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State University of New York College of Environmental Science and Forestry

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ANNOUNCEMENT
OF COURSES

GRADUATE AND
UNDERGRADUATE

STATE UNIVERSITY
OF NEW YORK
COLLEGE OF FORESTRY

VOL. 10

1982-83
TO
1983-84



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1982-83 Catalog

SUNY College of
Environmental Science
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CORRESPONDENCE DIRECTORY

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470-6599

Financial Assistance

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Transcripts and Academic Records

Registrar
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470-6655

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Additional information is available upon request from any of the above addresses. This undergraduate/graduate catalog was published by the College of Environmental Science and Forestry, June 1982.

The calendar, courses, tuition, and fees described in this catalog are subject to change at any time by official action either of the State University of New York Board of Trustees or of the College of Environmental Science and Forestry.

The State University of New York College of Environmental Science and Forestry does not discriminate on the basis of race, sex, religion, national origin, age, handicap, marital or veteran's status in admissions, employment, and treatment of students and employees in any program, activity or service.

COLLEGE OF
 ENVIRONMENTAL SCIENCE AND FORESTRY
 1982-83 *General Catalog*

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Academic Calendar

SYRACUSE CAMPUS

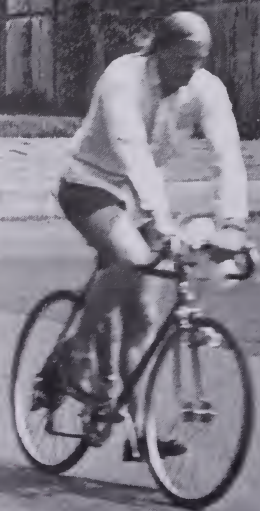
FALL 1982

Registration	September 8, 9	Wednesday, Thursday
First Day of Classes	September 10	Friday
Thanksgiving Vacation	November 24-28	Wednesday-Sunday
Last Day of Classes	December 16	Thursday
Exam Period	December 17-23	Friday-Thursday

SPRING 1983

Registration	January 11, 12	Tuesday, Wednesday
First Day of Classes	January 13	Thursday
Spring Recess	March 5-13	Saturday-Sunday
Last Day of Classes	April 27	Wednesday
Reading Day	April 28	Thursday
Exam Period	April 29—May 5	Friday-Thursday
Commencement	May 7	Saturday

STATE UNIVERSITY
OF NEW YORK
COLLEGE OF
ENVIRONMENTAL
SCIENCE AND FORESTRY



ESF: What's In A Name?

1911. Governor John A. Dix signed a bill establishing the New York State College of Forestry at Syracuse University.

1948. Legislative action incorporated into State University of New York all state-supported higher education. Thus, the State University College of Forestry at Syracuse University.

1972. By special legislative act, the College was renamed the State University of New York College of Environmental Science and Forestry.

Why, in the first place, all the name changes? And, secondly, what difference do they make? What, really, is in our name?

ESTABLISHING A TRADITION

While a professional forestry education in this country is almost entirely a development of the twentieth century, its primary roots can be traced back as early as 1862 when Congress passed the Morrill Act establishing a system of land-grant colleges.

The growing importance of forests in America's economy was reflected in the 1870 census, when, for the first time, information on forest resources was included. Several attempts to establish a national school of forestry were made; while none was approved, the movement shows that there was considerable demand for professionally trained foresters.

By 1900 there was a spirit of reform in the country—the same spirit that produced the early muckrakers also produced a generation interested in the conservation, preservation and careful management of precious natural resources. Between 1903 and 1914, 21 schools of forestry were established.

The first college of forestry in this country to offer a full, four-year undergraduate program was established in 1898 at Cornell University. Under the leadership of Bernard E. Fernow, students were introduced to critical field experience in their junior and senior years at the college's 30,000-acre forest in the Adirondack Mountains. There, Fernow taught many experimental management practices, including clear-cutting and surface-burning. These techniques have always been controversial, and they aroused criticism by the wealthy summer residents in adjacent areas of the Adirondacks. After only five years of operation, the Cornell College of Forestry was closed in 1903 when the state Legislature, yielding to the influential property owners, ended fiscal support.

The beginnings and early development of the New York State College of Forestry were largely due to James R. Day, chancellor of Syracuse University, and community leaders who were attuned to the growing national

sentiment favoring forest conservation and who sensed the need for a professional school of forestry. The legislative act which created the College instructed that the institution "conduct such special research in statewide investigations in forestry as will throw light upon and help in the solution of forestry problems. . ." and that it be "the institution for educational work in forestry in the State."

From the very first years of its existence under the first dean, Hugh P. Baker, the College responded to the broad needs of environmental professionalism. While other schools and colleges of forestry became more specialized, the College at Syracuse broadened to include the essentials of environmental science: design, engineering, and the life sciences, as well as resource management.

BROADENING THE BASE

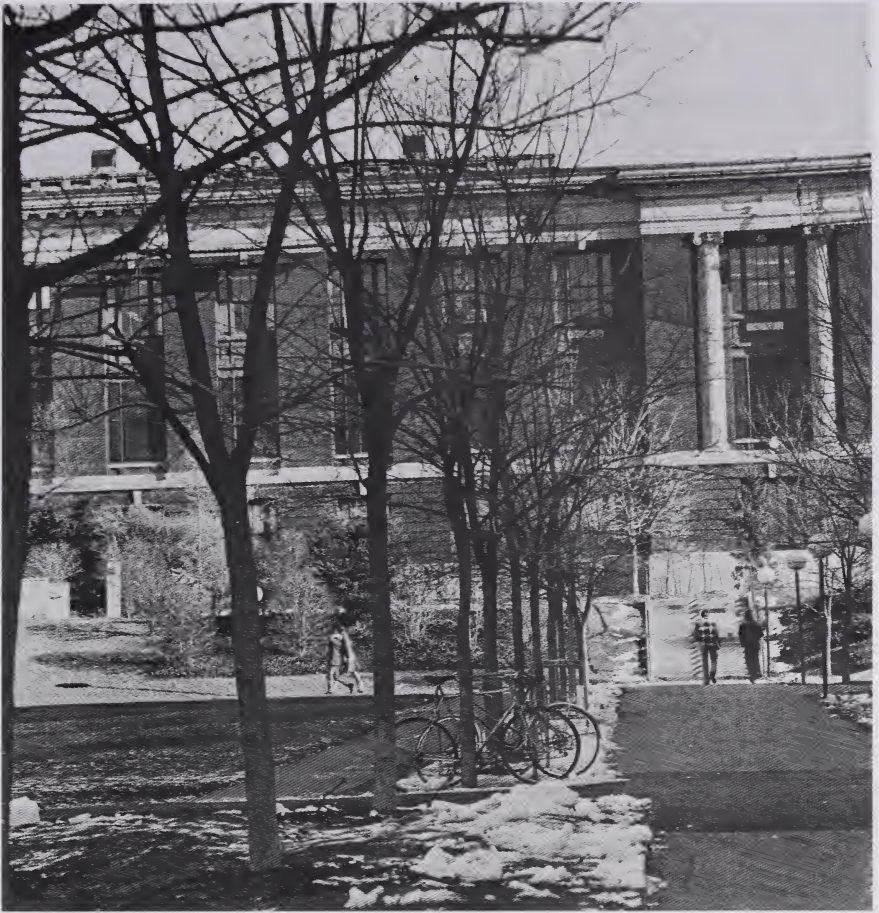
With the formation of the State University of New York in 1948, coordination and systematization came to higher education in the state. The University, according to its charter, was to "supplement, not supplant, the great network of private colleges and universities." The College of Forestry, which from its beginning had been state-supported and governed by a Board of Trustees currently made up of nine members appointed by the Governor and six *ex officio* members, was recognized as a specialized college within the State University system.

Stemming from Chancellor Day's early sponsorship of the College, Syracuse University and ESF have long been engaged in numerous fruitful devices of institutional cooperation. This relationship is probably the most outstanding example in this country of collaboration between public and private institutions of higher education. Even as a part of State University, the College maintains this unique position. The major character of the relationship stems from the fact that since its beginning, the College purchased from Syracuse University the major portion of its supportive and enrichment instruction, thus allowing the College to more fully develop its professional upper division and graduate level instruction.

Other cooperative areas are living centers and dining facilities, athletic programs, the use of the University's infirmary and health counseling services, the bookstore facilities, the University library system, and participation in numerous social activities including the elaborate religious, dramatic, and cultural benefits of a large university.

ESF TODAY

The third phase in the evolution of the College's name came in 1972 when it was rechartered as the State University of New York College of Environmental Science and Forestry. Thus, the name reflects more deeply the traditional grounding and concern of forestry in the environment; it illuminates more clearly the capabilities of its program.



The College of Environmental Science and Forestry has completed a plan, conceived more than 10 years ago, to achieve complete upper division/graduate status. Undergraduate students wishing to embark upon a career in the environmental sciences and forestry will enroll for two years at a junior college or four-year institution, studying an ESF prescribed program and transfer to this college as juniors. The move to upper division/graduate college status marks another step in the College's long-standing commitment to educate professionals capable of facing the complex environmental problems of today and of the future.

For more than 70 years, the full thrust of the State University of New York College of Environmental Science and Forestry has been focused on the environment on all of its six campuses and in each of its three mission areas—instruction, research, and public service. The College has been, and continues to be, devoted to the advancement of environmental science and forestry.

The Mission: Instruction, Research, and Public Service

INSTRUCTION

In the fall of 1981, student enrollment reached 1,738. Of this number, 1,235 were undergraduates and 503 were graduate students. In addition, there were 11 students engaged in postdoctoral work.

Undergraduate Education

At the baccalaureate level, the College offers professional study in eight areas: chemistry; environmental and forest biology; environmental studies; *forest engineering*; *paper science and engineering*; *wood products engineering*; *resource management*; and *landscape architecture*. These programs are registered with the New York State Education Department.

Each of these curricula leads to the bachelor of science degree. In the case of landscape architecture, an additional year of study results in a bachelor of landscape architecture degree, and in the forest engineering program, a fifth year leading to a bachelor's degree in civil engineering can be taken at Syracuse University or State University at Buffalo.

Graduate Education

The College awarded its first graduate degree in 1913. Today the College offers advanced degrees in seven major program areas: *environmental and forest biology*; *chemistry*; *resource management and policy*; *silviculture and forest influences*; *environmental and resource engineering*; *landscape architecture*; and *environmental science*. These programs are registered with the New York State Education Department.

Graduate study leads to the master of science degree, the master of landscape architecture degree, and the doctor of philosophy degree. A postdoctoral study program, closely related to the College's research effort, is also available.

In addition to these degrees, the College and Syracuse University provide the opportunity for graduate students to complete concurrently a degree at ESF and, at Syracuse University, either the J.D. degree in the College of Law, the M.P.A. degree in the Maxwell School of Citizenship and Public Affairs, the M.A. or M.S. degree in the S.I. Newhouse School of Public Communications, or the M.B.A. degree in the School of Management. Students must complete at least one semester of graduate level coursework



at ESF before being considered for a concurrent degree program at Syracuse University.

Technical Education

At the paraprofessional level, the College has been training forest technicians since 1912 at its Wanakena Campus in the Adirondack Mountains. It is the oldest Ranger School in the United States and offers a two-year *forest technology* curriculum. Graduates are awarded an associate in applied science degree. In this curriculum, students take their first year of general education at a two- or four-year college. The second year, with its emphasis on practical field training in the relationships between forest technology and managerial needs, is taken at Wanakena with its 2,800 acres of forested land. Graduates of this degree program in practical forestry are prepared for positions as forest rangers; federal, state, and private industry forest technicians and forestry aides; district forest supervisors; timber inventory specialists; timber sales supervisors; forest surveyors and engineering aides; and forest protection technicians.

Continuing Education

The philosophy that education is a lifelong pursuit is an ancient one and was written into the law creating the College. This concept is doubly important to the sciences and professions in this technological age when, with knowledge expanding in all directions, major environmental problems still remain to be resolved. The informational needs of New York's citizens also are undergoing change. The increasing urban character of our population; the changing pattern of agricultural and forest land ownership

and use; the rise in level of education and sophistication in a more efficient society; and the increase in leisure time, travel mobility and need for recreational facilities and pursuits all contribute to a growing need for educational opportunities in environmental science and forestry for adult audiences.

The College has, over the years, succeeded in communicating knowledge on forest resources management, utilization, and conservation to a variety of off-campus publics. The entire College faculty has contributed to these programs. To reinforce this commitment, the College established a School of Continuing Education upon which to base expanded educational opportunities at both the undergraduate and graduate course levels.

Conferences, symposia, seminars, and shortcourses on various aspects of forestry and the related sciences are conducted at both the basic and applied levels. Audiences include forest owners, managers, and operators; wood engineers and forest industries personnel; academic and scientific groups; conservation and recreation personnel from local and other public and private planning groups; and citizen-action committees. Upon request, continuing education programs can be designed to meet specific needs of professional organizations, agencies, and industry. Credit or noncredit courses, at campus or off-campus sites, can be arranged.

Expansion of "in-service" training courses, establishment of "environmental learning centers" on College forest properties, and production of media materials for public information and education are examples of activities directed toward updating and upgrading professional clients and broadening the public's awareness and appreciation of New York's forestlands and other natural resources.

For information on specific continuing education projects, inquiries should be sent to Director, School of Continuing Education.

RESEARCH

The College's commitment to scientific inquiry stretches far back to its second year of existence. In 1912, Dean Hugh P. Baker initiated the first research project of the College by joining forces with the U.S. Forest Service in an industry study designed to show what kinds of firms were using wood in New York State and the species and quantities used.

In the 1980's, the College's research program has attracted a worldwide clientele of industrial, governmental, professional and scientific groups, and through liaison with them, the program maintains its vigor and relevancy to the important environmental issues. Support from this clientele amounts to about \$4 million a year, a two-fold increase in the last decade.

Students and faculty from across the College contribute to the depth and diversity of the research program. Findings from these studies are applied to a host of issues and problems through various demonstrations and information devices. Recent examples include studies of limestone quarry

reclamation; the development of polymeric materials for artificial human organs; nonchemical control measures for insect pests, e.g., the gypsy moth; studies of the ecology of Antarctic birds; new wood pulping processes leading to pollution-free water and air effluents; and the ecological effects of winter navigation in the Great Lakes and the St. Lawrence River.

Institute of Environmental Program Affairs

Research and public service programs at the College of Environmental Science and Forestry are given additional emphasis through the Institute of Environmental Program Affairs (IEPA). This Collegewide coordination vehicle was initiated in 1972 in recognition of the College's traditionally broad and integrated approach to natural resources science and in response to new perceptions of the relationship between human endeavors and environmental quality. The Institute, which is staffed by the Office of Research Programs, functions to bring together groups of faculty scientists to explore research and public service needs and opportunities which transcend the programs of the schools, departments, and organized research centers and institutes of the College.

Study teams of scientists and graduate students from many disciplines have collaborated with external program cooperators from governmental agencies, citizens' groups, and private industry to pursue multidisciplinary research and public service programming as part of the IEPA program. Early efforts were focused on regional natural resource and environmental studies conducted at the request of New York State agencies such as the St. Lawrence-Eastern Ontario Commission, the Tug Hill Commission, the Catskill Study Commission, and the Adirondack Park Agency. Other studies which transcend regional problems and issues have been conducted with diverse sponsorship, including environmental service systems, leisure time and recreational activities appropriate to the Hudson River Basin; solid waste processing and heavy metals recovery from processing residues from the forest products industry; wetlands evaluation studies; remote sensing techniques to facilitate environmental monitoring of coastal water quality and land use patterns; reclamation of open pit limestone quarries; the siting of nuclear power generation facilities; and environmental assessment studies associated with proposals for extended season navigation in Lake Ontario and the St. Lawrence River.

More recently, IEPA has provided a focus for faculty interested in pursuing research and public service programming through diverse sponsorships in particular areas of high public concern. Three task forces are currently operating in these areas to develop new project activity and coordinate the Collegewide research focus in bioenergy projects, acid precipitation and atmospheric deposition, and sludge and sludge management concerns.

Empire State Paper Research Institute

The Empire State Paper Research Institute (ESPRI) is the only worldwide basic research organization in the pulp and paper field. It performs investiga-

tions in cooperation with the Empire State Paper Research Association (ESPRA), which is comprised of 78 pulp and paper companies in 14 countries. The Institute was established in 1945 when the members of ESPRA recognized the need for new scientific and technical knowledge and methods, and since then ESPRI has been able to maintain an efficient balance between the practical and theoretical bases of the pulp and paper industry.

Housed in the modern J. Henry Walters Hall with its own pilot paper mill, and staffed by scientists who are internationally recognized for their accomplishments, ESPRI provides a research base for long-range industry development. Its program has widened in scope to cover almost all aspects pulping and papermaking, including additive retention, oxygen pulping and bleaching, effluent control, sheet drying, printability, and energy efficiencies.

Polymer Research Institute

Scientists at the College have made many original contributions to the field of pure and applied polymer chemistry, including the development of living polymers, the study of anionic polymerization and electron-transfer initiation, and work on the permeation of gases and films through polymeric films.

College faculty members specializing in polymer chemistry have trained several hundred graduates and postdoctoral researchers, many of whom now hold leading positions in universities and industrial and governmental laboratories.

Nelson Courtlandt Brown Laboratory for Ultrastructure Studies

This Center, located in Baker Laboratory, is a teaching, research, and service facility of the College. It is equipped to handle virtually every type of modern microscopy. This includes light, scanning electron, and transmission electron microscopy. Among the major items of equipment are: two RCA EMU-3 transmission electron microscopes; an RCA EMU-4, an ETEC Autoscan scanning electron microscope, energy dispersive X-ray analyzer, several types of light microscopes, high vacuum evaporators, microtomes and ultramicrotomes. The laboratory resources include specimen preparation rooms, several photographic darkrooms, three electron microscope laboratories and other supporting facilities.

The primary service of the Center is teaching; course offerings include photomicrography, scanning electron microscopy, and interpretation of cellular ultrastructure. Research is a second major activity since support is provided for students, faculty, and research staff who have projects involving structural studies. Public service is extended to local high school groups, medical facilities, other regional colleges and universities, and industry.

Adirondack Ecological Center

The Adirondack Ecological Center (AEC) is located on the College's Newcomb Campus in the center of the Adirondack Mountains. Staffed by

resident scientists, technicians, and support staff, the AEC conducts studies of the Adirondack region year-round. Research includes studies of managed and unmanaged forest lands, wildlife populations and habitats, terrestrial and aquatic ecology, and wilderness management. Work is carried on in close collaboration with the New York State Department of Environmental Conservation, the U.S. Fish and Wildlife Service, the U.S. Department of Agriculture, and forest industries.

The vigorous research program of the Center provides excellent opportunities for collaboration by Syracuse-based faculty and students. Several graduate students are regularly in residence at Newcomb pursuing their thesis research.

Renewable Materials Institute

The Renewable Materials Institute (RMI) has as its principal goal research on wood and other renewable materials such as agricultural waste products, which would include straw, rice hulls, and bagasse. To meet its mission, research on the characterization of the material itself is primary. Closely related with it is the determination of physical properties which control the behavior of the material during utilization as well as in use in consumer products. In exploring renewable materials, strong emphasis is placed on energy considerations. This can be in terms of energy savings during production or economies of energy because of the use of the end product in housing or in some other application. Also included are related studies in the combustion of wood, the efficiency of heating with wood and the emissions resulting from wood combustion.

The principal facilities for the materials characterization are found in the Center for Ultrastructure Studies and include the transmission electron microscopes, a scanning electron microscope with EDXA and rapid particle analysis. All of the facilities of the Department of Wood Products Engineering are also available, including a sawmill, veneer and plywood manufacturing facility, dry kilns, wood machining equipment, and timber testing laboratory. The facilities of other research institutes and Departments in the College are also available for special projects.

Tropical Timber Information Center

The Tropical Timber Information Center (TTIC) provides identifications of wood samples and information about tropical woods for both general characteristics and technical properties. These services are oriented toward importers and users of tropical woods. The Center began operation in 1975 as part of the Department of Wood Products Engineering and is one of only two such sources of information in the western hemisphere. The Center also carries out special studies under contract for production of data that is not available in the literature. The technical base for operation of the Center is a large, worldwide collection of authenticated wood samples and an extensive

collection of reference materials in Moon Library and the Department of Wood Products Engineering. Both of these resources have been built up over the past 60 years by close cooperation with institutions throughout the world. Activity of the Center is oriented toward requests for services from importers and users of tropical woods and to expanding the collections.

Cellulose Research Institute

Research at the Cellulose Research Institute is at present centered on the fine structure of native cellulose and its transformations into other commercially important forms of cellulose. For example, the structural differences between native and regenerated celluloses have been determined, for the first time, through x-ray crystallographic studies. The same techniques are now being used to study the structural aspects of cellulose mercerization, an important commercial process in cellulose chemistry. Other recent research has been concerned with the organization, chemical composition, and function of the vascular cambium in trees, the ultimate source of all wood and bark produced in nature.

U.S. Department of Agriculture—Forest Service Cooperative Research Unit

The Northeast Forest Experiment Station of the U.S. Department of Agriculture-Forest Service maintains a research center at the College. Until 1977, this unit pursued studies of forest-centered recreation with the aim of developing methods for integrating recreation and other uses of forests.

Beginning in 1978, the Cooperative Research Unit was re-oriented to research on urban environmental forestry problems. This provides increased opportunities for faculty and students to collaborate with Forest Service scientists in studies of urban and environmental problems.

PUBLIC SERVICE

The College, throughout its 70-year history, has continued to respond to its specific legislative mission prescribing major responsibilities in the area of public service. Public education and information, technical advice and guidance to cooperating local, state, and federal agencies and organizations, and technical assistance to the forest and wood-using industries constitute the principal formal public service activities. The Institute of Environmental Program Affairs (described in the Research section) coordinates the College's public service activities on the professional level.

While the list of public service contributions is lengthy, a few examples include: the College's Film Library; the Tree Pest and Disease Service, which provides technical advice to private citizens and to governmental agencies; and the participation of ESF faculty members in Central New York's Poison Control Center. Altogether, the public service programs of the College reach approximately one million New York State residents each year.

The Campuses

The College operates a multiple campus system with regional campuses and field stations located at Syracuse, Tully, Wanakena, Warrensburg, Cranberry Lake, Newcomb, and Clayton. This system, composed of about one million square feet of facilities in 186 buildings and 25,000 acres of land, represents the largest fully-utilized campus in the world.

THE SYRACUSE CAMPUS

The main campus is in Syracuse and lies on 12 acres adjacent to Syracuse University in an area that traditionally has been known as "The Hill." Located here are the Schools of Biology, Chemistry, and Ecology; Environmental and Resource Engineering; Forestry; Landscape Architecture; and Continuing Education. In addition, the main campus houses the Institute of Environmental Program Affairs, the Empire State Paper Research Institute, the Polymer Research Institute, a cooperative research unit of the USDA Forest Service, the Ultrastructure Center, the Graduate Program in Environmental Science, and the Renewable Materials Institute.

These program units are housed in five major academic buildings (Baker Laboratory, and Walters, Bray, Marshall and Illick Halls). The main campus also includes Moon Memorial Library, the Maintenance Building and several other small service and storage facilities.

Specialized facilities at the Syracuse campus include electron microscopes, plant growth chambers, air-conditioned greenhouses, an animal environmental simulating chamber, a bio-acoustical laboratory, a 1,000-curie cobalt-60 radiation source, radioisotope laboratory, computing center, and specialized instrumentation including nuclear magnetic resonance spectrometers, electron spin resonance spectrometer, gas chromatography, mass spectrometer, ultracentrifuge, and X-ray and infrared spectrophotometer. Photogrammetric and geodetic facilities of the forest engineering department include one of the most extensive arrays of equipment in the United States, with a Nistri TA-3 stereocomparator, Mann comparator, computerized Nistri photocartograph, and nine other varieties of plotters. The paper science and engineering laboratory has a semicommercial paper mill with accessory equipment. The wood products engineering department has a complete strength-of-materials laboratory as well as a pilot scale plywood laboratory and a machining laboratory. The greenhouses and forest insectary are used to produce plant and insect material for classroom and laboratory. Extensive collections are available for study, including wood samples from all over the world, botanical materials, insects, birds, mammals, and fishes.

The **F. Franklin Moon Library** contains more than 80,000 cataloged items. Over 800 journals and corresponding indices are currently received. The collections constitute an information center for forestry and environmental science programs in ecology, botany and pathology, biochemistry, chemical ecology, forest chemistry, polymer chemistry, economics, entomology, environmental studies, industrial pollution abatement, landscape architecture, environmental design, management, paper science and engineering, photogrammetry, silviculture, soil science, water resources, world forestry, wildlife biology, wood products engineering, and zoology. These are supplemented by large collections in the environmental resource field. Additional strength is found in the comprehensiveness of abstract and indexing services relevant to the College's programs.

The collections of Syracuse University libraries and State University Upstate Medical Center are within walking distance. They may be used by all members of the College of Environmental Science and Forestry. Arrangements often can be made to use industrial libraries in the Syracuse area. Other collections from throughout New York State and the United States are accessible through Inter-library loan privilege.

The library building, opened in 1968, can accommodate 132,000 volumes and can seat 575 persons. The main reading areas are in the center of the upper level, surrounded by open stacks. The library contains a current periodicals room, bibliographic center, individual study carrels, and library staff offices. The archives, special collections, conference rooms, autotutorial center, and informal study rooms are located on the lower level.

Leisure reading material, distributed throughout the total collection, represents the Robin Hood and Raymond F. Crossman collections, which contain books on national and world social problems, humanities, education, and popular books concerned with the environment. The archives consist of historical items relevant to the College and forestry developments in New York State. The special collections room contains rare and valuable books and folios.

Reference service, orientation, and bibliographic instruction (Library Research 300) are provided by the librarians. Study guides, user aids, and other such publications are prepared and distributed by the librarians as needed.

The **Educational Communications** unit directly supports the program areas of the College through development and application of media materials and methods for the classroom, for the presentation of research findings, and for public service endeavors. These include television programming, slide/tape and motion picture production and photographic services. Other services to the College community include engineering, audio-visual equipment distribution, and maintenance and support functions. The Educational Communications staff also participates directly and actively in

instructional programs in environmental communication at both the undergraduate and graduate levels, as well as through the School of Continuing Education.

The College **Computer Center** provides computational service in several forms. The primary source is via remote communication with the facilities at Syracuse University which consist of an academic computer center and an administrative center. The academic facilities permit both batch and interactive processing on one of three processors—two IBM 4341's and one DEC-KL10; the administrative facilities service the data-processing needs of ESF with an IBM System/370 model 158. Extensive software is available for the academic user in the form of most of the major languages—Fortran and APL finding the heaviest usage—and most of the major applications packages for statistics, graphics, text editing, and general mathematical needs. In addition to the centrally supplied services described above, there are numerous micro-computer facilities being established for specialized needs in chemistry, engineering, remote sensing, forestry and other related and supporting fields.

THE TULLY CAMPUS

Located about 25 miles south of Syracuse is the Tully Campus which is composed of the Heiberg Memorial Forest and the Genetic Field Station.

Heiberg Memorial Forest is located on the northern escarpment of the Allegheny Plateau. It includes 3,800 acres of diverse terrain and forest growth. The Forest is utilized both as an extensive outdoor teaching laboratory and as a site for intensive research. The **Forest Ecosystem Lab**, which is a highly instrumented outdoor teaching laboratory, a large complex of all-weather classrooms, many experimental plantings from throughout the world, a commercial-scale maple syrup operation, and an experimental deer research area are among the developments on this forest. Each fall the Heiberg Memorial Forest is the site of an intensive program for environmental and resource management students in a total ecosystem approach to forest community management instruction.

THE WANAKENA CAMPUS

The Wanakena Campus, located on the Oswegatchie River, 65 miles northeast of Watertown and 35 miles west of Tupper Lake, is the site of the **James F. Dubuar Forest** and the **School of Forest Technology**. This campus, with its large instructional and demonstration forest, supports the College's associate degree program for the training of forest technicians. This is the oldest forest technician school in the country. This campus is situated on the western plateau of the "lakes region" of the Adirondacks.

In addition to its full academic program, this campus hosts various summer short courses in forest biology and forest technology.

THE WARRENSBURG CAMPUS

The Warrensburg Campus is located in the southeastern Adirondack region and encompasses the **Charles Lathrop Pack Demonstration Forest**, an area of roughly 2,500 acres of heavily forested land noted for its white pine. The Forest has been under intensive management since 1927 for the combined purpose of instruction, research, and demonstration in forestry and allied fields.

Each year this campus hosts the Summer Session in Field Forestry, a five-week course devoted to introductory instruction in field forestry principles and techniques. The course is required of all entering students in Environmental and Resource Management and is open to election by students in Environmental and Forest Biology.

Formal offerings in Continuing Education and various meetings and conferences are also held here for practicing professionals and organizations directly associated with forestry and allied environmental fields.

THE CRANBERRY LAKE CAMPUS

The Cranberry Lake Campus, approximately 1,000 acres of forested property situated in the northwestern section of the Adirondack Mountains of northern New York State, is the site of the College's **Biological Station** where the College operates a ten-week summer field program in environmental biology. The campus is bounded by 150,000 acres of New York State forest preserve lands, by Cranberry Lake and by isolated forest bogs and beaver meadows.

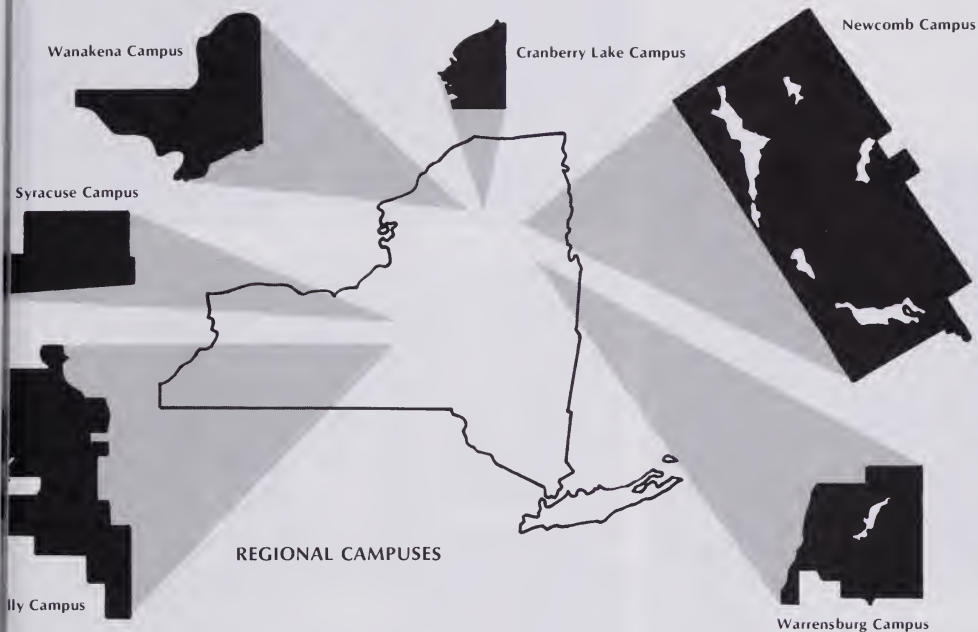
The extensive facilities are intensely utilized in a comprehensive curriculum of upper-level and graduate courses.

Use of this campus before and after the summer session program varies to include individual research projects, cooperative studies with other agencies and visits by large groups from both the College and outside institutions.

THE NEWCOMB CAMPUS

Located in the central Adirondack Mountains, Newcomb is the largest of the regional campuses and home to the **Adirondack Ecological Center** where extensive studies of animal biology and ecology are carried out. Also located there is **The Archer and Anna Huntington Wildlife Forest** which is about 15,000 acres in size.

This campus is of mountainous terrain and contains a variety of vegetative types and wildlife. The campus is used year round for a general research and forest management program participated in by faculty, graduate students, and visiting scientists.



THE FIELD STATIONS

In addition to its regional campus system, the College operates several field stations which directly support the instruction, research, and public service programs of the institution. The 44-acre **Forest Experiment Station**, located only a few minutes drive from the main campus in Syracuse, is used to support main campus academic programs. Located at the Station are a large arboretum, tree nursery, and experimental greenhouse facility. Adjacent to the Tully Campus is the College's **Genetic Field Station**. It is a 59-acre area devoted to relatively short-term outplantings of plant materials developed in the various genetic research projects of the College. With its irrigation system and layout of level blocks, it is an excellent facility for developing hybrids, for grafting, doing experiments, and for research in heritability. A magnificent island, the **Ellis International Laboratory**, is situated in the heart of the Thousand Islands—St. Lawrence River area off the village of Clayton. Accessible only by boat, this laboratory is an unusually appropriate site for the College-wide, cooperative and international, environmental monitoring and research activities of the St. Lawrence Seaway area. The College's most recent acquisition is a 15.2-acre facility on **Wellesley Island**. This island property, formerly a Coast Guard Station, has short frontage on the American channel of the St. Lawrence Seaway. It is ideally suited for aquatic studies of many types.



The Syracuse Metropolitan Area

The College of Environmental Science and Forestry is located on one of several hills that overlook Syracuse, a growing metropolitan area of nearly 500,000. Known as the "Salt City" because of the great salt industry which was centered here for more than seventy years, Syracuse is today a city of diversified industry and commerce. The area is a leader in the manufacture of china, quality shoes, air conditioning equipment, medical diagnostic equipment, drugs, automotive parts, and lighting equipment.

The City of Syracuse offers students many cultural, recreational and educational opportunities, including a symphony orchestra, several museums, live theater and historical points of interest.

Called the "Crossroads of New York State," Syracuse is one of the few cities in the nation situated at the crossing point of two major super-highways. It is located at the intersection of the 500-mile east-west New York State Thruway and the north-south Penn-Can Highway. Driving time from New York City, Philadelphia, Boston, Toronto and Montreal is about five hours; from Buffalo and Albany about three hours. The city is served also by a modern international airport and major bus and rail lines.



Academic Life

Society is increasingly in the hands of those who have broad foresight and a balance of judgment in applying scientific, sociological, and technical knowledge to guide human and environmental forces. Modern civilization—with its compelling demands from industry, government, and educational institutions—requires people who think objectively and constructively, and who act creatively and responsibly.

From its beginnings in 1911, the State University of New York College of Environmental Science and Forestry has served New York State and the nation in meeting the needs of its citizens in regard to the environment through education, research, and public service. The faculty and students of the institution are committed to the resolution of immediate environmental problems, the development of the knowledge necessary to predict occurrences in the future, and the presentation of public policy alternatives that will both protect the environment and accommodate the real needs of society.

At the undergraduate level, ESF offers curricula in the general areas of resource management, engineering, environmental design, and the physical and life sciences that prepare graduates to enter and contribute to the professional world or to continuing their education at the graduate level, at ESF or elsewhere.

Graduate years are a time of discovery and excitement, a time of answers and new insights, a time of personal productivity and contributions to scholarship. It is during graduate education that the student sharpens the ability to think critically and analytically, to plan research, to design experiments, to work effectively with the basic research tools as well as specialized equipment, and to undertake the discipline of purposeful study toward a specific goal.

The College currently supports significant graduate degree programs in six discipline areas and in its broad program in Environmental Science, which encourages multidisciplinary study. Both undergraduate and graduate programs of the College reflect the work of its faculty and their student colleagues, who, together, utilizing some of the most modern facilities and laboratories in the country, maintain a long-standing tradition of academic and professional excellence.

This catalog provides an introduction to the College and its programs of undergraduate and graduate study and research. It only begins to suggest the diversity and depth of the existing and potential programs that make environmental science the challenge of the 1980's and beyond.

UNDERGRADUATE ADMISSION

The College of Environmental Science and Forestry is an upper division/graduate center, enrolling at the undergraduate level transfer students who have completed at least two years of postsecondary coursework. Outstanding high school seniors can assure their acceptance by the College as junior transfers by applying to the Advanced Early Admission program.

Freshman and sophomore level courses may be taken at any two- or four-year college or university; all students considering transfer to ESF as juniors should follow the prescribed program appropriate to their intended major at the College. Each curriculum offered at the College of Environmental Science and Forestry and listed in this catalog defines the required lower division courses necessary for admission. These requirements are listed in the Areas of Study section of the catalog.

Students who are certain they intend to transfer to ESF may enroll in established pre-environmental science programs organized by the College in cooperation with a number of two- and four-year colleges in and out of New York State. Students who attend these colleges will find a smooth articulation has been established and upon successful completion of these prerequisites will generally gain admission to the college with full junior status. It is not required to specifically attend one of these colleges; a student may obtain the necessary lower division courses at almost any college or university in the country.

Application to ESF's associate degree program in Forest Technology at the Wanakena Campus must be made one year in advance. Therefore, high school students desiring to attend the Wanakena program in 1984 must apply this year. For further information on ESF's School of Forest Technology, see page 126, or contact the Office of Admissions.

ADVANCED EARLY ADMISSION PROGRAM

High school students who are strongly motivated toward attending ESF may apply to the College of Environmental Science and Forestry during their senior year under the *Advanced Early Admission Program*.

Those seniors whose academic background is successfully competitive will receive a letter of acceptance to the College for entrance two years later with full junior status, contingent upon successful completion of all prerequisite courses of the first two years of the curriculum to which they have been admitted. The prerequisite courses will be outlined and described in an enclosure with the acceptance letter.

This early acceptance will alleviate much of the anxiety about admissibility. High school seniors will know prior to graduation if they have been accepted to the College for entrance at the junior level. It affords those accepted students the opportunity to attend any college of their choice that offers the

appropriate lower division courses. SUNY applications for the Advanced Early Admission Program may be obtained from high school guidance offices in New York State or directly from the Office of Admissions at ESF.

TRANSFER ADMISSIONS

For those students not accepted under the Advanced Early Admission Program, admission to the College of Environmental Science and Forestry is based on the student's previous college coursework, overall academic aptitude, and interest in the programs offered at this College. Consideration is given to both the quality and appropriateness of the student's prior academic experience. The minimum grade point average for acceptance is 2.0 (4.00 = A).

PRE-ESF COOPERATIVE TRANSFER PROGRAMS

The College, working in cooperation with other collegiate institutions, both in and out of New York State, has developed over 53 pre-environmental science and forestry programs. The development of these programs illustrates that high school students can look forward to a wide selection of colleges in which they can obtain all the necessary lower division courses and appropriate advisement to transfer to ESF as full juniors.

These colleges represent the total spectrum of higher education (private, public, 4-year, 2-year) and are located in New York, Connecticut, Massachusetts, New Jersey, Pennsylvania, Rhode Island, Iowa, and Maryland. Students who attend these colleges will find a smooth articulation has been established and once they transfer to ESF will share a common academic background with other transfer students.

Currently, the list of cooperating colleges includes:

New York State Colleges

Adirondack Community College, Glens Falls
 Broome Community College, Binghamton
 Canisius College, Buffalo
 Cayuga County Community College, Auburn
 Columbia-Greene Community College, Hudson
 Community College of Finger Lakes, Canandaigua
 Corning Community College, Corning
 Dutchess Community College, Poughkeepsie
 Erie Community College, Buffalo
 Genesee Community College, Batavia
 Herbert H. Lehman College, Bronx
 Herkimer Community College, Herkimer
 Hudson Valley Community College, Troy

Jamestown Community College, Jamestown
 Jefferson Community College, Watertown
 LeMoyne College, Syracuse
 Mohawk Valley Community College, Utica
 Monroe Community College, Rochester
 Nassau Community College, Garden City
 Niagara County Community College, Sanborn
 North Country Community College, Saranac Lake
 Onondaga Community College, Syracuse
 Orange Community College, Middletown
 Paul Smith's College, Paul Smiths
 Rockland Community College, Suffern
 Siena College, Loudonville
 Suffolk County Community College, Selden
 Sullivan County Community College, Loch Sheldrake

SUNY Alfred Ag. & Tech., Alfred
 SUNY Canton Ag. & Tech., Canton
 SUNY Cobleskill Ag. & Tech., Cobleskill
 SUNY Delhi Ag. & Tech., Delhi
 SUNY College at Geneseo, Geneseo
 SUNY Morrisville Ag. & Tech., Morrisville
 SUNY College at New Paltz, New Paltz
 SUNY College at Oswego, Oswego
 Syracuse University, Syracuse
 Tompkins Cortland Community College,
 Dryden
 Ulster County Community College, Stone
 Ridge
 Westchester Community College, Valhalla

Out-of-State Colleges

Allegany Community College, Cumberland, MD
 Berkshire Community College, Pittsfield, MA
 Camden County College, Blackwood, NJ
 Garrett Community College, McHenry, MD
 Holyoke Community College, Holyoke, MA
 Housatonic Community College, Bridgeport, CT
 Keystone Junior College, LaPlume, PA
 Kirkwood Community College, Cedar Rapids, IA
 Mercer County Community College,
 Trenton, NJ
 Middlesex Community College, Edison, NJ
 Ocean County College, Toms River, NJ
 Roger Williams College, Bristol, RI
 Union College, Cranford, NJ

TRANSFER CREDIT

Courses transferred for credit must be appropriate to the student's curriculum choice. Credit will be awarded for all such courses completed with a passing grade of "D" or better.

Furthermore, courses to be transferred as required courses in a curriculum must be acceptable in content. Course credit hours are transferred, but grades and grade points are not.

No transfer credit will be awarded until all final transcripts are received. It is the student's responsibility to see that this is done.

COLLEGE PROFICIENCY EXAMINATIONS

The College recognizes that an increasing number of students are obtaining college-level credit through examination and/or completion of College credit while in high school. The College's policy on this, and other forms of nontraditional credit, is to grant the same amount of credit in parallel courses as the student's previous collegiate institution granted. It becomes the student's responsibility to be sure that *all* earned credits are on the previous college transcript and clearly identified by academic discipline.

EDUCATIONAL OPPORTUNITY PROGRAM

The basic goal of the Educational Opportunity Program at the College is to provide qualified students with a college education—the opportunity for personal growth and professional development. Upon completion of the program, graduates will be provided access to jobs in professional fields. The program is not designed for students who need only financial assistance. It serves students who ordinarily would not be able to attend college because of a lack of financial resources and insufficient academic preparation. To qualify, students must be New York State residents and demonstrate the potential to successfully complete the courses of study at the College.

Further information regarding the Educational Opportunity Program may be obtained by contacting the Office of Admissions.

INTERNATIONAL STUDENTS

The College accepts international students on the undergraduate level if they can satisfy all regular admission requirements. It is recommended, however, that students from foreign countries obtain their baccalaureate degree in their home country, and apply to the College as graduate students. Experience has shown that this arrangement provides for greater academic achievement and more efficient use of the student's time and funds. International students applying for admission must satisfy all of the course prerequisites for their intended major. In addition they must:

1. Demonstrate proficiency in the English language through acceptable performance on the Test of English as a Foreign Language (TOEFL) and/or the College Entrance Examination Board (CEEB) Achievement Text in English, and

2. Produce evidence of their ability to meet all their financial obligations.

Undergraduate international students must file official State University of New York foreign student admission forms. Prior to international student acceptance, adequate financial resources must be demonstrated, and after acceptance health and accident insurance must be obtained before the student will be allowed to register at the College.

International students who are currently at an American college may apply for transfer to the College. They must meet all entrance requirements of international students plus those of a transfer student as listed above. Permission to transfer must be obtained from the U.S. Immigration and Naturalization Service district office having jurisdiction over the college in which the student is currently enrolled.

HEALTH EXAMINATION BOARD

Each new student is required to submit a medical history and physical examination report on a form that will be sent after the initial acceptance notice.

GRADUATE ADMISSION

Admission to graduate study may be granted only to applicants with at least a bachelor's degree from a recognized institution and whose preparation has been suitable in quality and content for the proposed field of major study. Applicants will be evaluated on the basis of the following: (1) their academic record should show at least a B or 80 percent average for the junior and senior years; (2) Graduate Record Examination aptitude scores, and, in some cases, subject matter (advanced) tests indicative of graduate study ability (see below); (3) supporting letters of recommendation; (4) a statement of specific educational and professional goals which describes the

choice of degree program and the students' plan for the pursuit of the objectives in the program; and (5) other evidence of scholarly achievement and potential. Admission is selective with priority given to applicants who have high scholastic standing.

ADVANCED TESTS

Subject matter (advanced) test scores are required by the following programs:

<i>Graduate Programs</i>	<i>Advanced Test</i>
Chemistry	Chemistry
Environmental and Forest Biology	Biology

PROCEDURE

All applicants are required to submit Graduate Record Examination aptitude scores. This examination is offered several times each year in major cities of the world. For information on registration and scheduling write to the Educational Testing Service, Princeton, New Jersey 08540. Test scores should be sent to the Office of Academic Programs (Institutional number R2530).

The College provides a special application form for graduate work. Requests for information and applications should be addressed to the Office of Academic Programs.

INTERNATIONAL STUDENTS

Citizens of other countries with special educational objectives are accepted for graduate study in all programs. They must show satisfactory evidence that they have completed studies in their major field equivalent to those at a recognized American institution with a scholastic record equivalent to a B average in their junior and senior years. They must submit Graduate Record Examination scores as explained in the section on Admission Requirements. Also, applicants whose native language is other than English must submit scores on the Test of English as a Foreign Language (TOEFL). This requirement may be waived if the student has received a degree from an American institution. This examination is offered several times each year in major cities of the world.

For information on registration and scheduling, write to the Educational Testing Service, Princeton, New Jersey 08540, U.S.A. In submitting test scores, request that they be sent to the Office of Academic Programs.

EXPENSES

APPLICATION FEE

When a student applies for admission to an undergraduate program at any of the State University of New York units, a nonrefundable application fee

is required. More information about the fee and guidelines for exemptions is provided in the "Application Guidebook" for the State University of New York. There is a \$20 application fee for those applying for graduate study.

ADVANCED PAYMENT FEE

All admitted undergraduate students pay a fee of \$50, which is credited to the student's first semester tuition. This payment should be sent to the College Business Office accompanied by the form provided by the Office of Admissions. The payment is required prior to May 1, or 30 days after acceptance, whichever is later. It is refundable up to May 1, or within that 30-day period. There is no advanced payment fee required for those accepted for graduate study.

TUITION AND FEES (As of June 15, 1982)

The tuition and fee structure of the College of Environmental Science and Forestry covers usage of library, infirmary, physical education facilities, ROTC, special testing, and other services, as well as an assessment for student activities and charges for expendable supplies and equipment.

Tuition is charged in the following rate per semester:

Tuition Type	NYS Resident Students	Out-of-State Students
Undergraduate		
Matriculated		
Full-Time	\$525.00	\$ 875.00
Part-Time	\$ 35.00/credit hour	\$ 58.50/credit hour
Graduate Matriculated		
Full-Time	\$850.00	\$1092.50
Part-Time	\$ 71.00/credit hour	\$ 91.50/credit hour
Students who do not hold a Baccalaureate Degree (less than 12 credit hours)		
Course Nos. 100-599	\$ 35.00/credit hour	\$ 58.50/credit hour
Course Nos. 600-999	\$ 71.00/credit hour	\$ 91.50/credit hour
Continuing Education Non-Degree students who hold a Baccalaureate Degree		
Course Nos. 100-499	\$ 35.00/credit hour	\$ 58.50/credit hour
Course Nos. 500-999	\$ 71.00/credit hour	\$ 91.50/credit hour
Maximum Total Tuition for 12 credit hours or more	\$850.00	\$1092.50

STUDENT ACTIVITY FEES

In addition to tuition, the student body has voted to assess each full-time undergraduate student \$24 per year to cover the cost of student activities. Full-time, non-matriculated students are charged a fee of \$12 per semester, and part-time matriculated students \$1 per credit hour. Full-time graduate students likewise have a mandatory activity fee of \$15. ESF students also pay an activity fee to Syracuse University to cover SU-sponsored activities and services available to ESF students, not duplicated by College organizations. These fees are \$26.75 for full-time undergraduate and \$15 for full-time graduate students. Part-time matriculated students are charged \$17.50 per year payable at fall registration; part-time matriculated graduate students are charged \$10 per year.

COLLEGE FEE

There is a State University of New York general college fee of \$25 per year for all full-time students. Part-time student fee is \$.85 per credit hour.

COMMENCEMENT FEE

A commencement fee of \$12 is required at the beginning of the semester in which the degree is expected. Additional costs are incurred by graduate students for the binding, abstracting, and microfilming of theses.

TERMS OF PAYMENT

A check or money order for tuition and fees should be made payable to State University of New York College of Environmental Science and Forestry. This payment is required by the last day of the registration period and can be paid at the College's Business Office either prior to registration or during registration. A fee of \$10 may be assessed for payment later than the established date.

HOUSING AND BOARD COSTS

ESF does not operate student residences or dining halls. These facilities are offered by Syracuse University. Specific information about available housing and board plans is available from the Office of Residence and Dining Services, Syracuse University, Syracuse, New York 13210.

In general, housing costs at SU range from \$1,550 to \$2,148 for an academic year, reflecting the diversity of available accommodations for graduate or undergraduate, single or married students. Most dormitory rooms accommodate two students and are furnished with beds, mattresses, desks, chairs, study lamps and dressers. A commercial linen service is available to those who order it. Separate dormitories are maintained for graduate students.

Furnished and unfurnished apartments are also available for both single and married students. These are located in a housing complex

approximately two miles from the main campus, and are regularly serviced by a free shuttle-bus.

A variety of options on board offerings are available for all students, whether or not they reside in University dormitories. Costs range from \$830 to \$1,500 for an academic year.

In addition, a wide variety of living arrangements in private homes and apartment complexes is available in the Syracuse metropolitan area.

Payment for housing and board is made directly to Syracuse University.

OTHER COSTS

Students majoring in resource management attend a five-week Summer Session in Field Forestry at the Warrensburg Campus between the sophomore and junior years. Forest biology majors have the option of attending this session or the Summer Session in Environmental Biology at the Cranberry Lake Biological Station at the end of the junior year. Cost for either five-week session is approximately \$400 plus travel and personal expenses.

An extended field trip of up to three weeks at the end of the junior year costs approximately \$250 for Wood Products Engineering students.

Field trips for Landscape Architecture students range between \$125 and \$150. In addition, students enrolled in the five-year Landscape Architecture program are required to spend one semester off campus. This is a self-described and student-budgeted program. Costs do not necessarily exceed those of a semester on campus, but additional costs are often incurred depending upon the location chosen.

The cost of books and supplies is approximately \$200 to \$400 a year. Additional costs for personal expenses, recreation, clothes and travel depend on the individual, and they may range from \$600 to \$800 a year.

REFUNDS

The following policies apply to tuition liability and refunds for students canceling their registration.

A student who is given permission to cancel registration is liable for payment of tuition in accordance with the following schedule:

Liability During Semester

1st week:	0%
2nd week:	30%
3rd week:	50%
4th week:	70%
5th week:	100%

Application for refund must be made within one year after the end of term for which the tuition was paid to State University. The first day of

class session is considered the first day of the semester, and Saturday of the week in which this first session occurs is considered the end of the first week for refund purposes. It is interpreted that a student who does not attend any class sessions after Saturday of the first week and who notifies the College of his intent to cancel registration on or before the second Saturday following the first day of classes will be considered to have canceled his registration during the first week.

There is no tuition or fee liability established for a student who withdraws to enter military service prior to the end of an academic term for those courses in which the student does not receive academic credit.

A student who is dismissed for academic or disciplinary reasons prior to the end of an academic term is liable for all tuition and fees due for that term.

A student who cancels registration at a unit of the State University and within the same term registers at another unit of the State University is entitled to full credit for tuition and fees paid for that term.

Notwithstanding any other provisions for refund, when a student has withdrawn through circumstances beyond the student's control, under conditions in which the denial of refund would cause undue hardship, the Chief Administrative Officer of the unit may, at his discretion, determine that no liability for tuition has been incurred by the student, provided the student has not completed more than one half of the term and has not received or will not receive academic credit for the term. Such action, including the reason for withdrawal, must be in writing.

FINANCIAL ASSISTANCE

The College of Environmental Science and Forestry offers four basic forms of student financial assistance: scholarships or grants, part-time employment, long-term loans, and assistantships for graduate students. These programs are coordinated to supplement parental support, summer work, savings, and assistance from other sources. The sources of funds for financial assistance programs, the guidelines for determining the recipients, the procedures for applying, and the method of disbursement of funds vary from one program to another. This information is presented in detail in *Financial Assistance at ESF*, a separate publication which is mailed to all applicants, and is available to the public by contacting the Office of Financial Aid.

Financial aid advisors are aware of the many problems of financing higher education and meeting day-to-day living expenses for both undergraduate and graduate students, and are available to discuss individual student problems. All students are encouraged to apply for financial aid.

HOW TO APPLY

Each year students interested in receiving financial assistance, *except for graduate assistantships*, must complete the application process. (Graduate students who wish to be considered for a graduate assistantship refer to page 38, and follow those instructions.) Two forms are necessary to apply:

1. The candidate must complete a College Application for Financial Aid Transcript and return it to the Office of Financial Aid by MARCH 15. The application is included in the publication, *Financial Assistance at ESF*. Applications will be accepted after March 15; it should be noted, however, that available funds may already be committed to other students. Applicants need not wait for notification of acceptance to the College before applying for financial aid.

2. The candidate must also complete and submit by February 15 the Family Financial Statement (FFS) to the American College Testing Co., Iowa City, Iowa. The FFS is available in the College's Office of Financial Aid, high school guidance offices, and most college financial aid offices.

3. Students are invited to discuss with the professionals in the Financial Aid Office any problems in financing their education.

This application information is based on current requirements, and financial aid systems and forms are undergoing constant change. Applicants are urged to contact the Office of Financial Aid for the latest information and requirements.

SELECTION OF RECIPIENTS

In making award decisions, consideration is given primarily to comparative financial need; however, scholastic standing, character, and potential contribution to the College community are also factors in making certain awards.

Retention of Awards

All students who are awarded financial assistance will be required to maintain satisfactory academic progress each semester in order to keep their awards. Satisfactory academic progress for all programs, *except New York State (TAP, Regents, etc.)*, is defined on page 36 of this catalog.

Recipients of a New York State award must adhere to the following State requirements:

- (1) Academic Progress—A student will need to read the stated minimums on the following charts to be eligible for the next semester award.

**Standard of Satisfactory Academic Progress for Purpose of Determining
Eligibility for Student Aid
All Campuses—State University of New York**

Calendar: Semester

Programs: Associate Degrees and Certificate Programs

Before being certified for this payment,	First	Second	Third	Fourth	Fifth	Sixth	Seventh	Eighth
a student must have accrued at least this many credits,	0	3	9	18	30	45	60	75
with at least this grade point average.	.0	.5	.75	1.3	1.5	1.7	2.0	2.0

Noncredit remedial instruction can be counted toward a full-time academic load as set forth in 145-2.1 of the Commissioner's Regulations. The number of credits in this chart refers to work completed toward the degree.

Calendar: Semester

Program: Baccalaureate Degree

Before being certified for this payment,	First	Second	Third	Fourth	Fifth	Sixth	Seventh	Eighth	Ninth	Tenth
a student must have accrued at least this many credits,	0	3	9	18	30	45	60	75	90	105
with at least this grade point average	0	.5	.75	1.20	1.40	1.50	1.60	1.70	1.80	1.90

Noncredit remedial instruction can be counted toward a full-time academic load as set forth in 145-2.1 of the Commissioner's Regulations. The number of credits in this chart refers to work completed toward the degree.

Calendar: Semester

Programs: All Graduate Level Programs except Professional

Before being certified for this payment,	First	Second	Third	Fourth	Fifth	Sixth	Seventh	Eighth
a student must have accrued at least this many credits,	0	6	12	21	30	45	60	75
with at least this grade point average.	0	2.0	2.5	2.75	3.00	3.00	3.00	3.00

- (2) Program Pursuit—Students must complete a minimum number of semester hours each semester. *For A.A.S. Degree students*, they are required to complete 75 percent of the full-time load. Full-time is defined as 12 credit hours. Therefore, $.75 \times 12 = 9$. Nine credit hours must be completed each semester.

For Bachelor, Master, and Ph.D. students, they must complete 100 percent of full-time load each term. Full-time is 12 credit hours. Therefore, students must register for and complete at least a minimum of 12 credit hours each term.

Waivers

Should a student fall below the requirement, he/she may apply for a waiver. Students are allowed *only one* waiver during undergraduate work and *only one* during graduate work. The issuance of the waiver will be granted only after the student and the institutional waiver designee have mutually concurred that such issuance is in the best interest of the student. Request for a waiver is made through the Vice President of Student Affairs.

SCHOLARSHIP AND GRANT PROGRAMS (SEOG)

Supplemental Educational Opportunity Grants

The College is the recipient of funds authorized under Title IV-A of the Higher Education Act of 1965, as amended. These funds enable the College to award grants to undergraduate students who have high financial need. Grants range from \$200 to \$2,000 per year and must be matched by other awards.

ESF Educational Opportunity Grant Program (EOP)

Students accepted into the College's Educational Opportunity Program may receive, in addition to other financial assistance, a special award to pay for education-related costs. Students must come from a socio-economically disadvantaged background to be eligible.

Prospective Educational Opportunity Program students must apply for financial aid when submitting their admissions applications.

Pell Grants (Formerly Basic Educational Opportunity Grants)

The Pell (BEOG) Program was authorized in the Education Amendments of 1972. Grants are available to eligible full-time and half-time undergraduate students. The amount of the award can vary from \$200 to \$1,670.

Applications are available from high school guidance offices or any college office of financial aid. Students should submit the Student Aid Report (SAR) to the Office of Financial Aid as soon as it is received from the processor.

Regents Programs

Additional information and applications for the following programs are available from the College or:

New York Higher Education Services Corporation
Tower Building
Empire State Plaza
Albany, New York 12255

REGENTS COLLEGE SCHOLARSHIPS

High school students who are New York State residents may qualify for a \$250 annual scholarship by taking a competitive exam during their senior year.

TUITION ASSISTANCE PROGRAM

These awards are available to New York State residents who are enrolled in full-time degree programs. Based on income, awards range from \$250 to full tuition. Separate application is necessary.

REGENTS GRANTS OR CHILDREN OF DECEASED OR DISABLED VETERANS

These grants are awarded to children of parents who served during specific periods of war or national emergency and who died as a result of such service, or suffered a disability of at least 50 percent. The award entitles a New York State resident to \$450 per year.

Vocational Rehabilitation Grants

Financial assistance and program counseling are provided by New York State for students with disabling handicaps. Information is available from any Office of Vocational Rehabilitation.

Veterans' Benefits

The Veterans' Readjustment Benefits Act of 1966 as amended enables veterans and children of deceased or disabled veterans to obtain financial aid for their college education.

Additional information and counseling are available from the Veterans' Affairs Counselor at the College. Local veterans' administration offices, or the State Regional Office, 111 West Huron Street, Buffalo, New York 14202, can provide information and application forms.

Social Security Benefits

The 1965 amendments to the Social Security Act extended the age limit for a child's benefits from 18 to 22, providing the child is a full-time student. Local Social Security offices have additional information. These benefits are slated to expire in 1985.

Assistance for Native American Students

Native American students with financial need may be eligible for scholarship and grant assistance through programs sponsored by the federal Bureau of Indian Affairs and the New York State Education Department. For more information about the programs, students should contact the Bureau of Indian Affairs, 1951 Constitution Avenue NW, Washington, D.C., or the Native American Education Unit, State Education Department, Education Building Annex, Albany, New York 12234.

Private Fellowships, Scholarships, and Grants

The College administers a number of programs which have been established by private individuals, companies, organizations and foundations. These scholarships and grant programs have varying eligibility requirements and are awarded to students according to their respective guidelines which are described in more detail in *Financial Assistance at ESF*. The following is a list of the programs: Alumni Memorial Awards; Alumni Educational Grants; Nelson Courtlandt Brown Scholarship Fund; Henry H. Buckley Student Aid Award; New York State College of Forestry Foundation, Inc.; Mary E. Palmer Memorial Scholarship; Portia Farrell Morgan Scholarship; Phyllis Roskin Memorial Award; and Student Association grants.

Syracuse Pulp and Paper Foundation, Inc. Scholarships

Scholarships from this foundation are awarded to students in paper science and engineering. The scholarship amount is \$100 more than the recipient's annual tuition charge. Incoming transfer students entering the program should request a Pulp and Paper Scholarship application from the Office of Financial Aid. It is necessary to reapply each year for the scholarship. Students must maintain an overall 2.5 G.P.A. (out of 4.0) to retain their scholarship. Grades are reviewed each semester.

State University Supplemental Tuition Assistance

A limited number of small grant awards are determined annually by the College for students with financial need.

EMPLOYMENT OPPORTUNITIES

College Work-Study Program (CW-SP)

The College participates in the Federal College Work-Study Program, which provides part-time jobs during the academic year and full-time positions during the summer to students who need financial assistance to attend the College. Wages for these positions begin at minimum wage and increase as duties and responsibilities increase.

Job Locator Service

The College coordinates and maintains an active program of part-time and summer employment opportunities. Interested students should contact the Student Employment Coordinator in the Office of Financial Aid for additional information. Program is open to all ESF students seeking employment.

A part-time employment program is available to qualified veterans. More information is available from the Veterans' counselor at the College.

LOANS

National Direct Student Loans

These loans are available to students with financial need who are enrolled at least half-time. Amounts which can be borrowed are \$3,000 for 2 years and \$6,000 for 4 years with a maximum of \$12,000, including graduate study. Repayment and 5 percent interest begin six months after leaving college. Deferment and cancellation benefits are available for certain situations.

Insured Student Loans

This program is administered by the New York Higher Education Services Corporation (NYHESC) for New York State residents. These loans are available from a bank or other lending agent to students who are registered at least half-time. Undergraduates can borrow an aggregate of \$12,500 for their undergraduate studies, and a graduate student can borrow an aggregate of \$25,000. Repayment and 9 percent interest begin six months after leaving college (an additional 1 percent interest is paid at the time the loan is received). Applications are available at local banks.

Parent's Loan (PLUS)

Parents of students may borrow up to \$3,000 annually and \$15,000 overall, at an interest rate of 14 percent. Loan repayment begins 60 days after receipt of the loan. Total loans to parents and students cannot exceed total cost of education.

Emergency Loans

The College is able to provide registered students interest-free, short-term loans (30 days). These loans are available because of the interest and support of the following donors: Alumni Association Short-term Loan Fund; David B. Schorer Memorial Fund; and Edward Vail Emergency Fund.

Students should contact the Office of Financial Aid when need arises for a short-term loan.

GRADUATE ASSISTANTSHIPS

Assistantships are awarded to students of demonstrated scholarship and whose education and experience enable them to assist in laboratory

instruction and research. The amounts of the assistantships range from \$3,800 to \$7,600 per year. In addition, tuition may be waived. Students who hold an assistantship must be enrolled for full-time study.

Beginning graduate students may apply for assistantships on their application for admission, and continuing graduate students should consult with their major professors.

ACADEMIC POLICIES

The following academic policies are extracted from the complete undergraduate and graduate policies which are contained in the *Student Handbook*. The *Student Handbook* is available from the Office of Student Affairs, 105 Bray Hall.

UNDERGRADUATE AND GRADUATE POLICIES

Published Requirement

Students must satisfy the requirements for graduation in effect at the time of their first matriculation as a student. Students may graduate under the requirements stated subsequent to those in effect at their matriculation, but they may not use prior ones.

Attendance

Students are expected to adhere to the attendance policy stated by each course instructor. Instructors may make attendance part of the course requirement.

Education Law

Students unable, because of religious beliefs, to attend classes on certain days are guided by Section 224a of the New York State Education Law which is as follows:

“1. No person shall be expelled from or be refused admission as a student to an institution of higher education for the reason that he is unable, because of his religious beliefs, to attend classes or to participate in any examination, study or work requirements on a particular day or days.

“2. Any student in an institution of higher education who is unable, because of his religious beliefs, to attend classes on a particular day or days shall, because of such absence on the particular day or days, be excused from any examination or any study or work requirements.

“3. It shall be the responsibility of the faculty and of the administrative officials of each institution of higher education to make available to each student who is absent from school, because of

his religious beliefs, an equivalent opportunity to make up any examination, study or work requirements which he may have missed because of such absence on any particular day or days. No fees of any kind shall be charged by the institution for making available to the said student such equivalent opportunity.

"4. If classes, examinations, study or work requirements are held on Friday after four o'clock post meridian or on Saturday, similar or makeup classes, examinations, study or work requirements shall be made available on other days, where it is possible and practicable to do so. No special fees shall be charged to the student for these classes, examinations, study or work requirements held on other days.

"5. In effectuating the provisions of this section, it shall be the duty of the faculty and of the administrative officials of each institution of higher education to exercise the fullest measure of good faith. No adverse or prejudicial effects shall result to any student because of his availing himself of the provisions of this section.

"6. Any student, who is aggrieved by the alleged failure of any faculty or administrative officials to comply in good faith with the provisions of this section, shall be entitled to maintain an action or proceeding in the supreme court of the county in which such institution of higher education is located for the enforcement of his rights under this section."

Audits

Students may informally audit ESF courses with the permission of the course instructor. No record will be maintained of the informal audit nor will any grade be assigned. No fee is required for informal audits.

Students may formally audit courses with the permission of their major professor and the course instructor. They may not be used to satisfy any graduation requirements. Formally audited courses will appear on the student's transcript and will be graded either "SAU" (satisfactory audit) or "UAU" (unsatisfactory audit). The grade will be assigned based on the criteria for audit established by the course instructor.

Withdrawal from ESF

Students who withdraw on or before the "drop date" for a semester will have their records marked "(date): Withdrawal." Courses will appear for that semester with the grade of "W".

Students who withdraw after the "drop date" for a semester, but before the semester ends, will have either "WP" (withdraw passing) or "WF" (withdraw failing) listed after each such course.

Students who withdraw from the College and in the future wish to return must apply for readmission.

Prior to withdrawal from ESF, students must schedule an interview in the Office of Student Affairs.

Statement of "Good Academic Standing"

The term "in good academic standing" means that a student is eligible or has been allowed to register for and undertake academic coursework at the College for the semester in question. In some instances the College may define a student as being "on academic probation." The mechanism of academic probation, including any accompanying constraints upon a student's activities, is intended merely as an educational device designed to encourage greater effort on the part of students who appear to be having difficulty in meeting certain academic standards. Placement on academic probation may precede denial of the right to register for academic coursework if certain conditions are not met, but a student on academic probation is considered to be in good academic standing. Any question concerning whether or not an individual student is in good academic standing will be determined by the College Academic Affairs Committee.

UNDERGRADUATE POLICIES

Credit Hour Load

To be classified as full-time, an undergraduate student must register for at least 12 credit hours during a semester. A student may not register for more than 18 credits during a semester unless permission from the student's advisor is obtained.

Evaluation

For each course completed, one of the following grades will be awarded:

<i>Grade</i>	<i>Definition</i>	<i>Grade Points</i>
A		4.0
A-	Excellent	3.7
B+		3.3
B	Good	3.0
B-		2.7
C+		2.3
C	Passing	2.0
C-		1.7
D	Minimum Passing	1.0
F	Failure	0
I/F	Unresolved Incomplete	0

Under conditions defined elsewhere, the following grades may be assigned, none of which yield grade points:

<i>Grade</i>	<i>Definition</i>
W	Withdraw
WP	Withdraw Passing
WF	Withdraw Failing
SAU	Audit (Satisfactory)
UAU	Audit (Unsatisfactory)
I	Incomplete

Grade Point Averages

Semester and cumulative averages are computed by dividing the total grade points earned by the total credit hours completed, i.e., all courses graded "A - F."

Academic Honors

PRESIDENT'S LIST

Students who carried 12 or more credits of coursework graded "A - F" and earned a minimum grade point average of 3.00 will be placed on the President's List for that semester.

Graduation Honors

Students will be graduated with the appropriate honor if the following criteria have been met:

A minimum of 30 credits of ESF and Syracuse University courses have been completed as a matriculated, upper-division student.

A grade point average of: 3.00 - 3.33, *cum laude*; 3.34 - 3.82, *magna cum laude*, 3.83 - 4.00, *summa cum laude*.

Academic Dismissal

Undergraduate students who earn less than a 2.00 cumulative grade point average shall have their records reviewed by the appropriate College-wide faculty committee which may delegate this authority. Based upon this review, students with less than this minimum cumulative grade point average will be placed on either academic probation or dismissed from ESF. The decision on probation or dismissal will be based upon an overview of the total academic record and the mathematical possibility for attaining a 2.00 cumulative average by the projected graduation date.

When extraordinary conditions contributed to the academic dismissal of students, such students may submit a written appeal to the dismissal decision to the Office of Academic Programs. These appeals will be reviewed by the appropriate faculty committee which will decide either to sustain the dismissal or place the students on probation. There is no appeal beyond this committee.

Students who have been dismissed for academic performance may not reapply until at least one semester has elapsed.

Students dismissed a second time for academic performance may not again be considered for readmission.

Graduation Requirements

Undergraduate students are responsible for meeting the following requirements for graduation:

- A. Matriculated status as an undergraduate student.
- B. All course requirements must be satisfied.

- C. A minimum cumulative grade point average of 2.00 (4.00 = A) for all courses taken as a matriculated student at ESF.
- D. At least 24 of the last 30 credits must be registered through ESF.
- E. Consistent with the State Education Department requirements, a total of at least 120 credits from courses accepted as transfer credit by ESF and courses successfully completed while a matriculated student at ESF.

Graduation Rate

Of the transfer students who began their studies in the fall of 1979 at ESF, over 78 percent received their degree, or continued in a five-year program, after four semesters of study. For those who began in the fall of 1980, approximately 80 percent received their degree, or are continuing in a five-year program, after four semesters of study. Further information on student retention is available from the Office of Academic Programs at ESF.

GRADUATE POLICIES

Master's Credit Hours

A minimum of 30 credit hours of graduate level work is required for the master's degree. This degree shall represent completion of at least one academic year of graduate-level study or an equivalent that can be shown to accomplish the same goals.

Doctoral Credit Hours

For the doctorate, credit hour requirements vary depending on the student's background and specific degree program. Early in a student's program the coursework requirement will be established which is intended to provide the student with the required level of competency to satisfactorily complete the doctoral candidacy examination. The doctorate shall represent completion of at least three full-time academic years of graduate study beyond the baccalaureate degree or an equivalent that can be shown to accomplish the same goals.

Doctoral Research Tool Requirement

There is no College-wide requirement for languages or other tools of research for doctoral students. However, the faculty of any program may establish such requirements.

Time Limit

Students must complete all requirements for the master's degree within three years of the first date of matriculation. For the doctoral degree, students must complete all requirements for their degree within three years of satisfactory completion of the doctoral candidacy examination or they will be required to retake the candidacy examination.

Credit Hour Load

A graduate student must be registered for at least one credit each semester, excluding summers, from the first date of matriculation until all degree requirements have been completed. Failure to register will indicate the student no longer wishes to pursue a graduate degree.

Although there is no full-time requirement for degree purposes, there is such a requirement for those who qualify for a tuition waiver and for some other forms of financial support. For these students the following definition applies:

With a master's degree, or the completion of 24 or more credits after the bachelor's degree, students holding an assistantship are considered full-time if they are registered for nine or more credits. All other students are considered full-time if they carry 12 or more credits. All graduate students in landscape architecture must carry 12 or more credits to be considered full-time.

Evaluation

For each course completed, one of the following grades will be awarded.

<i>Grade</i>	<i>Definition</i>	<i>Grade Points</i>
A		4.0
A-	Excellent	3.7
B+		3.3
B	Passing	3.0
B-		2.7
C+		2.3
C	Minimum Passing	2.0
C-		1.7
F	Failure	0
I/F, I/U	Unresolved Incomplete	0

Under conditions defined elsewhere, the following grades may be assigned, none of which yield grade points:

<i>Grade</i>	<i>Definition</i>
W	Withdraw
WP	Withdraw Passing
WF	Withdraw Failing
S	Satisfactory
U	Unsatisfactory
SAU	Audit (Satisfactory)
UAU	Audit (Unsatisfactory)
I	Incomplete

Grade Point Averages

Semester and cumulative averages are based on graduate level courses only and are computed by dividing the grade points earned by the credit hours completed, i.e., all courses graded "A - F".

Master's Study Integration

Students enrolled in a master's degree program are required to demonstrate the ability:

- A. to critically evaluate, organize, analyze, and synthesize the coursework and other components of their program of study;
- B. to relate these components to current concepts and issues in their chosen field and associated disciplines;
- C. to work logically and independently; and
- D. to communicate effectively.

Master's study integration requirements may be met by successful completion of one of the following three options. The faculty of any program may limit the number of permissible options for its students. As permitted by their program, students will choose and follow one option with the approval of their major professor and with the guidance of their steering committee. Each option must be designed to satisfy the above requirements.

OPTION 1. THESIS OR PROJECT AND DEFENSE

Scope. Under this option, in addition to completion of necessary coursework, students must prepare either:

1. a research-oriented thesis which investigates a problem that expands or clarifies knowledge in the field, with generalizable results, or
2. an application-oriented project which applies skills or techniques from the field to a specific problem.

Whichever is chosen, students are required to define an appropriate problem for investigation; review relevant information sources; develop a study design; collect, organize, analyze, and interpret data; and draw conclusions.

Product. The thesis or project must be documented in a thorough and appropriate format and style. It must be in a permanent form, which may consist of print or nonprint materials.

Credits. Students must satisfactorily complete 6 to 12 credits for the investigation leading up to completion of the document. These credits will be graded on an "S/U" basis. Students must register for the approved number of credits for their investigation sometime during the three-year limit for the master's degree. They may register for more than the approved number of credits for their investigation, but the excess credits may not be used to fulfill the minimum 30 credits required for the master's degree.

OPTION 2. ACADEMIC OR PROFESSIONAL EXPERIENCE AND MASTER'S COMPREHENSIVE EXAMINATION

Scope. Under this option, in addition to completion of necessary coursework, students must engage in an academic or professional experience which applies, enriches, and/or complements the more formal coursework of their plan of study. This option might include, but not be limited to, an internship or an independent study experience. Whatever the form of the option, its objectives, organization, procedure, and manner of documentation must be submitted in writing and be approved by the student's major professor and steering committee before the experience is begun.

Product. This experience must be reported in a thorough and appropriate format and style. It need not be in a permanent form.

