Standard Letter

GEO 7308. Advanced Regional Field Studies.
Advanced study of geographic phenomena during field excursions to a particular site or region. Course includes preparation of site inventory, site guides, and on-site presentations. Repeatable once for additional credit with a different site or region.

3 Credit Hours. 1 Lecture Contact Hour. 4 Lab Contact Hours.
Grade Mode: Standard Letter

GEO 7313. Environmental Systems Analysis.
Theories and concepts involved in environmental systems will be examined. Tools and research issues relevant to their analysis will also be explored. Basic principles, as well as specific research questions and techniques, will be proposed to give students a foundation for analysis of current issues involving environmental systems.

3 Credit Hours. 3 Lecture Contact Hours. 0 Lab Contact Hours.
Grade Mode: Standard Letter

GEO 7314. Environmental Geography of Resource Development.
The purpose of this course is to develop an appreciation for the process of research as practiced by contemporary professional geographers. Topics covered include formulating research problems, reviewing and critiquing published literature, developing and executing a research design, and completing a research project.

3 Credit Hours. 3 Lecture Contact Hours. 0 Lab Contact Hours.
Grade Mode: Standard Letter

A detailed examination and implementation of sophisticated approaches for processing satellite digital images with emphasis on environmental applications.

3 Credit Hours. 3 Lecture Contact Hours. 0 Lab Contact Hours.
Grade Mode: Standard Letter

GEO 7316. GIS and Environmental Geography.
This course examines the nature of environmental problems and explores the potential of GIS for environmental modeling and management. The conceptual basis for using GIS as well as the framing of environmental research problems will be covered.

3 Credit Hours. 3 Lecture Contact Hours. 0 Lab Contact Hours.
Grade Mode: Standard Letter

GEO 7317. Geography of Natural Hazards.
This seminar examines the interdisciplinary nature of natural hazards research, the evolution of theories and thought in natural hazards, the geophysical causes of natural hazards, human impact and response to natural disasters, and issues and challenges in the Third World.

3 Credit Hours. 3 Lecture Contact Hours. 0 Lab Contact Hours.
Grade Mode: Standard Letter

GEO 7318. GIS and Environmental Geography.
This course examines the nature of environmental problems and explores the potential of GIS for environmental modeling and management. The conceptual basis for using GIS as well as the framing of environmental research problems will be covered.

3 Credit Hours. 3 Lecture Contact Hours. 0 Lab Contact Hours.
Grade Mode: Standard Letter

GEO 7330. Geography of Natural Hazards.
This seminar examines the interdisciplinary nature of natural hazards research, the evolution of theories and thought in natural hazards, the geophysical causes of natural hazards, human impact and response to natural disasters, and issues and challenges in the Third World.

3 Credit Hours. 3 Lecture Contact Hours. 0 Lab Contact Hours.
Grade Mode: Standard Letter

GEO 7331. Geography of the Hazards of Technology.
This research seminar focuses on the theories, methods, issues, and concepts of the major themes in geographic research on technological hazards. Special attention will be paid to the theoretical and conceptual understandings of hazards among both professionals and the public to evaluate how these views affect policies, choices, behaviors, and impacts.

3 Credit Hours. 3 Lecture Contact Hours. 0 Lab Contact Hours.
Grade Mode: Standard Letter
GEO 7334. Geographic Aspects of Water.
This seminar is a critical analysis of developmental and current literature that define water’s critical role in determining the physical and cultural characteristics of the earth. Principal focus will be placed on water’s role on land use and as a critical resource.

3 Credit Hours. 3 Lecture Contact Hours. 0 Lab Contact Hours.
Grade Mode: Standard Letter

GEO 7342. Theories and Methods in Geographic Education.
This seminar is a critical analysis of previous and current literature concerning problems in pedagogy, philosophy, learning theory, research methods, teaching methodologies, and techniques of geographic education. A research paper will be required of each student on a topic related to the course content.

