

ECOLOGICAL, EARTH, AND ENVIRONMENTAL SCIENCES, PH.D.

The Institute for Ecological, Earth, and Environmental Sciences (TIE³S) offers a unique program for advanced interdisciplinary study leading to the doctoral (Ph.D.) degree. This program utilizes courses and faculty partners from Anthropology, Biology, Chemistry & Biochemistry, Engineering, Environmental Science and Geology.

Graduate applicants to the program will be required to submit a letter of intent, a supporting letter from a TIE³S Fellow mentor, along with standard GRE scores (taken within the last five years), transcripts, and if necessary TOEFL, IELTS, or Duolingo scores. The letter of intent should indicate a research plan that has been discussed with a potential (TIE³S) Fellow mentor. Applicants are expected to have superior GRE scores and grade point averages. For non-native English speakers, recommended TOEFL scores will be 600 for the "paper" exam and 250 for the "computer" exam.

Students accepted into the program are expected to enter with a master's degree in Biology, Ecology, Geology, Physical Science, Environmental Science, Chemistry or a related discipline. Candidates with a bachelor's degree may be accepted provided they demonstrate through their application exceptional qualities including research experience. A graduate course in basic statistics is also required. Most students are expected to have at least one published work related to their previous research experience. Appropriate background courses or their equivalents for applicants should be in one of the following areas:

- Life Sciences. 24 semester hours in life sciences including courses in ecology, genetics, physiology (animal or plant), and evolutionary biology (e.g., taxonomy or systematics), or
- Physical Sciences. 24 semester hours including courses in geology, earth science, atmospheric science, hydrology, and at least 3 hours in chemistry or biochemistry, or
- Environmental Science. 24 semester hours of science or engineering, including a minimum of 8 hours in advanced chemistry and physical sciences, engineering or environmental science, or
- Chemistry. 24 semester hours including courses in physical chemistry and instrumental analysis, and at least 6 additional hours of course work in one of the three areas listed above.

The degree program has two components:

1. the course work component, and
2. the research component.

The course work component requires a qualifying examination early in the Ph.D. program and not less than 60 semester hours, which includes credit for course work beyond the bachelor's degree and approved by the student's committee and the Baylor University Graduate School. Course credit from the master's degree may be applied for by petition to the Graduate School with a maximum of 24 hours allowable. After successfully completing all required course work, the student will concentrate on the remaining research planning leading to the preliminary examination, the doctoral research, dissertation preparation, and the final defense. The dissertation committee administers the preliminary (comprehensive) exam and evaluates the proposal and the student's preparedness in the area of his/her dissertation and

related fields. The preliminary exam will include a written and an oral portion. The written exam will assess the student's knowledge of foundations of general areas of Biotic Systems, Physical Systems, and Quantitative Analysis. The oral portion will test the student's knowledge of their proposal background and methodology as an assessment of the student's preparation to move on to the dissertation phase of their program. Admission to doctoral candidacy requires successful completion of the preliminary exam coupled with acceptance of the written dissertation proposal by the doctoral committee.

Specific requirements include a minimum of 60 semester hour credits of approved course work and research credit hours beyond the bachelor's degree, at least 21 of which must be in regular graduate-level foundation courses as required for the Ph.D. by the Baylor University Graduate Catalog. A master's degree from an accredited university may be accepted for up to 24 semester hour credits upon approval of the faculty mentor and Baylor Graduate School. The minimum 60 semester hours required beyond the bachelor's degree may be expanded depending on the student's research concentration, background and recommendation of the graduate committee. Students entering the program with graduate-level work or a master's degree in a related scientific discipline may apply up to 30 semester hours of approved courses toward the Ph.D.

The dissertation will be composed of three published (or submitted) written papers. A student may proceed to the defense with one published work, with two additional submitted manuscripts in national or international journals pertinent to the field of study.

The TIE³S doctoral program does not have a foreign language requirement for the Ph.D. degree; however, students are strongly encouraged to become competent in technological interface skills including computer programming, instrumentation, or analytical software such as SAS, Mathematika or IDL. At least half of the hours of course work (exclusive of dissertation) must be at the 5000/6000 level. The remaining hours will normally come from the dissertation (minimum of 12 hours) and its associated research, but a portion may be devoted to additional course and laboratory work at the discretion of the student's dissertation committee.