Credits. Students must satisfactorily complete 6 to 12 credits for this experience. These credits will be graded on an "S/U" basis. Students must register for the approved number of credits for their experience sometime during the three-year time limit for the master's degree. They may register for more than the approved number of credits for their experience, but the excess credits may not be used to fulfill the minimum 30 credits required for the master's degree.

Master's Comprehensive Examination. At the completion of their plan, students must successfully pass a comprehensive examination covering the major field, allied fields, and the content of their completed experience.

OPTION 3. COURSEWORK AND MASTER'S COMPREHENSIVE EXAMINATION

Scope. Under this option, students must satisfactorily complete a minimum of 42 hours of graduate level coursework appropriate to their field of study. As in other options, the design and sequencing of the coursework plan must be conducted with the guidance and approval of the student's major professor and steering committee.

Product. No product is required beyond that required for individual courses.

Credits. Students must satisfactorily complete a minimum of 42 credits of graduate level coursework. Students must complete these required credits sometime during the three-year time limit for the master's degree.

Master's Comprehensive Examination. At the completion of their plan, students must successfully pass a comprehensive examination covering the major field and allied fields.

Doctoral Thesis

Nature and Purpose

A thesis must be completed and successfully defended in order for the doctoral degree to be awarded. The doctoral thesis is the final and most important component of the series of academic experiences which culminate in the awarding of the Ph.D. degree. Three major functions are fulfilled by the thesis experience: (1) It is a work of original research or scholarship which makes a contribution to existing knowledge; (2) It is an educational experience which demonstrates the candidate's mastery of research methods and tools of the specialized field; and (3) It demonstrates the student's ability to address a major intellectual problem and arrive at a successful conclusion.

Examinations

Doctoral Preliminary Examination

An examination may be required of those admitted into a doctoral program to ascertain their level of understanding of the basic principles and techniques necessary to function effectively in that program. The results of the preliminary examination will be used to guide the major professor and the student in determining the appropriate coursework necessary to complete that requirement for the doctorate.

The format for the examination will be determined by the faculty in the program involved. It is recommended that the examination be primarily written with a supplemental oral presentation. When a preliminary examination is required it should be conducted as early as possible in a student's program, at least before the completion of the student's second semester.

Doctoral Candidacy Examination

A student admitted into a doctoral program must satisfactorily complete a candidacy examination covering the major field and, in a broader manner, allied fields in order to be advanced into the status of doctoral candidate.

The purposes of the doctoral candidacy examination are to determine the student's knowledge of factual material and ability to use this knowledge creatively and intelligently.

The doctoral candidacy examination must be taken when the majority of coursework is completed but before the student begins serious thesis investigation. The candidacy examination must be passed at least one year before the student may present a thesis for defense.

Defense Examination for Thesis or Project

All graduate students who are required to complete a thesis or project must successfully defend it and have it accepted by the College.

The purposes of the defense examination are to determine the validity and significance of the data; and evaluate the student's understanding of investigative methods, ability to critically analyze data, and ability to relate the study

results to the appropriate field and to more general scientific principles and knowledge.

Academic Dismissal

Graduate students who earn less than a 3.00 cumulative grade point average or who earn two grades of "U" shall have their records reviewed by the College Academic Affairs Committee, which may delegate this authority. Based upon this review, students either will be placed on academic probation or will be dismissed from ESF. The decision on probation or dismissal will be based upon an overview of the total academic record, the mathematical possibility for attaining a 3.00 cumulative average by the projected graduation date, and the recommendation from the major professor, program coordinator, and school dean or program director.

When extraordinary conditions contributed to the academic dismissal of students, such students may submit a written appeal to the dismissal decision to the Office of Academic Programs. These appeals will be reviewed by the College Academic Affairs Committee, which will decide either to sustain the dismissal or place the students on probation. There is no appeal beyond this committee.

Students who have been dismissed for academic performance may not reapply until at least one semester has elapsed.

Students dismissed a second time for academic performance may not again be considered for readmission.

Graduation Requirements

Graduate students are responsible for meeting the following requirements for graduation:

- A. The student must be in a matriculated status as a graduate student.
- B. The approved academic plan for each student must be completed within the applicable time limit.
- C. For the doctoral degree, the student must be admitted to candidacy and a thesis completed and successfully defended.
- D. A minimum cumulative grade point average of 3.00 (4.00 = A) for all graduate level courses taken during the program of study at ESF must be achieved.
- E. Consistent with the State Education Department requirements, a total of at least 30 graduate credits is required for the master's degree and, for the doctorate, at least three full-time academic years of graduate study beyond the baccalaureate degree or an equivalent that can be shown to accomplish the same goals.

STUDENT LIFE

HOUSING

The College of Environmental Science and Forestry does not operate its own residence facilities or food service. Students enter into a Room and Board Agreement with Syracuse University, which is adjacent to the State-operated College. Contracts for room and board made with Syracuse cover a full academic year (fall and spring semesters) and are not normally renegotiable during that time period.

Students have a choice of living centers at Syracuse University—large halls, apartment houses, cottages, fraternities and sorority houses, or cooperative units. Student resident advisors live on each floor or in each unit and are available for counseling, advisement, and referral services.

Syracuse University also has housing units available for married students and their families. While veterans are given preference, nonveterans can usually find housing.

Students who wish to live off campus may contact Alternative Action Services (ALTERACTS), a student-run housing organization at Syracuse University. An extensive listing of available housing in the Syracuse area is provided free of charge.

FOOD SERVICE

Syracuse University offers different meal plans to help meet the varying nutritional needs and interests of individual students. Students living in University apartments, co-ops, fraternities and sororities or off-campus can take advantage of the board plans available. Students living in dormitories and area housing without full kitchen services are required to subscribe to a board plan.

The College does not provide a food service program. However, a snack bar, located in the basement of Marshall Hall, is open 8 a.m. to 3:30 p.m. weekdays during the academic year.

EXTRACURRICULAR ACTIVITIES

Students at the College of Environmental Science and Forestry have many extracurricular activities to choose from, both on campus and in the community.

At the College

The *Undergraduate Student Association (USA)* and the *Graduate Student Association (GSA)* are the official representative bodies on campus governing student activities. Undergraduate and graduate students elect representatives from each school to manage the affairs of their respective organizations and the concerns of their constituents.

Campus organizations offer students an opportunity to broaden their knowledge and meet other students with similar personal and academic interests. These include: the *Basketball Club*; *Bob Marshall Club*, an organization of students concerned about the future of the Adirondack Mountains; the *Forestry Club*, the traditional sponsor of the intercollegiate Woodsmen's Team; *Botany Club*; *Mollet Club*, an organization of landscape architecture students; the *Recycling Club*; and the *Zoology Club*, which sponsors lectures, films, and field trips.

Other groups on campus include *Saengerbund*, the College singing group; and *Alpha Xi Sigma*, senior honorary society. There are also student chapters of the *Wildlife Society*, the *Society of American Foresters*, the *American Fisheries Society*, the *American Water Resources Association*, the *Forest Products Research Society*, the *American Society of Landscape Architecture*, the *Association of General Contractors*, *Society of Wood Science and Technology*, and the *Technical Association of Pulp and Paper Industries (TAPPI)*.

The two major student publications at ESF are the *Knothole*, a weekly newspaper, and *The Empire Forester*, an annual yearbook which has won many awards in past years.

Recent GSA-sponsored activities include a lecture series, a traditional fall picnic, and various social functions designed to encourage interaction between graduate students and College faculty.

At Syracuse University

Students at the College of Environmental Science and Forestry have all the privileges of Syracuse University students: participation in student government, organizations, sports, and other extracurricular activities.

Men and women at the College participate in all Syracuse University intercollegiate sports, club sports, and intramurals. Archbold Gymnasium on the Syracuse University campus is the center of athletics and physical education. Additional indoor facilities are provided through Manley Field House and the new Carrier Dome which is the site of Syracuse University home football and basketball games. Facilities at Skytop recreation area include a lodge, and 22 tennis courts. The Women's Building offers instructional, social, and recreational facilities. All full-time undergraduate women are eligible to participate in intercollegiate competition in tennis, field hockey, volleyball, basketball, swimming, and diving.

Students are provided with many opportunities for acquiring musical training and performing experience through the Syracuse University Band, (Symphonic Band, Wind Ensemble, Stage Band, Concert Band and Jazz Workshops), the Syracuse University Orchestra, and the Syracuse University Chorus.

Membership is allowed in all Syracuse University student groups, including a wide variety of clubs, the International Student Association, religious and military organizations, and professional and honor societies.

In the Syracuse Area

The City of Syracuse and its surrounding countryside offer many cultural, educational, and recreational opportunities. The city has several fine museums, including the Everson with its outstanding collection of works by local, regional, and international artists; a local repertory theater; several points of historical interest; a professional symphony orchestra; and a Civic Center which attracts artists from around the world.

Eight parks lie within the city limits, numerous county and state parks, including Beaver Lake Nature Center and Montezuma Wildlife Reservation are within a short drive.

COLLEGE SERVICES

Career and Counseling Services

The Office of Career and Counseling Services is available throughout the student's college career as a place where they may seek, at any time, the advice of experienced counselors. This office should be the first contact when questions or personal problems arise. Most student problems can be dealt with in one or two brief contacts. The most severe problems requiring extensive assistance are referred to the cooperative facilities at Syracuse University and/or specialized agencies in Syracuse.

The Office is designed to provide additional assistance to students throughout the year to help them adjust to and successfully graduate from ESF. Through various presentations, counseling sessions, group activities and workshops, students are given the opportunity to further develop such skills as decision making, reading, studying, and test taking. Additional programs deal with coping with adjustments related to transferring colleges and exploring relationships between academic pursuits and career objectives.

Special efforts are made to assist students identified as having academic difficulties or adjustment problems. Often personal and academic problems are associated with career decisions. A key component of this office is to provide a variety of opportunities through resource materials, presentations, job development, and counseling to meet the individual needs of each student at his/her various stages of career readiness. Some career services offered through this Office are skills development workshops; list of full-time, part-time, and summer jobs; on campus recruiting; advanced study information; career newsletters; reference information; a library out-reach program; and an alumni job list.

Each year this office conducts a Placement Survey to monitor the success and progress of our college graduates. The reports are shared with the college community and made available to the public upon request. The following is a brief summary for the classes of 1980, 1981.

Of the 352 graduates from the Class of 1981, 6-9 months after graduation:

- 129 were employed in their major field of study
- 36 were employed outside their major field of study
- 81 were enrolled in an advanced study program
- 17 were available for employment
- 89 were unavailable for employment or did not respond

Of the 606 graduates from the Class of 1980:

- 260 were employed in their major field of study
- 98 were employed outside their major field of study
- 116 were enrolled in an advanced study program
- 49 were available for employment
- 80 were unavailable for employment or did not respond

More detailed information is available in the Office of Counseling and Career Placement in Room 108, Bray Hall.

Services for the Handicapped

The Office of Administration and Services, assisted by Student Affairs, provides specialized support services and adapts general resources to assist handicapped students to obtain maximum academic, social, and cultural benefits within the College community. Some of the specific services provided or made available include: pre-admissions guidance, orientation, mobility training, reader recruitment, preferential housing assignments, tutoring and other supportive services as required to meet individual living/learning needs. The College is also prepared to respond to handicapped students' needs for personal and career counseling and job placement assistance.

For further information, contact the ESF 504 Coordinator, Mr. David G. Anderson, Office of Administration and Services, Room 209, Bray Hall (315) 470-6622. The College maintains liaison relationships with rehabilitation agencies within the local community and the state, including the Office of Vocational Rehabilitation and the Commission for the Visually Handicapped. For specific information regarding their own eligibility, students should contact the respective agency directly.

Health and Medical Facilities

Students may consult a physician for medical care or health advice at the Syracuse University Student Health Service. Full-time students are entitled to unlimited visits to the out-patient clinic and also 10 days of confinement per college year with ordinary medical care in the infirmary. Infirmary usage over 10 days will be at prevailing infirmary rates. Some laboratory examinations, if necessary for treatment or diagnosis of common illness, are provided without cost. Most common legal drugs are provided at a minimal charge.

A student accident or sickness insurance plan, available at fall registration, not only supplements the usual infirmary privileges, but is also a

health protection plan during the summer months when students are not under the care of the Health Service. Married students with dependents who are not covered by Health Service privileges are strongly urged to provide themselves and their families with special insurance made available to University students. *All international students are required to carry health and accident insurance.*

SU Speech and Hearing Clinics

The Gebbie Speech and Hearing Clinics provide remedial assistance to all regularly enrolled students who may be handicapped by hearing, speech, and voice disorders. This service is free to students.

SU Psychological Services and Research Center

Students desiring an analysis of their aptitudes, abilities and interests may secure special testing programs at the Testing and Evaluation Service Center on the Syracuse University campus.

SU ROTC Opportunities

Students attending the College are eligible to participate in the Army or Air Force ROTC Program at Syracuse University.

ROTC at Syracuse University consists of both 4- and 2-year programs. Students attending the College for two years can gain admission to either the Army or Air Force program through participation in summer training. Both six week and four week camps and on-campus programs are available to suit individual needs.

The ROTC programs offer academic instruction, alternate and supplementary career opportunities, leadership experience and financial aid.

ESF Alumni Association

The Alumni Office serves as the liaison between the College, the Alumni Association Board of Directors and more than 6,000 alumni. The Association supports education programs through scholarships, publishes a quarterly newsletter and represents alumni concerns.

ESF Student Rules and Regulations

The complete listing of guidelines for all students attending ESF is found in a separate publication, the *Student Handbook*, which is distributed at registration. Also distributed at registration are copies of "Rules and Regulations of Conduct and Behavior" which pertain to all students. It is the student's responsibility to be familiar with these regulations and abide by them.

DEGREE PROGRAMS AND AREAS OF STUDY

The College is authorized to award degrees in the following programs. Enrollment in other than registered or otherwise approved programs may jeopardize a student's eligibility for certain financial aid programs.

School of Biology, Chemistry and Ecology

Chemistry; B.S., M.S., Ph.D., with areas of study in biochemistry, natural products chemistry, environmental chemistry, or natural and synthetic polymer chemistry. (HEGIS Code 1905)

Environmental and Forest Biology; B.S., M.S., Ph.D., with areas of study in ecology, entomology, environmental physiology, fish and wildlife biology and management, pathology and mycology, pest management, plant science, soil ecology, or zoology. (HEGIS Code 0499)

Interdepartmental area of study in chemical ecology; M.S., Ph.D.

School of Forestry

Resource Management—General Forestry; B.S. (HEGIS Code 0115)

Resource Management and Policy; M.S., Ph.D., with areas of study in forest management, recreation management, policy and administration, forestry economics, quantitative methods, or land use planning. (HEGIS Code 0115)

Silviculture and Forest Influences; M.S., Ph.D., with areas of study in silvics, silviculture, forest soil science, tree improvement, or forest influences. (HEGIS Code 0114)

Interprogram areas of study in urban forestry or international forestry; B.S., M.S., Ph.D.

School of Forest Technology

Forest Technology; A.A.S. (HEGIS Code 5403)

School of Environmental and Resource Engineering

Forest Engineering; B.S. (HEGIS Code 0999)

Paper Science and Engineering; B.S. (HEGIS Code 0999)

Wood Products Engineering; B.S., with options in building construction, or forest products in which emphasis may be chosen in marketing, production systems engineering, or wood science. (HEGIS Code 0999)

Environmental and Resource Engineering; M.S., Ph.D., with areas of study in forest engineering, paper science and engineering, or wood products engineering. (HEGIS Code 0999)

School of Landscape Architecture

Environmental Studies, B.S. (HEGIS Code 0201)

Landscape Architecture; B.L.A. (HEGIS Code 0204)

Landscape Architecture; M.L.A., with areas of study in social/behavioral studies, natural/physical applied sciences, or design process, methods and management. (HEGIS Code 0204)

College-Wide Program

Graduate Program in Environmental Science; M.S., Ph.D., with areas of study in environmental education/communication, environmental assessment and impact analysis, environmental land use planning, water resources, or environmental science. (HEGIS Code 0420)

THE SCHOOL OF BIOLOGY, CHEMISTRY AND ECOLOGY

STUART W. TANENBAUM, *Dean*

The School of Biology, Chemistry and Ecology offers two curricula which support environmental science and forestry through the Department of Environmental and Forest Biology and the Department of Chemistry.

ENVIRONMENTAL AND FOREST BIOLOGY

ROBERT L. BURGESS, *Chairman*

The Department of Environmental and Forest Biology provides students with a firm foundation in basic biology in association with the principles of forest ecosystem dynamics and environmental science. It encompasses a variety of interconnected disciplines concerned with living systems, and treats not only the form, function, and evolution of organisms, but their life requirements, tolerances, and interactions that are central to the stewardship of renewable natural resources and the maintenance of environmental quality.

Effective management and protection of forests and related natural resources is increasingly dependent upon the understanding of living systems relative to productivity and tolerance to environmental impacts caused by the activities of man. Therefore, basic knowledge of biology is prerequisite to desirable practices and sound regulations for optimizing both the development and use of natural resources while avoiding deleterious impacts.

The critical importance modern society places upon the utilization of natural resources and the quality of our environment adds new and increasingly diverse dimensions to the services a well-trained biologist can render. The department is committed to meet this dynamically changing

array of opportunity through diverse courses enriched by an active program of research that focuses upon upper-level undergraduate and graduate study. Through the addition of selected electives to a required core, undergraduates may focus their program toward a special biological field (see page 59) or toward future graduate study. Graduate students may develop a course of study under the guidance of a major professor and graduate committee within any of several study concentrations (see p. 61).

The academic programs attempt to stimulate interest in the recognition and understanding of plants, animals, and protists, and to deal with an understanding of the dynamic changes in biological systems which can be best ascertained in the context of the broad fields of ecology, physiology, evolution, and genetics. This understanding is accomplished by an integration of coursework with a strong research program, much of which is concerned with natural resource management and improvement of the quality of our environment.

Undergraduate Program

The curriculum for the Bachelor of Science degree is built around a core of required courses which provide the student with a general education, an orientation to forestry, and a basic background in the principles of the biological and the physical sciences. Its design develops breadth in biology as well as depth in a selected biological field. Thus, although individual course selections around the required core may vary, all students major in biology and each, with an assigned advisor, develops a special plan of study.

A dual-major program is available that meets the undergraduate requirements of both the School of Forestry and the School of Biology, Chemistry and Ecology. (For details see p. 118.)

A total of 125 credit hours, 60 of them prior to matriculation, is required for the Bachelor of Science degree. In addition to the core courses specified below, at least 21 hours in biology must be completed and, of these, at least 15 are to be from courses given in the College of Environmental Science and Forestry. These courses should be compatible with the intended concentration of study and must be at the 300 level or above. Six of the 21 credit hours must involve subject matter in plant science (courses designated FBO) and six in animal science (courses designated FEN, FZO), both exclusive of the five-hour summer field requirement. The balance of the required hours are chosen in consultation with the advisor.

Lower Division Courses

The curriculum facilitates transfer of freshman and sophomore credits from other institutions. To assume training in residence at the junior level, entering students should have successfully completed a minimum of 60 credits which include:

<i>Course Area</i>	<i>Credit Hours</i>
General Chemistry with Laboratory	8
Organic Chemistry with Laboratory	8
General Physics with Laboratory	8
Mathematics proficiency, through Integral Calculus	4-8
English	6
*Social Sciences—Humanities	9-12
General Botany and Zoology OR General Biology with Laboratory	8
Biology Electives	3-6
TOTAL MINIMUM LOWER DIVISION CREDITS	60

*A course in technical writing and/or speech is recommended as part of the Social Science—Humanities group.

Upper Division Courses

Junior Year			<i>Credit Hours</i>
<i>First Semester</i>	FBO 315	Dendrology	3
	FBL 320	General Ecology	3
	FEN 350	Elements of Forest Entomology	3
	Electives	.....	6
			15
<i>Second Semester</i>	APM 491	Introduction to Probability and Statistics	3
	ERM 345	Soils OR GOL 105 Earth Science	3
	FBL 330	Principles of General Physiology	3
	Electives	.....	6
			15
SUMMER FIELD EXPERIENCE—Must be met as described on page 58			5

Senior Year			<i>Credit Hours</i>
<i>First Semester</i>	Electives	.....	15
<i>Second Semester</i>	FBL 470	Principles of Genetics	3
	FBL 471	Genetics Laboratory	1
	Electives	.....	11
			15
TOTAL MINIMUM UPPER DIVISION CREDITS			65

A total of 125 credit hours is required to complete the B.S. degree in Environmental and Forest Biology.

SUMMER FIELD EXPERIENCE

The curriculum requires that between the junior and senior year each student completes a minimum of five semester credit hours or its equivalent during five weeks' residence in an approved academic program in field biology. This requirement can be met by the appropriate selection of courses in Environmental Biology at the Cranberry Lake Biological Station (CLBS) where six to eight courses are offered during each of two five-week sessions (see p. 60). Earning five credits at one session satisfies the requirement; any additional courses taken in the other session count as elective credits.

One of the following alternatives to the CLBS program may instead be selected to fulfill the summer field requirement:

Alternative 1

Students desiring an experience in the principles and practices of professional forestry should attend the five-week Summer Session in field Forestry at the Pack Forest, Warrensburg Campus. Field instruction at this Campus emphasizes subject matter in dendrology, forest ecology, surveying, mensuration, and cartography.

Alternative 2

Other biological field stations may be attended to earn the minimum five semester hours credit or its equivalent during a five-weeks' term of junior-senior level coursework. Petitions requesting this alternative must include course descriptions and the program contemplated and be submitted no later than one month prior to the end of the spring semester preceding the summer program. A current file of alternative stations and course descriptions is maintained by the director of the Cranberry Lake Biological Station.

Alternative 3

FBL 420, Field Experience-internship, under professional supervision may be authorized when containing a major academic-learning component and when thoroughly planned and well documented. It must be related to and supportive of the indicated career goal. The student must receive advance agreement from a member within the Department of Environmental and Forest Biology faculty to guide, collaborate, evaluate a work plan for the summer, and later assign a grade and credits to the internship. The plan must be submitted at least one month prior to the end of the spring semester and must be approved by the Curriculum Director.

Electives

General requirements for graduate study and a wide range of federal, state, municipal, and private biology positions are met by the curriculum. Through skillful selection of electives, the student may prepare for special biological fields related to natural resources or the environment. Those

training for biological positions in federal and state service should review Civil Service publications and become familiar with specific course requirements early enough to make timely elective choices. Students planning to meet special requirements for Federal Civil Service positions in forestry may do so by electing 10 credits in forestry courses and attending the Summer Session in Field Forestry at the Warrensburg Campus. Students are urged to use some elective time to enhance their communications skills. Courses in technical writing, applied communications or a language (as approved by their faculty advisor) are useful.

Special Biological Fields

Animal Physiology. Without further specialization, job opportunities in this field are limited, but those at the bachelor level include technician work in a laboratory, medical school, hospital, or in a liberal arts college; clerical work in government information agencies such as at the National Medical Library, and the Smithsonian Institution; and sales opportunities with the pharmaceutical and chemical industries.

Entomology. Insects play significant roles, both beneficial and detrimental, in their interactions with man, his resources, and his environment. Several courses are available on insect life and functions that enable a student to fulfill requirements of Civil Service and a variety of other employers. Program strengths are in forest entomology, medical entomology, pest management, and environmental toxicology.

Environmental Microbiology. Microbiology is a young, dynamic, and exciting science—vital in the world today and for the future. This science deals with bacteria, molds, algae, yeasts, protozoa, rickettsiae, and viruses: their roles in industry, disease, the environment, and everyday life. Careers in microbiology are available throughout the public and private sectors, and related to many different professions and industries.

Fish and Wildlife Biology and Management. A basic and applied program in fish and wildlife biology, including management and behavior, is provided for the student whose objectives are to develop professional skills in the biology and management of these natural resources.

Forest Pathology and Mycology. Protection of vascular plants and wood products from invading organisms, such as fungi, is basic to forest productivity, effective wood product use, and the maintenance of environmental quality. Program strength is in the ecological, physiological, genetic, and environmental aspects of disease. Students may train for positions in forest pathology, mycology, pest management, plant quarantine, or diagnostic laboratories. Opportunities for employment exist with federal, state, and private agencies.

Pest Management. Modern control of insects and disease dictates practices appropriate to maintaining an acceptable environmental quality. Through proper selection of courses, a student is able to achieve training that will result in wise selections of methods for an integrated approach to pest management. Training is more than adequate to prepare students for state examinations required for pesticide applicator's certification.

Plant Physiology. Plant physiology, part of the broader science of botany, attempts to understand the life processes that occur in plants. Career opportunities are available through federal, state, and local governments through their extensive testing and monitoring programs. Additionally, positions are available in agriculture and forestry concerning pathogenic microorganisms and physiological mechanisms of infection.

Plant Science. Students may prepare for a wide variety of opportunities in the botanically oriented professions. Essential to understanding plants are their biochemical and physiological processes; their interactions with the environment and with one another; with animals and other organisms; their genetic makeup, evolution and classification. Requirements may be satisfied for technical positions in areas such as botany, plant ecology, tree genetics, plant physiology, horticulture, tree maintenance, or plant quarantine.

Zoology. A basic and broad program is provided for the student whose objectives are to go on for graduate study or to further training in such subjects as physiology, soil invertebrate ecology, animal behavior, or animal ecology. Some opportunities with federal and state agencies are available at the baccalaureate level.

Cranberry Lake Biological Station

Students in the Environmental and Forest Biology curriculum generally satisfy their summer requirement by attending either session at the Cranberry Lake Biological Station. Courses at the Station are senior-level offerings designed to come after the junior year spent on the Syracuse Campus. Students elect courses during the five-week session for a total of five semester-hours. Extra credits earned by attending both sessions count toward elective hours in biology. Students from other institutions are welcome.

Cranberry Lake and its environs are ideally suited for an advanced biology summer program. The surrounding topography is rolling hill and lake country dotted with numerous small ponds, closed bogs, and stream drainages. The lake itself is the third largest body of water in the Adirondacks. Because 80 percent of the shoreline is in State ownership, the lake remains relatively unspoiled by recreational developments and is free of pollution problems. Much of the original forest cover in the region was

harvested years ago; today a rich variety of community types occupy those sites as the vegetation reverts to natural conditions. The remaining virgin forests also provide the student with many examples of stable forests, each type reflecting the particular environmental conditions controlling forest development. A wealth of wildlife parallels the variety of cover types over the region. The area provides easy access to a wide range of additional ecosystems ranging from bog to alpine types.

Facilities include four classroom-laboratories; dining facilities capable of serving 120; faculty quarters and cabins; an administration building; 12 cabins housing 6-8 students each; a recreation hall; and several smaller, supporting buildings.

The 10-week program extends from mid-June into mid-August and is divided into two five-week sessions. Courses are designed to emphasize and effectively utilize the unique nature of this Adirondack setting, and all involve field trips each day into the surrounding forest and aquatic ecosystems. The scheduling of courses remains fairly constant from year to year.

Students wishing more information about the Summer Program, including courses and fees, may write to the Director, Cranberry Lake Biological Station, State University of New York College of Environmental Science and Forestry, Syracuse, New York 13210.

Graduate Program

The graduate program in Environmental and Forest Biology is organized in nine interdependent biological study concentrations that provide comprehensive coverage within specific interest areas. Each concentration is governed by indicated faculty who define the scope of subject matter, recommend acceptance of students and guide them in a course of study. Some of these concentrations follow taxonomic lines while others are broad unifying areas basic to all taxa. Students choosing to emphasize a taxonomic category should explore the desirability of engaging to some extent in the broader interdisciplinary areas. Similarly, it is often opportune for students enrolled in the latter to develop a degree of specialization in at least one taxon as a means of assuring a useful mix of talents. Those students whose interests are not served by the designated areas of concentration should explore the feasibility of alternate routes of study, provided the needed expertise is available, and they may be guided by faculty listed in the concentration nearest the student's interest.

Most students seeking the M.S. degree include in their study plan a research thesis and its defense (see p. 43). There also is an option to earn the degree with 42 hours of coursework, the latter specified by the student's advising faculty according to concentration core requirements. All who seek the Ph.D. must include original research and dissertation or its equivalent in the form of refereed publications.

The major center of activity is Illick Hall, with the laboratories, classrooms, controlled spaces, and equipment that one would expect in a modern, build-

ing in which 85,000 square feet of working space is available for graduate study and research. Laboratories, many of them temperature and temperature-humidity controlled, and one sound-controlled, are provided for diverse study: plant development, physiology, tissue culture, biochemistry and toxicology, ecology, animal behavior, and similar endeavors. An herbarium, mycological collections, insect and other arthropod collections, and the Roosevelt Wildlife Collection of vertebrates are maintained in archival condition as useful resources for the academic program. Eight rooftop glasshouse units, three of them air-conditioned and one incorporated into a five-room indoor-outdoor insectary, are important to the full array of interests in plant science and plant-animal interactions.

Also available to the Department's students and faculty is a variety of sophisticated instrumentation: convenient access to a computer center; radio-isotope counting equipment, including liquid scintillation spectrometer and Cobalt-60 source; diverse analytical equipment and measuring devices; gas-liquid chromatography; and, in collaboration with the Chemistry Department, a comprehensive analytical expertise. The Nelson C. Brown Center for Ultrastructure offers scanning and transmission electron microscopy capability.

Supportive to the program are the academic resources, including courses, of Syracuse University, SUNY's Upstate Medical Center and the several campus facilities described elsewhere in this catalog. Our students participate as well in courses and utilize faculty and facilities at Cornell University in cooperative exchanges.

Excellent field sites and facilities are available for research in all aspects of the program in nearby or moderately distant locations from the Syracuse campus. In addition to the College's several campuses and field stations that offer a broad diversity of forest types, sites, and conditions, there are New York State Department of Environmental Conservation lands, the Montezuma National Wildlife Refuge, the Adirondack Mountains, and the transition zones near Lake Ontario, Oneida Lake, and Cicero Swamp that collectively offer a variety of habitat diversity from highlands to aquatic-terrestrial zones. The ponds, streams, and lakes in Central New York and the St. Lawrence River are regularly used by graduate students in wetlands and aquatic ecology and fishery biology.

Further academic advantages stem from the urban setting of the Syracuse campus. The Greater Syracuse area provides a convenient laboratory for studies basic to urban forestry: the growth and protection of woody vegetation, greenspace maintenance, the utilization of waste beds for plant growth, the detoxification of pollutants, and the restoration of terrain stripped of vegetation. Disposal of industrial and human pollutants and wastes require deeper understanding of the role of plants, animals and microorganisms in the biodegradation of organic matter. The conversion of organic materials into useful fuel, into additives for plant growth, or into protein feeds for domestic animals are stimulating study-in-depth of many

elements of basic biology offering substantial assistance toward the solution of pressing human problems.

Of the nine available study concentrations, eight are contained within the department: *Ecology, Entomology, Environmental Physiology, Fish and Wildlife Biology and Management, Pathology and Mycology, Plant Science, Soil Ecology, and Zoology*. One concentration, *Chemical Ecology*, is shared with faculty of the Chemistry Department.

Ecology

ALEXANDER (Vertebrates, Wetlands), ALLEN (Forest Insects), BEHREND (Wildlife), BROCKE (Wildlife, Bioenergetics), BURGESS (Forest Ecology), CHAMBERS (Wildlife), DINDAL (Invertebrates), GEIS (Plants, Wetlands), KETCHLEDGE (Dendrology, Bryology), KURCZEWSKI (Insect Behavior), MITCHELL (Invertebrates, Bioenergetics), MULLER-SCHWARZE (Vertebrates, Behavior), NAKAS (Microbiology), PORTER (Vertebrate Ecology), RAYNAL (Higher Plants, Taxonomy), RINGLER (Aquatic Ecology), SCHAEDEL (Plant Nutrition), SHIELDS (Vertebrate Behavior), SIMEONE (Forest and Wood-boring Insects), TIERSON (Wildlife), VANDRUFF (Wildlife), WERNER (Limnology).

Adjunct Faculty

GANNON (Aquatic Ecology), MORRIS (Diptera).

Understanding relationships between living organisms and their abiotic and biotic environment is fundamental to environmental science which also encompasses man's role in ecological systems. Ecology is an integrative science which depends on an understanding of ecological theory, habitat characteristics, and the basic biological attributes of organisms. This concentration area encourages the incorporation of this knowledge into those areas of practical concern. Specific research may entail the study of: distribution and abundance of organisms; community structure including trophic relationships, diversity or succession; and ecosystem properties such as patterns of energy transfer and biogeochemical cycling.

Entomology

ABRAHAMSON (Forest Insects, Pest Management), ALLEN (Forest Insects, Population Ecology), BREZNER (Physiology), KURCZEWSKI (Morphology, Taxonomy, Behavior), LANIER (Forest Insects, Pheromones, Cytotaxonomy), MILLER (Pest Management), NAKATSUGAWA (Toxicology), NORTON (Spiders and Mites, Insect Larval Taxonomy), SIMEONE (Forest and Wood-inhabiting Insects).

Adjunct Faculty

HOWARD (Medical Entomology), MORRIS (Medical Entomology).

Graduate study opportunities prepare students in the basic aspects of insect life and the role of insects in relation to man and his environment. The wide range of effects stemming from insect activity, from the beneficial to

the deleterious, allows for a variety of research subjects in which insects play a major role. Thesis topics may concern insects that affect forests, shade trees and wood products, those relating to the health and well-being of man and those playing key roles as parasites and predators of pest species. Current research areas include population dynamics of forest defoliators, pheromone communications among beetles and moths, speciation of insects as understood through behavioral and cytogenetic study, natural control of insects in forest systems and basic biochemistry of insect detoxification mechanisms.

Environmental Physiology

BREZNER (Insect Physiology), CASTELLO (Plant Virology), GRIFFIN (Fungus Physiology), HARTENSTEIN (Invertebrate Physiology), MITCHELL (Environmental Energetics), NAKAS (Microbial Physiology), NAKATSUGAWA (Insect and Vertebrate Toxicology), SCHAEDEL (Plant Physiology), WALTON (Plant Physiology), WILCOX (Plant Physiology).

The Environmental Physiology Concentration provides students with advanced training both at the M.S. and Ph.D. levels to develop an understanding of the nature and control of biological processes. Study programs are developed according to chosen academic goals and research opportunities available. Current interests include mechanisms of action of plant growth hormones; biochemical regulation of seed germination; plant and microbial enzymology; virology; toxicity and disposition of insecticides and environmental toxicants in vertebrates; production and action of plant phytoalexins and antibiotics; plant defenses against phytophagous invertebrates; mycorrhizae, ion transport; mineral nutrition, cambial physiology and photosynthesis.

Fish and Wildlife Biology and Management

ALEXANDER (Vertebrates, Herpetology), BEHREND (Vertebrates), BROCKE (Vertebrates), CHAMBERS (Vertebrates), MULLER-SCHWARZE (Vertebrate Behavior), PAYNE (Ornithology), PORTER (Vertebrate Ecology), RINGLER (Fisheries, Aquatic Ecology), SHIELDS (Vertebrate Behavior), TIERSON (Vertebrates), VANDRUFF (Vertebrates, Ornithology), WERNER (Limnology, Fisheries).

Adjunct Faculty

MATTFELD (Wildlife Biology), NOON (Wildlife Biology), SCHACHTE (Fisheries Biology), SUGATT (Aquatic Toxicology).

Study in this area provides students with advanced preparation at both the M.S. and Ph.D. levels in biological concepts of fish and wildlife populations, particularly as they relate to the proper management of these important resources. Widespread and increasing concern for management of

these wild animal resources has been matched by strong student interest in educational programs which prepare them for careers in the fish and wildlife professions. Graduate education, such as is available through this study area, is rapidly becoming a universal prerequisite to employment as a professional fisheries or wildlife biologist.

Areas of research include wetland ecology and management of wetland species, population-habitat relationships, predator ecology, urban wildlife relationships, endangered species studies, feeding ecology of fishes, stream ecology, ecology of larval fishes and homing behavior of fishes.

Forest Pathology and Mycology

ABRAHAMSON (Forest Pathology, Entomology), CASTELLO (Forest Pathology), GRIFFIN (Fungus Physiology), MANION (Forest Pathology), NAKAS (Microbiology), VALENTINE (Genetics), WANG (Mycology), WILCOX (Mycorrhizae), ZABEL (Forest Pathology and Wood Deterioration).

The study area in Forest Pathology and Mycology seeks to train students interested in developing an expertise responsive to the increasing pressures on forest and shade tree systems for wood fiber, public services, and amenities. This requires new sophisticated levels of disease understanding, disease control, a broad knowledge of fungi, bacteria and viruses, their environmental impacts and their roles in biodeterioration. Areas of staff interest and expertise appropriate for graduate student research emphasis include: environmental, fungal and viral tree diseases; mycorrhizae; wood decay and biodegradation processes; monitoring and impact assessment of disease in forest and urban tree systems; chemical and biological control of tree diseases; epidemiology of tree diseases and the genetics of resistance to tree diseases and to pathogen variability; physiology of fungus growth and development; taxonomy and biology of decay and imperfect fungi; fungus ultrastructure.

Plant Science

BURGESS (Ecology), CASTELLO (Virology), GEIS (Ecology), GRIFFIN (Mycology, Fungus Physiology), KETCHLEDGE (Ecology, Bryology), LOWE (Mycology), MANION (Pathology), NAKAS (Microbiology), RAYNAL (Ecology, Taxonomy), SCHAEDEL (Physiology), SILVERBORG (Pathology), TEPPER (Anatomy, Morphogenesis), VALENTINE (Genetics), WALTON (Physiology), WANG (Mycology), WILCOX (Physiology, Mycorrhizae), ZABEL (Pathology, Wood Deterioration).

Adjunct Faculty

AMES (Physiology), FAUST (Taxonomy), KARNOSKY (Genetics), ZABLOTOWICZ (Microbiology).

Plants, as the principal energy source for ecological food chains, serve as the structural and functional foundation of natural and managed eco-

systems. The plant science concentration provides opportunity for study in a broad range of specialties fundamental to the understanding of plants and their interaction with other organisms, emphasizing both forest and related plant systems. Current faculty and student research interests include: dynamics of plant communities as affected by man and the environment; mechanisms of plant succession; epidemiology of forest and urban tree diseases; decay, discoloration and biomodification of wood; taxonomy, physiology, growth and ultrastructure of fungi; heritability of wood properties and disease resistance of trees; biochemistry and physiology of plant growth regulators; photosynthesis; mineral nutrition; mycorrhizae; bryoecology; morphogenesis in shoot and root systems; and plant tissue culture.

Soil Ecology

DINDAL (Invertebrates), HARTENSTEIN (Invertebrates, Physiology), MITCHELL (Invertebrates, Energetics), NAKAS (Microbiology), NORTON (Invertebrates, Taxonomy), WANG (Mycology), WILCOX (Mycorrhizae), ZABEL (Wood Biodegradation).

Soil ecology includes the study of interrelationships of soil-inhabiting organisms (as individuals, populations and communities) with their biotic, chemical, and physical environments. This field can be considered to be a frontier of science because of the myriad of undescribed species of soil-dwelling arthropods, nematodes and annelids, and the wealth of incompletely understood symbiotic relationships that can be readily discovered by students in this concentration. Soil ecology deals with fundamental aspects of biodegradation and nutrient cycling and is therefore important for improvements in crop culture and enlightened waste disposal.

The soil ecology concentration is supported by courses in physical aspects of soils, plant and animal taxonomy and general ecology.

Zoology

ALEXANDER (Vertebrates, Wetlands), BROCKE (Vertebrates), CHAMBERS (Wildlife Ecology, Management), DINDAL (Invertebrates), HARTENSTEIN (Physiology, Invertebrates), MITCHELL (Invertebrates, Bioenergetics), MULLER-SCHWARZE (Vertebrate Behavior), NORTON (Arachnology), PORTER (Wildlife Biology), RINGLER (Fish Behavior), SHIELDS (Vertebrate Behavior), VANDRUFF (Vertebrates, Wildlife Biology), WERNER (Limnology, Aquatic Ecology).

Adjunct Faculty

BENZO (Vertebrate Physiology), DEGENNARO (Vertebrate Physiology, Embryology).

Zoology provides opportunity for in-depth coursework and fundamental research in morphology, physiology, taxonomy, and behavior of invertebrate

and vertebrate animals. As one of the basic areas in the Department of Environmental and Forest Biology, Zoology is supportive of other concentrations such as Ecology, Fish and Wildlife Biology and Management, and Soil Ecology. Graduate studies in Zoology include both basic and applied research on animals of our natural ecosystems, including their associated soils and waters.

CHEMISTRY

KENNETH J. SMITH, *Chairman*—(Physical and Polymer Chemistry), CABASSO (Polymer Chemistry), CALUWE (Organic Polymer Chemistry), CAMPBELL (Phytoenzymology), FLASHNER (Biochemistry), HASSETT (Environmental Chemistry), JOHNSON (Environmental Chemistry), LALONDE (Organic and Natural Products Chemistry), MEYER (Nuclear Chemistry), SARKO (Physical and Polymer Chemistry), SCHUERCH (Wood and Polymer Chemistry), SILVERSTEIN (Ecological Chemistry), SMID (Physical and Polymer Chemistry), TIMELL (Wood Chemistry).

The academic program in chemistry enables the student to develop not only an understanding of chemical phenomena, but also an appreciation for chemistry that can link it to the biological and applied sciences. Programs include courses in traditional areas of chemistry, with additional study in those fields pertaining to environmental science and forestry. This broad spectrum of academic offerings is possible through close cooperation with Syracuse University, where a wealth of accessory courses at both the undergraduate and graduate levels are available. Emphasis on the investigative function of chemical science is manifest in the wide array of ongoing research projects within the department.

The Department of Chemistry offers the following areas of concentration leading to the Bachelor of Science degree:

Biochemistry and Natural Products Chemistry

Environmental Chemistry

Natural and Synthetic Polymer Chemistry

Students in all options, by selecting proper electives, may be certified on graduation as having completed an American Chemical Society approved curriculum. All options are excellent grounding for professional work at the B.S. level or for advanced graduate study.

Undergraduate Program

Lower Division Courses

For students transferring into the College as juniors, recommended courses consist of 68 credits or an associate degree and include:

<i>Course Area</i>	<i>Credit Hours</i>
Biology with Laboratory	8
General Chemistry with Laboratory	8
Organic Chemistry with Laboratory	8
Physics with Laboratory	8
Economics	3
English	6
Language, Literature or Communication	6
Electives	12-15
*Mathematics	6-9
TOTAL MINIMUM LOWER DIVISION CREDITS	
	68

*Mathematics through integral calculus. An additional mathematics course beyond integral calculus is required for the B.S. degree.

Upper Division Courses

Junior Year		<i>Credit Hours</i>
<i>First Semester</i>	FCH 325 Organic Chemistry III	4
	³ CHE 332 Quantitative Analysis	2
	CHE 333 Quantitative Analysis Lab	1
	FCH 360 Physical Chemistry	3
	¹ Professional Elective	2-4
	Elective	3
		<hr/> 15-17
<i>Second Semester</i>	² Math or Elective	3
	FCH 380 Instrumental Methods	3
	FCH 361 Physical Chemistry	3
	CHE 357 Physical Chemistry Lab	2
	FCH 384 Spectrometric Identification of Organic Compounds	1
	¹ Professional Elective	2-3
	Elective	3
		<hr/> 17-18

¹A sequence of professional electives should be chosen in the junior year. In addition to the freshman biology courses, a student whose emphasis is in biochemistry must take 3 semester hours of genetics and at least one other 3-semester-hour biology course. A student whose emphasis is in natural products must take 3 semester hours of biology in addition to the freshman biology courses and an additional hour of organic chemistry laboratory (FCH 496) and a second hour of FCH 384.

²One course of mathematics or applied mathematics beyond MAT 397, or equivalent, is required.

³CHE designations refer to courses offered at Syracuse University.

Biochemistry and Natural Products Chemistry Option

This option is designed for students who wish to approach problems in the life sciences with the tools and point of view of the chemist. In addition to a major concentration in the several branches of chemistry, the student obtains a solid grounding in the fundamentals of physics, mathematics, and biology. Professional electives can provide a minor concentration in botany, ecology, entomology, zoology, or physiology. Collaborative efforts of chemists and biologists are providing new solutions to problems of environment, natural resources, and health.

Senior Year		<i>Credit Hours</i>
<i>First Semester</i>	LIB 300 Library Research	1
	FCH 495 Introduction to Professional Chemistry	1
	FCH 571 Wood Chemistry I	2
	FCH 574 Wood Chemistry Lab	1
	FCH 530 Biochemistry I	3
	FCH 531 Biochemistry Lab	2
	¹ Elective	3
	Elective	3
		16
<i>Second Semester</i>	² FCH 498 Introduction to Research	5
	FCH 497 Undergraduate Seminar	1
	FCH 532 Biochemistry II	3
	FCH 573 Wood Chemistry III	2
	Elective	3
	Elective	3
		17
	TOTAL MINIMUM UPPER DIVISION CREDITS	65

¹Introduction to Polymer Science, FCH 550 (3 credit hours) is suggested.

²Petition by student to Department for replacement of this requirement will be considered to allow time for special interest.

A total of 133 credit hours is required to complete the B.S. degree in Chemistry with the Biochemistry and Natural Products option.

Environmental Chemistry Option

The environmental chemistry option is designed for those students who wish to obtain a solid fundamental background in chemistry which will enable them to make a strong contribution towards the identification and solution of problems in the areas of pollution, air and water quality, analysis and basic research in environmental chemistry. A large number of professional electives, available through course offerings of other departments such as biology and engineering, provide the important interface with other disciplines necessary for a working understanding of the complex problems inherent in environmental studies.

Senior Year			Credit Hours
<i>First Semester</i>	LIB 300	Library Research	1
	FCH 495	Introduction to Professional Chemistry	1
	FCH 510	Environmental Chemistry I	3
	FCH 515	Methods of Environmental Chemical Analysis	3
	Chemistry Elective	.....	3
	¹ Elective	.....	3
	Elective	.....	3
			17
<i>Second Semester</i>	² FCH 498	Introduction to Research	5
	FCH 511	Environmental Chemistry II	3
	FCH 497	Undergraduate Seminar	1
	FCH 519	Environmental Chemistry Seminar	1
	Electives	.....	6
			16
TOTAL MINIMUM UPPER DIVISION CREDITS			65

¹Biochemistry I, FCH 530, (3 credit hours) is suggested.

²Petition by student to Department for replacement of this requirement will be considered to allow time for special interest.

A total of 133 credit hours is required to complete the B.S. degree in Chemistry with the Environmental Chemistry option.

Natural and Synthetic Polymer Chemistry Option

This option is designed for students interested in the structure and physical properties of man-made and natural materials, the giant molecules of wood, plastics, polysaccharides, proteins, rubbers, and fibers. The recently discovered chemistry of these materials constitutes one-half the concern of the chemical industry and is the origin of a major revolution in our way of life and our understanding of nature. This special subject area is an advanced core of studies beyond the basic courses of the classical undergraduate chemistry curriculum.

Senior Year			Credit Hours
<i>First Semester</i>	LIB 300	Library Research	1
	FCH 495	Introduction to Professional Chemistry	1
	FCH 550	Introduction to Polymer Science I	3
	FCH 551	Polymer Techniques	2
	FCH 571	Wood Chemistry I	2
	FCH 574	Wood Chemistry Lab	1
	¹ Elective	.....	3
Elective	.....	3	
			16

Second Semester	² FCH 498	Introduction to Research	5
	FCH 552	Introduction to Polymer Science II	3
	FCH 497	Undergraduate Seminar	1
	FCH 573	Wood Chemistry III	2
	Electives	.....	6
			17
		TOTAL MINIMUM UPPER DIVISION CREDITS	65

¹Biochemistry I, FCH 530 (3 credit hours) is suggested.

²Petition by the student to Department for replacement of this requirement will be considered to allow time for special interest.

A total of 133 credit hours is required to complete the B.S. degree in Chemistry with the Natural and Synthetic Polymer option.



Graduate Program

Recent years have seen profound advances in the fundamental knowledge of chemical areas which have special significance for forestry and the environment. The following research areas have received active attention by both faculty and graduate students in the programs: polymer chemistry and physics; wood chemistry; environmental chemistry; biochemistry; chemistry of natural products, including ecological chemistry; and materials sciences.

Requirements for a master of science or doctor of philosophy degree in chemistry include a research project and thesis, along with an appropriate program of courses at the College and at Syracuse University.

Specific projects may vary from year to year, since they reflect the current interests of the faculty. Current research projects with *physiochemical* emphasis are: the chemistry, physics, solid-state and solution properties of natural and synthetic polymers, including studies in thermodynamics, statistical mechanics, crystallization, morphology, elasticity, conformation of macromolecules, optical properties, polymer catalysis, mechanism of polymerizations, polyelectrolytes, ion binding to macromolecules and ion pairing; chemistry of free radicals, radical ions and charge transfer processes; structure and properties of ionic solutions in nonaqueous media; crystal structure and morphology of cell wall constituents; membrane properties and technology; heavy metal speciation. Current *organic* chemistry programs deal with synthesis of special polymers such as high temperature aromatic block, stereoregular vinyl polymers, and polysaccharides, various aspects of natural products chemistry, but especially alkaloids and terpenes, isolation and characterization of insect and mammalian attractants. An active program on the structure and topochemistry of the *polymeric* wood components, hemicelluloses, lignins and celluloses is underway. In *biochemistry*, department members are studying mechanisms of action of plant growth hormones, biochemical regulation of seed germination, plant enzymology and ultrastructural plant cytology.

Graduate research laboratories in the Hugh P. Baker Laboratory are well equipped for polymer studies, chemical, and biochemical research. Instrumentation includes analytical and preparative ultracentrifuges, Warburg respirometer, recording infrared and ultraviolet spectrophotometers, mass spectrometer, differential refractometer, electron spin resonance spectrometer, nuclear magnetic resonance spectrometers, automatic membrane osmometers, solid-and solution-state light scattering photometers, recording polarimeter and optical dispersion spectrometer, analytical and preparative high performance liquid chromatographs, combined gas chromatographs—mass spectrometry center, spectrofluorimeter, several ultramicrotomes, electron microscopes, X-ray diffraction, instrumentation chromatography and cold laboratories, and radiochemical laboratories with counters for solids, liquids and gases.



INTERDEPARTMENTAL AREA OF STUDY

The following concentration in chemical ecology is offered in collaboration with faculties of the Department of Environmental and Forest Biology and the Department of Chemistry. Interested students should apply to the department of major interest, which will have prime responsibility for setting requirements. Faculty from both departments can aid in the development of a plan of study enabling a student to acquire sophisticated skills in either chemistry or biology and an ample understanding of the other to grapple with problems requiring an understanding of both.

Chemical Ecology

LANIER (Insect Pheromones), MULLER-SCHWARZE (Vertebrate Pheromones), SILVERSTEIN (Pheromone Chemistry), SIMEONE (Insect Pheromones), TANENBAUM (Microbial Chemistry).

As a relatively new interdisciplinary endeavor, workers in this field attempt to understand organismal interactions, both intra- and interspecific, mediated by chemical substances such as hormones, pheromones, kairomones and phytoalexins. These occur at all taxonomic levels: between uni- and multi-cellular organisms, microbes and plants, plants and plants, plants and animals, microbes and animals, animals and animals. Study of such interactions has been accelerated in recent years through joint efforts of biologists and chemists in meaningful research accompanied by a growing body of literature.

THE SCHOOL OF ENVIRONMENTAL AND RESOURCE ENGINEERING

WILLIAM P. TULLY, *Dean*

The School of Environmental and Resource Engineering offers three undergraduate curricula and one graduate program which support the engineering aspects of environmental science and forestry through the Departments of Forest Engineering, Paper Science and Engineering and Wood Products Engineering. A Bachelor of Science degree is awarded in each of these fields while advanced degrees (M.S. and Ph.D.) are offered through the graduate program in Environmental and Resource Engineering.

The undergraduate curricula provide students with a broad base of study and specialized education in engineering, science, and technology. Students learn to apply their education to improve the economic use of forest and rural resources, to enhance environmental quality and to increase the efficiency of processes and the wise use of water and timber, wood, paper, and related fibrous material products. Graduates are prepared for a variety of careers in industry and government service in these fields.

The specific requirements for entering each curriculum at the junior level and for completing the coursework residency requirements for the B.S. degree are described with the individual departmental programs which follow. During late May the School offers a Summer Institute for pre-ESF students preparing to enroll in these curricula one or two years hence. Participants receive detailed academic guidance and learn about career opportunities.

Qualified applicants with associate degrees in engineering science or an appropriate blend of science and mathematics usually gain full admission at the junior level. Graduates of two-year technology programs also may qualify for junior standing in certain curricula if their previous studies included the courses appropriate to departmental requirements.

Graduate Program

The Graduate Program in Environmental and Resource Engineering is based on a synthesis of the professional activities of the three curricular areas described above. Both the Master of Science (M.S.) and Doctor of Philosophy (Ph.D.) degrees are offered. The program provides students with a balanced understanding of scientific research, engineering measurement, and engineering analysis and design, and with specialized depth and appropriate interdisciplinary breadth of knowledge in environmental and resource engineering. Its graduates are prepared for professional careers as leaders in the private and public sectors of research, engineering, technology, teaching and administration in the industries and professions served by this program. science and engineering to the development and improved utilization of the natural environment and its forest-related resources. Thus, graduate education is understood to involve a wide range of scientific and engineering abilities and attitudes.

Specialized areas of study have been delineated to serve student interests. Within these areas of study, an individually-designed study program is developed for and with each student. A partial listing of specialized areas of graduate study and research include: wood science and technology, composite materials and wood treatments, design of timber structures, tropical timbers, anatomy and ultrastructure, pulp and paper technology, fiber and paper mechanics, chemistry of pulping and bleaching, colloid chemistry and fiber flocculation, chemical process engineering, pollution abatement engineering, forest engineering, water resources engineering, transportation and soils, energy and environmental quality, and remote sensing and photogrammetry.

Applicants to the graduate program in Environmental and Resource Engineering must meet general College-wide requirements, have prior education or experience suitable for beginning advanced study in their chosen area of specialization and have a deep commitment to the advancement of the academic and professional aspects of their career goals. Some coursework deficiencies may be corrected within individual study programs.

Candidates for the Master of Science degree must complete a program of study totaling at least 30 hours of credit earned through graduate level coursework. Six to 12 of these credits shall be given for a master's thesis or project. Up to six credit hours of graduate level coursework may be transferred from another institution.

The Ph.D. program usually builds upon a master's degree and demands further advanced mastery of material in the area of study and the dissertation topic. This includes additional graduate level coursework beyond the M.S. degree as determined with the student's committee.

Candidates for the Ph.D. must demonstrate competence in at least two of the following tools of research (statistics, computer programming or foreign language), pass a doctoral candidacy examination, and write and defend a dissertation.

Students are able to draw on the combined resources of the three academic departments in the School. In addition, courses and facilities of other schools of the College as well as Syracuse University complement those of the School of Environmental and Resource Engineering.

Prospective students who desire more information than is presented for each of the departmental descriptions and specialties described should contact the Dean, School of Environmental and Resource Engineering.

FOREST ENGINEERING

ROBERT H. BROCK, *Chairman* (Photogrammetric and Geodetic Engineering, Mapping Systems)

DUGGIN (Agricultural Assessment, Remote Sensing, Physics), HENNIGAN (Water Resources, Environmental and Water Quality Management and Policy), HOPKINS (Surveying, Site Assessment, Remote Sensing), LEE (Computers and Systems Engineering, Transportation and Equipment, Soil Mechanics), MCCLIMANS (Soils, Hydrology, Site Engineering), PALMER (Engineering Economics, Energy, Production and Harvesting Systems), TULLY (Structures, Engineering Hydrology, Water Resources).

A large portion of our nation's resources exist on forested and rural lands. These include: the increasingly valued renewable resources of timber, biomass and wildlife; the sustaining resources of water, soil and nutrients; and the derivative resources of paper, wood, and fibrous products and recreation and amenity values. Forest engineering is a unique field of engineering which is concerned with the design of systems and facilities to improve the sustained high quality yield of resources and multiple use benefits of goods and services from forested and rural lands.

The undergraduate curriculum in Forest Engineering provides a broad base of study and specialized education in engineering with an emphasis on site development for improved resource use and conservation. Instruction focuses on: locating and quantifying resources; designing harvesting, conveyance and transportation systems and networks for water and timber; designing structures, facilities and pollution abatement systems; and engineering planning for the development of sites and regions for multiple use.

Programs of advanced studies toward an M.S. or Ph.D. degree in environmental and resource engineering are offered. Individually designed programs provide graduates with sufficient understanding of the methodologies of scientific research and of the principles of engineering analysis or design to work with competence in resource related research, engineering design and management. There are opportunities for individuals who seek advanced education in such areas as water resources engineering, photogrammetry and remote sensing, transportation and soils, energy and environmental quality as well as forest engineering.

Because of the special importance of continual measurement and evaluation of the broad scaled parameters which affect the resource base, unique opportunities for study are available for students aiming toward professional careers involving the conceptualization, design, and maintenance of geographically referenced resource information systems. This includes elements of surveying, photogrammetry, remote sensing, and resource information systems design.

Undergraduate Program

The primary objective of this curriculum is to prepare qualified engineering graduates to operate with professional competence within the context of forest and natural resources development. The curriculum includes basic, forest, and engineering sciences. It utilizes elements of traditional engineering disciplines and develops its unique aspects from interweaving engineering design with an understanding of the natural environment and its renewable resource base including water, soil, timber, wildlife, and amenity values. Studies in the humanities and social and economic sciences are integrated throughout the curriculum to help achieve a broad and balanced perspective of professional practice in forest engineering.

Qualified graduates in search of advanced degree education enjoy ready acceptance to engineering graduate schools throughout the country. Graduates of the Forest Engineering curriculum may enter an established five-year program in either civil, industrial, or mechanical engineering at Syracuse University. A bachelor of science degree in engineering will be awarded by Syracuse University upon completion of the requirements of the fifth year.

To enter the Forest Engineering curriculum at the junior level, a transferring student must have acceptable college credit in the following coursework areas or be able to have suitable coursework substitutions for courses listed in the junior and senior years.

Lower Division Courses

<i>Course Area</i>	<i>Credit Hours</i>
Biology (Botany preferred)	3
General Chemistry with Laboratory	8
Engineering Physics with Laboratory	8
Calculus through Differential Equations	15
English	6
Economics (Macro- and Microeconomics)	6
Engineering Drawing (Graphics)	1
Computer Programming (FORTRAN or APL)	3
Engineering Mechanics (Statics and Dynamics)	4
Electrical Science	3
Humanities or Social Science Electives	3

TOTAL MINIMUM LOWER DIVISION CREDITS 60

Students must meet these minimum requirements, and they are encouraged to exceed the minima in the elective areas, to facilitate scheduling during the upper division years.

Upper Division Courses

Junior Year		<i>Credit Hours</i>
<i>First Semester</i>	ERE 362	Mechanics of Materials 3
	ERE 371	Surveying for Engineers 3
	FOR 321	General Silviculture 3
	CIE 327	Principles of Fluid Mechanics 4
	FBO 305	Dendrology 2
	Elective	..... 3
		<hr/> 18
<i>Second Semester</i>	FEG 340	Engineering Hydrology and Flow Controls 4
	FEG 350	Introduction to Remote Sensing 2
	FEG 363	Photogrammetry I 3
	MEE 285	Design of Mechanical Equipment 3
	IOR 326	Statistics for Engineers 3
	ERE 351	Basic Engineering Thermodynamics 2
		<hr/> 17
Senior Year		<i>Credit Hours</i>
<i>First Semester</i>	FEG 410	Structures I 4
	FEG 422	Production Systems Engineering 4
	CIE 437	Soil Mechanics and Foundations I 4
	FOR 477	Resource Policy and Management 3
	Elective	..... 3
		<hr/> 17
<i>Second Semester</i>	ERE 488	Engineering Economics 1
	FEG 437	Transportation Systems 4
	ERE 440	Water Pollution Engineering 3
	FEG 489	Forest Engineering Planning and Design 3
	Elective in Engineering Design Sequence	..... 3
	Elective	..... 3
		<hr/> 17
TOTAL MINIMUM UPPER DIVISION CREDITS		70

TOTAL UPPER AND LOWER DIVISION ELECTIVE REQUIREMENTS

Humanities or Social Sciences: At least 9 credit hours must be elected in social sciences or humanities, at least 6 of which are recommended to be upper division. (If lower division English coursework does not include at least 3 credit hours of humanities coverage, then an additional 3 credit hours of humanities are required.) Humanities coursework deals with branches of knowledge concerned with man and his culture, while social sciences coursework concerns individual relationships in and to society. Traditional subjects in these areas are philosophy, religion, history, literature, fine arts, sociology, psychology, anthropology, economics, and modern languages beyond the introductory skills courses, while modern nontraditional subjects are exemplified by courses such as technology and human affairs, history of technology, and professional ethics and social responsibility. Subjects such as accounting, industrial management, finance, personnel administration, ROTC studies, and skills courses, such as public speaking and technical report writing, do not fulfill the humanities and social science content.

Engineering Sciences: Electrical Science and coverage of Dynamics (separately or in combination with Statics) are required.

Engineering Design: At least 3 credit hours are required in upper division engineering coursework as part of an advisor approved sequence which complements other forest engineering coursework and provides the equivalent of at least 1 credit hour of depth in the design and synthesis component of the program, such as:

Design of Wood Structural Elements	Air Pollution Engineering
Structures II	Synthesis of Mechanical Systems
Soil Mechanics II	

A total of 130 credit hours is required to complete the B.S. degree in Forest Engineering.

Graduate Program

Graduate studies and research are primarily concerned with environmental and resource related programs. Individual study programs leading to the master of science and doctor of philosophy degrees are available to meet the student's needs and interests in graduate study. Successful programs of graduate study may be efficiently designed by students with bachelor of science degrees in engineering or in forestry, natural sciences, physics, or mathematics.

Study programs with emphasis on environmental and resource engineering measurements may be designed in remote sensing, photo interpretation, geodetic engineering, analytical photogrammetry and photogrammetric systems. Programs emphasizing engineering analysis and design are available in water resources, energy, transportation, harvesting and site engineering systems. Included are the monitoring, measurement and evaluation of physical parameters affecting water, soil, timber, vegetation, and wildlife.

Support for graduate study and research in these areas is both internal and external. The internal support includes modern laboratory and instrumentation facilities in the Engineering Schools at both ESF and at Syracuse University. Exceptional departmental support exists for programs in environmental engineering measurements in the form of remote sensing and photogrammetric laboratories and the extensive forest properties owned by the College at which research may be conducted.

External support comes from several active sources, including industrial, commercial and governmental. Over the past two decades, close cooperation has developed special study and research opportunities with these sources.

PAPER SCIENCE AND ENGINEERING

BENGT LEOPOLD, *Chairman* (Organic Chemistry and Mechanical Properties of Fibers and Paper)

BAMBACHT (Pulping, Papermaking, Paper Machine Operation), BRITT (Chemistry of Paper Formation), DENCE (Organic Chemistry, Pulping, Bleaching), GORBATSEVICH (Pulping, Bleaching, Paper Technology and Paper Properties), JELINEK (Computer Applications, Process Engineering, Thermodynamics), LAI (Organic Chemistry, Pulping), LUNER (Surface and Colloid Chemistry of Papermaking Systems), MARK (Mechanical Properties of Fibers and Paper), MARTON (Mechanical and High-Yield Pulping), ROTHENBERG (Pulping, Bleaching), STENUF (Chemical Engineering, Instrumentation, Thermodynamics, Flow Phenomena, Process Control, Corrosion), THORPE (Fiber Physics, Paper Physics and Mechanics), TURAI (Water and Air Pollution Abatement Engineering, Materials Science and Engineering).

Outstanding for its vigorous growth and diversity of products, the pulp and paper industry is the fifth largest in the nation and exceptionally strong worldwide. Its need for professional men and women with training in science, engineering and technology is increasing even more rapidly than the industry itself. The College pioneered instruction in this area in 1920 with the organization of the paper science and engineering department, which has maintained a singularly high position in professional education for the continuing development of the pulp, paper and allied industries. Its graduates, who are in constant demand, occupy positions of leadership throughout the world.

The curriculum in Paper Science and Engineering is designed to provide a broad base of study and to prepare students for a variety of careers in the paper and related industries. Excellent opportunities are provided for men and women qualified to fill positions as research chemists, process engineers, technical service representatives, line management personnel, and many others.

The program provides education in the physical sciences and chemical engineering, with specific emphasis on those aspects of these disciplines which relate to the manufacture of pulp and paper. This includes the chemistry and anatomy of wood, the conversion of wood to pulp and paper, and the chemistry and physics of paper and paper formation. Instruction in chemical engineering includes a foundation of unit operations basic to the pulp and paper industry, as well as specialized courses, such as water and air pollution engineering.

The department is located in Walters Hall, opened in 1969. This facility is devoted exclusively to education and research in the field of pulp and

paper. In addition to a large number of special purpose laboratories and highly sophisticated scientific equipment, the department maintains an experimental pulp and paper mill equipped with machinery and instrumentation for studies of pulping, pulp purification, reuse of secondary fibers, refining, paper additives, and papermaking. This facility includes one 12-inch and one 48-inch fourdrinier paper machine, a number of disk refiners, one atmospheric and one pressurized grinder for mechanical pulping, and auxiliary equipment. In addition, the Department maintains an environmental engineering laboratory designed to demonstrate various methods used for the recycling of waste paper and the treatment of waste water. Also included is a modern chemical engineering laboratory, used for studies in all phases of unit operations and processes, process control, and analog simulation.

Undergraduate Program

The curriculum is entered at the junior level. Students with an associate degree in engineering science, science and mathematics, or chemical technology usually qualify for admission if their studies have included 8 credit hours of organic chemistry with laboratory. Other applicants with two years of college study may also gain admission if their curriculum includes the appropriate courses, as indicated below:

Lower Division Courses

<i>Course Area</i>	<i>Credit Hours</i>
Botany or Biology with Laboratory	4
General Chemistry with Laboratory	8
Organic Chemistry with Laboratory	8
Quantitative Analysis	3
Physics with Laboratory	8
Mathematics—Analytic Geometry and Calculus, Differential Equations	12
Computer Science	3
Economics	3
English	6
Engineering Drawing	1
Humanities or Social Science Electives	8
TOTAL MINIMUM LOWER DIVISION CREDITS	64

Minor deficiencies can usually be made up during the junior year.

The Paper Science and Engineering curriculum consists primarily of chemical engineering courses and specialized courses relating to the manufacture of pulp and paper products. A detailed listing of these courses is given below:

Upper Division Courses

Junior Year		Credit Hours
<i>First Semester</i>	FCH 572 Wood Chemistry II	3
	FCH 360 Physical Chemistry	3
	PSE 300 Introduction to Papermaking	3
	WPE 387 Wood Structure and Properties	3
	PSE 370 Principles of Mass and Energy Balance	3
	PSE 371 Fluid Mechanics	3
	<hr/>	18
<i>Second Semester</i>	PSE 372 Heat Transfer	2
	FCH 361 Physical Chemistry	3
	WPE 388 Wood and Fiber Identification Lab	1
	PSE 301 Pulp and Paper Processes	3
	PSE 302 Pulp and Paper Processes Lab	1
	ERE 377 Process Control	3
	LIB 300 Library Research Methods	1
	*Elective	3
	<hr/>	17

SUMMER MILL EXPERIENCE: PSE 304 Mill Experience 2
 (Twelve weeks of full-time pulp or paper mill employment approved by the Department between the junior and senior years.)

Senior Year		Credit Hours
<i>First Semester</i>	PSE 461 Pulping Technology	3
	PSE 465 Paper Properties	4
	PSE 473 Mass Transfer	3
	PSE 491 Paper Science and Engineering Project	1
	*Electives	6
	<hr/>	17
<i>Second Semester</i>	PSE 466 Paper Coating and Converting	2
	PSE 468 Papermaking Processes	3
	ERE 440 Water Pollution Engineering	3
	*Electives	6
	<hr/>	14

TOTAL MINIMUM UPPER DIVISION CREDITS 67

*At least 9 hours of electives must be selected from an advisor-approved sequence of technical courses. Examples of suggested areas are shown below.

TECHNICAL ELECTIVES

Colloid and Surface Chemistry	Applied Mathematics
Instrumental Analysis	Computer Modeling
Polymer Chemistry	Principles of Management
Pollution Abatement	Mechanics
Independent Research Project	Engineering Design
Thermodynamics	Materials Science

A total of 132 credit hours is required to complete the B.S. degree in Paper Science and Engineering.

Graduate Program

Graduate studies reflect the strong trend toward diversification in the industry and offer opportunities for obtaining master of science and doctor of philosophy degrees in a variety of subjects related to the manufacture of pulp and paper. Individual study programs are designed to meet specific personal needs. Typical areas of study range from the development of new pulping processes, chemical interactions on the paper machine and the disposal of pulping and papermaking effluents, to the fluid dynamics of fiber suspensions, the colloid chemistry of papermaking constituents, and the physical properties of fiber networks.

An important component of the graduate program is thesis research under direction of a graduate advisor. Much of this research is carried out under the auspices of one of the outstanding research facilities in the world, the Empire State Paper Research Institute (ESPRI), an integral part of the department. Its research activities aim to generate new information regarding the fundamentals, the science, the engineering and the technology of the papermaking process, utilizing advanced techniques such as electron microscopy, specialized spectrophotometry, nuclear magnetic and electron spin resonance and nuclear tracer methods. Recent work has been directed to fundamental investigations of pulping, bleaching, additives, paper recycling, effluent disposal, the papermaking process, the properties of paper, reactions of wood components during mechanical and chemical treatments, the structure of wood and wood fibers, evaporation, fluid dynamics, heat transfer, and chemical recovery.

Many research projects are carried out in cooperation with other College departments. Examples of such projects include a wide-ranging study of the toxicity of paper industry effluents in cooperation with the Department of Environmental and Forest Biology, and a cooperative project on the theoretical and experimental analysis of the mechanical properties of fiber and paper with the Department of Wood Products Engineering, as well as the Department of Aerospace and Mechanical Engineering at Syracuse University.

The department enjoys excellent external support in the form of graduate fellowships and grants from ESPRI, the Syracuse Pulp and Paper Foundation, and other industry sources, as well as a number of government granting agencies.

WOOD PRODUCTS ENGINEERING

GEORGE H. KYANKA, *Chairman* (Applied Mechanics, Structures) CÔTE (Cellular Ultrastructure, Light and Electron Microscopy), DAVIDSON (Physical Properties of Wood), DE ZEEUW (Wood Anatomy, Structure-Property Relations), HANNA (Ultrastructure and Microscopy), J. MEYER (Wood-Polymer Systems Radioisotope Techniques), R. MEYER (Wood Properties and Anatomy), MOORE (Wood Materials Processing and Technology), SIAU (Protective Treatments, Transport Processes), SMITH (Adhesives, Coatings, Wood-based Composites).

While wood is one of the oldest structural materials known to man, it occupies a position of major economic importance today with the annual tonnage of wood produced in the United States exceeding that of any other major structural material. This fact becomes even more important in this age of environmental and ecological concern because wood is the only major structural material that comes from a renewable natural resource, and demand is growing for more efficient utilization of available material. Improved efficiency must be based on solid scientific and engineering information. The Department of Wood Products Engineering provides undergraduate instruction in basic wood science and technology and stresses the application of science and engineering to building construction and the production, design, and utilization of wood-based materials. At the graduate level, the Department provides guidance via advanced courses and research opportunities in wood science and timber engineering.

Undergraduate Program

The Department of Wood Products Engineering prepares students for a wide variety of professional occupations concerned with the use of wood as a material. Two curriculum options are available: Building Construction and Forest Products. Both options have elective courses which permit tailoring the program to serve the needs of individual students from a wide variety of two-year preparatory programs. The Forest Products option is individualized to serve students that wish to emphasize Marketing, Production Systems Engineering, or Wood Science and Technology.

As the only major engineering material derived from a renewable natural resource, wood is receiving increased attention as an alternative to other materials which originate from the depleted nonrenewable resources. Thus, a principal aim of the departmental program is to teach students the fundamental properties of wood as a material to promote efficient wood processing, product design, and final use, whether as a piece of furniture or as a complete building.

To enter either option at the junior level, a transferring student must have acceptable college credit in the following coursework areas. Individuals not meeting the basic outline shown are encouraged to contact the Admissions Office to work out special arrangements and/or additional study requirements:

Lower Division Courses

<i>Course Area</i>	<i>Credit Hours</i>
*General Chemistry with Laboratory	4
*General Physics with Laboratory	8
Mathematics—Analytical Geometry and Calculus	8-9
English	6
<i>Recommended Additional Courses</i>	
Accounting	6
Biology or Botany	3-4
Computer Programming	3
Economics (Micro- and Macroeconomics)	6
Engineering Drawing (Graphics)	2
Organic Chemistry	3
Electives	16-18
TOTAL MINIMUM LOWER DIVISION CREDITS	62

*Four credits of physics are required, although 8 hours are recommended. However, students who wish to emphasize wood science and technology in the forest products option must have: general chemistry with laboratory (8); general physics with laboratory (8); and general botany with laboratory (4); organic chemistry (3).

The A.S. or A.A.S. degree in Architectural, Civil, Construction, or Mechanical Technology may also fulfill the requirements for admission. Students who lack the above background courses are nevertheless encouraged to consult the Admissions Office and the faculty of the department for an evaluation of their academic records.

Building Construction Option

Current economic pressures are dictating that the construction industry become more efficient in the design and construction of new facilities and structures. These structures range in size from residential structures to massive power generation stations. Consequently, the industry has increased its demand for technically trained professionals who have the skills to manage construction projects. These professionals must be prepared to develop new and innovative construction techniques, deal with a highly organized union work force, prepare competent cost estimates, and manage entire projects from start through completion.

Although the Building Construction curriculum emphasizes the use of wood as a building material, it allows the students an opportunity to develop a broad educational background in construction which will prepare them for a wide range of job positions in the construction industry and related fields. The program has a certain degree of flexibility which allows the student to specialize in a particular area of interest.