3 Credit Hours. 3 Lecture Contact Hours. 0 Lab Contact Hours.
Grade Mode: Standard Letter

GEO 7344. Seminar in Geographic Curriculum.
The seminar will be a survey and discussion of major curricula in geographic education. Geography will be viewed as a school subject that is part of the social studies, as an element of interdisciplinary studies, and as a stand alone subject.

3 Credit Hours. 3 Lecture Contact Hours. 0 Lab Contact Hours.
Grade Mode: Standard Letter

GEO 7346. Standards and Assessment in Geography.
An introduction to assessment procedures in geography education is central to the course. Analysis of national standards in geography and how they have affected geographic learning in grades K-12 will be addressed.

3 Credit Hours. 3 Lecture Contact Hours. 0 Lab Contact Hours.
Grade Mode: Standard Letter

GEO 7348. Ethnic Geography.
This course will engage student in the in-depth critical analysis of the theories and methods of ethnic geography. The students will conduct careful research on a topic in ethnic geography.

3 Credit Hours. 3 Lecture Contact Hours. 0 Lab Contact Hours.
Course Attribute(s): Multicultural Content
Grade Mode: Standard Letter

GEO 7349. Population Geography.
An in-depth study of the growth, movement, and spatial distribution of human populations is the central theme. Students will read and discuss professional articles that stress both theory and analytical techniques. Topics will include population growth and the environment, rural and small town depopulation, spatial diffusion processes, migration trends and theories, urban population growth, and techniques such as multivariate analysis and population projections.

3 Credit Hours. 3 Lecture Contact Hours. 0 Lab Contact Hours.
Grade Mode: Standard Letter

GEO 7361. Advanced Geographic Information Systems.
This course provides exposure to advanced topics in GIS, particularly to quantitative methods and techniques for developing and interpreting models of natural and anthropogenic phenomena over the geographical space.

3 Credit Hours. 3 Lecture Contact Hours. 0 Lab Contact Hours.
Grade Mode: Standard Letter

GEO 7362. Geographic Visualization.
This course focuses on the interdisciplinary field of Geographic Visualization. Students will review visualization research in computer graphics, human computer interaction, GIScience, and cartography and relate the research approaches to useful and usable geographic visualizations. Prerequisite: GEO 3411 or equivalent.

3 Credit Hours. 3 Lecture Contact Hours. 0 Lab Contact Hours.
Grade Mode: Standard Letter

GEO 7364. Geocomputation.
Geocomputation reviews and analyzes concepts of computational modeling in Geography. The course will include modeling theory and advanced topics such as parallel processing, neural networks, cellular automata, scientific visualization, and fuzzy modeling. Students will practice model development, specifically spatially explicit simulation.

3 Credit Hours. 3 Lecture Contact Hours. 0 Lab Contact Hours.
Grade Mode: Standard Letter

GEO 7365. Theoretical Cartography.
This course focuses on theoretical developments in cartography, and in particular looks at the role of maps and other graphic devices as tools for the discovery, analysis, and communication of geographical knowledge. Prerequisite: GEO 3411 or equivalent.

3 Credit Hours. 3 Lecture Contact Hours. 0 Lab Contact Hours.
Grade Mode: Standard Letter
The course focuses on advanced topics including the theoretical basis, mathematical foundations, and current research frontiers in remote sensing. Prerequisite: GEO 5415 or equivalent.  
Grade Mode: Standard Letter  
about Advanced Topics in Remote Sensing  
3 Credit Hours. 3 Lecture Contact Hours. 0 Lab Contact Hours.  

GEO 7370. Advanced Seminar in Environmental Geography.  
This research seminar focuses on the methods, approaches, issues, and concepts of major themes in environmental geography. Special emphasis will be placed on theoretical and conceptual understandings of how humans interact with the environment from a geographical perspective. Repeatable once for additional credit with a different topic.  
Grade Mode: Standard Letter  
about Advanced Seminar in Environmental Geography  
3 Credit Hours. 3 Lecture Contact Hours. 0 Lab Contact Hours.  