A core curriculum is required and available from the Biology, Chemistry & Biochemistry, Environmental Science, Geology, and Statistics departments. All Ph.D. students must fulfill the core curriculum, which consists of foundational course work associated with the holistic earth system curricula and philosophy of the program. These courses exclude research specialization that will depend on mentor expertise and consultation.

Individual courses cannot fulfill more than one core requirement, but may count toward requirements for specialization areas. Students who have completed equivalent courses in a master's program may request waivers from the Graduate Program Director and Graduate Committee. These foundational competencies are designed to give the student a common base for scientific research in the TIE³S program. A plan for completing the foundation courses is to be prepared by the student and their advisor, and then submitted to the student's graduate committee for approval by the start of the student's second semester. Courses taken to fulfill these requirements must be taken for credit and listed on the student's program of study. An overall GPA of 3.0 must be maintained in these courses. The following are acceptable courses to satisfy competency requirement for these foundational areas:

Code	Title	Hours
Advanced Chemistry Foundation Course		
Select 3-4 course hours from the following:		3-4
CHE 4316	Instrumental Analysis	
CHE 4341	General Biochemistry	
CHE 5314	Separation Science	
GEO 5320	Geochemistry	
GEO 5321	Isotope Geochemistry	
ENV 4304	Aquatic Chemistry	
ENV 5303	Environmental Chemical Analysis	
ENV 5370	Advanced Environmental Toxicology and Chemistry	
ENV 5387	Advanced Environmental Chemistry	
ENV 5393	Atmospheric Chemistry and Physics	
Numerical Methods of Analysis Foundation Course		
Select 3-4 course hours from the following:		3-4
BIO 5320	Ecological Biophysics	
BIO 5340	Ecosystem Process Modeling	
BIO 5413	Advanced Ecological Data Analysis	
GEO 4386	Remote Sensing	
GEO 5348	Applied Ground Water Modeling	
ENV 5391	Measurement Methods and Data Analysis for Air Pollution Research	
STA 5300	Statistical Methods	
STA 5305	Advanced Experimental Design	
Physical Systems Foundation Course		
Select 3-4 course hours from the following:		3-4
GEO 4341	Introduction to Hydrology	
GEO 4346	Hydrogeology	
GEO 4459	Engineering Geology	
GEO 5308	Advanced Studies in Earth Science	
GEO 5340	Paleopedology	
GEO 5342	Micromorphology of Soils and Paleosols	
GEO 5347	Advanced Hydrogeology	
GEO 5389	Earth System Science	
Ecological Foundation Course		
Select 3-4 course hours from the following:		3-4
BIO 4310	Biogeography	
BIO 4405	Limnology	
BIO 5300	Advanced Studies in Biology	
BIO/ENV 5330	Conservation Biology	
BIO/ENV 5360	Biological Invasions: Ecology and Management	
BIO 5377	Landscape Ecology	
BIO 5404	Wetland Ecology and Management	
BIO 5405	Stream Ecology	
ENV 4450	Applied Forest Ecology	
ENV 5342	Ecological Risk Assessment	
ENV 5379	Ecosystem Management	

Other course requirements include Seminar Courses (2 course hours) such as EEES 6100 Seminar in Ecology, Earth, and Environmental Sciences. Six more credits in upper-division earth science, ecology, environmental science, and chemistry courses most related to the

intended research interest. A maximum of 9 hours of Special Problems (5V90 from participating departments) can be applied to degree requirements. The number of upper-division credits required varies with the research program recommended by the student's committee. Completion of any courses listed as prerequisites for the courses listed above is also generally required. Finally, twelve or more credits in dissertation research credit as currently offered as 6V99 courses TIE³S.