Illustrative electives are listed below:

<i>Engineering</i>	<i>Management</i>	<i>Environmental</i>
Structural Analysis	Marketing	Air Pollution Engineering
Foundation Design	Business Law	Solid Waste Disposal
Building Systems	Accounting	Waste Water Treatment
Energy Systems	Finance	Environmental Sanitation
Engineering Design	Operations Research	Land Use Planning

The following are some of the position titles past graduates now hold:

Assistant Project Superintendent	Timber Engineer
Project Supervisor	Truss Design Engineer
Construction Manager	Research Engineer
Cost Engineer	Construction Consultant
Resource Scheduler	Technical Sales Representative

Upper Division Courses

Junior Year		<i>Credit Hours</i>
<i>First Semester</i>	WPE 320 Adhesives, Sealants and Coatings	3
	WPE 387 Wood Structure and Properties	3
	ERE 371 Surveying for Engineers	3
	ACC 204 Financial Accounting Systems	3
	WPE 361 Statics	3
		15
<i>Second Semester</i>	ERE 362 Mechanics of Materials	3
	ERE 364 Engineering Materials	3
	ACC 252 Introduction to Managerial Accounting	3
	Management Elective Course	3
	Elective or APL Programming	3
		15
INDUSTRIAL FIELD TRIP (a two-week field trip immediately following final exam period): WPE 399 Field Trip		2
Senior Year		<i>Credit Hours</i>
<i>First Semester</i>	FEG 410 Structures	4
	CIE 437 Soil Mechanics and Foundations	4
	ERE 496 Professional Development	1
	WPE 454 Construction Management	3
	Probability and Statistics Course	3
	Elective	3
		18
<i>Second Semester</i>	WPE 326 Fluid Treatments	2
	WPE 327 Fluid Treatments Laboratory	1
	WPE 450 Construction Equipment	3
	WPE 422 Composite Materials	3
	Elective	6
		15
TOTAL MINIMUM UPPER DIVISION CREDITS		65

A total of 127 credit hours is required to complete the B.S. degree in Wood Products Engineering with the Building Construction option.

Forest Products Option

The forest products option prepares students for employment in the wood products industry. A forest products graduate should be able to walk into any wood products manufacturing operation and, after observing the process be able to fully understand what is going on. Instruction is individualized by selecting emphasis courses that are combined with required core courses designed to develop a comprehensive knowledge and understanding of wood as a raw material. The forest products option trains wood technologists, utilizing an individualized program with a series of emphasis courses to develop additional background in manufacturing, marketing, or specialization in wood science and technology.

Students wishing to enter graduate school can plan a series of electives to meet entrance requirements of major graduate institutions, whether in wood science and technology, business administration, or another branch of the sciences.

Marketing Emphasis

A special knowledge of the material properties of wood and the suitability of specific wood species for use in various products or processes enable a graduate with marketing emphasis to assist a customer in selection of the right wood product for the intended end use or makes possible the procurement of the best wood raw material for some manufacturing operation. These situations include considering the correct species of wood, treatments to prolong the useful life of a wood product, or selection of the most suitable manufactured product, such as medium density fiberboard or plywood, for a specific application. In some cases market research surveys or economic analyses may be required. Complete understanding of the employer's products, the material properties of wood, and the customer's special needs and problems are necessary for the marketing specialist to function efficiently. In addition to many sales-related or purchasing-related positions are other employment possibilities such as those requiring analysis of economic and trade conditions or relating engineering properties of wood to established or new product lines.

Job titles of recent graduates include:

Veneer Sales Manager	Retail Manager
Technical Sales Representative	Export Trade Analyst
Applications Engineer	Purchasing Agent
Assistant Sales Manager	Product Development Engineer
Regional Sales Manager	Marketing Research Analyst

Production Systems Engineering Emphasis

Numerous manufacturing methods are used to produce the over 5,000 products that use wood in one form or another. By studying various production systems, plant layout, techniques for time and motion studies, engineering properties of wood and ways to modify wood properties, a wood production systems engineer is prepared for a career in the manufacture of

forest products (veneer, plywood, particleboard, etc.). These careers deal with product and process development, quality control, production control, design engineering, personnel relations, and management.

Job titles of recent graduates include:

Production Coordinator	Plant Engineer
Quality Control Supervisor	Maintenance Supervisor
Plywood Production Manager	Production Supervisor

Wood Science and Technology Emphasis

Wood science and technology deals with materials science and engineering. Graduates that have stressed the science and technology of wood are prepared to utilize their knowledge of wood in numerous ways: to increase the efficiency of wood use, apply existing or new knowledge to wood product manufacture or utilization, or to do the research and development required for the new products, processes, and treatments necessary to meet the increasing demands made on our limited forest resources for wood commodities. Such research projects could be either basic, in which case the frontiers of wood science are extended, or applied, in which case existing knowledge is applied to current technological problems. Much of the work that needs to be done is technology transfer, so that known techniques of wood science and technology can be applied to the manufacturing or utilization environment. A wood science and technology graduate who has a good background in wood as a material can adapt the present state of knowledge to a broad range of utilization, research, or manufacturing operations. Employment opportunities include corporations, trade associations, government research institutes, and universities. An M.S. degree is highly recommended for those wishing to formally enter the research field, and a Bachelor's degree for those wishing to work in technical service or manufacturing.

Job titles of recent graduates include:

Forest Products Specialist	Forestry Specialist (Wood Products)
Materials Research Associate	Research Associate in Wood Science
Wood Products Technologist	Product Development Engineer

Upper Division Courses

Junior Year			Credit Hours
First Semester	WPE 320	Adhesives, Sealants and Coatings	3
	WPE 322	Mechanical Processing	3
	WPE 361	Engineering Mechanics—Statics	3
	WPE 387	Wood Structure and Properties	3
	WPE 388	Wood and Fiber Identification Laboratory	2
	*Electives	.....	3

<i>Second Semester</i>	WPE 326	Fluid Treatments	2
	WPE 327	Fluid Treatments Laboratory	1
	ERE 362	Mechanics of Materials	3
	*Computer	Programming Course	3
	*Emphasis	Course	3
	*Electives		3
			15

INDUSTRIAL FIELD TRIP (a two-week field trip immediately following final exam period): WPE 399 Field Trip 2

Senior Year

Credit Hours

<i>First Semester</i>	Probability and Statistics Course	3
	WPE 497 Seminar	2
	*Emphasis Courses	9
	*Electives	3
		17
<i>Second Semester</i>	FOR 404 Economics of Wood-using Industries	3
	WPE 422 Composite Materials	3
	*Emphasis Courses	6
	*Electives	3
		15

TOTAL MINIMUM UPPER DIVISION CREDITS 66

*Specific courses selected for these requirements must have the advisor's approval.

A total of 128 credit hours is required to complete the B.S. degree in Wood Products Engineering with the Forest Products option.

Emphasis Courses

Students desiring to emphasize Marketing, Production Systems Engineering, or Wood Science and Technology should select 24 credit hours of emphasis courses. These courses are defined upon consultation with the academic advisor. Typical concentration areas might be as follows:

<i>Marketing</i>	<i>Production Systems Engineering</i>	<i>Wood Science</i>
Finance	Probability and Statistics	Tropical Timbers
Accounting	Quality Control	Wood Chemistry
Statistics	Engineering Economics	Physiology and Pathology
Materials Science	Computer Science	Independent Research

Graduate Program

Recent research projects in wood ultrastructure have dealt with the interaction of coatings and adhesives with the wood substrate, with cell wall development, with the effectiveness of wood preservatives, and with the identification of natural inclusions in wood. Projects in tropical wood identi-

fication and structure-property relations in foreign and domestic timbers are examples of work in the field of systematic wood anatomy. The field of wood physics has had active projects in the permeability of wood and the mechanics of fluid transport. Current projects in the field of mechanics are focused on the elastic behavior of wood and wood-base composites, fracture mechanics of wood, the behavior of new structural designs such as truss systems, and the mechanical properties of laminated-veneer-lumber. In addition, there is growing interest in studying the physical properties of wood-based composite materials and the chemical modification of wood, as well as wood finishing systems.

Laboratory facilities include a mechanical testing laboratory with a wide range of testing machines, a physics laboratory with electronic instrumentation, and complete wood processing facilities including a sawmill, plywood mill, dry kilns, and wood preservation equipment. One of the United States' largest foreign wood collections is used for graduate research and to support the program of the Tropical Timber Information Center (TTIC).

In addition, the College has available a complete microscopy laboratory, containing transmission electron microscopes, scanning electron microscope with energy dispersive x-ray analysis and particulate analysis accessories, a wide variety of light microscopes, and related equipment. Extensive equipment for chemical analysis and nuclear chemical techniques also serve the research program.

The program works closely and cooperates with the Renewable Materials Institute. Students use this unique opportunity to investigate the properties of wood and related renewable engineering materials.

THE SCHOOL OF FORESTRY

JOHN V. BERGLUND, *Dean* (Silvics, Silviculture)

ABRAHAMSON (Entomology, Pathology, Pesticides), BENNETT (Economic Theory, Economic Thought in Forestry), BLACK (Watershed Management), BURRY (Forestry Extension, Primary Processing), CANHAM (Economics of Non-Market Forest Resources), CRAUL (Forest Soil Science), CUNIA (Operations Research, Statistics, Mensuration), DALL (Environmental Policy and Law), DREW (Silvics) ESCHNER (Forest Influences), GRATZER (Forest Recreation, Forest Management), GRAVES (Forest Resource Policy, Planning, and Management), HERRINGTON (Meteorology, Urban Forestry), HORN (Forest Business Management, Law), HOWARD (Silvics, Forest Management), KAUFMAN (Tropical Silviculture), KOTEN (Forest Management, Systems Analysis), LARSON (Forest Resource Policy and Administration, International Forestry), LEA (Silviculture, Timber Harvesting), MAYNARD (Tree Improvement), MONTEITH (Forestry Economics, Land Use), MORRISON (Forestry Extension, Outdoor Recreation), NYLAND (Silviculture), PETRICEKS (International Forestry Economics,

Macro-economics), RICHARDS (Silviculture, Urban Forestry), SAGE (Huntington Forest), STITELER (Biometry, Experimental Design, Computer Applications), TIERSON (Adirondack Ecological Center), WHITE Forest Soil Science), YAVORSKY (International Forestry).

Adjunct Faculty

CZAPOWSKYJ (Forest Soil Science), HEISLER (Meteorology), HORSELEY (Silvics), MARQUIS (Silviculture).

Undergraduate Program in Resources Management

The School of Forestry prepares students for the critical role of managing forests and related resources and their associated environments for human benefit. Management in this sense embraces the integration of basic ecological and social principles into comprehensive programs of planning, manipulation, and use of forest and open lands for the sustained production of timber, forage, water, wildlife, and recreational values consistent with national needs and the protection and enhancement of environmental quality. It includes, further, the effective implementation of these programs via the administrative process, in accordance with established policies and goals and in cooperation with individuals and organizations, both public and private.

Students completing the School's undergraduate program are qualified for professional practice as foresters and environmental managers with public and private organizations or as private consultants serving a wide array of clients. The potential for a meaningful career in service to human welfare becomes significant when one recognizes the vast amount of land area covered by forests. Nearly 60 percent of New York State is classified as forest land, while roughly one-third of the land area of both the United States and the world is so classified. The goods and services that flow from this vast resource base are of critical and growing importance to the needs of modern society and influence, in a major way, the quality of the environment.

The program also offers opportunity for students to pursue special interests, to prepare for advanced study, or to develop their capabilities for service in a variety of fields pertinent to renewable natural resources and the environment, but not specifically forestry oriented.

A dual-major program is available that meets the undergraduate requirements of both the School of Forestry and the School of Biology, Chemistry and Ecology. (For details see p. 118.)

Though it represents the oldest area of professional instruction in the College, the current curriculum was implemented with the entering class in 1973. It is accredited by the Society of American Foresters and meets the minimum educational requirements of the Office of Personnel Management for forester employment in Federal agencies. A core of required upper division courses, totaling 42 semester hours, presents the basic principles and practices that underlie the purposeful management of forest and related

resources for optimum production and use of any one, or more, of their potential products and services.

Considerable emphasis in the curriculum is placed on field instruction to provide students with intimate knowledge of how the forest ecosystem functions and how it is manipulated and used for a variety of owner objectives. Attendance at a five-week, six-credit hour Summer Session in Field Forestry is required prior to registration for the junior year. This session serves as the major avenue of entrance into the curriculum.

Close to half of the required upper division core courses are conducted wholly or primarily in the forest environment and entail substantial physical activity such as conducting field surveys, inventorying timber and other resources, and thinning forest stands. As part of the conditions for admission to this program, applicants must be willing and able to function effectively in the field under a wide range of terrain and weather conditions. Any questions or concerns about this requirement should be directed to the Director of Admissions.

Extensive elective opportunities, totaling over one-fourth of the program, are available to help broaden the student's general education, to strengthen perceptions and integration of knowledge, to enable the student to enhance depth of understanding in areas of forest resource management of special interest, or as a base for subsequent study at the graduate level. Areas of concentration provide meaningful sequences in terms of subject matter coverage. Such areas currently include forest resource science, urban forestry, international forestry, and applied forest resource management within any of which emphasis may be focused on multiple-use forest management, or on single-use values such as timber, forage, watershed, wildlife, recreation, and aesthetics. The only restriction in selecting elective courses is that such selections have the approval of the student's faculty advisor.

A significant feature of the elective component of the curriculum in forest resource management is that the spring semester of the senior year consists wholly of electives and thus is available for a variety of independent or group study activities. These may be conducted in whole or in part on any one of the College's several campuses, off campus at another institution, in cooperation with some resource management agency or firm, or in conjunction with an overseas academic program operated by the College. Proposals for off-campus study are subject to faculty review and are carried out with varying degrees of faculty guidance to ensure adherence to academic standards.

The curriculum is designed to facilitate the transfer of qualified students from liberal arts and science programs in community colleges and other institutions of higher learning. For students contemplating such transfer, it is required they have completed at least 64 semester credit hours or an associate degree, and further, that they have a minimum of 48 of these credits distributed among specific course areas as outlined below. The maximum number of freshman-sophomore semester credit hours which may be

transferred is 64. Up to 12 additional hours of junior-senior level courses may be transferred. The professional forester must understand both the biological and social influences that impinge upon the use of forest resources. Prospective transfer students should choose elective courses that will serve to broaden and enhance their understanding in the social and political sciences, humanities, and communication skills.

Lower Division Courses

<i>Course Area</i>	<i>Credit Hours</i>
Biology (Botany and Zoology) with Laboratory	8
General Chemistry with Laboratory	8
General Physics with Laboratory	8
Mathematics, through Integral Calculus	6
*Economics (Macro- and Microeconomics)	6
*Introductory Sociology or Psychology (3 credits each)	6
*Political Science (U.S. Institutions)	6
English	6
*Electives	10
<i>TOTAL MINIMUM LOWER DIVISION CREDITS</i>	64

*Students may be admitted with 3 credit hours in each of the following: economics, psychology/sociology, and political science. These deficiencies must be removed as early as possible in the student's program, including the use of summer sessions.

Upper Division Courses

Summer: ¹ Summer Program in Field Forestry		
	FOR 301 Field Dendrology	1
	FOR 302 Forest Surveying and Cartography	2½
	FOR 303 Forest Inventory	2½
Junior Year		<i>Credit Hours</i>
<i>First Semester</i>	FOR 331 Introduction to the Physical Environment	6
	FOR 332 Silvics-Silviculture	8
	FOR 322 Forest Mensuration	3
		17
<i>Second Semester</i>	FOR 360 Principles of Management	3
	FOR 370 Management of the Forest Enterprise	3
	Computer Science Course	1
	APM 391 Introduction to Probability and Statistics	3
	² Electives	6
		16

Senior Year		Credit Hours
First Semester	APM 492 Forest Biometrics	3
	FOR 400 The Social Environment of Resource Management	3
	FOR 461 Management Models	3
	² Electives	6
		15
Second Semester	² Electives	17
		17
<i>TOTAL MINIMUM UPPER DIVISION CREDITS</i>		71

¹SUMMER PROGRAM IN FIELD FORESTRY—five weeks, 6 credit hours: Required of all students prior to registration for the junior year.

²One half of the student's elective hours during the junior and senior years must be in courses taken in no fewer than three of the following Schools: Forestry, Environmental and Resource Engineering; Biology, Chemistry and Ecology; Landscape Architecture. The remaining elective hours should be used to round out the professional education of a student.

A total of 135 credit hours is required to complete the B.S. degree in Resource Management.

Graduate Programs

Graduate education in the School of Forestry builds upon the basic foundation of professional knowledge acquired by students in its undergraduate curriculum or in similar or closely allied programs of study. Instruction at this level is designed to prepare students for careers in resource administration, professional education and research, and a variety of other specialized positions in public and private employment bearing directly or indirectly on forest resources management.

The School offers advanced study opportunities under two broad degree programs: Forest Resource Management and Policy, and Silviculture and Forest Influences. In addition, its faculty contribute significantly to several College-wide graduate programs and joint areas of advanced study, including fish and wildlife, managerial science, water resources, environmental planning, environmental science, and soil science.

Several areas of specialization are available within the two degree programs. Opportunity is also provided for students, in consultation with faculty advisors, to arrange areas of study specific to their interests and needs which integrate elements of two or more areas of specialization, as in urban forestry and international forestry. Whatever the program, the basic purpose is to help the student acquire the tools and facility for disciplined, logical, critical, constructive, and creative thinking, and for clear expression in the selected field.

Those prospective graduate students without a Bachelor of Science degree from an accredited forestry school, and desiring to be qualified as a

professional forester upon completion of their program, will need to include certain of the required undergraduate forestry courses and the summer field forestry program for nondegree credit, together with certain required graduate courses. The mix of undergraduate and graduate courses required will depend primarily upon the science background of the student. Students with this goal in mind should expect to spend at least two and one-half to three years to complete the M.S. degree in either of the two graduate programs in the School of Forestry. The Ph.D. program would be extended accordingly.

Prospective students who desire more information than is presented for each of the graduate programs and specialties described below should contact the Dean, School of Forestry.

RESOURCE MANAGEMENT AND POLICY (RMP)

The objective of the RMP program is to prepare graduates at the Master's or Ph.D. level with a sufficient depth and breadth of understanding so that they will be able to function in and ultimately make significant contributions to the field of resource management and policy. This field is extremely diverse and includes employment opportunities with private firms that own, manage, and/or use natural resources, a myriad of public agencies from the federal to the local level, teaching opportunities in forestry or natural resource programs, or research work as conducted by a number of public and private agencies. Furthermore, students may choose to concentrate study in a particular specialty area of the field, or to prepare themselves more broadly for traditional managerial duties.

Each of these possibilities demands different interests and talents on the part of the student and different types of preparation in the course of graduate study. For these reasons our entering students are expected to have made a searching self-analysis of their abilities, potentials, and ambitions so they can enter the program with well defined career goals and utilize the graduate experience to its best advantage. The RMP program differs from the more science oriented offerings of the College in that while technical competence is expected, students are additionally required to relate this competence to the social and political environment in which they will be functioning. The student's interest must be broad enough to encompass these social areas, or be prepared to devote some study to these subjects while in residence.

The expertise of the RMP faculty is in the area of management, policy and economics as it relates to forest and associated natural resources. It is expected that students entering the program will share similar interests and concentrate their studies in this broadly defined field. However, the resources of Syracuse University's School of Management and Maxwell School of Public Administration are available to our students, and graduate level courses in the more general area of management and policy may be

taken in these schools when appropriate to the student's overall graduate program.

Fields of Specialization

As previously described, the RMP program is individualized to meet the scholastic and career goals of the student within the capabilities of the faculty. Faculty strength and student interest over the years have been highest in the following concentrations, and they are described as illustrative of the type of graduate study available to entering students.

FOREST MANAGEMENT

Forest management focuses on the planning and implementation processes necessary to achieve integrated use of forests and associated natural resources. The educational objective is to develop expertise sufficient for capable, professional resource management under a variety of natural and societal environments.

The study of forest management requires a broad knowledge of both the natural and social environments as the basis for an understanding of the way in which these environments affect or are affected by the development and utilization of forests and associated wildlands. Implementation of plans also requires an understanding of the social environment as well as the managerial process to facilitate working with people both inside and outside of the organization.

Programs are flexible and a student may pursue a special interest in a single product, several products or services, tools and processes of planning for integrated forest use, or in developing managerial skills. The emphasis of the program, however, would be in the application of the skills and knowledge to the management of forest lands. Where appropriate, courses may be taken at Syracuse University's School of Management and the Maxwell School of Public Administration to complement course offerings in the School of Forestry and other Schools of the College. Recent graduates have found employment in all of the diverse areas described above.

POLICY AND ADMINISTRATION

Graduate study in the area of resources policy and administration is designed to prepare students for leadership positions in the broad range of responsibilities at the planning, budgeting, programming, and operating levels of public agencies and businesses. The expanded role of federal and state government oversight over resource use and land management has brought substantially increased need for thorough understanding of policy matters, legal requirements, and governmental and political interactions with resource owners and users. Advanced courses, seminars and special problems structured around these needs and the complex interrelationships of society with resources are offered. A wide array of complex problems of

administrative management, resources policy issues, and related legal, financial, and executive needs are included among the topics that may be emphasized.

Students are encouraged to round out their academic programs through the courses offered by other units of the College as well as Syracuse University Graduate School of Citizenship and Public Affairs and the School of Management or other graduate units. Students with undergraduate preparation in forestry, liberal arts, engineering, or other appropriate areas who have strong interest in resource administration and policy can be served through selection of necessary emphases that complement work already taken.

The broad array of possibilities of course selection and the diverse points of view that are available allow the student to build a program to meet specific career objectives. The breadth and diversity also offers the student an opportunity to develop talents for managerial leadership and policy positions in various aspects of enterprises and public agencies whose work is critical to the future of resources management.

FORESTRY ECONOMICS

The program is designed to meet the needs of the student with an undergraduate degree in forestry or forest products. With some additional courses in forestry, the program also serves the graduate in liberal arts, engineering, or business, should interest point toward the economics of forest management. The goals are depth of understanding and familiarity with economic tools contributing to making competent decisions in resource economics, management, and policy.

The core of the program consists of courses in forestry and resource economics as offered by School faculty. In addition, one must be aware of the social and biological environment in which forestry economics is applied. To this end the program is supplemented by courses in general economics, statistics and operations research, resource policy, business administration, and related managerial and biological fields. The course offerings and facilities of the School, the rest of the College, and Syracuse University are actively drawn upon.

Individual programs are tailored to fit the student's particular interest: for example, the economics of timber management, land use economics, economics of natural environments, economic development and forestry. Graduates with the master's degree find employment typically as forest economists or resource analysts with federal and state agencies, and with private industry. Graduates with the Ph.D. usually find careers in teaching or research.

RECREATION MANAGEMENT

Graduate study in this area equips students with a broad understanding of the nature and purposes of outdoor recreation and how they relate to natural

resources, and builds the skills necessary for capable recreation management.

Individual programs combine study in resources management with relevant studies in the social and political sciences and development of analytical capabilities needed to implement plans and programs. Other schools of the College and of Syracuse University, treating such areas as planning, engineering, design, and education, provide a wide range of supporting courses and facilities.

All program areas in RMP require that each student take a minimum of 12 credits of coursework within the School of Forestry. Courses in Applied Mathematics (APM) can also be used to meet this requirement. If a student's prior preparation is inadequate to meet the graduate program objectives, the major professor and/or committee will suggest appropriate remedial coursework to make up the deficiency.

Master's Degree Program

All three masters' options are available to students in the RMP program. Although differing in format, the options have the common purpose of bringing each student to a similar level of understanding and ability in his chosen field. Because each option emphasizes a different element of the total program goals, the choice of an option should be based primarily upon a student's career objectives.

In the case of option 2, Academic or Professional Experience, the RMP faculty has chosen to increase the coursework requirement to 30 credit hours. At the present time the use of this option is limited to situations where appropriate experience can be negotiated between a student and an outside institution.

Doctoral Degree Program

Requirements for the doctorate usually build upon a master's degree, and demand a substantial mastery of material related to the dissertation topic. At the same time, a number of other fields are chosen to support or integrate the selected central topic of doctoral study. There is no minimum credit requirement, but the normal course workload is 30 credits and a minimum of 12 credits of coursework must be taken within the School of Forestry. The field work for and the writing of a dissertation usually requires a minimum of 12 months.

The additional requirements for a doctoral program, beyond a master's degree are the passing of written and oral candidacy examinations which are intended to test the student's integration of subject matter, and the writing and successful defense of a dissertation. A preliminary examination may be required to make an early appraisal of the student's intellectual qualifications to determine levels of understanding of the scientific and technical disciplines he is studying, and to guide the development of an adequate program of study.

SILVICULTURE AND FOREST INFLUENCES

Concern for the forest ecosystem provides a major focus for graduate study in the Silviculture and Forest Influences Program. This ecosystem is viewed as a producer of goods and services and as a modifier of the physical environment in which man lives. It is in this context that translation of these concerns to broader questions of environmental quality is emphasized.

Silviculture in its functional sense is the bridge between fundamental biological and physical relationships and the applications of these relationships in the forest environment. Thus, graduate study in the many aspects of silviculture can cover a broad spectrum of disciplines, and can be as basic or as applied as the objectives of the student indicate. Individual study programs are coordinated with various areas of specialization both within the School of Forestry and with other departments of the College, of the State University of New York, and with Syracuse University. A major strength is the close association of faculty scientists, representing a wide range of specialties, and the formal and informal cooperative arrangements they have developed with their counterparts in federal and state agencies, and in industry.

Physical facilities that are routinely used in graduate study within the Silviculture Program include well-equipped laboratories, specialized equipment, greenhouse facilities, and extensive College forests. On these 25,000 acres of forestlands are located natural and planted stands, seed orchards, a forest tree nursery, and two large micro-climate tower complexes with associated automated data acquisition systems and instrumentation. Major field installations include long-term northern hardwood stand improvement studies and the oldest continuous forest fertilization study in the United States. Cooperative arrangements also exist for work on corporate lands, private properties, and governmental ownerships.

Fields of Specialization

Included within the Silviculture and Forest Influences Program are five fields of specialization that, singly or in combination, provide the graduate student with a wide array of coursework, research activities, and faculty guidance all aimed at enhancing understanding of the forest ecosystem. These specializations are silvics, silviculture, forest soil science, tree improvement, and forest influences. Students in the program can direct their studies toward careers in professional practice, research, or education. Similarly, study in these specialty areas can emphasize any of a number of areas of professional application, such as public or private forest management, urban forestry, or international forestry, depending on the individual's interest.

SILVICS

Silvics has been defined as that branch of forestry which provides the scientific base for the cultural treatment of forest vegetation by (1) studying and defining interrelationships within forest ecosystems and (2) cataloging general intraspecific characteristics of tree species. In a sense, silvics is the ecology of managed forest ecosystems, although unmanaged and natural forests are often studied intensively to provide the benchmark conditions from which the silviculturist begins.

The specialist in silvics must maintain channels of communication with colleagues in the basic disciplines, including those in soil physics, soil chemistry, micro-meteorology and climatology, genetics and tree breeding, plant ecology and physiology, wildlife biology, entomology, and pathology. In addition, certain tools, including a comprehensive knowledge of probability and statistics, the ability to use modern computers effectively, and a familiarity with measurement and sampling theory, are required by specialists in most applied sciences including silvics.

The specialist in silvics is essentially at one focal point of much of what has been called fundamental forest research. His most useful function and worthwhile contribution to the field of forestry may very well depend on the ability to synthesize relevant material and, through experimentation, provide the silviculturist with information and possible techniques for use in the cultural treatment of forest vegetation.

SILVICULTURE

Classical silviculture can be defined as the theory and practice of the manipulation of forest ecosystems, including the control of vegetation establishment, composition, growth, and quality. The nature of cultural treatments, the theories upon which they are based, and the biological, physical, and social constraints to their implementation are stressed in this area of specialization. Elements of forest vegetation are intensively examined from the dual standpoints of fulfilling management goals for goods and services and maintaining or enhancing biotic productivity for the future.

Management goals are considered to include all the many and varied goods and services that the basic forest resource is capable of supplying. Forest productivity is of basic concern; the student specializing in this area progresses through formal coursework and research toward an understanding of the effect of various treatments on the continuous, balanced, and adequate supplies of wood, water, wildlife, recreation opportunities, and amenity values. One major area of emphasis within this specialization relates to treatment of tree stands for their continued production of wood products and other commodities. Another emphasis centers on the treatment of stands that are managed for several values simultaneously, where the harmonious integration of uses is of concern. A third emphasis focuses on evaluation and manipulation of vegetation sys-

tems primarily for their on-site values, such as in wilderness and recreation areas, highway and utility rights-of-way, mining and other wasteland reclamation, and urban greenspace. This involves a broad interpretation of forest ecosystems that includes herbaceous and shrub systems as well as silvics.

The Silviculture graduate specialization is aimed at preparing foresters to understand and evaluate forest ecosystems in whatever depth may be required, and to prescribe treatments or further experimentation to attain management objectives or increase knowledge toward this end.

FOREST SOIL SCIENCE

Graduate studies in this area of specialization may be directed toward aspects of soil science related to the quantity and/or quality of goods and services in the management of resources of nonagricultural lands, and the impact of management practices on environmental quality. These include soil moisture, soil temperature, and nutrient element status interrelationships in the evaluation of soil productivity; evaluation of ecosystems to quantify nutrient element balances and cycling; amelioration of soils for increased productivity; and impact of various land-use practices on soil productivity.

Modern well-equipped laboratories are available for graduate student use in plant, soil, and water chemical analyses; soil water-holding capacity and compaction; infiltration and runoff; and other chemical and physical property investigations. The extensive College properties noted previously permit forest soil research to be conducted under a wide variety of environments and ecological conditions.

Programs are coordinated with other areas of specialization through cooperation among school personnel, with other departments of the College, Syracuse University, and the U.S. Forest Service.

TREE IMPROVEMENT

Tree improvement is an important component of forestry, and as demands on the resource increase, it will become even more vital. The most common objective of a tree improvement program is to develop populations of trees that are well-adapted, rapid growing, and disease-free. Other possible objectives may be to increase the aesthetic or recreational value of forest trees through selection for other traits.

Modern, well-equipped laboratories and greenhouses are available for graduate student use. Many established test plantations are available for collection of materials and field evaluations. Graduate students will take formal coursework in plant biochemistry and physiology, statistical genetics, and plant breeding. This specialization prepares graduates for positions in seed orchard management, tree improvement, and forest genetics with private, state, and federal organizations.

FOREST INFLUENCES

Forest influences as an area of graduate study includes all the effects resulting from the presence of forest trees and associated vegetation on climate, the hydrologic cycle, erosion, floods, and soil productivity. Health considerations and human comfort have often been included in older definitions of forest influences, and are assuming greater importance today with our growing concern for the environment.

Included among the principal studies in this area are energy exchange between forest and atmospheres; moderation of urban environments by vegetation; soil and slope stability; and watershed hydrology, including snow.

Graduates fill a variety of positions in research, teaching, and public and private management as watershed management specialists, hydrologists, environmental officers, meteorologists, and ecologists.

Master's Degree Program

Candidates for the master of science degree are required to complete 30 semester hours of graduate work beyond the baccalaureate degree. From 6 to 12 semester hours of this total can be credited for writing and defending a thesis.

This graduate degree is intended for students seeking an intermediate level of education in a scientific, professional, or technological field. It provides an introduction to research and related scholarly or professional activities and requires the student to demonstrate competence in a selected field of study. Consideration may be given to the development of a study program that provides a foundation for continuation to the Ph.D. degree, or provides an advanced professional education in forestry and serves as preparation for a career requiring special technical ability, or familiarity with research techniques.

Most master's candidates will be expected to prepare a thesis to satisfy requirements for the completion of the Silviculture and Forest Influences program. The topic addressed by the student should be research oriented, and expand or clarify knowledge in a particular field with some opportunity for generalizing the results. A student may, with the consent of the major professor and advisory committee, petition the School Executive Committee to elect a program of 42 credit hours of graduate coursework and a comprehensive examination. The petition must be submitted prior to completing 12 credits of graduate coursework.

Doctoral Degree Program

The Ph.D. program usually builds upon a master's degree and demands mastery of material in a specialized field as well as the integration of a number of supporting fields. It requires scholarship of a high order, and successful fulfillment of independent research that makes an original contribution to forestry science.

The degree provides for advanced scientific study and development of the capability to independently organize and conduct research. Graduates fill a variety of positions in research, research administration, teaching and consulting in public agencies, private corporations, universities and foundations.

Students must develop strong scientific capabilities and demonstrate a capacity to solve complex problems in research. They must demonstrate a capability for independent work, but must interact effectively with faculty and other scientists in their chosen field of specialization.

There is no minimum credit requirement, but the normal course workload is 30 graduate credits beyond the master's degree. In addition, the fieldwork for and the writing of the dissertation usually requires a minimum of 12 months.

Candidates for the Ph.D. degree must pass a written and oral candidacy examination, and write and defend a dissertation.

Doctoral candidates are required to demonstrate competency in one foreign language and statistics.

SCHOOL-WIDE AREAS OF STUDY

INTERNATIONAL FORESTRY

Graduate education in international forestry as an area of emphasis is available to students under both the Forest Resource Management and Policy, and Silviculture and Forest Influences programs and is designed to assist individuals who are intent upon pursuing internationally-oriented careers in forestry and related fields.

Instruction is aimed at supplementing and enriching the student's technical forestry knowledge and providing the broad background deemed necessary for effective service in a variety of professional areas. These include forestry advisor, teacher, or research specialist with national and international agencies, private business and industrial firms, philanthropic foundations, and voluntary service organizations whose activities include the development and use of forest resources in other lands.

At the master's level, program emphasis is on the attainment of general competence in research methods, foreign languages, cultural anthropology, world geography, and international affairs, plus a broad understanding of the world forestry situation. At the doctoral level, program concentration is on a specialized discipline area such as forestry economics, forest policy and administration, forest management, or silviculture. Orientation to the world forestry field is achieved in part through the selection of formal coursework, and in part through providing an opportunity for the student to conduct his thesis research in residence abroad.

A wide variety of course offerings are available to support the nonforestry elements of this area of study through Syracuse University. Opportunity for

field training and research in tropical forestry and related fields is available to qualified candidates, especially at the doctoral level, under cooperative agreements maintained by the College with the Institute of Tropical Forestry in Puerto Rico and the University of the Andes, Merida, Venezuela.

URBAN FORESTRY

Graduate study in urban forestry allows the student to pursue either of two broad objectives. Professional Urban Forestry skills may be broadened in the many areas of information important to the practice of forestry in urban and urbanizing areas through advanced coursework and applied research. More specialized study may be pursued in scientific disciplines supporting the practice of urban forestry. Active areas of specialized research and study in the School includes soils, greenspace ecology, atmospheric science, tree improvement, forest resource inventory and evaluation, and resource economics and planning. There is strong interaction with other urban-related areas of study within the College, including remote sensing, botany, pathology, entomology, wildlife ecology, and landscape architecture. Academic departments in the Maxwell School of Public Affairs at Syracuse University such as Geography, Economics, Political Science and Sociology, cooperate with teaching and research programs in urban forestry. The U.S. Forest Service Northeastern Forest Experiment Station maintains a permanent staff of scientists in their Urban Forest Research Project on campus who are engaged in studies dealing with the planning and management of urban forest ecosystems. This work complements the College's participation as one of nine universities in the Consortium for Environmental Forestry Studies, an organization of scientists and graduate students studying a wide range of problems in urban forestry.

QUANTITATIVE METHODS

Study in the area of quantitative methods is designed to develop professionals skilled in mathematical and statistical problem solution and equipped to act as biometricians or mensurationists.

The program is designed primarily for students who have done their undergraduate work in areas such as biological sciences, forestry, wildlife, or agriculture. Others who lack background courses may take this material concurrently. Students may concentrate in statistics, operations research, biometry, or forest mensuration. Syracuse University's computer facility and a wide range of courses in mathematics, statistics, and quantitative methods give strong support to the program.

THE SCHOOL OF LANDSCAPE ARCHITECTURE

ROBERT G. REIMANN, *Dean*

FACULTY

GEORGE W. CURRY. *Professional Experience:* The Reimann-Buechner Partnership, Landscape Architects, Syracuse; The Curry-Paulo Partnership; Member, Syracuse Conservation Advisory Council, Syracuse Urban Cultural Parks Advisory Committee, and Chairman, Syracuse Landmark Preservation Board. Licensed Landscape Architect, New York State. *Fields of Specialization:* Site Planning, Urban Analysis and Design, Historic Preservation.

TIMOTHY R. DAY. *Professional Experience:* The Architects Collaborative Inc., Architects and Planners; EDAW, Inc. *Fields of Specialization:* Rural Planning, Solar Energy at the Community Scale, Visual Resource Management, Remote Sensing.

GEORGE F. EARLE. *Professional Experience:* School of Architecture, Syracuse University; Artist; President, World Affairs Council. *Fields of Specialization:* History of Art, Cultural History; Painting, Latin American Art; History of Landscape Architecture; Design; Pre-Colombian Art.

JOHN P. FELLEMAN. *Professional Experience:* Planning Engineer, Monroe County, N.Y.; Urban Planner, NYS Hudson River Valley Commission; Chief Planner, Bruce Howlett, Inc.; Partner, Impact Consultants; Licensed Professional Engineer, New York State; Designated Planner-in-Charge, New York State. *Fields of Specialization:* Site Systems Engineering; Route Location; Environmental Simulation.

CLAUDE C. FREEMAN. *Professional Experience:* Russell Bailey and Associates, Landscape Architects and Planners; Alfred Obrist, Landscape Architect and Civil Engineer. *Fields of Specialization:* Site Design, Plant Materials, Graphics.

DAVID L. HANSELMAN. *Professional Experience:* Ohio Department of Education, Ohio Department of Natural Resources, Ohio State University. *Fields of Specialization:* Communications Strategies and Message Design, Non-Print Communications.

RICHARD S. HAWKS. *Professional Experience:* EDAW, Inc., Cambridge Research Institute. *Fields of Specialization:* Regional Planning and Design, Facility Siting and Routing, Geographic Digital Data Banks.

ALLEN R. LEWIS. *Professional Experience:* Bucks County Planning Commission, Pennsylvania. Member, American Institute of Certified Planners. *Fields of Specialization:* Community Planning; Planning Theory; System Dynamics; Modeling and Simulation.

FRANK L. MARAVIGLIA. *Professional Experience:* Senior High School Teacher; Business and Management Consultant; President, Centre of

Applied Creativity, Baltimore, Maryland; Faculty, Annual Creative Problem Solving Institute, SUNY Buffalo, Organizational Communication. *Fields of Specialization*: Technical Graphics, Creative Problem Solving, Education, Communication, Video, Management.

VINEETA MEHRA. *Professional Experience*: North Carolina State University; School of Planning and Architecture, New Delhi, India. *Fields of Specialization*: Landscape Design, Landscape Materials and Construction, Plant Materials, Landscape Engineering, Residential Landscaping.

RICHARD T. MURPHY. *Professional Experience*: Research Analyst, Minnesota Center for Urban and Regional Affairs; Landscape Architect, W. Butler Engineering Company; Partner, Murphy-Lindberg, Landscape Architects. *Fields of Specialization*: Environmental Land Use Planning, Regional Resource Analysis Methods, Energy and Land Use Planning Design.

JAMES F. PALMER. *Professional Experience*: Research Associate, The Environmental Institute, University of Massachusetts; Associate Social Scientist and Resource Planner, Carlozzi, Sinton & Vilkilis, Inc.; College Planner, Kresge College, University of California at Santa Cruz. *Fields of Specialization*: Landscape Perception, Design Evaluation, Social Impact Assessment, Environment and Behavior Research Methods.

RICHARD C. SMARDON. *Professional Experience*: Wallace, Floyd, Ellenzweig, Inc., Cambridge, Mass.; Executive Office of Environmental Affairs, Commonwealth of Massachusetts; Oregon State University Extension Service; Institute for Urban and Regional Development, University of California; USDA Forest Service. *Fields of Specialization*: Landscape and Environmental Planning, Visual Resource Analysis, Environmental Assessment/Administration, Wetland Assessment.

KATHLEEN A. STRIBLEY. *Professional Experience*: Department of Landscape Architecture, The Ohio State University; Anderson-Lesniak and Associates, Inc.; Research Project, University of Michigan; Johnson, Johnson and Roy, Inc.; Colvin-Robinson Associates, Inc.; Dalton-Dalton-Little-Newport, Inc. *Fields of Specialization*: Design and Behavior; Public Participation; Urban Design, Parks and Recreation; Site Planning and Design.

DANIEL A. SUNDQUIST. *Professional Experience*: American Peace Corps; EDAW, Inc., University of New Hampshire. *Fields of Specialization*: Site Planning and Design, Environmental Impact Assessment, Siting and Routing, Synaesthetics.

Introduction

The alteration of the physical environment has been a product of human activity since the earliest times of human settlement. While environments of enduring beauty and vitality occasionally resulted, the history of environ-

mental manipulation more often demonstrated degradation and abuse of the landscape. As the knowledge of natural and human processes has expanded, environmental change has been transformed over the centuries from the casual efforts of many to that requiring skilled individual effort and often demanding multidisciplinary attention.

The School of Landscape Architecture offers curricula designed to educate students to contribute in varied ways to the wise use of land and landscape. Each degree program provides a basis for students to establish career directions in landscape architecture or in related disciplines. These curricula are offered at both the undergraduate and graduate levels.

UNDERGRADUATE PROGRAM

The School of Landscape Architecture offers two undergraduate degrees—the bachelor of science with a major in environmental studies (B.S.) and the Bachelor of Landscape Architecture (B.L.A.).

Both degrees share the ultimate purpose of providing senior level education for those concerned with the condition and form of the physical environment. The B.S. degree is basically designed for those students desiring a general undergraduate degree to be followed by an environmentally related graduate degree. The B.L.A. degree is basically designed for those students desiring to enter the profession of landscape architecture either directly after completing this degree or after completing a graduate degree. Students are urged to seek complete clarification of the two degree programs with regard to their own career goals by arranging an interview with the School.

Recently approved curriculum changes will require students to apply for either the B.S. or B.L.A. degree upon application to the College, beginning with the 1983-84 academic year. In the interim, direct entry into either of the two degree programs is possible with faculty approval at the time of admission.

BACHELOR OF SCIENCE IN ENVIRONMENTAL STUDIES

The Bachelor of Science in Environmental Studies (B.S./E.S.) program is primarily concerned with interrelationships among the natural environment, people, and the human environment, including society's institutions. Its focus is on the issues involving the condition and form of the physical environment. The goal of the program is to educate students to be more sensitive, articulate, and knowledgeable about the complex environmental issues facing contemporary society.

The B.S./E.S. degree is granted at the end of four years and requires the successful completion of 125 credit hours. Students typically enter the program with 62 lower division credits. During their junior and senior years, students are required to complete a group of core courses in the humanities, natural, and social sciences. The particular emphasis of an individual stu-

dent's program is determined by the development of two concentration areas investigating specific environmental concerns directly related to the student's career purposes and goals. It is recommended that students engage some integrative academic experience during their senior year that provides an opportunity to synthesize their environmental studies education.

The complexity and scope of coursework required in the B.S./E.S. program demands both discipline and commitment from students seeking the degree. A clear sense of purpose and objectives is necessary to beneficially engage the curriculum. To successfully meet each student's objectives, a close-working relationship between faculty and student is also necessary. The program's flexibility makes it especially suited for advanced undergraduates desiring a general environmental background in preparation for either graduate training or environmental careers that may appropriately be entered with a baccalaureate degree.

Students receiving the B.S./E.S. degree have pursued graduate study in the disciplines of planning, landscape architecture, and other environmentally related areas such as business, education, and law. Students with academic standing in the top one-third of their class may apply at the end of their junior year for advanced standing admission to the School's M.L.A. program in community design and planning.

Prerequisites for Entry into the B.S./E.S. Program

Because of the wide range of opportunities available to students who enter the B.S./E.S. program, it is important that they prepare themselves with a broad range of lower division coursework. Understanding the issues involved in the condition and form of the physical environment requires a background in the humanities, natural, and social sciences. The following required and recommended prerequisite coursework will prepare the entering student to engage the B.S./E.S. curriculum.

Lower Division Courses

<i>Course Area</i>	<i>Credit Hours</i>
Written Communications	3
Required credit hours in this area should be taken in courses dealing with English comprehension, the basic skills of grammar and composition.	
Humanities	9
Required credit hours in this area should be taken in coursework in philosophy, literature, art, music, drama, and language.	
Social Sciences	9
Required credit hours in this area should be taken in coursework in history (preferably U.S.), cultural geography, sociology, psychology, political science (preferably U.S. institutions), social or cultural anthropology, or economics.	

Natural Sciences	6
Required credit hours in this area must include a course in general biology. Additional hours should be taken from coursework in ecology, physical geography, earth science, geology, biology, chemistry, and physics.	
Mathematics	3
Required credit hours in this area should be taken in computer programming, statistics, or mathematics at the level of college algebra, trigonometry, and calculus.	
Electives	32
<i>TOTAL MINIMUM LOWER DIVISION CREDITS</i>	
	62

Each applicant is required to submit a statement of program interest. This statement should describe how study in the B.S./E.S. program will contribute to the student's educational and career goals. It should reflect an understanding of the curriculum and represent the student's preparedness to take advantage of the special nature of the program.

Bachelor of Science in Environmental Studies Curriculum

I. CORE REQUIREMENTS

	<i>Credit Hours</i>
A. <i>WRITTEN COMMUNICATIONS</i>	4
Coursework intended to develop a professional-level skill in written communication. Required are three credit hours in report writing or equivalent and one credit hour in library research.	
B. <i>METHODS AND TECHNIQUES</i>	6
Coursework intended to develop methods and techniques useful for analyzing environmental information. Required are six credit hours, including a two- or three-credit-hour course in statistics or computer programming.	
C. <i>ENVIRONMENTAL CONCEPTS AND SYSTEMS THINKING</i>	6
Coursework intended to develop critical facilities and systems thinking useful for an appreciation of the holistic nature of environmental issues. Required are six credit hours, including EST 300 Introduction to Environmental Studies.	
D. <i>NATURAL SCIENCES</i>	9
Coursework intended to provide a natural science foundation useful for understanding natural phenomena and processes. Required are nine credit hours, including EIN 311 Natural Processes in Planning and Design. It is recommended that the remaining courses have a laboratory or fieldwork component.	
E. <i>HUMAN-ENVIRONMENT INTERACTIONS</i>	9
Coursework intended to provide a foundation for understanding the interaction of humans and the environment from social, institutional, and historical perspectives. Required are nine credits, including EIN 390 Social/Cultural Influences and Environmental Form, EIN 451 Introduction to City and Regional Planning, and either EIN 371 History of American Landscape Attitudes, or EIN 471 History of Landscape Architecture.	

II. CONCENTRATION REQUIREMENTS

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This coursework provides an opportunity to develop proficiency in two particular aspects of the interrelationship of the natural environment, people, society's institutions, and their influence on the condition and form of the physical environment. Two concentration areas of nine credit hours each are required. Concentrations are proposed by students after consultation with faculty and must be approved by the faculty advisor. Accepted coursework must be of grade C or better.

III. DIRECTED ELECTIVES 11

Eleven credit hours of coursework selected with the approval of the faculty advisor to complement core requirements or concentration areas. It may include a senior-year integrative academic experience.

It is recommended that some integrative academic experience providing an opportunity to synthesize their environmental studies education be engaged by each student during their senior year. Possible alternatives include independent readings, a research project, an internship, a senior seminar, or an off-campus study. Each option has its own prerequisites and some have limited enrollments.

TOTAL MINIMUM UPPER DIVISION CREDITS 63

A total of 120 credit hours is required to complete the B.S. degree in Environmental Studies.

BACHELOR OF LANDSCAPE ARCHITECTURE

The B.L.A. degree is a professional degree with an emphasis on the skills and knowledge required to qualify as a landscape architect. The degree is accredited by the American Society of Landscape Architects (ASLA) as the first professional degree offered at the School. The B.L.A. is granted at the end of five years of study and requires the successful completion of 160 credit hours. Students enter into the third year of the program with a minimum of 62 lower division credit hours and follow the prescribed curriculum.

The B.L.A. degree program consists of a core of courses involving the basic principles and skills of landscape architecture design, land manipulation and engineering, applied ecology, and communications. Additionally, students are required to participate in an independent study semester of the Off-Campus Program during the fall semester of the fifth year. The major objective of the B.L.A. program is the development of basic proficiency in design, engineering, and communication skills necessary for formal admission into the profession of landscape architecture.

When the prerequisite period of work experience has been completed, a person holding a B.L.A. degree may obtain a license to practice landscape architecture. At present, the State of New York requires those holding a 5th-year B.L.A. degree to complete a three-year period of internship in the field prior to applying for the licensing examination. Other states have varying requirements for obtaining a license.

As in any area of professional study, students seeking the B.L.A. degree are expected to demonstrate a high level of commitment and scholarship in their studies. This professional commitment is demonstrated by a desire to serve society in an objective, rational, and ethical manner in designing the form of the environment.

Students receiving a B.L.A. degree have entered the profession as employees in public agencies or in private offices offering landscape architectural services. Also, B.L.A. graduates have entered graduate schools

in landscape architecture, planning, urban design, regional design, and specific specialties including historic preservation, energy conservation, environmental policy management and research.

Prerequisites for Entry into the B.L.A. Degree Program

Because of the breadth of concern of the B.L.A. degree, it is imperative that entering students prepare themselves with a broad range of lower division coursework. The environmental efforts with which the students will be involved require a strong background in both the natural and social sciences. In addition, prior skill development in graphics, mathematics, and computer science is required. The following required prerequisite coursework must be met to prepare the entering student to engage the B.L.A. curriculum.

Lower Division Courses

<i>Course Area</i>	<i>Credit Hours</i>
Written and Oral Communication	6
Required credit hours in this area should be taken in courses dealing with English comprehension, the basic skills of grammar and composition, and public speaking.	
Graphics	3
A minimum of one semester's work preferably in a course in engineering drawing, mechanical drawing, or architectural drafting may be selected.	
Natural Sciences	6
Required credit hours in this area must include a course in botany or plant biology. Additional hours should be taken from coursework in ecology*, physical geography, earth science, geology, or environmental geology.	
Social Sciences	3
Required credit hours in this area are to be taken from coursework in U.S. history, sociology, social psychology, social or cultural anthropology, political science, or economics.	
Mathematics	6
Required coverage of college algebra and trigonometry. Students with prior coverage in math who can demonstrate proficiency at time of admission may substitute elective hours for this prerequisite. More advanced math is desirable but not required.	
Computer Science (Required in Fall 1983)	3
Required course must include introduction to programming utilizing BASIC FORTRAN, or APL.	
Electives	35
<i>TOTAL MINIMUM LOWER DIVISION CREDITS</i>	<u>62</u>

ELECTIVE GUIDELINES

Students planning to transfer to the School of Landscape Architecture should consider the following as guidelines in selecting their 35 credit hours of electives. The subject areas are considered highly desirable but are not required. Course areas marked (*) are required following transfer to the

School, but can be waived if completed prior to transferring. This will allow a student to take additional electives at ESF.

1. In addition to the required prerequisite credit hours listed, further subject coverage in Written and Oral Communications, Natural Sciences, and Social Sciences as listed above is recommended.
2. Art and Design
Courses in this category should preferably include Art History* and Studio Art. Studio courses in Drawing or Three-Dimensional Design, i.e., Sculpture, Ceramics, etc., are recommended.
3. Analytical Tools
Courses in this category should preferably include Elementary Plane Surveying*, Air Photo Interpretation*, or Elementary Physics.

Bachelor of Landscape Architecture Curriculum

Third Year			<i>Credit Hours</i>
<i>First Semester</i>	LSA 320	Introduction to Landscape Architecture and Planning	3
	LSA 326	Landscape Architectural Design Studio I	3
	CMN 382	Graphic Communication	2
	EIN 311	Natural Processes in Planning and Design	3
	FBL 320	General Ecology or Elective	3
	APM 360	Introduction to Computer Programming or Elective	2
			16
<i>Second Semester</i>	LSA 327	Landscape Architecture Design Studio II	3
	LSA 330	Site Research and Analysis	2
	EIN 371	History of American Landscape Attitudes	3
	EIN 390	Social/Cultural Influences and Environmental Form	3
	ERE 306	Elements of Map and Air Photo Interpretation or Elective	1
	ERE 308	Elements of Plane Surveying or Elective	1
	ENG 406	Technical Writing	3
			16

NOTE: Prior to the required direct application to the B.S. or B.L.A. degree programs in 1983-84, students must select either the B.S. or B.L.A. degree option before the conclusion of the third year. This selection is made with a faculty advisor after a complete evaluation of the student's career goals and program opportunities.

Fourth Year			<i>Credit Hours</i>
<i>First Semester</i>	LSA 422	Landscape Design Studio III	4
	LSA 433	Plant Materials	2
	LSA 434	Design Materials	1
	LSA 442	Site Grading	2
	LSA 443	Site Drainage Systems	1
	EIN 451	Fundamentals of City and Regional Planning	3
	EIN 471	History of Landscape Architecture	3
			16

Second Semester	LSA 423	Landscape Design Studio IV	4
	LSA 425	Orientation for Experiential Studio	2
	LSA 444	Vehicular Circulation Design	1
	LSA 445	Introduction to Structures	1
	LSA 455	Professional Practice in Landscape Architecture	2
	EIN 470	Art History or Elective	3
	LIB 300	Library Research	1
	Elective	.....	3
			<hr/> 17

Fifth Year			Credit Hours
Summer	LSA 533	Plant Materials	2
First Semester	LSA 524	Experiential Landscape Design Studio V (Off-Campus Program)	16
Second Semester	LSA 522 or	Landscape Design Studio VI—Urban Design	4
	LSA 525 or	Landscape Design Studio VI—Site Design	4
	LSA 527	Landscape Design Studio VI—Regional Design	4
	LSA 545	Professional Practice Studio	2
	Architecture Elective	.....	3
	Elective	.....	3
	Elective	.....	3
			<hr/> 15

A total of 160 credit hours is required to complete the B.L.A. degree.

NOTE: A number of the courses listed in the B.L.A. curriculum are in the process of being revised. Upon revision, new course descriptions will be available after approval by the College of Environmental Science and Forestry Faculty.

GRADUATE PROGRAM

MASTER OF LANDSCAPE ARCHITECTURE

The master's degree is open to those students who hold an undergraduate degree and meet the prerequisites for admission. The program is accredited by the American Society of Landscape Architects and focuses on community design and planning. The three-year course of study provides a strong foundation of design theory and process while emphasizing mastery of the skills associated with an individually selected area of concentration. The core curricula focus on processes of community design and planning. Students are required to integrate the required core coursework with an elected area of concentration in physical, cultural, or communications/public participation arenas. The program requires cross-disciplinary study to prepare students to enter a variety of emerging positions in the public and private sectors. Illustration of these positions may be found in design research, community development, impact analysis, and environmental

management. Although these positions require working knowledge of design, they transcend the traditional skills normally associated with project design. Processes related to management, analysis techniques, technological application, and the social and natural sciences are considered necessary to undertake these and other similar positions. Graduates of the program are currently employed by government, educational institutions and private offices practicing environmental design and analysis across a broad and comprehensive scope or purview. The M.L.A. degree is granted upon the completion of 72 credit hours (42 graduate) in a prescribed curriculum.

A variety of joint degree program opportunities exists for applicants wishing to develop a unique career track. Dual professional degrees in Law, Public Administration, Public Communication, or Business Management may simultaneously be pursued at Syracuse University. Ph.D. programs for careers in teaching and research are available within the College's Graduate Program in Environmental Science, and with a variety of programs at Syracuse University, such as geography. Applicants interested in dual degree programs are encouraged to contact the College's Graduate Admissions Office at an early date.

M.L.A. DEGREE PROGRAM

The M.L.A. curriculum has four components: a foundation year, a sequence of required core courses, a series of elected courses in an area of concentration, and a terminal experience. The foundation coursework provides the skill and knowledge basis for engaging environmental design. The required core courses have as their focus the development, enhancement, and refinement of understanding of landscape architectural philosophy, theory, skills, and techniques, as focused on community design and planning. Emphasis is placed on the refinement of proficiency in design analysis skills, concepts, and objectives.

Each student is required to select and complete a group of courses in an area of concentration in one of three design-related areas. These areas are cultural, physical, and communications/public participation, as related to community environmental design. Selection of an area of concentration is the responsibility of each student assisted by a faculty advisor at the end of the first year.

Three terminal experience options are available: thesis or project, coursework, academic, or professional experience. A project consists of the critical application of professional knowledge and skills to a landscape architectural problem. A thesis consists of research which expands or clarifies basic knowledge related to community environmental design. The coursework option involves selected electives in the designated area of concentration. The academic/professional experience is typically a semester-long internship with a public agency, private firm, or nonprofit institution.

The following describes the broad sequential linkages of the six-semester program:

First Year: Foundation courses in design analysis, physical factors, graphics, history, and theory, and start of graduate elective sequence, or engagement of additional undergraduate technical subjects. The scale focus is human, site, and neighborhood.

Second Year, Fall Semester: The third semester of study is intended to provide an introduction to decision making processes, including computer applications in community design and planning. An examination of the impact of physical factors on the environment is provided. Scale focus includes municipal and site in rural/suburban scenarios.

Second Year, Spring Semester: The fourth semester of study is intended to investigate community design and planning through a variety of projects focusing on the form and condition of environments supporting human behavior. Methods of research and analysis relevant to social determinants are introduced. Scale focus is urban district.

Third Year: This year is individually designed, with the assistance of a major professor, to meet the student's career objectives while satisfying the requirements of the selected concentration area, and terminal experience. Study and research opportunities exist both at the Syracuse Campus and throughout the world. Often, all or a portion of the fall semester involves off-campus pursuits, while the spring semester entails final coursework and project documentation.

Research and community service play a significant role in the graduate program, primarily through funded projects and projects/thesis. Not only does research provide new knowledge and applications for the profession, but it enriches the curriculum, enhances faculty expertise and develops student skills in rigorous observation, clear thinking, and lucid writing.

By the nature of a profession which exists on evolving frontiers of human interaction with natural and built environments, much of the research in landscape architecture deals with issues in an exploratory way. Faculty members and graduate students usually work together on research projects in an atmosphere of mutual learning. Approaches may vary from rigorously quantitative analysis of data, to highly qualitative evaluation of broad problems, to application of design and planning methods to specific cases.

The College library and the several libraries on the Syracuse University campus offer reference material to support study programs. Facilities at the School are extensive. They include adequate studio and office space as well as reproduction, model making, photographic, audio-visual equipment, micro-computer, video simulator, and heliodon. The College's Computer Center is fully interfaced with Syracuse University to provide a complete range of academic and research capabilities. The College also has a fully-equipped video tape recording (VTR) studio, photogrammetric labs and micro-computer based image processing capability for LANDSAT tape interpretation.

The School is unique in its location within the College of Environmental Science and Forestry. This situation provides the M.L.A. candidate with the opportunity to draw upon information and knowledge in ecology, natural sciences, resource management, forestry and many other related environmental disciplines. The U.S. Forest Service Urban Forestry unit located at the College provides a unique opportunity to promote interdisciplinary environmental design research. In addition, the relationship with Syracuse University provides the School with an extensive intellectual as well as physical resource basis.

The Syracuse area has the largest concentration of landscape architectural firms in the state, outside New York City. With a metropolitan population of nearly 500,000, the city has many opportunities for urban-oriented study. Also, the city's central location in Upstate New York provides easy access to a rich variety of community design and planning contexts throughout the northeastern U.S. and the major metropoli of Canada.

Students seeking admission to the M.L.A. program may apply to enter in either the first or second year based on education and experience. Admission to the first year requires:

1. An undergraduate degree.
2. Graduate Record Examination scores.
3. Undergraduate transcript.
4. Three letters of recommendation.
5. A completed course in each of three areas:
 - a. botany, biology, or ecology;
 - b. geology, geomorphology, or earth science;
 - c. anthropology, psychology, or sociology;
 - d. computer application or programming course.

In addition, students seeking admission to the second year must have:

6. Accredited design degree or equivalent;
7. Design and engineering portfolio;
8. TOEFL scores required for all applicants whose native language is not English. Applications should be made prior to March 1 for the following fall.

M.L.A. Program Sequence

The M.L.A. program is established as a three-year sequence of courses. The following sequence illustrates a typical three-year program.

First Year	<i>Credit Hours</i>
LSA 520 Design Analysis Studio I	3
CMN 382 Graphic Communication	2
LSA 671 History of Landscape Architecture	3
¹ LSA 697 Topics and Issues of CDP	2
LSA 521 Design Analysis Studio II	3
LSA 330 Site Analysis	2
ERE 306 Air Photo Interpretation	1
LSA 445 Structures	1
LSA 496 Site Grading	1
² Directed Electives	6

Second Year

Credit Hours

LSA 620	Community Design and Planning Studio I	3
LSA 696	Community Development Process	3
LSA 656	Environmental Factors, Community Response, and Form	3
³ LSA 433	Plant Materials	2
³ LSA 434	Design Materials	1
LSA 621	Community Design and Planning Studio II	3
LSA 650	Behavioral Factors of Community Design	3
Directed Electives	.....	4
		22

Third Year

⁴*Typical Options for Integrative Experience:*

	<i>Academic/</i>					
	<i>Thesis/Project</i>		<i>Professional Experience</i>		<i>Coursework</i>	
	<i>Fall</i>	<i>Spring</i>	<i>Fall</i>	<i>Spring</i>	<i>Fall</i>	<i>Spring</i>
LSA 898 Academic/Professional			12			
LSA 899 Thesis/Project	3	6				
LSA 641 Formal Organization		1		1		1
LSA 642 Project and Program Scheduling		1		1		1
LSA 643 Ethical Issues in Community Design and Planning		1		1		1
Directed Electives	<u>9</u>	<u>3</u>	<u>—</u>	<u>9</u>	<u>12</u>	<u>9</u>
	12	12	12	12	12	12

¹Also required for students who enter with advanced standing.

²Directed electives are selected in consultation with the student's advisor. They are designed to augment the student's undergraduate preparation, to develop the required concentration, and to fulfill the requirement for a computer or statistics course.

³Usually not required for students who enter with advanced standing.

⁴The precise number of credit hours taken by a student during a given semester in LSA 899, LSA 898, or in directed electives is determined in consultation with the student's advisor.

DUAL UNDERGRADUATE PROGRAM IN ENVIRONMENTAL AND FOREST BIOLOGY AND RESOURCES MANAGEMENT

This dual curriculum is designed to provide students with a strong background in basic biology and forestry. In doing so it meets the core course requirements in two undergraduate curricula: Environmental and Forest Biology, and Resources Management. The Dual Program is one level in a continuum of Biology and Forestry study opportunities at the College:

- Environmental and Forest Biology
- Environmental and Forest Biology with Forestry Electives
- Dual Program
- Resources Management with Biology Electives
- Resources Management

Upon completion of the Dual Program, graduates will be highly qualified to work professionally in forested ecosystems. The breadth of training received by students who elect this option will prepare them for a career in forestry and other aspects of environmental science in the federal, state, and private sectors. Exposure to diverse courses and extensive field experience enhances their employment opportunities in multidisciplinary programs that are characteristic of contemporary approaches to forestry management and other environmental problems.

The Dual Program requires a minimum of five semesters at the upper division level. Six semesters may be necessary for those students who lack appropriate lower division courses, or who wish to develop specific interests in forest biology or forestry. A total of 147 credit hours, 62 of them prior to matriculation, is required for this Bachelor of Science degree. In addition to the 58 credit hours of upper division core courses listed below, six of the elective credit hours must be in courses designated FBO (Plant Science), six in FEN or FZO (Animal Science), six in FOR (Forestry) and three in WPE (Wood Products Engineering) or FEB (Forest Engineering), exclusive of the six-hour summer camp experience.

There is less opportunity to take free electives in the Dual Program than in the two curricula which it combines. It is recommended that elective requirements in plant science and animal science address critical support areas such as forest pathology, plant ecology, fish and wildlife management, and forest entomology. Similarly, forestry electives in silviculture, hydrology, or tree improvement are examples of elective opportunities in important forestry support areas. In all cases, choice of electives depends on the student's professional goals. Course selection is made after consultation with each of two advisors; one from the School of Environmental and Forest Biology and one from the School of Forestry.

To facilitate transfer at the junior level, it is important that students satisfy the lower division course requirements prior to matriculation at the College of Environmental Science and Forestry.

Students entering at the junior level should have successfully completed a minimum of 62 credits which include:

Lower Division Courses

Course Area	Credit Hours
General Chemistry with Laboratory	8
Organic Chemistry with Laboratory	8
General Physics with Laboratory	8
Mathematics, through Integral Calculus	6-8
English	6
General Botany and Zoology OR General Biology with Laboratory	8
*Social Sciences	6
*Political Science (U.S. Institutions)	6
*Biology Electives OR Economics (Macro- and Microeconomics)	6
	62

Upper Division Courses

Junior Level		Credit Hours
<i>Fall Semester</i>	FBO 315 Dendrology	3
	FBL 320 General Ecology	3
	**FEN 350 Entomology	3
	***ECN 201 Microeconomics	3
	****Elective	3
	15	
<i>Spring Semester</i>	ABM 391 Statistics	3
	FBL 330 Physiology	3
	FOR 360 Principles of Management	3
	****Elective	3
	**ECN 202 Macroeconomics	3
	Computer Application	1
	16	
Summer:	FOR 300 Field Forestry Program at Warrensburg	6
<i>Fall Semester</i>	FOR 331 Introduction to Physical Environment	6
	FOR 332 Silvics/Silviculture	8
	FOR 322 Mensuration	3
	17	
Senior Level		Credit Hours
<i>Spring Semester</i>	FOR 370 Management of Forest Enterprise	3
	FBL 470 Genetics	3
	FBL 471 Genetics Laboratory	1
	****Electives	9
	16	

Fall	APM 492	Biometrics	3
Semester	FOR 400	Social Environment of Resource Management	3
	FOR 461	Management Models	3
	****Electives		6

15

*Students may be admitted with 3 credit hours in each of these subject areas. Deficiencies must be removed as early as possible in the student's program.

**A spring course, FEN 300, may be substituted if scheduling problems conflict with FEN 350. This will open up 3 hours of electives during the fall semester rather than in the spring.

***If the economics requirement is satisfied in the freshman and sophomore years, biology or forestry electives may be substituted and vice versa.

****These electives should include at least 3 credits in WPE or FEG, 6 credits in FOR, 6 credits in plant sciences, and 6 credits in animal science.

COLLEGE-WIDE PROGRAM IN ENVIRONMENTAL SCIENCE

ROBERT H. FREY, *Acting Director* (Public Policy Analysis, Organization Theory), ALEXANDER (Wildlife Biology, Wetland Ecology), BENNETT (Forestry Economics), BLACK (Watershed Hydrology, Water Quality), BROCK (Analytic and Interpretative Photogrammetry, Remote Sensing), CANHAM (Resource and Land Use Economics, Regional Planning), CHAMBERS (Wildlife Ecology and Management), COCHRAN (Communications), CUNIA (Operations Research, Statistics, Mensuration), DALL (Legal and Institutional Arrangements for Management of Natural Resources and Environmental Protection, Environmental Policy), DENCE (Organic Chemistry and Lignin Reactions), DINDAL (Soil and Microcommunity Ecology), DUGGIN (Agricultural Assessment, Remote Sensing, Physics), ESCHNER (Watershed Hydrology, Snow Hydrology), FELLEMAN (Site Engineering, Environmental Land Use Planning), GEIS (Plant Community Dynamics, Plant-Soil Relationships), GRATZER (Recreation Resource Management and Planning), GRAVES (Resources and Environmental Management, Policy Analysis), HANNA (Transmission Electron Microscopy, Cellular Ultrastructure), HANSELMAN (Education and Communications Strategies, Learning Simulations), HAWKS (Landscape Architecture, Regional Planning and Design, Facility Siting and Routing), HENNIGAN (Environmental Management, Policy and Programming, Water Quality and Urban Water Management), HOLTMAN (Educational Communications, Message Design, Applied Communications), HORN (Legal and Business Aspects of Resources Management and Policy), JELINEK (Computer Applications, Process Design), JOHNSON (Speciation of Heavy Metals in Air, Water and Other Materials), KETCHLEDGE (Plant Science, Ecology, Bryology), LEE (Systems Engineering Computers, Soil Mechanics), LUNER (Mechanical and Surface Properties of Fibers, Films and Paper), MARAVIGLIA

(Creative Problem Solving, Management), MARK (Properties of Woods and Fibers, Solid Mechanics of Cell Walls), MCCLIMANS (Soil and Water Conservation, Mechanization, Energy Systems), MEYER (Wood Properties and Utilization), MITCHELL (Decomposition Processes, Flora-Faunal Interactions), MORRISON (Psychology, Sociology, Environmental Policy), NAKAS (Nutrient Cycling and Decomposition of Microorganisms, Soil and Aquatic Microbiology), NAKATSUGAWA (Detoxification Mechanisms, Health Effects of Pesticides, Pollutants), PALMER, D. (Biomass Energy Systems, Engineering Economics), PALMER, J. (Landscape Perception, Social Impact Assessment, Environment and Behavior Research Methods), PAYNE (Wildlife Conservation, Nature Interpretation), PORTER (Nature Interpretation, Wildlife Habitat Research), RAYNAL (Plant Populations, Community Ecology), RINGLER (Environmental Biology of Fishes, Stream Ecology), SMARDON (Landscape Design, Environmental Impact Analysis, Environmental Planning), SMITH, K. (Physical and Polymer Chemistry), TULLY (Computer Modeling of Stormwater Runoff, Relationships Between Hydrologic Models and Water Resources Decisions), TURAI (Water and Air Pollution Abatement Engineering, Materials Science and Engineering), VAN DRUFF (Urban Wildlife, Wetland and Waterfowl Biology), WEBSTER (Research Methods, Environmental Education and Communications), WERNER (Limnology, Fish Ecology).

Adjunct Faculty

ALEXANDER, DURKIN, ELY, ROBERTSON, ROWNTREE, SANDERS, THOMPSON, WEEKS.

A PERSPECTIVE

Environmental science is the study of people and their relationships with the environment. The environment is the physical, chemical, biological, and social setting in which people live, work, and play. Consequently, environmental science is concerned with the natural setting, the culture imposed by man in this setting, and the institutional system man has devised to order the relationships between many conflicting demands and desires in light of natural and social constraints. Few, if any, locations on this earth are totally independent; external dependencies and impacts exist, to a greater or lesser degree, and must be factored into this environmental matrix.

Environmental science connotes a holistic orientation, one that recognizes interdependence and interrelatedness of all the social and technical facets of the environment, as opposed to an atomistic orientation which treats these facets as fragmented and unrelated. Armed with this perspective, it is apparent that the environmental problems facing society today are a product of human interaction with the environment, not simply a number of technological difficulties.

Present day interest and concern with environmental matters had as its antecedents the separate development of conservation and public health programs in the 1880s which had a rather narrow focus. These concerns became progressively broader under the press of social and technological growth in the 40s, 50s, and 60s. A new environmental movement then emerged outside of these traditional approaches culminating in Earth Day, 1970.

This environmental movement enlisted a constituency outside of the conservation and public health traditions and agencies. Conservation and public health elements were combined in a unified approach. The resource focus of conservation and the people focus of public health became merged into the single focus of people and resources. The goal is to maintain acceptable environmental conditions, while simultaneously providing for the effective utilization of resources.

In order to meet the demands for a broader integrative approach to environmental affairs, a number of new statutes were passed, epitomized by the National Environmental Policy Act; new agencies were formed, old agencies were reorganized. The new participants included citizen activists, lawyers, natural scientists, and planners in unprecedented numbers to add to the cadre of professionals and citizen activists from the public health and conservation traditions. One major result of this was the realization that the environment must be viewed holistically, and that there were two major aspects to all environmental issues, the technical-scientific, and the political-social. This requires that all students of environmental science fully understand and comprehend both of these components of environmental affairs.

THE PROGRAM

The Graduate Program in Environmental Science (GPES) resulted from the realization that there is a need to provide an opportunity for interdepartmental and interdisciplinary study. Consequently, the faculty for the program is drawn from the faculty of the existing schools and departments.

Other important inputs to this program are the resources of Syracuse University in the coursework areas of communications, policy, law, engineering, science, sociology and political science, and the community and institutional resources of the region such as federal, state, and local agencies, faculties of other colleges, and private organizations.

PROGRAM OBJECTIVES

The GPES is designed to prepare graduate students for careers in environmental affairs. This includes working in such diverse areas as teaching and research, communications, planning, regulatory administration, general administration, policy and program analysis. The emphasis can be technical-scientific or institutional-social with varying blends of the two.

Students enter directly from undergraduate schools or, as is increasingly happening, after some years of professional experience. The goals of the entering students vary considerably, such as development of needed career skills and expertise, career changes, adding breadth to a technical background, adding depth to a general background, and mid-career updating.

AREAS OF STUDY

Public policy and programming is a major study area which integrates all aspects of environmental science.

The areas of concentration, in addition to policy, now being offered under the GPES are environmental education/communication, environmental assessment and impact analysis, environmental land use planning, water resources, and energy conservation and development. These areas are not exclusionary. It may well be that a student will desire a program that does not fall into the listed categories. This need can be met providing that the faculty resources are available in the College and associated institutions. Students with a desire for a highly individualized program falling within the scope of the College's offerings are encouraged to make application for admission.

Students with an undergraduate major in engineering, science, mathematics, political science, economics, journalism, public communications, or forestry would be best prepared to undertake a graduate program in environmental science. All applicants must meet the general admission requirements of ESF. Each applicant is evaluated on an individual basis, and judgment is exercised if the student appears to be deficient in some aspects. Considerations include years of experience, maturity, and motivation. Potential applicants should not hesitate to submit applications for consideration. All applicants are urged to visit the campus and confer with appropriate faculty and administrative personnel.

REQUIREMENTS

Program requirements are designed on a highly individual basis. The purpose is to design a program that fits the student's particular needs, goals, and preparation. Each program must meet the need for *depth* in a particular area, *breadth* across the environmental spectrum, and *synthesis* of information and analysis in evaluating environmental situations. Program evaluation is based on undergraduate work and experience, as well as courses taken at the College. The program must also be coherent, logical, and result in a meaningful whole. Current areas of study are:

Environmental Policy

GPES is the policy center for the College. As such, it is involved and concerned with the public policy and programming aspects of the entire spectrum of environmental conservation and protection. Consequently, policy study is the integrating force bringing all concentration study areas

together in pursuit of the common goal of meaningful and effective research and education in environmental science.