GEO 7371. Advanced Seminar in Geographic Education.  
This research seminar analyzes literature and research into recent trends in geographic education. Emphasis will be on new developments in curriculum, content, and teaching methodologies. Repeatable once for additional credit with a different topic.  
Grade Mode: Standard Letter  
about Advanced Seminar in Geographic Education  
3 Credit Hours. 3 Lecture Contact Hours. 0 Lab Contact Hours.  

GEO 7372. Seminar in Geographic Information Science.  
This course deals with advanced and current research issues in Geographic Information Science. Based on this objective, the course aims at educating doctoral students to conduct research in Geographic Information Science as well as develop innovative applications of Geographic Information Science. May be repeated for credit with a different topic.  
Grade Mode: Standard Letter  
about Seminar in Geographic Information Science  
3 Credit Hours. 3 Lecture Contact Hours. 0 Lab Contact Hours.  

GEO 7390. Independent Study.  
Research in geography under the direction of a supervising professor. Repeatable once for additional credit with a different topic.  
Grade Mode: Standard Letter  
about Independent Study  
3 Credit Hours. 3 Lecture Contact Hours. 0 Lab Contact Hours.  

GEO 7391. Foundation Studies in Geography.  
Students develop knowledge and skills required for success in graduate-level coursework in Geography. Course content varies depending on academic preparation. This course does not earn graduate credit. Repeatable with different emphasis. Prerequisite: Approval of graduate advisor in Geography.  
Grade Mode: Standard Letter  
about Foundation Studies in Geography  
3 Credit Hours. 3 Lecture Contact Hours. 0 Lab Contact Hours.  
Course Attribute(s): Exclude from Graduate GPA|Leveling  
Grade Mode: Standard Letter  
about Foundation Studies in Geography  
3 Credit Hours. 3 Lecture Contact Hours. 0 Lab Contact Hours.  

GEO 7393A. Qualitative Methods.  
This course introduces the qualitative research paradigm, including appropriate research design, methods of data collection, types of inductive analysis and evaluation, as well as, standards of rigor for research that calls for a deeper understanding of more complex human relationships. The focus and application will be oriented towards human geography.  
Grade Mode: Topics  
about Qualitative Methods  
3 Credit Hours. 3 Lecture Contact Hours. 0 Lab Contact Hours.  
Course Attribute(s): Topics  
Grade Mode: Standard Letter  
about Qualitative Methods  
3 Credit Hours. 3 Lecture Contact Hours. 0 Lab Contact Hours.  

GEO 7393B. Biogeography in Mountain Environments.  
This course examines how plants and animals interact with and affect geomorphological processes and landforms, and how geomorphological processes, landforms and geological factors affect spatial distribution of animals and plants; all within the environmental limitation and conditions of mountains. The role of humans in affecting these interrelationships will be emphasized.  
Grade Mode: Standard Letter  
about Biogeography in Mountain Environments  
3 Credit Hours. 3 Lecture Contact Hours. 0 Lab Contact Hours.  
Course Attribute(s): Exclude from 3-peat Processing|Topics  
Grade Mode: Standard Letter  
about Biogeography in Mountain Environments  
3 Credit Hours. 3 Lecture Contact Hours. 0 Lab Contact Hours.  

GEO 7393C. Managing Urbanization.  
This course examines survey methods and procedures related to managing and preparing for urban growth. Selected topics for examination include transportation planning, housing, historic preservation, and environmental design.  
Grade Mode: Standard Letter  
about Managing Urbanization  
3 Credit Hours. 3 Lecture Contact Hours. 0 Lab Contact Hours.  
Course Attribute(s): Exclude from 3-peat Processing|Topics  
Grade Mode: Standard Letter  
about Managing Urbanization  
3 Credit Hours. 3 Lecture Contact Hours. 0 Lab Contact Hours.  

GEO 7393D. International Migration.  
This course provides a survey of geographic and social science research conducted across various topics of international migration.  
Grade Mode: Standard Letter  
about International Migration  
3 Credit Hours. 3 Lecture Contact Hours. 0 Lab Contact Hours.  
Course Attribute(s): Exclude from 3-peat Processing|Topics  
Grade Mode: Standard Letter  
about International Migration  
3 Credit Hours. 3 Lecture Contact Hours. 0 Lab Contact Hours.  

