Department of Environmental Resources and Forest Engineering

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Participating Faculty

DALEY (Water Resources, Solid and Hazardous Waste Management, Ecological Engineering, Environmental Restoration), DIEMONT (Ecological Engineering), ENDRENY (Environmental Engineering, Engineering Hydrology, Watershed Management), J.M.HASSETT (Environmental Engineering, Water Resources), IM (Geospatial Information Systems, Image Processing, Remote Sensing) KROLL, Chair (Stochastic and Deterministic Hydrology, Environmental Modeling and Water Resource Systems 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), TAO (Ecological Engineering)

The Environmental Resources and Forest 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. The Environmental Resources and Forest 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 800 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 and Forest Engineering participates in graduate education leading to the master of science, master of professional studies and doctor of philosophy degrees in environmental and resource engineering.

Bachelor of Science in Forest Engineering

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

- Will engage in professional engineering practice while employed by government agencies, industry and private consulting that specialize in public works and the inventory, management, design, use, restoration and protection of natural and cultural resources;
- Are prepared to enter advanced academic studies involved with natural resources engineering, mapping sciences and water resources; and
- Will continue to develop the knowledge and skills needed to adapt to changing technological, environmental and business conditions to the benefit of society, employer and self.

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 nonrenewable 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. In this way, 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 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 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.

Undergraduate Program Requirements

Lower Division Required Courses (58 credits)

Courses			Credits	
APM	485	Differential Equations for Engineers and Scientists *Math Course*	M	3
CLL	190	Writing and the Environment *Meets the requirements for general education skills and knowledge area. A complete listing of ESF or Syracuse University courses that meet general education standards established by SUNY.* *Natural Science course*	G, NS	3
CLL	290	Writing, Humanities and the Environment	G	3
EFB	101/ 102	General Biology I & Laboratory	G, NS	4
ERE	223	Statics and Dynamics Professional engineering course Engineering course	PE, E	4
ERE	362	Mechanics of Materials *Students who transfer to ESF typically take this course as part of their upper-division requirements, having already completed a general education course at the lower division.*	PE, E	3
FCH	150/ 151	General Chemistry I and Laboratory	NS	4
FCH	152/ 153	General Chemistry II and Laboratory	NS	4
FEG	132	Orientation Seminar: Forest Engineering Required for students who enter as freshmen or transfers.	PE	1
FEG	133	Introduction to Engineering Design	PE, E	3
FEG	275	Ecological Engineering I	E	3
FOR	321	Forest Ecology and Silviculture	NS	3
MAT	295	Calculus I	G, M	4
MAT	296	Calculus II	M	4
MAT	397	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	391	Introduction to Probability and Statistics	M	3
CIE	337	Introduction to Geotechnical Engineering *Engineering design course.*	ED	4
ERE	351	Basic Engineering Thermodynamics	E	2
ERE	371	Surveying for Engineers	E	4
ERE	440	Water Pollution Engineering	ED	3
FEG	335	Numerical and Computing Methods	M	3
FEG	340	Engineering Hydrology and Hydraulics	ED	4
FEG	365	Principles of Remote Sensing for Engineers	E	4
FEG	430	Engineering Decision Analysis	E	3
FEG	468	Solid Waste Management	ED	3
FEG	489	Forest Engineering Planning and Design	ED	3
MAE	341	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 II, ERE 527 Stormwater Management, ERE 551 GIS for Engineers, FEG 412 River Classification, and FEG 448 Open Channel Hydraulics*	ED	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, ERE 441 Air Pollution Engineering, ERE 445 Hydrologic Modeling, ERE 506 Hazardous Waste, FEG 311 Ecological Engineering in the Tropics, or Special Topics (by petition)*	ED	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 laboratories in Baker Laboratory were renovated in 2008 and support graduate study and research with modern laboratories and instrumentation in the engineering departments at both ESF and Syracuse University. Research efforts are supported by a range of computing platforms and software. Off-campus facilities include the extensive ESF properties, the Heiberg Experimental Watershed, and numerous field sites supported by an array of field equipment for environmental engineering measurements.

The ERFEG option in environmental and resources engineering offers areas of study in:

Ecological Engineering (M.S., Ph.D.)

Participating Faculty: DALEY, DIEMONT, ENDRENY, J.M. HASSETT, KROLL, TAO

- Ecosystem restoration
- Watershed and river restoration
- Ecosystems for waste treatment
- Biomass-to-energy systems
- Industrial ecology/life cycle 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.

Students in this option must demonstrate competency in the knowledge areas of physics, biology, chemistry, calculus, probability and statistics, mechanics, and hydrology. Students must take at least one course (3 credit hours) in each of the following areas:

- Systems engineering analysis
- Applied systems ecology

At least 12 credit hours of graduate coursework must be completed in engineering courses; 3–6 credit hours in natural sciences; and 3-6 hours in resource management. Research credits complete the degree.

Environmental Management (M.P.S.)

Participating Faculty: DALEY, ENDRENY, J.M. HASSETT, KROLL, QUACKENBUSH, TAO

- 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.

Students in the M.P.S. program must complete at least six 3-credit undergraduate courses from at least three of the following fields as pre- or co-requisites: chemistry, physics, geographic measurements, calculus, statistics, engineering mechanics, ecology, computer science, and economics.

At least 12 credit hours of graduate coursework must be 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.

Forest Engineering (M.S., Ph.D.)

Participating Faculty: DALEY

- Production management and efficiency
- Site modification
- Access design and construction

Students who focus on forest engineering are broadening the traditional areas of logging and harvesting. Emphasis is placed on engineering approaches to the design and analysis of operational systems for such activities as harvesting, construction, transportation, and land management. Graduate programs are based on a familiarity with operations and man-machine systems, biologic-geologic interactions, and various selections as needed from the array of engineering selections.

Geospatial Information Science and Engineering (M.S., Ph.D.)

Participating Faculty: IM, MOUNTRAKIS, QUACKENBUSH

- Analytical and digital photogrammetry
- Remote sensing and digital image/video analysis
- Spatial and spatiotemporal databases
- Artificial intelligence 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.

Students in this option must demonstrate competency in the knowledge areas of physics, calculus, statistics, surveying, or computer science. Students may take fundamental and advanced courses in remote sensing, geographic information systems, global positioning systems, photogrammetry, spatial analysis and modeling, and statistics. These courses are supplemented by studies in systems analysis, environmental sciences and management, geography, computer science, and information management. 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. 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.

Students in this option should have a background in fields such as physics, calculus, statistics, surveying, or computer science and upon completion of the program must demonstrate competency in spatial data acquisition and fundamental spatial analysis concepts.

Water Resources Engineering (M.S., Ph.D.)

Participating Faculty: DALEY, ENDRENY, J.M. HASSETT, KROLL

- Watershed hydrology
- Hydrologic/hydraulic monitoring and modeling
- Water resource systems engineering
- Stochastic/deterministic modeling
- Pollutant fate and transport
- Solid waste treatment and industrial residual flow capture

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. Analytical techniques using statistics, numerical analyses, and computer applications are emphasized. Modeling efforts include GIS and remote sensing applications, distributed and real-time models, and model calibration and validation.

Students in this option must demonstrate competency in the knowledge areas of physics, biology, chemistry, calculus, probability and statistics, mechanics, and hydrology.

Students must take at least one course (3 credit hours) in each of the following areas:

- Hydraulic analysis
- Watershed processes
- Systems engineering analysis
- Pollutant fate and transport

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