Environmental policy studies prepare individuals for leadership positions in the formulation and execution of public policy and the implementation of programs related to Environmental Conservation and Protection. Studies deal mainly with the decision processes of governmental systems including public involvement and provide integrated knowledge of environmental science and the evaluative techniques of economics, political science, public administration and law.

Environmental Education/Communication

The Environmental Education/Communication area of study is concerned with those facets of environmental protection, enhancement, management, and design in which the flow of information and the processes of education are integral to end results. The basic emphasis is to integrate a solid and substantial background in environmental science with a mastery of appropriate education and communications theory and practice in such a manner as to prepare students in the program for careers in environmental education and communications.

Although closely related, there are several rather distinct career areas under the umbrella of EE/C for which this program unit provides preparatory graduate degree training. These career areas can be generally categorized as follows: Public Information Officer, Environmental Education Specialist, Extension Specialist, Interpretive Naturalist, Environmental Journalist.

Water Resources

The Water Resources area of study is based on the recognition that water relationships are important in almost every aspect of human concern and merit attention as integrative and central elements rather than accessories.

The thrust of the program is either technical or social depending on student interest. The technical aspect is concerned with water quality and quantity relationships, their quantifications and determinants. The social aspect is concerned with planning, regulation, law and institutions, and management. National concern with water resources planning, water supply, and water pollution control attest to the need for people trained in these areas.

Environmental Assessment and Impact Analysis

The main objective of this area of study is to bring together, in an organized educational unit, the various skills and disciplines required for an environmental impact analysis. In practice, such an analysis is a team effort, and the program is intended to ensure that potential team members are conversant with, and operationally adapted to, the language and procedures of a number of the disciplines involved. Starting with students who have an

in-depth background in a traditional (i.e., chemistry, biology, engineering, ecology, forestry, et al.) discipline, the program seeks to refine existing strengths while at the same time broadening the students' ability to deal effectively with the complex, interdisciplinary problems which arise in studies of environmental impact. To ensure the depth and breadth aspects simultaneously, the academic plan stresses a problem-oriented team research approach.

Environmental Land Use Planning

The land use planning area of study is based on the concept that land use is a fundamental determinant of environmental conditions, be it water pollution, air pollution, population density, solid waste disposal, or other impacts. The program is designed to acquaint the student with the physical elements of land use such as location and natural resources, and the social side relating to law, economics, and regulation. Land use management and control is fast becoming the major environmental issue of the day. Land use planners and implementors are sorely needed on a local and regional level. This program unit proposes to meet that need.

Energy Conservation and Development

The energy concentration provides a framework within which a student can study energy-environment-economy relationships with a focus on renewable resource alternatives to social energy resource requirements. Because of the interdisciplinary nature of the subject, opportunities are available for a wide variety of academic studies which combine and integrate physical and social considerations.

Additional Area

This is not a specific area of study but a program element to provide for the highly individual program designed to meet a particular student's needs. Special provisions may be made for a study concentration not listed. The emphasis can be on any appropriate subject within the resources of the College and related institutions.

THE STUDENT

A major advisor is assigned by the program director to accept primary responsibility for the program of each student. Two additional faculty members in areas of expected academic or research emphasis are also selected. These three faculty members constitute the academic program committee for the student. The student is required to submit a formal proposal to the committee consisting of a detailed plan describing and defending the academics and research objectives of the program and a schedule of courses to be taken. The plan is reviewed and updated at the beginning of each semester. The program committee also serves as the thesis or project committee.

The program operates within the Collegewide requirements for graduate students. All students in the program are required to participate in the environmental science seminar which brings together a variety of lecturers with a wide spectrum of interest. Communication, and a campus visit and an interview are highly recommended prior to or during the application process.

THE SCHOOL OF FOREST TECHNOLOGY

JAMES E. COUFAL, *Director* (Silviculture, Forest Management, Pathology, and Personnel Management)

JAHNKE (Ecology, Silvics and Silviculture, Wildlife Ecology, Graphics, Entomology, and Recreation), MARTIN (Mensuration, Statistics, Tree Physiology and Morphology, and Wildlife Ecology), MILLER (Forest Roads, Installations, Recreation, and Policy), REMELE (Ecology, Silvics and Silviculture, Forest Management, and Aerial Photogrammetry), STERBENZ (Surveying, Computer Science, and Remote Sensing), SUHR (Water Resource Management, Dendrology, Aerial Photogrammetry, Fire Management).

FOREST TECHNICIAN PROGRAM

In 1912, some 1,800 acres of land in the Adirondack Mountains were donated to the College as a site for the development of a Ranger School. Since that time, the forest technician program has trained over 3,000 graduates, most of whom are now working in a variety of forest activities, and it has earned the School a national reputation for excellence.

The two-year curriculum trains students as forest technicians. The degree of Associate of Applied Science in Forest Technology (A.A.S.) is awarded. The objectives of the curriculum are to provide students with a knowledge of the field practices of forestry as related to forestry managerial needs; the ability to work and communicate effectively with professional and paraprofessional forestry personnel; and an understanding of the sciences and practices of forestry with some emphasis on ecological applications.

Graduates are generally classified as forest technicians or forestry aides in initial employment positions. Forestry agencies and wood-using industries employ forest technicians as an important part of their forest management teams, usually as the "people on the ground" who plan and execute the field practice of forestry normally under the supervision of a professional forester.

Since the curriculum is a terminal, two-year program at the paraprofessional level, students interested in a professional degree in forestry should investigate enrollment directly in one of the College's undergraduate programs. Transfer into some of these programs is possible upon completion of the A.A.S. degree. There is also a transfer package agreement with the University of Michigan, School of Natural Resources, Forest Resources Program.

If a student feels transfer to a baccalaureate program is a possibility after graduation from the School of Forest Technology, he or she should pay close attention to the footnotes under "Freshman Year" on page 130.

The freshman year forest technology curriculum consists of general studies courses which may be taken at any accredited four-year college, community or junior college, or agricultural and technical institute except Farmingdale or Alfred (although transfer credits from these schools are acceptable otherwise).

The second year of the curriculum is offered at the College's School of Forest Technology on the Wanakena Campus. Presented in a varied forest environment, the curriculum's emphasis is on fundamental forestry knowledge and applied field training as well as the relationships between forest technology and managerial needs. Fifty percent of the studies are devoted to field exercises, most of which are held in the School's forest. This managed forest, containing both hardwood and coniferous species, covers an area some 3½ miles long with widths varying up to 2¼ miles. On two sides, the forest is bounded by State Forest Preserve lands. The forest is also adjacent to several square miles of virgin timber within the Adirondack Forest Preserve. This excellent forest backdrop for the technology program provides a diverse laboratory for instructional purposes.

Since the School is situated within a forest environment, some applicants to the forest technology program may mistakenly believe that the program is one of forest lore and wilderness survival. It is, therefore, strongly emphasized that the forest technology curriculum demands high quality academic achievement. Students cannot complete the program without concentrated and consistent study. Classes are scheduled from 8 a.m. to 5 p.m., Monday through Friday, with classroom and laboratory or field time equally divided. The intensity of the program normally requires a minimum of 70 hours a week of evening and weekend study, daily classes, and laboratory/field exercises. Several short trips, at no additional expense to the student, are made during the year in connection with courses in logging, forest recreation, forest mensuration and silviculture, but especially during the general forestry course.

LIFE AT WANAKENA

The Wanakena Campus of the College of Environmental Science and Forestry is located on the banks of the Oswegatchie River near the hamlet of Wanakena, approximately 65 miles northeast of Watertown, and 35 miles west of Tupper Lake. The School's buildings and its surrounding forest border on the river which flows directly into Cranberry Lake.

The main School building consists of a central service unit with dormitory wings on either side. The central unit contains classrooms, laboratories, a student lounge, faculty offices, the library, a kitchen, dining room and 47 student rooms, each housing two students.

Faculty houses are nearby on the campus. Other buildings include a maintenance shop, garages, a sugar house, and storage buildings.

The close proximity of faculty offices and student quarters and the intensive field-work pattern enables students to consult easily and frequently with the faculty. The School considers this traditional close student-faculty association to be of major benefit in its training program.

A small library of approximately 1,500 volumes consists of highly specialized materials required for the teaching and study programs of the School.

Students taking the second year of the forest technology curriculum at the Wanakena Campus are required to live in the School's dormitories. An exception may be made for married students who bring their families and rent their own private accommodations in the vicinity. Such accommodations are not plentiful. Each married student should make rental arrangements well in advance of the registration date.

The Wanakena Campus does not maintain an infirmary, nor does it employ a physician or nurse. There are two excellent physicians and a dentist as well as an excellent Community Hospital in nearby Star Lake, New York. In emergency situations, the School transports sick or injured students to the local physician of their choice or to the hospital. A student accident or sickness insurance plan is available through the Wanakena Campus, and it is strongly suggested that the student consider such coverage before reporting to the Campus.

Because of the comparatively isolated location of the Wanakena Campus, a stock of books and supplies used in connection with the second year of the program is maintained on campus for sale to students.

During the first year of the program, College-enrolled students will be guided by the rules and regulations that govern attendance at their local campus. During the second year of the program, students will be guided by the general rules and regulations for College of Environmental Science and Forestry students and an additional set of Wanakena Campus "house rules."

ADMISSION

Admission Requirements

Requirements for entrance into the forest technology curriculum require a minimum of high school units consisting of: English; history (social science); science (including biology); mathematics (including trigonometry or Math 11); and electives. Mechanical drawing is a suggested elective.

In addition to the academic requirements, the following must also be met by all applicants:

1. The applicant must be strongly motivated toward a career as a forest technician.
2. The applicant must be willing and able to meet the physical requirements of the program which include pole and tree

climbing, walking 2 to 6 miles through forest areas often carrying 15-20 pounds of equipment, and using a wide array of hand tools and power equipment.

3. The applicant's parents (if the applicant is under 18 years of age) must be fully aware of the field nature of the study program, its rigorous study-work regime and supporting academic facilities.
4. A full medical examination report must be submitted.

Questions concerning any of these requirements should be referred to the Director of Admissions who may, under special circumstances, waive some of them.

Admission Procedures

The decision to admit any student to the Forest Technician Program rests solely with the College of Environmental Science and Forestry. Most openings in the program are filled by students who received conditional acceptances while still seniors in high school, contingent on successful completion of the first year of college. Remaining openings are filled by transfer students who have already attended college. Therefore, it is suggested that the potential forest technician student apply while still a high school senior.

Here is the procedure:

1. Seniors in high school must submit a regular SUNY freshman application for the College of Environmental Science and Forestry, using a Curriculum Code 620 (Forest Technology). These applicants should indicate entry date to be one year in advance of the current year.
2. Submit a regular application to that school selected for the first year of study, using Curriculum Code 620. It is important that students gain entry on their own for the first year of studies. The College will request information at a later date concerning what institution the student will be attending.

Transfer Students

Students with previous college experience, or students who are currently enrolled at another college, may apply for transfer. However, courses transferred for credit can be applied only to the freshman year course of studies, and they must be appropriate to those courses and comparable in subject matter, content, and level. All second year courses must be taken at the Wanakena Campus and, therefore, a student cannot transfer any previously earned credit toward the second year. Transfer applicants must submit a recent official copy of their college transcript and a list of courses they anticipate completing prior to enrollment.

EXPENSES

Cost of the first year will vary with the specific institution attended.

Estimated costs of the second year program on the Wanakena Campus are as follows:

	<i>Tuition</i>	<i>Board & Room</i>	<i>Books & Supplies</i>
New York Resident	\$1,050	Approx. \$1,908	Approx. \$600
Nonresident	\$1,750	Approx. \$1,908	Approx. \$600

An additional estimated expense of \$200 will likely be incurred to cover the cost of laundry and clothing. There is also a \$20 graduation fee and a \$13 student activity fee, plus a \$25 residence deposit and a \$25 equipment deposit. The latter two fees are fully or partially refundable, depending on breakage charged to a student during the year.

FOREST TECHNOLOGY CURRICULUM
(Associate of Applied Science Degree)

Freshman Year	<i>Credit Hours</i>
<i>(Completed at a college of the student's choice)</i>	
¹ General Biology	8
English	6
² Math	6
Economics	3
³ Electives	7
	30

¹Courses selected may be in general biology, but at least one course in introductory botany is preferred.

²Competency in plane trigonometry and college algebra is required. If demonstrated, credits become electives. If a student feels transfer to a baccalaureate program is a possibility, he would be well advised to take calculus.

³If a student feels transfer to a baccalaureate program is a possibility, general chemistry and physics should be taken as electives. Otherwise, courses in sociology, psychology, political science, geology, accounting, business, etc. are desirable electives.

Senior Year	<i>Credit Hours</i>
(Wanakena Campus)	
<i>First</i> FTC 200 Dendrology I	2
<i>Semester</i> FTC 202 Plane Surveying I	4
FTC 204 Forest Mensuration and Statistics I	3½
FTC 206 Forest Ecology	3
FTC 207 Aerial Photogrammetry	2
FTC 208 Forest Installations	3
FTC 213 Forest Protection I	2
FTC 223 Graphics	1
	20½

Second Semester	FTC 203	Plane Surveying II	1
	FTC 205	Forest Mensuration and Statistics II	2
	FTC 209	Forest Roads	2
	FTC 211	Silviculture	2½
	FTC 212	General Forestry	1½
	FTC 214	Personnel Management	1½
	FTC 215	Timber Harvesting	2
	FTC 217	Forest Management	2½
	FTC 218	Forest Recreation	1½
	FTC 219	Elements of Wildlife Ecology	1½
	FTC 221	Water Resource Management	2
	FTC 227	Forest Protection II	2
	FTC 228	Structure and Growth of Trees	1½
	FTC 229	Silviculture II	
		or	2
	FTC 230	Plane Surveying III	
			25½

A total of 76 credit hours is required. Upon satisfactory completion, an Associate of Applied Science (A.A.S.) degree in Forest Technology will be awarded.

FINANCIAL ASSISTANCE

Financial aid is available upon acceptance to the College of Environmental Science and Forestry. There are three basic loans, scholarships or grants, and part-time employment.

More detailed information on these financial aid opportunities can be found on pages 32-38 of this catalog and the publication *Financial Assistance at ESF*.

The student must file an application with the Office of Financial Aid at the Syracuse Campus and submit a *Family Financial Statement* to ACT, Iowa City, Iowa 52243.

PLACEMENT

The School assists in placement of graduates. The reputation of the College's Forest Technology School assists graduates to find employment. Employment is common with local, state and federal forestry, and land resource agencies, private forestry enterprises, and surveying firms. Positions most frequently filled by recent graduates include: state forest ranger, state forest technician, forest aide, industrial forest district supervisor, timber inventory specialist, timber sales supervisor, forest surveyor, forest engineering aide, forest protection technician, forest research technician, forest equipment salesman, tree service technician and urban park ranger.

Graduate Exchange Programs

INTERCAMPUS DOCTORAL EXCHANGE

There is an opportunity for doctoral students at ESF to study for one or two semesters at the following schools: State University Centers at Albany, Binghamton, Buffalo, or Stony Brook; City University of New York; or New York University.

This exchange program provides students with an opportunity to take advantage of over 160 faculty, specialized research laboratories and equipment, technical libraries, and field study areas which complement the extensive programs and resources at ESF which are discussed throughout this catalog.

This fellowship provides a grant-in-aid of up to \$5,000 a year and may include a tuition waiver. For further information, please contact the Office of Academic Programs.

COLLEGE OF AGRICULTURE AND LIFE SCIENCES AT CORNELL UNIVERSITY

The State University of New York College of Environmental Science and Forestry and the New York State College of Agriculture and Life Sciences at Cornell University provide an opportunity to exchange graduate students so they can take advantage of special courses, faculty, and research facilities.

There are a number of programs on both campuses which complement one another. The following research and instructional areas at the College of Agriculture and Life Sciences appear likely to be of greatest interest to ESF students:

Agricultural Economics—Land Economics; Resource Economics; Resource Investment and Environmental Quality; Agricultural Land Policy.

Agricultural Engineering—Physical Analysis of Plant and Animal Materials; Soil and Water Engineering; Environmental Systems Analysis; Drainage Engineering; Soil and Water Conservation.

Agronomy—Identification, Appraisal and Geography of Soils; Soil Fertility Management; Soil and Water Conservation; Aquatic Plant Management; Forest Soils; Soil Microbiology; Microbial Ecology; Use of Soil Information and Maps as Resource Inventories; Soil Organic Matter; Soil Chemistry; Weed Science; Dynamic Climatology; Physics of Clouds, Rain, and Rainmaking.

Natural Resources—Wildlife and Fisheries Management; Environmental Conservation; Resource Analysis and Planning; Woodland Management; Forest Ecology; Maple Syrup Production.

Floriculture—Woody Plant Materials; Herbaceous Plant Materials; Plants and Design.

Entomology—Insect Pest Management; Arthropod Pests of World Importance; Biological Control; Insect Pathology; Environmental Biology; Pesticides in the Environment.

Plant Breeding and Pathology—Plant Cell Genetics; Methods of Plant Breeding; Genetics and Breeding for Disease and Insect Resistance; Plant Pathology; Advanced Disease Control; Dendropathology; Pest Management for Plant Protection; Advanced Mycology; Plant Virology; Plant Nematology; Bacterial Plant Pathogens; Disease Physiology; Philosophy of Plant Pathology; Taxonomy of Fungi; Pathology of Trees and Shrubs.

Pomology—Tree Fruits; Orchard Management; Growth and Development of Woody Plants.

Rural Sociology—Rural Development and Cultural Change; Political Structure and Development; Social Power and Community Change; Political Economy of Rural and Regional Development.

For detailed information please contact the Office of Academic Programs.





Course Offerings

Students at the College of Environmental Science and Forestry have not only the academic and research resources of their own institution, but also the resources of nearby Syracuse University and State University Upstate Medical Center.

COLLEGE OF ENVIRONMENTAL SCIENCE AND FORESTRY COURSE DESCRIPTIONS

The courses offered by the College are grouped by general subject areas, and the number of credit hours appears after the course title. A credit hour means one recitation (or lecture) hour per week. Three laboratory hours are equivalent to one lecture hour.

The semester and year after each course indicates when it will next be offered. The College reserves the right to alter the scheduled offering of a course when its enrollment is too small, or when there is no qualified faculty member available to teach it.

Courses listed in this catalog are subject to change through normal academic channels. New courses, course deletions, and changes in courses are initiated by the cognizant departments or programs, approved by the appropriate academic dean, faculty committee, and the college faculty.

Course Numbering System

Code Levels:

- 100-299 Lower-division undergraduate courses for which no graduate credit may be given.
 300-499 Upper-division undergraduate courses for which no graduate credit may be given.
 500-599 Graduate courses designed expressly for areas of specialization in post-baccalaureate programs or in the professional program leading to the Bachelor of Landscape Architecture. Undergraduate students with superior academic records may register for these courses.
 600-699 Graduate courses which permit undergraduate students to enroll only by petition with a well-documented justification approved by the undergraduate advisor, curriculum director, and course instructor.
 700-999 Graduate courses for which no undergraduate may enroll.

General Subject Areas

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APM—APPLIED MATHEMATICS

360. Introduction to Computer Programming (3)

The basic course in computer use offered by the College. It is intended to provide the student with the skill and understanding needed to utilize digital computer languages for problem solving. The course will cover instruction in APL, FORTRAN IV, use of operating systems, and some background material in general hardware/software designs. Fall and Spring, 1982-83.

391. Introduction to Probability and Statistics (3)

Two hours of lecture, three hours of laboratory. Elementary probability, theoretical and sampling distributions, hypothesis testing, statistical estimation, analysis of variance, regression and correlation, nonparametrics and sampling concepts. Fall and Spring, 1982-83.

Prerequisite: Two semesters of calculus.

492. Forest Biometrics (3)

Two hours of lecture, three hours of laboratory. Analysis of variance including nested and cross-classification. Matrix approach to multiple linear regression and weighted least squares. Nonlinear regression. Sampling methods and design. Applications to forestry problems. Fall, 1982.

Prerequisite: APM 391 or equivalent.

500. Introduction to Computer Programming for Graduate Students (3)

A basic course in computer usage. Provides the skill needed to utilize digital computer languages for problem solving. Includes a study of FORTRAN IV and APL with a discussion of an Assembly Language. Other topics include representation of information, management of files, error control, operational systems and job control. Fall and Spring, 1982-83.

510. Statistical Analysis (3)

Two hours of lecture and three hours of laboratory. A treatment of statistical inference, including paired design, group design, linear regression and correlation, one way analysis of variance and some applications of chi-square. Calculation of statistics, test of hypotheses and proper interpretation of calculated statistics. Fall, 1982.

605. Theory of Probability Distributions (1-3)

Three hours of weekly sessions over five to 14 weeks. Statistical problems and mathematical models; random experiments, random variables, probability, frequency and distribution functions of discrete, continuous and mixed random variables; functions of random variables and the probability distributions; mathematical expectation and its applications; discussion of the main theoretical distributions such as binomial, Poisson, negative binomial, normal, Gamma, Beta, exponential and others; applications of this framework to the model construction problem in the statistical, operations research and forest mensuration areas. Fall or Spring, 1982-83.

Prerequisites: Two semesters of differential and integral calculus and an introductory course in statistics, or permission of the instructor. The course can be taken in conjunction with APM 651—Operations Research I (for one credit hour) or independent of it for one to three credit hours.

620. Analysis of Variance (3)

Three hours of lecture and recitation and three hours of laboratory. Multiway classifications in the analysis of variance, with emphasis on the development of models, including randomized blocks, latin squares, split plots, and factorial designs with fixed effects, random effects, and mixed effects; multiple and partial regression and correlation (including curvilinear), using matrix methods; analysis of covariance. Fall, 1982.

Prerequisites: Graduate standing and an introductory course in statistics covering material through the one-way analysis of variance.

625. Introduction to Sampling Techniques (3)

Two hours of lecture and three hours of laboratory. Introduction to the scientific basis of sampling: selecting an appropriate sampling unit; choosing an efficient design; calculating sampling error; determining a sample size to meet stated objectives. Spring, 1983.

Prerequisite: APM 391 or equivalent.

630. Regression Techniques with Applications to Forestry (3)

Two one and one-half hours of lecture. Review of matrix algebra, probability theory and statistical methods. Basic concepts in regression analysis. Classical linear regression model. Least and weighted least squares method. Dummy variables and their uses in regression and covariance analysis. Applications to problems of statistical prediction and estimation from the field of forestry in general and forest mensuration and inventory in particular. Fall, 1982.

Prerequisite: APM 391 or equivalent.

635. Multivariate Statistical Methods (3)

Estimation and inference for the multivariate normal distribution. Multivariate analysis of variances, factor analysis, principal components analysis, canonical correlation, discriminant analysis, cluster analysis. Spring, 1983.

Prerequisite: One semester of statistics.

651. Operations Research I (3)

Two one and one-half hours of lecture. Stochastic OR models applicable to managerial process or systems analysis. Elements of probability theory, theory of games and decision theory, queuing model, simulation techniques with applications to queuing and inventory problems, and, if time permits, Markov chains. Fall, 1982.

Prerequisites: APM 391 and MAT 227 or equivalent.

652. Operations Research II (3)

Two one and one-half hours of lecture. Deterministic OR models applicable to managerial problems or systems analysis. Elements of Matrix Algebra, solving simultaneous linear equations, mathematical programming, classical optimization techniques, Lagrange multipliers. Linear programming transportation and allocation models, dynamic programming, network analysis and, if time permits, quadratic, parametric and integer programming. Spring, 1983.

Prerequisites: APM 391 and MAT 227 or equivalent.

CMN—COMMUNICATIONS (LANDSCAPE ARCHITECTURE)

(See also courses listed below under E1N and LSA.)

380. Technical Drawing I (1)

One three-hour drafting room period. Elements of perspective, isometric, oblique, and orthographic projection. Practice in freehand and instrument drawing. Fall, 1983. (Will be taught Spring, 1983.)

381. Technical Drawing II (2)

Two three-hour drafting room periods. Elements of perspective, isometric, oblique, and orthographic projection. Practical applications of these principles in machine and architectural drawing, including piping and electrical drawings. Spring, 1983.

382. Graphic Communication (2)

Two three-hour studios with up to one hour of studio per week devoted to group presentation meetings, instruction, and review of new techniques such as diagramming, drafting, perspective, and plan graphics. Drawings, examinations, and a final portfolio constitute the basis for grades. Fall, 1982.

482. Advanced Graphic Media (1-3)

Three hours of studio. Discussions, demonstrations, critiques and individual study. Study oriented toward perception and self-expression, use and possibilities of various media, as selected by student and instructor. Fall and Spring, 1982-83.

Prerequisites: Prior art media training or experience and permission of the instructor.

530. Environmental Communications Studio (2)

Three-hour studio and one-hour discussion. For seniors and graduate students, this course offers the opportunity for students to apply communications theory and strategies through the planning, production, and display of media projects developed around the student's area of professional interest. Enrollment limited to 20 students. Fall, 1982.

Prerequisite: CMN 531 or permission of the instructor.

531. Environmental Communications

(3)

Three hours of lecture/discussion. An introductory course for seniors and graduate students which presents techniques and processes in education and communications applicable in environmental science, management, planning, and design. Topics include basic teaching, learning and communications theory and strategy, working with the press, electronic media, gaming and simulation, public address techniques, slide/tape production and use, film production and use. Spring, 1983.

637. Environmental Communications Project

(1-3)

This course is designed to give graduate students an opportunity to work as a team in identifying, developing, administering, and evaluating a communications project related to an environmental issue. Typically, a workshop or shortcourse will be developed and offered for some targeted public through the School of Continuing Education. The nature of the topic and format of the project will be determined according to experience background of students enrolled. Task responsibilities and time commitments are correlated with number of hours for which student has registered. Spring, 1983.

682. Video Communications

(3)

Three hours of studio plus lecture. This course will provide students with instruction and experience in the skills necessary to provide video tape programs. Each student will prepare and develop a video script for production of a program on an assigned topic. Completed programs will be tested and evaluated. Class size is limited. Fall and Spring, 1982-83.

Prerequisite: Permission of the instructor.

738. Environmental Education Programs of Agencies and Institutions

(1-3)

One three-hour seminar session. An analysis of contemporary environmental education objectives, methodologies, and philosophies employed by various public and private institutions. Attendance, readings, and short paper required for one-hour credit. For two or three hours credit, and individual investigation of the environmental education and communications activity of an agency or organization is also required. Fall, 1982.

EIN—ENVIRONMENTAL INFLUENCES (LANDSCAPE ARCHITECTURE)

(See also courses listed under CMN and LSA.)

311. Natural Processes in Planning and Design

(3)

Section 1: Landform and Soils

Section 2: Hydrology, Climate and Energy

Section 3: Plant, Animal, and Human Ecology

Three hours of lecture. This course presents an overview of the basic principles governing the dynamics of natural resources and processes which should be understood in planning and designing the human landscape. In each section, sources of reference data application to planning and project scale design will be discussed. Occasional local field trips will be utilized. Fall, 1982.

Prerequisite: Permission of the instructor.

371. History of American Landscape Attitudes

(3)

Three hours of lecture-discussion. This course presents, through lectures, readings, and slides, uniquely American historical attitudes toward land and nature as shown through various cultural activities and disciplines, such as painting, architecture, landscape architecture, religion, philosophy, utopianism, exploration and recreation, land development and economics, and certain technological developments. Cultural expressions of the 19th century will be of primary interest, but formative attitudes from the Colonial period and certain 20th century results will be included. One-third to one-half of lecture periods are given over to student reports, criticism, and discussion. Spring, 1983.

Prerequisite: Permission of the instructor.

390. Social/Cultural Influences and Environmental Form (3)

Three hours of lecture. This course provides an introduction to an interdisciplinary social science analysis of human settlements. The course introduces the basic concepts, vocabulary, theories, and units of analysis for an interdisciplinary social perspective of the environmental form of human settlements. As such, it focuses upon developing an understanding of the context for the planning and design of human settlements. Course requirements include readings, examinations, and reports. Field trips may be scheduled. Spring, 1983.

451. Fundamentals of City and Regional Planning (3)

Three hours of lecture. An introductory survey course in planning. The historical development of American City and Regional Planning, theories of the planning process, the role of planning in public decisionmaking, landmark legislation and judicial decision related to planning, and approaches to controlling land use will be presented. Fall, 1982.

452. Simulated Planning in Metropolitan Systems: Theory and Practice (3)

Three hours of laboratory, two hours of lecture/discussion. A computerized simulation designed to provide an understanding of the decisionmaking environment of metropolitan planning. Each participant is assigned a role consistent with his/her background. Lectures provide a theoretical framework for the activities in the simulation; a discussion section provides for evaluation. Computer experience is not necessary. Spring, 1983.

470. Art History (3)

Three hours of lecture. Informal lectures will emphasize and review assigned text and other readings and handout notes. Slides will be shown regularly; reports, quizzes and examinations. Evolutionary nature of the main cultural periods of Western man and fine art as man's selected environment will be the course emphasis. Spring, 1983.

Prerequisite: Permission of the instructor.

471. History of Landscape Architecture (3)

Three hours of lecture. Informal lectures and class participation, reports, assigned text and assigned reserve shelf reading, optional text and handout notes, quizzes and exams. Slides. Historical study and style analysis of Western man's efforts to design his environment and his changing attitudes and relationships to environment. Also, non-Western coverage where significant or influential on Western Man. Study of historical personalities as well as periods that are of environmental concern up into the modern period. Fall, 1982.

Prerequisite: Permission of the instructor.

510. Creative Problem Solving Seminar (3)

Three hours of lecture and discussion. A course designed to extend the student's understanding and application of creative problem solving processes. One requirement will be to select and carry out an application of the techniques to a particular problem, with consultation and guidance from the instructor. Critique and survey of the literature on creativity, in-depth analysis of the synectics process, and various procedures which have been developed for nurturing creative behavior comprise the essence of the program. Spring, 1983.

Prerequisite: Undergraduate degree or permission of the instructor.

ENS—ENVIRONMENTAL SCIENCE**796. Special Topics in Environmental Science and Policy (1-3)**

Lectures and discussion, seminars, conferences and group research on topics of special or current interest, in fields related to environmental science and policy. See schedule of classes for current offerings. Fall and Spring, 1982-83.

797. Environmental Science Seminar (1-2)

Discussion of current topics and research related to environmental science. Fall and Spring, 1982-83.

798. Problems in Environmental Science and Policy (Credit hours to be arranged)

Individualized, special study of environmental science and policy subjects and issues. Comprehensive oral or written report required for some problems. Fall and Spring, 1982-83.

899. Master's Thesis Research (Credit hours to be arranged)

Research and independent study for the master's degree and thesis. Fall and Spring, 1982-83.

999. Doctoral Thesis Research (Credit hours to be arranged)

Research and independent study for the doctoral degree and dissertation. Fall and Spring, 1982-83.

The following courses offered by the College and Syracuse University are especially useful to graduate students in GPES:

School of Forestry

RMP 587	Environmental Law
RMP 588	Law of Natural Resources Administration
RMP 602	Resource Economics
RMP 603	Research Methods
RMP 629	Environmental Impact
RMP 643	Urban Water Resources
RMP 664	Soil and Water Conservation
RMP 753	Resources Policy

School of Environmental and Resource Engineering

ERE 612	Energy
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Syracuse University

GEO 558	Environmental Quality Analysis
GEO 613	New York State: Problems and Prospects
GEO 790	Economic Growth and the Natural Environment
PLA 626	Planning and Policy Analysis
PPA 631	Advanced Public Administration
PPA 701	Washington Seminar: Public Policy and Administration
PPA 707	National Planning
PPA 743	Administrative Law
PPA 745	Intergovernmental Relations
SOC 704	Science, Technology and Society
PTS/NAS 532	Progress and Technology
PTS/NAS 551	Alternative Futures for Technological Society
LPP 675	Environmental Issues in Management

ERE—ENGINEERING (ENVIRONMENTAL AND RESOURCE ENGINEERING)**306. Elements of Map and Air Photo Interpretation (1)**

Two hours of lecture and three hours of laboratory per week for five weeks of a semester. Introduction to map and photograph interpretation to extract information useful to site inventory, analysis, planning, and design activities. The physical and geometric properties of maps and photographs, the characteristics of information contained in them, and the principles and procedures of interpretation are discussed. Spring, 1983.

Prerequisite: Junior standing in Landscape Architecture.

308. Elements of Plane Surveying (1)

Two hours of lecture and three hours of laboratory per week for the last five weeks of the semester. Introduction to the principles and procedures of plane surveying for mapping and construction layout purposes. Topics briefly discussed include the basic mathematical principles of surveying, the types and uses of surveying, horizontal and vertical distance measurement, angle measurement, traversing and computations, construction layout, tacheometry, and surveying errors (and their treatment). Spring, 1983.

Prerequisites: Junior standing in Landscape Architecture and college level plane trigonometry.

320. APL for Engineers and Scientists (2 or 3)

Programming and operation of time-sharing digital computer systems via the APL language. Analysis, modeling, and solution of basic problems in environmental science and engineering. Students desiring three credits will complete an original, substantial term project. Fall or Spring, 1982-83.

Prerequisites: Calculus and physics or permission of the instructor.

321. Analog Computation for Engineers and Scientists (1 or 2)

Programming and operation of electronic analog computers. Analysis, modeling, and simulation of dynamic phenomena and systems in environmental science and engineering. Students desiring two credits will complete an original term project. Fall or Spring, 1982-83.

Prerequisites: Calculus and physics or permission of the instructor.

342. Hydraulics in Construction (4)

Three hours of lecture, three hours of laboratory. The physical, mechanical, thermal, and hydraulic properties of fluids relevant to the construction industry. A study of solutions to hydraulic problems in contemporary construction activities. Not open for credit to forest engineering students. Spring, 1983.

Prerequisites: Physics and differential calculus.

350. Wood Preservation (2)

Two hours of lecture with some demonstrations. A survey of basic wood-water relationships, shrinking and swelling, elementary wood structure, wood permeability, capillary forces, heat transmission, agencies of wood deterioration, wood preservation processes, wood fire performance, fire tests, and fire retardant treatments. Not open to WPE students. Fall, 1982.

351. Basic Engineering Thermodynamics (2)

Principles of energy conservation and conversion: first and second laws. Relation to PVT behavior, property functions, equilibria, and heat and mass transfer. Introduction to engineering problem analysis and computer methods. Spring, 1983.

Prerequisites: Physics, general chemistry, and calculus. Not open for credit to students who have completed successfully FCH 360 or equivalent.

352. Applied Engineering Thermodynamics (2)

Classical principles applied to devices and systems. Emphasis on efficient design of manufacturing equipment and processes. Power and refrigeration cycles; energy conversion; materials recovery. Environmental case studies and design project. Computer-aided data correlation and system simulation. Spring, 1983.

Prerequisites: ERE 351, FCH 360, or equivalent.

362. Mechanics of Materials (3)

Three hours of lecture. Theories of stress, deformation, and stability of common structural materials subjected to various force systems. Spring, 1983.

Prerequisites: Integral calculus and statics.

364. Engineering Materials (3)

Two hours of lecture and one three-hour laboratory per week. An introduction to the study of materials science emphasizing the structure and properties of materials used in the construction industry in general. Lab work includes fabrication, testing, and evaluation of actual systems. Spring, 1983.

Prerequisites: Junior standing, physics, chemistry, and engineering mechanics.

371. Surveying for Engineers (3)

Two hours of lecture and recitation and three hours of laboratory. The principles of plane surveying for engineers. Subject matter areas include introduction to the theory of measurement and errors. Linear and angular measurements in both the horizontal and vertical planes, traversing and computations, horizontal and vertical control and associated computations, areal and volumetric computation, circular and parabolic curves, state plane coordinates, public land surveys, and the analysis and treatment of systematic and random errors. Laboratory field work and computations culminate in a topographic map. Fall, 1982.

Prerequisites: Differential and integral calculus.

375. Elementary Corrosion (1)

One hour of lecture. Basic electro-chemistry, film formation and passivation, galvanic corrosion and pitting, cathodic and anodic protection, protective coatings and inhibitors. Application of the above in the home, car, field, at sea, and in industrial plants. Spring, 1983.

377. Process Control (3)

Three hours of lecture. The study of the principles of process control both with and without electronic computers. The emphasis is on sensing and control elements, signal transmission, non-computerized controllers, conversion of signals to digital input for computer programs, control problems such as lag and errors, and applications with emphasis on the paper industry. Spring, 1983.

Prerequisite: College level physics.

420. Computer Applications in Science and Engineering (3)

Principles and methods of mathematical modeling for analog and digital computer solution. Applications to data reduction and correlation, statistical analysis, process and equipment simulation, optimization and control, and computer-assisted instruction. Typical examples, class problems and student projects. Current status and future projection of computation equipment, software and operating techniques. Fall or Spring, 1982-83.

Prerequisites: Calculus and computer programming, or permission of the instructor.

440. Water Pollution Engineering (3)

Two hours of lecture and three hours of laboratory. Introduction to the physical, chemical, and biological parameters of waste water treatment processes and to the principles of the unit operations involved. Study of the design parameters and design procedures of waste water treatment systems. Spring, 1983.

Prerequisites: Physics and CHE 356 or equivalent.

441. Air Pollution Engineering (3)

Three hours of lecture and discussions. Study of the chemical, physical and meteorological principles of air pollution and its control. Local and global effects of air pollution. The atmospheric survey. Examination of the operating principles and design parameters of the various air pollution control systems. Air quality and emission standards. Spring, 1983.

Prerequisites: Physics and CHE 356 or equivalent.

488. Engineering Economics (1)

One hour of lecture and three hours of laboratory; first half of semester. This course provides students with the tools to understand the economic aspects of engineering and to evaluate engineering proposals in terms of worth and cost. Coverage extends through alternatives analysis, using rate of return, present worth, average annual cost and other methods, and evaluation of public activities, focusing on benefit-cost analysis. Spring, 1983.

496. Special Topics (1-3)

Lectures, readings, problems, and discussions. Topics as announced in the areas of environmental or resource engineering. Fall and/or Spring, 1982-83.

563. Photogrammetry I (3)

Two hours of lecture and discussion, three hours of laboratory and discussion. Basic photogrammetric and photo interpretation concepts as a means of acquiring reliable data for engineering and management planning. Potentials, limitations, instrumentation and unique requirements are considered. Fall and Spring, 1982-83.

Prerequisite: ERE 371 or equivalent.

585. Microscopy and Photomicrography (3)

Two hours of lecture, one hour of demonstration, and three to five hours of laboratory. Principles of light microscopy and photomicrography with extensive laboratory practice. Introduction to scanning and transmission electron microscopy. Fall, 1982.

Prerequisite: Permission of the instructor.

596. Special Topics (1-3)

Lectures, conferences, discussions, and laboratory. Topics in environmental and resource engineering not covered in established courses. Designed for the beginning graduate student or selected upper division undergraduate. Fall and/or Spring, 1982-83.

610. Energy: Alternate Systems (3)

Three hours of lecture. An introduction to alternate energy resources and conversion processes. Focus is on relatively small-capacity, decentralized systems and means for judging appropriateness, costs, and impacts of application under varying conditions and needs. Fall, 1982.

611. Energy: Production and Conservation (3)

Three hours of lecture. An introduction to the technology, impacts, hazards, and costs of large-scale, centralized power generation, with emphasis on opportunities for resource conservation. Spring, 1983.

640. Water Resource Systems (3)

Three hours of lecture and discussion. Fundamentals of the systems approach to complex water resource problems. Characteristics of water resource systems, related to systems engineering methodologies. Quantitative and qualitative subsystems are considered in a technical nature which exposes the socio-legal-political interfaces of water resource decisionmaking. Spring, 1983.

Prerequisite: FEG 340 or equivalent.

643. Water Pollution Engineering (3)

Two hours of lecture and three hours of laboratory. Introduction to the physical, chemical, and biological parameters of waste water treatment processes and to the principles of the unit operations involved. Study of the design parameters and design procedures of waste water treatment systems. Spring, 1983.

Prerequisites: Physics and CHE 356 or permission of the instructor.

Note: A student may not enroll in or receive credit for both ERE 440 and ERE 643.

652. Remote Sensing Interpretation (3)

Two hours of lecture and three hours of laboratory. Introduction with a qualitative emphasis on the fundamentals of acquiring, analyzing, and utilizing remote sensing data in the performance of natural resource inventories, environmental quality surveys, site development studies and land use analyses. Oriented for multidisciplinary participation. Fall and/or Spring, 1982-83.

Prerequisites: Physics and calculus or permission of the instructor.

Note: Not open to students having previous credit for FEG 352.

655. Remote Sensing Measurements (3)

Two hours of lecture comprising an in-depth coverage of the theory, design, and application of remote sensing systems and techniques employed to obtain precise spectroradiometric measurements to map and monitor natural resources. Photographic and non-photographic systems are considered. Laboratory experiments in the form of an assignment using remote sensing data. Fall or Spring, 1982-83.

Prerequisites: ERE 572 and FEG 363 or ERE 563 or consent of the instructor.

658. Geometric Geodesy (3)

An introductory graduate level course for those without previous background in theoretical geodesy. Topics covered include position determination for short and long lines on the ellipsoid, the ellipsoidal triangle, the parametric equations, three-dimensional geodesy, and mappings of the ellipsoid. Fall, 1982.

Prerequisite: Permission of the instructor.

659. Astronomic and Gravimetric Geodesy (3)

An introductory graduate level course in geodetic astronomy and the gravity field of the earth. Topics covered include updating star positions; precise time keeping; position determination by natural and artificial satellites; the fundamental concepts of gravimetric geodesy, including the potential function; attraction; undulations of the geoid and deflections of the vertical. Fall, 1982.

Prerequisite: ERE 658.

660. Theory of Errors and Adjustments (3)

The theory of errors and adjustments, of observations oriented toward geodesy and photogrammetry. Topics include error definitions, weighted observations, method of least squares, matrix algebra in adjustments, variance-covariance matrix, the error ellipse and the general case of adjustment. Fall or Spring, 1982-83.

Prerequisites: Calculus and a beginning course in statistics.

664. Photogrammetry II (3)

Two hours of lecture and three hours of laboratory. General analytic photogrammetry including interior and exterior orientation systems, intersection, space resection and orientation. Correction of photo coordinates for film deformation, lens distortions, atmospheric refraction and earth curvature. Introduction to photogrammetric plotters. Planning photogrammetric projects, and designing optimum procedures for selected photogrammetric tasks. Fall, 1982.

Prerequisite: ERE 563 or equivalent.

670. Principles of Pulping and Bleaching (3)

Two hours of lecture and three hours of laboratory plus literature study of assigned topics, independent project planning and/or laboratory study. Discussion of pulping and bleaching processes. Effects of chemical and physical variables on the wood components and pulp properties; chemistry involved. Experiments in pulping and bleaching and pulp evaluation. Fall, 1982.

Prerequisites: Organic, physical, and analytic chemistry.

Note: A student may not enroll in or receive credit for both PSE 461 and ERE 670.

671. Chemistry of Pulping and Bleaching (3)

Three hours of lecture. Discussion of the chemistry underlying the commercial pulping and bleaching processes, designed to assist in interpreting the phenomena observed in these operations. Emphasis is placed on those reactions which contribute to delignification and the removal of chromophoric groups in lignin and extractives. Spring, 1983.

Prerequisite: FCH 572 or permission of the instructor.

672. Selected Topics in Colloid and Surface Science (3)

Three hours of lecture, discussions, and problem solving. The following topics will be covered: 1) viscosity of dilute dispersions, 2) osmotic and equilibrium, 3) light scattering, and 4) surface tension. Fall, 1982.

Prerequisites: Two semesters of physical chemistry and permission of instructor.

673. Selected Topics in Colloid and Surface Science (3)

Three hours of lecture, discussions, and problem solving. The following topics will be covered: 1) absorption from solution and at Gas-Solid interface, 2) electrical double layer, 3) Van der Waals attraction and flocculation, and 4) electrophoresis, zeta potential, and electro-osmosis. Fall, 1982.

Prerequisites: Two semesters of physical chemistry and permission of the instructor.

675. Principles of Unit Operations (4)

Three hours of lecture and discussion and one two-hour computation period. Fundamentals of fluid dynamics, heat and mass transfer, appropriate analogies and process applications. Stage operations and computation methods. Application to distillation, extraction, gas absorption, evaporation, crystallization and drying. Design, operation, and computer simulation of equipment. Fall, 1982.

Prerequisites: Calculus and physical chemistry or permission of the instructor.

677. Paper Properties (4)

Three hours of lecture, three hours of laboratory, and discussion plus evaluation of literature, independent project planning and/or laboratory study. Evaluation and study of the physical, optical, and chemical properties of paper and the interrelationships existing between paper manufacturing methods, papermaking additives, test results and the ultimate properties desired in the finished paper. Fall, 1982.

Prerequisite: Permission of the instructor.

Note: A student may not enroll in or receive credit for both PSE 465 and ERE 677.

678. Paper Coating and Converting (3)

Two hours of lecture and three hours of laboratory plus evaluation of literature, independent project planning, and/or laboratory study. Evaluation and study of the various coating materials and processes used by the paper industry. Introduction to polymers and their use in converting operations. Study of materials and equipment used in converting operations, fundamentals and parameters which control their use, effects on final properties of papers. Spring, 1983.

Prerequisite: PSE 465 or permission of the instructor.

Note: A student may not enroll in or receive credit for both PSE 466 and ERE 678.

680. The Anatomy and Ultrastructure of Wood (2)

Two hours of lecture and/or demonstration and discussion. The gross, microscopic and submicroscopic structure of wood including organization of the cell wall, distribution of chemical constituents and abnormalities in wood. Fall, 1982.

682. Transport Processes (3)

Two hours of lecture and three hours of laboratory. The relationship between wood structure and wood permeability, moisture movement, and heat transfer. Fire retardant and wood preservation treatments. Wood drying. Unsteady-state transport processes. An advanced laboratory problem with report in wood-moisture relationships, wood drying, the relationship between wood permeability and treatability, or wood preservative treatments. Spring, 1983.

Prerequisite: Permission of the instructor.

Note: A student may not enroll in or receive credit for WPE 326 or WPE 327 and ERE 682.

683. Structure and Properties of Engineering Materials (3)

Three hours of lecture and discussions. Study of the mechanical, thermal, electronic, and magnetic behavior of metals, ceramics, polymers, and composite materials relating internal structure and engineering properties. "Internal structure" may range from subatomic, atomic, and molecular levels through the structure of crystals and amorphous solids up to the macro-structure of multiphase and composite materials. Spring, 1983.

Prerequisite: Permission of the instructor.

684. Mechanical Properties of Wood (3)

Two hours of lecture and three hours of laboratory. The effect of the anatomical and chemical nature of wood on its response to static and dynamic force systems. The theory of elasticity as applied to wood and wood-based composites. Fall or Spring, 1982-83.

Prerequisite: Permission of the instructor.

685. Applied Electron Microscopy (5)

Two hours of lecture, two hours of laboratory/demonstration, minimum of ten hours of individual laboratory. The theory and operation of the transmission electron microscope including specimen preparation, photographic technique and interpretation of micrographs. Fall, 1982.

Prerequisite: Consultation with the instructor.

686. Wood-Water Relationships (3)

Two hours of lecture and three hours of laboratory. Relationship between wood moisture content and the environment, electrical and thermal properties, theories of moisture sorption, hygroscopic swelling and shrinking, thermodynamics of moisture sorption, mechanism of moisture movement as it relates to activation theory. Laboratory exercises will complement the theoretical topics discussed in the lecture. Fall, 1982.

Prerequisite: Permission of the instructor.

688. Tropical Timbers in Commerce (2)

Two hours of lecture. Introduction to the commercial use of tropical timbers; the factors of forest conditions, stand types and wood qualities influencing their utilization and the development of trade. Sources of information. Spring, 1983.

Prerequisite: Permission of the instructor.

689. Tropical Wood Anatomy (1)

Anatomical characters, identification and taxonomy of tropical woods important in commerce. Spring, 1983.

Prerequisite: WPE 387 or ERE 360. Recommended that ERE 688 be taken concurrently or previously.

691. Air Pollution Engineering (3)

Three hours of lecture and discussion. Study of the chemical, physical, and meteorological principles of air pollution and its control. Local and global effects of air pollution. The atmospheric survey. Examination of the operating principles and design parameters of the various air pollution control systems. Air quality and emission standards, Spring, 1983.

Prerequisites: Physics and CHE 356 or permission of the instructor.

Note: A student may not enroll in or receive credit for both ERE 441 and ERE 691.

760. Analytical Photogrammetry I (3)

Two hours of lecture and three hours of laboratory. Mathematical theory of photogrammetry including space resection, orientation, intersection and aerial triangulation. Fall or Spring, 1982-83.

Prerequisites: FEG 363, APM 360 and FEG 464 or equivalent.

762. Instrumental Photogrammetry I (3)

Two hours of lecture and three hours of laboratory. The theory and practice of extracting information from photographs with the aid of photogrammetric plotters. Fall or Spring, 1982-83.

Prerequisite: FEG 363 or equivalent.

775. Applied Thermodynamics (3)

The study and application of thermodynamics, including the first and second law, phase relationships, thermochemistry, the production of work and equilibrium relationships. Fall or Spring, 1982-83.

Prerequisites: FCH 360, FCH 361 or equivalent.

785. Scanning Electron Microscopy (3)

Two hours of lecture, demonstration and laboratory. Six hours of independent laboratory experience. The theory and operation of the scanning electron microscope including specimen preparation, photographic technique, and interpretation of micrographs. Spring, 1983.

Prerequisite: Permission of the instructor.

796. Advanced Topics (1-3)

Lectures, conferences, discussions, and laboratory. Advanced topics in Forest Engineering, Paper Science and Engineering, and Wood Products Engineering. Fall and/or Spring, 1982-83.

Prerequisite: Permission of the instructor.

797. Seminar (1-3)

I. Forest Engineering topics. II. Paper Science and Engineering topics. III. Wood Products Engineering topics. Fall and Spring, 1982-83.

798. Research in Environmental and Resource Engineering (Credit hours to be arranged)

I. Independent research topics in Forest Engineering. II. Independent research topics in Paper Science and Engineering. III. Independent research topics in Wood Products Engineering. Fall and Spring, 1982-83.

880. Interpretation of Cellular Ultrastructure (2)

One hour of lecture and two hours of demonstration and discussion. The organization and sculpturing of the walls of plant cells; the cellulose microfibril, matrix and incrusting substances, and the warty layer. The ultrastructure and function of cytoplasmic organelles in cells. The nucleus, the mitochondrion, the chloroplast, the endoplasmic reticulum, microtubules, the gap junction and the tight junction. The tools and techniques used for light and electron microscopic study of cells, and the interpretation of structural evidence. Directed study and discussion of the latest (current) literature on pertinent topics. Spring, 1983.

Prerequisite: Permission of the instructor.

899. Master's Thesis Research (Credit hours to be arranged)

Research and independent study for the master's degree and thesis. Fall and Spring, 1982-83.

999. Doctoral Thesis Research (Credit hours to be arranged)

Research and independent study for the doctoral degree and dissertation. Fall and Spring, 1982-83.

ESF—NONDEPARTMENTAL

332. Seminar for New Transfer Students (No Credit)

One hour of weekly lectures and discussions designed to introduce the transfer student to the College and its academic and social environs. Fall and Spring, 1982-83.

EST—ENVIRONMENTAL STUDIES

100. Introduction to Environmental Studies (3)

Lecture and discussion on the nature of man, his social, cultural, economic and political institutions and how these condition his views of the environment. Fall, 1982.

498. Undergraduate Problem (1-3)

Interdisciplinary research designed to solve environmental problems. Selection of subject matter to be determined by students in conference with the Undergraduate Environmental Studies Advisory Group. Problem analysis and programs for solution in the form of a final report required. Fall and/or Spring, 1982-83.

Prerequisite: Permission of the instructor.

FBL—BIOLOGY (FOREST BIOLOGY)

303. Introductory Environmental Microbiology (4)

Three hours of lecture and three hours of laboratory. An introduction to the biology of microorganisms and viruses and a study of their interactions with other microbes and macroorganisms. Fall, 1982.

Prerequisite: A year course in biology or equivalent.

320. General Ecology (3)

Two hours of lecture, three hours of field trips during the first half of the semester. Three hours of lecture during the second half of the semester. Introduction to ecosystem ecology stressing the dynamic interrelationships of plant and animal communities with their environments, ecological factors, energy flow and trophic levels in natural communities, plant responses and animal behavior, population dynamics, biogeography, and representative ecosystems. The ecological impact of man is reviewed. Spring, 1983.

Prerequisite: A year course in biology or equivalent.

330. Principles of General Physiology (3)

Three hours of lecture. Introduction to the dynamics of living systems with emphasis on the universality of the biological world. Spring, 1983.

Prerequisite: One semester of organic chemistry.

400. Forest Techniques for Biologists (1)

Full-time for one week. Cranberry Lake Biological Station. Techniques of forest stand inventory and measurements; mensurational analysis; stand manipulation, harvesting, regeneration, and protection. Summer, 1983.

405. History of Natural Science (1)

One hour of lecture. A review of the history of western science from pre-Ionian times to Darwin, with evaluation of the impact of culture and religion on scientific progress. Spring, 1983.

420. Field Experience—Internship (5)

Full-time for at least five weeks, or equivalent, of employment with an agency or professional involved in field activity. A resident faculty member is required to serve as course evaluator. Approval of curriculum director is necessary. See advisor for detailed procedural information. Summer, 1983.

421. Ecology of Freshwaters (2)

Half-time for four weeks. Cranberry Lake Biological Station. Experimental and observational studies of environmental and biotic interactions influencing productivity of freshwaters. Basic concepts at the organismic, population, and community level. Summer, 1983.

430. Fungal Physiology (3)

Three hours of lecture and discussion. Principles of growth, morphogenesis, and reproduction of the fungi emphasizing the role of the environment in controlling fungal processes. Spring, 1983.

Prerequisite: FBL 330 or equivalent.

431. Fungal Physiology Laboratory (1)

Three hours of laboratory. Selected experiments in the quantitative study of fungal growth, nutrition, sporulation, and spore germination. Spring, 1983.

Co-requisite: FBL 430.

432. Physiological Ecology of Plants (3)

Three hours of lecture. Examination of the interactions between plants and their environment. Emphasis will be given to the physiology of plants as it is modified by fluctuating external conditions and the mechanisms of plant adaptation. Students completing FBO 432 should not enroll in FBO 330. Spring, 1983.

Prerequisites: Introductory courses in physics, FBO 300, or permission of the instructor.

470. Principles of Genetics (3)

Three hours of lecture and discussion. A general course covering concepts of genetics and evolution base to upper division biology and biochemistry courses. Includes the inheritance and analysis of Mendelian and quantitative traits, the chemical nature of the gene and its action, the genetic structure of populations and their evolution. Numerical methods for characterizing and analyzing genetic data are introduced. Spring, 1983.

Prerequisite: A one-year college introductory biology course.

471. Principles of Genetics Laboratory (1)

Three hours of autotutorial laboratory. Experiments with plants and animals and computer simulation exercises demonstrate the basic principles of inheritance of Mendelian and quantitative traits and changes in populations caused by major forces in evolution or by breeding procedures. Numerical methods for characterizing quantitative traits and for testing hypotheses are introduced. Spring, 1983.

Co-requisite: FBL 470 or equivalent.

472. Introduction to Quantitative and Population Genetics (1)

Ten lecture-discussions and four autotutorial laboratories the second half of the semester (incl. Lecture-Lab Modules 5 and 6 of FBL 470 and 471). Basic genetic concepts of quantitative inheritance, the structure of populations and evolution. Laboratory experiments and computer simulations are used to demonstrate these concepts. Numerical methods for characterizing and analyzing genetic data are introduced. Spring, 1983.

Prerequisite: An introductory genetic lecture-laboratory course deficient in these areas of genetics and permission of the instructor.

Note: Not open to students taking FBL 470 and 471.

496. Topics in Biology (1-3)

Experimental, interdisciplinary, or special coursework in biology for undergraduate students. Subject matter and method of presentation varies from semester to semester. May be repeated for additional credit. Fall or Spring, 1982-83.

497. Undergraduate Seminar (1)

Literature surveys and seminars on topics of biological interest and importance. Subject to be generated by faculty and students and to be announced prior to registration. Fall and Spring, 1982-83.

498. Research Problem in Biology (1-3)

Independent research in topics in Forest Biology for the superior undergraduate student. Selection of subject area determined by the student in conference with appropriate faculty member. Tutorial conferences, discussions and critiques scheduled as necessary. Final written report required for departmental record. Fall, Summer and/or Spring, 1982-83.

Prerequisite: Permission of the instructor.

500. Forest Biology Field Trip (2)

A seven- to ten-day trip to (1) agencies engaged in biological research, management, and administration, or (2) regions or areas of unusual biological interest. A final report is required. Estimated student expense, \$75. Fall or Spring, 1982-83.

Prerequisite: Permission of the instructor.

522. Populations Ecology (3)

Two hours of lecture and three hours of laboratory. Description, analysis, evolution, interactions and stability of natural and experimental populations. Spring, 1983.

Prerequisite: FBL 320 or equivalent.

525. Limnology (3)

Three hours of lecture. An introduction to the physics, chemistry, and biology of inland waters, with particular emphasis on lakes. The course focuses on lakes as integrated ecosystems, and analyzes perturbations in this environment on the structure and function of the biological communities contained therein. Fall, 1982.

Prerequisites: An introductory course in physics, chemistry, and ecology.

526. Limnology Laboratory (1)

One laboratory or field trip. An introduction to limnology techniques and the procedures for empirically analyzing ecological relations in aquatic ecosystems. Field trips to local aquatic habitats. FBL 525 must be taken concurrently or previously. Fall, 1982.

530. Microbial Ecology (3)

Two hours of lecture and three hours of laboratory. Applied and environmental aspects of microbiology with emphasis on biochemical interactions. Examining microbial processes and interrelationships in aquatic and terrestrial ecosystems. Spring, 1983.

540. Chemical Ecology (3)

Two hours of lecture and one hour of discussion. A treatment of biological phenomena incorporating elements of ecology, physiology, and chemistry as a basis for development, behavior, and survival. Emphasis is on the intra- and inter-specific relationships involving chemical messengers at the organismal, population, and community levels. Spring, 1983.

Prerequisites: Organic chemistry, general ecology, general physiology.

Note: FBL 540 is also listed as FCH 540.

627. Wetland Ecology (2)

One hour of lecture and one field trip or discussion session. A study of the status, ecology, value, use and regulation of wetlands in the Northeast and emphasis on freshwater areas. Fall, 1982.

Prerequisite: A course in general ecology.

635. Membranes and Biological Transport (3)

Two hours of lecture and one hour of discussion. Composition, structure, and physical properties of membranes. Membrane functions including transport, bioelectricity, and cell compartmentalization. Specific transport processes in biological systems. Fall, 1982.

Prerequisites: One semester of biochemistry and an advanced physiology course, or permission of the instructor.

796. Topics in Biology (1-3)

A course offered by the faculty for students interested in biology. Check the Schedule of Courses for details. Fall and Spring, 1982-83.

898. Professional Experience (1-12)

Professional experience which applies, enriches, and/or complements formal coursework. Graded on an "S/U" basis. Fall, Spring, and Summer, 1982-83.

899. Master's Thesis or Project Research (1-12)

Investigation leading to the completion of a research-oriented thesis or to an application-oriented project. Graded on an "S/U" basis. Fall, Spring, and Summer, 1982-83.

- 997. Biology Seminar** (1)
One hour of lecture and discussion. The course emphasizes current concepts and developments in biology. Fall and/or Spring, 1982-83.
- 999. Doctoral Thesis Research** (1-12)
Investigation leading to the completion of the doctoral thesis. Graded on an "S/U" basis. Fall, Spring, and Summer, 1982-83.

FBO—BOTANY (FOREST BOTANY AND PATHOLOGY)

- 300. Structure and Function of Plants** (3)
Two hours of lecture and three hours of laboratory in the Autotutorial Learning Center. An introduction to plant biology with special emphasis on the structure and functions of the green plant. Fall, 1982.
Prerequisite: A year course in biology or equivalent.
- 305. Dendrology** (2)
One hour of lecture and one three-hour laboratory/field trip. Field study, identification, and major characteristics of important forest trees of North America. Open only to students in the Forest Engineering curriculum. Fall, 1982.
- 310. Classification of the Plant Kingdom** (3)
Two hours of lecture and three hours of laboratory. Introductory study of the plant kingdom with emphasis on the angiosperms. Spring, 1983.
- 315. Dendrology I** (3)
Two hours of lecture and one three-hour laboratory/field trip. Field study, identification, natural history, and elementary silvics of important forest trees of North America. Fall, 1982.
- 330. Plant Nutrition** (3)
Three hours of lecture. Descriptive aspects of the fundamental activities of plants. Subjects to be covered include cell structure, water and mineral metabolism, organic nutrition, and a brief introduction to biological control mechanisms. Will not satisfy the plant physiology requirement of botany majors. Spring, 1983.
Prerequisite: FBO 300 or equivalent.
- 360. Forest and Shade Tree Pathology** (3)
Two hours of lecture and three hours of autotutorial laboratory. Major diseases of forest, shade, and ornamental trees and deterioration of forest products will be discussed with emphasis on disease identification, principles of disease development, effects of disease on the host and practical control measure. Spring, 1983.
- 415. Dendrology II** (1)
One three-hour field trip/laboratory. A continuation of Dendrology I emphasizing trees and shrubs ecologically important in the Central New York region and economically important in North America. Fall, 1982.
- 417. Adirondack Flora** (2)
Half-time for four weeks. Cranberry Lake Biological Station. Field study of the summer flora of the Adirondack Mountains. Summer, 1983.
- 422. Ecology of Forest Communities** (2)
Half-time for four weeks. Cranberry Lake Biological Station. Study of the structural and functional characteristics of selected Adirondack forest ecosystems; techniques of vegetational analysis. Special requirement: students must be prepared to go on one over-night camping trip to an isolated study area. Summer, 1983.

- 425. Plant Ecology** (3)
Two hours of lecture and discussion and one laboratory session. A first course in plant community ecology dealing with the dynamics of community development and change and the process of community analysis and description. Fall, 1982.
Prerequisite: FBL 320.
- 427. Bryoecology** (3)
Two hours of lecture and one three-hour laboratory or field trip. A study of the taxonomic diversity and ecological adaptations of Bryophytes in regional ecosystem. Spring, 1983.
- 428. Wetland Plant Ecology** (1-2)
Full-time for one week. Cranberry Lake Biological Station. Study of wetland plant community dynamics and environmental relationships in the Adirondack Mountain Region. Summer, 1983.
- 432. Physiological Ecology of Plants** (3)
Three hours of lecture. Examination of the interactions between plants and their environment. Emphasis will be given to the physiology of plants as it is modified by fluctuating external conditions and the mechanisms of plant adaptation. Students completing FBO 432 should not enroll in FBO 330. Fall, 1982.
Prerequisites: Introductory courses in physics, FBO 300, FBL 320, or permission of the instructor.
- 460. Field Problems in Forest Pathology** (1)
Full-time for one week. Cranberry Lake Biological Station. Field study of important tree diseases in the Adirondacks, including heart-rots, root-rots, cankers, rusts, foliage diseases, mistletoe, and physiological diseases. Also field study of mycorrhizae and other tree-root mutualisms. Summer, 1983.
- 461. Principles of Forest Pathology** (3)
Three hours of lecture, discussion or laboratory. Concepts and principles of tree diseases in relation to forest practices and practical experience in disease diagnosis and impact evaluation. Fall, 1982.
Prerequisite: FBO 360 or permission of the instructor.
- 465. Field Mycology** (2)
Half-time for four weeks. Cranberry Lake Biological Station. An introduction to the collection and identification of the Adirondack fungal flora. Field techniques and laboratory identification of the major fungi found in selected ecosystems. Summer, 1983.
- 490. Plant Propagation** (1)
One combined lecture-demonstration-laboratory plus supervised greenhouse assignments. Instruction in principles and practices of plant propagation and in related greenhouse operations. Fall and Spring, 1982-83.
Prerequisite: Senior status in biology curriculum.
- 510. Mycology** (3)
Three hours of lecture and six hours of laboratory. Fundamentals of the morphology, taxonomy, cytology, life histories, and ecology of fungi. Fall, 1982.
Prerequisite: One year of biology.
- 515. Systematic Botany** (3)
Two hours of lecture and three hours of laboratory. Identification, nomenclature, and classification of flowering plants with special emphasis on local flora and on developing the ability to classify the plants of any region. Fall, 1982.
Prerequisites: FBO 300, FBO 310 or permission of the instructor.

530. Plant Physiology (3)

Three hours of lecture. Internal processes and conditions in higher plants with emphasis on physiological and biochemical concepts. For students majoring in the biological sciences. Spring, 1983.

Prerequisites: FBO 300, FBL 330, or permission of the instructor.

Note: Botany majors electing this course for their concentration must also take FBO 531.

531. Plant Physiology Laboratory (1)

One laboratory session. Introduction to methods and procedures of physiological research. Spring, 1983.

Co-requisite: FBO 530, or permission of the instructor.

562. Wood Microbiology (3)

Two hours of lecture and three hours of laboratory/field trip. Major types of fungus defects of wood and its products and principles of control. Special emphasis on chemistry of wood decay, wood durability, toxicants, lumber discolorations, heart-rots and decay in forest products. Fall, 1982.

Prerequisites: Organic chemistry, FBO 360, or permission of the instructor.

585. Plant Anatomy (3)

Two hours of lecture and three hours of laboratory. An introductory course in plant anatomy designed to familiarize the student with the organization and development of the primary and secondary plant body of higher plants. Spring, 1983.

Prerequisite: FBO 300.

600. Plant Virology (3)

Three hours of lecture. The structure function, and replication of virus particles. Transmission mechanisms, vector relationships, symptomatology, and disease control strategies also will be covered in detail. Spring, 1983.

Prerequisites: Two courses in general biology plus organic chemistry or permission of the instructor.

601. Plant Virology Laboratory (2)

Four hours of laboratory. Methodologies necessary to manipulate viruses and to identify and fully characterize virus unknowns will be presented. Spring, 1983.

Prerequisite: FBO 600 or permission of the instructor.

625. Plant Ecology (3)

Two hours of lecture and discussion and one laboratory/discussion. A first course in plant community ecology for beginning graduate students focusing on dynamics of community development and change and the processes of community analysis and description. Fall, 1982.

Prerequisite: FBL 320, or equivalent.

630. Fungus Physiology (3)

Two hours of lecture and one hour of discussion. Principles of growth, reproduction, and differentiation of the fungi emphasizing the role of the environment in controlling fungal processes. Spring, 1983.

Prerequisite: Two semesters of physiology or biochemistry.

636. Photosynthesis (3)

Two hours of lecture and one hour of discussion. Advanced study of photosynthesis on the cellular and organismal level. Specific topics will reflect basic concepts and current emphasis in this field. Fall (odd years), 1983.

Prerequisite: Two semesters of physiology or a course in biochemistry.

660. Phytopathology (3)

Two hours of lecture and discussion and three hours of autotutorial laboratory. Principles and concepts of plant pathology. Major diseases of ornamental plants, vegetable crops, fruit crops, field crops, and trees. This is an introductory plant pathology course for graduate students in all departments. Spring, 1983.

- 661. Principles of Forest Pathology (3)**
 Four hours of lecture, discussion, and laboratory. Concepts and principles of tree diseases in relation to forest practices and practical experience in disease diagnosis and impact evaluation. Fall, 1982.
Prerequisite: FBO 360, 660, or permission of the instructor.
- 665. Principles and Practices of Tree Disease Control (3)**
 Two hours of lecture and three hours of laboratory or discussion. An advanced course considering the major chemical, cultural, and biological practices and integrated disease management strategies for tree disease control. Spring, 1983.
Prerequisites: FBO 510, 461, or permission of the instructor.
- 725. Topics in Plant Ecology (2)**
 Two hours of seminar and discussion. An advanced course dealing with current research in plant community dynamics. May be repeated for additional credit. Fall, 1982.
Prerequisite: FBO 425 or 625 or permission of the instructor.
- 733. Techniques in Plant Physiology (2-4)**
 Comprehensive study of techniques essential for research in plant physiology. Students may choose the instructors they wish to work with, and should consult the instructors for further details. May be repeated for credit in different specialties. Fall, 1982.
Prerequisites: FBO 530 and 531 or an equivalent physiology course, biochemistry with laboratory, or permission of the instructor.
- 761. Topics in Phytopathology (3)**
 Two two-hour lectures and discussions. Discussions of specific subjects in phytopathology and wood microbiology. Topic selection is based on availability of expertise and will be announced in advance. This course may be repeated for credit in different specialties. Fall or Spring, 1982-83.
- 763. Mycorrhizae (3)**
 Two hours of lecture and three hours of laboratory/discussion. A basic background course covering structural, functional, and ecological aspects of mycorrhizae; their methods of field and laboratory study; and applications in forestry practice. Fall (odd years), 1983.
- 797. Botany Seminar (1)**
 Seminar discussions of subjects of interest and importance to the biology of plants. Fall and Spring, 1982-83.
- 798. Research in Forest Botany (Credit hours arranged according to nature of problem)**
 Advanced study in research problems in forest pathology, wood deterioration, tree physiology, anatomy, mycology, ecology, taxonomy, and genetics. Typewritten report required. Fall and Spring, 1982-83.
- 810. Advanced Mycology, Homobasidiomycetes (3)**
 Review of selected literature as well as laboratory training in identification and research techniques. Fall, 1982.
Prerequisite: FBO 510.
- 811. Advanced Mycology, Heterobasidiomycetes (3)**
 Review of selected literature as well as laboratory training in identification and research techniques. Spring (even years), 1984.
Prerequisite: FBO 510.
- 812. Advanced Mycology, Ascomycetes (3)**
 Review of selected literature as well as laboratory training in identification and research techniques. Fall (even years), 1982.
Prerequisite: FBO 510.

- 813. Advanced Mycology, Myxomycetes, Phycomycetes, Fungi Imperfecti (3)**
Review of selected literature as well as laboratory training in identification and research techniques. Spring (odd years), 1983.
Prerequisite: FBO 510.
- 830. Physiology of Growth and Development (2)**
Lecture. A study of the growth and development of plants and the physiological and biochemical processes that influence the development of form and structure in higher plants. Fall (even years), 1982.
Prerequisites: FBO 530, 585, and organic chemistry or permission of the instructor.

FCH—CHEMISTRY

- 222. Organic Chemistry Laboratory I (1)**
One three-hour laboratory. Laboratory techniques in organic chemistry. Melting points, distillation, recrystallization, extraction, column and thin layer chromatography, natural product isolation. Qualitative functional group analysis. Fall, 1982.
- 223. Organic Chemistry II (3)**
Two hours of lecture, one hour of recitation. A study in depth of the reactivity characteristics of the various classes of carbon compounds. The relation of chemical reactivity and physical properties to electronic and three-dimensional characteristics of carbon compounds. Spring, 1983.
Prerequisite: One semester of organic chemistry.
- 224. Organic Chemistry Laboratory II (1)**
One three-hour laboratory. Continuation of FCH 222. Simple physical, quantitative, and instrumental techniques applied to organic chemistry. Gas chromatography, polarimetry, kinetics. Introduction to synthesis. Spring, 1983.
Prerequisite: FCH 222 or equivalent.
Co-requisite: FCH 223 or equivalent.
- 225. Organic Chemistry I (3)**
Two hours of lecture, one hour of recitation. A survey of representative classes of carbon compounds with emphasis on structure, fundamental reactivity, and other important properties and characteristics relevant to biological systems. Fall, 1982.
- 226. Organic Chemistry II (3)**
Three hours of lecture and discussion. The structure and reactivity of organic compounds, utilizing natural products as examples, will be studied in order to develop an organic chemical background for further study of biological chemistry. Spring, 1983.
Prerequisite: FCH 225 or equivalent.
- 325. Organic Chemistry III (4)**
Two hours of lecture, one six-hour laboratory. Classical and recent literature synthesis of organic compounds, employing advanced techniques. Fall, 1982.
Prerequisite: Two semesters of elementary organic chemistry.
- 360. Physical Chemistry (3)**
Three hours of lecture. Includes discussion on the properties of gases and liquids, laws of thermodynamics, solutions and colligative properties, and electrochemical cells. Fall, 1982.
Prerequisites: One year of college physics, differential and integral calculus.
- 361. Physical Chemistry (3)**
Three hours of lecture. Includes discussion on the structure of matter, principles of quantum mechanics, spectroscopy, and chemical kinetics. Spring, 1983.
Prerequisite: Physical Chemistry FCH 360 or the equivalent.

380. Instrumental Methods of Analysis (3)

Two hours of lecture and one three-hour laboratory. Lecture includes theory, applicability, and limitations of a number of current methods of instrumental analysis. Laboratory sessions provide practice with several of these techniques. Spring, 1983.

Prerequisites: General chemistry and quantitative analysis.

384. Spectrometric Identification of Organic Compounds (1-2)

Two hours of lecture and discussion. The first half semester (1 credit) will deal with common classes of organic compounds; the second half semester (1 credit) will deal with more complex structures. The use of complementary information from mass, infrared, nuclear magnetic resonance, and ultraviolet spectrometry will be applied to identification of organic natural products. Spring, 1983.

Prerequisites: Organic chemistry; one semester of advanced organic chemistry for second credit.

410. Topics in the Chemistry of Pollution (1-3)

Three hours of lecture. Discussion of some specific areas of current concern to the environmental chemist. Lectures by staff members supplemented by outside speakers from industry and governmental agencies. This course is taught in modules. Spring, 1983.

Prerequisites: Organic chemistry and permission of the instructor.

495. Introduction to Professional Chemistry (1)

The professional chemist and his relationships with industry, government, and universities. Employment opportunities for the chemist, professional organizations, and unions will be discussed. The selection of a senior research topic and a literature survey will be required. Fall, 1982.

Prerequisite: Senior status.

496. Special Problems in Chemistry (1-3)

An opportunity for a special problem, technique development, independent or unstructured study in an area related to the chemical profession. The work may be technical, professional, or interdisciplinary. Advisors outside this department may be solicited. A brief proposal must be presented for approval with specific arrangements outlined including faculty advisor and objectives of the study. Evidence of competence and appropriate effort is required for credit. A written report will be expected. Fall and Spring, 1982-83.

Prerequisite: Upper division status.