GEO 7393E. Geography of Land Management.  
This course explores U.S. land management philosophies, techniques, and development approaches. Major topics include land ethics/philosophies, U.S. traditions in cadastral geography, urban sprawl and green development, land conservation techniques, the role of local/state/federal regulation in land management, and the human-environment impacts of land development.  
Grade Mode: Standard Letter  
about Geography of Land Management  
3 Credit Hours. 3 Lecture Contact Hours. 0 Lab Contact Hours.  
Course Attribute(s): Exclude from 3-peat Processing|Topics  
Grade Mode: Standard Letter  
about Geography of Land Management  
3 Credit Hours. 3 Lecture Contact Hours. 0 Lab Contact Hours.  

GEO 7394. Advanced Seminar in Miscellaneous Topics.  
This course focuses on advanced and current research issues in miscellaneous topics in geographic education. Based on this objective, the course aims at educating doctoral students to conduct research in miscellaneous topics of geographic education as well as develop innovative applications of geographic education. May be repeated for credit with a different topic.  
Grade Mode: Standard Letter  
about Advanced Seminar in Miscellaneous Topics  
3 Credit Hours. 3 Lecture Contact Hours. 0 Lab Contact Hours.  
Course Attribute(s): Exclude from 3-peat Processing|Topics  
Grade Mode: Standard Letter  
about Advanced Seminar in Miscellaneous Topics  
3 Credit Hours. 3 Lecture Contact Hours. 0 Lab Contact Hours.
GEO 7393F. Gender and Development.
This course is a survey of geographic and social science research conducted across various topics of gender studies and international development.
Grade Mode: Standard Letter
Credit: 3 Credit Hours. 3 Lecture Contact Hours. 0 Lab Contact Hours.
Course Attribute(s): Exclude from 3-peat Processing|Topics
about Gender and Development

GEO 7393G. Political Geography.
This course is a survey of geographic and social science research conducted across various topics of political geography.
Grade Mode: Standard Letter
Credit: 3 Credit Hours. 3 Lecture Contact Hours. 0 Lab Contact Hours.
Course Attribute(s): Exclude from 3-peat Processing|Topics
about Political Geography

GEO 7393H. Urban Environment.
This course explores scholarly and governmental research relating to urban environments, urban environmentalism, and urban environmental management. Emphasis is placed on the myriad ways in which human-environment interaction influences, and is influenced by, urban geography and the urban experience.
Grade Mode: Standard Letter
Credit: 3 Credit Hours. 3 Lecture Contact Hours. 0 Lab Contact Hours.
Course Attribute(s): Exclude from 3-peat Processing|Topics
about Urban Environment

GEO 7393I. Contemporary Topics in Geography Education.
This course will be a survey of recent initiatives in geography education. This course will focus on areas such as research, assessment, and the development and use of instructional materials in relation to the National Science Foundation funded "Road Map for 21st Century Geography Education".
Grade Mode: Standard Letter
Credit: 3 Credit Hours. 3 Lecture Contact Hours. 0 Lab Contact Hours.
Course Attribute(s): Exclude from 3-peat Processing|Topics
about Contemporary Topics in Geography Education

GEO 7393J. Soil and Society.
This course explores the importance of soil resources for environmental and socioeconomic sustainability. Soil science will be introduced, but the majority of the course will focus on soil’s value to societies. Specific topics that will be explored include soil geography, historical abuses of soil resources, and current conservation efforts.
Grade Mode: Standard Letter
Credit: 3 Credit Hours. 3 Lecture Contact Hours. 0 Lab Contact Hours.
Course Attribute(s): Exclude from 3-peat Processing|Topics
about Soil and Society

