Department of Environmental Resources Engineering

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Participating Faculty

DALEY (Water Resources, Solid and Hazardous Waste Management, Ecological Engineering, Environmental Restoration), DIEMONT (Ecological Engineering), ENDRENY, Chair (Water Resources Engineering, Ecological Engineering), IM (Geospatial Information Systems, Image Processing, Remote Sensing) KROLL, (Stochastic and Deterministic Hydrology, Environmental Modeling, Water Resource Systems Engineering, Ecological Engineering), MOUNTRAKIS (Brownfield Studies, Geospatial Information Systems, Image Processing, Mapping Sciences, Remote Sensing, Water Resources), QUACKENBUSH (Geospatial Information Systems, Image Processing, Remote Sensing, Spatial Measurements), SHAW (Hydroclimatology, Water Resources Engineering), TAO (Ecological Engineering)

The Environmental Resources Engineering department engages in teaching, research, and service to advance engineering practices to meet the needs of the world. With an innovative undergraduate curriculum and a wide variety of graduate courses, we provide outstanding opportunities for students to create and explore a host of educational opportunities. The department offers an accredited undergraduate program in forest engineering that originated at ESF in 1971. Our ABET-accredited B.S. in Forest Engineering program will continue to be offered through a transition period thorugh 2015. The Environmental Resources Engineering faculty have particular strengths in water resource engineering, ecological engineering, and geospatial engineering, though our flexible undergraduate curriculum allows students to also focus on traditional civil engineering practices. Required coursework in the humanities and social sciences ensures a well-balanced educational experience for graduates entering professional practice in engineering or those moving directly on to graduate school. With more than 1,200 graduates now in engineering practice, this unique program offers a breadth of engineering science and design coursework unparalleled in the United States.

The Department of Environmental Resources Engineering participates in graduate education leading to the master of professional studies, master of science, and doctor of philosophy degrees in environmental resource engineering.

Bachelor of Science in Environmental Resources Engineering

The objectives of the program are to prepare baccalaureate students who can successfully:

- Engage in professional engineering practice specializing in natural and designed environments
- Pursue graduate studies in environmental resources engineering, including ecological, geospatial and water resources engineering, and
- Expand and adapt their knowledge and skills to address the technological, environmental and social challenges of a changing world

A broad base of study in the fundamentals of engineering enables graduates to enter professional practices that focus on civil works as well as use and protection of soil, water, air and other renewable and non-renewable resources to ensure sustainable development.

Emphasis in this unique program is placed on applications in resource inventory, prediction, and evaluation; site analysis and development; environmental monitoring and impact assessment; environmental systems design, evaluation and management; pollution abatement and residuals management; and environmental site remediation.

The special importance of continual measurement and evaluation of the broad-scale parameters that affect the resource base provides unique opportunities for study to students aiming toward professional careers involving the conceptualization, design and maintenance of geographically referenced resource information systems.

Graduates of the program enjoy many benefits derived from their capstone-curriculum course in engineering planning and design. This project-oriented course serves to help the student integrate four years of education to solve complex design problems commonly encountered in professional practice.

Students with an interest in graduate study can plan their undergraduate studies along an individualized track to prepare themselves for ESF's master of science program in environmental and resource engineering. Students who qualify will be admitted to a quality graduate program with minimal interruption in their studies. In addition, qualified graduates in search of additional education find ready acceptance to top engineering graduate schools throughout the country.

The forest engineering program is accredited by the Engineering Accreditation Commission/Accreditation Board for Engineering and Technology (EAC/ABET).

Students having advanced placement credits are encouraged to work closely with their adviser in order to best prepare for various upper-division elective sequences in technology, science, design and/or management.

The undergraduate curriculum in forest engineering consists of two broad categories of courses. The general education component provides students with knowledge and skills that are useful and important for all educated persons. The second category, professional courses, provides students with direct preparation for a career in engineering and applied sciences.

Students may be admitted directly as first-year freshman students at ESF or through a variety of transfer options. To enter the curriculum at the sophomore or junior level, a transferring student must have acceptable college credit in the designated coursework areas or suitable coursework substitutions. Regardless of which way students enter ESF, they must complete both the general and professional education requirements.