497. Undergraduate Seminar (1)

One hour per week. Literature surveys and seminars on topics of current research interest and recent advances in chemistry. Spring, 1983.

498. Introduction to Research (5)

Eighteen hours of laboratory, library search and report writing. Solution of a selected research problem using special laboratory techniques. Typewritten report on data, procedures, results, and conclusions. Spring, 1983.

510. Environmental Chemistry I (3)

Three hours of lecture. Introduction to the processes that control chemical behavior in aquatic environments, including precipitation, gas exchange, acid-base, redox, complexation, and adsorption reactions. Emphasis will be on explanation and prediction of chemical behavior, using computer models where appropriate. Examples will be from the areas of water and wastewater treatment, pollutant fates and geochemistry. Fall, 1982.

Prerequisites: An introductory course in physical chemistry is required and a shortcourse in computer programming is recommended.

511. Environmental Chemistry II (3)

Three hours of lecture. Includes a detailed chemical explanation of current topics of concern in environmental chemistry and the chemistry of pollution. Lectures will cover topics relating to air, soil and biota pollutional impact. Spring, 1983.

Prerequisite: Chemistry through physical chemistry, or consent of the instructor.

515. Methods of Environmental Chemical Analysis (3)

One hour of lecture and six hours of laboratory. An introduction to sampling, analytical and quality control procedures necessary to obtain reliable water quality data. All analyses will be performed on a single aquatic system with the purpose of developing a final report characterizing the water quality of that system. Fall, 1982.

Prerequisite: A course in quantitative chemical analysis.

519. Environmental Chemistry Seminar (1)

One hour of lecture. Seminars on current research and issues in environmental chemistry and related areas. Spring, 1983.

520. Nuclear and Radiation Chemistry (2)

The two one-hour lectures will cover the information required for the basic understanding of nuclear reactions, the types of radiation emitted, the instrumentation necessary to detect and measure this radiation, the principles of radioisotope tracer techniques, and radiation chemistry which is the effect of radiation on organic systems. Visits to the Cornell Reactor and the Nuclear Medicine Department of the Upstate Medical Center will be arranged. Spring, 1983.

Prerequisites: Physical, organic and inorganic chemistry or by permission of the instructor.

Note: This course can be taken independently of FCH 521.

521. Nuclear Chemical Techniques (1)

The laboratory will consist of one four-hour laboratory class every two weeks, with one hour to be made up at the student's discretion to accommodate counting periods which extend over several weeks. A short movie by the AEC each week will be required for the sixth hour. The laboratory will give each student the opportunity to use the individual counting instruments, gain experience in the handling and preparation of radioactive samples and the use of the 1000-curie-cobalt source in radiation chemistry. Spring, 1983.

Prerequisites: Physical, organic, and inorganic chemistry or permission of the instructor. Advanced tentative registration is required.

Co-requisite: FCH 520.

530. Biochemistry I (3)

Three hours of lecture. General biochemistry with emphasis on cellular constituents and metabolic reactions. The chemical, physical, and biological properties of amino acids, proteins, carbohydrates and their intermediary metabolism will be discussed. The chemistry of enzymes, energy transfers, and biological oxidations will also be covered. Fall, 1982.

Prerequisites: One year of organic chemistry and one year of physical chemistry.

531. Biochemistry Laboratory (2)

Six hours of laboratory. This course will stress techniques used in biochemical research. Techniques used include various types of chromatography, electrophoresis, and spectrophotometry and methods involved in the isolation, purification, and assay of enzymes. Fall, 1982.

Prerequisite: One semester of quantitative analysis with laboratory.

532. Biochemistry II (3)

Three hours of lecture. Topics discussed are: application of tracer techniques to biochemistry, the chemical and biochemical properties of lipids, theories on the origin of life, photosynthesis and the biosynthesis of steroids and terpenes, plant aromatics, amino acids, porphyrins and other aspects of nitrogen metabolism. Spring, 1983.

Prerequisites: FCH 530 and its prerequisites.

539. Principles of Biological Chemistry (3)

Three hours of lecture. Principles of biochemistry with emphasis on their relationship to biology. Topics include basic metabolic pathways, structure, and function of proteins, enzymes, and nucleic acids, energy relationships and biochemical control mechanisms. Nonchemistry majors. Fall, 1982.

Prerequisite: A two-semester course in organic chemistry is desirable, but a one-semester course is acceptable.

540. Chemical Ecology

This course is the same as FBL 540. Refer to description on page 73.

Note: Credit cannot be received for both FCH 540 and FBL 540.

550. Introduction to Polymer Science I: Polymer Synthesis and Mechanisms (3)

Three hours of lecture. Introduction to the synthesis of polymers and the mechanism of polymerization processes. Addition homopolymerization and copolymerization by radical, ionic and coordination type catalysts. Synthesis of block and graft copolymers. Stepwise polymerization, network formation and gelation. Structure of polymers and stereoregular polymerization. Degradation of polymers, reaction on polymers, polyelectrolytes. Fall, 1982.

Prerequisites: One year of organic chemistry and one year of physical chemistry.

551. Polymer Techniques (2)

One hour of lecture and discussion and three hours of laboratory; lab reports. Techniques of polymer preparation: free radical solution and emulsion polymerization, gel permeation. Molecular weight determination by light scattering, osmometry, viscosity, gel chromatography. Structure characterization by X-ray diffraction, electron microscopy, nuclear magnetic polarized microscopy, stress-strain and swelling equilibrium and thermal analysis. Fall, 1982.

Prerequisites: One year of organic and one year of physical chemistry.

552. Introduction to Polymer Science II: Polymer Properties and Technology (3)

Three hours of lecture. Introduction to the physical chemistry, physics, processing and technology of synthetic polymers. Polymer solutions, including molecular weight determinations and chain statistics. Polymer solid states, including rubber elasticity, viscoelasticity, the glassy state and the crystalline state. Properties, processing and technology of films, fibers, elastomers and foams. Spring, 1983.

Prerequisites: One year of organic chemistry and one year of physical chemistry.

555. Natural and Synthetic Polymers: An Overview (2)

Two hours of lecture. A series of 24 introductory lectures on all aspects of polymer science. The material covered will include: types of natural and synthetic polymers; molecular size and shape; molecular weight determinations; chemical synthesis and reactions; polymer type vs. properties; properties in the liquid state; properties in the solid state; rubber and elastomers; crystallinity and morphology; mechanical and thermal characteristics; manufacturing and polymer technology. Fall, 1982.

Prerequisites: Organic chemistry. Some knowledge of physical chemistry is helpful, although not required.

571. Wood Chemistry I: General Wood Chemistry (2)

Two hours of lectures. Introduction to carbohydrate chemistry. Chemistry of cellulose, hemicelluloses, and lignin. Cellulose derivatives. Distribution of polysaccharides and lignin in wood. Wood extractives. Chemistry of bark. Formation of heartwood. Wood as a chemical raw material. Fall, 1982.

Prerequisite: One or two semesters of a three credit undergraduate course in organic chemistry.

572. Wood Chemistry II: Wood and Pulping Chemistry (3)

Three hours of lectures. Introduction to carbohydrate chemistry. Chemistry of cellulose, hemicelluloses, and lignin. Cellulose derivatives. Distribution of polysaccharides and lignin in wood. Wood extractives. Chemistry of bark. Formation of heartwood. Wood as a chemical raw material. Chemistry of the industrial pulping processes with emphasis on sulfite and kraft pulping of wood. Chemistry of the major bleaching agents. Chemical byproducts in the pulping industry. Complete tree utilization in the manufacture of pulp and paper. Fall, 1982.

Prerequisite: One or two semesters of a 3-credit undergraduate course in organic chemistry.

573. Wood Chemistry III: Biosynthesis of Wood (2)

Two hours of lecture. Chemistry of pectin and starch. Photosynthesis with emphasis on the chemical phase. Chemistry of the primary cell wall in plants. Biosynthesis of cellulose, hemicelluloses, pectin, and starch. Biosynthesis of aromatics, including lignin. Biodegradation of wood. Spring, 1983.

Prerequisite: FCH 571 or an equivalent course in general wood chemistry.

574. Wood Chemistry IV: Wood Chemistry Laboratory (1)

Three hours of laboratory. Reports. Gravimetric and spectrophotometric determinations of lignin. Determination of the number-average molecular weight of ethylcellulose by osmometry. Estimation of the weight-average molecular weight of ethylcellulose by viscometry. Calibration of a gel permeation chromatography (GPC) column. Separation and characterization of larch arabinogalactans A and B by GPC. Fall, 1982.

Prerequisite: FCH 571 Wood Chemistry I or an equivalent course in general wood chemistry.

630. Plant Biochemistry (3)

Three hours of lecture and discussion. Includes the biochemistry of photosynthetic electron transport and phosphorylation, photosynthetic carbon fixation, photorespiration, nitrogen fixation, nitrate reduction, photochrome, and plant hormones. The economic, ecological, and environmental aspects of plant biochemistry will also be discussed. Spring, 1983.

Prerequisites: FCH 530—532 or FCH 539 or equivalent.

650. Physical Chemistry of Polymers I (3)

Three hours of lecture. Includes: thermodynamics of polymer solutions, phase equilibria, fractionation, structure-property relationships, elementary chain statistics, molecular geometry, network elasticity, polyelectrolyte theory, and viscosity. Fall, 1982.

Prerequisites: One year of organic chemistry and one year of physical chemistry.

651. Physical Chemistry of Polymers II (3)

Three hours of lecture. Viscoelasticity. The glassy state and glass transition temperature. The crystalline state and crystallization kinetics. Characterization of structure and morphology of polymer solid states. Survey of structure and properties of native polymers. Spring, 1983.

Prerequisites: One year of organic and one year of physical chemistry.

652. Organic Chemistry of Polymers I (3)

Three hours of lecture. A broad survey of the chemistry of polyfunctional molecules and methods for their conversion to high molecular weight materials. Synthesis of a variety of specialty polymers and chemical reactions on natural and synthetic polymers. Some relations between molecular structure and useful properties. Fall, 1982.

Prerequisite: One year of organic chemistry.

653. Organic Chemistry of Polymers II (3)

Three hours of lecture. Kinetics and mechanism of polymerization processes, with emphasis on addition polymerization reactions initiated by radical, cationic and anionic initiators. Mechanism of stereospecific polymerization. Structure of polymers. Reactions on polymers and their modification for specific end uses. Block and graft polymers. Spring, 1983.

Prerequisites: One year of organic chemistry and one year of physical chemistry.

681. Principles of Physical Chemistry (2)

Two hours of lecture on chemical kinetics. Collision theory in the gas phase, transition state theory, kinetics in liquid solutions, ionic reactions including electron transfer reactions, rate equations near equilibrium, enzyme kinetics, and photochemical reactions. Spring, 1983.

Prerequisites: CHE 656 (Chemical Thermodynamics) or permission of the instructor.

682. Principles of Organic Structure and Synthesis (3)

Three hours of lecture and discussion. A broad survey of strategies for constructing organic molecules and of physical and chemical methods for the elucidation of structure. Emphasis on material relevant to different chemical disciplines. Fall, 1982.

Prerequisite: One year of organic chemistry.

796. Special Topics in Chemistry (1-3)
(Credit hours arranged according to nature of topic)

Lectures, conferences, and discussion. Advanced topics in physical chemistry, organic chemistry, or biochemistry. Fall and Spring, 1982-83.

798. Research in Chemistry**(Credit hours arranged according to nature of problem)**

Independent research in physical and organic chemistry of synthetic polymers, physical and organic chemistry of natural polymers, organic chemistry of natural products, ecological chemistry and biochemistry. One typewritten report required. Fall and Spring, 1982-83.

884. Organic Natural Products Chemistry (3)

Three hours of lecture. The chemistry of terpenoids, steroids, and alkaloids with an emphasis on the determination of structure by both modern instrumental methods and chemical degradation. Biogenetic considerations and the confirmation of structure by synthesis are covered. Fall or Spring, 1982-83.

Prerequisite: One semester of advanced organic chemistry.

899. Master's Thesis Research (Credit hours to be arranged)

Research and independent study for the master's degree and thesis. Fall and Spring, 1982-83.

997. Seminar (1)

Seminars scheduled weekly; an average of twenty to thirty seminars are given annually. Discussion of recent advances in chemistry. Credit is given only once to a student. Fall and Spring, 1982-83.

999. Doctoral Thesis Research (Credit hours to be arranged)

Research and independent study for the doctoral degree and dissertation. Fall and Spring, 1982-83.

FEG—FOREST ENGINEERING**300. Introduction to Forest Engineering and Design (2)**

One hour of lecture and three hours of laboratory. An introduction to the design process with emphasis on the application of engineering fundamentals to the analysis and design of systems useful in resource manipulation and development. Fall, 1982.

340. Engineering Hydrology, and Flow Controls (4)

Three hours of lecture and three hours of laboratory and discussion. Analysis of the waters of the earth, their occurrence, circulation, and distribution; physical properties and their interaction with their environment. Principles of hydrologic budgeting and routing; and basic hydraulics of open channel, conduit, groundwater and overland flow. Applications of probability as a basis for the design of solutions to groundwater, surface runoff, flooding and water supply problems. Spring, 1983.

Prerequisites: CIE 327, IOR 326, and APM 360.

350. Introduction to Remote Sensing for Engineers (2)

Two hours of lecture. The fundamentals of acquiring, analyzing, and utilizing remote sensing data in the performance of natural resource inventories, environmental quality surveys and site development analyses. Oriented for multidisciplinary participation. Spring, 1983.

Prerequisite: Junior standing and FEG 363 (which may be taken concurrently with FEG 350).

352. Introduction to Remote Sensing (3)

Two hours of lecture and three hours of laboratory. Qualitative and quantitative introduction to the fundamentals of acquiring, analyzing, and utilizing remote sensing data in the performance of natural resource inventories, environmental quality surveys, site development studies, and land use analyses. Oriented for multidisciplinary participation. Fall and Spring, 1982-83.

Prerequisites: Physics and calculus or permission of the instructor.

363. Photogrammetry (3)

Two hours of lecture and discussion, three hours of laboratory. Basic photogrammetric and photo interpretation concepts as a means of acquiring reliable data for engineering and management planning. Potentials, limitations, instrumentation, and unique requirements are considered. Fall and Spring, 1982-83.

Prerequisite: ERE 371 or equivalent.

410. Structures (4)

Three hours of lecture, three hours of computation laboratory and discussion. Engineering principles in the analysis, planning design and construction of components and framed structures under various types of loadings. The proportioning of wood, steel and concrete members and the design of statically determinate structural systems. Emphasis is placed on the relationship between theoretical stress analysis and codes and specifications for appropriate materials and structural design practices. Fall, 1982.

Prerequisites: ERE 362, APL Computing.

422. Production Systems Engineering (4)

Four hours of lecture. An introduction to concepts and procedures for planning, designing, and managing production and large-scale physical systems with focus on forest resources and products. Systems analysis and quantitative techniques are introduced as design tools. Fall, 1982.

Prerequisites: IOR 326 and senior standing in forest engineering.

437. Transportation Systems (4)

Three hours of lecture and three hours of laboratory. Interrelationships among natural features, transportation types, design, and management objectives to provide the most effective system within the given framework. Basic engineering principles in the planning location, design, construction, and maintenance of suitable transportation systems to serve various aspects of forest resource management. Spring, 1983.

Prerequisites: CIE 437, FEG 422.

447. Hydrologic and Quality Controls (3)

Two hours of lecture and three hours of laboratory. A continuation of FEG 340 coupled with principles and practices of water quality control for forested sites and low density areas. Design of facilities and systems for water, sewerage and waste water treatment and for the abatement of pollution from nonpoint sources. Planning and analysis for water resources development. Spring, 1983.

Prerequisites: FEG 340, ERE 488 and CIE 437 or equivalent as evaluated by instructor.

464. Photogrammetry II (3)

Two hours of lecture and three hours of laboratory. General analytic photogrammetry including interior and exterior orientation systems, intersection, space resection, and orientation. Correction of photo coordinates for film deformation, lens distortions, atmospheric refraction, and earth curvature. Introduction to photogrammetric plotters. Planning photogrammetric projects and designing optimum procedures for selected photogrammetric tasks. Fall, 1982.

Prerequisite: FEG 363.

477. Survey Systems Design (3)

Three hours of lecture and discussion. Land survey systems including the U.S. Public Land System, plane coordinate systems, and land use and resource systems—Specifications for Surveying and Mapping Projects. The design of future systems. Spring, 1983.

Prerequisites: FEG 371 and FEG 363.

489. Forest Engineering Planning (3)

Two hours of lecture and three hours of laboratory. A curriculum capstone course designed to integrate other coursework with a systematic approach to real life engineering problems. Semester-long laboratory projects are selected to provide experience in dealing not only with technical and economic constraints, but also with environmental, social, legal, and political aspects of the planning process. Spring, 1983.

Prerequisite: Senior standing in forest engineering.

498. Research Problem in Forest Engineering (1-3)

Independent research in topics in Forest Engineering for the highly motivated undergraduate student. Selection of subject area determined by the student in conference with appropriate faculty member. Tutorial conferences, discussions and critiques scheduled as necessary. Final written report required for departmental record. Fall and Spring, 1982-83.

Prerequisite: Permission of the instructor.

FEN—ENTOMOLOGY (FOREST ENTOMOLOGY)

300. Principles of Forest Entomology (3)

Two hours of lecture, three hours of laboratory field work. Elements of insect classification, living requirements and control manipulations that are prerequisite, with further study, to an understanding of insects in relation to applied aspects of forestry. Spring, 1983.

350. Elements of Forest Entomology (3)

Two hours of lecture, three hours of laboratory/field work. General classification of insects, morphology, physiology, ecology behavior, and basic principles of population control. Emphasis through illustration is on the role of insects in the forest environment. Fall, 1982.

Prerequisite: FBO 300.

404. Wood Deterioration by Insects (3)

Three hours of lecture, discussion, and demonstration. Biology, identification, ecology of insect and wood interrelations; prevention of injury and control of insects injurious to forest products and wood in use. Spring, 1983.

Prerequisite: FEN 350, FEN 300 or permission of the instructor.

450. Forest and Aquatic Insects (2)

Half-time for four weeks. Cranberry Lake Biological Station. The forest and aquatic insects of Cranberry Lake Region and their role in these environments and habitats. Insect collection required. Summer, 1983.

451. Pest Management—Theory and Practice (2)

Two hours of lecture for nine weeks; then one lecture hour and one three-hour laboratory for four weeks. A review of history and governmental policy of pest management, as well as basic instruction in theory and practicum. Spring, 1984. (Will be offered Fall, 1982.)

452. Principles of Chemical Control (3)

Two hours of lecture; one three-hour laboratory. A study of the chemistry, toxicology, handling and application of chemicals used to manage pest populations. A primer for the State Pesticide Application examinations. Fall, 1982.

Prerequisite: FEN 451.

460. Insect Behavior and Ecology (2)

Half-time for four weeks. Cranberry Lake Biological Station. Descriptive, comparative, and experimental behavior of aquatic and terrestrial insect species of the Cranberry Lake Region. Field project, involving field study and paper required. Ecology of forest insects and field techniques used in their study. Emphasis on functional roles played by insects in forest ecosystems. Summer, 1983.

Prerequisite: FEN 350 or equivalent; background in introductory biology and ecology.

502. Forest and Shade Tree Entomology (2)

Two hours of lecture. Important forest and shade tree insects, detection, evaluation, prevention, and control of their damage; their relation to silviculture and management of forests and shade trees. Spring, 1983.

Prerequisite: FEN 350 or equivalent.

503. Forest and Shade Tree Entomology Laboratory (1)

Three hours of laboratory/field trip. Identification of important forest and shade tree insects and their damage. Spring, 1983.

Pre- or Co-requisite: FEN 502.

510. Arachnology (3)

Two hours of lecture and discussion and three hours of laboratory. Introduction to biology and ecology of spiders, mites, scorpions, and other arachnid groups. Laboratories emphasize classification and identification of specimens. Spring (even years), 1984.

Prerequisite: Course in general entomology or invertebrate zoology.

- 520. Aquatic Entomology** (3)
Two hours of lecture and three hours of laboratory. The biology, ecology, and identification of fresh water insects, with emphasis on the role of aquatic insects in the hydrobiome. Fall, 1982.
Prerequisite: FEN 350 or equivalent.
- 530. Insect Physiology** (3)
Two hours of lecture and three hours of laboratory. Study of the life processes in insects; introduction to modern physiological instrumentation and laboratory methods. Spring, 1983.
Prerequisite: FBL 330.
- 553. Biological Control** (2)
Two hours of lecture. Theory and practice of biological control of insect pests and weeds. Emphasis on the ecology of major groups of predators, parasitoids, and pathogens used in pest management and interpretation of mortality. Fall, 1982.
- 560. Environmental Toxicology of Insecticides** (2)
Two hours of lecture. Basis of action of insecticides in living systems, behavior of insecticides and microtoxins in environment, interaction of insecticides and biological systems. Fall, 1982.
Prerequisite: FBL 330 or equivalent course in physiology or biochemistry.
- 580. Insect Morphology** (3)
Two hours of lecture and three hours of laboratory. A comparative study of the external morphology of insects emphasizing evolutionary trends, especially modifications of homologous structures. Topics of special importance include intersegmental relationships, feeding, sensory mechanisms, locomotion, and reproduction. Spring, 1983.
Prerequisite: FEN 350.
- 590. Medical Entomology** (3)
Three hours of lecture and recitation. Study of arthropods affecting man, domestic animals, and wildlife with emphasis on their biology, control, and relationship to vertebrate disease. Spring, 1983.
Prerequisite: A beginning course in biology, entomology, zoology or permission of the instructor.
- 610. General Insect Taxonomy** (3)
Two hours of lecture and three hours of laboratory. Identification and classification of the important orders and families of insects; acquaintance with pertinent taxonomic literature and use of keys; and understanding of evolutionary principles and concepts and a knowledge of systematic theory and practice. Insect collection required. Fall, 1982.
Prerequisites: FEN 350, FEN 580.
- 660. Insecticide Toxicology Laboratory** (2)
One hour of discussion and three hours of laboratory. Laboratory experiments in mode of action and behavior of insecticides, biological and instrumental analysis of insecticides including tracer analyses. Spring (odd years), 1983.
Prerequisites: FEN 560 or equivalent and permission of the instructor.
- 796. Special Topics in Forest Entomology**
(Credit hours arranged according to nature of work)
Special instruction, conference, advanced study, and research projects in the fields of insect toxicology, insect physiology, taxonomy of immature insects, phases of biology and ecology of insects. Typewritten report required in some fields. Fall and Spring, 1982-83.
- 797. Seminar** (1)
One hour of conference. Assigned reports and discussion of topics in entomology. Fall and Spring, 1982-83.
- 798. Research Problems in Forest Entomology**
(Credit hours arranged according to nature of problem)
Comprehensive report required in some projects. Fall and Spring, 1982-83.

810. Advanced Insect Taxonomy (3)

Two hours of lecture and three hours of laboratory. Methods, procedures, and concepts of systematics. Examples and material will be drawn from among important groups of forest insects. Fall, 1982.

Prerequisites: FEN 580 and FEN 610.

820. Taxonomy of Diptera (3)

One hour of lecture and discussion and six hours of laboratory. Methods and procedures for collecting, preserving, and determining generic and specific identifications of adult and larval flies will be practiced. Problems and concepts of Diptera systematics will be discussed. Fall (even years), 1982.

Prerequisites: FEN 350, FEN 580, FEN 610; FEN 810 suggested.

FOR—FORESTRY (RESOURCES MANAGEMENT)**301. Field Dendrology (1)**

One half-day lecture, five eight-hour days field study, presented as the first portion of the Summer Program in Field Forestry held at Pack Demonstration Forest, Warrensburg, N.Y. Field identification and ecology of common woody species of the southeastern Adirondack area. Natural and cultural history of the area as it affects the growth and development of these species. Summer.

302. Forest Surveying and Cartography (2½)

Course consists of thirteen, eight-hour class days, combining lectures and practical field applications. The course stresses development of functional ability in the areas of cartography, overland navigation, and land measurement. Two repeating sessions per summer; held at the Warrensburg Campus. A service charge is required to cover individual expenses while in residence at Pack Demonstration Forest, Warrensburg, N.Y. Summer offering. Prerequisite for FOR 303, 322, and 332.

Prerequisite: FOR 301.

303. Forest Inventory (Summer Field Session) (2½)

Introduction to the concepts and practices of elementary forest resources inventory necessary to prepare forest tree and stand data to meet defined objectives. Emphasis is given to field procedures, methods, instruments used, and recognition of need for standards of performance. Summer Field Session. Prerequisite for FOR 322 and 332.

Prerequisites: FOR 301 and FOR 302.

321. General Silviculture (3)

Two hours of lecture and one three-hour laboratory first half of semester, three hours of lecture last half of semester. Survey of silvical principles and concepts and practice of silviculture for the production of goods and services from the forest. Designed for students in curricula other than resources management. Not available for resources management majors. Fall, 1982.

322. Introductory Forest Mensuration (3)

Two hours lecture and discussion, one three-hour laboratory. Principles and methods of estimation and measurement of forest trees and products, singularly and in the aggregate; of trees, forest products, forest stands, forest growth in time area and value. Determination by graphical and mathematical analysis of volume, growth, and valuation of wood products and other nonwood products and services of the forest through laboratory problems. Fall, 1982.

Prerequisite: Summer Field Program or permission of the instructor.

331. Introduction to the Physical Environment (6)

Lectures, discussions, field and laboratory work blocked in time and subject matter with FOR 332, Silvics-Silviculture. Study of the environmental media: air, soil, and water, through examination of the flow of energy and matter within and between these components of the environment. Drawing together information from geology, physical geology, soil science, water science and meteorology, this course provides understanding of these areas, their interactions and the interface with the biological system. Fall, 1982.

Prerequisite: Junior year standing in FOR curriculum or equivalent. Course should be taken concurrently with FOR 332, Silvics-Silviculture, because of the blocking of these two courses.

332. Silvics-Silviculture (8)

Three one-hour lectures and five three-hour labs or field trips. Fundamentals of silvics and practices of silviculture enabling manipulation of forests to attain objectives of the forest owner. Emphasis is placed on the biological interrelationships within the forest community, including site factors and forest stand dynamics, and the consideration of these in silvicultural operations. Fall, 1982.

Prerequisites: Summer Program in Field Forestry, and FOR 331 (taken concurrently) or permission of the instructor.

335. Regional Silviculture (3)

Three hours of classroom study. Topics cover regional factors that influence silvicultural methods commonly used in different forest types. Provides study of various silvicultural systems used in operating forest properties in various regions, with attention to geographical differences in land use, market opportunities, species characteristics, and economic conditions. Spring, 1983.

Prerequisite: FOR 332 or FOR 321.

345. Soils (3)

Two hours of lecture and three hours of laboratory. Introduction to the fundamentals of soil science with particular reference to forestry, but including other land uses. Spring, 1983.

351. Meteorology and Fire Behavior (3)

Lectures and recitations in atmospheric physics and the physics and chemistry of combustion lead to discussions of fire behavior and the strategy and tactics of fire suppression. Fall, 1982.

Prerequisites: PHY 103 and 104 (Calculus helpful but not required).

360. Principles of Management (3)

Three hours of lecture and recitation. Basic principles and concepts of management which are universally applicable to any organization, business enterprise, or public agency. The various approaches to management including the classical, behavioral and quantitative concepts with emphasis upon the integrative approach, now required to meet modern society's changing life styles and values and the new awareness of the public regarding environmental matters and natural resources management. Spring, 1983.

364. Soil and Water Conservation (3)

Three hours of lecture. An integrated historical survey of water and related land resource conservation in the United States. Interrelationships of planning, administration, and evaluation of policies, programs and projects by all levels of government and private units. Spring, 1983.

370. Management of the Forest Enterprise (3)

Two hours of lecture and one hour of discussion and laboratory. This course is concerned with the management alternatives, both of a technical and social nature, that are available in the planning for and the production of timber, recreation, wildlife, forage, and water from the forest and with the criteria for choice to meet management objectives. Spring, 1983.

371. Range Management (3)

Three hours of lecture and discussion covering range ecology, inventory and evaluation; animal husbandry and grazing management; multiple-use of rangelands; range improvement practices; and range policy and administration. Spring, 1983.

Prerequisite: Upper division status in Resource Management or Biology, or by permission of the instructor.

372. Planning and Developing Access for Forest Use (3)

Combination of lecture and laboratory/discussion. Planning, location, and design of suitable access necessary in producing a wide range of goods and services derived from forest land. Field and laboratory exercises. Spring, 1983.

Prerequisite: Senior standing or permission of the instructor. Surveying course helpful.

373. Timber Harvesting (3)

Two hours of lecture and one three-hour laboratory and discussion. Harvesting as a production system including equipment, equipment mixes, costs and manpower in serving and logmaking and primary and secondary transportation. Evaluation of various systems as to environmental impacts. Wood as a raw material to the primary processing system and trees as inputs to the harvesting system. Spring, 1983.

400. The Social Environment of Resource Management (3)

Three hours of lecture and discussion. This course describes the institutional framework within which the resource manager practices his profession. It intends to show how economics, law, public policy, pressure groups and financial considerations constrain the professional judgment of the resource manager and the goals and objectives of the institution employing him. Fall, 1982.

Prerequisites: FOR 332, 360, 461, 322 and one hour of computer science; Senior standing.

404. Economics of Wood-Using Industries (3)

Three hours of lecture and discussion. Structure and organization of selected wood-using industries. Analysis of decisionmaking by the firm. Principles of production and marketing including demand and cost analysis and pricing. Special issues and current problems of the industries, and introduction to the newer mathematical and statistical tools for meeting them. Spring, 1983.

Prerequisite: Microeconomics.

405. World Forestry Resources: Problems and Prospects (3)

Three hours of lecture and discussion plus guided readings, pertaining to world forest resources and the problems and opportunities associated with their use and development. Major topics include: world forest resources; production and trade; principal wood-producing countries; forestry and the problems of underdevelopment; and special areas and topics of interest to world forestry. Spring, 1983.

Prerequisite: Senior status preferred.

429. Environmental Impact: Principles and Strategy (3)

Three hours of lecture and discussion. Principles and theory of environmental impact and statements of impact as required by federal law. Administrative procedures for review and evaluation. Procedural strategy and effective constitution before various governmental levels. Means of obtaining and sources of authoritative information. Spring, 1983.

Prerequisite: Senior standing.

433. Commodity Production Silviculture (3)

Six hours of lecture and study, or field work. Classroom instruction and exercises will introduce topics, followed by field exercises stressing application of silvicultural methods for growing wood products, mostly in hardwood stands. Topics will cover concepts, techniques, diagnostic methods, and field application for thinning, reproduction methods for even- and uneven-aged stands, assessing site and stand capabilities, and measuring and evaluating stand growth and development following management, where producing wood and other commodities represents a primary goal. Offered one day per week as a block of instruction and exercise. Spring, 1983.

Prerequisites: FOR 331-332, FOR 335, and one mensuration course beyond Summer Program in Field Forestry; Senior standing.

434. Greenspace Silviculture (3)

Two hours of lecture, one to three hours seminar or field trip. Concepts, techniques, and field practice of evaluating and manipulating vegetation systems, including site conditions, woody and herbaceous vegetation, and use impacts, primarily for on-site values in park, recreation, wildlife and multiple-use lands, roadsides, utility rights-of-way, protection areas, etc. Fall, 1982.

Prerequisites: At least one silviculture course and senior status or permission of the instructor.

435. Integrated Use Silviculture (3)

Four hours of lecture and seminar during first half of semester; six hours of field practice thereafter each week. Development of silvicultural decisions in management of woodlands to achieve results under various integrated use objectives. Trips to forest areas. Several technical reports and a cultural plan prepared prescribing treatment to attain various ownership objectives. Spring, 1983.

Prerequisites: FOR 331 and 332 or permission of the instructor. Senior standing.

441. Forest Influences (1-2)

Half time for four weeks. Cranberry Lake Biological Station. Field observation of the effect of the presence of forest vegetation on easily quantified parameters of climate and the hydrologic cycle. Basic measurements of precipitation, radiation, temperature, interception, soil moisture, groundwater, and streamflow. Summer, 1983.

446. Forest Soil Classification, Survey, and Interpretation (3)

Two hours of lecture and discussion, one three-hour laboratory. Detailed examination of soil genesis and classification, and the survey and description of the soilscape. Interpretations are made for various land uses, especially forestry. Fall, 1982.

Prerequisites: FOR 331 or 345 or an introductory soils course.

452. General Meteorology (3)

Three hours of lecture. Examination of the physical processes of the atmosphere as they relate to the exchange of heat, moisture, and momentum in the earth-atmosphere system. Emphasis on the meteorological and micrometeorological basis of climate and its interaction with the biological world. Spring, 1983.

453. Biometeorology (2)

Two hours of lecture and discussion covering the fundamentals of organism-physical environment interaction. Spring, 1983.

455. Forest Tree Improvement (3)

Two hours of lecture, three hours of laboratory or field work. General principles and methods of tree improvement practiced in this country and abroad. Tree selection, techniques of vegetative propagation, hybridization, polyploidy, establishment of seed orchards, clonal and offspring testing and other problems. Spring, 1983.

Prerequisites: FBL 470, or Introduction to Mendelian Genetics or Population Genetics.

456. Management of the Forest Business (3)

Three hours of discussion. Overview of major business management principles and methods of operation in forestry enterprises. Emphasis is on general business concepts which forest managers must use. Actual case studies are basis of instruction. Complementary to RMP 611. Fall or Spring, 1982-83.

461. Management Models (3)

Two hours of lectures, three hours of laboratory. Introduction to the various models used in managerial decisionmaking. Emphasis is on the characteristics of the various models: their formulation, assumptions, uses, and limitations. The major topics covered will include: the role of models in management; simple optimization; constrained optimization; multi-valued choices; time adjustment of value; simulation; and models in nondeliberated decisions. Integration of the deliberative and intuitive models is stressed. Fall, 1982.

465. Managerial Economics (3)

Three hours of lecture and discussion. Analysis of decisionmaking by the firm. Review of principles employed in modeling, predicting, risk assessment, evaluation and selection of alternative actions. Emphasis on economic and financial decisions and on the delineation of systematic processes of decision. Spring, 1983.

Prerequisite: Not available to Resource Management undergraduates except with permission of the instructor.

471. Resources Management (3)

Three hours of lecture/discussion/recitation/case studies. The interrelationships between man and forest land resources and the multiple services which these resources provide; the extent and nature of responsibilities of the resource manager to the community and to society in his stewardship of natural resources. Spring, 1983.

472. Fundamentals of Outdoor Recreation (3)

Three hours of lecture. Introduction to the programs and practices of federal, state, and local agencies and private organizations involved in planning, administration, and management of outdoor recreation areas. Emphasis is on major recreational issues and conflicts faced by area managers, and how they integrate solutions into their plans. Spring, 1983.

473. Planning and Development of Forest Recreation Areas (3)

Three hours of lectures or equivalent laboratory and assignments. Planning and designing forest recreation areas, structures, and facilities. Development of construction plans for camp and picnic sites, for waterfront areas and for trails. Emphasis is on the functional relationship between planning and design, management, and maintenance. Field trips required. Fall, 1982.

Prerequisites: FOR 472 and permission of the instructor.

475. Sociology and Psychology of Leisure Behavior (3)

Three hours of lecture and discussion. Introduction to theory and research findings dealing with the sociological and psychological aspects of leisure behavior; field work and lectures demonstrate applications, particularly with regard to leisure behavior. Spring, 1983.

Prerequisites: FOR 472, and an introductory course in sociology or psychology, or permission of the instructor.

477. Resource Policy and Management (3)

Three hours of lecture supplemented by one hour of discussion and/or lecture. Public and private forest policy formation; principles of modern management; overall management and operation of a productive forest property. Primarily for forest engineers. Not available to Resource Management undergraduates. Fall or Spring, 1982-83.

Prerequisites: Mensuration and silviculture, senior standing in Forest Engineering, or by permission of the instructor.

478. Marketing of Forest Products (3)

Three hours of discussion and analysis. Case study analysis of product, pricing and market research policies and problems of market structure in the lumber, pulp and paper and other major wood-using industries. Spring, 1983.

480. Urban Forestry (3)

Two hours lecture and three hours of laboratory or field trip. Introduction to urban forestry: its professional status and potentials. Elements of urban physical geography. Nature and functions of various kinds of urban greenspace; their physical and social interactions as an integrated system, and management within the broader context of urban processes. Field practice in evaluating urban greenspace resources. Spring, 1983.

Prerequisites: Senior status. FOR core courses or permission of the instructor. For students in other schools FOR 434 is desirable.

496. Special Topics in Environmental and Resource Management (1-3)

Guided readings, lectures, discussions, tutorial conferences, or special coursework designed to help the undergraduate student apply scientific analysis of a social, biological, or physical nature to questions within his area of interest. Questions and analyses would include those dealing with forest resources management and administration; forest cultural practices; land use and land use planning; hydrology and watershed management; outdoor recreation; resource economics; world forestry; and others. Fall and Spring, 1982-83.

Prerequisite: Permission of the instructor.

497. Resources Management Seminar (3)

Three hours of group discussion and analysis. Current literature, plans and principles, and new developments in forest management. Fall or Spring, 1982-83.

498. Special Studies in Environmental and Resource Management (1-3)

Independent research in environmental and resource management for selected undergraduate students. Selection of subject areas determined by the student in conference with appropriate faculty member. Final written report is required for departmental record. Fall or Spring, 1982-83.

Prerequisite: Permission of the instructor and department chairman.

499. Independent Study in Resources Management (7-17)

Independent study of some significant aspect of environmental and resources management. The selection of the topic will be determined by the student in consultation with his advisor. Guidance will be provided by a faculty committee. Limited to Spring semester seniors in Resources Management. Spring, 1983.

FTC—FOREST TECHNOLOGY**200. Dendrology I (2)**

Twenty-five hours of lecture and 34 hours of field time. A study of the distinguishing characteristics, growth features, distribution, associates and importance of the major tree species of North America. Seasonal field identification and on-the-spot discussion of habitats, associates, and the place in succession of the predominant forest trees and shrubs as found in the Adirondack area of the Northeast, plus a limited number of introduced species. Fall, 1982.

202. Plane Surveying I (4)

Fifty-four hours of lecture and 100 hours of field and laboratory time. An introduction to the theory and practice of plane surveying. Emphasis is on individual skill development through small crew projects, handling typical surveying equipment in typical field situations. Lecture topics include the theory of measurements and errors, mathematics for plane surveying, introduction to field problems and introduction to map use and preparation. Field projects include traversing, methods, and proficiency projects in handling typical surveying instruments. Fall, 1982.

203. Plane Surveying II (1)

Twelve hours of lecture and 32 hours of field time. A continuation of FTC 202 with emphasis on small crew field projects introducing the use of the engineer's level and the theodolite. Classroom work is directed at explaining the United States Public Land Survey system and introducing the concepts of modern deed descriptions and recordkeeping procedures. A trip to the County Court House is scheduled for a first hand look at a modern deed and record keeping operation. Spring, 1983.

Prerequisite: FTC 202.

204. Forest Mensuration and Statistics I (3½)

Sixty-seven hours of lecture and 36 hours of field time. A classroom and field study of the basic principles and skills required for timber measurements. Volume tables, their use and construction are studied. Cruise reports are required in which the student presents cruise results. Various methods of forest sampling are studied including methods of calculating necessary sampling intensities and sampling errors. Fall, 1982.

205. Forest Mensuration and Statistics II (2)

Four hours of lecture and 44 hours of field and laboratory time. A field problem of practical nature utilizing methods for collecting, analyzing, and presenting data dealing with timber volumes. Spring, 1983.

Prerequisite: FTC 204.

206. Forest Ecology (3)

Forty-two hours of lecture and 50 hours of field time. Study of weather and weather data collection; students manning a forest weather station. Study of weather and soil factors as to how they affect trees and forests, plus the interactions within the forest community and with the environment. Introduction to cover type mapping. Final field problem and report on detailed measurement and analysis of a belt transect. Fall, 1982.

207. Aerial Photogrammetry (2)

Twenty hours of lecture and 36 hours of laboratory. Development of the ability to interpret important ground features by viewing aerial photos singly and in pairs, using stereoscopic techniques and equipment. Scale problems and the making of reliable horizontal and vertical measurements. Radial line plot control for the transfer of detail to base maps. Forest type mapping and forest mensuration using photos. Fall, 1982.

208. Forest Installations (3)

Thirty-six hours of lecture and 60 hours of field time. This course provides the student with the technical competence necessary to use, plan, construct, and maintain such typical forest improvements as telephone lines, radio systems, trails, and light frame structures. Fall, 1982.

209. Forest Roads (2)

Twenty-two hours of lecture and 32 hours of laboratory time. This course provides the student with the technical competence necessary to administer, locate, and design the construction and maintenance of a typical forest gravel road. Spring, 1983.

Prerequisite: FTC 202.

211. Silviculture (2½)

Thirty hours of lecture and 40 hours of laboratory and field work blocked with forest management. Lectures based on text study cover orientation, terminology and present a framework of the various treatments used in many common stand conditions to bring the forest into a more productive state in accord with the objectives of management. Emphasis on thinning in computer simulation and field practice. Exercises in planting and pruning. Demonstrations in chemical silviculture. Spring, 1983.

Prerequisite: FTC 206.

212. General Forestry (1½)

Thirty-one hours of lecture and two all-day field trips. This course provides an overview of the American forest-based resource, the development of forestry in the United States, Multiple-Use, the functions of government forestry agencies and private industry. Career opportunities for forest technicians are explored. Spring, 1983.

213. Forest Protection I (2)

Thirty-eight hours of lecture and 36 hours of laboratory/field time. A study of the insect and disease agents that damage trees and their role in the total forest community. The course covers identification of local forest insects and disease-causing organisms, study of the major pest groups of other forest regions, and control measures including the effects of pesticides on the environment. Field trips cover local pests and the damage caused, while laboratory work covers major groups of pests likely to be encountered elsewhere. Fall, 1982.

214. Personnel Management (1½)

Fourteen hours of lecture and 12 hours of laboratory. A study of company and agency organization functions, including selection of and placement of personnel, training of personnel and performance evaluations, planning for and administering crew responsibilities, human relations in the working situation and special personnel problems of the forest are covered. Techniques of foremanship are applied in various field exercises in other courses, along with the duty of safety hazards, accident prevention, accident classification and accident reporting. Spring, 1983.

215. Timber Harvesting (2)

Sixteen hours of lecture and 36 hours of field time. This course acquaints the student with the basic harvesting methods and techniques, with emphasis on the Northeast, along with the knowledge of how and where harvesting fits in with other forest uses. Students gain technical competence in timber sale contract administration and basic timber appraising. Spring, 1983.

217. Forest Management (2½)

Thirty-six hours of lecture and 40 hours of laboratory and field work blocked with silviculture. Coverage of the common problems met in organizing a forest property to approach the goals of ownership. Study and practice in techniques of growth measurement and the gathering and use of forest records in general. Summary application of pertinent information from many other courses in a work plan involving management decisions for an assigned forestry property. Spring, 1983.

Prerequisite: FTC 206.

- 218. Forest Recreation** (1½)
Fifteen hours of lecture and 32 hours of laboratory or field time. This course acquaints the student with the forest recreational resources—its present and future needs. Principles of recreation development and management are discussed with special emphasis placed on the technical aspects. Spring, 1983.
- 219. Elements of Wildlife Ecology** (1½)
Twenty-eight hours of lecture and four hours of field time. A study of the principles of wildlife ecology with fundamentals related to the actions of the preservationist, conservationist, and particularly those of the forest manager. Spring, 1983.
Prerequisite: A course in biology or its equivalent.
- 221. Water Resource Management** (2)
Twenty-seven hours of lecture and 40 hours of field time. A comprehensive study of the concepts of the hydrologic cycle and quantification of its components. Particular stress on basic water measurements, erosion-sedimentation, and protection of the soil-water resource. Spring, 1983.
Prerequisite: FTC 206; FTC 202.
- 223. Graphics** (1)
Twenty-two hours of lecture. An introduction to lettering and drafting with emphasis on the skills needed by the forest or surveying technician. Individual skill development is achieved through several projects. The concept behind each project is explained in handout material and lecture, and each student is then expected to complete the project on his/her own time. Freehand and mechanical lettering plates are produced in addition to precision and pictorial drawings. Fall, 1982.
- 227. Forest Protection II** (2)
Twenty-three hours of lecture and 24 hours of field and laboratory time. The basic principles of fire ecology, forest fire behavior, fire danger and fire danger rating, forest fire prevention and control, and prescribed burning are covered. Handtool fire suppression techniques are demonstrated and practiced. Spring, 1983.
Prerequisite: FTC 213.
- 228. Structure and Growth of Trees** (1½)
Nineteen hours of lecture and twelve hours of laboratory. A study of the various tissues of forest trees and how their growth and development are affected by internal and external factors. Differences in stem structures of some of the more important commercial tree species of the United States are studied in the laboratory, and these differences are related to the commercial uses of these species. Spring, 1983.
Prerequisite: An introductory course in general botany or biology.
- 229. Silviculture II** (2)
Twenty-six hours of lecture and 28 hours of field and laboratory. Continuation of FTC 211 dealing mainly with the handling of the more complex hardwood and mixed stands common to the Northeast. Special coverages will be offered on current practices of regional importance beyond the Northeast where graduates are likely to be employed. Spring, 1983.
- 230. Plane Surveying III** (2)
Twenty-six hours of lecture and 28 hours of field time. A continuation of FTC 202 and FTC 203 with emphasis on small crew projects using the theodolite. Advanced field techniques are discussed and practiced, such as the determination of the true meridian by the method of direct solar observation, layout of highway curves and simple triangulation procedures. Each topic is developed in detail in the classroom before each field project is completed. Spring, 1983.
Prerequisites: FTC 202 and FTC 203.

298. Independent Study in Forest Technology (1-6)

Independent study in forest technology to apply, enhance, or supplement forest technology or related natural resource education. Objectives and scope of the project are negotiated in a learning contract between the student and instructor(s), with course admission based on permission of the instructor(s). Limited to those who have attended the complete regular SFT program, or those who have graduated from another forest technology program or a related natural resource program, or to students enrolled in any ESF program other than that of the SFT. A maximum of 6 credit hours may be taken by any student in total. Semesters as arranged. Fall, Spring, or Summer, 1982-83.

FZO—ZOOLOGY (FOREST ZOOLOGY)**332. Wildlife Conservation (3)**

Two hours of lecture, one hour of recitation. Introduction to the biological principles of conservation including the relationship of natural resources to modern society. The wildlife resource and its conservation will be emphasized. It is not designed for students concentrating in the area of Forest Wildlife Management. Fall, 1982.

Prerequisite: One semester of biological science.

381. Vertebrate Anatomy, Histology and Physiology I (4)

Three hours of lecture, three hours of laboratory. Vertebrate macroanatomy, microanatomy, and physiology with special emphasis on the skeletal, muscle, nerve, and endocrine systems. Fall, 1982.

Prerequisite: General zoology or general biology.

382. Vertebrate Anatomy, Histology and Physiology II (4)

Three hours of lecture and three hours of laboratory. Vertebrate macroanatomy, microanatomy, and physiology with special emphasis on digestion, metabolism, nutrition, circulation, respiration, excretion, and body defense and destructive systems. Spring, 1983.

Prerequisite: General zoology or biology.

385. Comparative Vertebrate Anatomy (4)

Three hours of lecture and three hours of laboratory. An introduction to the vertebrate body, with emphasis on comparative study of organ systems among representative forms. Includes major adaptive patterns, phylogeny, and classification of vertebrates. Spring, 1983.

Prerequisite: One year of biological science.

386. Vertebrate Histology (3)

Two hours of lecture and three hours of laboratory. A study of tissues from protochordates, fishes, amphibians, reptiles, birds, and mammals, with emphasis on evolution, environment, and function, and with introduction to histopathologies. Spring, 1983.

Prerequisite: One year of biological science.

387. Vertebrate Physiology (3)

Three hours of lecture. A study on functional responses of vertebrates to internal and external environmental conditions. Fall, 1982.

Prerequisite: One year of biological science.

411. Invertebrate Zoology (4)

Three hours of lecture, three hours of laboratory. Structure, function, classification, and evolution of invertebrates. Emphasis on ecological role of invertebrates in specific habitats. Fall, 1982.

413. Biology of Birds and Mammals (4)

A course surveying the taxonomy, anatomical-behavioral-physiological adaptations and natural history of birds and mammals. Techniques for the field study of a vertebrate species will be discussed. Fall, 1982.

- 415. Herpetology** (3)
Two hours of lecture and three hours of laboratory. An introduction to the structure, function, ecology, behavior, development, and distribution of amphibians and reptiles as they relate to the systematics of the various groups. Spring, 1983.
- 416. Ichthyology** (3)
Two hours of lecture, three hours of laboratory. An introduction to the anatomy, physiology, ecology, behavior, and taxonomy of fishes. Spring, 1983.
- 423. Microcommunity Ecology** (2)
Half-time for four weeks. Cranberry Lake Biological Station. Study of terrestrial invertebrate microcommunities; descriptive and comparative assay of microhabitats incorporating experimental and field techniques. Summer, 1983.
- 424. Vertebrate Ecology** (2)
Half-time for four weeks. Cranberry Lake Biological Station. Utilization of unique Adirondack forms and communities to study population dynamics, behavior, systematics, and ecological role of vertebrates; standard field and laboratory techniques. Summer, 1983.
- 426. Ecology of Adirondack Fishes** (2)
Half-time for four weeks. Cranberry Lake Biological Station. Study of the ecology of fishes, with detailed individual investigation of the ecology of Adirondack fishes. Summer, 1983.
- 427. Field Ornithology** (2)
Half-time for four weeks. Cranberry Lake Biological Station. Field study of the ecology, distribution and behavior of birds of the Adirondack region. Techniques used in conducting field studies in avian biology will be emphasized. Summer, 1983.
- 440. Fishery Biology** (4)
Three hours of lecture and three hours of laboratory. Introduction to models of growth, mortality, production, and exploitation; aspects of fish ecology and behavior related to the dynamics and management of fish populations. Fall, 1982.
Prerequisite: FZO 416 or equivalent.
- 456. Wildlife Ecology and Management** (3)
Three hours of lecture. A study of the ecological principles governing wild animal populations and their habitats and the relationship of these principles to management programs and decisions. Spring, 1983.
Prerequisites: FBL 320, general ecology or its equivalent.
- 457. Wildlife Ecology and Management Practicum** (2)
One hour discussion, three hours laboratory. Practical contact and experience with wildlife management techniques and programs; relates practices to principles of management. Designed for biology students wishing to pursue careers as wildlife biologists. Spring, 1983.
Co-requisite: FZO 456; *Pre- or co-requisite:* LIB 300.
- 470. Principles of Animal Behavior** (3)
Three hours of lecture. A study of the basic principles of animal behavior, stressing exogenous and endogenous mechanisms of control. Spring, 1983.
Prerequisite: One year of biology.
- 475. Behavioral Ecology** (2)
Half-time for four weeks. Cranberry Lake Biological Station. Study of the behavioral adaptations of animals to their environment. Emphasis will be placed on animal orientation and social behavior. Habitat selection and interspecific interactions will also be considered. Credit may not be received for both FZO 475 and FZO 470. Summer, 1983.

- 520. Terrestrial Community Ecology** (3)
 Three hours of lecture. Relation of terrestrial vertebrates and invertebrates to their physical, chemical, and biological environment. Emphasis on community principles, structural quantification, and evolutionary processes of terrestrial animals. Fall, 1982.
Prerequisite: A course in basic ecology.
- 553. Wilderness Wildlife Management** (2)
 Two hours of lecture followed by one hour of group discussion. Students will participate in a two-day field trip at Huntington Forest. Completion of a term paper will be required for graduate credit. Fall, 1982.
- 620. Invertebrate Symbiosis** (3)
 Two hours of lecture and one three-hour laboratory. An introduction to the ecology and evolution of interspecific relationships of invertebrates. Spring (even years), 1984.
Prerequisites: FBL 320, FZO 411.
- 621. Practicum in Terrestrial Community Ecology** (1)
 Three hours of laboratory. Intensive practical application of ecological principles to the study of terrestrial animal communities. Includes experimental and field collection of data, quantifications, synthesis, and final reporting. Fall, 1982.
Pre- or Co-requisite: FZO 520 or equivalent.
- 622. Ecological Energetics** (3)
 Two hours of lecture and three hours of laboratory or one hour of discussion. Investigation of the principles of energy flow in biological systems. Emphasizing understanding of energy transformations, energy budgets and energy structures of individual organisms, populations, and ecosystems. Spring, 1983.
Prerequisite: A course in general ecology.
- 635. Behavioral and Physiological Ecology** (3)
 Two hours of lecture and one hour of discussion. An examination of the concepts of animal adaptations to ecological change from a behavioral point of view. Particular emphasis will be placed on the role the environment plays in shaping the behavior of a given species. Behavioral and physiological responses to environmental conditions will be treated as a continuum. Spring (odd years), 1983.
Prerequisites: One course in ecology, behavior, and physiology.
- 650. Biology and Management of Waterfowl** (2)
 A consideration of the identification, life history, ecology, and economic importance of waterfowl of the Atlantic Flyway. The management of local, flyway, and continental waterfowl populations, including the establishment of hunting seasons, will be discussed. One Saturday field trip. Fall (odd years), 1983.
Prerequisite: Permission of the instructor.
- 654. Habitat Inventory and Evaluation** (3)
 Four hours of lecture and discussion. Habitat analysis techniques are dealt with at two levels. Micro or taxon-specific techniques are surveyed and compared. Macro or regional inventory procedures are then examined. Finally, approaches to habitat evaluation are explored. Spring, 1983.
Prerequisites: A course in wildlife management principles and permission of the instructor.
- 655. Urban Wildlife** (2)
 Three hours of lecture and discussion with field trips. A study of the occurrence, adaptations, and values of wildlife in urbanized areas, with emphasis on current research and agency programs. Spring, 1983.
Prerequisite: Permission of the instructor.

659. Management of Wildlife Habitats and Populations (4)

Three hours of lecture and three hours of laboratory; two weekend field trips. For graduate students intending to enter the wildlife profession. Focus is on the application of ecological principles and management techniques in the planning of habitat and harvest management programs for wildlife. Extensive independent work required. Fall, 1982.

Prerequisites: FZO 456, FZO 457 or permission of the instructor.

720. Topics in Soil Invertebrate Ecology (3)

Two one-hour lecture and discussion periods and a three-hour laboratory. Study of literature relating to soil invertebrate microcommunities; taxonomy, culturing, and collection methods of soil fauna; student will conduct an individual research problem. Spring (odd years), 1983.

727. Seminar in Aquatic Ecology (1)

Two hours of lecture and discussion. A seminar to explore in some depth areas of current research in aquatic ecology. Fall (even years), 1982.

Prerequisite: Six credits in aquatic ecology.

750. Topics in Wildlife Biology (1-3)

Hours to be arranged. Group study of a wildlife management topic. Fall or Spring, 1982-83.

Prerequisite: Six credits of wildlife management courses.

797. Forest Zoology Seminar (1)

Two hours of discussion and assigned reports on current problems and new developments in forest zoology. Fall and/or Spring, 1982-83.

798. Problems in Forest Zoology (Credit hours to be arranged)

Individual study of special problems in forest zoology. One typewritten report (original and one carbon) required. Fall and/or Spring, 1982-83.

970. Topics in Animal Behavior (2)

Two hours of lecture and discussion. A seminar-type course designed to explore in depth selected and controversial subject areas in animal behavior. Fall or Spring, 1982-83.

LIB—LIBRARY (COLLEGE OF ENVIRONMENTAL SCIENCE AND FORESTRY COURSE)**300. Library Research (1)**

Fifteen hours of class time per semester (usually the first five weeks). Introduction for students at all levels to basic library material and the research process leading to preparation of a bibliography. Fall and Spring, 1982-83.

LSA—LANDSCAPE ARCHITECTURE

(See also courses listed under EIN and CMN.)

320. Introduction to Landscape Architecture and Planning (3)

Three hours of lecture. The course presents an overview of the professions of landscape architecture and planning. It surveys the historic and contemporary situations of environmental design and planning. The course introduces the socio-cultural and natural factors which influence the form and condition of the physical environment. It will introduce issues, personality, and projects. Fall, 1982.

326. Landscape Architecture Design Studio I (3)

Six hours of studio and one hour of lecture. The first in a sequence of studios focusing on the concepts, skills, and methods of design. This course introduces students to the basic vocabulary, concepts, and principles of design; the application and operation of these in the physical environment, development of three-dimensional spatial concepts. The requirements for this course include readings, examinations, field trips, design exercises, and projects. (Student field trip expense \$125-150.) Fall, 1982.

Prerequisite: Permission of the instructor.

327. Landscape Design Studio II (3)

One hour of lecture and six hours of studio. The second in a sequence of studios focusing on the concepts, skills, and methods of design. This course continued the development of design abilities through study of the interrelationship between the requirements of a design established in a program, the visual character of the site and the development of a designed result. The development of spatial concepts which meet principles of composition organization and a given set of requirements. The requirements for this course include readings, examinations, field trips, design exercises, and projects. (Student field trip expense \$125-150.) Spring, 1983.

Prerequisites: LSA 326 with a minimum grade of C and CMN 382.

330. Site Research and Analysis (2)

One hour of lecture and three hours of studio. This course will require those enrolled to apply principles of natural resources and processes to assess the land use and development potentials and limitation of a site. The principles will include landforms, soils, hydrology, climate, energy, and plant, animal, and human ecology. A variety of manual and computer techniques for data collection, analysis and synthesis of natural systems information will be explored. The course will concentrate on the comparison of synthesis techniques and their implications for land use and design decisionmaking. Occasional local field trips will be utilized. Spring, 1983.

Prerequisite: EIN 311 or permission of the instructor.

422. Landscape Design Studio III (4)

Twelve hours of studio. This course is a continuation of skill development, theory, and strategies as they relate to design issues and process. Emphasis is placed on in-depth investigation on projects of a direct scale illustrating form derivation and the man-made and natural form. Occasional field trips to illustrate various design solution. Fall, 1982.

Prerequisites: LSA 327 with a minimum grade of C, and LSA 330.

423. Landscape Design Studio IV (4)

Twelve hours of studio. This course emphasizes skill development, theory, and strategy as they relate to large-scale site design situations. Continues prior courses emphasis on design process and form manipulation. Occasional field trips to illustrate and inspect design form. Spring, 1983.

Prerequisite: LSA 422 with a minimum grade of C.

425. Orientation for Experiential Studio (3)

Three hours of lecture and recitation. Investigation and documentation of an area of specialty, discussion, readings, and research. Fall and Spring, 1982-83.

Prerequisite: Permission of the instructor.

433. Plant Materials (2)

Three hours of lecture and field work for first one-third of semester. Two hours of lecture for second one-third of semester. This course concentrates on woody plant materials used in landscape architecture, the ecological relationships of plants, ornamental plant materials use and identification, plant culture propagation, transplanting, planting plans and specifications. Fall, 1982.

Prerequisite: Permission of instructor.

434. Design Materials (1)

Three hours of lecture for last one-third of semester. An introduction to wood, concrete, masonry, asphalt, stone, and synthetic materials intended to provide students with an understanding of the basic visual, structural, and maintenance principles of each, in order to both use the materials in design and prepare written specifications. Fall, 1982.

442. Site Grading (2)

Two hours of lecture and three hours of studio during first two-thirds of semester. Lectures, projects, and assigned readings. The study of grading as the primary means of landform modification in landscape architectural design. Primary emphasis will be given to principles of grading, including contour manipulation, sections, profiles, and computations. Concepts of establishing acceptable slopes and positive surface drainage will be introduced. Enrollment limited to BLA or MLA students. Fall, 1982.

Prerequisite: LSA 330, Site Research.

443. Site Drainage Systems (1)

Three hours of lecture for last one-third of semester. Lectures, projects, and assigned readings. Provides a basis for the design of drainage systems. Coverage includes concepts relevant to understanding precipitation, methods of run-off quantification, open channel flow, systematic pipe network analysis. Enrollment limited to BLA or MLA students. Fall, 1982.

Prerequisite: LSA 330, Site Research.

444. Vehicular Circulation Design (1)

Three hours of lecture for first one-third of semester. Lectures, projects, and assigned readings. Must be taken concurrently with LSA 423. Introduces the circular geometry of horizontal curves and the parabolic geometry of vertical curves, curve coordination based on safety and aesthetic relationships, road grading. Enrollment limited to BLA or MLA students. Spring, 1983.

Prerequisites: Computer Programming and Surveying.

445. Elements of Structures (1)

Three hours of lecture during the second one-third of the semester. Lectures, projects, and examinations. An introduction to the concepts of assembling engineering materials into structure. All common building systems will be surveyed and emphasis will be placed on fundamentals rather than on detailed mathematical design procedures.

Prerequisite: Non-School of Landscape Architecture students by permission of the instructor. Not open to engineering majors. Spring, 1983.

455. Professional Practice in Landscape Architecture (2)

Two hours of lecture. This course examines the historic and contemporary modes of landscape architectural practice including practice types, ethics, operations, and client systems. Particular emphasis is given to the projected trends of professional practice and with impact on future roles for the landscape architect. Professional development is reviewed as it relates to internship, licensing, and continuing education. Occasional field trips will be utilized. Spring, 1983.

Prerequisites: Senior status in landscape architecture or permission of instructor.

495. Selected Readings in Environmental Studies (1-3)

Exploration of selected readings in depth with individual independent study upon a plan submitted by the student and related to credit hours assigned. Upon approval of the instructor, the student may systematically investigate some subject area encountered in regularly scheduled courses or may initiate research on a variety of subject areas of determined relevance. Fall and Spring, 1982-83.

Prerequisite: Permission of the instructor.

496. Special Topics in Landscape Architecture (1-3)

One to three hours of class meetings. Special topics of current interest to undergraduate students in landscape architecture and related fields. A detailed course subject description will be presented as a topic area is identified and developed. Fall and Spring, 1982-83.

Prerequisite: Permission of the instructor.

498. Introductory Research Problem (1-3)

Guided study of a selection of problems relating to landscape architecture and environmental design. Emphasis on study procedure and methods employed. Enrollment at periodic intervals throughout the semester. Fall and Spring, 1982-83.

Prerequisite: Permission of the instructor.

520. Design Analysis Studio I (3)

Six hours of studio and one hour of lecture-discussion. The first in a sequence of studios focusing on the concepts, skills, and methods of design. This course introduces students to the basic vocabulary of theoretical design principles, to the application and operation of these in the physical environment, and to the development of three-dimensional spatial concepts in community scale patterns. The requirements for the course include readings, examinations, field trips, design exercises, and projects, Fall, 1982.

Prerequisites: First-year MLA standing or permission of the instructor. Not open to BLA students.

- 521. Design Analysis Studio II (3)**
Six hours of studio and one hour of lecture. The second in a sequence of studio applying the concepts, skills, and methods of design in a critical analysis of various natural and human systems in community scale environments. Concentration is on the evaluation of options in the ordering of a variety of land use activities, with special emphasis on the functional and spatial quality of built environments. The requirements for this course include readings, examinations, field trips, design exercises, and projects. Spring, 1983.
Prerequisites: LSA 520, CMN 382, or permission of the instructor.
- 522. Landscape Design Studio VI (4)**
Twelve hours of studio. Studio problems, research, drafting and field trips. Concentration on complex urban problems. Concern for social and psychological considerations of the individual and large groups of people, their interaction and resultant forms of the environment. Spring, 1983.
Prerequisite: Permission of the instructor.
- 524. Experiential Landscape Studio Design (16)**
Forty-eight hours per week. The articulation of the study proposal established in LSA 425, as approved by faculty, through research, readings, field study with graphic and written documentation, and group discussion. Academic study in an off-campus location in an area of landscape architectural significance, as described and delineated in a student-prepared proposal approved by the faculty. Fall or Spring, 1982-83.
Prerequisites: LSA 425 and LSA 423 with a minimum grade of C.
- 525. Landscape Design Studio VI (4)**
Twelve hours of studio. Investigation of a problem in landscape architecture as proposed by the student and conducted in conjunction with faculty advisor. Spring, 1983.
Prerequisite: Permission of the instructor.
- 527. Landscape Design Studio VI (4)**
Twelve hours of studio. Studio problems, research, reports, and field trips. Concentration on regional landscape problems, the techniques of their analysis and derivation of their significance to the practice of landscape design. Spring, 1983.
Prerequisite: Permission of the instructor.
- 529. The Major Elements of Environmental Design (3)**
Lectures, readings, discussions, and studios. The course presents an introductory survey of environmental design methods and associated skills and techniques. While studio work is part of the course, no design background is required. Fall, 1982.
- 533. Plant Materials (2)**
Field trips and discussion. Ornamental woody plant identification. Observation and sketches of outstanding examples of planting design. Two weeks. Summer, 1983.
Prerequisite: Permission of the instructor.
- 545. Professional Practice Studio II (2)**
Three hours of studio, one hour of recitation. Studio problems, research, discussion and recitation sessions on the processes and methods of office practice. Emphasis on all aspects of site development. Spring, 1983.
Prerequisite: Permission of the instructor.
- 547. Principles of Professional Practice (2)**
Two hours of lecture. Lectures, assigned readings, reports, cost estimates, specifications, contracts, professional ethics, registration laws, professional practice. Spring, 1983.
- 595. Selected Readings in Landscape Architecture (1-3)**
Exploration of selected readings in depth with individual independent study upon a plan submitted by the student and related to credit hours assigned. Upon approval of the instructor, the student may systematically investigate some subject area encountered in regularly scheduled courses or may initiate research on a variety of subject areas of determined relevance. Fall and Spring, 1982-83.
Prerequisite: Fifth-year status or permission of the instructor.

596. Special Topics in Landscape Architecture (1-3)

Experimental or special coursework in landscape architecture for graduate and undergraduate students. Subject matter and method of presentation vary from semester to semester. Fall and spring, 1982-83.

Prerequisite: Permission of instructor.

598. Research Problem (1-3)

Independent study of selected areas of environmental interest. Emphasis on a self-disciplined study, development of procedures and techniques to be employed in environmental design and planning. Engagement with specific sites and problems as proposed for study by individual communities. Enrollment at periodic intervals throughout the semester. Fall and Spring, 1982-83.

Prerequisite: Permission of the instructor.

620. Community Design Studio I (3)

Six hours of studio and one lecture-seminar hour. An examination and evaluation of the landscape architectural design process with an emphasis on the methodological variations which occur in its definition and application. A variety of projects, scales, and programs are employed as a vehicle for study of the design process. Fall, 1982.

Prerequisite: Permission of the instructor.

621. Community Design Studio II (3)

Six hours of studio and one lecture-seminar hour. An examination and evaluation of the landscape architectural design process with an emphasis on the methodological variations which occur in its definition and application. A variety of projects, scales, and programs are employed as a vehicle for study of the design process. Spring, 1983.

Prerequisite: Permission of the instructor.

641. Formal Organizations (1)

Three hours of lecture-discussion for one-third of semester. This course presents basic functional concepts of formal organizations for landscape architects who intend to work at the community scale. Three types of organization arenas are presented: private, public, and non-profit organizational characteristics of division of work, hierarchy, authority, and communications are introduced. Comparisons are made between traditional bureaucracies and interdisciplinary teams. Each student will prepare an organizational description. Fall or Spring, 1982-83.

Prerequisites: MLA status or permission of the instructor.

642. Project and Program Scheduling (1)

Three hours of lecture-discussion for one-third of semester. The course presents an introduction to alternative scheduling methods for design projects, including bar charts, critical path, and program evaluation review techniques. Fall or Spring, 1982-83.

Prerequisites: MLA status or permission of the instructor.

643. Ethical Issues in Community Design and Planning (1)

Three hours of lecture-discussion for one-third of a semester. Status and role of the profession in society, standards of professional conduct and responsibility, ethical responses to a variety of professional situations is the focus of the course. Fall or Spring, 1982-83.

Prerequisites: MLA status or permission of the instructor.

650. Behavioral Factors of Community Design (3)

Three hours of lecture and discussion. An introduction to the contribution of the behavioral sciences to community design and planning is provided. Readings and discussions concern both theoretical and methodological aspects. Case studies are used to illustrate a variety of current behavioral science applications. Course assignments to familiarize the student with basic behavioral science methods including questionnaires, observations, and interviews. A final project provides an opportunity to synthesize course materials. Fall, 1982.

Prerequisites: MLA status or permission of the instructor.

651. Process of Urban/Regional Planning (3)

Three hours of seminar. The purpose of this course is the introduction of planning as a process of decisionmaking and to familiarize graduate students with its scope and content. The course relies upon lectures and readings to develop introductory knowledge as well as seminars and discussions to cover the constitutional basis, tools, and techniques and the current directions of planning. Spring, 1983.

Prerequisite: Permission of the instructor.

653. Environmental Land Use Planning (3)

An introduction to the interdisciplinary techniques and emphasis on environmental land use planning. Consideration of the underlying ecological and planning philosophies. Readings and discussions are used in order to familiarize students with the disciplines involved and the process of data analysis, synthesis, and plan formulation. Case studies and research projects used to enhance understanding. Fall and Spring, 1982-83.

Prerequisite: Permission of the instructor.

656. Environmental Factors, Community Response, and Form (3)

Two and one-half hours of lecture and six studios per semester. The course presents an introduction to a comprehensive process for the integration of environmental phenomena, such as solar access, visual access, noise, and wind into community design. The process includes data gathering and analysis, prediction methods, objective criteria, and implementation. Fall, 1982.

Prerequisites: Second year MLA status, or permission of the instructor.

671. History of Landscape Architecture (3)

Three hours of lecture-seminar. Regular use of slides and other projected lecture material; assigned texts as a basis for lecture; supplemental readings, assigned and individually researched; class discussion from readings and lecture; and student presentations and term paper. Historical study and style analysis of Western man's efforts to design his environment and his changing attitudes and relationships to environment. Also, non-Western coverage where significant or influential on Western man. Study of historical personalities as well as periods that are of environmental concern up into the modern periods. Fall, 1983.

Prerequisites: MLA standing or permission of the instructor.

696. Special Topics in Landscape Architecture (1-3)

Experimental or special coursework in landscape architecture for graduate and undergraduate students. Subject matter and method of presentation vary from semester to semester. Fall and spring, 1982-83.

Prerequisite: Permission of the instructor.

697. Topics and Issues of Community Design and Planning (2)

Two hours of lecture and discussion. Topics for discussion are selected to acquaint the entering graduate student with a generalized view of current issues facing landscape architects in community design and planning. Readings and papers are regularly assigned. Fall, 1982.

Prerequisites: MLA students or permission of the instructor.

699. Research Methods and Techniques (3)

Three hours of lecture. The course examines the design and development of research problems pertinent to landscape architecture and environmental planning. The course will concentrate on three major areas: (1) Areas of Potential Research, (2) Research Methods and Techniques, and (3) Proposal Writing. A variety of approaches to research in human-environment interactions will be discussed and explored with reference to their relevance and applicability to graduate research. Spring, 1983.

Prerequisite: Permission of the instructor.

731. Plant Materials (3)

Seminars, individual conferences, field trips, readings. Guided individual study in aspects of plant materials related to landscape architecture. Fall or Spring, 1982-83.

Prerequisite: Permission of the instructor.

752. Urban and Regional System Dynamics (3)

Lectures and workshop. The major concerns of this course are application of system dynamics; basic principles of system dynamics; and system dynamics modeling. This method is investigated as a useful tool in modeling many landscape architectural and planning problems. No prior computer experience is necessary. Fall, 1982.

Prerequisite: Permission of the instructor.

757. Methods of Corridor Location (3)

Three hours of lecture. This course emphasizes study of corridor types, traditional economic determinism, and the emergence of environmental, aesthetic, and social concerns. Landscape architectural methods for corridor location and evaluation are reviewed and compared. These methods include graphic overlays, an automated data bank, unified scoring systems, and multiple accounts. Students will engage a course project. Spring, 1983.

Prerequisite: Permission of the instructor.

796. Special Topics in Landscape Architecture (1-3)

One to three hours of class meetings. Special topics of current interest to graduate students in landscape architecture and related fields. A detailed course subject description will be presented as a topic area is identified and developed. Fall and Spring, 1982-83.

Prerequisite: Permission of the instructor.

797. Seminar (2)

Two hours of seminar. Discussion of current topics, trends, and, research related to landscape architecture, planning, and management. Fall and Spring, 1982-83.

Prerequisite: Permission of the instructor.

798. Research Problem**(Credit hours to be arranged according to nature of problem)**

Special study of assigned problems relating to landscape architecture or planning, with emphasis on critical thinking. Fall and Spring, 1982-83.

Prerequisite: Permission of the instructor.

799. Thesis Project Proposal Development (1)

One hour of lecture and workshop. During this course, a student will prepare a proposal for a thesis/project in the MLA program. Fall, 1982.

Prerequisites: LSA 699 and permission of the instructor.

899. Master's Thesis Research (Credit hours to be arranged)

Research and independent study for the master's degree and thesis. Fall and Spring, 1982-83.

PSE—PAPER SCIENCE AND ENGINEERING**300. Introduction to Papermaking (3)**

Three hours of lecture. Historical and commercial consideration of the paper industry. Technology of papermaking with emphasis on stock furnish, stock preparation and paper machine operation. Introductory discussions of papermaking materials and formation and reactions of a fibrous web. Fall, 1982.

301. Pulp and Paper Processes (3)

Three hours of lecture. Technological consideration of pulping and bleaching of woody raw material. Includes consideration of wood procurement and preparation, pulping and bleaching processes, recovery of secondary fibers, pollution abatement and other ancillary operations. Spring, 1983.

Prerequisites: FCH 571 and 572, PSE 300 (or concurrent).

302. Pulp and Paper Processes Laboratory (1)

One three-hour laboratory. Study and practice in the techniques of laboratory procedures normally encountered in the pulp and paper industry. Laboratory exercises selecting and using standard testing methods. Field trips to observe commercial equipment of the pulp and paper industry. Spring, 1983.

Prerequisite: PSE 301 (or concurrent).

304. Mill Experience (2)

Twelve weeks full-time pulp or paper mill employment approved by the department between the junior and senior years. The student must submit a comprehensive report to fulfill this requirement. Summer, 1983.

370. Principles of Mass and Energy Balance (3)

Three hours of lecture. Conservation of mass and energy applied to steady-state and dynamic process units and systems. Problem analysis and solution; computational techniques. Thermodynamic data and their use; real vs. perfect gases; steam properties; psychrometry. Fall, 1982.

