

# MASTER OF ENVIRONMENTAL SCIENCE

## Program Overview/Course Catalog

- The Taylor University Master of Environmental Science program is a fully accredited traditional on-campus graduate program with off-campus field experiences and internship possibilities.
- Primary focus: Professional degree (MES) rather than theoretical/research degree (MA/MS)
- Traditional curricular format: 30 credit hours including a minimum of 21 hours of graded coursework, 3 hours Graduate Seminar, and thesis research or internship hours
- Traditional course structure represented by:
  - 16 500 level courses representing 5 curricular areas
  - 7 600 level courses in environmental science
  - 1 600 level graduate seminar
  - 2 700 level capstone events (thesis or internship)
  - 10 Taylor University faculty members from 5 curricular areas
- Typical student semester load: 8-10 hours graded coursework, 1 hour graduate seminar (full load at 9 hours, normal maximum load 13 hours)
- Class size 7-10 per year in a 2-year curriculum yielding an average of no more than 20 students in the program at any one time. Target numbers, 8 per year and 16 extant in the program.
- Unique elements:
  - Flexible “Plan of Study”
  - Off campus “career based” internship opportunities
  - Thesis option yielding publishable manuscript
  - “4+1” option for Taylor University environmental science students
  - **Full tuition fellowships** supporting up to 16 full-time students per year
  - **Teaching assistantships** are available
  - A “personal librarian” program linking each student with a university reference librarian to assist in information technology issues related to coursework and thesis preparation

## Contact Information

Send all admission materials (including transcripts and GRE scores) to:

Becky Taylor, MES Program Assistant  
Taylor University  
236 W Reade Ave, Upland IN 46989-1001  
765-998-4960  
Fax 765-998-4976  
[mes@taylor.edu](mailto:mes@taylor.edu)

## MES PREPARATION

### Entrance Requirements

- BS or BA degree from an accredited college or university
  - Preference for strong undergraduate training in environmental science, biology, chemistry, math, computer science, geography, political science
  - The following courses or their equivalent are required\* for admission:
    - Introduction to Environmental Science 1 semester
    - Introduction to Statistics 1 semester
    - Principles of Ecology 1 semester
    - General Chemistry 1 semesters (2 semesters are strongly recommended)
- \*Note: students with deficiencies may be admitted on a provisional basis.*
- GPA minimum 3.0 on a 4.0 point scale
  - GRE general exam minimum score of 1000 (verbal+ quantitative sections) Students with high scores (600+) on the analytical section will be given preference.

### Admission Requirements

- A letter of intent including a brief discussion of the reasons for your interest in the program, academic background, and career goals. A personal resume may be included with the letter.
- Application – download from [www.taylor.edu/mes](http://www.taylor.edu/mes)
- Official transcripts from all college level academic institutions that you have attended.
- Recent GRE scores on the general exam. Subject specific score are also useful as supporting information.
- Three letters of recommendation, at least two of which should be from individuals who can speak to your academic abilities and work ethic.

Applications received before 15 November, will be considered for early admission and notified of their status during the second week of December. Applications received after 15 November will be considered on a “rolling admissions” basis.

## MES PERSONALIZATION

### Plan of Study / Candidate Status

During the first semester in residence, students enrolled in the MES program will work with the program director and a faculty committee to develop a “Plan of Study” (PS), which integrates the student’s academic background and experience with an appropriate graduate course of study so as to allow the student to achieve their career goals. The development of the PS is a four-phase process: 1) a thorough evaluation of the student’s admission materials, 2) an interview to ascertain the student’s interests and career goals, 3) a oral candidacy exam to ascertain the appropriate graded coursework to recommend in the PS, and 4) the development of a formal PS which identifies the specific coursework, research or teaching experience, and capstone component that the student will be expected to complete before the MES will be awarded. Students who have completed the PS process will be considered degree candidates.