Note: The requirements listed below also apply to currently matriculated students in the Forest Engineering program.

Undergraduate Program Requirements

Lower Division Required Courses (58 credits)

Courses			Credits	
APM	205	Calculus I	G, M	4
APM	206	Calculus II	M	4
APM	485	Differential Equations for Engineers and Scientists	M	3
EWP	190	Writing and the Environment	G, NS	3
EWP	290	Writing, Humanities and the Environment	G	3
EFB	101/ 102	General Biology I & Laboratory	G, NS	4
ERE	223	Statics and Dynamics	PE, E	4
ERE	362	Mechanics of Materials	PE, E	3
FCH	150/ 151	General Chemistry I and Laboratory	NS	4
FCH	152/ 153	General Chemistry II and Laboratory	NS	4
ERE	132	Orientation Seminar: Environmental Resources Engineering *Required for students who enter as freshmen or transfers.*	PE	1
ERE	133	Introduction to Engineering Design	PE, E	3
ERE	275	Ecological Engineering I	E	3
FOR	321	Forest Ecology and Silviculture	NS	3
MAT	296	Calculus III	M	4
PHY	211/ 221	General Physics I and Laboratory	NS	4
PHY	212/ 222	General Physics II and Laboratory	NS	4

Lower Division Electives (9 credits)

General Education Course	G	3
General Education Course	G	3
General Education Course	G	3

Upper Division Required Courses (40 credits)

APM	395	Probability and Statistics for Engineers	M	3
CIE	337	Introduction to Geotechnical Engineering	ED	4
ERE	351	Basic Engineering Thermodynamics	E	3
ERE	371	Surveying for Engineers	E	4
ERE	440	Water Pollution Engineering	ED	3
ERE	335	Numerical and Computing Methods	M	3
ERE	340	Engineering Hydrology and Hydraulics	ED	4
ERE	365	Principles of Remote Sensing for Engineers	E	4
ERE	430	Engineering Decision Analysis	E	3
ERE	468	Solid Waste Management	ED	3
ERE	489	Forest Engineering Planning and Design	ED	3

ERE	496	Fluid Mechanics	E	4

Upper Division Electives (18 credits)

Directed Engineering Design Elective An upper-division engineering course that is adviser-approved and provides the equivalent of at least one credit hour of depth in the design and synthesis component of the program. Approved directed engineering elective courses are: ERE 475 Ecological Engineering for Waste Management, ERE 551 GIS for Engineers, ERE 412 River Form and Process, and ERE 448 Open Channel Hydraulics	E D	3
Engineering Design Elective Approved engineering design elective courses are: CIE 331 Analysis of Structures and Materials, CIE 332 Design of Concrete Structures, CIE 338 Foundation Engineering, CIE 443 Transportation Engineering, CIE 473 Transport Processes in Environmental Engineering, ERE 441 Air Pollution Engineering, ERE 445 Hydrologic Modeling, ERE 496 Environmental Systems Engineering, ERE 496 Ecosystem Restoration Design, ERE 511 Ecological Engineering in the Tropics, ERE 596 Stormwater Management, ERE 596 Remote Sensing of the Environment, ERE 596 Digital Image Analysis, ERE 596 Spatial Analysis, or Special Topics (by petition)	E D	6
Free Elective		3
General Education Course	G	3
General Education Course	G	3

Total minimum credits for the degree 125 credits

Graduate Programs

Graduate studies and research are primarily concerned with environmental and resource-related problems. Students with a bachelor of science degree in engineering or in environmental sciences, physics, or mathematics have the opportunity to design an individual program of graduate study.

Facilities

The teaching and research facilities in Baker Laboratory were renovated in 2008 and support graduate study and research with modern laboratories and instrumentation. We have dedicated laboratories for ecological engineering, geospatial engineering, and water resources engineering research and instruction, supported by campus staff; wood and machine shops, and analytical and technical services. Research and analysis is facilitated by a powerful range of computing platforms and software. Off-campus facilities include the extensive ESF properties, and numerous field sites supported by an array of field equipment for environmental resource engineering measurements.