Prerequisites: Calculus, physics, and FCH 360 (or concurrent).

371. Fluid Mechanics (3)

Three hours of lecture and/or demonstrations. The study of momentum transfer. Steady and unsteady flow of liquids and gases in pipelines, ducts, open channels, and porous media. Movement of particles in fluid media. Newtonian and non-Newtonian flow and flow of suspensions. Filtration, sedimentation, centrifugation, agitation and mixing. Characteristics and selection of pumps, blowers, agitators and other equipment. Flow measurement and flow system design with economic considerations. Fall, 1982.

Prerequisites: College level physics and chemistry, calculus.

372. Heat Transfer (2)

Two hours of lecture and/or demonstration. The study of heat transfer including conduction, convection, radiation and their applications in industry. Heater and heat exchanger design and selection, and industrial evaporation. Spring, 1983.

Prerequisites: PSE 370 and 371 or equivalent.

461. Pulping Technology (3)

One hour of lecture and six hours of laboratory. Discussion of pulping and bleaching processes: effect of chemical and physical variables on the wood components and pulp properties; chemistry involved. Experiments in pulping and bleaching, and pulp evaluation. Fall, 1982.

Prerequisites: PSE 301, CHE 346 and CHE 356.

Note: A student may not enroll in or receive credit for both PSE 461 and ERE 671.

465. Paper Properties (4)

Three hours of lecture, three hours of laboratory and discussion. Evaluation and study of the physical, optical, and chemical properties of paper and the interrelationships existing between paper manufacturing methods, papermaking additives, test results and the ultimate properties desired in the finished paper. Fall, 1982.

Prerequisites: PSE 301 and PSE 302.

Note: A student may not enroll in or receive credit for both PSE 465 and ERE 677.

466. Paper Coating and Converting (2)

One hour of lecture and three hours of laboratory. Evaluation and study of various coating materials and processes used by the paper industry. Introduction to polymers and their use in converting operations. Study of materials and equipment used in converting operations, fundamentals and parameters which control their use, effects on final properties of papers. Spring, 1983.

Prerequisite: PSE 465.

Note: A student may not enroll in or receive credit for both PSE 466 and ERE 678.

468. Papermaking Processes (3)

One hour of lecture and six hours of laboratory. Laboratory study of the papermaking process, with emphasis on operation of the semicommercial Fourdrinier paper machine. Emphasis is on the fundamentals of stock preparation, paper machine operation, evaluation of the finished product and the collection and analysis of data to develop material and energy balance. Results of each paper machine run are evaluated in seminar-type discussions. Spring, 1983.

Prerequisites: PSE 461 and PSE 465.

473. Mass Transfer (3)

Three hours of lecture. The study of mass transfer, humidification, air conditioning, drying, gas absorption, distillation, leaching, washing, and extraction. Fall, 1982.

Prerequisites: PSE 370, 371, and 372 or equivalent.

491. Paper Science and Engineering Project I (1)

Student makes a systematic survey of all available literature on the problem assigned him and incorporates it in a formal, typewritten report. An essential part of this report is a detailed outline of a research project which the student proposes to undertake during the next semester (PSE 492). Fall, 1982.

Prerequisites: PSE 300 and PSE 301.

492. Paper Science and Engineering Project II (3)

The analysis of a problem, the synthesis of a solution and the basic design of the facilities needed to solve a problem. Laboratory research, field work, and consulting as needed in addition to the literature survey completed in PSE 491. Progress reports and a final report and seminar-style presentation. Spring, 1983.

Prerequisite: PSE 491.

496. Special Topics (1-3)

Lectures, conferences, and discussions. Specialized topics in chemistry, chemical engineering, and physics as well as topics pertaining to management as related to the pulp, paper, paperboard, and allied industries. Fall and Spring, 1982-83.

498. Research Problem (1-4)

The student is assigned a research problem in pulping, bleaching, refining, additives, quality control of paper or paper products, or chemical engineering. The student must make a systematic survey of available literature on the assigned problem. Emphasis is on application of correct research technique rather than on the results of commercial importance. The information obtained from the literature survey, along with the data developed as a result of the investigation, is to be presented as a technical report. Fall and Spring, 1982-83.

Prerequisites: PSE 461 and PSE 465.

RMP—RESOURCE MANAGEMENT AND POLICY**560. Nonindustrial Private Forest Management (3)**

Three hours of lecture and discussion. Resource conditions and management issues associated with private nonindustrial private forest lands. Special attention is given to owner characteristics and objectives, public and private programs which directly or indirectly influence management decisions and the role of foresters in relation to the above. Spring, 1983.

Prerequisites: Senior or graduate student standing in Forestry.

561. Land Use Economics (3)

Three hours of lecture-discussion. Study of the theory and methods of land use economics and the application of economic analysis to open space and regional planning. Emphasis is on understanding basic concepts; development of operational methods and data sources. Case studies, outside readings, and guest speakers are utilized. Spring, 1983.

Prerequisite: One course in macroeconomics and one in microeconomics and permission of the instructor.

562. International Timber Trade (3)

Three hours of lecture. Basic principles of international trade. Structure and procedures of international timber trade. Major trade regions and their relationships. Economic context of timber trade. Emphasis is placed upon methods of analyses for understanding both opportunities and limitations of timber products exports and imports. Fall, 1982.

Prerequisites: Two semesters of undergraduate economics, and senior standing in forestry or wood products engineering.

587. Environmental Law (3)

Three hours of lecture and discussion. Studies in Environmental Law designed for resource managers. Review of structure and processes of American legal system, constitutional framework of environmental law, The National Environmental Policy Act, legal framework for management of federal lands, focus on legal aspects of common property resource management, land, water, and air. Fall, 1982.

588. The Law of Natural Resource Administration (3)

Three hours of lecture and discussion. An introduction to the law concerning the procedures, powers, and judicial review of public agencies responsible for the management of natural resources. Topics will include the extent of an agency's rule-making power and the rights of aggrieved parties to appeal from agency decisions. Spring, 1983.

Prerequisite: FOR 360 or equivalent course in public administration.

601. Resource Management Systems (3)

Three hours of lecture and seminar. Review of the structure and operation of the ecological and social environment within which resource managers operate. Major characteristics of the ecological utilization and control systems for forest and related natural resources are described and compared. Fall, 1982.

602. Resource Economics (3)

Three hours of lecture and discussion. Economic theory and analysis in resource management and use decisions. Study and application of economic models to land, water, forest, wildlife, and recreational resources. Relationships and interactions of public and private sector in resource management. Fall, 1982.

Prerequisite: Two semesters of undergraduate economics.

603. Research Methods in Resource Management and Policy (3)

Three hours of lecture and discussion. Study of the elements of research methodology including statistics and their application to analyzing and resolving problems both basic and applied in the managerial and policy sciences. Fall, 1982.

Prerequisite: Undergraduate statistics course.

611. Economics of the Forest Business (3)

Two hours of lecture and three hours of laboratory. Economic evaluation of alternative uses of land, labor, and capital in the operation of forest properties and related marketing and processing enterprises. Emphasis is on application of principles and methods of economic analysis. Part of the term is spent in appraising a forest property and preparing a plan for its operation. Complementary to instruction in FOR 456. Spring, 1983.

Prerequisite: Permission of the instructor.

629. Environmental Impact: Principles and Strategies (3)

Three hours of lecture and discussion. Principles and theory of environmental impact and statements of impact as required by federal law. Administrative procedures for review and evaluation. Procedural strategy and effective constitution of statements for various governmental levels. Means of obtaining sources of authoritative information. Fall and Spring, 1982-83.

643. Urban Water Management (3)

Three hours of lecture and seminar. A review of the role of urban water management in water resources management. The problems and issues of providing water utilities services of water supply, drainage, and waste water facilities including such considerations as planning, financing, local government, intergovernmental relations, state and federal role, water institutions and applicable law. Spring, 1983.

664. Soil and Water Conservation (3)

Three hours of lecture and discussion. An integrated examination of the many aspects of the field of water and related land resource conservation in the United States. Topics include the evaluation and present status of planning, organizational, economic and legal constraints on the development of policies and programs of the federal agencies, state and local government and private units. Fall, 1982.

Prerequisite: Permission of the instructor.

670. Economics of Nonmarket Goods (3)

Group discussion, lectures, guided readings, case studies, and student projects on the economic aspects of watershed management, fish and wildlife management, and outdoor recreation. Major topics include theories of valuation and application to nonmarket goods, cost analysis for nonmarket goods, and measurement of regional impacts. Spring, 1983.

Prerequisites: Microeconomics, knowledge of basic statistical analysis, and six hours or more of resource management coursework.

- 672. Open Space Planning (Recreation) (3)**
 Three hours of lecture and discussion. Study of methods and techniques applicable to open space planning in nonurban areas. Survey of literature and current research. Open space standards, classification systems, and inventory methods. Development of plans for large scale recreation areas, and inclusion of recreation into regional plans. The interrelationship and conflicts between resource utilization/development and recreation/aesthetics reviewed through case studies. Fall, 1982.
Prerequisites: One course in outdoor recreation, one course in planning, and permission of the instructor.
- 675. Psychology of Leisure Behavior (3)**
 Three hours of lecture and discussion. Introduction to theory and research findings dealing with the sociological and psychological aspects of leisure behavior: field work and lectures demonstrate applications, particularly in outdoor recreation. Spring, 1983.
- 751. World Forestry (3)**
 Three hours of lecture and discussion. World forest distribution and types; regional production and consumption of forest products; international trade in timber and related products; the role of forest resources in development; and special topics; tropical forestry, comparative forest policies and programs, forestry education, the problems of developing countries, international cooperation in forestry development, the role of the United States in world forestry, etc. Fall or Spring, 1982-83.
- 753. Resources Policy (3)**
 Three hours of lecture and seminar. Evaluation of basic environmental and resource issues and their involvement in public and institutional policies. Exploration of alternative resource goals, policies, and program approaches and their implications. Analysis of processes for policy delineation and modification. Spring, 1983.
- 754. Advanced Forest Administration (3)**
 Critical appraisal of existing public, semipublic and private forestry agencies in the United States, and the comparative study of major administrative organizations and practices. Occasional inspection trips to forestry headquarters and field units and discussion of internal administrative problems with forest officers. Fall or Spring, 1982-83.
Prerequisite: FOR 360 or equivalent.
- 796. Special Topics in Resource Management and Policy (1-3)**
 Lectures, seminars, and discussion. Advanced topics in resource management and policy. Check schedule of classes for details of subject matter. Fall and/or Spring, 1982-83.
- 797. Seminar (1)**
 Group discussion and individual conference concerning current topics, trends, and research in management. Fall and Spring, 1982-83.
- 798. Research Problems in Resources Management and Policy (Credit hours arranged according to nature of problem)**
 Special investigation and analysis of resources management problems where integrative relationships of several subject aspects of forestry are a major consideration. Fall and Spring, 1982-83.
- 898. Professional Experience (1-12)**
 Professional experience which applies, enriches, and/or complements formal coursework. Graded on an "S/U" basis. Fall, Spring, and Summer, 1982-83.
- 899. Master's Thesis or Project Research (1-12)**
 Investigation leading to the completion of a research-oriented thesis or to an application-oriented project. Graded on an "S/U" basis. Fall, Spring, and Summer.
- 999. Doctoral Thesis Research (1-12)**
 Investigation leading to the completion of the doctoral thesis. Graded on an "S/U" basis. Fall, Spring, and Summer.

SCE—SCHOOL OF CONTINUING EDUCATION

510. Creative Problem Solving Seminar (3)

Three hours of lecture and discussion. A course designed to extend the students' understanding and application of creative problem solving processes. One requirement will be to select and carry out an application of the techniques to a particular problem, with consultation and guidance from the instructor. Critique and survey of the literature on creativity, in-depth analysis of the synetics process and various procedures which have been developed for nurturing creative behavior comprise the essence of the program. Fall, 1983.

Prerequisite: Undergraduate degree or permission of the instructor.

Note: Also listed as EIN 510.

530. (FEN) Pest Identification, Biology and Management (3)

A study of the life history and management practices for pests common to the home, landscape and recreational areas. Suggested for pest control personnel and teachers of primary and secondary science areas. Not open to College of Environmental Science and Forestry students. Summer, 1983.

Prerequisite: One course in biology.

576. Special Topics Course: Environmental Education Processes and Strategies (3)

Lectures, discussions, field problems, and structured outdoor laboratory assignments in environmental education processes and strategies for professional educators in elementary and secondary schools who are part-time, nonmatriculated at ESF. Summer, 1983.

Prerequisite: Permission of the instructor. Not acceptable for credit in graduate programs of the School of Forestry.

596. Special Topics in Resource Management (1-3)

Lectures, field exercises, guided readings and discussions, in a shortcourse format. The study of recent developments and applications in resource management. Illustrative topics include management of forest stands, resource economics, land planning or recreation planning and site development. Not acceptable for credit in graduate programs of the School of Forestry. Summer, 1983.

Prerequisite: Permission of the instructor.

SIL—SILVICULTURE

520. Application of Ecology (3)

Two hours of lecture and discussion and one to three hours seminar, workshop, or field trip. Exploration of use and implications of ecological concepts for practices modifying terrestrial ecosystems for human benefit. Discussion of ecological writings in relation to applied problems; workshops, field trips and student presentations exploring ecological implications of specific situations. Course designed for interdisciplinary participation. Spring, 1983.

Prerequisite: An ecology course or permission of the instructor.

535. Advanced Forest Soils (3)

Three hours of lecture-discussions concerning the current state-of-the-art in forest soils. Effect of intensive forest management on soil, soil-site-species relationships, forest fertilization tree nutrition. Application of forest soils information to silviculture. Spring, 1983.

Prerequisite: Forestry 331, 332 or beginning courses in soils and silviculture.

540. Forest Hydrology (3)

Two hours of lecture and three hours of laboratory. The relation of forest and range vegetation to its environment, and its effect upon soil and water. Measurement of precipitation, runoff, erosion, and other variables. Fall and Spring, 1982-83.

542. Practice of Watershed Management (3)

Two hours of lecture and three hours of laboratory. The impact of the multiple use of forest and range lands on water yield and soil stability. Regional problems and potential solutions. Spring, 1983.

Prerequisite: SIL 540.

553. Energy Exchange at the Earth's Surface (3)

Two hours of lecture and three hours of laboratory. A comprehensive study of the physical processes taking place in the lowest layer of the atmosphere. Primary emphasis on the turbulent transfer of heat, momentum, and water vapor and the expression of these fluxes in the microclimate. Spring, 1983.

Prerequisites: FOR 452, physics, and calculus.

620. Silvicultural Concepts and Applications (3)

Six hours of lecture, study, or field work. Classroom instruction and exercises introduce topics important to silvicultural practice. Students explore these in depth through independent study and the solving of assigned problems. Field exercises will serve as a means to apply concepts, primarily in hardwood stands. Topics include concepts, techniques, diagnostic methods, and formulation and application of silvicultural prescriptions. Offered one day per week as a block of instruction. Spring, 1983.

Prerequisite: Previous undergraduate study of silviculture.

625. Productivity of Forest Stands (3)

Examination of forest tree and stand production variables as related to silvicultural manipulation. Analysis of stand response, such as rate of growth, stem form, product quality, tree quality, and value. Preparation of stand treatment schedules. Spring, 1983.

Prerequisite: Permission of the instructor.

635. Forest Soils and Their Analyses (3)

One hour of lecture, one hour of recitation, four hours of field and laboratory study of forest soils, emphasizing plant-soil relationships. Stress on quantification of plant-soil diagnostic techniques and their interpretation. Fall, 1982.

Prerequisites: FOR 446; background in physical and biological sciences recommended.

640. Advanced Wildland Hydrology (3)

Lecture, discussion, and laboratory sessions in advanced problems of forest and range hydrology, watershed management methods, and techniques and evaluation of new methods of hydrologic data collection and analysis. Fall, 1982.

Prerequisite: SIL 540 or FEG 340.

641. Watershed Analysis (3)

One hour of lecture and six hours of laboratory. Lecture and field experience in watershed characterization, inventory, and analysis in terms of land management problems. Fall, 1982.

Prerequisites: SIL 540 and permission of the instructor.

642. Snow Hydrology (3)

Three one-hour lectures and two three-day field trips. Physical characteristics of snow and the energy relations important in its accumulation and dissipation. Problems of measurement and prediction of runoff and melt. Potentials for management. Spring, 1983.

Prerequisite: SIL 540 or FEG 340.

677. Advanced Forest Tree Improvement (3)

Two hours of lecture and discussion and three hours of laboratory. A study of advanced principles and techniques for genetic improvement of forest trees. Special emphasis is placed on selection and breeding for growth rates, wood quality, and insect and disease resistance. Problems of tree hybridization, racial variations, sexual reproduction, and quantitative genetics in forest trees. Laboratory training in cytology and cytogenetics, pollen germination, vegetative propagation and other problems. Independent research problems will be undertaken by the student. Fall or Spring, 1982-83.

Prerequisites: FBL 470 and 471, FOR 455.

730. Research Methods in Silviculture (3)

Three hours of lecture or discussion. Research concepts and methodology with particular application to silviculture and its related sciences. More appropriate to beginning students or before taking thesis work. Fall, 1982.

Prerequisite: Permission of the instructor.

735. Forest Soil Fertility (Applied Studies) (2-4)

Two hours of lecture and one hour of discussion. Up to six hours of laboratory depending on number of credit hours. Influence of soil fertility on development and growth of seedlings and trees, and techniques involved to determine this influence. Chemical and biological analysis to determine levels of soil fertility. Nutrient element deficiencies and their correction by soil amendments and fertilizers. Term projects by the student will be undertaken. Spring, 1983.

Prerequisites: CHE 332 and 333, FBO 530, FOR 446 and SIL 635, or equivalent.

737. Forest Soil Physics (4)

Three hours of lecture and discussion and three hours of laboratory. Presentation of principles of soil physics including water flow, storage and availability, soil permeability, heat transfer, and their consideration as root environmental factors. Analytical procedures are introduced and evaluated. Applications of soil physics to silvics, soil fertility, watershed management and hydrology, soil biology and land-use. Spring, 1983.

Prerequisites: FOR 345, 446, or their equivalents. Physical chemistry and integral calculus strongly recommended.

796. Special Topics in Silviculture (1-3)

Lectures, seminars, and discussion. Advanced topics in silviculture. Check schedules of classes for details of subject matter. Fall and/or Spring, 1982-83.

797. Graduate Silviculture Seminar (1)

Three-hour class discussion. Assigned reports and discussion of silvicultural topics. Fall and Spring, 1982-83.

**798. Research Problems in Silviculture
(Credit hours arranged according to nature of problem)**

Fall and Spring, 1982-83.

899. Master's Thesis or Project Research (1-12)

Investigation leading to the completion of a research-oriented thesis or to an application-oriented project. Graded on an "S/U" basis. Fall, Spring, and Summer, 1982-83.

999. Doctoral Thesis Research (1-12)

Investigation leading to the completion of the doctoral thesis. Graded on an "S/U" basis. Fall, Spring, and Summer, 1982-83.

WPE—WOOD PRODUCTS ENGINEERING**300. Properties of Wood for Designers (2)**

Two hours of lecture. An introduction to the basic structure and properties of wood for the designer. Discussion of the effects of wood structure and properties on practical woodworking techniques. Fall and/or Spring, 1982-83.

320. Adhesives, Sealants, and Coatings (3)

Two hours of lecture and three hours laboratory. An introduction to adhesives, sealants, and coatings used in the wood products and building construction industries. All three types of materials, based upon polymers, will be evaluated in terms of their properties and respective technologies when used with wood systems. Emphasis will be placed on knowing how to apply this knowledge to understand current practice and to solve problems that may occur. Laboratory demonstrations to identify materials, methods of application, and methods of evaluating these materials. Fall, 1982.

Prerequisite: Junior standing.

322. Mechanical Processing (3)

Two hours of lecture and three hours of laboratory. Primary log reduction methods and industry practices. Lumber grading. Wood cutting principles. Machining practice in secondary wood-using industries. Experience in the operation of certain primary and secondary machining equipment. Fall, 1982.

326. Fluid Treatments (2)

Two hours of lecture. An introduction to wood-moisture relationships, wood permeability and pressure treatments, thermal conductivity, water-vapor movement, and drying and fire retardancy. The flow of fluids, heat and water vapor are treated as analogous phenomena and are related to the cellular structure of wood. Unsteady-state flow of gases, heat and water vapor are introduced. Spring, 1983.

327. Fluid Treatments Laboratory (1)

Three hours of laboratory. Laboratory studies in relative humidity measurement, wood-moisture relationships, the relationship between permeability and treatability, wood-preservative treatments, wood drying and flame testing. Spring, 1983.

Prerequisite: WPE 326 (or concurrent).

343. Introduction to Structural Design (3)

Three hours of lecture. The concepts of structural design are introduced with fundamental strength of materials. There are practical applications of steel, timber, and concrete in contemporary structural designs. Systems such as trusses, arches, and frames are introduced. Spring, 1983.

361. Engineering Mechanics—Statics (3)

Three hours of lecture. Forces and vectors, moments, equivalent force systems, free bodies, structures, section properties. Fall, 1982.

Prerequisites: Integral calculus and general physics.

386. Structure and Properties of Wood (3)

Two hours of lecture and three hours of laboratory. Structure of wood in relation to defects, properties and uses. The variability of wood. Identification of major U.S. timber by gross features. Spring, 1983.

387. Wood Structure and Properties (3)

Three hours of lecture. Structure of wood and its relation to physical properties and uses. The normal variability of wood, abnormal growth, defects, deterioration of wood and their influence on properties and uses. Fall, 1982.

Prerequisite: FBO 300 or equivalent is recommended.

389. Wood Identification Laboratory (1)

Three hours of laboratory. Identification of principal commercial timbers of United States on gross characteristics. Spring, 1983.

Prerequisite: WPE 387.

390. Fiber Identification Laboratory (1)

Three hours of laboratory. Identification of woody and nonwoody papermaking fibers. Spring, 1983.

Prerequisite: WPE 387.

399. Field Trip (2)

Two weeks supervised study and reporting of representative wood products industries. Required of all students in WPE. Estimated individual expenses are \$200-250 while on the trip. Spring, 1983.

400. Introduction to Forest Products (2)

Two hours of lecture. Characteristics of the products of the forest tree and manufacture of wood products. Fall or Spring, 1982-83.

422. Composite Materials (3)

Two hours of lecture and three hours of laboratory. Manufacturing methods, physical and mechanical properties, and major uses of each of the following products will be examined—decorative plywood, construction and industrial plywood, particleboards, waferboards, fiberboards, laminated beams, laminated-veneer lumber, wood polymer composites, and paper overlays. Laboratory exercises will be patterned after ASTM standard tests to evaluate the physical and mechanical properties of these materials with written reports to be submitted by each student. Spring, 1983.

Prerequisites: WPE 320. Concurrent or prior registration in ERE 362.

442. Light Construction (3)

Two hours of lecture and two hours of discussion. Elements of light frame construction, blue-print reading, and estimating. Fall, 1982.

444. Materials Marketing (3)

Three hours of lecture and discussion. Marketing functions, agencies and management in the wood products and related industries. Principles of salesmanship and their application. Spring, 1983.

450. Construction Equipment (3)

Three hours of lecture. Principles of selection, operation, and maintenance of construction equipment. Primary types of site preparation, handling and assembly devices and their efficient utilization will be examined. Spring, 1983.

Prerequisite: Senior standing.

454. Construction Management (3)

Three hours of lecture. Fundamental concepts of construction management activities. Topics include construction contracts, scheduling, project planning, estimating and bidding. Fall, 1982.

Prerequisite: OPM 365 or permission of the instructor.

497. Senior Seminar for Wood Products Engineering Majors (2)

Discussion and assigned reports in current problems and new developments in Wood Products Engineering. Fall, 1982.

498. Research or Design Problem (1-3)

Conferences, library, laboratory and/or field research on a specific problem in Wood Products Engineering. Typewritten report (original and one copy) required. Fall and/or Spring, 1982-83.

Prerequisite: Permission of the instructor and advisor.

504. Design of Wood Structural Elements (3)

Lectures. A development of the principles involved in designing structural elements in wood and practice in their application. Fall or Spring, 1982-83.



State University of New York

STATE UNIVERSITY OF NEW YORK

Chancellor of the University CLIFTON R. WHARTON, JR., B.A., M.A., Ph.D.

Secretary of the University MARTHA J. DOWNEY, B.S., M.A.

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State University's 64 geographically dispersed campuses bring educational opportunity within commuting distance of virtually all New York citizens and comprise the nation's largest, centrally managed system of public higher education.

When founded in 1948, the University consolidated 29 State-operated, but unaffiliated, institutions. In response to need, the University has grown to a point where its impact is felt educationally, culturally, and economically the length and breadth of the State.

More than 380,000 students are pursuing traditional study in classrooms or are working at home, at their own pace, through such innovative institutions as Empire State College, whose students follow individualized and often nontraditional paths to a degree. Of the total enrollment, more than 100,000 students are 24 years or older, reflecting State University's services to specific constituencies, such as refresher courses for the professional community, continuing educational opportunities for returning servicemen, and personal enrichment for the more mature persons.

State University's research contributions are helping to solve some of modern society's most urgent problems. It was a State University scientist who first warned the world of potentially harmful mercury deposits in canned fish, and another who made the connection between automobile and industrial smoke combining to cause

changes in weather patterns. Other University researchers continue important studies in such wide-ranging areas as immunology, marine biology, sickle-cell anemia, and organ transplantation.

More than 1,000 Public Service activities are currently being pursued on State University campuses. Examples of these efforts include: special training courses for local government personnel, State civil service personnel, and the unemployed; participation by campus personnel in joint community planning or project work, and campus-community arrangements for community use of campus facilities.

A distinguished faculty includes nationally and internationally recognized figures in all the major disciplines. Their efforts are recognized each year in the form of such prestigious awards as Fulbright-Hayes, Guggenheim, and Danforth Fellowships.

The University offers a wide diversity of what are considered the more conventional career fields, such as engineering, medicine, literature, dairy farming, medical technology, accounting, social work, forestry, and automotive technology. Additionally, its responsiveness to progress in all areas of learning and to tomorrow's developing societal needs has resulted in concentrations which include pollution, urban studies, computer science, immunology, preservation of national resources, and microbiology.

SUNY programs for the educationally and economically disadvantaged have become models for delivering better learning opportunities to a once-forgotten segment of society. Educational Opportunity Centers offer high school equivalency and college preparatory courses to provide young people and adults with the opportunity to begin college or to learn marketable skills. In addition, campus based Educational Opportunity Programs provide counseling, developmental education and financial aid to disadvantaged students in traditional degree programs.

Overall, at its EOC's, two-year colleges, four-year campuses and university and medical centers, the University offers 3,600 academic programs. Degree opportunities range from two-year associate programs to doctoral studies offered at 12 senior campuses.

The 30 two-year community colleges operating under the program of State University play a unique role in the expansion of educational opportunity, by:

Providing local industry with trained technicians in a wide variety of occupational curricula;

Providing transfer options to students who wish to go on and earn advanced degrees, and;

Providing the community with yet another source for technical and professional upgrading as well as personal enrichment.

During its brief history, State University has graduated more than 805,000 alumni, the majority of whom are pursuing their careers in communities across the State.

State University is governed by a Board of Trustees, appointed by the Governor, which directly determines the policies to be followed by the 34 State-supported campuses. Community colleges have their own local boards of trustees whose relationship to the SUNY board is defined by law. The State contributes one-third to 40 percent of their operating cost and one-half of their capital costs.

The State University motto is: "To Learn—To Search—To Serve."

STATE UNIVERSITY OF NEW YORK

UNIVERSITY CENTERS

State University of New York at Albany
State University of New York at Binghamton

State University of New York at Buffalo
State University of New York at Stony Brook

COLLEGES OF ARTS AND SCIENCES

Empire State College
State University College at Brockport
State University College at Buffalo
State University College at Cortland
State University College at Fredonia
State University College at Geneseo
State University College at New Paltz

State University College at Old Westbury
State University College at Oneonta
State University College at Oswego
State University College at Plattsburgh
State University College at Potsdam
State University College at Purchase

COLLEGES AND CENTERS FOR THE HEALTH SCIENCES

Downstate Medical Center at Brooklyn
Upstate Medical Center at Syracuse
College of Optometry at New York City

Health Sciences Center at Buffalo University Center*
Health Sciences Center at Stony Brook University Center*

AGRICULTURAL AND TECHNICAL COLLEGES

Agricultural and Technical College at Alfred
Agricultural and Technical College at Canton
Agricultural and Technical College at Cobleskill

Agricultural and Technical College at Delhi
Agricultural and Technical College at Farmingdale
Agricultural and Technical College at Morrisville

SPECIALIZED COLLEGES

College of Environmental Science and Forestry at Syracuse
Maritime College at Fort Schuyler
College of Technology at Utica/Rome
Fashion Institute of Technology at New York City***

STATUTORY COLLEGES**

College of Agriculture and Life Sciences at Cornell University
College of Ceramics at Alfred University
College of Human Ecology at Cornell University
School of Industrial and Labor Relations at Cornell University
College of Veterinary Medicine at Cornell University

COMMUNITY COLLEGES

(Locally-sponsored, two-year colleges under the program of State University)

Adirondack Community College at Glens Falls
Broome Community College at Binghamton
Cayuga County Community College at Auburn
Clinton Community College at Plattsburgh
Columbia-Greene Community College at Hudson
Community College of the Finger Lakes at
Canandaigua
Corning Community College at Corning
Dutchess Community College at Poughkeepsie
Erie Community College at Williamsville, Buffalo
and Orchard Park
Fashion Institute of Technology at New York City
Fulton-Montgomery Community College at
Johnstown
Genesee Community College at Batavia
Herkimer County Community College at Herkimer
Hudson Valley Community College at Troy
Jamestown Community College at Jamestown
Jefferson Community College at Watertown

Mohawk Valley Community College at Utica
Monroe Community College at Rochester
Nassau Community College at Garden City
Niagara County Community College at Sanborn
North Country Community College at Saranac
Lake
Onondaga Community College at Syracuse
Orange County Community College at
Middletown
Rockland Community College at Suffern
Schenectady County Community College at
Schenectady
Suffolk County Community College at Selden,
Riverhead and Brentwood
Sullivan County Community College at Loch
Sheldrake
Tompkins Cortland Community College at Dryden
Ulster County Community College at Stone Ridge
Westchester Community College at Valhalla

*The Health Sciences Centers at Buffalo and Stony Brook are operated under the administration of their respective University Centers.

**These operate as "contract colleges" on the campuses of independent universities.

***While authorized to offer such baccalaureate and master's degree programs as may be approved pursuant to the provisions of the Master Plan, in addition to the associate degree, the Fashion Institute of Technology is financed and administered in the manner provided for community colleges.

College of Environmental Science and Forestry

ESF BOARD OF TRUSTEES

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COLLEGE ADMINISTRATION

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Assistant Vice President for Research Programs	JAMES W. GEIS
Assistant Vice President for Academic Programs	ROBERT H. FREY
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Director of Admissions	ROBERT L. FRIEDMAN
Director, Institute of Environmental Program Affairs (IEPA)	JAMES W. GEIS
Coordinator of Demonstration and Information, IEPA	ROLLA W. COCHRAN
Vice President for Student Affairs	HARRISON H. PAYNE
Director of Financial Aids	JOHN E. VIEW
Registrar	ROBERT S. NORTH
Advisor, Foreign Student Exchange Visitor Programs	VIRGINIA T. TORELLI
Vice President for Administration and Services	DAVID G. ANDERSON
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Director of Business and Fiscal Affairs	HARRY J. CORR
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Director of Physical Plant	BRUCE E. REICHEL
Director of Public Safety	BRIAN M. SPEER
Acting Director of Analytical and Technical Services	ROWENA V. KATHER
Director of Administrative Data Processing and Institutional Research	SHEILA M. CROWLEY
Director of Forest Properties	RICHARD A. SCHWAB
Dean, School of Biology, Chemistry and Ecology	STUART W. TANENBAUM
Dean, School of Continuing Education and Assistant Vice President for International Programs	JOHN M. YAVORSKY
Dean, School of Environmental and Resource Engineering	WILLIAM P. TULLY
Dean, School of Forestry	JOHN V. BERGLUND
Dean, School of Landscape Architecture	ROBERT G. REIMANN
Director, School of Forest Technology	JAMES E. COUFAL
Acting Director, Graduate Program in Environmental Science	ROBERT H. FREY
Acting Director, Adirondack Ecological Center	WILLIAM F. PORTER
Director, Empire State Paper Research Institute	BENGT LEOPOLD
Acting Director, Polymer Research Institute	KENNETH J. SMITH
Director, Ultrastructure Studies Center	WILFRED A. CÔTÉ, JR.
Director, Tropical Timber Information Center	ROBERT W. MEYER
Director, Cellulose Research Institute	TORE E. TIMELL
Project Leader, U.S. Forest Service Cooperative Research Unit	ROWAN A. ROWNTREE
Director, Renewable Materials Institute	WILFRED A. CÔTÉ, JR.

COLLEGE FACULTY AND PROFESSIONAL STAFF

DISTINGUISHED PROFESSOR

CONRAD SCHUERCH, *Distinguished Professor*, Department of Chemistry

DISTINGUISHED TEACHING PROFESSOR

EDWIN H. KETCHLEDGE, *Distinguished Teaching Professor*, Department of Environmental and Forest Biology.

THEODORE J. STENUF, *Distinguished Teaching Professor*, Department of Paper Science and Engineering

DISTINGUISHED ADJUNCT PROFESSOR

HARRY L. FRISCH, *Distinguished Adjunct Professor*, Department of Chemistry

DISTINGUISHED PROFESSOR EMERITUS

MICHAEL M. SZWARC, *Distinguished Professor Emeritus*, Polymer Research Institute

This listing represents an official record of the State University of New York College of Environmental Science and Forestry faculty and professional staff for 1982. It is designed for use in 1982-83.

The date in parentheses after each name denotes the first year of service, two or more dates, the term of service.

LAWRENCE P. ABRAHAMSON (1977), *Senior Research Associate*, School of Forestry and Department of Environmental and Forest Biology; B.S., Michigan University, 1964; M.S., University of Wisconsin, 1967; Ph.D., 1969

JUDD H. ALEXANDER (1979), *Adjunct Professor*, Graduate Program in Environmental Science; B.A., Carleton College, 1949; P.M.D., Harvard Business School, 1967

MAURICE M. ALEXANDER (1949), *Professor*, Department of Environmental and Forest Biology; Graduate Program in Environmental Science; *Director*, Roosevelt Wildlife Forest Experiment Station; B.S., New York State College of Forestry, 1940; M.S., University of Connecticut, 1942; Ph.D., State University of New York College of Forestry, 1950

DOUGLAS C. ALLEN (1968), *Professor*, Department of Environmental and Forest Biology; B.S., University of Maine, 1962; M.S., 1965; Ph.D., University of Michigan, 1968

IRA H. AMES (1972), *Adjunct Associate Professor*, Department of Environmental and Forest Biology; B.A., Brooklyn College, 1959; M.S., New York University, 1962; Ph.D., 1966

DAVID G. ANDERSON (1959), *Vice President for Administration and Services; Professor*; A.A.S., State University of New York College of Forestry (Ranger School), 1950; B.S., State University of New York College of Forestry, 1953; M.S., University of Utah, 1958; M.P.A., Syracuse University, 1977

ROBERT E. ANTHONY (1953), *Technical Specialist*, Department of Environmental and Forest Biology; A.A.S., State University of New York Agricultural and Technical College at Morrisville, 1952

ROBERT W. ARSENEAU (1972), *Programmer/Analyst*, Administrative Data Processing; A.A.S., Mohawk Valley Community College, 1967; B.S., Syracuse University, 1978

CAROLINE B. BAILEY (1978), *Technical Assistant*, School of Landscape Architecture

JAMES P. BAMBACHT (1967), *Professor*, Department of Paper Science and Engineering; A.B., Kalamazoo College, 1954; M.S., The Institute of Paper Chemistry, 1956; Ph.D., State University of New York College of Environmental Science and Forestry, 1973

C. ELLISON BECK (1970), *Technical Specialist*, Analytical and Technical Services, Office of the Vice President for Administration and Services

DONALD F. BEHREND (1960-67) (1968), *Vice President for Program Affairs*, Office of Program Affairs; *Professor*, Department of Environmental and Forest Biology; B.S., University of Connecticut, 1958; M.S., 1960; Ph.D., State University of New York College of Forestry, 1966

JOHN D. BENNETT (1960), *Associate Professor*, School of Forestry; Graduate Program in Environmental Science; B.A., Ohio Wesleyan University, 1954; Ph.D., Syracuse University, 1968; *Chancellor's Award for Excellence in Teaching* (1973)

CAMILLO A. BENZO (1975), *Adjunct Associate Professor*, Department of Environmental and Forest Biology; B.A., Utica College of Syracuse University, 1964; Ph.D., University of Pennsylvania, 1969

JOHN V. BERGLUND (1965), *Dean and Professor*, School of Forestry; B.S., Pennsylvania State University, 1962; M.S., 1964; Ph.D., State University of New York College of Forestry, 1968

DONALD H. BICKELHAUPT (1969), *Research Assistant*, School of Forestry; B.S., State University of New York College of Forestry, 1969; M.S., State University of New York College of Environmental Science and Forestry, 1980

PETER E. BLACK (1965), *Professor*, School of Forestry; Graduate Program in Environmental Science; B.S., University of Michigan, 1956; M.F., 1958; Ph.D., Colorado State University, 1961; *Executive Chairman of the Faculty* (1974-76) (1976-78)

GARY BLISS (1972), *Technical Assistant*, Department of Environmental and Forest Biology; State University of New York College of Environmental Science and Forestry (Ranger School), 1972

DENNIS A. BOGYO (1981), *Research Associate*, Chemistry Department; B.A., Earlham College, 1962, Ph.D., University of Buffalo, 1975

WILLIAM R. BORGSTEDT (1971), *Technical Assistant*, Department of Environmental and Forest Biology; A.A.S., Miner Institute, 1966; A.A.S., State University of New York College at Delhi, 1970; B.S., State University of New York College of Environmental Science and Forestry, 1975, M.S.; Syracuse University, 1978

JEROME BREZNER (1961), *Professor*, Department of Environmental and Forest Biology; A.B., University of Rochester, 1952; A.M., University of Missouri, 1956; Ph.D., 1959; Post-doctoral, Dartmouth Medical School, 1960; *Executive Chairman of the Faculty*, 1970

KENNETH W. BRITT (1971), *Senior Research Associate*; Department of Paper Science and Engineering; B.Chem., Cornell University, 1929

ROBERT H. BROCK, JR. (1967), *Chairman and Professor*, Department of Forest Engineering; Graduate Program in Environmental Science; B.S., State University of New York College of Forestry, 1958; M.S., 1959; Ph.D., Cornell University, 1971

RAINER H. BROCKE (1969), *Senior Research Associate*, Department of Environmental and Forest Biology, B.S., Michigan State University, 1955; M.S., 1957; Ph.D., 1970

DAVID F. BRODOWSKI (1977), *Technical Assistant*, Department of Environmental and Forest Biology; B.S., Cornell University, 1975

ALTON F. BROWN (1963), *Technical Specialist*, Empire State Paper Research Institute

THOMAS E. BROWN (1977), *Adjunct Assistant Professor*, Department of Environmental and Forest Biology; B.S., Niagara University, 1957; M.S., State University of New York College of Forestry, 1968

ROBERT O. BRUSH (1982), *Adjunct Associate Professor*, School of Forestry; B.S., University of Massachusetts, 1966; M.L.A., 1968; Ph.D., 1978

ROBERT L. BURGESS (1981), *Chairman and Professor*, Department of Environmental and Forest Biology; B.S., University of Wisconsin (Milwaukee), 1957; M.S., University of Wisconsin (Madison), 1959; Ph.D., 1961

KENNETH F. BURNS (1970), *Technical Assistant*, School of Forestry; A.A.S., Paul Smith's College, 1969

HARRY W. BURRY (1962), *Senior Research Associate*, School of Forestry; *Associate Professor*; B.S., New York State College of Forestry, 1941; M.F., State University of New York College of Forestry, 1964

ISRAEL CABASSO (1981), *Professor*, Department of Chemistry; *Associate Director*, Polymer Research Institute; B.S., Hebrew University, 1966; M.S., 1968; Ph.D. Weizmann Institute of Science, 1973

PAUL M. CALUWE (1969), *Associate Professor*, Department of Chemistry; *Associate Member*, Polymer Research Institute; Ph.D., University of Leuven, Belgium, 1967

WILBUR H. CAMPBELL (1975), *Associate Professor*, Department of Chemistry; A.A., Santa Ana College, 1965; B.A., Pomona College, 1967; Ph.D., University of Wisconsin, 1972

HUGH O. CANHAM (1966), *Associate Professor*, School of Forestry; Graduate Program in Environmental Science; B.S., State University of New York College of Forestry, 1960; M.S., 1962; Ph.D., 1971

DIANNE M. CAPRITTA (1967), *Associate Librarian*, F. Franklin Moon Library; B.S., University of Illinois, 1965; M.S.L.S., Syracuse University, 1967

LAEL S. CARTER (1979), *Administrative Manager*, Syracuse Pulp and Paper Foundation; B.A., Mount Holyoke College, 1966

COSTAS A. CASSIOS (1978), *Adjunct Professor*, School of Landscape Architecture; B.S., University of Thessaloniki, 1965; M.S., Graduate Industrial School, 1969; M.S., University of Wisconsin, 1972; Ph.D., 1976

JOHN D. CASTELLO (1978), *Assistant Professor*, Department of Environmental and Forest Biology; B.A., Montclair State College, 1973; M.S., Washington State University, 1975; Ph.D., University of Wisconsin, 1978

THOMAS M. CATTERSON (1982), *Adjunct Associate Professor*, Office of International Programs; B.S., State University of New York College of Forestry, 1967; M.S., State University of New York College of Environmental Science and Forestry, 1973

ROBERT E. CHAMBERS (1967), *Professor*, Department of Environmental and Forest Biology; Graduate Program in Environmental Science; B.S., Pennsylvania State University, 1954; M.S., 1956; Ph.D., Ohio State University, 1972

ROLLA W. COCHRAN (1964), *Assistant to the President for Community Relations*; Office of the President; *Associate Professor*; Coordinator of Demonstration and Information, Institute of Environmental Affairs; *Associate Professor*, Graduate Program in Environmental Science; B.A., Denison University, 1949; M.S., Ohio State University, 1951

JOHN C. COFFEY (1982), *Assistant Facilities Program Coordinator*; Maintenance and Operations; B.S., Rensselaer Polytechnic Institute, 1971; B. Architecture, 1972; M.R.P., Syracuse University, 1977; Registered Architect, New York

ETHEL M. COMP (1978), *Personnel Associate*, Office of the Vice President for Administration and Services

MICHAEL T. CONTI (1981), *Technical Assistant*, Department of Forest Engineering; A.S. Delhi ATC, 1979; B.S., State University of New York College of Environmental Science and Forestry, 1981

HARRY J. CORR (1967), *Director of Business and Fiscal Affairs*, Office of the Vice President for Administration and Services; B.S. Siena College, 1957

WILFRED A. CÔTÉ, JR. (1950), *Professor*, Department of Wood Products Engineering; *Director*, Renewable Materials Institute and N.C. Brown Center for Ultrastructure Studies; B.S., University of Maine, 1949; M.F., Duke University, 1950; Ph.D., State University of New York College of Forestry, 1958

JAMES E. COUFAL (1965), *Director and Professor*, School of Forest Technology; State University of New York College of Forestry (Ranger School), 1957; B.S., State University of New York College of Forestry, 1960; M.S., 1962; Ed.S., State University of New York at Albany, 1976

PHILLIP J. CRAUL (1968), *Professor and Curriculum Director*, School of Forestry; B.S.F., Pennsylvania State University, 1954; M.S., 1960; Ph.D., 1964

THIERRY CRESSON (1981), *Technical Specialist*, Empire State Paper Research Institute; M.S., Ingenieur Ecole Francaise de Papeterie, 1981

JAMES O. CREVELLING (1970), *Forest Property Manager*, Wanakena and Cranberry Campuses; A.A.S., Paul Smith's College, 1965; B.S., University of Massachusetts, 1967

CLAY M. CROSBY (1964), *Research Assistant*, Empire State Paper Research Institute; B.S., State University of New York College of Forestry, 1964; M.S., 1970

SHEILA M. CROWLEY (1977), *Director, Administrative Data Processing and Institutional Research*, Office of the Vice President for Administration and Services; A.B., Albertus Magnus College, 1967; M.S., Syracuse University, 1979

JUSTIN CULKOWSKI (1978), *Director of Alumni Affairs*, B.S., State University of New York College of Environmental Science and Forestry, 1973

- TIBERIUS CUNIA (1968), *Professor*, School of Forestry; Graduate Program in Environmental Science; Forest Engineer, Ecole Nat. des Eaux et Forets, 1951; M.S., McGill University, 1957
- GEORGE W. CURRY (1966), *Professor*, School of Landscape Architecture; B.A., Michigan State University, 1962; B.S., 1965; M.L.A., University of Illinois, 1969
- MIROSLAW M. CZAPOWSKYJ (1979), *Adjunct Professor*, School of Forestry; Diplom-forstwirt, Ludwig-Maximilians University, 1949; M.S., University of Maine, 1958; Ph.D., Rutgers University, 1962
- ANDREA CZERKIES (1981), *Technical Assistant*, Department of Paper Science and Engineering; B.S., State University of New York College of Environmental Science and Forestry, 1981
- BENJAMIN V. DALL (1975), *Professor*, School of Forestry; Graduate Program in Environmental Science; B.S., Yale University, 1955; M.F., 1956; J.D., University of Virginia, 1959; Ph.D., Pennsylvania State University, 1972
- ROBERT W. DAVIDSON (1957), *Professor*, Department of Wood Products Engineering; B.S., Montana State University, 1948; M.S., State University of New York College of Forestry, 1956; Ph.D., 1960
- ARNOLD C. DAY (1947), *Technical Specialist*, N.C. Brown Center for Ultrastructure Studies
- TIMOTHY R. DAY (1981), *Assistant Professor*, School of Landscape Architecture; B.S.L.A., California Polytechnic State University, 1976; M.L.A., Harvard Graduate School of Design, 1980
- LOUIS D. DE GENNARO (1980), *Adjunct Professor*, Department of Environmental and Forest Biology; B.S., Fordham University, 1948; M.S., Boston College, 1950; Ph.D., Syracuse University, 1959
- SALVACION DE LA PAZ (1973), *Associate Librarian*, F. Franklin Moon Library; B.S.L.S., University of the Philippines, 1956; M.S.L.S., Simmons College, 1962
- ELLEN M. DELLMORE (1980), *Computer Operator*, Administrative Data Processing; A.A.S., State University of New York College of Environmental Science and Forestry (School of Forest Technology), 1977; A.A.S., Community College of the Air Force, 1979
- FERDINAND A. DEL ROSARIO (1981), *Technical Assistant*, Department of Paper Science and Engineering
- CARLTON W. DENCE (1951), *Professor*, Empire State Paper Research Institute; Graduate Program in Environmental Science; B.S., Syracuse University, 1947; M.S., State University of New York College of Forestry, 1949; Ph.D., 1959
- CARL H. DE ZEEUW (1946), *Professor*, Department of Wood Products Engineering; A.B., Michigan State College, 1934; B.S., 1937; M.S., New York State College of Forestry, 1939; Ph.D., State University of New York College of Forestry, 1949
- ARTHUR G. DILLON (1976), *Technical Specialist*, Department of Paper Science and Engineering; B.S., State University of New York College of Environmental Science and Forestry, 1974; M.S., 1982
- DANIEL L. DINDAL (1966), *Professor*, Department of Environmental and Forest Biology; Graduate Program in Environmental Science; B.S., Ohio State University, 1958; M.A., 1961; Ph.D., 1967, *Chancellor's Award for Excellence in Teaching* (1974)
- JULIA O. DOMINGUE (1980), *Technical Specialist*, Department of Forest Engineering; B.A., University of Illinois, 1975; M.S., 1979
- ALLAN P. DREW (1980), *Assistant Professor*, School of Forestry; B.S., University of Illinois, 1965; M.S., University of Arizona, 1967; Ph.D., Oregon State University, 1974
- MICHAEL J. DUGGIN (1979), *Associate Professor*, Department of Forest Engineering; Graduate Program in Environmental Science; B.Sc., Melbourne University, 1959; Ph.D., Monash University, 1965
- PATRICK R. DURKIN (1980), *Adjunct Assistant Professor*, Graduate Program in Environmental Science; B.S., State University of New York College at Fredonia, 1968; M.S., Fordham University, 1972; Ph.D., State University of New York College of Environmental Science and Forestry, 1979

- GEORGE F. EARLE (1952), *Professor*, School of Landscape Architecture; B.F.A., Syracuse University, 1937; M.F.A., Yale University, 1946
- RONALD EBY (1968), *Research Associate*, Chemistry Department; B.S., State University of New York College of Forestry, 1969; M.S., State University of New York College of Environmental Science and Forestry, 1972; Ph.D., 1974
- ANDREW L. EGGERS (1967), *Technical Specialist*, Educational Communications Section, Office of the Vice President for Administration and Services
- ELIZABETH A. ELKINS (1973), *Associate Librarian*, F. Franklin Moon Library; B.A., Hartwick College, 1968; M.L.S., State University of New York at Geneseo, 1970
- DONALD P. ELY (1980), *Adjunct Professor*, Graduate Program in Environmental Science; B.A., State University College for Teachers, Albany, 1951; M.A., Syracuse University, 1953; Ph.D., 1961
- JOHN H. ENGELKEN (1952), *Assistant Professor*; Forest Property Manager, Tully Campus; B.S.F., Utah State University, 1950
- ARTHUR R. ESCHNER (1961), *Professor*, School of Forestry; Graduate Program in Environmental Science; B.S., State University of New York College of Forestry, 1950; M.S., Iowa State College, 1952; Ph.D., State University of New York College of Forestry, 1965
- AMINUR EUSUFZAI (1977), *Technical Assistant*, Empire State Paper Research Institute; B.Sc. (Hons.), Dacca University, 1957; M.Sc., 1960; B.Sc. (Hons.), Forestry, Peshawar University, 1962; M.S., West Virginia University, 1969
- MILDRED FAUST (1976), *Adjunct Professor*, School of Biology, Chemistry and Ecology; A.B., Penn College, 1921; M.S., University of Chicago, 1923; Ph.D., 1933
- JOHN P. FELLEMAN (1973), *Professor*, School of Landscape Architecture; Graduate Program in Environmental Science; B.C.E., Cornell University, 1966; M.E.C., 1966; N.D.E.A. Fellow, University of North Carolina, 1967; D.P.A., New York University, 1973
- JOHN S. FISHLOCK (1965), *Technical Assistant*, Department of Environmental and Forest Biology; A.A.S., State University of New York College of Forestry (Ranger School), 1965
- MICHAEL FLASHNER (1973), *Associate Professor*, Department of Chemistry; B.S., Brooklyn College, 1965; A.M., University of Michigan, 1970; Ph.D., 1971
- LEROY C. FORTMANN (1980), *Technical Specialist*, Department of Chemistry; B.S., University of Iowa, 1976; M.S., University of Nevada, Las Vegas, 1978
- CLAUDE C. FREEMAN (1959), *Associate Professor*, School of Landscape Architecture; B.S., State University of New York College of Forestry, 1959
- ROBERT H. FREY (1977), *Assistant Vice President for Academic Programs*, *Associate Professor*, *Acting Director*, Graduate Program in Environmental Science; B.A., Valparaiso University, 1965; M.Ed., Springfield College, 1966; Ed.D., Indiana University, 1973
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SUNY College of
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Academic Calendar

SYRACUSE CAMPUS

FALL 1983

New Student Orientation Program	Sept. 5	Monday
Academic Advising	Sept. 6	Tuesday
Registration	Sept. 7, 8	Wednesday, Thursday
Classes Begin	Sept. 9	Friday
Registration Planning Day (no classes)	Nov. 15	Tuesday
Graduate Student Registration	Nov. 15	Tuesday
Thanksgiving Recess	Nov. 22—27	Tuesday—Sunday
Early Registration	Nov. 28—Dec. 9	Monday—Friday
Last Day of Classes	Dec. 16	Friday
Exam Period	Dec. 19—23	Monday—Friday

SPRING 1984

Orientation and Advising for New Students	Jan. 16	Monday
Registration	Jan. 16, 17	Monday, Tuesday
Classes Begin	Jan. 18	Wednesday
Spring Recess	Mar. 10—18	Saturday, Sunday
Registration Planning Day (no classes)	Apr. 4	Wednesday
Graduate Student Registration	Apr. 4	Wednesday
Early Registration	Apr. 9—20	Monday—Friday
Last Day of Classes	May 2	Wednesday
Reading Day	May 3	Thursday
Exam Period	May 4—10	Friday—Thursday
Commencement	May 12	Saturday

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SCIENCE AND FORESTRY



ESF: What's In A Name?

1911. Governor John A. Dix signed a bill establishing the New York State College of Forestry at Syracuse University.

1948. Legislative action incorporated into State University of New York all state-supported higher education. Thus, the State University College of Forestry at Syracuse University.

1972. By special legislative act, the College was renamed the State University of New York College of Environmental Science and Forestry.

Why, in the first place, all the name changes? And, secondly, what difference do they make? What, really, is in our name?

ESTABLISHING A TRADITION

While a professional forestry education in this country is almost entirely a development of the twentieth century, its primary roots can be traced back as early as 1862 when Congress passed the Morrill Act establishing a system of land-grant colleges.

The growing importance of forests in America's economy was reflected in the 1870 census, when, for the first time, information on forest resources was included. Several attempts to establish a national school of forestry were made; while none was approved, the movement shows that there was considerable demand for professionally trained foresters.

By 1900 there was a spirit of reform in the country—the same spirit that produced the early muckrakers also produced a generation interested in the conservation, preservation and careful management of precious natural resources. Between 1903 and 1914, 21 schools of forestry were established.

The first college of forestry in this country to offer a full, four-year undergraduate program was established in 1898 at Cornell University. Under the leadership of Bernard E. Fernow, students were introduced to critical field experience in their junior and senior years at the college's 30,000-acre forest in the Adirondack Mountains. There, Fernow taught many experimental management practices, including clear-cutting and surface-burning. These techniques have always been controversial, and they aroused criticism by the wealthy summer residents in adjacent areas of the Adirondacks. After only five years of operation, the Cornell College of Forestry was closed in 1903 when the state Legislature, yielding to the influential property owners, ended fiscal support.

The beginnings and early development of the New York State College of Forestry were largely due to James R. Day, chancellor of Syracuse University, and community leaders who were attuned to the growing national

sentiment favoring forest conservation and who sensed the need for a professional school of forestry. The legislative act which created the College instructed that the institution "conduct such special research in statewide investigations in forestry as will throw light upon and help in the solution of forestry problems. . ." and that it be "the institution for educational work in forestry in the State."

From the very first years of its existence under the first dean, Hugh P. Baker, the College responded to the broad needs of environmental professionalism. While other schools and colleges of forestry became more specialized, the College at Syracuse broadened to include the essentials of environmental science: design, engineering, and the life sciences, as well as resource management.

BROADENING THE BASE

With the formation of the State University of New York in 1948, coordination and systematization came to higher education in the state. The University, according to its charter, was to "supplement, not supplant, the great network of private colleges and universities." The College of Forestry, which from its beginning had been state-supported and governed by a Board of Trustees currently made up of nine members appointed by the Governor and six *ex officio* members, was recognized as a specialized college within the State University system.

Stemming from Chancellor Day's early sponsorship of the College, Syracuse University and ESF have long been engaged in numerous fruitful devices of institutional cooperation. This relationship is probably the most outstanding example in this country of collaboration between public and private institutions of higher education. Even as a part of State University, the College maintains this unique position. The major character of the relationship stems from the fact that since its beginning, the College purchased from Syracuse University the major portion of its supportive and enrichment instruction, thus allowing the College to more fully develop its professional upper division and graduate level instruction.

Other cooperative areas are living centers and dining facilities, athletic programs, the use of the University's infirmary and health counseling services, the bookstore facilities, the University library system, joint Commencement ceremonies held in the Carrier Dome, and participation in numerous social activities including the elaborate religious, dramatic, and cultural benefits of a large university.

ESF TODAY

The third phase in the evolution of the College's name came in 1972 when it was rechartered as the State University of New York College of Environmental Science and Forestry. Thus, the name reflects more deeply the traditional grounding and concern of forestry in the environment; it illuminates more clearly the capabilities of its program.



The College of Environmental Science and Forestry has completed a plan, conceived more than 10 years ago, to achieve complete upper division/graduate status. Undergraduate students wishing to embark upon a career in the environmental sciences and forestry will enroll for two years at a junior college or four-year institution, studying an ESF prescribed program and transfer to this college as juniors. The move to upper division/graduate college status marks another step in the College's long-standing commitment to educate professionals capable of facing the complex environmental problems of today and of the future.

For more than 70 years, the full thrust of the State University of New York College of Environmental Science and Forestry has been focused on the environment on all of its six campuses and in each of its three mission areas—instruction, research, and public service. The College has been, and continues to be, devoted to the advancement of environmental science and forestry.

The Mission: Instruction, Research, and Public Service

INSTRUCTION

In the fall of 1982, student enrollment reached 1,587. Of this number, 1,086 were undergraduates and 501 were graduate students. In addition, there were 11 students engaged in postdoctoral work.

Undergraduate Education

At the baccalaureate level, the College offers professional study in eight areas: *chemistry; environmental and forest biology; environmental studies; forest engineering; paper science and engineering; wood products engineering; resource management; and landscape architecture*. These programs are registered with the New York State Education Department.

Each of these curricula leads to the bachelor of science degree. In the case of landscape architecture, an additional year of study results in a bachelor of landscape architecture degree, and in the forest engineering program, a fifth year leading to a bachelor's degree in civil engineering can be taken at Syracuse University or State University at Buffalo.

Graduate Education

The College awarded its first graduate degree in 1913. Today the College offers advanced degrees in seven major program areas: *environmental and forest biology; chemistry; resource management and policy; silviculture and forest influences; environmental and resource engineering; landscape architecture; and environmental science*. These programs are registered with the New York State Education Department.

Graduate study leads to the master of science degree, the master of landscape architecture degree, and the doctor of philosophy degree. A postdoctoral study program, closely related to the College's research effort, is also available.

In addition to these degrees, the College and Syracuse University provide the opportunity for graduate students to complete concurrently a degree at ESF and, at Syracuse University, either the J.D. degree in the College of Law, the M.P.A. degree in the Maxwell School of Citizenship and Public Affairs, the M.A. or M.S. degree in the S.I. Newhouse School of Public Communications, or the M.B.A. degree in the School of Management. Students must complete at least one semester of graduate level coursework



at ESF before being considered for a concurrent degree program at Syracuse University.

Technical Education

At the paraprofessional level, the College has been training forest technicians since 1912 at its Wanakena Campus in the Adirondack Mountains. It is the oldest Ranger School in the United States and offers a two-year *forest technology* curriculum. Graduates are awarded an associate in applied science degree. In this curriculum, students take their first year of general education at a two- or four-year college. The second year, with its emphasis on practical field training in the relationships between forest technology and managerial needs, is taken at Wanakena with its 2,800 acres of forested land. Graduates of this degree program in practical forestry are prepared for positions as forest rangers; federal, state, and private industry forest technicians and forestry aides; district forest supervisors; timber inventory specialists; timber sales supervisors; forest surveyors and engineering aides; and forest protection technicians.

Continuing Education

The philosophy that education is a lifelong pursuit is an ancient one and was written into the law creating the College. This concept is doubly important to the sciences and professions in this technological age when, with knowledge expanding in all directions, major environmental problems still remain to be resolved. The informational needs of New York's citizens also are undergoing change. The increasing urban character of our population; the changing pattern of agricultural and forest land ownership

and use; the rise in level of education and sophistication in a more efficient society; and the increase in leisure time, travel mobility and need for recreational facilities and pursuits all contribute to a growing need for educational opportunities in environmental science and forestry for adult audiences.

The College has, over the years, succeeded in communicating knowledge on forest resources management, utilization, and conservation to a variety of off-campus publics. The entire College faculty has contributed to these programs. To reinforce this commitment, the College established a School of Continuing Education upon which to base expanded educational opportunities at both the undergraduate and graduate course levels.

Conferences, symposia, seminars, and shortcourses on various aspects of forestry and the related sciences are conducted at both the basic and applied levels. Audiences include forest owners, managers, and operators; wood engineers and forest industries personnel; academic and scientific groups; conservation and recreation personnel from local and other public and private planning groups; and citizen-action committees. Upon request, continuing education programs can be designed to meet specific needs of professional organizations, agencies, and industry. Credit or noncredit courses, at campus or off-campus sites, can be arranged.

Expansion of in-service training courses, establishment of environmental learning centers on College forest properties, and production of media materials for public information and education are examples of activities directed toward updating and upgrading professional clients and broadening the public's awareness and appreciation of New York's forestlands and other natural resources.

For information on specific continuing education projects, inquiries should be sent to Director, School of Continuing Education.

RESEARCH

The College's commitment to scientific inquiry stretches far back to its second year of existence. In 1912, Dean Hugh P. Baker initiated the first research project of the College by joining forces with the U.S. Forest Service in an industry study designed to show what kinds of firms were using wood in New York State and the species and quantities used.

In the 1980's, the College's research program has attracted a worldwide clientele of industrial, governmental, professional and scientific groups, and through liaison with them, the program maintains its vigor and relevancy to the important environmental issues. Support from this clientele amounts to more than \$4 million a year, a two-fold increase in the last decade.

Students and faculty from across the College contribute to the depth and diversity of the research program. Findings from these studies are applied to a host of issues and problems through various demonstrations and information devices. Recent examples include studies of limestone quarry

reclamation; the development of polymeric materials for artificial human organs; nonchemical control measures for insect pests, e.g., the gypsy moth; studies of the ecology of Antarctic birds; new wood pulping processes leading to pollution-free water and air effluents; and the ecological effects of winter navigation in the Great Lakes and the St. Lawrence River.

Institute of Environmental Program Affairs

Research and public service programs at the College of Environmental Science and Forestry are given additional emphasis through the Institute of Environmental Program Affairs (IEPA). This Collegewide coordination vehicle was initiated in 1972 in recognition of the College's traditionally broad and integrated approach to natural resources science and in response to new perceptions of the relationship between human endeavors and environmental quality. The Institute, which is staffed by the Office of Research Programs, functions to bring together groups of faculty scientists to explore research and public service needs and opportunities which transcend the programs of the schools, departments, and organized research centers and institutes of the College.

Study teams of scientists and graduate students from many disciplines have collaborated with external program cooperators from governmental agencies, citizens' groups, and private industry to pursue multidisciplinary research and public service programming as part of the IEPA program. Early efforts were focused on regional natural resource and environmental studies conducted at the request of New York State agencies such as the St. Lawrence-Eastern Ontario Commission, the Tug Hill Commission, the Catskill Study Commission, and the Adirondack Park Agency. Other studies which transcend regional problems and issues have been conducted with diverse sponsorship, including environmental service systems, leisure time and recreational activities appropriate to the Hudson River Basin; solid waste processing and heavy metals recovery from processing residues from the forest products industry; wetlands evaluation studies; remote sensing techniques to facilitate environmental monitoring of coastal water quality and land use patterns; reclamation of open pit limestone quarries; the siting of nuclear power generation facilities; and environmental assessment studies associated with proposals for extended season navigation in Lake Ontario and the St. Lawrence River.

More recently, IEPA has provided a focus for faculty interested in pursuing research and public service programming through diverse sponsorships in particular areas of high public concern. Three task forces are currently operating in these areas to develop new project activity and coordinate the Collegewide research focus in bioenergy projects, acid precipitation and atmospheric deposition, and sludge and sludge management concerns.

Empire State Paper Research Institute

The Empire State Paper Research Institute (ESPRI) is the only worldwide basic research organization in the pulp and paper field. It performs investiga-

tions in cooperation with the Empire State Paper Research Association (ESPRA), which is comprised of 78 pulp and paper companies in 14 countries. The Institute was established in 1945 when the members of ESPRA recognized the need for new scientific and technical knowledge and methods, and since then ESPRI has been able to maintain an efficient balance between the practical and theoretical bases of the pulp and paper industry.

Housed in the modern J. Henry Walters Hall with its own pilot paper mill, and staffed by scientists who are internationally recognized for their accomplishments, ESPRI provides a research base for long-range industry development. Its program has widened in scope to cover almost all aspects pulping and papermaking, including additive retention, oxygen pulping and bleaching, effluent control, sheet drying, printability, and energy efficiencies.

Polymer Research Institute

Scientists at the College have made many original contributions to the field of pure and applied polymer chemistry, including the development of living polymers, the study of anionic polymerization and electron-transfer initiation, and work on the permeation of gases and films through polymeric films.

College faculty members specializing in polymer chemistry have trained several hundred graduates and postdoctoral researchers, many of whom now hold leading positions in universities and industrial and governmental laboratories.

Nelson Courtlandt Brown Laboratory for Ultrastructure Studies

This Center, located in Baker Laboratory, is a teaching, research, and service facility of the College. It is equipped to handle virtually every type of modern microscopy. This includes light, scanning electron, and transmission electron microscopy. Among the major items of equipment are: two RCA EMU-3 transmission electron microscopes; an RCA EMU-4, an ETEC Autoscan scanning electron microscope, energy dispersive X-ray analyzer, several types of light microscopes, high vacuum evaporators, microtomes and ultramicrotomes. The laboratory resources include specimen preparation rooms, several photographic darkrooms, three electron microscope laboratories and other supporting facilities.

The primary service of the Center is teaching; course offerings include photomicrography, scanning electron microscopy, and interpretation of cellular ultrastructure. Research is a second major activity since support is provided for students, faculty, and research staff who have projects involving structural studies. Public service is extended to local high school groups, medical facilities, other regional colleges and universities, and industry.

Adirondack Ecological Center

The Adirondack Ecological Center (AEC) is located on the College's Newcomb Campus in the center of the Adirondack Mountains. Staffed by

resident scientists, technicians, and support staff, the AEC conducts studies of the Adirondack region year-round. Research includes studies of managed and unmanaged forest lands, wildlife populations and habitats, terrestrial and aquatic ecology, and wilderness management. Work is carried on in close collaboration with the New York State Department of Environmental Conservation, the U.S. Fish and Wildlife Service, the U.S. Department of Agriculture, and forest industries.

The vigorous research program of the Center provides excellent opportunities for collaboration by Syracuse-based faculty and students. Several graduate students are regularly in residence at Newcomb pursuing their thesis research.

Renewable Materials Institute

The Renewable Materials Institute (RMI) has as its principal goal research on wood and other renewable materials such as agricultural waste products, which would include straw, rice hulls, and bagasse. To meet its mission, research on the characterization of the material itself is primary. Closely related with it is the determination of physical properties which control the behavior of the material during utilization as well as in use in consumer products. In exploring renewable materials, strong emphasis is placed on energy considerations. This can be in terms of energy savings during production or economies of energy because of the use of the end product in housing or in some other application. Also included are related studies in the combustion of wood, the efficiency of heating with wood and the emissions resulting from wood combustion.

The principal facilities for the materials characterization are found in the Center for Ultrastructure Studies and include the transmission electron microscopes, a scanning electron microscope with EDXA and rapid particle analysis. All of the facilities of the Department of Wood Products Engineering are also available, including a sawmill, veneer and plywood manufacturing facility, dry kilns, wood machining equipment, and timber testing laboratory. The facilities of other research institutes and Departments in the College are also available for special projects.

Tropical Timber Information Center

The Tropical Timber Information Center (TTIC) provides identifications of wood samples and information about tropical woods for both general characteristics and technical properties. These services are oriented toward importers and users of tropical woods. The Center began operation in 1975 as part of the Department of Wood Products Engineering and is one of only two such sources of information in the western hemisphere. The Center also carries out special studies under contract for production of data that is not available in the literature. The technical base for operation of the Center is a large, worldwide collection of authenticated wood samples and an extensive

collection of reference materials in Moon Library and the Department of Wood Products Engineering. Both of these resources have been built up over the past 60 years by close cooperation with institutions throughout the world. Activity of the Center is oriented toward requests for services from importers and users of tropical woods and to expanding the collections.

Cellulose Research Institute

Research at the Cellulose Research Institute is at present centered on the fine structure of native cellulose and its transformations into other commercially important forms of cellulose. For example, the structural differences between native and regenerated celluloses have been determined, for the first time, through x-ray crystallographic studies. The same techniques are now being used to study the structural aspects of cellulose mercerization, an important commercial process in cellulose chemistry. Other recent research has been concerned with the organization, chemical composition, and function of the vascular cambium in trees, the ultimate source of all wood and bark produced in nature.

U.S. Department of Agriculture—Forest Service Cooperative Research Unit

The Northeast Forest Experiment Station of the U.S. Department of Agriculture-Forest Service maintains a research center at the College. Until 1977, this unit pursued studies of forest-centered recreation with the aim of developing methods for integrating recreation and other uses of forests.

Beginning in 1978, the Cooperative Research Unit was re-oriented to research on urban environmental forestry problems. This provides increased opportunities for faculty and students to collaborate with Forest Service scientists in studies of urban and environmental problems.

PUBLIC SERVICE

The College, throughout its 73-year history, has continued to respond to its specific legislative mission prescribing major responsibilities in the area of public service. Public education and information, technical advice and guidance to cooperating local, state, and federal agencies and organizations, and technical assistance to the forest and wood-using industries constitute the principal formal public service activities. The Institute of Environmental Program Affairs (described in the Research section) coordinates the College's public service activities on the professional level.

While the list of public service contributions is lengthy, a few examples include: the College's Film Library; the Tree Pest and Disease Service, which provides technical advice to private citizens and to governmental agencies; and the participation of ESF faculty members in Central New York's Poison Control Center. Altogether, the public service programs of the College reach approximately one million New York State residents each year.

The Campuses

The College operates a multiple campus system with regional campuses and field stations located at Syracuse, Tully, Wanakena, Warrensburg, Cranberry Lake, Newcomb, and Clayton. This system, composed of about one million square feet of facilities in 186 buildings and 25,000 acres of land, represents the largest fully-utilized campus in the world.

THE SYRACUSE CAMPUS

The main campus is in Syracuse and lies on 12 acres adjacent to Syracuse University in an area that traditionally has been known as "The Hill." Located here are the Schools of Biology, Chemistry, and Ecology; Environmental and Resource Engineering; Forestry; Landscape Architecture; and Continuing Education. In addition, the main campus houses the Institute of Environmental Program Affairs, the Empire State Paper Research Institute, the Polymer Research Institute, a cooperative research unit of the USDA Forest Service, the Ultrastructure Center, the Graduate Program in Environmental Science, and the Renewable Materials Institute.

These program units are housed in five major academic buildings (Baker Laboratory, and Walters, Bray, Marshall and Illick Halls). The main campus also includes Moon Memorial Library, the Maintenance Building and several other small service and storage facilities.

Specialized facilities at the Syracuse campus include electron microscopes, plant growth chambers, air-conditioned greenhouses, an animal environmental simulating chamber, a bio-acoustical laboratory, a 1,000-curie cobalt-60 radiation source, radioisotope laboratory, computing center, and specialized instrumentation including nuclear magnetic resonance spectrometers, electron spin resonance spectrometer, gas chromatography, mass spectrometer, ultracentrifuge, and X-ray and infrared spectrophotometer. Photogrammetric and geodetic facilities of the forest engineering department include one of the most extensive arrays of equipment in the United States, with a Nistri TA-3 stereocomparator, Mann comparator, computerized Nistri photocartograph, and nine other varieties of plotters. The paper science and engineering laboratory has a semicommercial paper mill with accessory equipment. The wood products engineering department has a complete strength-of-materials laboratory as well as a pilot scale plywood laboratory and a machining laboratory. The greenhouses and forest insectary are used to produce plant and insect material for classroom and laboratory. Extensive collections are available for study, including wood samples from all over the world, botanical materials, insects, birds, mammals, and fishes.

The **F. Franklin Moon Library** contains more than 83,000 cataloged items and over 900 journals are currently received. The collection constitutes a specialized information source for the forestry, environmental science, and landscape architecture programs of the college, and it has concentrations in such areas as botany and plant pathology, biochemistry, chemical ecology, forest chemistry, polymer chemistry, economics, entomology, environmental studies, landscape architecture, environmental design, management, paper science and engineering, photogrammetry, silviculture soil science, water resources, world forestry, wildlife biology, wood products engineering, and zoology.

The collections of Syracuse University libraries (SU's Science and Technology Library is immediately adjacent to the ESF campus), and SUNY Upstate Medical Center are within walking distance. These libraries may be used by all members of the College of Environmental Science and Forestry. Other collections located throughout New York State and the United States are readily accessible through Inter-library loan. All Syracuse University collections may be searched by using the SULIRS terminal located in Moon Library.

The library building, opened for service in 1968, can accommodate 132,000 volumes and can seat 575 persons. The main reading areas are located on the upper level adjacent to the open stacks and are divided by the card catalog and reference service area. The library contains a current periodical room, a bibliographic center containing indexes and abstracts, individual study carrels and library faculty offices. The Hoverter Archives and special collections, conference room, audio tutorial center, Directed Studies Center and the computer terminal room are located on the lower level.

Leisure reading material is not housed separately but is distributed throughout the collection. This collection contains books on national and world social problems, humanities, education, and popular books concerned with the environment. The archives consists of historical items relevant to the college and forestry development in New York State. The special collections area of the archives contains rare, scarce, and valuable books, and folios as well as the Fletcher Steele collection on landscape architecture.

Public services provided by the library faculty includes a credit course, orientation, class lectures, study guides, user aids, and reference desk service.

The **Educational Communications** unit directly supports the program areas of the College through development and application of media materials and methods for the classroom, for the presentation of research findings, and for public service endeavors. These include television programming, slide/tape and motion picture production and photographic services. Other services to the College community include engineering, audio-visual equipment distribution, and maintenance and support functions. The Educational Communications staff also participates directly and actively in

instructional programs in environmental communication at both the undergraduate and graduate levels, as well as through the School of Continuing Education.