## MES PROGRAM

### Graded Coursework

A minimum of 21 credit hours of graded coursework selected during the development of each student's individualized Plan of Study. **A minimum of three (3) 600 level courses are required.** Specific course combinations will be tailored to each student's career goals and formalized in their Plan of Study. *The following serve only as examples of what is possible:*

A student with a solid science background (Biology, Business, Chemistry, Physics or Engineering) might elect a sequence of courses leading to a career in **Environmental Management**, choosing from the following courses:

IAS 530	Human Relations & Organizations
ENS 502	Environmental Law and Policy
ECO 515	Environmental and Natural Resources Economics
ENS 583	Environmental Ethics
ENS 610	Environmental Assessment
ENS 620	Environmental Management
ENS 670	International Community Development

A student with an undergraduate background in environmental biology might elect a sequence of courses broadening her experience in **Environmental Geology**, choosing from the following courses:

ENS 561	Geomorphology
ENS 562	Hydrogeology
ENS 563	Applied Geology & Environmental Planning
ENS 583	Environmental Ethics
ENS 555	Geospatial Analysis
ENS 590	Applied Hydrology
ENS 610	Environmental Assessment

A student with a strong undergraduate biology degree might elect to expand that degree by taking advance courses in **Environmental Biology**, choosing from the following courses:

BIO 501	Taxonomy of Vascular Plants
BIO 507	Vertebrate Natural History
BIO 541	Environmental Physiology
ENS 580	Systems Ecology
ENS 583	Environmental Ethics
ENS 630	Ecosystem Assessment
ENS 555	Geospatial Analysis

A student with a diverse science background may wish to use the following course sequence to pursue a career in **Public and Environmental Health**, choosing from the following courses:

ENS 640	Global Ecology
BIO 571	Microbiology and Immunology
IAS 530	Human Relations & Organizations
BIO 541	Environmental Physiology
ENS 502	Environmental Law and Policy
ENS 610	Environmental Assessment
ENS 555	Geospatial Analysis
ENS 670	International Community Development

Different combinations could also lead to careers in **Environmental Education**, **Environmental Assessment**, or **Environmental Chemistry**. Students with other specific career interests are encouraged to contact the Program Director and discuss additional appropriate course combinations.

### **Graduate Seminar**

- Focusing on orientation, collegiality, and professional development
- Library skills through participation in the Personal Librarian Program
- Manuscript development skills
- Professional presentation skills (verbal, written, and electronic)
- Faculty/student and student/student mentoring
- Career development and networking

### **Capstone Component**

- **Thesis** (Education to education focus)
  - Research skills
  - Writing and computational skills
  - Library skills
  - Manuscript development
  - Final assessment by graduate committee
- **Internship** (Education to work focus)
  - Application of academic skills
  - Writing and computational skills
  - Adaptation to the workplace
  - Teamwork and interpersonal skills
  - Final assessment by graduate committee and work supervisor

### **MES CURRICULAR OFFERINGS**

ENS 570 **Experimental Design** (2 hr.) An introduction to the theory and practice of hypothesis generation, experimental design and data management. The course is treated as a bridge between training in formal statistics and the practical needs of the working scientist. **Required first semester.** Squiers.

ENS 555 **Geospatial Analysis** (3 hr.) Applications of spatial analysis to environmental problems, including traditional mapping and surveying, remote sensing, Global Positioning Systems (GPS) and Geographic Information Systems (GIS). Introductory tutorial material will be followed by application to real world environmental problems. Reber/Guebert.

ENS 561 **Geomorphology** (4 hr.) An applied approach to the study of earth surface processes and the landforms they produce. Topics include processes and land forms associated with weathering, mass wasting, rivers, karst, tectonics, glaciers, shore lines, wind. Emphasis placed on environmental and land-use applications. Field and lab assignments include qualitative descriptions and quantitative measurements from fieldwork, topographic and geologic maps, and aerial photographs. Three hours of lecture and two hours of lab per week. Guebert.

ENS 562 **Hydrogeology** (4 hr.) Basic processes and measurement of the hydrologic cycle including precipitation, evaporation, surface runoff, stream flow, soil moisture, and groundwater. Emphasis placed on groundwater including aquifer characteristics, principles of flow, conceptual models of regional flow, geology of occurrence, well hydraulics, chemistry and quality, detection of pollutants, contaminant transport and remediation, and resource development. Three hours of lecture and two hours of lab per week. Guebert.