Existing Courses Applicable to the Ph.D. Degree Program:

Biology

Code	Title	Hours
BIO 4405	Limnology	4
BIO 4406	Aquatic Biology	4
BIO 4418	Biology of Wetland and Aquatic Vascular Plants	4
BIO 4422	Ichthyology	4
BIO 4310	Biogeography	3
BIO 4306	Molecular Genetics and Genomics	3
BIO 4307	Biochemistry and Physiology of the Cell	3
BIO 4381	Restoration Ecology	3
BIO 5201	Research Methods in Biology	2
BIO 5300	Advanced Studies in Biology	3
BIO 5303	Behavioral Ecology	3
BIO 5306	Molecular Evolution	3
BIO 5310	Advanced Microbiology	3
BIO 5320	Ecological Biophysics	3
BIO 5330	Conservation Biology	3
BIO 5340	Ecosystem Process Modeling	3
BIO 5360	Biological Invasions: Ecology and Management	3
BIO 5377	Landscape Ecology	3
BIO 5380	Integrative Ecophysiology	3
BIO 5400	Population Genetics	4
BIO 5401	Microbial Ecology	4
BIO 5402	Invertebrate Zoology	4
BIO 5403	Population Ecology	4
BIO 5404	Wetland Ecology and Management	4
BIO 5405	Stream Ecology	4
BIO 5407	Bioenergetics	4
BIO 5412	Biometrics	4
BIO 5413	Advanced Ecological Data Analysis	4
BIO 5425	Molecular Ecology	4

Chemistry

Code	Title	Hours
CHE 4316	Instrumental Analysis	3
CHE 4341	General Biochemistry	3
CHE 5314	Separation Science	3

Environmental Science

Code	Title	Hours
ENV 4304	Aquatic Chemistry	3
ENV 4307	Environmental Law	3

ENV 4333	Coastal Zone Management	3
ENV 4344	Fundamentals of Toxicology	3
ENV 4365	The Environment and Energy	3
ENV 4375	Natural Landscape Evaluation and Planning	3
ENV 4349	Pollution Abatement and Prevention Systems	3
ENV 4355	Principles of Renewable Resource Management	3
ENV 4450	Applied Forest Ecology	4
ENV 4487	Advanced GIS Analysis	4
ENV 4393	Environmental Ethics	3
ENV 5303	Environmental Chemical Analysis	3
ENV 5310	Agricultural Ecology	3
ENV 5330	Conservation Biology	3
ENV 5342	Ecological Risk Assessment	3
ENV 5360	Biological Invasions: Ecology and Management	3
ENV 5368	Integrated Energy Resource Systems	3
ENV 5370	Advanced Environmental Toxicology and Chemistry	3
ENV 5373	Advanced Environmental Biotechnology	3
ENV 5376	Advanced Urban and Regional Comprehensive Environmental Planning	3
ENV 5379	Ecosystem Management	3
ENV 5387	Advanced Environmental Chemistry	3
ENV 5391	Measurement Methods and Data Analysis for Air Pollution Research	3
ENV 5393	Atmospheric Chemistry and Physics	3
GEO 5342	Micromorphology of Soils and Paleosols	3
GEO 5347	Advanced Hydrogeology	3
GEO 5348	Applied Ground Water Modeling	3
GEO 5349	Urban Geology	3
GEO 5378	Advanced Studies in Hydrogeology	3
GEO 5388	Advanced Studies in Hydrology-Engineering Geology	3
GEO 5389	Earth System Science	3

TIE³S

Code	Title	Hours
EEES 6100	Seminar in Ecology, Earth, and Environmental Sciences	1
EEES 6V99	Dissertation in Ecology, Earth, and Environmental Sciences	1-3

Geology

Code	Title	Hours
GEO 4312	Oceanography	3
GEO 4313	Astronomy	3
GEO 4314	Meteorology	3
GEO 4337	Paleoecology	3
GEO 4340	Geomorphology	3
GEO 4341	Introduction to Hydrology	3
GEO 4346	Hydrogeology	3
GEO 4339	Advanced Marine Field Studies	3
GEO 4459	Engineering Geology	4
GEO 4371	Wetlands	3
GEO 4373	Global Soil Systems	3
GEO 4375	Natural Landscape Evaluation and Planning	3
GEO 4485	Introduction to Geographic Information Systems	4
GEO 4386	Remote Sensing	3
GEO 4487	Advanced GIS Analysis	4
GEO 5308	Advanced Studies in Earth Science	3
GEO 5320	Geochemistry	3
GEO 5321	Isotope Geochemistry	3
GEO 5337	Advanced Studies in Remote Sensing	3
GEO 5340	Geomorphology	3
GEO 5340	Paleopedology	3