The College **Computer Center** provides computational service in several forms. The primary source is via remote communication with the facilities at Syracuse University which consist of an academic computer center and an administrative center. The academic facilities permit both batch and interactive processing on one of three processors—two IBM 4341's and one DEC-KL10; the administrative facilities service the data-processing needs of ESF with a separate IBM 4341. Extensive software is available for the academic user in the form of most of the major languages—Fortran and APL finding the heaviest usage—and most of the major applications packages for statistics, graphics, text editing, and general mathematical needs. In addition to the centrally supplied services described above, there are numerous micro-computer facilities being established for specialized needs in chemistry, engineering, remote sensing, forestry and other related and supporting fields.

THE TULLY CAMPUS

Located about 25 miles south of Syracuse is the Tully Campus which is composed of the Heiberg Memorial Forest and the Genetic Field Station.

Heiberg Memorial Forest is located on the northern escarpment of the Allegheny Plateau. It includes 3,800 acres of diverse terrain and forest growth. The Forest is utilized both as an extensive outdoor teaching laboratory and as a site for intensive research. The **Forest Ecosystem Lab**, which is a highly instrumented outdoor teaching laboratory, a large complex of all-weather classrooms, many experimental plantings from throughout the world, a commercial-scale maple syrup operation, and an experimental deer research area are among the developments on this forest. Each fall the Heiberg Memorial Forest is the site of an intensive program for environmental and resource management students in a total ecosystem approach to forest community management instruction.

THE WANAKENA CAMPUS

The Wanakena Campus, located on the Oswegatchie River, 65 miles northeast of Watertown and 35 miles west of Tupper Lake, is the site of the **James F. Dubuar Forest** and the **School of Forestry's Forest Technician Program**. This campus, with its large instructional and demonstration forest, supports the College's associate degree program for the training of forest technicians. This is the oldest forest technician school in the country. This campus is situated on the western plateau of the "lakes region" of the Adirondacks.

In addition to its full academic program, this campus hosts various summer short courses in forest biology and forest technology.

THE WARRENSBURG CAMPUS

The Warrensburg Campus is located in the southeastern Adirondack region and encompasses the **Charles Lathrop Pack Demonstration Forest**, an area of roughly 2,500 acres of heavily forested land noted for its white pine. The Forest has been under intensive management since 1927 for the combined purpose of instruction, research, and demonstration in forestry and allied fields.

Each year this campus hosts the Summer Session in Field Forestry, a seven-week course devoted to introductory instruction in field forestry principles and techniques. The course is required of all entering students in Environmental and Resource Management and is open to election by students in Environmental and Forest Biology.

Formal offerings in Continuing Education and various meetings and conferences are also held here for practicing professionals and organizations directly associated with forestry and allied environmental fields.

THE CRANBERRY LAKE CAMPUS

The Cranberry Lake Campus, approximately 1,000 acres of forested property situated in the northwestern section of the Adirondack Mountains of northern New York State, is the site of the College's **Biological Station** where the College operates a ten-week summer field program in environmental biology. The campus is bounded by 150,000 acres of New York State forest preserve lands, by Cranberry Lake and by isolated forest bogs and beaver meadows.

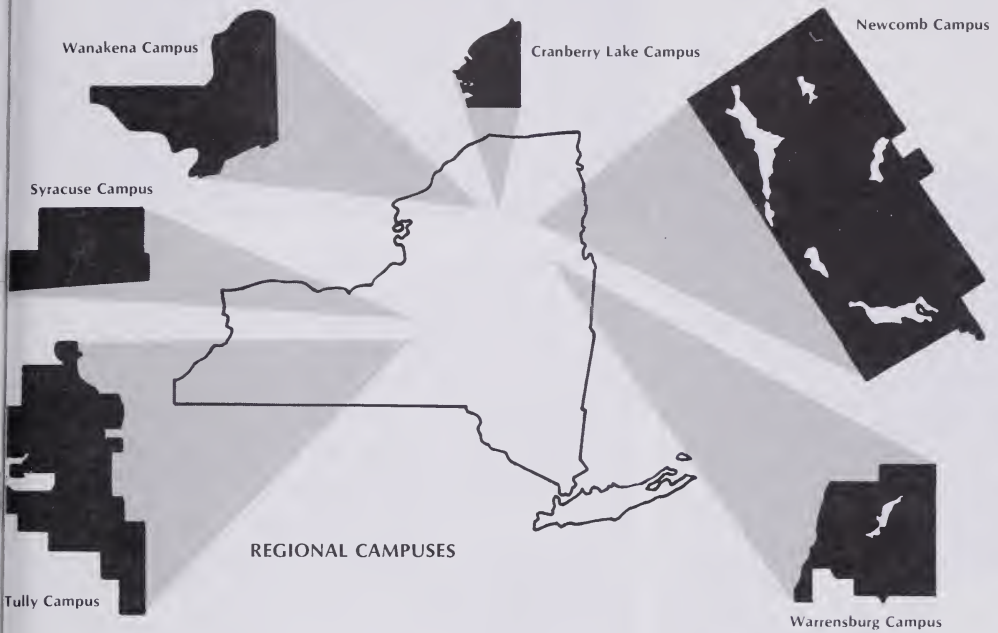
The extensive facilities are intensely utilized in a comprehensive curriculum of upper-level and graduate courses.

Use of this campus before and after the summer session program varies to include individual research projects, cooperative studies with other agencies and visits by large groups from both the College and outside institutions.

THE NEWCOMB CAMPUS

Located in the central Adirondack Mountains, Newcomb is the largest of the regional campuses and home to the **Adirondack Ecological Center** where extensive studies of animal biology and ecology are carried out. Also located there is **The Archer and Anna Huntington Wildlife Forest** which is about 15,000 acres in size.

This campus is of mountainous terrain and contains a variety of vegetative types and wildlife. The campus is used year round for a general research and forest management program participated in by faculty, graduate students, and visiting scientists.



THE FIELD STATIONS

In addition to its regional campus system, the College operates several field stations which directly support the instruction, research, and public service programs of the institution. The 44-acre **Forest Experiment Station**, located only a few minutes drive from the main campus in Syracuse, is used to support main campus academic programs. Located at the Station are a large arboretum, tree nursery, and experimental greenhouse facility. Adjacent to the Tully Campus is the College's **Genetic Field Station**. It is a 59-acre area devoted to relatively short-term outplantings of plant materials developed in the various genetic research projects of the College. With its irrigation system and layout of level blocks, it is an excellent facility for developing hybrids, for grafting, doing experiments, and for research in heritability. A magnificent island, the **Ellis International Laboratory**, is situated in the heart of the Thousand Islands—St. Lawrence River area off the village of Clayton. Accessible only by boat, this laboratory is an unusually appropriate site for the Collegewide, cooperative and international, environmental monitoring and research activities of the St. Lawrence Seaway area. The College's most recent acquisition is a 15.2-acre facility on **Wellesley Island**. This island property, formerly a Coast Guard Station, has shore frontage on the American channel of the St. Lawrence Seaway. It is ideally suited for aquatic studies of many types.



The Syracuse Metropolitan Area

The College of Environmental Science and Forestry is located on one of several hills that overlook Syracuse, a growing metropolitan area of nearly 500,000. Known as the "Salt City" because of the great salt industry which was centered here for more than seventy years, Syracuse is today a city of diversified industry and commerce. The area is a leader in the manufacture of china, quality shoes, air conditioning equipment, medical diagnostic equipment, drugs, automotive parts, and lighting equipment.

The City of Syracuse offers students many cultural, recreational and educational opportunities, including a symphony orchestra, several museums, live theater and historical points of interest.

Called the "Crossroads of New York State," Syracuse is one of the few cities in the nation situated at the crossing point of two major super-highways. It is located at the intersection of the 500-mile east-west New York State Thruway and the north-south Penn-Can Highway. Driving time from New York City, Philadelphia, Boston, Toronto and Montreal is about five hours; from Buffalo and Albany about three hours. The city is served also by a modern international airport and major bus and rail lines.



Academic Life

Society is increasingly in the hands of those who have broad foresight and a balance of judgment in applying scientific, sociological, and technical knowledge to guide human and environmental forces. Modern civilization—with its compelling demands from industry, government, and educational institutions—requires people who think objectively and constructively, and who act creatively and responsibly.

From its beginnings in 1911, the State University of New York College of Environmental Science and Forestry has served New York State and the nation in meeting the needs of its citizens in regard to the environment through education, research, and public service. The faculty and students of the institution are committed to the resolution of immediate environmental problems, the development of the knowledge necessary to predict occurrences in the future, and the presentation of public policy alternatives that will both protect the environment and accommodate the real needs of society.

At the undergraduate level, ESF offers curricula in the general areas of resource management, engineering, environmental design, and the physical and life sciences that prepare graduates to enter and contribute to the professional world or to continuing their education at the graduate level, at ESF or elsewhere.

Graduate years are a time of discovery and excitement, a time of answers and new insights, a time of personal productivity and contributions to scholarship. It is during graduate education that the student sharpens the ability to think critically and analytically, to plan research, to design experiments, to work effectively with the basic research tools as well as specialized equipment, and to undertake the discipline of purposeful study toward a specific goal.

The College currently supports significant graduate degree programs in six discipline areas and in its broad program in Environmental Science, which encourages multidisciplinary study. Both undergraduate and graduate programs of the College reflect the work of its faculty and their student colleagues, who, together, utilizing some of the most modern facilities and laboratories in the country, maintain a long-standing tradition of academic and professional excellence.

This catalog provides an introduction to the College and its programs of undergraduate and graduate study and research. It only begins to suggest the diversity and depth of the existing and potential programs that make environmental science the challenge of the 1980's and beyond.

UNDERGRADUATE ADMISSION

The College of Environmental Science and Forestry is an upper division/graduate center, enrolling at the undergraduate level transfer students who have completed at least two years of postsecondary coursework. Outstanding high school seniors can assure their acceptance by the College as junior transfers by applying to the Advanced Early Admission program.

Freshman and sophomore level courses may be taken at any two- or four-year college or university; all students considering transfer to ESF as juniors should follow the prescribed program appropriate to their intended major at the College. Each curriculum offered at the College of Environmental Science and Forestry and listed in this catalog defines the required lower division courses necessary for admission. These requirements are listed in the Areas of Study section of the catalog.

Students who are certain they intend to transfer to ESF may enroll in established pre-environmental science programs organized by the College in cooperation with a number of two- and four-year colleges in and out of New York State. Students who attend these colleges will find a smooth articulation has been established and upon successful completion of these prerequisites will generally gain admission to the college with full junior status. It is not required to specifically attend one of these colleges; a student may obtain the necessary lower division courses at almost any college or university in the country.

Application to ESF's associate degree program in Forest Technology at the Wanakena Campus must be made one year in advance. Therefore, high school students desiring to attend the Wanakena program in 1985 must apply this year. For further information on ESF's School of Forestry's Forest Technician Program, see page 127, or contact the Office of Admissions.

ADVANCED EARLY ADMISSION PROGRAM

High school students who are strongly motivated toward attending ESF may apply to the College of Environmental Science and Forestry during their senior year under the *Advanced Early Admission Program*.

Those seniors whose academic background is successfully competitive will receive a letter of acceptance to the College for entrance two years later with full junior status, contingent upon successful completion of all prerequisite courses of the first two years of the curriculum to which they have been admitted. The prerequisite courses will be outlined and described in an enclosure with the acceptance letter.

This early acceptance will alleviate much of the anxiety about admissibility. High school seniors will know prior to graduation if they have been accepted to the College for entrance at the junior level. It affords those accepted students the opportunity to attend any college of their choice that offers the

appropriate lower division courses. SUNY applications for the Advanced Early Admission Program may be obtained from high school guidance offices in New York State or directly from the Office of Admissions at ESF.

TRANSFER ADMISSIONS

For those students not accepted under the Advanced Early Admission Program, admission to the College of Environmental Science and Forestry is based on the student's previous college coursework, overall academic aptitude, and interest in the programs offered at this College. Consideration is given to both the quality and appropriateness of the student's prior academic experience. The minimum grade point average for acceptance is 2.0 (4.00 = A).

PRE-ESF COOPERATIVE TRANSFER PROGRAMS

The College, working in cooperation with other collegiate institutions, both in and out of New York State, has developed 54 pre-environmental science and forestry programs. The development of these programs illustrates that high school students can look forward to a wide selection of colleges in which they can obtain all the necessary lower division courses and appropriate advisement to transfer to ESF as full juniors.

These colleges represent the total spectrum of higher education (private, public, 4-year, 2-year) and are located in New York, Connecticut, Massachusetts, New Jersey, Pennsylvania, Rhode Island, Iowa, and Maryland. Students who attend these colleges will find a smooth articulation has been established and once they transfer to ESF will share a common academic background with other transfer students.

Currently, the list of cooperating colleges includes:

New York State Colleges

Adirondack Community College, Glens Falls

Broome Community College, Binghamton

Canisius College, Buffalo

Cayuga County Community College, Auburn

Columbia-Greene Community College, Hudson

Community College of Finger Lakes, Canandaigua

Corning Community College, Corning

Dutchess Community College, Poughkeepsie

Erie Community College, Buffalo

Genesee Community College, Batavia

Herbert H. Lehman College, Bronx

Herkimer Community College, Herkimer

Hudson Valley Community College, Troy

Jamestown Community College, Jamestown

Jefferson Community College, Watertown

LeMoyne College, Syracuse

Mohawk Valley Community College, Utica

Monroe Community College, Rochester

Nassau Community College, Garden City

Niagara County Community College, Sanborn

North Country Community College, Saranac Lake

Onondaga Community College, Syracuse

Orange Community College, Middletown

Paul Smith's College, Paul Smiths

Rockland Community College, Suffern

Siena College, Loudonville

Suffolk County Community College, Selden

Sullivan County Community College,

Loch Sheldrake

SUNY Alfred Ag. & Tech., Alfred
 SUNY Canton Ag. & Tech., Canton
 SUNY Cobleskill Ag. & Tech., Cobleskill
 SUNY College at Cortland, Cortland
 SUNY Delhi Ag. & Tech., Delhi
 SUNY College at Geneseo, Geneseo
 SUNY Morrisville Ag. & Tech., Morrisville
 SUNY College at New Paltz, New Paltz
 SUNY College at Oswego, Oswego
 Syracuse University, Syracuse
 Tompkins Cortland Community College,
 Dryden
 Ulster County Community College,
 Stone Ridge
 Westchester Community College,
 Valhalla

Out-of-State Colleges

Allegheny Community College, Cumberland,
 MD
 Berkshire Community College, Pittsfield, MA
 Camden County College, Blackwood, NJ
 Garrett Community College, McHenry, MD
 Holyoke Community College, Holyoke, MA
 Housatonic Community College, Bridgeport,
 CT
 Keystone Junior College, LaPlume, PA
 Kirkwood Community College, Cedar Rapids,
 IA
 Mercer County Community College,
 Trenton, NJ
 Middlesex Community College, Edison, NJ
 Ocean County College, Toms River, NJ
 Roger Williams College, Bristol, RI
 Union College, Cranford, NJ

TRANSFER CREDIT

Courses transferred for credit must be appropriate to the student's curriculum choice. Credit will be awarded for all such courses completed with a passing grade of "D" or better.

Furthermore, courses to be transferred as required courses in a curriculum must be acceptable in content. Course credit hours are transferred, but grades and grade points are not.

No transfer credit will be awarded until all final transcripts are received. It is the student's responsibility to see that this is done.

COLLEGE PROFICIENCY EXAMINATIONS

The College recognizes that an increasing number of students are obtaining college-level credit through examination and/or completion of College credit while in high school. The College's policy on this, and other forms of nontraditional credit, is to grant the same amount of credit in parallel courses as the student's previous collegiate institution granted. It becomes the student's responsibility to be sure that *all* earned credits are on the previous college transcript and clearly identified by academic discipline.

EDUCATIONAL OPPORTUNITY PROGRAM

The basic goal of the Educational Opportunity Program at the College is to provide qualified students with a college education—the opportunity for personal growth and professional development. Upon completion of the program, graduates will be provided access to jobs in professional fields. The program is not designed for students who need only financial assistance. It serves students who ordinarily would not be able to attend college because of a lack of financial resources and insufficient academic preparation. To qualify, students must be New York State residents and demonstrate the potential to successfully complete the courses of study at the College.

Further information regarding the Educational Opportunity Program may be obtained by contacting the Office of Admissions.

INTERNATIONAL STUDENTS

The College accepts international students on the undergraduate level if they can satisfy all regular admission requirements. It is recommended, however, that students from foreign countries obtain their baccalaureate degree in their home country, and apply to the College as graduate students. Experience has shown that this arrangement provides for greater academic achievement and more efficient use of the student's time and funds. International students applying for admission must satisfy all of the course prerequisites for their intended major. In addition they must:

1. Demonstrate proficiency in the English language through acceptable performance on the Test of English as a Foreign Language (TOEFL) and/or the College Entrance Examination Board (CEEB) Achievement Text in English, and

2. Produce evidence of their ability to meet all their financial obligations.

Undergraduate international students must file official State University of New York foreign student admission forms. Prior to international student acceptance, adequate financial resources must be demonstrated, and after acceptance health and accident insurance must be obtained before the student will be allowed to register at the College.

International students who are currently at an American college may apply for transfer to the College. They must meet all entrance requirements of international students plus those of a transfer student as listed above. Permission to transfer must be obtained from the U.S. Immigration and Naturalization Service district office having jurisdiction over the college in which the student is currently enrolled.

HEALTH EXAMINATION BOARD

Each new student is required to submit a medical history and physical examination report on a form that will be sent after the initial acceptance notice.

GRADUATE ADMISSION

Admission to graduate study may be granted only to applicants with at least a bachelor's degree from a recognized institution and whose preparation has been suitable in quality and content for the proposed field of major study. Applicants will be evaluated on the basis of the following: (1) their academic record should show at least a B or 80 percent average for the junior and senior years; (2) Graduate Record Examination aptitude scores, and, in some cases, subject matter (advanced) tests indicative of graduate study ability (see below); (3) supporting letters of recommendation; (4) a statement of specific educational and professional goals which describes the

choice of degree program and the students' plan for the pursuit of the objectives in the program; and (5) other evidence of scholarly achievement and potential. Admission is selective with priority given to applicants who have high scholastic standing.

ADVANCED TESTS

Subject matter (advanced) test scores are required by the following programs:

<i>Graduate Programs</i>	<i>Advanced Test</i>
Chemistry	Chemistry
Environmental and Forest Biology	Biology

PROCEDURE

All applicants are required to submit Graduate Record Examination aptitude scores. This examination is offered several times each year in major cities of the world. For information on registration and scheduling write to the Educational Testing Service, Princeton, New Jersey 08540. Test scores should be sent to the Office of Academic Programs (Institutional number R2530).

The College provides a special application form for graduate work. Requests for information and applications should be addressed to the Office of Academic Programs.

INTERNATIONAL STUDENTS

Citizens of other countries with special educational objectives are accepted for graduate study in all programs. They must show satisfactory evidence that they have completed studies in their major field equivalent to those at a recognized American institution with a scholastic record equivalent to a B average in their junior and senior years. They must submit Graduate Record Examination scores as explained in the section on Admission Requirements. Also, applicants whose native language is other than English must submit scores on the Test of English as a Foreign Language (TOEFL). This requirement may be waived if the student has received a degree from an American institution. This examination is offered several times each year in major cities of the world.

For information on registration and scheduling, write to the Educational Testing Service, Princeton, New Jersey 08540, U.S.A. In submitting test scores, request that they be sent to the Office of Academic Programs.

EXPENSES

APPLICATION FEE

When a student applies for admission to an undergraduate program at any of the State University of New York units, a nonrefundable application fee

is required. More information about the fee and guidelines for exemptions is provided in the "Application Guidebook" for the State University of New York. There is a \$35 application fee for those applying for graduate study.

ADVANCED PAYMENT FEE

All admitted undergraduate students pay a fee of \$50, which is credited to the student's first semester tuition. This payment should be sent to the College Business Office accompanied by the form provided by the Office of Admissions. The payment is required prior to May 1, or 30 days after acceptance, whichever is later. It is refundable up to May 1, or within that 30-day period. There is no advanced payment fee required for those accepted for graduate study.

TUITION AND FEES (As of June 9, 1983)

The tuition and fee structure of the College of Environmental Science and Forestry covers usage of library, infirmary, physical education facilities, ROTC, special testing, and other services, as well as an assessment for student activities and charges for expendable supplies and equipment.

Tuition is charged in the following rate per semester:

Tuition Type	NYS Resident Students	Out-of-State Students
Undergraduate		
Matriculated		
Full-Time	\$ 675.00	\$1,325.00
Part-Time	\$ 45.00/credit hour	\$ 88.50/credit hour
Graduate Matriculated		
Full-Time	\$1,075.00	\$1,592.50
Part-Time	\$ 90.00/credit hour	\$ 133.00/credit hour
Students who do not hold a Baccalaureate Degree (less than 12 credit hours)		
Course Nos. 0-599	\$ 45.00/credit hour	\$ 88.50/credit hour
Course Nos. 600-999	\$ 90.00/credit hour	\$ 133.00/credit hour
Continuing Education Non-Degree students who hold a Baccalaureate Degree		
Course Nos. 0-499	\$ 45.00/credit hour	\$ 88.50/credit hour
Course Nos. 500-999	\$ 90.00/credit hour	\$ 133.00/credit hour
Maximum Total Tuition for 12 credit hours or more	\$1,075.00	\$1,592.50

RESIDENCY

'Residence' for purposes of this (tuition payment) question refers to the principal or permanent home to which the student returns. If the principal or permanent home has not been located in New York State for a twelve-month period prior to the date of registration for the academic term for which this application is made, the student will be presumed to be an Out-of-State resident for purposes of tuition.

STUDENT ACTIVITY FEES

In addition to tuition, the student body has voted to assess each full-time undergraduate student \$30 per year to cover the cost of student activities. Full-time, non-matriculated students are charged a fee of \$15 per semester, and part-time matriculated students \$1 per credit hour. Full-time graduate students likewise have a mandatory activity fee of \$15. ESF students also pay an activity fee to Syracuse University to cover SU-sponsored activities and services available to ESF students, not duplicated by College organizations. These fees are \$26.75 for full-time undergraduate and \$15 for full-time graduate students. Part-time matriculated students are charged \$17.50 per year payable at fall registration; part-time matriculated graduate students are charged \$10 per year.

COLLEGE FEE

There is a State University of New York general college fee of \$25 per year for all full-time students. Part-time student fee is \$.85 per credit hour.

COMMENCEMENT FEE

A commencement fee of \$12 is required at the beginning of the semester in which the degree is expected. Additional costs are incurred by graduate students for the binding, abstracting, and microfilming of theses.

TERMS OF PAYMENT

A check or money order for tuition and fees should be made payable to State University of New York College of Environmental Science and Forestry. This payment is required by the last day of the registration period and can be paid at the College's Business Office either prior to registration or during registration. A fee of \$10 may be assessed for payment later than the established date.

HOUSING AND BOARD COSTS

ESF does not operate student residences or dining halls. These facilities are offered by Syracuse University. Specific information about available housing and board plans is available from the Office of Residence and Dining Services, Syracuse University, Syracuse, New York 13210.

In general, housing costs at SU range from \$1,680 to \$2,320 for an academic year, reflecting the diversity of available accommodations for graduate or undergraduate, single or married students. Most dormitory rooms accommodate two students and are furnished with beds, mattresses, desks, chairs, study lamps and dressers. A commercial linen service is available to those who order it. Separate dormitories are maintained for graduate students.

Furnished and unfurnished apartments are also available for both single and married students. These are located in a housing complex approximately two miles from the main campus, and are regularly serviced by a free shuttle-bus.

A variety of options on board offerings are available for all students, whether or not they reside in University dormitories. Costs range from \$1,000 to \$1,700 for an academic year.

In addition, a wide variety of living arrangements in private homes and apartment complexes is available in the Syracuse metropolitan area.

Payment for housing and board is made directly to Syracuse University.

OTHER COSTS

Students majoring in resource management attend a seven-week Summer Session in Field Forestry at the Warrensburg Campus between the sophomore and junior years. Forest biology majors have the option of attending this session or the Summer Session in Environmental Biology at the Cranberry Lake Biological Station at the end of the junior year. Cost for the Warrensburg session is \$650 and \$500 for the four-week program at Cranberry Lake, plus travel and personal expenses.

An extended field trip of up to two weeks at the end of the junior year costs approximately \$250 for Wood Products Engineering students.

Field trips for Landscape Architecture students range between \$125 and \$150. In addition, students enrolled in the five-year Landscape Architecture program are required to spend one semester off campus. **This is a self-described and student-budgeted program. Costs do not necessarily exceed those of a semester on campus, but additional costs are often incurred depending upon the location chosen.**

The cost of books and supplies is approximately \$200 to \$400 a year. Additional costs for personal expenses, recreation, clothes and travel depend on the individual, and they may range from \$600 to \$800 a year.

REFUNDS

The following policies apply to tuition liability and refunds for students canceling their registration.

A student who is given permission to cancel registration is liable for payment of tuition in accordance with the following schedule:

Liability During Semester

1st week:	0%
2nd week:	30%
3rd week:	50%
4th week:	70%
5th week:	100%

Application for refund must be made within one year after the end of term for which the tuition was paid to State University. The first day of class session is considered the first day of the semester, and Saturday of the week in which this first session occurs is considered the end of the first week for refund purposes. It is interpreted that a student who does not attend any class sessions after Saturday of the first week and who notifies the College of his intent to cancel registration on or before the second Saturday following the first day of classes will be considered to have canceled his registration during the first week.

There is no tuition or fee liability established for a student who withdraws to enter military service prior to the end of an academic term for those courses in which the student does not receive academic credit.

A student who is dismissed for academic or disciplinary reasons prior to the end of an academic term is liable for all tuition and fees due for that term.

A student who cancels registration at a unit of the State University and within the same term registers at another unit of the State University is entitled to full credit for tuition and fees paid for that term.

Notwithstanding any other provisions for refund, when a student has withdrawn through circumstances beyond the student's control, under conditions in which the denial of refund would cause undue hardship, the Chief Administrative Officer of the unit may, at his discretion, determine that no liability for tuition has been incurred by the student, provided the student has not completed more than one half of the term and has not received or will not receive academic credit for the term. Such action, including the reason for withdrawal, must be in writing.

FINANCIAL ASSISTANCE

The College of Environmental Science and Forestry offers four basic forms of student financial assistance: scholarships or grants, part-time employment, long-term loans, and assistantships for graduate students. These programs are coordinated to supplement parental support, summer work, savings, and assistance from other sources. The sources of funds for financial assistance programs, the guidelines for determining the recipients, the procedures for applying, and the method of disbursement of funds vary

from one program to another. This information is presented in detail in *Financial Assistance at ESF*, a separate publication which is mailed to all applicants, and is available to the public by contacting the Office of Financial Aid.

Financial aid advisors are aware of the many problems of financing higher education and meeting day-to-day living expenses for both undergraduate and graduate students, and are available to discuss individual student problems. All students are encouraged to apply for financial aid.

HOW TO APPLY

Each year students interested in receiving financial assistance, *except for graduate assistantships*, must complete the application process. (Graduate students who wish to be considered for a graduate assistantship refer to page 38, and follow those instructions.) Two forms are necessary to apply:

1. The candidate must complete a College Aid Application and Financial Aid Transcript and return it to the Office of Financial Aid by MARCH 15. The application is included in the publication, *Financial Assistance at ESF*. Applications will be accepted after March 15; it should be noted, however, that available funds may already be committed to other students. Applicants need not wait for notification of acceptance to the College before applying for financial aid.

2. The candidate must also complete and submit by February 15 the Family Financial Statement (FFS) to the American College Testing Co., Iowa City, Iowa. The FFS is available in the College's Office of Financial Aid, high school guidance offices, and most college financial aid offices.

3. Students are invited to discuss with the professionals in the Financial Aid Office any problems in financing their education.

This application information is based on current requirements, and financial aid systems and forms are undergoing constant change. Applicants are urged to contact the Office of Financial Aid for the latest information and requirements.

SELECTION OF RECIPIENTS

In making award decisions, consideration is given primarily to comparative financial need; however, scholastic standing, character, and potential contribution to the College community are also factors in making certain awards.

Retention of Awards

All students who are awarded financial assistance will be required to maintain satisfactory academic progress each semester in order to keep their awards. Satisfactory academic progress for all programs, *except New York State (TAP, Regents, etc.)*, is defined on page 36 of this catalog.

Recipients of a New York State award must adhere to the following State requirements:

- (1) Academic Progress—A student will need to read the stated minimums on the following charts to be eligible for the next semester award.

**Standard of Satisfactory Academic Progress for: Purpose of Determining
Eligibility for Student Aid
All Campuses—State University of New York**

Calendar: Semester Programs: Associate Degrees and Certificate Programs

Before being certified for this payment,	First	Second	Third	Fourth	Fifth	Sixth	Seventh	Eighth
a student must have accrued at least this many credits,	0	3	9	18	30	45	60	75
with at least this grade point average.	.0	.5	.75	1.3	1.5	1.7	2.0	2.0

Noncredit remedial instruction can be counted toward a full-time academic load as set forth in 145-2.1 of the Commissioner's Regulations. The number of credits in this chart refers to work completed toward the degree.

Calendar: Semester Program: Baccalaureate Degree

Before being certified for this payment,	First	Second	Third	Fourth	Fifth	Sixth	Seventh	Eighth	Ninth	Tenth
a student must have accrued at least this many credits,	0	3	9	18	30	45	60	75	90	105
with at least this grade point average	0	.5	.75	1.20	1.40	1.50	1.60	1.70	1.80	1.90

Noncredit remedial instruction can be counted toward a full-time academic load as set forth in 145-2.1 of the Commissioner's Regulations. The number of credits in this chart refers to work completed toward the degree.

Calendar: Semester Programs: All Graduate Level Programs except Professional

Before being certified for this payment,	First	Second	Third	Fourth	Fifth	Sixth	Seventh	Eighth
a student must have accrued at least this many credits,	0	6	12	21	30	45	60	75
with at least this grade point average.	0	2.0	2.5	2.75	3.00	3.00	3.00	3.00

- (2) Program Pursuit—Students must complete a minimum number of semester hours each semester. *For A.A.S. Degree students*, they are required to complete 75 percent of the full-time load. Full-time is defined as 12 credit hours. Therefore, $.75 \times 12 = 9$. Nine credit hours must be completed each semester.

For Bachelor, Master, and Ph.D. students, they must complete 100 percent of full-time load each term. Full-time is 12 credit hours. Therefore, students must register for and complete at least a minimum of 12 credit hours each term.

Waivers

Should a student fall below the requirement, he/she may apply for a waiver. Students are allowed *only one* waiver during undergraduate work and *only one* during graduate work. The issuance of the waiver will be granted only after the student and the institutional waiver designee have mutually concurred that such issuance is in the best interest of the student. Request for a waiver is made through the Vice President of Student Affairs.

SCHOLARSHIP AND GRANT PROGRAMS (SEOG)

Supplemental Educational Opportunity Grants

The College is the recipient of funds authorized under Title IV-A of the Higher Education Act of 1965, as amended. These funds enable the College to award grants to undergraduate students who have financial need. Grants range from \$200 to \$2,000 per year.

ESF Educational Opportunity Grant Program (EOP)

Students accepted into the College's Educational Opportunity Program may receive, in addition to other financial assistance, a special award to pay for education-related costs. Students must come from a socio-economically and academically disadvantaged background to be eligible.

Prospective Educational Opportunity Program students must apply for financial aid when submitting their admissions applications.

Pell Grants (Formerly Basic Educational Opportunity Grants)

The Pell (BEOG) Program was authorized in the Education Amendments of 1972. Grants are available to eligible full-time and half-time undergraduate students. The amount of the award can vary from \$200 to \$1,800.

Applications are available from high school guidance offices or any college office of financial aid. Students should submit the Student Aid Report (SAR) to the Office of Financial Aid as soon as it is received from the processor.

Regents Programs

Additional information and applications for the following programs are available from the College or:

New York Higher Education Services Corporation
Tower Building
Empire State Plaza
Albany, New York 12255

REGENTS COLLEGE SCHOLARSHIPS

High school students who are New York State residents may qualify for a \$250 annual scholarship by taking a competitive exam during their senior year.

TUITION ASSISTANCE PROGRAM

These awards are available to New York State residents who are enrolled in full-time degree programs. Based on income, awards range from \$250 to full tuition. Separate application is necessary.

REGENTS GRANTS OR CHILDREN OF DECEASED OR DISABLED VETERANS

These grants are awarded to children of parents who served during specific periods of war or national emergency and who died as a result of such service, or suffered a disability of at least 50 percent. The award entitles a New York State resident to \$450 per year.

Vocational Rehabilitation Grants

Financial assistance and program counseling are provided by New York State for students with disabling handicaps. Information is available from any Office of Vocational Rehabilitation.

Veterans' Benefits

The Veterans' Readjustment Benefits Act of 1966 as amended enables veterans and children of deceased or disabled veterans to obtain financial aid for their college education.

Additional information and counseling are available from the Veterans' Affairs Counselor at the College. Local veterans' administration offices, or the State Regional Office, 111 West Huron Street, Buffalo, New York 14202, can provide information and application forms.

Social Security Benefits

The 1965 amendments to the Social Security Act extended the age limit for a child's benefits from 18 to 22, providing the child is a full-time student. Local Social Security offices have additional information. These benefits are slated to expire in 1985.

Assistance for Native American Students

Native American students with financial need may be eligible for scholarship and grant assistance through programs sponsored by the federal Bureau of Indian Affairs and the New York State Education Department. For more information about the programs, students should contact the Bureau of Indian Affairs, 1951 Constitution Avenue NW, Washington, D.C., or the Native American Education Unit, State Education Department, Education Building Annex, Albany, New York 12234.

Private Fellowships, Scholarships, and Grants

The College administers a number of programs which have been established by private individuals, companies, organizations and foundations. These scholarships and grant programs have varying eligibility requirements and are awarded to students according to their respective guidelines which are described in more detail in *Financial Assistance at ESF*. The following is a list of the programs: Alumni Memorial Awards; Alumni Educational Grants; Nelson Courtlandt Brown Scholarship Fund; Henry H. Buckley Student Aid Award; Simeon H. Bornt III Scholarship Award; Eugene C. Reichard Scholarship Award; Walter Tarbox Memorial Scholarship; Warren Bennett Memorial Award; Wilford A. Dence Memorial Award; Meyer Environmental Chemistry Scholarship Award; Meyer Wood-Plastic Scholarship Award; Edward Aalbue Memorial Scholarship; Lt. Gary Scott Memorial Scholarship; Gerald H. Williams Scholarship; Mary E. Palmer Memorial Scholarship; Portia Farrell Morgan Scholarship; Phyllis Roskin Memorial Award; and Student Association grants.

Syracuse Pulp and Paper Foundation, Inc. Scholarships

Scholarships from this foundation are awarded to students in paper science and engineering. The scholarship amount is \$100 more than the recipient's annual tuition charge. Incoming transfer students entering the program should request a Pulp and Paper Scholarship application from the Office of Financial Aid. It is necessary to reapply each year for the scholarship. Students must maintain an overall 2.5 G.P.A. (out of 4.0) to retain their scholarship. Grades are reviewed each semester.

State University Supplemental Tuition Assistance

A limited number of small grant awards are determined annually by the College for students with financial need.

EMPLOYMENT OPPORTUNITIES

College Work-Study Program (CW-SP)

The College participates in the Federal College Work-Study Program, which provides part-time jobs during the academic year and full-time positions during the summer to students who need financial assistance to attend the College. Wages for these positions begin at minimum wage and increase as duties and responsibilities increase.

Job Locator Service

The College coordinates and maintains an active program of part-time and summer employment opportunities. Interested students should contact the Student Employment Coordinator in the Office of Financial Aid for additional information. The program is open to all ESF students seeking employment.

A part-time employment program is available to qualified veterans. More information is available from the Veterans' counselor at the College.

LOANS

National Direct Student Loans

These loans are available to students with financial need who are enrolled at least half-time. Amounts which can be borrowed are \$3,000 for 2 years and \$6,000 for 4 years with a maximum of \$12,000, including graduate study. Repayment and 5 percent interest begin 6 months after leaving college. Deferment and cancellation benefits are available for certain situations.

Insured Student Loans

This program is administered by the New York Higher Education Services Corporation (NYHESC) for New York State residents. These loans are available from a bank or other lending agent to students who are registered at least half-time. Undergraduates can borrow an aggregate of \$12,500 for their undergraduate studies, and a graduate student can borrow an aggregate of \$25,000. Repayment and 9 percent interest begin 6 months after leaving college (an additional 1 percent interest is paid at the time the loan is received). Applications are available at local banks.

Parent's Loan (PLUS)

Parents of students may borrow up to \$3,000 annually and \$15,000 overall, at an interest rate of 12 percent. Loan repayment begins 60 days after receipt of the loan. Total loans to parents and students cannot exceed total cost of education.

Emergency Loans

The College is able to provide registered students interest-free, short-term loans (30 days). These loans are available because of the interest and support of the following donors: Alumni Association Short-term Loan Fund; David B. Schorer Memorial Fund; and Edward Vail Emergency Fund.

Students should contact the Office of Financial Aid when need arises for a short-term loan.

GRADUATE ASSISTANTSHIPS

Assistantships are awarded to students of demonstrated scholarship and whose education and experience enable them to assist in laboratory

instruction and research. The amounts of the assistantships range from \$3,800 to \$7,500 per year. In addition, tuition may be waived. Students who hold an assistantship must be enrolled for full-time study.

Beginning graduate students may apply for assistantships on their application for admission, and continuing graduate students should consult with their major professors.

ACADEMIC POLICIES

The following academic policies are extracted from the complete undergraduate and graduate policies which are contained in the *Student Handbook*. The *Student Handbook* is available from the Office of Student Affairs, 105 Bray Hall.

UNDERGRADUATE AND GRADUATE POLICIES

Published Requirement

Students must satisfy the requirements for graduation in effect at the time of their first matriculation as a student. Students may graduate under the requirements stated subsequent to those in effect at their matriculation, but they may not use prior ones.

Attendance

Students are expected to adhere to the attendance policy stated by each course instructor. Instructors may make attendance part of the course requirement.

Education Law

Students unable, because of religious beliefs, to attend classes on certain days are guided by Section 224a of the New York State Education Law which is as follows:

“1. No person shall be expelled from or be refused admission as a student to an institution of higher education for the reason that he is unable, because of his religious beliefs, to attend classes or to participate in any examination, study or work requirements on a particular day or days.

“2. Any student in an institution of higher education who is unable, because of his religious beliefs, to attend classes on a particular day or days shall, because of such absence on the particular day or days, be excused from any examination or any study or work requirements.

“3. It shall be the responsibility of the faculty and of the administrative officials of each institution of higher education to make available to each student who is absent from school, because of

his religious beliefs, an equivalent opportunity to make up any examination, study or work requirements which he may have missed because of such absence on any particular day or days. No fees of any kind shall be charged by the institution for making available to the said student such equivalent opportunity.

“4. If classes, examinations, study or work requirements are held on Friday after four o’clock post meridian or on Saturday, similar or makeup classes, examinations, study or work requirements shall be made available on other days, where it is possible and practicable to do so. No special fees shall be charged to the student for these classes, examinations, study or work requirements held on other days.

“5. In effectuating the provisions of this section, it shall be the duty of the faculty and of the administrative officials of each institution of higher education to exercise the fullest measure of good faith. No adverse or prejudicial effects shall result to any student because of his availing himself of the provisions of this section.

“6. Any student, who is aggrieved by the alleged failure of any faculty or administrative officials to comply in good faith with the provisions of this section, shall be entitled to maintain an action or proceeding in the supreme court of the county in which such institution of higher education is located for the enforcement of his rights under this section.”

Audits

Students may informally audit ESF courses with the permission of the course instructor. No record will be maintained of the informal audit nor will any grade be assigned. No fee is required for informal audits.

Students may formally audit courses with the permission of their major professor and the course instructor. They may not be used to satisfy any graduation requirements. Formally audited courses will appear on the student’s transcript and will be graded either “SAU” (satisfactory audit) or “UAU” (unsatisfactory audit). The grade will be assigned based on the criteria for audit established by the course instructor.

Withdrawal from ESF

Students who withdraw on or before the “drop date” for a semester will have their records marked “(date): Withdrawal.” Courses will appear for that semester with the grade of “W”.

Students who withdraw after the “drop date” for a semester, but before the semester ends, will have either “WP” (withdraw passing) or “WF” (withdraw failing) listed after each such course.

Students who withdraw from the College and in the future wish to return must apply for readmission.

Prior to withdrawal from ESF, students must schedule an interview in the Office of Student Affairs.

Statement of “Good Academic Standing”

The term “in good academic standing” means that a student is eligible or has been allowed to register for and undertake academic coursework at the College for the semester in question. In some instances the College may define a student as being “on academic probation.” The mechanism of academic probation, including any accompanying constraints upon a student’s activities, is intended merely as an educational device designed to encourage greater effort on the part of students who appear to be having difficulty in meeting certain academic standards. Placement on academic probation may precede denial of the right to register for academic coursework if certain conditions are not met, but a student on academic probation is considered to be in good academic standing. Any question concerning whether or not an individual student is in good academic standing will be determined by the College Academic Affairs Committee.

UNDERGRADUATE POLICIES

Credit Hour Load

To be classified as full-time, an undergraduate student must register for at least 12 credit hours during a semester. A student may not register for more than 18 credits during a semester unless permission from the student’s advisor is obtained.

Evaluation

For each course completed, one of the following grades will be awarded:

<i>Grade</i>	<i>Definition</i>	<i>Grade Points</i>
A		4.0
A-	Excellent	3.7
B+		3.3
B	Good	3.0
B-		2.7
C+		2.3
C	Passing	2.0
C-		1.7
D	Minimum Passing	1.0
F	Failure	0
I/F	Unresolved Incomplete	0

Under conditions defined elsewhere, the following grades may be assigned, none of which yield grade points:

<i>Grade</i>	<i>Definition</i>
W	Withdraw
WP	Withdraw Passing
WF	Withdraw Failing
SAU	Audit (Satisfactory)
UAU	Audit (Unsatisfactory)
I	Incomplete

Grade Point Averages

Semester and cumulative averages are computed by dividing the total grade points earned by the total credit hours completed, i.e., all courses graded "A - F."

Academic Honors

PRESIDENT'S LIST

Students who carried 12 or more credits of coursework graded "A - F" and earned a minimum grade point average of 3.00 will be placed on the President's List for that semester.

Graduation Honors

Students will be graduated with the appropriate honor if the following criteria have been met:

A minimum of 30 credits of ESF and Syracuse University courses have been completed as a matriculated, upper-division student.

A grade point average of: 3.00 - 3.33, *cum laude*; 3.34 - 3.82, *magna cum laude*, 3.83 - 4.00, *summa cum laude*.

Academic Dismissal

Undergraduate students who earn less than a 2.00 cumulative grade point average shall have their records reviewed by the appropriate College-wide faculty committee which may delegate this authority. Based upon this review, students with less than this minimum cumulative grade point average will be placed on either academic probation or dismissed from ESF. The decision on probation or dismissal will be based upon an overview of the total academic record and the mathematical possibility for attaining a 2.00 cumulative average by the projected graduation date.

When extraordinary conditions contributed to the academic dismissal of students, such students may submit a written appeal to the dismissal decision to the Office of Academic Programs. These appeals will be reviewed by the appropriate faculty committee which will decide either to sustain the dismissal or place the students on probation. There is no appeal beyond this committee.

Students who have been dismissed for academic performance may not reapply until at least one semester has elapsed.

Students dismissed a second time for academic performance may not again be considered for readmission.

Graduation Requirements

Undergraduate students are responsible for meeting the following requirements for graduation:

- A. Matriculated status as an undergraduate student.
- B. All course requirements must be satisfied.

- C. A minimum cumulative grade point average of 2.00 (4.00 = A) for all courses taken as a matriculated student at ESF.
- D. At least 24 of the last 30 credits must be registered through ESF.
- E. Consistent with the State Education Department requirements, a total of at least 120 credits from courses accepted as transfer credit by ESF and courses successfully completed while a matriculated student at ESF.

Graduation Rate

Of the transfer students who began their studies in the fall of 1979 at ESF, over 78 percent received their degree, or continued in a five-year program, after four semesters of study. For those who began in the fall of 1980, approximately 80 percent received their degree, or are continuing in a five-year program, after four semesters of study. Further information on student retention is available from the Office of Academic Programs at ESF.

GRADUATE POLICIES

Master's Credit Hours

A minimum of 30 credit hours of graduate level work is required for the master's degree. This degree shall represent completion of at least one academic year of graduate-level study or an equivalent that can be shown to accomplish the same goals.

Doctoral Credit Hours

For the doctorate, credit hour requirements vary depending on the student's background and specific degree program. Early in a student's program the coursework requirement will be established which is intended to provide the student with the required level of competency to satisfactorily complete the doctoral candidacy examination. The doctorate shall represent completion of at least three full-time academic years of graduate study beyond the baccalaureate degree or an equivalent that can be shown to accomplish the same goals.

Doctoral Research Tool Requirement

There is no College-wide requirement for languages or other tools of research for doctoral students. However, the faculty of any program may establish such requirements.

Time Limit

Students must complete all requirements for the master's degree within three years of the first date of matriculation. For the doctoral degree, students must complete all requirements for their degree within three years of satisfactory completion of the doctoral candidacy examination or they will be required to retake the candidacy examination.

Credit Hour Load

A graduate student must be registered for at least one credit each semester, excluding summers, from the first date of matriculation until all degree requirements have been completed. Failure to register will indicate the student no longer wishes to pursue a graduate degree.

Although there is no full-time requirement for degree purposes, there is such a requirement for those who qualify for a tuition waiver and for some other forms of financial support. For these students the following definition applies:

With a master's degree, or the completion of 24 or more credits after the bachelor's degree, students holding an assistantship are considered full-time if they are registered for nine or more credits. All other students are considered full-time if they carry 12 or more credits. All graduate students in landscape architecture must carry 12 or more credits to be considered full-time.

Evaluation

For each course completed, one of the following grades will be awarded.

<i>Grade</i>	<i>Definition</i>	<i>Grade Points</i>
A		4.0
A-	Excellent	3.7
B+		3.3
B	Passing	3.0
B-		2.7
C+		2.3
C	Minimum Passing	2.0
C-		1.7
F	Failure	0
I/F, I/U	Unresolved Incomplete	0

Under conditions defined elsewhere, the following grades may be assigned, none of which yield grade points:

<i>Grade</i>	<i>Definition</i>
W	Withdraw
WP	Withdraw Passing
WF	Withdraw Failing
S	Satisfactory
U	Unsatisfactory
SAU	Audit (Satisfactory)
UAU	Audit (Unsatisfactory)
I	Incomplete

Grade Point Averages

Semester and cumulative averages are based on graduate level courses only and are computed by dividing the grade points earned by the credit hours completed, i.e., all courses graded "A - F."

Master's Study Integration

Students enrolled in a master's degree program are required to demonstrate the ability:

- A. to critically evaluate, organize, analyze, and synthesize the coursework and other components of their program of study;
- B. to relate these components to current concepts and issues in their chosen field and associated disciplines;
- C. to work logically and independently; and
- D. to communicate effectively.

Master's study integration requirements may be met by successful completion of one of the following three options. The faculty of any program may limit the number of permissible options for its students. As permitted by their program, students will choose and follow one option with the approval of their major professor and with the guidance of their steering committee. Each option must be designed to satisfy the above requirements.

OPTION 1. THESIS OR PROJECT AND DEFENSE

Scope. Under this option, in addition to completion of necessary coursework, students must prepare either:

1. a research-oriented thesis which investigates a problem that expands or clarifies knowledge in the field, with generalizable results, or
2. an application-oriented project which applies skills or techniques from the field to a specific problem.

Whichever is chosen, students are required to define an appropriate problem for investigation; review relevant information sources; develop a study design; collect, organize, analyze, and interpret data; and draw conclusions.

Product. The thesis or project must be documented in a thorough and appropriate format and style. It must be in a permanent form, which may consist of print or nonprint materials.

Credits. Students must satisfactorily complete 6 to 12 credits for the investigation leading up to completion of the document. These credits will be graded on an "S/U" basis. Students must register for the approved number of credits for their investigation sometime during the three-year limit for the master's degree. They may register for more than the approved number of credits for their investigation, but the excess credits may not be used to fulfill the minimum 30 credits required for the master's degree.

Defense Examination. The thesis or project must be successfully defended.

OPTION 2. ACADEMIC OR PROFESSIONAL EXPERIENCE AND MASTER'S COMPREHENSIVE EXAMINATION

Scope. Under this option, in addition to completion of necessary coursework, students must engage in an academic or professional experience which applies, enriches, and/or complements the more formal coursework of their plan of study. This option might include, but not be limited to, an internship or an independent study experience. Whatever the form of the option, its objectives, organization, procedure, and manner of documentation must be submitted in writing and be approved by the student's major professor and steering committee before the experience is begun.

Product. This experience must be reported in a thorough and appropriate format and style. It need not be in a permanent form.

Credits. Students must satisfactorily complete 6 to 12 credits for this experience. These credits will be graded on an "S/U" basis. Students must register for the approved number of credits for their experience sometime during the three-year time limit for the master's degree. They may register for more than the approved number of credits for their experience, but the excess credits may not be used to fulfill the minimum 30 credits required for the master's degree.

Master's Comprehensive Examination. At the completion of their plan, students must successfully pass a comprehensive examination covering the major field, allied fields, and the content of their completed experience.

OPTION 3. COURSEWORK AND MASTER'S COMPREHENSIVE EXAMINATION

Scope. Under this option, students must satisfactorily complete a minimum of 42 hours of graduate level coursework appropriate to their field of study. As in other options, the design and sequencing of the coursework plan must be conducted with the guidance and approval of the student's major professor and steering committee.

Product. No product is required beyond that required for individual courses.

Credits. Students must satisfactorily complete a minimum of 42 credits of graduate level coursework. Students must complete these required credits sometime during the three-year time limit for the master's degree.

Master's Comprehensive Examination. At the completion of their plan, students must successfully pass a comprehensive examination covering the major field and allied fields.

Doctoral Thesis

Nature and Purpose

A thesis must be completed and successfully defended in order for the doctoral degree to be awarded. The doctoral thesis is the final and most important component of the series of academic experiences which culminate in the awarding of the Ph.D. degree. Three major functions are fulfilled by the thesis experience: (1) It is a work of original research or scholarship which makes a contribution to existing knowledge; (2) It is an educational experience which demonstrates the candidate's mastery of research methods and tools of the specialized field; and (3) It demonstrates the student's ability to address a major intellectual problem and arrive at a successful conclusion.

Examinations

Doctoral Preliminary Examination

An examination may be required of those admitted into a doctoral program to ascertain their level of understanding of the basic principles and techniques necessary to function effectively in that program. The results of the preliminary examination will be used to guide the major professor and the student in determining the appropriate coursework necessary to complete that requirement for the doctorate.

The format for the examination will be determined by the faculty in the program involved. It is recommended that the examination be primarily written with a supplemental oral presentation. When a preliminary examination is required it should be conducted as early as possible in a student's program, at least before the completion of the student's second semester.

Doctoral Candidacy Examination

A student admitted into a doctoral program must satisfactorily complete a candidacy examination covering the major field and, in a broader manner, allied fields in order to be advanced into the status of doctoral candidate.

The purposes of the doctoral candidacy examination are to determine the student's knowledge of factual material and ability to use this knowledge creatively and intelligently.

The doctoral candidacy examination must be taken when the majority of coursework is completed but before the student begins serious thesis investigation. The candidacy examination must be passed at least one year before the student may present a thesis for defense.

Defense Examination for Thesis or Project

All graduate students who are required to complete a thesis or project must successfully defend it and have it accepted by the College.

The purposes of the defense examination are to determine the validity and significance of the data; and evaluate the student's understanding of investigative methods, ability to critically analyze data, and ability to relate the study

results to the appropriate field and to more general scientific principles and knowledge.

Academic Dismissal

Graduate students who earn less than a 3.00 cumulative grade point average or who earn two grades of "U" shall have their records reviewed by the College Academic Affairs Committee, which may delegate this authority. Based upon this review, students either will be placed on academic probation or will be dismissed from ESF. The decision on probation or dismissal will be based upon an overview of the total academic record, the mathematical possibility for attaining a 3.00 cumulative average by the projected graduation date, and the recommendation from the major professor, program coordinator, and school dean or program director.

When extraordinary conditions contributed to the academic dismissal of students, such students may submit a written appeal to the dismissal decision to the Office of Academic Programs. These appeals will be reviewed by the College Academic Affairs Committee, which will decide either to sustain the dismissal or place the students on probation. There is no appeal beyond this committee.

Students who have been dismissed for academic performance may not reapply until at least one semester has elapsed.

Students dismissed a second time for academic performance may not again be considered for readmission.

Graduation Requirements

Graduate students are responsible for meeting the following requirements for graduation:

- A. The student must be in a matriculated status as a graduate student.
- B. The approved academic plan for each student must be completed within the applicable time limit.
- C. For the doctoral degree, the student must be admitted to candidacy and a thesis completed and successfully defended.
- D. A minimum cumulative grade point average of 3.00 (4.00 = A) for all graduate level courses taken during the program of study at ESF must be achieved.
- E. Consistent with the State Education Department requirements, a total of at least 30 graduate credits is required for the master's degree and, for the doctorate, at least three full-time academic years of graduate study beyond the baccalaureate degree or an equivalent that can be shown to accomplish the same goals.

STUDENT LIFE

HOUSING

The College of Environmental Science and Forestry does not operate its own residence facilities or food service. Students enter into a Room and Board Contract with Syracuse University, who have housing facilities available adjacent to the State-operated College. Contracts for room and board made with Syracuse cover a full academic year (both fall and spring semesters) and are not normally renegotiable during that time period.

Students have a choice of living centers at Syracuse University—large halls, apartment houses, cottages, fraternities and sorority houses, or cooperative units. Student resident advisors live on each floor or in each unit and are available for counseling, advisement, and referral services.

Syracuse University also has housing units available for married students and their families. While veterans are given preference, nonveterans can usually find housing.

Students who wish to live off campus may contact Alternative Action Services (ALTERACTS), a student-run housing organization at Syracuse University. An extensive listing of available housing in the Syracuse area is provided free of charge.

FOOD SERVICE

Syracuse University offers different meal plans to help meet the varying nutritional needs and interests of individual students. Students living in University apartments, co-ops, fraternities and sororities or off-campus can take advantage of the board plans available. Students living in dormitories and area housing without full kitchen services are required to subscribe to a board plan.

The College does not provide a food service program. However, a snack bar, located in the basement of Marshall Hall, is open 8 a.m. to 3:30 p.m. weekdays during the academic year.

EXTRACURRICULAR ACTIVITIES

Students at the College of Environmental Science and Forestry have many extracurricular activities to choose from, both on campus and in the community.

At the College

The *Undergraduate Student Association* (USA) and the *Graduate Student Association* (GSA) are the official representative bodies on campus governing student activities. Undergraduate and graduate students elect representatives from each school to manage the affairs of their respective organizations and the concerns of their constituents.

Campus organizations offer students an opportunity to broaden their knowledge and meet other students with similar personal and academic interests. These include: the *Basketball Club*; *Bob Marshall Club*, an organization of students concerned about the future of the Adirondack Mountains; the *Forestry Club*, the traditional sponsor of the intercollegiate Woodsmen's Team; *Botany Club*; *Mollet Club*, an organization of landscape architecture students; the *Recycling Club*; and the *Zoology Club*, which sponsors lectures, films, and field trips.

Other groups on campus include *Saengerbund*, the College singing group; and *Alpha Xi Sigma*, senior honorary society. There are also student chapters of the *Wildlife Society*, the *Society of American Foresters*, the *American Fisheries Society*, the *American Water Resources Association*, the *Forest Products Research Society*, the *American Society of Landscape Architecture*, the *Association of General Contractors*, *Society of Wood Science and Technology*, and the *Technical Association of Pulp and Paper Industries (TAPPI)*.

The two major student publications at ESF are the *Knothole*, a weekly newspaper, and *The Empire Forester*, an annual yearbook which has won many awards in past years.

Recent GSA-sponsored activities include a lecture series, a traditional fall picnic, and various social functions designed to encourage interaction between graduate students and College faculty.

At Syracuse University

Students at the College of Environmental Science and Forestry have all the privileges of Syracuse University students: participation in student government, organizations, sports, and other extracurricular activities.

Men and women at the College participate in all Syracuse University intercollegiate sports, club sports, and intramurals. Archbold Gymnasium on the Syracuse University campus is the center of athletics and physical education. Additional indoor facilities are provided through Manley Field House and the new Carrier Dome which is the site of Syracuse University home football and basketball games. Facilities at Skytop recreation area include a lodge, and 22 tennis courts. The Women's Building offers instructional, social, and recreational facilities. All full-time undergraduate women are eligible to participate in intercollegiate competition in tennis, field hockey, volleyball, basketball, swimming, and diving.

Students are provided with many opportunities for acquiring musical training and performing experience through the Syracuse University Band, (Symphonic Band, Wind Ensemble, Stage Band, Concert Band and Jazz Workshops), the Syracuse University Orchestra, and the Syracuse University Chorus.

Membership is allowed in all Syracuse University student groups, including a wide variety of clubs, the International Student Association, religious and military organizations, and professional and honor societies.

In the Syracuse Area

The City of Syracuse and its surrounding countryside offer many cultural, educational, and recreational opportunities. The city has several fine museums, including the Everson with its outstanding collection of works by local, regional, and international artists; a local repertory theater; several points of historical interest; a professional symphony orchestra; and a Civic Center which attracts artists from around the world.

Eight parks lie within the city limits, numerous county and state parks, including Beaver Lake Nature Center and Montezuma National Wildlife Refuge are within a short drive.

COLLEGE SERVICES

Career and Counseling Services

The Office of Career and Counseling Services is available throughout the students' college career as a place where at any time they may seek the advice of experienced counselors. This office should be the first contact when questions or personal problems arise. Most student problems can be dealt with in one or two brief contacts. Severe problems requiring extensive assistance are referred to the cooperative facilities at Syracuse University and/or specialized agencies in Syracuse.

The Office is designed to provide additional assistance to students throughout the year to help them adjust to and successfully graduate from ESF. Through various presentations, counseling sessions, group activities and workshops, students are given the opportunity to further develop such skills as decisionmaking, reading, studying, and test taking. Additional programs deal with coping with adjustments related to transferring colleges and exploring relationships between academic pursuits and career objectives.

Special efforts are made to assist students identified as having academic difficulties or adjustment problems. Often personal and academic problems are associated with career decisions. A key component of this office is to provide a variety of opportunities through resource materials, presentations, job development, and counseling to meet the individual needs of each student at his/her various stages of career readiness. Some career services offered through this Office are skills development workshops; list of full-time, part-time, and summer jobs; on campus recruiting; advanced study information; career newsletters; reference information; a library outreach program; and an alumni job list.

Each year this office conducts a Placement Survey to monitor the success and progress of our college graduates. The reports are shared with the college community and made available to the public upon request.

Since 1978, placement statistics for ESF graduates, 6-9 months past graduation, have not varied significantly. On the average 70 percent of the graduates are employed, 23 percent are continuing their education, and 7 percent are available for employment.

More detailed information is available in the Office of Counseling and Career Placement in Room 108, Bray Hall.

Services for the Handicapped

Students who experience short-term handicaps and/or incapacitating injuries that need special transport or classroom assistance should contact the Office of Student Affairs.

The Office of Administration and Services, assisted by Student Affairs, also provides specialized support services and adapts general resources to assist more permanently handicapped students to obtain maximum academic, social, and cultural benefits within the College community. Some of the specific services provided or made available include: pre-admissions guidance, orientation, mobility training, reader recruitment, preferential housing assignments, tutoring and other supportive services as required to meet individual living/learning needs. The College is also prepared to respond to handicapped students' needs for personal and career counseling and job placement assistance.

For further information, contact the ESF 504 Coordinator, Mr. David G. Anderson, Office of Administration and Services, Room 209, Bray Hall (315) 470-6622. The College maintains liaison relationships with rehabilitation agencies within the local community and the state, including the Office of Vocational Rehabilitation and the Commission for the Visually Handicapped. For specific information regarding their own eligibility, students should contact the respective agency directly.

Health and Medical Facilities

Students may consult a physician for medical care or health advice at the Syracuse University Student Health Service. Full-time students are entitled to unlimited visits to the out-patient clinic and also 10 days of confinement per college year with ordinary medical care in the infirmary. Infirmary usage over 10 days will be at prevailing infirmary rates. Some laboratory examinations, if necessary for treatment or diagnosis of common illness, are provided without cost. Most common legal drugs are provided at a minimal charge.

A student accident or sickness insurance plan, available at fall registration, not only supplements the usual infirmary privileges, but is also a health protection plan during the summer months when students are not under the care of the Health Service. Married students with dependents who are not covered by Health Service privileges are strongly urged to provide themselves and their families with special insurance made available to University students. *All international students are required to carry health and accident insurance.*

SU Speech and Hearing Clinics

The Gebbie Speech and Hearing Clinics provide remedial assistance to all regularly enrolled students who may be handicapped by hearing, speech, and voice disorders. This service is free to students.

SU Psychological Services and Research Center

Students desiring an analysis of their aptitudes, abilities and interests may secure special testing programs at the Testing and Evaluation Service Center on the Syracuse University campus.

SU ROTC Opportunities

Students attending the College are eligible to participate in the Army or Air Force ROTC Program at Syracuse University.

ROTC at Syracuse University consists of both 4- and 2-year programs. Students attending the College for two years can gain admission to either the Army or Air Force program through participation in summer training. Both six-week and four-week camps and on-campus programs are available to suit individual needs.

The ROTC programs offer academic instruction, alternate and supplementary career opportunities, leadership experience and financial aid.

ESF Alumni Association

The Alumni Office serves as the liaison between the College, the Alumni Association Board of Directors and more than 9,000 alumni. The Association supports education programs through scholarships, publishes a quarterly newsletter and represents alumni concerns.

ESF Student Rules and Regulations

The complete listing of guidelines for all students attending ESF is found in a separate publication, the *Student Handbook*, which is distributed at registration. "Rules and Regulations of Conduct and Behavior" which pertain to all students is included in the *Handbook*. It is the student's responsibility to be familiar with these regulations and abide by them.

DEGREE PROGRAMS AND AREAS OF STUDY

The College is authorized to award degrees in the following programs. Enrollment in other than registered or otherwise approved programs may jeopardize a student's eligibility for certain financial aid programs.

School of Biology, Chemistry and Ecology

Chemistry; B.S., M.S., Ph.D., with areas of study in biochemistry, natural products chemistry, environmental chemistry, or natural and synthetic polymer chemistry. (HEGIS Code 1905)

Environmental and Forest Biology; B.S., M.S., Ph.D., with areas of study in ecology, entomology, environmental physiology, fish and wildlife biology and management, pathology and mycology, pest management, plant science, soil ecology, or zoology. (HEGIS Code 0499)

Interdepartmental area of study in chemical ecology; M.S., Ph.D.

School of Forestry

Forest Technician Program; A.A.S. (HEGIS Code 5403)

Resource Management—General Forestry; B.S. (HEGIS Code 0115)

Resource Management and Policy; M.S., Ph.D., with areas of study in forest management, recreation management, policy and administration, forestry economics, quantitative methods, or land use planning. (HEGIS Code 0115)

Silviculture and Forest Influences; M.S., Ph.D., with areas of study in silvics, silviculture, forest soil science, tree improvement, or forest influences. (HEGIS Code 0114)

Interprogram areas of study in urban forestry or international forestry; B.S., M.S., Ph.D.

School of Environmental and Resource Engineering

Forest Engineering; B.S. (HEGIS Code 0999)

Paper Science and Engineering; B.S. (HEGIS Code 0999)

Wood Products Engineering; B.S., with options in building construction, or forest products in which emphasis may be chosen in marketing, production systems engineering, or wood science. (HEGIS Code 0999)

Environmental and Resource Engineering; M.S., Ph.D., with areas of study in forest engineering, paper science and engineering, or wood products engineering. (HEGIS Code 0999)

School of Landscape Architecture

Environmental Studies; B.S. (HEGIS Code 0201)

Landscape Architecture; B.L.A. (HEGIS Code 0204)

Landscape Architecture; M.L.A., with areas of study in social/behavioral studies, natural/physical applied sciences, or design process, methods and management. (HEGIS Code 0204)

Collegewide Program

Graduate Program in Environmental Science; M.S., Ph.D., with areas of study in energy, environmental communications, land use, urban ecosystems, waste management, and water resources. (HEGIS Code 0420)

THE SCHOOL OF BIOLOGY, CHEMISTRY AND ECOLOGY

STUART W. TANENBAUM, *Dean*

The School of Biology, Chemistry and Ecology offers two curricula which support environmental science and forestry through the Department of Environmental and Forest Biology and the Department of Chemistry.

ENVIRONMENTAL AND FOREST BIOLOGY

ROBERT L. BURGESS, *Chairman*

The Department of Environmental and Forest Biology provides students with a firm foundation in basic biology in association with the principles of forest ecosystem dynamics and environmental science. It encompasses a variety of interconnected disciplines concerned with living systems, and treats not only the form, function, and evolution of organisms, but their life requirements, tolerances, and interactions that are central to the stewardship of renewable natural resources and the maintenance of environmental quality.

Effective management and protection of forests and related natural resources is increasingly dependent upon the understanding of living systems relative to productivity and tolerance to environmental impacts caused by the activities of man. Therefore, basic knowledge of biology is prerequisite to desirable practices and sound regulations for optimizing both the development and use of natural resources while avoiding deleterious impacts.

The critical importance modern society places upon the utilization of natural resources and the quality of our environment adds new and increasingly diverse dimensions to the services a well-trained biologist can render. The department is committed to meet this dynamically changing

array of opportunity through diverse courses enriched by an active program of research that focuses upon upper-level undergraduate and graduate study. Through the addition of selected electives to a required core, undergraduates may focus their program toward a special biological field (see page 59) or toward future graduate study. Graduate students may develop a course of study under the guidance of a major professor and graduate committee within any of several study concentrations (see p. 61).

The academic programs attempt to stimulate interest in the recognition standing of plants, animals, and protists, and deal with an understanding of the dynamic changes in biological systems in the context of the broad fields of ecology, physiology, evolution, and genetics. This understanding is accomplished by an integration of coursework with a strong research program, much of which is concerned with natural resource management and improvement of the quality of our environment.

Undergraduate Program

The curriculum for the Bachelor of Science degree is built around a core of required courses which provide the student with a general education, an orientation to forestry, and a basic background in the principles of the biological and the physical sciences. Its design develops breadth in biology as well as depth in a selected biological field. Thus, although individual course selections may vary, all students major in environmental and forest biology and each, with an assigned advisor, develops a special plan of study.

A dual-major program is available that meets the undergraduate requirements of both the School of Forestry and the School of Biology, Chemistry and Ecology (see p. 118).

A total of 125 credit hours, 60 of them prior to matriculation, is required for the Bachelor of Science degree. In addition to the core courses specified below, at least 21 hours in biology must be completed and, of these, at least 15 are to be from courses given in the College of Environmental Science and Forestry. These courses should be compatible with the intended concentration of study and must be at the 300 level or above. Six of the 21 credit hours must involve subject matter in plant science and six in animal science, both exclusive of the five-hour summer field requirement. The balance of the required hours are chosen in consultation with the advisor.

Lower Division Courses

The curriculum facilitates transfer of freshman and sophomore credits from other institutions. To assume training in residence at the junior level, entering students must have successfully completed a minimum of 60 credits which include:

<i>Course Area</i>	<i>Credit Hours</i>
General Chemistry with Laboratory	8
Organic Chemistry with Laboratory	8
General Physics with Laboratory	8
Mathematics proficiency, through Integral Calculus	4-8
English	6
*Social Sciences—Humanities	9-12
General Botany and Zoology OR General Biology with Laboratory	8
Biology Electives	3-6
TOTAL MINIMUM LOWER DIVISION CREDITS	60

*A course in technical writing and/or speech is recommended as part of the Social Science—Humanities group.

Upper Division Courses

Junior Year			<i>Credit Hours</i>
<i>First Semester</i>	EFB 336	Dendrology I	3
	EFB 320	General Ecology	3
	EFB 352	Elements of Forest Entomology	3
	Electives	.....	6
			15
<i>Second Semester</i>	APM 491	Introduction to Probability and Statistics	3
	ERM 345	Soils OR GOL 105 Earth Science	3
	EFB 325	Cell Physiology	3
	Electives	.....	6
			15
SUMMER FIELD EXPERIENCE—Must be met as described on page 58			5

Senior Year			<i>Credit Hours</i>
<i>First Semester</i>	Electives	.....	15
<i>Second Semester</i>	EFB 407	Principles of Genetics	3
	EFB 408	Genetics Laboratory	1
	Electives	.....	11
			15
TOTAL MINIMUM UPPER DIVISION CREDITS			65

A total of 125 credit hours is required to complete the B.S. degree in Environmental and Forest Biology.

SUMMER FIELD EXPERIENCE

The curriculum requires that between the junior and senior year each student completes a minimum of five semester credit hours or its equivalent during residence in an approved academic program in field biology. This requirement can be met by the appropriate selection of courses at the Cranberry Lake Biological Station (CLBS) where courses are offered during each of two sessions (see p. 60). Earning five credits at one session satisfies the requirement; any additional courses taken in the other session count as elective credits.

One of the following alternatives to the CLBS program may be selected to fulfill the summer field requirement:

Alternative 1

Students desiring an experience in the principles and practices of professional forestry should attend the Summer Session in Field Forestry at the Pack Forest, Warrensburg Campus. Field instruction at this Campus emphasizes subject matter in dendrology, forestry, surveying, mensuration, and cartography.

Alternative 2

Other biological field stations may be attended to earn the minimum five semester hours credit or its equivalent. Petitions requesting this alternative must include course descriptions and the program contemplated and be submitted no later than one month prior to the end of the spring semester preceding the summer program. A current file of alternative stations and course descriptions is maintained by the director of the Cranberry Lake Biological Station.

Alternative 3

EFB 420, Field Experience-Internship, may be authorized when containing a major academic-learning component and when thoroughly planned and well documented. It must be related to and supportive of the indicated career goal. The student must receive advance agreement from a member of the Department of Environmental and Forest Biology faculty to guide, collaborate, evaluate a work plan for the summer, and later assign a grade and credits to the internship. The plan must be submitted at least one month prior to the end of the spring semester and must be approved by the Curriculum Director.

Electives

General requirements for graduate study and a wide range of federal, state, municipal, and private biology positions are met by the curriculum. Through skillful selection of electives, the student may prepare for special biological fields related to natural resources or the environment. Those training for biological positions in federal and state service should review

Civil Service publications and become familiar with specific course requirements early enough to make timely elective choices. Students planning to meet special requirements for Federal Civil Service positions in forestry may do so by electing 10 credits in forestry courses and attending the Summer Session in Field Forestry at the Warrensburg Campus. Students are urged to use some elective time to enhance their communications skills. Courses in technical writing, applied communications or a language (as approved by their faculty advisor) are useful.

Special Biological Fields

Animal Physiology. Without further specialization, job opportunities in this field are limited, but those at the bachelor level include technician work in a laboratory, medical school, hospital, or in a liberal arts college; clerical work in government information agencies such as at the National Medical Library, and the Smithsonian Institution; and sales opportunities with the pharmaceutical and chemical industries.

Entomology. Insects play significant roles, both beneficial and detrimental, in their interactions with man, his resources, and his environment. Several courses are available on insect life and functions that enable a student to fulfill requirements of Civil Service and a variety of other employers. Program strengths are in forest entomology, medical entomology, pest management, and environmental toxicology.

Environmental Microbiology. Microbiology is a dynamic and exciting science—vital in the world today and for the future. This science deals with bacteria, molds, algae, yeasts, protozoa, rickettsiae, and viruses: their roles in industry, disease, the environment, and everyday life. Careers in microbiology are available throughout the public and private sectors, and related to many different professions and industries.

Fish and Wildlife Biology and Management. A basic and applied program in fish and wildlife biology, including management and behavior, is provided for the student whose objectives are to develop professional skills in the biology and management of these natural resources.

Forest Pathology and Mycology. Protection of vascular plants and wood products from invading organisms, such as fungi, is basic to forest productivity, effective wood product use, and the maintenance of environmental quality. Program strength is in the ecological, physiological, genetic, and environmental aspects of disease. Students may train for positions in forest pathology, mycology, pest management, plant quarantine, or diagnostic laboratories. Opportunities for employment exist with federal, state, and private agencies.

Pest Management. Modern control of insects and disease dictates practices appropriate to maintaining an acceptable environmental quality. Through proper selection of courses, a student is able to achieve training that will result in wise selections of methods for an integrated approach to pest management. Training is more than adequate to prepare students for state examinations required for pesticide applicator's certification.

Plant Physiology. Plant physiology, part of the broader science of botany, attempts to understand the life processes that occur in plants. Career opportunities are available through federal, state, and local governments through their extensive testing and monitoring programs. Additionally, positions are available in agriculture and forestry concerning pathogenic microorganisms and physiological mechanisms of infection.

Plant Science. Students may prepare for a wide variety of opportunities in the botanically oriented professions. Essential to understanding plants are their biochemical and physiological processes; their interactions with the environment and with one another; with animals and other organisms; their genetic makeup, evolution and classification. Requirements may be satisfied for technical positions in areas such as botany, plant ecology, tree genetics, plant physiology, horticulture, tree maintenance, or plant quarantine.

Zoology. A basic and broad program is provided for the student whose objectives are to go on for graduate study or to further training in such subjects as physiology, soil invertebrate ecology, animal behavior, or animal ecology. Some opportunities with federal and state agencies are available at the baccalaureate level.

Cranberry Lake Biological Station

Students in the Environmental and Forest Biology curriculum generally satisfy their summer requirement by attending either session at the Cranberry Lake Biological Station. Courses at the Station are senior-level offerings designed to come after the junior year spent on the Syracuse Campus. Students elect courses during one session for a total of five semester-hours. Extra credits earned by attending both sessions count toward elective hours in biology. Students from other institutions are welcome.