The ERE program in environmental and resources engineering offers options in:

Ecological Engineering (M.S., Ph.D.)
Participating Faculty: DALEY, DIEMONT, ENDRENY, KROLL, SHAW, TAO

Ecological Engineering is the design of ecosystems for the mutual benefit of humans and the environment. Ideal design considers humans to be part of nature rather than apart from nature. At SUNY–ESF we believe that ecological engineering education and research should meet local to global needs. We teach and research sustainable solutions and approach ecological engineering broadly, working in many areas of the world and in most major areas of ecological engineering. Graduates from the ecological engineering option commonly find employment or continue their advanced graduate education in any of the following areas of practice:

- Ecosystem restoration, including watershed, river, forest and wetland restoration
- Design of sustainable systems for wastewater treatment and stormwater management
- Environmental remediation
- Urban ecosystem design and development
- Industrial ecology, life cycle analysis and sustainability analysis

Ecological Engineering emphasizes engineering design of ecosystems consistent with ecological principles of natural, self-organizing, self-maintaining systems. This interdisciplinary field incorporates knowledge in engineering, ecology and social sciences to produce energy- and information-efficient solutions to environmental problems. Public policy, ethics and values are considered in the decision-making process. Students select between alternative solutions to ecological resource problems, in recognition of environmental, economic, legal, social and managerial constraints.

Program prerequisite or co-requisite courses include at least one semester of study in thermodynamics, fluid mechanics, or statics; probability and statistics; ecology; and hydrology. These are in addition to general course expectations for the Division of Engineering.

Program mastery courses include at least one course (3+ credit hours per course) in each of the 4 areas of competence listed below (illustrative courses are listed in parenthesis).

- Ecosystem Restoration (e.g., Ecosystem Restoration Design, Sustainability Analysis, River Form and Process, Ecological Engineering in the Tropics)
- Pollutant Treatment (e.g., Methods in Ecological Treatment, Ecological Engineering for Waste Management, Stormwater Management)
- Modeling (e.g., Hydrologic Modeling, Systems Engineering, Engineering Hydrology & Hydraulics)

- Ecosystem Sciences (e.g., Microbial Ecology, Ecosystems, Systems Ecology, Tropical Ecology, Ecological Biogeochemistry, Plant Ecology and Global Change, Aquatic Ecosystem Restoration, Limnology, Environmental Chemistry)

At least 12 credit hours of graduate coursework must be completed in engineering courses. Research credits complete the degree requirements.

Environmental Management (M.P.S.)
Participating Faculty: DALEY, ENDRENY, IM, KROLL, QUACKENBUSH, SHAW

- Brownfield development
- Hazardous waste management
- Solid waste management
- Energy resources management
- Water resource management

Environmental Management combines environmental engineering with business management and environmental law or policy to provide breadth and perspective for the student aspiring to managerial responsibility in public or private employment. Student coursework is designed to enhance technical and problem-solving skills.

Program prerequisite or co-requisite courses include at least six 3-credit undergraduate courses from at least three of the following fields: chemistry, physics, geographic measurements, calculus, statistics, engineering mechanics, ecology, computer science, and economics.

Program mastery courses include at least 12 credit hours of graduate coursework completed in engineering courses; 3–6 credit hours in natural sciences; and 3-6 hours in resource management. A comprehensive project or practicum completes the M.P.S. degree requirements. Study programs are flexible and are tailored to the interests and strengths of individuals.

Geospatial Information Science and Engineering (M.S., Ph.D.)
Participating Faculty: IM, MOUNTRAKIS, QUACKENBUSH

- Remote sensing and digital image/video analysis
- Spatial and spatiotemporal databases
- Artificial intelligence/machine learning in spatial analysis and modeling
- Environmental resources monitoring, modeling and assessment

Geospatial Information Science and Engineering is designed for specialized research in spatial information acquisition, analysis, modeling and applications. This includes theoretical and applied study in sensing systems and the location, measurement, analysis and description of ground features and earth resources. It also includes use of geographic information systems (GIS) to incorporate spatial data into a wide range of environmental and engineering problems.

Program prerequisite or co-requisite courses include at least one year of physics and calculus, one course in statistics, and one engineering science course in surveying, numerical methods, or computer science. These are in addition to general course expectations for the Division of Engineering.