GEO 7393K. Biogeomorphology.
This course will examine the ways in which plants and animals interact with and affect geomorphological processes and landforms, and how geomorphological processes, landforms, and geological factors affect spatial distributions of animals and plants. The role of humans in affecting these interrelationships will be emphasized.
Grade Mode: Standard Letter
Credit: 3 Credit Hours. 3 Lecture Contact Hours. 0 Lab Contact Hours.
Course Attribute(s): Exclude from 3-peat Processing|Topics
about Biogeomorphology

GEO 7393L. Lidar.
This course is an introduction to Light Detection and Ranging (lidar) systems for mapping and analysis. Students will learn to successfully apply knowledge of lidar sensors and technology for a variety of geographic information science applications. Students must have prior knowledge and experience with GIS analysis and mapping tools.
Grade Mode: Standard Letter
Credit: 3 Credit Hours. 3 Lecture Contact Hours. 0 Lab Contact Hours.
Course Attribute(s): Exclude from 3-peat Processing|Topics
about Lidar

GEO 7399A. Dissertation.
Original research and writing in Environmental Geography, to be accomplished under direct supervision of the dissertation advisor. While conducting dissertation research and writing, students must be continuously enrolled each semester (including summer) for at least three dissertation hours. Graded on a credit (CR), progress (PR), no-credit (F) basis.
Grade Mode: Credit/No Credit
Credit: 3 Credit Hours. 3 Lecture Contact Hours. 0 Lab Contact Hours.
Course Attribute(s): Exclude from 3-peat Processing|Topics
about Dissertation

GEO 7399B. Dissertation.
Original research and writing in Geographic Education, to be accomplished under direct supervision of the dissertation advisor. While conducting dissertation research and writing, students must be continuously enrolled each semester (including summer) for at least three dissertation hours. Graded on a credit (CR), progress (PR), no-credit (F) basis.
Grade Mode: Credit/No Credit
Credit: 3 Credit Hours. 3 Lecture Contact Hours. 0 Lab Contact Hours.
Course Attribute(s): Exclude from 3-peat Processing|Topics
about Dissertation