**ENS 590 Water Resources and Appropriate Technology** (3 hr.) The application of geologic and hydrologic methods to the problem of water supply development in developing countries. Includes a 2-4 week well drilling project in Guatemala. Guebert.

**ENS 563 Applied Geology & Environmental Planning** (4 hr.) The application of principles from surficial geology and hydrology in the recognition, assessment, and mapping of environmental geo-hazards in the context of environmental planning. Topics include hazards and land-use analysis of soils, slopes, floods, groundwater, coasts, and tectonic activities. Three hours of lecture and two hours of lab per week. Guebert.

**ENS 580 Systems Ecology** (4 hr.) The principles of systems theory are introduced in an integrated study of the development, dynamics, and disruption of natural ecosystems. Theoretical, analytical, and experimental aspects of ecosystems are explored. Students are introduced to the use of microcomputers as a tool in ecosystem modeling. Reber

**ENS 583 Environmental Ethics** (4 hr.) An in-depth discussion of the ethical implications of major environmental problems such as world population and food supply, inequities in land and resource distribution, animal rights, materialism and personal life styles, and exploitation vs. stewardship of the environment. Three hours of lecture and a discussion section per week. Squiers.

**ENS 502 Environmental Law and Policy** (4 hr.) Lectures introduce the major elements of US environmental law including the NEPA, EIS, CAA, CWA, RCRA, CERCLA, TSCA, FIFRA, and CRTK. The administrative process, cost/benefit analysis, and the role of litigation in enforcement are also discussed. Presentation techniques and debate skills are introduced. Three lectures and a discussion section per week. Squiers.

**BIO 501 Taxonomy of Vascular Plants** (4 hr.) Identification, classification, and systematics of vascular plants are studied. Laboratory emphasis is on local flora, plant family characteristics, and modern systematic techniques. Two hours lecture and four hours lab per week. Rothrock.

**BIO 507 Vertebrate Natural History** (4 hr.) This course looks at the adaptive anatomy, feeding relationships, behavior, life history, and geographical distribution of vertebrates from fishes to mammals. Labs focus on methods currently employed for study of vertebrates in the field and involve several outdoor sessions. Reber

**BIO 541 Environmental Physiology** (4 hr.) An introduction to the physiology of cells and tissues with emphasis on responses to environmental challenges. Topics include cell structure, protein synthesis and enzymes, water balance, transport, mineral nutrition, metabolism including photosynthesis, and responses to stress and toxins. Three hours lecture and three hours lab per week. Rothrock.

**BIO 571 Microbiology and Immunology** (4 hr.) A study of micro-organisms. Major emphasis is placed on the fundamental principles underlying the activities of bacteria and on the preparation of slides and cultures. Some emphasis is placed on the study of virology as well as cellular and humoral immunology. Two hours lecture and four hours lab per week. Whipple.

**CHE 520 Environmental Chemistry** (4 hr) Emphasizes principles and analysis of chemical movement and distribution in natural environments. The lab provides experiences in sampling and analysis of water, soil, and air. Experimental work is conducted in both natural habitats and the lab. King

**CHE 570 Environmental Toxicology** (4 hr) Hammond

**ECO 515 Environmental and Natural Resource Economics** (3 hr.) An analysis of the economics of environmental issues, such as pollution and pollution abatement, discussing cost-benefit analysis together with the economics of using both renewable and non-renewable natural resources. Issues of stewardship and dominion will be considered in light of economic tools. Mitchell.

**IAS 530 Human Relations & Organizations** (3 hr.) The study of human relationships in organizations as they pertain to management theories, processes, and organizational systems and structure. Vertical, lateral, and diagonal relationships and planning techniques and strategies as well as techniques of systems intervention and problem solving are studied. Staff

**ENS 610 Environmental Assessment** (3 hr.) Methodologies associated with the practical application of the Federal and State requirements for project and programmatic environmental impact statement as required by the NEPA. Additional land assessment tools such as Phase I and Phase II environmental assessments will also be covered. Squiers.

**ENS 620 Environmental Management** (3 hr.) An introduction to industrial processes and the methodologies associated with environmental monitoring and reporting in industrial settings. Remediation strategies, with a focus on the application of pollution prevention concepts, will also be discussed. Squiers.