Program mastery courses include at least one course (3+ credit hours) in each of the four Geospatial Information Science and Engineering areas (illustrative courses are listed in parenthesis):

- Remote sensing (e.g., Principles of Remote Sensing, Remote Sensing of the Environment)
- Geographic information systems (e.g., Introduction to Spatial Information, GIS for Engineers, GIS-Based Modeling, Introduction to Global Positioning Systems,
- Spatial analysis and programming (e.g., Spatial Analysis, Digital Image Analysis, Numerical and Computing Methods, Systems Engineering, Design and Analysis of Algorithm, Introduction to Artificial Neural Networks, Introduction to Database Management Systems, Data Mining, Artificial Intelligence)
- Statistics (e.g., Statistical Analysis, Multivariate Statistical Methods, Nonparametric Statistics, Analysis of Variance, Regression Analysis, Map Accuracy Assessment, Sampling Methods)

Ph.D. students will take an additional course in at least two of these areas (6+ credit hours total). These areas of competence form the basis for your graduate coursework and are supplemented by studies in systems analysis, environmental sciences and management, and geography. Departmental and other seminars are also required. Of the total graduate coursework, at least 12 credit hours must be completed in engineering courses. Research credits complete the degree requirements.

Mapping Sciences (M.P.S.)
Participating Faculty: IM, MOUNTRAKIS, QUACKENBUSH

- Geographic information systems (GIS)
- Global positioning systems (GPS)
- Analytical and digital photogrammetry

- Remote sensing and image processing

Mapping Sciences covers the development and practice of mapping technologies for environmental and engineering applications. Technologies used include GIS and GPS, as well as remote sensing and image processing tools.

Program prerequisite or co-requisite courses include at least one year of both physics and calculus, one course in statistics, and one course in either surveying or computer science. Students admitted without necessary background would be required to take additional prerequisite courses.

Program mastery courses are taken so students upon completion demonstrate competency in spatial data acquisition and fundamental spatial analysis concepts. This is typically achieved through completion of fundamental courses in remote sensing, geographic information systems, spatial analysis, and statistics. Students may specialize by taking advanced courses in the mapping sciences, statistics, computing, environmental sciences and management, or other fields.

A comprehensive project or practicum completes the M.P.S. degree requirements. Study programs are flexible and are tailored to the interests and strengths of individuals.

Water Resources Engineering (M.S., Ph.D.)
Participating Faculty: DALEY, ENDRENY, KROLL, SHAW

- Watershed hydrology monitoring, modeling, management
- Hydrologic and hydraulic experimentation and analysis
- Water resource systems engineering
- Stochastic and deterministic modeling
- Pollutant fate and transport
- River and watershed restoration

Water Resources Engineering deals with analysis and design of water resource systems through field, laboratory, and computer methods. Emphasis is placed on coordinating engineering to reduce impacts on human and natural systems. Students select among alternative solutions to water resource problems, in recognition of environmental, economic, legal, social and managerial constraints. Laboratory equipment includes soil columns, a river table and two tilting and sediment circulating flumes, all supported by monitoring sensors. Analytical techniques using statistics, numerical analyses, and computer applications are emphasized. Modeling efforts include computational fluid dynamics, GIS, and remote sensing applications, distributed and real-time models, and model calibration and validation.

Program prerequisite or co-requisite courses include probability and statistics, fluid mechanics, and engineering hydrology. These are in addition to general course expectations for the Division of Engineering.

Program mastery courses include at least one course (3+ credit hours) in each of the four areas of competence listed below (illustrative courses are listed in parenthesis). These areas of competence form the basis for your graduate coursework. Departmental and other seminars are also required.

- Environmental Hydraulics (e.g., Engineering Hydrology and Hydraulics, Open Channel Hydraulics, Transport Processes, Environmental Sediment Transport)
- Water Resources Modeling (e.g., Hydrologic Modeling, Systems Engineering, Groundwater Modeling)
- Hydrologic Zones and Fluxes (e.g., River Form and Process, HydroMeteorology, Vadose Zone Physics, Limnology, Hydrogeology)
- Water Quality (e.g., Water Pollution Engineering, Ecological Biogeochemistry, Environmental Chemistry; Environmental Aqueous Geochemistry,)

At least 12 credit hours of graduate coursework must be completed in engineering courses. Research credits complete the degree requirements.