GEO 7399C. Dissertation.
Original research and writing in Geographic Information Science, to be accomplished under direct supervision of the dissertation advisor. While conducting dissertation research and writing, students must be continuously enrolled each semester (including summer) for at least three dissertation hours. Graded on a credit (CR), progress (PR), no-credit (F) basis.
Grade Mode: Credit/No Credit
Credit: 3 Credit Hours. 3 Lecture Contact Hours. 0 Lab Contact Hours.
Course Attribute(s): Exclude from 3-peat Processing|Topics
about Dissertation
Students will focus on geographic applications of the principles and practices of digital image processing, classification, and modeling using satellite images.
about Geographic Applications of Remote Sensing
4 Credit Hours. 2 Lecture Contact Hours. 4 Lab Contact Hours.
Course Attribute(s): Lab Required
Grade Mode: Standard Letter
about Geographic Applications of Remote Sensing
GEO 7417. Geographic Information Systems.
Course is concerned with the analysis of interpretation of maps stored in digital form. Students are introduced to the concepts involving computerized cartographic and geographic data input, storage and retrieval, data manipulation and analysis, graphic and tabular report generation, and cartographic modeling.
about Geographic Information Systems
4 Credit Hours. 2 Lecture Contact Hours. 4 Lab Contact Hours.
Course Attribute(s): Lab Required
Grade Mode: Standard Letter
about Geographic Information Systems
This course is concerned with the analysis and interpretation of maps stored in digital form. It will cover a variety of topics of interest to those seeking more in-depth knowledge of GIS and ancillary topics such as spatial statistics. The course provides an in-depth understanding of spatial analysis and modeling.
about Technical Foundations and Methods in Geographic Information Science
4 Credit Hours. 2 Lecture Contact Hours. 4 Lab Contact Hours.
Course Attribute(s): Lab Required
Grade Mode: Standard Letter
about Technical Foundations and Methods in Geographic Information Science
GEO 7430. Field Methods.
Methods and techniques for observing, measuring, recording, and reporting on geographic phenomena are investigated in this course. Students will learn the use of instruments and materials in the collection of data for mapping and field research in the local area. Prerequisites: GEO 2410 and GEO 3301 or equivalents.
about Field Methods
4 Credit Hours. 2 Lecture Contact Hours. 4 Lab Contact Hours.
Course Attribute(s): Lab Required
Grade Mode: Standard Letter
about Field Methods
GEO 7447. Spatial Graphics in Geographic Education.
This course examines traditional and innovative geoinformation and geovisualization technologies and their relationship to spatial thinking and the teaching and learning of geography. The course reviews academic literature, research methods, and teaching methodologies related to spatial graphics in geographic education. The lab portion provides geovisualization design skills for geographic education.
about Spatial Graphics in Geographic Education
4 Credit Hours. 2 Lecture Contact Hours. 4 Lab Contact Hours.
Course Attribute(s): Lab Required
Grade Mode: Standard Letter
about Spatial Graphics in Geographic Education
GEO 7599A. Dissertation in Geography - Environmental Geography.
Original research and writing in Geography-Environmental Geography to be accomplished under direct supervision of the dissertation advisor.
While conducting dissertation research and writing, students must be continuously enrolled each long semester. Graded on a credit (CR), no-credit (F) basis.
about Dissertation in Geography - Environmental Geography
5 Credit Hours. 5 Lecture Contact Hours. 0 Lab Contact Hours.
Grade Mode: Credit/No Credit
about Dissertation in Geography - Environmental Geography
GEO 7599B. Dissertation.
Original research and writing in Geography-Geographic Education to be accomplished under direct supervision of the dissertation advisor.
While conducting dissertation research and writing, students must be continuously enrolled each long semester. Graded on a credit (CR), no-credit (F) basis.
about Dissertation
5 Credit Hours. 5 Lecture Contact Hours. 0 Lab Contact Hours.
Grade Mode: Credit/No Credit
about Dissertation
GEO 7599C. Dissertation.
Original research and writing in Geography-Geographic Information Science, to be accomplished under direct supervision of the dissertation advisor.
While conducting dissertation research and writing, students must be continuously enrolled each long semester. Graded on a credit (CR), no-credit (F) basis.
about Dissertation
5 Credit Hours. 5 Lecture Contact Hours. 0 Lab Contact Hours.
Grade Mode: Credit/No Credit
about Dissertation
GEO 7699A. Dissertation in Geography - Environmental Geography.
Original research and writing in Geography-Environmental Geography to be accomplished under direct supervision of the dissertation advisor.
While conducting dissertation research and writing, students must be continuously enrolled each long semester. Graded on a credit (CR), no-credit (F) basis.
about Dissertation in Geography - Environmental Geography
6 Credit Hours. 6 Lecture Contact Hours. 0 Lab Contact Hours.
Grade Mode: Credit/No Credit
about Dissertation in Geography - Environmental Geography
GEO 7699B. Dissertation.
Original research and writing in Geographic Education, to be accomplished under direct supervision of the dissertation advisor.
While conducting dissertation research and writing, students must be continuously enrolled each long semester. Graded on a credit (CR), progress (PR), no-credit (F) basis.
about Dissertation
6 Credit Hours. 6 Lecture Contact Hours. 0 Lab Contact Hours.
Grade Mode: Credit/No Credit
about Dissertation
GEO 7699C. Dissertation.
Original research and writing in Geography-Geographic Information Science, to be accomplished under direct supervision of the dissertation advisor.
While conducting dissertation research and writing, students must be continuously enrolled each long semester. Graded on a credit (CR), progress (PR), no-credit (F) basis.
about Dissertation
6 Credit Hours. 6 Lecture Contact Hours. 0 Lab Contact Hours.
Grade Mode: Credit/No Credit
about Dissertation
GEO 7699C. Dissertation.  
Original research and writing in Geographic Information Science, to be accomplished under direct supervision of the dissertation advisor. While conducting dissertation research and writing, students must be continuously enrolled each semester (including summer) for at least three dissertation hours. Graded on a credit (CR), progress (PR), no-credit (F) basis.  