**ENS 630 Ecosystem Assessment** (3 hr.) Methodologies associated with the assessment of the biotic and habitat components of terrestrial and aquatic ecosystems. The course will focus on the practical application of one or more standard assessment tools and include a discussion of EPA approved ASTM site assessment methods. Rothrock.

**ENS 640 Global Ecology** (3 hr.) The purpose of this course is two-fold: first, to (re)introduce students to the grandeur of the major ecosystems of planet earth and second, to provide a vehicle for exploring the current status of some of the global issues that threaten the sustainability of those ecosystems. The course will include: 1) a screening and discussion of the 2007 BBC/Discovery Channel series "Planet Earth" and the companion series "Planet Earth: The Future", 2) a review of critical global environmental issues as presented in two current textbook's, and 3) a series of student-led lectures and commentaries on the most recent developments relating to the issues presented in the texts. Squiers

**ENS 670 Topics in International Community Development** (3 hrs.) This course focuses on economic and social development of rural and urban communities in the so-called "Third World" nations and regions of Asia, Africa, and Latin America. This course should be particularly valuable to those students hoping or intending to pursue short-term projects or lifelong careers in the areas of charitable assistance, community development, or international business, especially as those efforts apply to the Third World's less affluent and secure people. Social and cultural phenomena that may pervert, distort, retard, oppose, or promote and encourage development are emphasized. Staff

**ENS 670 Topics in Conservation Biology** (3 hr) Reber

**ENS 670 Topics in Soil Science** (3 hr) Reber

**ENS 693 Graduate Seminar** (1 hr.) An introduction to the preparation and delivery of classroom lectures and professional papers. Papers delivered by invited speakers, faculty, and graduate students. Required attendance to all enrolled MES students with a minimum of one formal presentation per year. A cumulative total of 3 hours is required for degree completion. Squiers.

ENS 670 **Topics in Environmental Science** (1-4 hr.)

ENS 660 **Independent Study** (1-4 hr.)

ENS 790 **Thesis Research** as needed

ENS 792 **MES Internship** as needed

## MES PROGRAM FACULTY

Dr. Dan Bowell

Associate Dean of Academic Services and University Librarian

Dr. Ken Constantine

Professor of Mathematics and Statistics

BS, Eastern Nazarene College 1977

MS, Purdue University 1979

PhD, Purdue University 1981

Dr. Michael D. Guebert

*Hydrology and Environmental Geology*

Professor of Geology and Environmental Science

BS, University of Illinois 1985

MS, University of Illinois 1988

PhD, Penn State University 1991

Dr. Dan King

*Environmental Chemistry*

Associate Professor of Chemistry

BS, Huntington College 1998

PhD, University of Georgia 2002

Dr. Hadley T. Mitchell

*Environmental and Natural Resource Economics*

Associate Professor of Economics

BS, Houghton College 1969

MBA, University of Colorado 1975

MA, University of Tennessee 1985

PhD, University of Tennessee 1993

Dr. Jan M. Reber

*Wildlife Biology and Animal Ecology*

Associate Professor of Biology

BA, Taylor University 1989

MS, Purdue University 1991

PhD, Purdue University 1994

Robert T. Reber

*Forestry, Soils, and Terrestrial Ecology*

Associate Professor of Environmental Science

BS, University of Illinois 1989

MSF, Purdue University (Forestry) 1994

Dr. Paul E. Rothrock

*Plant Taxonomy and Systematics, Wetlands Assessment*

Professor of Biology and Environmental Science

BA, Rutgers University 1970

MS, Penn State University 1973

PhD, Penn State University 1976

Dr. Edwin R. Squiers

*Systems Ecology and Applied Environmental Science*

Professor of Biology and Environmental Science

BA, SUNY Binghamton 1970

MS, Rutgers University 1973

PhD, Ohio University 1976

Dr. Andrew P. Whipple

*Microbiology and Microbial Ecology*

Professor of Biology

BS, Ohio State University 1971

MS, SUNY Albany 1974

PhD, SUNY Albany 1979