Grade Mode: Credit/No Credit  
3 Credit Hours. 3 Lecture Contact Hours. 0 Lab Contact Hours.  
about Dissertation  

GEO 7999A. Dissertation.  
Original research and writing in Environmental Geography, to be accomplished under direct supervision of the dissertation advisor. While conducting dissertation research and writing, students must be continuously enrolled each semester (including summer) for at least three dissertation hours. Graded on a credit (CR), progress (PR), no-credit (F) basis.  

Grade Mode: Credit/No Credit  
9 Credit Hours. 9 Lecture Contact Hours. 0 Lab Contact Hours.  
about Dissertation  

GEO 7999B. Dissertation.  
Original research and writing in Geographic Education, to be accomplished under direct supervision of the dissertation advisor. While conducting dissertation research and writing, students must be continuously enrolled each semester (including summer) for at least three dissertation hours. Graded on a credit (CR), progress (PR), no-credit (F) basis.  

Grade Mode: Credit/No Credit  
9 Credit Hours. 9 Lecture Contact Hours. 0 Lab Contact Hours.  
about Dissertation  

GEO 7999C. Dissertation.  
Original research and writing in Geographic Information Science, to be accomplished under direct supervision of the dissertation advisor. While conducting dissertation research and writing, students must be continuously enrolled each semester (including summer) for at least three dissertation hours. Graded on a credit (CR), progress (PR), no-credit (F) basis.  

Grade Mode: Credit/No Credit  
9 Credit Hours. 9 Lecture Contact Hours. 0 Lab Contact Hours.  
about Dissertation  

Health Research (HR)  
HR 7375. Aquatic Health Ecology and Human Disease.  
Introduction to the health consequences of human-environment interaction and aquatic pollution. Topics to include bacterial and toxic aquatic agents and their relation to human disease. Control of communicable and noninfectious diseases from water resources, and epidemiological principals important to research in waterborne human disease, will be examined.  

Grade Mode: Standard Letter  
3 Credit Hours. 3 Lecture Contact Hours. 0 Lab Contact Hours.  
about Aquatic Health Ecology and Human Disease  

Philosophy (PHIL)  
PHIL 7323. Environmental Ethics and Sustainable Aquatic Resources.  
Examination of the ethical implications of environmental use and management policies and practices, with emphasis on sustainable aquatic resources.  

Grade Mode: Standard Letter  
3 Credit Hours. 3 Lecture Contact Hours. 0 Lab Contact Hours.  
about Environmental Ethics and Sustainable Aquatic Resources  

Political Science (POSI)  
POSI 7310. Resolution of Disputes Involving Aquatic Resources.  
Analysis of historically significant environmental disputes affecting aquatic resources and establishing precedents for resolution of subsequent disputes. Techniques for resolving environmental disputes (e.g., litigation, arbitration, mediation, negotiation) and how science and scientists are used in each procedure. Design of systems for using dispute resolution procedures in appropriate sequence.  

Grade Mode: Standard Letter  
3 Credit Hours. 3 Lecture Contact Hours. 0 Lab Contact Hours.  
about Resolution of Disputes Involving Aquatic Resources  

POSI 7320. Research Practicum.  
This class uses structured group research to analyze a current policy, management, or administrative issue of concern to communities, public, or nonprofit sector partnering organizations. A professor led research team of graduate students will prepare a final report detailing findings and recommendations for action. Repeatable once for additional credit.  

Grade Mode: Standard Letter  
3 Credit Hours. 3 Lecture Contact Hours. 0 Lab Contact Hours.  
about Research Practicum  

POSI 7330. Environmental Policy, Politics, and Law.  
This class examines the formulation and implementation of environmental policy and law at the state, federal, and international level. The class highlights the historical drivers of policy formulation, legislation, rulemaking, permitting, treaties and international conventions, institutional capacity, risk assessment, economic development, property rights, implementation strategies, policy mechanisms, and compliance adherence.  

Grade Mode: Standard Letter  
3 Credit Hours. 3 Lecture Contact Hours. 0 Lab Contact Hours.  
about Environmental Policy, Politics, and Law