Cranberry Lake and its environs are ideally suited for an advanced biology summer program. The surrounding topography is rolling hill and lake country dotted with numerous small ponds, closed bogs, and stream drainages. The lake itself is the third largest body of water in the Adirondacks. Because 80 percent of the shoreline is in State ownership, the lake remains relatively unspoiled by recreational developments and is free of pollution problems. Much of the original forest cover in the region was

harvested years ago; today a rich variety of community types occupy those sites as the vegetation reverts to natural conditions. The remaining virgin forests also provide the student with many examples of stable forests, each type reflecting the particular environmental conditions controlling forest development. A wealth of wildlife parallels the variety of cover types over the region. The area provides easy access to a wide range of additional ecosystems ranging from bog to alpine types.

Facilities include four classroom-laboratories; dining facilities capable of serving 120; faculty quarters and cabins; an administration building; 12 cabins housing 6-8 students each; a recreation hall; and several smaller, supporting buildings.

The program extends from mid-June into mid-August and is divided into two sessions. Courses are designed to emphasize and effectively utilize the unique nature of this Adirondack setting, and all involve field trips each day into the surrounding forest and aquatic ecosystems. The scheduling of courses remains fairly constant from year to year.

Students wishing more information about the Summer Program, including courses and fees, may write to the Director, Cranberry Lake Biological Station, State University of New York College of Environmental Science and Forestry, Syracuse, New York 13210.

Graduate Program

The graduate program in Environmental and Forest Biology is organized in nine interdependent biological study concentrations that provide comprehensive coverage within specific interest areas. Each concentration is governed by indicated faculty who define the scope of subject matter, recommend acceptance of students and guide them in a course of study. Some of these concentrations follow taxonomic lines while others are broad unifying areas basic to all taxa. Students choosing to emphasize a taxonomic category should explore the desirability of engaging to some extent in the broader interdisciplinary areas. Similarly, it is often opportune for students enrolled in the latter to develop a degree of specialization in at least one taxon as a means of assuring a useful mix of talents. Those students whose interests are not served by the designated areas of concentration should explore the feasibility of alternate routes of study, provided the needed expertise is available, and they may be guided by faculty listed in the concentration nearest the student's interest.

Most students seeking the M.S. degree include in their study plan a research thesis and its defense (see p. 43). There also is an option to earn the degree with 42 hours of coursework, the latter specified by the student's advising faculty according to concentration core requirements. All who seek the Ph.D. must include original research and dissertation or its equivalent in the form of refereed publications.

The major center of activity is Illick Hall, with the laboratories, classrooms, controlled spaces, and equipment that one would expect in a modern build-

ing in which 85,000 square feet of working space is available for graduate study and research. Laboratories, many of them temperature and temperature-humidity controlled, and one sound-controlled, are provided for study and research in plant development, physiology, tissue culture, biochemistry and toxicology, ecology, and animal behavior. An herbarium, mycological collections, insect and other arthropod collections, and the Roosevelt Wildlife Collection of vertebrates are maintained in archival condition as useful resources for the academic program. Eight rooftop glasshouse units, three of them air-conditioned and one incorporated into a five-room indoor-outdoor insectary, are important to the full array of interests in plant science and plant-animal interactions.

Also available to the Department's students and faculty is a variety of sophisticated instrumentation: convenient access to a computer center; radio-isotope counting equipment, including liquid scintillation spectrometer and Cobalt-60 source; diverse analytical equipment and measuring devices; gas-liquid chromatography; and, in collaboration with the Chemistry Department, a comprehensive analytical expertise. The Nelson C. Brown Center for Ultrastructure offers scanning and transmission electron microscopy capability.

Supportive to the program are the academic resources, including courses, of Syracuse University, SUNY's Upstate Medical Center and the several campus facilities described elsewhere in this catalog. Our students participate as well in courses and utilize faculty and facilities at Cornell University in cooperative exchanges.

Excellent field sites and facilities are available for research in all aspects of the program in nearby or moderately distant locations from the Syracuse campus. In addition to the College's several campuses and field stations that offer a broad diversity of forest types, sites, and conditions, there are New York State Department of Environmental Conservation lands, the Montezuma National Wildlife Refuge, the Adirondack Mountains, and the transition zones near Lake Ontario, Oneida Lake, and Cicero Swamp that collectively offer a variety of habitat diversity from highlands to aquatic-terrestrial zones. The ponds, streams, and lakes in Central New York and the St. Lawrence River are regularly used by graduate students in wetlands and aquatic ecology and fishery biology.

Further academic advantages stem from the urban setting of the Syracuse campus. The Greater Syracuse area provides a convenient laboratory for studies basic to urban forestry: the growth and protection of woody vegetation, greenspace maintenance, the utilization of waste beds for plant growth, the detoxification of pollutants, and the restoration of terrain stripped of vegetation. Disposal of industrial and human pollutants and wastes require deeper understanding of the role of plants, animals and microorganisms in the biodegradation of organic matter. The conversion of organic materials into useful fuel, into additives for plant growth, or into protein feeds for domestic animals are stimulating study-in-depth of many elements of basic biology offering substantial assistance toward the solution of pressing human problems.

Of the nine available study concentrations, eight are contained within the department: *Ecology, Entomology, Environmental Physiology, Fish and Wildlife Biology and Management, Pathology and Mycology, Plant Science, Soil Ecology, and Zoology*. One concentration, *Chemical Ecology*, is shared with faculty of the Chemistry Department.

Ecology

ALEXANDER (Vertebrates, Wetlands), ALLEN (Forest Insects), BEHREND (Wildlife), BRANDT (Fisheries Biology), BROCKE (Wildlife, Bioenergetics), BURGESS (Forest Ecology), CHAMBERS (Wildlife), DINDAL (Invertebrates), GEIS (Plants, Wetlands), KETCHLEDGE (Dendrology, Bryology), KURCZEWSKI (Insect Behavior), MITCHELL (Invertebrates, Bioenergetics), MÜLLER-SCHWARZE (Vertebrates, Behavior), NAKAS (Microbiology), PORTER (Vertebrate Ecology), RAYNAL (Higher Plants, Taxonomy), RINGLER (Aquatic Ecology), SCHAEDEL (Plant Nutrition), SHIELDS (Vertebrate Behavior), SIMEONE (Forest and Wood-boring Insects), VANDRUFF (Wildlife), WERNER (Limnology).

Adjunct Faculty

GANNON (Aquatic Ecology), LANDERS (Aquatic Ecology).

Understanding relationships between living organisms and their abiotic and biotic environment is fundamental to environmental science which also encompasses man's role in ecological systems. Ecology is an integrative science which depends on an understanding of ecological theory, habitat characteristics, and the basic biological attributes of organisms. This concentration area encourages the incorporation of this knowledge into those areas of practical concern. Specific research may entail the study of: distribution and abundance of organisms; community structure including trophic relationships, diversity or succession; and ecosystem properties such as patterns of energy transfer and biogeochemical cycling.

Entomology

ABRAHAMSON (Forest Insects, Pest Management), ALLEN (Forest Insects, Population Ecology), BREZNER (Physiology), CASTELLO (Virology, Insect Vectors), KURCZEWSKI (Morphology, Taxonomy, Behavior), LANIER (Forest Insects, Pheromones, Cytotaxonomy), MILLER (Pest Management), MITCHELL (Population Ecology), NAKATSUGAWA (Toxicology), NORTON (Spiders and Mites, Insect Larval Taxonomy), RINGLER (Aquatic Entomology), SIMEONE (Forest and Wood-inhabiting Insects).

Adjunct Faculty

HOWARD (Medical Entomology).

Graduate study opportunities prepare students in the basic aspects of insect life and the role of insects in relation to man and his environment. The wide range of effects stemming from insect activity, from the beneficial to the deleterious, allows for a variety of research subjects in which insects

play a major role. Thesis topics may concern insects that affect forests, shade trees and wood products, those relating to the health and well-being of man and those playing key roles as parasites and predators of pest species. Current research areas include population dynamics of forest defoliators, pheromone communications among beetles and moths, speciation of insects as understood through behavioral and cytogenetic study, natural control of insects in forest systems and basic biochemistry of insect detoxification mechanisms.

Environmental Physiology

BREZNER (Insect Physiology), CASTELLO (Plant Virology), GRIFFIN (Fungus Physiology), HARTENSTEIN (Invertebrate Physiology), MITCHELL (Environmental Energetics), NAKAS (Microbial Physiology), NAKATSUGAWA (Insect and Vertebrate Toxicology), SCHAEDLE (Plant Physiology), WALTON (Plant Physiology), WILCOX (Plant Physiology).

The Environmental Physiology Concentration provides students with advanced training both at the M.S. and Ph.D. levels to develop an understanding of the nature and control of biological processes. Study programs are developed according to chosen academic goals and research opportunities available. Current interests include mechanisms of action of plant growth hormones; biochemical regulation of seed germination; plant and microbial enzymology; virology; toxicity and disposition of insecticides and environmental toxicants in vertebrates; production and action of plant phytoalexins and antibiotics; plant defenses against phytophagous invertebrates; mycorrhizae, ion transport; mineral nutrition, cambial physiology and photosynthesis.

Fish and Wildlife Biology and Management

ALEXANDER (Vertebrates, Herpetology), BEHREND (Vertebrates), BRANDT (Fisheries Management), BROCKE (Vertebrates), CHAMBERS (Vertebrates), MÜLLER-SCHWARZE (Vertebrate Behavior), PAYNE (Ornithology), PORTER (Vertebrate Ecology), RINGLER (Fisheries, Aquatic Ecology), SHIELDS (Vertebrate Behavior), VANDRUFF (Vertebrates, Ornithology), WERNER (Limnology, Fisheries).

Adjunct Faculty

MATTFELD (Wildlife Biology), NOON (Wildlife Biology), PALOUMPIS (Fish Osteology), SCHACHTE (Fisheries Biology), SUGATT (Aquatic Toxicology).

Study in this area provides students with advanced preparation at both the M.S. and Ph.D. levels in biological concepts of fish and wildlife populations, particularly as they relate to the proper management of these important resources. Widespread and increasing concern for management of

these wild animal resources has been matched by strong student interest in educational programs which prepare them for careers in the fish and wildlife professions. Graduate education, such as is available through this study area, is rapidly becoming a universal prerequisite to employment as a professional fisheries or wildlife biologist.

Areas of research include wetland ecology and management of wetland species, population-habitat relationships, predator ecology, urban wildlife relationships, endangered species studies, feeding ecology of fishes, stream ecology, ecology of larval fishes and homing behavior of fishes.

Forest Pathology and Mycology

ABRAHAMSON (Forest Pathology, Entomology), CASTELLO (Forest Pathology), GRIFFIN (Fungus Physiology), MANION (Forest Pathology), NAKAS (Microbiology), VALENTINE (Genetics), WANG (Mycology), WILCOX (Mycorrhizae), ZABEL (Forest Pathology and Wood Deterioration).

The study area in Forest Pathology and Mycology seeks to train students interested in developing an expertise responsive to the increasing pressures on forest and shade tree systems for wood fiber, public services, and amenities. This requires new sophisticated levels of disease understanding, disease control, a broad knowledge of fungi, bacteria and viruses, their environmental impacts and their roles in biodeterioration. Areas of staff interest and expertise appropriate for graduate student research emphasis include: environmental, fungal and viral tree diseases; mycorrhizae; wood decay and biodegradation processes; monitoring and impact assessment of disease in forest and urban tree systems; chemical and biological control of tree diseases; epidemiology of tree diseases and the genetics of resistance to tree diseases and to pathogen variability; physiology of fungus growth and development; taxonomy and biology of decay and imperfect fungi; and fungus ultrastructure.

Plant Science

BURGESS (Ecology), CASTELLO (Virology), GEIS (Ecology), GRIFFIN (Mycology, Fungus Physiology), KETCHLEDGE (Ecology, Bryology), LOWE (Mycology), MANION (Pathology), NAKAS (Microbiology), RAYNAL (Ecology, Taxonomy), SCHAEDEL (Physiology), SILVERBORG (Pathology), TEPPER (Anatomy, Morphogenesis), VALENTINE (Genetics), WALTON (Physiology), WANG (Mycology), WILCOX (Physiology, Mycorrhizae), ZABEL (Pathology, Wood Deterioration).

Adjunct Faculty

AMES (Physiology), FAUST (Taxonomy), ZABLOTOWICZ (Microbiology).

Plants, as the principal energy source for ecological food chains, serve as the structural and functional foundation of natural and managed eco-

systems. The plant science concentration provides opportunity for study in a broad range of specialties fundamental to the understanding of plants and their interaction with other organisms, emphasizing both forest and related plant systems. Current faculty and student research interests include: dynamics of plant communities as affected by man and the environment; mechanisms of plant succession; epidemiology of forest and urban tree diseases; decay, discoloration and biomodification of wood; taxonomy, physiology, growth and ultrastructure of fungi; heritability of wood properties and disease resistance of trees; biochemistry and physiology of plant growth regulators; photosynthesis; mineral nutrition; mycorrhizae; bryoecology; morphogenesis in shoot and root systems; and plant tissue culture.

Soil Ecology

DINDAL (Invertebrates), HARTENSTEIN (Invertebrates, Physiology), MITCHELL (Invertebrates, Energetics), NAKAS (Microbiology), NORTON (Invertebrates, Taxonomy), WANG (Mycology), WILCOX (Mycorrhizae), ZABEL (Wood Biodegradation).

Soil ecology includes the study of interrelationships of soil-inhabiting organisms (as individuals, populations and communities) with their biotic, chemical, and physical environments. This field can be considered to be a frontier of science because of the myriad of undescribed species of soil-dwelling arthropods, nematodes and annelids, and the wealth of incompletely understood symbiotic relationships that can be readily discovered by students in this concentration. Soil ecology deals with fundamental aspects of biodegradation and nutrient cycling and is therefore important for improvements in crop culture and enlightened waste disposal.

The soil ecology concentration is supported by courses in physical aspects of soils, plant and animal taxonomy and general ecology.

Zoology

ALEXANDER (Vertebrates, Wetlands), BROCKE (Vertebrates), CHAMBERS (Wildlife Ecology, Management), DINDAL (Invertebrates), HARTENSTEIN (Physiology, Invertebrates), MITCHELL (Invertebrates, Bioenergetics), MÜLLER-SCHWARZE (Vertebrate Behavior), NORTON (Arachnology), PORTER (Wildlife Biology), RINGLER (Fish Behavior), SHIELDS (Vertebrate Behavior), VANDRUFF (Vertebrates, Wildlife Biology), WERNER (Limnology, Aquatic Ecology).

Adjunct Faculty

BENZO (Vertebrate Physiology), DEGENNARO (Vertebrate Physiology, Embryology).

Zoology provides opportunity for in-depth coursework and fundamental research in morphology, physiology, taxonomy, and behavior of invertebrate

and vertebrate animals. As one of the basic areas in the Department of Environmental and Forest Biology, Zoology is supportive of other concentrations such as Ecology, Fish and Wildlife Biology and Management, and Soil Ecology. Graduate studies in Zoology include both basic and applied research on animals of our natural ecosystems, including their associated soils and waters.

CHEMISTRY

KENNETH J. SMITH, *Chairman*—(Physical and Polymer Chemistry), CABASSO (Polymer Chemistry), CALUWE (Organic Polymer Chemistry), CAMPBELL (Phytoenzymology), HASSETT (Environmental Chemistry), JOHNSON (Environmental Chemistry), LALONDE (Organic and Natural Products Chemistry), MEYER (Nuclear Chemistry), SARKO (Physical and Polymer Chemistry), SCHUERCH (Wood and Polymer Chemistry), SILVERSTEIN (Ecological Chemistry), SMID (Physical and Polymer Chemistry), TIMELL (Wood Chemistry).

The academic program in chemistry enables the student to develop not only an understanding of chemical phenomena, but also an appreciation for chemistry that can link it to the biological and applied sciences. Programs include courses in traditional areas of chemistry, with additional study in those fields pertaining to environmental science and forestry. This broad spectrum of academic offerings is possible through close cooperation with Syracuse University, where a wealth of accessory courses at both the undergraduate and graduate levels are available. Emphasis on the investigative function of chemical science is manifest in the wide array of ongoing research projects within the department.

The Department of Chemistry offers the following areas of concentration leading to the Bachelor of Science degree:

Biochemistry and Natural Products Chemistry

Environmental Chemistry

Natural and Synthetic Polymer Chemistry

Students in all options, by selecting proper electives, may be certified on graduation as having completed an American Chemical Society approved curriculum. All options are excellent grounding for professional work at the B.S. level or for advanced graduate study.

Undergraduate Program

Lower Division Courses

For students transferring into the College as juniors, recommended courses consist of 68 credits or an associate degree and include:

Course Area	Credit Hours
Biology with Laboratory	8
General Chemistry with Laboratory	8
Organic Chemistry with Laboratory	8
Physics with Laboratory	8
Economics	3
English	6
Language, Literature or Communication	6
Electives	12-15
*Mathematics	6-9
TOTAL MINIMUM LOWER DIVISION CREDITS	
	68

*Mathematics through integral calculus. An additional mathematics course beyond integral calculus is required for the B.S. degree.

Upper Division Courses

Junior Year	Credit Hours
<i>First Semester</i>	
FCH 325 Organic Chemistry III	4
³ CHE 332 Quantitative Analysis	2
CHE 333 Quantitative Analysis Laboratory	1
FCH 360 Physical Chemistry	3
¹ Professional Elective	2-4
Elective	3
	15-17
<i>Second Semester</i>	
² Math or Elective	3
FCH 380 Instrumental Methods	3
FCH 361 Physical Chemistry	3
CHE 357 Physical Chemistry Laboratory	2
FCH 384 Spectrometric Identification of Organic Compounds	1
¹ Professional Elective	2-3
Elective	3
	17-18

¹A sequence of professional electives should be chosen in the junior year. In addition to the freshman biology courses, a student whose emphasis is in biochemistry must take 3 semester hours of genetics and at least one other 3-semester-hour biology course. A student whose emphasis is in natural products must take 3 semester hours of biology in addition to the freshman biology courses and an additional hour of organic chemistry laboratory (FCH 496) and a second hour of FCH 384.

²One course of mathematics or applied mathematics beyond MAT 397, or equivalent, is required.

³CHE designations refer to courses offered at Syracuse University.

Biochemistry and Natural Products Chemistry Option

This option is designed for students who wish to approach problems in the life sciences with the tools and point of view of the chemist. In addition to a major concentration in the several branches of chemistry, the student obtains a solid grounding in the fundamentals of physics, mathematics, and biology. Professional electives can provide a minor concentration in botany, ecology, entomology, zoology, or physiology. Collaborative efforts of chemists and biologists are providing new solutions to problems of environment, natural resources, and health.

Senior Year		<i>Credit Hours</i>	
<i>First Semester</i>	LIB 300	Library Research	1
	FCH 495	Introduction to Professional Chemistry	1
	FCH 571	Wood Chemistry I	2
	FCH 574	Wood Chemistry Laboratory	1
	FCH 530	Biochemistry I	3
	FCH 531	Biochemistry Laboratory	2
	¹ Elective	.....	3
Elective	.....	3	
		16	
<i>Second Semester</i>	² FCH 498	Introduction to Research	5
	FCH 497	Undergraduate Seminar	1
	FCH 532	Biochemistry II	3
	FCH 573	Wood Chemistry III	2
	Elective	.....	3
	Elective	.....	3
		17	
TOTAL MINIMUM UPPER DIVISION CREDITS		65	

¹Introduction to Polymer Science, FCH 550 (3 credit hours) is suggested.

²Petition by student to Department for replacement of this requirement will be considered to allow time for special interest.

A total of 133 credit hours is required to complete the B.S. degree in Chemistry with the Biochemistry and Natural Products option.

Environmental Chemistry Option

The environmental chemistry option is designed for those students who wish to obtain a solid fundamental background in chemistry which will enable them to make a strong contribution towards the identification and solution of problems in the areas of pollution, air and water quality, analysis and basic research in environmental chemistry. A large number of professional electives, available through course offerings of other departments such as biology and engineering, provide the important interface with other disciplines necessary for a working understanding of the complex problems inherent in environmental studies.

Senior Year			Credit Hours
<i>First Semester</i>	LIB 300	Library Research	1
	FCH 495	Introduction to Professional Chemistry	1
	FCH 510	Environmental Chemistry I	3
	FCH 515	Methods of Environmental Chemical Analysis	3
	Chemistry Elective		3
	¹ Elective		3
	Elective		3
			17
<i>Second Semester</i>	² FCH 498	Introduction to Research	5
	FCH 511	Environmental Chemistry II	3
	FCH 497	Undergraduate Seminar	1
	FCH 519	Environmental Chemistry Seminar	1
	Electives		6
			16
TOTAL MINIMUM UPPER DIVISION CREDITS			65

¹Biochemistry I, FCH 530, (3 credit hours) is suggested.

²Petition by student to Department for replacement of this requirement will be considered to allow time for special interest.

A total of 133 credit hours is required to complete the B.S. degree in Chemistry with the Environmental Chemistry option.

Natural and Synthetic Polymer Chemistry Option

This option is designed for students interested in the structure and physical properties of man-made and natural materials, the giant molecules of wood, plastics, polysaccharides, proteins, rubbers, and fibers. The recently discovered chemistry of these materials constitutes one-half the concern of the chemical industry and is the origin of a major revolution in our way of life and our understanding of nature. This special subject area is an advanced core of studies beyond the basic courses of the classical undergraduate chemistry curriculum.

Senior Year			Credit Hours
<i>First Semester</i>	LIB 300	Library Research	1
	FCH 495	Introduction to Professional Chemistry	1
	FCH 550	Introduction to Polymer Science I	3
	FCH 551	Polymer Techniques	2
	FCH 571	Wood Chemistry I	2
	FCH 574	Wood Chemistry Laboratory	1
	¹ Elective		3
	Elective		3
			16

Second Semester	² FCH 498	Introduction to Research	5
	FCH 552	Introduction to Polymer Science II	3
	FCH 497	Undergraduate Seminar	1
	FCH 573	Wood Chemistry III	2
	Electives	.....	6
			17
		TOTAL MINIMUM UPPER DIVISION CREDITS	65

¹Biochemistry I, FCH 530 (3 credit hours) is suggested.

²Petition by the student to Department for replacement of this requirement will be considered to allow time for special interest.

A total of 133 credit hours is required to complete the B.S. degree in Chemistry with the Natural and Synthetic Polymer option.



Graduate Program

Recent years have seen profound advances in the fundamental knowledge of chemical areas which have special significance for forestry and the environment. The following research areas have received active attention by both faculty and graduate students in the programs: polymer chemistry and physics; wood chemistry; environmental chemistry; biochemistry; chemistry of natural products, including ecological chemistry; and materials sciences.

Requirements for a master of science or doctor of philosophy degree in chemistry include a research project and thesis, along with an appropriate program of courses at the College and at Syracuse University.

Specific projects may vary from year to year, since they reflect the current interests of the faculty. Current research projects with *physiochemical* emphasis are: the chemistry, physics, solid-state and solution properties of natural and synthetic polymers, including studies in thermodynamics, statistical mechanics, crystallization, morphology, elasticity, conformation of macromolecules, optical properties, polymer catalysis, mechanism of polymerizations, polyelectrolytes, ion binding to macromolecules and ion pairing; chemistry of free radicals, radical ions and charge transfer processes; structure and properties of ionic solutions in nonaqueous media; crystal structure and morphology of cell wall constituents; membrane properties and technology; heavy metal speciation. Current *organic* chemistry programs deal with synthesis of special polymers such as high temperature aromatic block, stereoregular vinyl polymers, and polysaccharides, various aspects of natural products chemistry, but especially alkaloids and terpenes, isolation and characterization of insect and mammalian attractants. An active program on the structure and topochemistry of the *polymeric* wood components, hemicelluloses, lignins and celluloses is underway. In *biochemistry*, department members are studying mechanisms of action of plant growth hormones, biochemical regulation of seed germination, plant enzymology and ultrastructural plant cytology.

Graduate research laboratories in the Hugh P. Baker Laboratory are well equipped for polymer studies, chemical, and biochemical research. Instrumentation includes analytical and preparative ultracentrifuges, Warburg respirometer, recording infrared and ultraviolet spectrophotometers, mass spectrometer, differential refractometer, electron spin resonance spectrometer, nuclear magnetic resonance spectrometers, automatic membrane osmometers, solid-and solution-state light scattering photometers, recording polarimeter and optical dispersion spectrometer, analytical and preparative high performance liquid chromatographs, combined gas chromatographs—mass spectrometry center, spectrofluorimeter, several ultramicrotomes, electron microscopes, X-ray diffraction, instrumentation chromatography and cold laboratories, and radiochemical laboratories with counters for solids, liquids and gases.



INTERDEPARTMENTAL AREA OF STUDY

The following concentration in chemical ecology is offered in collaboration with faculties of the Department of Environmental and Forest Biology and the Department of Chemistry. Interested students should apply to the department of major interest, which will have prime responsibility for setting requirements. Faculty from both departments can aid in the development of a plan of study enabling a student to acquire sophisticated skills in either chemistry or biology and an ample understanding of the other to grapple with problems requiring an understanding of both.

Chemical Ecology

LANIER (Insect Pheromones), MÜLLER-SCHWARZE (Vertebrate Pheromones), SILVERSTEIN (Pheromone Chemistry), SIMEONE (Insect Pheromones), TANENBAUM (Microbial Chemistry).

As a relatively new interdisciplinary endeavor, workers in this field attempt to understand organismal interactions, both intra- and interspecific, mediated by chemical substances such as hormones, pheromones, kairomones and phytoalexins. These occur at all taxonomic levels: between uni- and multi-cellular organisms, microbes and plants, plants and plants, plants and animals, microbes and animals, animals and animals. Study of such interactions has been accelerated in recent years through joint efforts of biologists and chemists in meaningful research accompanied by a growing body of literature.

THE SCHOOL OF ENVIRONMENTAL AND RESOURCE ENGINEERING

WILLIAM P. TULLY, *Dean*

The School of Environmental and Resource Engineering offers three undergraduate curricula and one graduate program which support the engineering aspects of environmental science and forestry through the Departments of Forest Engineering, Paper Science and Engineering and Wood Products Engineering. A Bachelor of Science degree is awarded in each of these fields while advanced degrees (M.S. and Ph.D.) are offered through the graduate program in Environmental and Resource Engineering.

The undergraduate curricula provide students with a broad base of study and specialized education in engineering, science, and technology. Students learn to apply their education to improve the economic use of forest and rural resources, to enhance environmental quality and to increase the efficiency of processes and the wise use of water and timber, wood, paper, and related fibrous material products. Graduates are prepared for a variety of careers in industry and government service in these fields.

The specific requirements for entering each curriculum at the junior level and for completing the coursework residency requirements for the B.S. degree are described with the individual departmental programs which follow. During late May the School offers a Summer Institute for pre-ESF students preparing to enroll in these curricula one or two years hence. Participants receive detailed academic guidance and learn about career opportunities.

Qualified applicants with associate degrees in engineering science or an appropriate blend of science and mathematics usually gain full admission at the junior level. Graduates of two-year technology programs also may qualify for junior standing in certain curricula if their previous studies included the courses appropriate to departmental requirements.

Graduate Program

The Graduate Program in Environmental and Resource Engineering is based on a synthesis of the professional activities of the three curricular areas described above. Both the Master of Science (M.S.) and Doctor of Philosophy (Ph.D.) degrees are offered. The program provides students with a balanced understanding of scientific research, engineering measurement, and engineering analysis and design, and with specialized depth and appropriate interdisciplinary breadth of knowledge in environmental and resource engineering. Its graduates are prepared for professional careers as leaders in the private and public sectors of research, engineering, technology, teaching and administration in the industries and professions served by this program. science and engineering to the development and improved utilization of the natural environment and its forest-related resources. Thus, graduate education is understood to involve a wide range of scientific and engineering abilities and attitudes.

Specialized areas of study have been delineated to serve student interests. Within these areas of study, an individually-designed study program is developed for and with each student. A partial listing of specialized areas of graduate study and research include: wood science and technology, composite materials and wood treatments, design of timber structures, tropical timbers, anatomy and ultrastructure, pulp and paper technology, fiber and paper mechanics, chemistry of pulping and bleaching, colloid chemistry and fiber flocculation, chemical process engineering, pollution abatement engineering, forest engineering, water resources engineering, transportation and soils, energy and environmental quality, and remote sensing and photogrammetry.

Applicants to the graduate program in Environmental and Resource Engineering must meet general College-wide requirements, have prior education or experience suitable for beginning advanced study in their chosen area of specialization and have a deep commitment to the advancement of the academic and professional aspects of their career goals. Some coursework deficiencies may be corrected within individual study programs.

Candidates for the Master of Science degree must complete a program of study totaling at least 30 hours of credit earned through graduate level coursework. Six to 12 of these credits shall be given for a master's thesis or project. Up to six credit hours of graduate level coursework may be transferred from another institution.

The Ph.D. program usually builds upon a master's degree and demands further advanced mastery of material in the area of study and the dissertation topic. This includes additional graduate level coursework beyond the M.S. degree as determined with the student's committee.

Candidates for the Ph.D. must demonstrate competence in at least two of the following tools of research (statistics, computer programming or foreign language), pass a doctoral candidacy examination, and write and defend a dissertation.

Students are able to draw on the combined resources of the three academic departments in the School. In addition, courses and facilities of other schools of the College as well as Syracuse University complement those of the School of Environmental and Resource Engineering.

Prospective students who desire more information than is presented for each of the departmental descriptions and specialties described should contact the Dean, School of Environmental and Resource Engineering.

FOREST ENGINEERING

ROBERT H. BROCK, *Chairman* (Photogrammetric and Geodetic Engineering, Mapping Systems)

DUGGIN (Agricultural Assessment, Remote Sensing, Physics), HASSETT (Environmental Engineering, Water Resources), HENNIGAN (Water Resources, Environmental and Water Quality Management and Policy), HOPKINS (Surveying, Site Assessment, Remote Sensing), LEE (Computers and Systems Engineering, Transportation and Equipment, Soil Mechanics), MCCLIMANS (Soils, Hydrology, Site Engineering), PALMER (Engineering Economics, Energy, Production and Harvesting Systems), TULLY (Structures, Engineering Hydrology, Water Resources).

A large portion of our nation's resources exist on forested and rural lands. These include: the increasingly valued renewable resources of timber, biomass and wildlife; the sustaining resources of water, soil and nutrients; and the derivative resources of paper, wood, and fibrous products and recreation and amenity values. Forest engineering is a unique field of engineering which is concerned with the design of systems and facilities to improve the sustained high quality yield of resources and multiple use benefits of goods and services from forested and rural lands.

The undergraduate curriculum in Forest Engineering provides a broad base of study and specialized education in engineering with an emphasis on site development for improved resource use and conservation. Instruction focuses on: locating and quantifying resources; designing harvesting, conveyance and transportation systems and networks for water and timber; designing structures, facilities and pollution abatement systems; and engineering planning for the development of sites and regions for multiple use.

Programs of advanced studies toward an M.S. or Ph.D. degree in environmental and resource engineering are offered. Individually designed programs provide graduates with sufficient understanding of the methodologies of scientific research and of the principles of engineering analysis or design to work with competence in resource related research, engineering design and management. There are opportunities for individuals who seek advanced education in such areas as water resources engineering, photogrammetry and remote sensing, transportation and soils, energy and environmental quality as well as forest engineering.

Because of the special importance of continual measurement and evaluation of the broad scaled parameters which affect the resource base, unique opportunities for study are available for students aiming toward professional careers involving the conceptualization, design, and maintenance of geographically referenced resource information systems. This includes elements of surveying, photogrammetry, remote sensing, and resource information systems design.

Undergraduate Program

The primary objective of this curriculum is to prepare qualified engineering graduates to operate with professional competence within the context of forest and natural resources development. The curriculum includes basic, forest, and engineering sciences. It utilizes elements of traditional engineering disciplines and develops its unique aspects from interweaving engineering design with an understanding of the natural environment and its renewable resource base including water, soil, timber, wildlife, and amenity values. Studies in the humanities and social and economic sciences are integrated throughout the curriculum to help achieve a broad and balanced perspective of professional practice in forest engineering.

Qualified graduates in search of advanced degree education enjoy ready acceptance to engineering graduate schools throughout the country. Graduates of the Forest Engineering curriculum may enter an established five-year program in either civil, industrial, or mechanical engineering at Syracuse University. A bachelor of science degree in engineering will be awarded by Syracuse University upon completion of the requirements of the fifth year.

To enter the Forest Engineering curriculum at the junior level, a transferring student must have acceptable college credit in the following coursework areas or be able to have suitable coursework substitutions for courses listed in the junior and senior years.

The curriculum in Forest Engineering is fully accredited by the Accreditation Board for Engineering and Technology (ABET).

Lower Division Courses

Course Area	Credit Hours
Biology (Botany preferred)	3
General Chemistry with Laboratory	8
Engineering Physics with Laboratory	8
Calculus through Differential Equations	15
English	6
Economics (Macro- and Microeconomics)	6
Engineering Drawing (Graphics)	1
Computer Programming	3
Engineering Mechanics (Statics and Dynamics)	4
Electrical Science	3
Humanities or Social Science Electives	3
<i>TOTAL MINIMUM LOWER DIVISION CREDITS</i>	
	<u>60</u>

Students must meet these minimum requirements, and they are encouraged to exceed the minima in the elective areas, to facilitate scheduling during the upper division years.

Upper Division Courses

Junior Year			<i>Credit Hours</i>
<i>First Semester</i>	ERE 362	Mechanics of Materials	3
	ERE 371	Surveying for Engineers	3
	FOR 321	General Silviculture	3
	CIE 327	Principles of Fluid Mechanics	4
	FBO 305	Dendrology	2
	Elective		3
			18
<i>Second Semester</i>	FEG 340	Engineering Hydrology and Flow Controls	4
	FEG 350	Introduction to Remote Sensing	2
	FEG 363	Photogrammetry I	3
	MEE 285	Design of Mechanical Equipment	3
	IOR 326	Statistics for Engineers	3
	ERE 351	Basic Engineering Thermodynamics	2
			17
Senior Year			<i>Credit Hours</i>
<i>First Semester</i>	FEG 410	Structures I	4
	FEG 422	Production Systems Engineering	4
	CIE 437	Soil Mechanics and Foundations I	4
	FOR 477	Resource Policy and Management	3
	Elective		3
			18
<i>Second Semester</i>	ERE 488	Engineering Economics	1
	FEG 437	Transportation Systems	4
	ERE 440	Water Pollution Engineering	3
	FEG 489	Forest Engineering Planning and Design	3
	Elective in Engineering Design Sequence		3
	Elective		3
			17
TOTAL MINIMUM UPPER DIVISION CREDITS			70

TOTAL UPPER AND LOWER DIVISION ELECTIVE REQUIREMENTS

Humanities or Social Sciences: At least 9 credit hours must be elected in social sciences or humanities, at least 6 of which are recommended to be upper division. (If lower division English coursework does not include at least 3 credit hours of humanities coverage, then an additional 3 credit hours of humanities are required.) Humanities coursework deals with branches of knowledge concerned with man and his culture, while social sciences coursework concerns individual relationships in and to society. Traditional subjects in these areas are philosophy, religion, history, literature, fine arts, sociology, psychology, anthropology, economics, and modern languages beyond the introductory skills courses, while modern nontraditional subjects are exemplified by courses such as technology and human affairs, history of technology, and professional ethics and social responsibility. Subjects such as accounting, industrial management, finance, personnel administration, ROTC studies, and skills courses, such as public speaking and technical report writing, do not fulfill the humanities and social science content.

Engineering Sciences: Electrical Science and coverage of Dynamics (separately or in combination with Statics) are required.

Engineering Design: At least 3 credit hours are required in upper division engineering coursework as part of an advisor approved sequence which complements other forest engineering coursework and provides the equivalent of at least 1 credit hour of depth in the design and synthesis component of the program, such as:

Design of Wood Structural Elements
Structures II
Soil Mechanics II

Air Pollution Engineering
Synthesis of Mechanical Systems

A total of 130 credit hours is required to complete the B.S. degree in Forest Engineering.

Graduate Program

Graduate studies and research are primarily concerned with environmental and resource related programs. Individual study programs leading to the master of science and doctor of philosophy degrees are available to meet the student's needs and interests in graduate study. Successful programs of graduate study may be efficiently designed by students with bachelor of science degrees in engineering or in forestry, natural sciences, physics, or mathematics.

Study programs with emphasis on environmental and resource engineering measurements may be designed in remote sensing, photo interpretation, geodetic engineering, analytical photogrammetry and photogrammetric systems. Programs emphasizing engineering analysis and design are available in water resources, environmental engineering, water quality management engineering, energy, transportation, harvesting and site engineering systems. Included are the monitoring, measurement and evaluation of physical parameters affecting water, soil, timber, vegetation, and wildlife.

Support for graduate study and research in these areas is both internal and external. The internal support includes modern laboratory and instrumentation facilities in the Engineering Schools at both ESF and at Syracuse University. Exceptional departmental support exists for programs in environmental engineering measurements in the form of remote sensing and photogrammetric laboratories and the extensive forest properties owned by the College at which research may be conducted.

External support comes from several active sources, including industrial, commercial and governmental. Over the past two decades, close cooperation has developed special study and research opportunities with these sources.

PAPER SCIENCE AND ENGINEERING

BENGT LEOPOLD, *Chairman* (Organic Chemistry and Mechanical Properties of Fibers and Paper)

BAMBACHT (Pulping, Papermaking, Paper Machine Operation), BRITT (Chemistry of Paper Formation), DENCE (Organic Chemistry, Pulping, Bleaching), GORBATSEVICH (Pulping, Bleaching, Paper Technology and Paper Properties), HOLM (Water and Air Pollution Abatement, Computer Simulation), JELINEK (Computer Applications, Process Engineering, Thermodynamics), LAI (Organic Chemistry, Pulping), LUNER (Surface and Colloid Chemistry of Papermaking Systems), MARK (Mechanical Properties of Fibers and Paper), MARTON (Mechanical and High-Yield Pulping), ROTHENBERG (Pulping, Bleaching), STENUF (Chemical Engineering, Instrumentation, Thermodynamics, Flow Phenomena, Process Control, Corrosion), THORPE (Fiber Physics, Paper Physics and Mechanics).

Outstanding for its vigorous growth and diversity of products, the pulp and paper industry is the fifth largest in the nation and exceptionally strong worldwide. Its need for professional men and women with training in science, engineering and technology is increasing even more rapidly than the industry itself. The College pioneered instruction in this area in 1920 with the organization of the paper science and engineering department, which has maintained a singularly high position in professional education for the continuing development of the pulp, paper and allied industries. Its graduates, who are in constant demand, occupy positions of leadership throughout the world.

The curriculum in Paper Science and Engineering is designed to provide a broad base of study and to prepare students for a variety of careers in the paper and related industries. Excellent opportunities are provided for men and women qualified to fill positions as research chemists, process engineers, technical service representatives, line management personnel, and many others.

The program provides education in the physical sciences and chemical engineering, with specific emphasis on those aspects of these disciplines which relate to the manufacture of pulp and paper. This includes the chemistry and anatomy of wood, the conversion of wood to pulp and paper, and the chemistry and physics of paper and paper formation. Instruction in chemical engineering includes a foundation of unit operations basic to the pulp and paper industry, as well as specialized courses, such as water and air pollution engineering.

The department is located in Walters Hall, opened in 1969. This facility is devoted exclusively to education and research in the field of pulp and

paper. In addition to a large number of special purpose laboratories and highly sophisticated scientific equipment, the department maintains an experimental pulp and paper mill equipped with machinery and instrumentation for studies of pulping, pulp purification, reuse of secondary fibers, refining, paper additives, and papermaking. This facility includes one 12-inch and one 48-inch fourdrinier paper machine, a number of disk refiners, one atmospheric and one pressurized grinder for mechanical pulping, and auxiliary equipment. In addition, the Department maintains an environmental engineering laboratory designed to demonstrate various methods used for the recycling of waste paper and the treatment of waste water. Also included is a modern chemical engineering laboratory, used for studies in all phases of unit operations and processes, process control, and analog simulation.

Undergraduate Program

The curriculum is entered at the junior level. Students with an associate degree in engineering science, science and mathematics, or chemical technology usually qualify for admission if their studies have included 8 credit hours of organic chemistry with laboratory. Other applicants with two years of college study may also gain admission if their curriculum includes the appropriate courses, as indicated below:

Lower Division Courses

<i>Course Area</i>	<i>Credit Hours</i>
Botany or Biology with Laboratory	4
General Chemistry with Laboratory	8
Organic Chemistry with Laboratory	8
Quantitative Analysis	3
Physics with Laboratory	8
Mathematics—Analytic Geometry and Calculus, Differential Equations	12
Computer Science	3
Economics	3
English	6
Engineering Drawing	1
Humanities or Social Science Electives	8
<i>TOTAL MINIMUM LOWER DIVISION CREDITS</i>	<u>64</u>

Minor deficiencies can usually be made up during the junior year.

The Paper Science and Engineering curriculum consists primarily of chemical engineering courses and specialized courses relating to the manufacture of pulp and paper products. A detailed listing of these courses is given below:

Upper Division Courses

Junior Year		Credit Hours
<i>First Semester</i>	FCH 572 Wood Chemistry II	3
	FCH 360 Physical Chemistry	3
	PSE 300 Introduction to Papermaking	3
	WPE 387 Wood Structure and Properties	3
	PSE 370 Principles of Mass and Energy Balance	3
	PSE 371 Fluid Mechanics	3
	<hr/>	18
<i>Second Semester</i>	PSE 372 Heat Transfer	2
	FCH 361 Physical Chemistry	3
	WPE 390 Wood and Fiber Identification Laboratory	1
	PSE 301 Pulp and Paper Processes	3
	PSE 302 Pulp and Paper Processes Laboratory	1
	ERE 377 Process Control	3
	LIB 300 Library Research Methods	1
*Elective	3	
	<hr/>	17
SUMMER MILL EXPERIENCE: PSE 304 Mill Experience		2
(Twelve weeks of full-time pulp or paper mill employment approved by the Department between the junior and senior years.)		
Senior Year		<i>Credit Hours</i>
<i>First Semester</i>	PSE 461 Pulping Technology	3
	PSE 465 Paper Properties	4
	PSE 473 Mass Transfer	3
	PSE 491 Paper Science and Engineering Project	1
	*Electives	6
	<hr/>	17
<i>Second Semester</i>	PSE 466 Paper Coating and Converting	2
	PSE 468 Papermaking Processes	3
	ERE 440 Water Pollution Engineering	3
	*Electives	6
	<hr/>	14
TOTAL MINIMUM UPPER DIVISION CREDITS		68

*At least 9 hours of electives must be selected from an advisor-approved sequence of technical courses. Examples of suggested areas are shown below.

TECHNICAL ELECTIVES

Colloid and Surface Chemistry	Applied Mathematics
Instrumental Analysis	Computer Modeling
Polymer Chemistry	Principles of Management
Pollution Abatement	Mechanics
Independent Research Project	Engineering Design
Thermodynamics	Materials Science

A total of 132 credit hours is required to complete the B.S. degree in Paper Science and Engineering.

Graduate Program

Graduate studies reflect the strong trend toward diversification in the industry and offer opportunities for obtaining master of science and doctor of philosophy degrees in a variety of subjects related to the manufacture of pulp and paper. Individual study programs are designed to meet specific personal needs. Typical areas of study range from the development of new pulping processes, chemical interactions on the paper machine and the disposal of pulping and papermaking effluents, to the fluid dynamics of fiber suspensions, the colloid chemistry of papermaking constituents, and the physical properties of fiber networks.

An important component of the graduate program is thesis research under direction of a graduate advisor. Much of this research is carried out under the auspices of one of the outstanding research facilities in the world, the Empire State Paper Research Institute (ESPRI), an integral part of the department. Its research activities aim to generate new information regarding the fundamentals, the science, the engineering and the technology of the papermaking process, utilizing advanced techniques such as electron microscopy, specialized spectrophotometry, nuclear magnetic and electron spin resonance and nuclear tracer methods. Recent work has been directed to fundamental investigations of pulping, bleaching, additives, paper recycling, effluent disposal, the papermaking process, the properties of paper, reactions of wood components during mechanical and chemical treatments, the structure of wood and wood fibers, evaporation, fluid dynamics, heat transfer, and chemical recovery.

Many research projects are carried out in cooperation with other College departments. Examples of such projects include a wide-ranging study of the toxicity of paper industry effluents in cooperation with the Department of Environmental and Forest Biology, and a cooperative project on the theoretical and experimental analysis of the mechanical properties of fiber and paper with the Department of Wood Products Engineering, as well as the Department of Aerospace and Mechanical Engineering at Syracuse University.

The department enjoys excellent external support in the form of graduate fellowships and grants from ESPRI, the Syracuse Pulp and Paper Foundation, and other industry sources, as well as a number of government granting agencies.

WOOD PRODUCTS ENGINEERING

GEORGE H. KYANKA, *Chairman* (Applied Mechanics, Structures) CÔTÉ (Cellular Ultrastructure, Light and Electron Microscopy), DAVIDSON (Physical Properties of Wood), HANNA (Ultrastructure and Microscopy), J. MEYER (Wood-Polymer Systems Radioisotope Techniques), R. MEYER (Wood Properties and Anatomy), MOORE (Wood Materials Processing and Technology), SIAU (Protective Treatments, Transport Processes), SMITH (Adhesives, Coatings, Wood-based Composites).

While wood is one of the oldest structural materials known to man, it occupies a position of major economic importance today with the annual tonnage of wood produced in the United States exceeding that of any other major structural material. This fact becomes even more important in this age of environmental and ecological concern because wood is the only major structural material that comes from a renewable natural resource, and demand is growing for more efficient utilization of available material. Improved efficiency must be based on solid scientific and engineering information. The Department of Wood Products Engineering provides undergraduate instruction in basic wood science and technology and stresses the application of science and engineering to building construction and the production, design, and utilization of wood-based materials. At the graduate level, the Department provides guidance via advanced courses and research opportunities in wood science and timber engineering.

Undergraduate Program

The Department of Wood Products Engineering prepares students for a wide variety of professional occupations concerned with the use of wood as a material. Two curriculum options are available: Building Construction and Forest Products. Both options have elective courses which permit tailoring the program to serve the needs of individual students from a wide variety of two-year preparatory programs. The Forest Products option is individualized to serve students that wish to emphasize Marketing, Production Systems Engineering, or Wood Science and Technology.

As the only major engineering material derived from a renewable natural resource, wood is receiving increased attention as an alternative to other materials which originate from the depleted nonrenewable resources. Thus, a principal aim of the departmental program is to teach students the fundamental properties of wood as a material to promote efficient wood processing, product design, and final use, whether as a piece of furniture or as a complete building.

To enter either option at the junior level, a transferring student must have acceptable college credit in the following coursework areas. Individuals not meeting the basic outline shown are encouraged to contact the Admissions Office to work out special arrangements and/or additional study requirements:

Lower Division Courses

<i>Course Area</i>	<i>Credit Hours</i>
*General Chemistry with Laboratory	4
*General Physics with Laboratory	8
Mathematics—Analytical Geometry and Calculus	8-9
English	6
Computer Programming	3
<i>Recommended Additional Courses</i>	
Accounting	6
Biology or Botany	3-4
Economics (Micro- and Macroeconomics)	6
Engineering Drawing (Graphics)	2
Organic Chemistry	3
Electives	16-18
<i>TOTAL MINIMUM LOWER DIVISION CREDITS</i>	
	62

*Four credits of physics are required, although 8 hours are recommended. However, students who wish to emphasize wood science and technology in the forest products option must have: general chemistry with laboratory (8); general physics with laboratory (8); and general botany with laboratory (4); organic chemistry (3).

The A.S. or A.A.S. degree in Architectural, Civil, Construction, or Mechanical Technology may also fulfill the requirements for admission. Students who lack the above background courses are nevertheless encouraged to consult the Admissions Office and the faculty of the department for an evaluation of their academic records.

Building Construction Option

Current economic pressures are dictating that the construction industry become more efficient in the design and construction of new facilities and structures. These structures range in size from residential structures to massive power generation stations. Consequently, the industry has increased its demand for technically trained professionals who have the skills to manage construction projects. These professionals must be prepared to develop new and innovative construction techniques, deal with a highly organized union work force, prepare competent cost estimates, and manage entire projects from start through completion.

Although the Building Construction curriculum emphasizes the use of wood as a building material, it allows the students an opportunity to develop a broad educational background in construction which will prepare them for a wide range of job positions in the construction industry and related fields. The program has a certain degree of flexibility which allows the student to specialize in a particular area of interest.

Illustrative electives are listed below:

<i>Engineering</i>	<i>Management</i>	<i>Environmental</i>
Structural Analysis	Marketing	Air Pollution Engineering
Foundation Design	Business Law	Solid Waste Disposal
Building Systems	Accounting	Waste Water Treatment
Energy Systems	Finance	Environmental Sanitation
Engineering Design	Operations Research	Land Use Planning

The following are some of the position titles past graduates now hold:

Assistant Project Superintendent	Timber Engineer
Project Supervisor	Truss Design Engineer
Construction Manager	Research Engineer
Cost Engineer	Construction Consultant
Resource Scheduler	Technical Sales Representative

Upper Division Courses

Junior Year			<i>Credit Hours</i>
<i>First Semester</i>	WPE 387	Wood Structure & Properties	3
	WPE 361	Engineering Mechanics-Statics	3
	ERE 371	Surveying for Engineers	3
	ACC 204	Financial Accounting Systems	3
	Elective		3
			<hr/> 15
<i>Second Semester</i>	ERE 362	Mechanics of Materials	3
	ERE 364	Engineering Materials	3
	ACC 252	Introduction to Managerial Accounting	3
	Management Elective		3
	Elective		3
			<hr/> 15
INDUSTRIAL FIELD TRIP (a two-week field trip immediately following final exam period): WPE 399 Field Trip			
			2
Senior Year			<i>Credit Hours</i>
<i>First Semester</i>	WPE 420	Adhesives, Sealants, and Coatings	3
	WPE 454	Construction Management	3
	FEG 410	Structures	4
	CIE 437	Soil Mechanics & Foundations I	4
		Statistical Analysis	3
			<hr/> 17
<i>Second Semester</i>	WPE 326	Fluid Treatments	2
	WPE 327	Fluid Treatments Laboratory	1
	WPE 450	Construction Equipment	3
	WPE 422	Composite Materials	3
	WPE 497	Senior Seminar	2
	WPE 404	Design of Wood Structural Elements	3
	Elective		3
			<hr/> 17
TOTAL MINIMUM UPPER DIVISION CREDITS			66

NOTE: Computer Programming required for entrance to program.

A total of 128 credit hours is required to complete the B.S. degree in Wood Products Engineering with the Building Construction option.

Forest Products Option

The forest products option prepares students for employment in the wood products industry. A forest products graduate should be able to walk into any wood products manufacturing operation and, after observing the process be able to fully understand what is going on. Instruction is individualized by selecting emphasis courses that are combined with required core courses designed to develop a comprehensive knowledge and understanding of wood as a raw material. The forest products option trains wood technologists, utilizing an individualized program with a series of emphasis courses to develop additional background in manufacturing, marketing, or specialization in wood science and technology.

Students wishing to enter graduate school can plan a series of electives to meet entrance requirements of major graduate institutions, whether in wood science and technology, business administration, or another branch of the sciences.

Marketing Emphasis

A special knowledge of the material properties of wood and the suitability of specific wood species for use in various products or processes enable a graduate with marketing emphasis to assist a customer in selection of the right wood product for the intended end use or makes possible the procurement of the best wood raw material for some manufacturing operation. These situations include considering the correct species of wood, treatments to prolong the useful life of a wood product, or selection of the most suitable manufactured product, such as medium density fiberboard or plywood, for a specific application. In some cases market research surveys or economic analyses may be required. Complete understanding of the employer's products, the material properties of wood, and the customer's special needs and problems are necessary for the marketing specialist to function efficiently. In addition to many sales-related or purchasing-related positions are other employment possibilities such as those requiring analysis of economic and trade conditions or relating engineering properties of wood to established or new product lines.

Job titles of recent graduates include:

Veneer Sales Manager	Retail Manager
Technical Sales Representative	Export Trade Analyst
Applications Engineer	Product Development Engineer
Regional Sales Manager	Marketing Research Analyst

Production Systems Engineering Emphasis

Numerous manufacturing methods are used to produce the over 5,000 products that use wood in one form or another. By studying various production systems, plant layout, techniques for time and motion studies, engineering properties of wood and ways to modify wood properties, a wood production systems engineer is prepared for a career in the manufacture of forest products (veneer, plywood, particleboard, etc.). These careers deal

with product and process development, quality control, production control, design engineering, personnel relations, and management.

Job titles of recent graduates include:

- | | |
|----------------------------|--------------------------|
| Production Coordinator | Plant Engineer |
| Quality Control Supervisor | Supervisor of Operations |
| Plywood Production Manager | Production Supervisor |
| Systems Analyst | Production Planner |

Wood Science and Technology Emphasis

Wood science and technology deals with materials science and engineering. Graduates that have stressed the science and technology of wood are prepared to utilize their knowledge of wood in numerous ways: to increase the efficiency of wood use, apply existing or new knowledge to wood product manufacture or utilization, or to do the research and development required for the new products, processes, and treatments necessary to meet the increasing demands made on our limited forest resources for wood commodities. Such research projects could be either basic, in which case the frontiers of wood science are extended, or applied, in which case existing knowledge is applied to current technological problems. Much of the work that needs to be done is technology transfer, so that known techniques of wood science and technology can be applied to the manufacturing or utilization environment. A wood science and technology graduate who has a good background in wood as a material can adapt the present state of knowledge to a broad range of utilization, research, or manufacturing operations. Employment opportunities include corporations, trade associations, government research institutes, and universities. An M.S. degree is highly recommended for those wishing to formally enter the research field, and a Bachelor's degree for those wishing to work in technical service or manufacturing.

Job titles of recent graduates include:

- | | |
|------------------------------|-------------------------------------|
| Forest Products Specialist | Forestry Specialist (Wood Products) |
| Materials Research Associate | Research Associate in Wood Science |
| Wood Products Technologist | Product Development Engineer |

Upper Division Courses

Junior Year			<i>Credit Hours</i>
<i>First</i>	FBO 305	Dendrology	2
<i>Semester</i>	WPE 361	Engineering Mechanics-Statics	3
	WPE 387	Wood Structure & Properties	3
	WPE 388	Wood & Fiber Identification Laboratory	2
	*Electives	.....	6

Second Semester	WPE 326	Fluid Treatments	2
	WPE 327	Fluid Treatments Laboratory	1
	ERE 362	Mechanics of Materials	3
	WPE 322	Mechanical Processing	3
	*Emphasis Course		3
	*Electives		3
			<hr/> 15

INDUSTRIAL FIELD TRIP (a two-week field trip immediately following final exam period): WPE 399 Field Trip 2

Senior Year *Credit Hours*

First Semester	WPE 420	Adhesives, Sealants, and Coatings	3
		Statistical Analysis	3
	*Emphasis Courses		6
	*Electives		3
			<hr/> 15

Second Semester	WPE 497	Senior Seminar	2
	WPE 422	Composite Materials	3
	FOR 404	Economics of Wood-Using Industries	3
	WPE 404	Design of Wood Structural Elements	3
	*Emphasis Course		3
	*Electives		3
			<hr/> 17

TOTAL MINIMUM UPPER DIVISION CREDITS 65

*Specific courses selected for these requirements must have the advisor's approval.

A total of 127 credit hours is required to complete the B.S. degree in Wood Products Engineering with the Forest Products option.

Emphasis Courses

Students desiring to emphasize Marketing, Production Systems Engineering, or Wood Science and Technology should select 24 credit hours of emphasis courses. These courses are defined upon consultation with the academic advisor. Typical concentration areas might be as follows:

<i>Marketing</i>	<i>Production Systems Engineering</i>	<i>Wood Science</i>
Finance	Operations Management	Tropical Timbers
Accounting	Quality Control	Wood Chemistry
Marketing	Engineering Economics	Physiology and Pathology
Materials Science	Computer Applications	Independent Research

Graduate Program

Recent research projects in wood ultrastructure have dealt with the interaction of coatings and adhesives with the wood substrate, with cell wall development, with the effectiveness of wood preservatives, and with the identification of natural inclusions in wood. Projects in tropical wood identi-

fication and structure-property relations in foreign and domestic timbers are examples of work in the field of systematic wood anatomy. The field of wood physics has had active projects in the permeability of wood and the mechanics of fluid transport. Current projects in the field of mechanics are focused on the elastic behavior of wood and wood-base composites, fracture mechanics of wood, the behavior of new structural designs such as truss systems, and the mechanical properties of laminated-veneer-lumber. In addition, there is growing interest in studying the physical properties of wood-based composite materials and the chemical modification of wood, as well as wood finishing systems.

Laboratory facilities include a mechanical testing laboratory with a wide range of testing machines, a physics laboratory with electronic instrumentation, and complete wood processing facilities including a sawmill, plywood mill, dry kilns, and wood preservation equipment. One of the United States' largest foreign wood collections is used for graduate research and to support the program of the Tropical Timber Information Center (TTIC).

In addition, the College has available a complete microscopy laboratory, containing transmission electron microscopes, scanning electron microscope with energy dispersive x-ray analysis and particulate analysis accessories, a wide variety of light microscopes, and related equipment. Extensive equipment for chemical analysis and nuclear chemical techniques also serve the research program.

The program works closely and cooperates with the Renewable Materials Institute. Students use this unique opportunity to investigate the properties of wood and related renewable engineering materials.

THE SCHOOL OF FORESTRY

JOHN V. BERGLUND, *Dean* (Silvics, Silviculture)

Syracuse Campus

ABRAHAMSON (Entomology, Pathology, Pesticides), BENNETT (Economic Theory, Economic Thought in Forestry), BICKELHAUPT (Nursery Soils, Forest Soils), BLACK (Water and Related Land Resources), BURRY (Forestry Extension, Wood Utilization), CANHAM (Forestry Economics, Economics, Economics of Natural Resources), COUFAL (Silviculture), CRAUL (Forest Soils), CUNIA (Operations Research, Biometry), DALL (Environmental Law and Policy), DREW (Tree Physiology, Physiological Ecology), ESCHNER (Forest Influences, Forest Hydrology), GRANT (Micrometeorology), GRATZER (Forest Recreation, Forest Management), GRAVES (Forest Resource Policy, Planning and Management), HALLIGAN (Silviculture), HERRINGTON (Meteorology, Urban Forestry), HORN (Mensuration, Law), HOWARD* (Silvics, Forest Management), KOTEN (Forest Management, Management Science and Planning), LEA** (Silviculture, Timber Harvesting), MAYNARD (Tree Improvement), MONTEITH (Forestry Economics, Land Use), MORRISON (Forest Recreation, Forestry Extension), NYLAND (Silviculture, Forestry Practice), PETRICEKS (Resource Economics, International Forestry Economics), RICHARDS

(Silviculture, Urban Forestry), STITELER (Statistics), WHITE (Forest Soils, Silviculture), YAVORSKY (International Forestry).

* On leave 1982-84

** On leave 1983-85

Forest Technician Program—Wanakena Campus

WESLEY E. SUHR, Director (Dendrology, Aerial Photogrammetry, Soil and Water Measurements, Fire Management).

JAHNKE (Ecology, Silviculture, Forest Management, Entomology, Pathology, Systems Analysis), MARTIN (Mensuration, Tree Physiology and Morphology, Wildlife Ecology), MILLER (Forest Roads, Installations, Aerial Photogrammetry, Graphics, Recreation), REMELE (Ecology, Silviculture, Forest Management, Surveying, Personnel Management).

Adjunct Faculty

CZAPOWSKYJ (Forest Soil Science), HEISLER (Meteorology), HORSLEY (Silvics), MARQUIS (Silviculture), ROWNTREE (Urban Forestry), SANDERS (Urban Forestry), TABER (Forestry Extension), YAWNEY (Silviculture).

Undergraduate Program in Resources Management

The School of Forestry prepares students for the critical role of managing forests and related resources and their environments for human benefit. Management here embraces the integration of basic ecological and social principles into comprehensive plans for the manipulation and use of forest and open lands for the sustained production of timber, forage, water, wildlife, and recreational values consistent with current and future national needs, and with the protection and enhancement of environmental quality. It also includes the effective implementation of these programs technically and via the administrative process, in accordance with established policies and goals and in cooperation with individuals and organizations, both public and private.

The successful management of forests and related resources involves many different people working together as teams to bring their special expertise to bear on problems created by society's demands upon these basic resources. The School of Forestry presently offers three undergraduate degree programs designed to help students fit into different parts of the interdisciplinary multi-level teams mentioned:

1. A professional forestry and resource management degree program, at the bachelor's level, offered at the Syracuse Campus.
2. A forest technician degree program at the associate's level, offered at the Wanakena Campus. For details of this program see p. 127.
3. A dual-major program that meets the bachelor's degree requirements of both the School of Forestry and the Department of Environmental and Forest Biology. For details of this program see p. 118.

Since the dual biology/forestry program and the forest technician program are covered in separate sections, the discussion which follows pertains to the School's professional forestry and resource management program.

Students completing the School's professional forestry program qualify for practice as foresters and environmental managers with public and private organizations or as private consultants serving a wide array of clients. The potential for a meaningful, rewarding career in service to human welfare becomes significant when one recognizes the vast amount of land area covered by forests. About 60 percent of New York State is classified as forest land, while roughly one-third of the land area of both the United States and the world is so classified. The goods and services that flow from this vast resource base are of critical and growing importance to the needs of modern society and influence, in a major way, the quality of the environment.

The professional forestry and resource management program offers opportunity for students to pursue special interests, to prepare for advanced study, or to develop their capabilities for service in a variety of fields pertinent to renewable natural resources and the environment, but not specifically forestry oriented. Though it represents the oldest area of professional instruction in the College, the current curriculum was implemented with the entering class of 1973, with some modification made since then. It is accredited by the Society of American Foresters and meets the educational requirements of the U.S. Government Office of Personnel Management for forester employment in Federal agencies. A core of required upper division courses, totaling 42 semester hours, presents the basic principles and practices underlying the purposeful management of forest and related resources for optimum production and use of any one, or combination, of their potential products and services.

Considerable emphasis in the curriculum is placed on field instruction to provide students with intimate knowledge of how the forest ecosystem functions and how it is manipulated and used for a variety of owner objectives. Close to half of the required upper division core courses are conducted wholly or primarily in the forest environment and entail substantial physical activity such as conducting field surveys, inventorying timber and other resources, and thinning forest stands. Attendance at a seven-week, eight-credit hour Summer Session in Field Forestry is required prior to registration for the junior year. This session emphasizes field skills and techniques and introduces ecological concepts, and serves as the major avenue of entrance into the professional forestry curriculum.

A unique feature of the curriculum in the fall semester of the junior year is a set of team-taught blocked courses emphasizing ecological foundations and applications based on the skills learned at the Summer Program in Field Forestry. This fall semester is largely held at the facilities of the College's 4,000-acre Heiberg Forest, nearby the Syracuse Campus, with all transportation provided by the College. The Summer Program in Field Forestry and the fall semester of the junior year total 22 credit hours of field oriented

core courses, and as part of the conditions for admission to this curriculum, applicants must be willing and able to function effectively in the field under a wide range of terrain and weather conditions. Any questions or concerns about this requirement should be directed to the Director of Admissions.

Extensive elective opportunities, totaling about one-fourth of the curriculum, allow students to shape their programs to meet individual needs and interests. In a broad sense, electives may be chosen to provide extensive coverage of either forest resource service or management, and they may be oriented toward immediate employment or as a base for graduate study. More specifically, one student might choose to broaden knowledge of forest resource management or science by distributing electives to cover all of the areas of forestry's multiple-use, while another might choose to enhance depth of understanding of a more specialized area by concentrating electives in areas such as timber, watersheds, forest wildlife, recreation, entomology, pathology, soils, international forestry, or urban forestry. Electives may also be taken at Syracuse University, usually to add to a student's general education or to gain knowledge of an area of business management, communications, geography or other similar topics not offered at ESF. Elective course selections must have the approval of the student's faculty advisor, and it is very important that they be planned early in the student's program.

A significant feature of the elective component of the professional forestry and resource management curriculum is that the spring semester of the senior year consists wholly of electives and thus is available for a variety of independent or group study activities. These may be conducted in whole or in part on any one of the College's several campuses, or off campus at another institution, in cooperation with some resource management agency or firm, or in conjunction with an overseas academic program operated by the College. Proposals for off-campus study must be well planned. They are subject to faculty review and approval and are carried out with varying degrees of faculty guidance to ensure adherence to academic standards.

A total of 135 credit hours is required to complete the B.S. degree curriculum. For students contemplating entrance to the program, it is required that they have completed at least 64 semester credit hours or have earned an associate degree, and further, that a minimum of 48 of these credits be distributed among specific course areas as outlined below. The maximum number of freshman-sophomore semester credit hours which may be transferred is 64. Students who have completed more than 64 lower division credits may transfer up to 12 additional hours of junior-senior level courses and should seek advice on upper division credits at the time of matriculation. The professional forester must understand both the biological and social influences that affect the use of forest resources. Prospective students should choose lower division elective courses that will serve to broaden and enhance their understanding in the social and political sciences, humanities, and communication skills.

Lower Division Courses

Course Area	Credit Hours
Biology (Botany and Zoology preferred) with Laboratory	8
General Chemistry with Laboratory	8
General Physics with Laboratory	8
Mathematics, through Integral Calculus	6
*Economics (Macro- and Microeconomics)	6
*Introductory Sociology and Psychology (3 credits each)	6
*Political Science (U.S. Institutions)	6
English (should include one writing course)	6
Electives	10
TOTAL MINIMUM LOWER DIVISION CREDITS	64

*Students may be admitted with 3 credit hours in each of the following: economics, psychology/sociology, and political science. These deficiencies must be removed as early as possible in the student's program, including the use of summer sessions.

Upper Division Courses

	Credit Hours
Summer: ¹ Summer Program in Field Forestry	
FOR 301 Field Dendrology	1
FOR 302 Forest Surveying and Cartography	2½
FOR 303 Introduction to Forest Mensuration	3½
FOR 304 Introduction to Forestry	1
	8
Junior Year	
<i>First Semester</i>	
FOR 331 Introduction to the Physical Environment	6
FOR 332 Silvics-Silviculture	8
FOR 322 Forest Mensuration	1
	15
<i>Second Semester</i>	
FOR 360 Principles of Management	3
FOR 370 Management of the Forest Enterprise	3
Computer Science Course	1
APM 391 Introduction to Probability and Statistics	3
² Electives	6
	16

¹SUMMER PROGRAM IN FIELD FORESTRY—7 weeks, 8 credit hours: Required of all students (except Forest Technician Program and Paul Smith's Forest Technician Program graduates prior to registration for junior year).

Senior Year

<i>First Semester</i>	
APM 492 Forest Biometrics	3
FOR 400 The Social Environment of Resource Management	3
FOR 461 Management Models	3
² Electives	6
	15
<i>Second Semester</i>	
² Electives	17
	17

TOTAL MINIMUM UPPER DIVISION CREDITS 71

²One half of the student's elective hours during the junior and senior years must be in courses taken in no fewer than three of the following schools: Forestry; Environmental and Resource Engineering; Biology, Chemistry and Ecology; Landscape Architecture. The remaining elective hours should be used to round out the professional education of a student.

A total of 135 credit hours is required to complete the B.S. degree in the Professional Forestry and Resource Management Curriculum.

Graduate Programs

NOTE: Effective with the fall semester 1984, the School of Forestry will be awarding the M.S. and Ph.D. in Forest Resources Management. This will replace the programs in Resource Management and Policy and Silviculture and Forest Influences. However, all the areas of study described below will continue to be available under the new program.

Graduate education in the School of Forestry builds upon the basic foundation of professional knowledge acquired by students in its undergraduate curriculum or in similar or closely allied programs of study. Instruction at this level is designed to prepare students for careers in resource administration, professional education and research, and a variety of other specialized positions in public and private employment bearing directly or indirectly on forest resources management.

The School offers advanced study opportunities under two broad degree programs: Forest Resource Management and Policy, and Silviculture and Forest Influences. In addition, its faculty contribute significantly to several Collegewide graduate programs and joint areas of advanced study, including fish and wildlife, managerial science, water resources, environmental planning, environmental science, and soil science.

Several areas of specialization are available within the two degree programs. Opportunity is also provided for students, in consultation with faculty advisors, to arrange areas of study specific to their interests and needs which integrate elements of two or more areas of specialization, as in urban forestry and international forestry. Whatever the program, the basic purpose is to help the student acquire the tools and facility for disciplined, logical, critical, constructive, and creative thinking, and for clear expression in the selected field.

Those prospective graduate students without a bachelor of science degree from an accredited forestry school, and desiring to be qualified as a professional forester upon completion of their program, will need to include certain required undergraduate forestry courses and the summer field forestry program for nondegree credit, together with certain required graduate courses. The mix of undergraduate and graduate courses required will depend primarily upon the science background of the student. Students with this goal in mind should expect to spend at least two and one-half to three years to complete the M.S. degree in either of the two graduate programs in the School of Forestry. The Ph.D. program would be extended accordingly.

RESOURCE MANAGEMENT AND POLICY (RMP)

The objective of the RMP program is to prepare graduates at the master's or Ph.D. level with a sufficient depth and breadth of understanding so that they will be able to function in and ultimately make significant contributions to the field of resource management and policy. This field is extremely diverse and includes employment opportunities with private firms that own, manage, and/or use natural resources, a myriad of public agencies from the federal to the local level, teaching opportunities in forestry or natural resource programs, or research work as conducted by a number of public and private agencies. Furthermore, students may choose to concentrate study in a particular specialty area of the field, or to prepare themselves more broadly for traditional managerial duties.

Each of these possibilities demands different interests and talents on the part of the student and different types of preparation in the course of graduate study. For these reasons our entering students are expected to have made a searching self-analysis of their abilities, potentials, and ambitions so they can enter the program with well defined career goals and utilize the graduate experience to its best advantage. The RMP program differs from the more science oriented offerings of the College in that while technical competence is expected, students are additionally required to relate this competence to the social and political environment in which they will be functioning. The student's interest must be broad enough to encompass these social areas, or be prepared to devote some study to these subjects while in residence.

The expertise of the RMP faculty is in the area of management, policy and economics as it relates to forest and associated natural resources. It is expected that students entering the program will share similar interests and concentrate their studies in this broadly defined field. However, the resources of Syracuse University's School of Management and Maxwell School of Public Administration are available to our students, and graduate level courses in the more general area of management and policy may be taken in these schools when appropriate to the student's overall graduate program.

Fields of Specialization

As previously described, the RMP program is individualized to meet the scholastic and career goals of the student within the capabilities of the faculty. Faculty strength and student interest over the years have been highest in the following concentrations, and they are described as illustrative of the type of graduate study available to entering students.

FOREST MANAGEMENT

Forest management focuses on the planning and implementation processes necessary to achieve integrated use of forests and associated natural resources. The educational objective is to develop expertise sufficient for capable, professional resource management under a variety of natural and societal environments.

The study of forest management requires a broad knowledge of both the natural and social environments as the basis for an understanding of the way in which these environments affect or are affected by the development and utilization of forests and associated wildlands. Implementation of plans also requires an understanding of the social environment as well as the managerial process to facilitate working with people both inside and outside of the organization.

Programs are flexible and a student may pursue a special interest in a single product, several products or services, tools and processes of planning for integrated forest use, or in developing managerial skills. The emphasis of the program, however, would be in the application of the skills and knowledge to the management of forest lands. Where appropriate, courses may be taken at Syracuse University's School of Management and the Maxwell School of Public Administration to complement course offerings in the School of Forestry and other Schools of the College. Recent graduates have found employment in all of the diverse areas described above.

POLICY AND ADMINISTRATION

Graduate study in the area of resources policy and administration is designed to prepare students for leadership positions in the broad range of responsibilities at the planning, budgeting, programming, and operating levels of public agencies and businesses. The expanded role of federal and state government oversight over resource use and land management has brought substantially increased need for thorough understanding of policy matters, legal requirements, and governmental and political interactions with resource owners and users. Advanced courses, seminars and special problems structured around these needs and the complex interrelationships of society with resources are offered. A wide array of complex problems of administrative management, resources policy issues, and related legal, financial, and executive needs are included among the topics that may be emphasized.

Students are encouraged to round out their academic programs through the courses offered by other units of the College as well as Syracuse University Graduate School of Citizenship and Public Affairs and the School of Management or other graduate units. Students with undergraduate preparation in forestry, liberal arts, engineering, or other appropriate areas who have strong interest in resource administration and policy can be served through selection of necessary emphases that complement work already taken.

The broad array of possibilities of course selection and the diverse points of view that are available allow the student to build a program to meet specific career objectives. The breadth and diversity also offers the student an opportunity to develop talents for managerial leadership and policy positions in various aspects of enterprises and public agencies whose work is critical to the future of resources management.

FORESTRY ECONOMICS

The program is designed to meet the needs of the student with an undergraduate degree in forestry or forest products. With some additional courses in forestry, the program also serves the graduate in liberal arts, engineering, or business, should interest point toward the economics of forest management. The goals are depth of understanding and familiarity with economic tools contributing to making competent decisions in resource economics, management, and policy.

The core of the program consists of courses in forestry and resource economics as offered by School faculty. In addition, one must be aware of the social and biological environment in which forestry economics is applied. To this end the program is supplemented by courses in general economics, statistics and operations research, resource policy, business administration, and related managerial and biological fields. The course offerings and facilities of the School, the rest of the College, and Syracuse University are actively drawn upon.

Individual programs are tailored to fit the student's particular interest: for example, the economics of timber management, land use economics, economics of natural environments, economic development and forestry. Graduates with the master's degree find employment typically as forest economists or resource analysts with federal and state agencies, and with private industry. Graduates with the Ph.D. usually find careers in teaching or research.

RECREATION MANAGEMENT

Graduate study in this area equips students with a broad understanding of the nature and purposes of outdoor recreation and how they relate to natural resources, and builds the skills necessary for capable recreation management.

Individual programs combine study in resources management with relevant studies in the social and political sciences and development of analytical capabilities needed to implement plans and programs. Other schools of the College and of Syracuse University, treating such areas as planning, engineering, design, and education, provide a wide range of supporting courses and facilities.

All program areas in RMP require that each student take a minimum of 12 credits of coursework within the School of Forestry. Courses in Applied Mathematics (APM) can also be used to meet this requirement. If a student's prior preparation is inadequate to meet the graduate program objectives, the major professor and/or committee will suggest appropriate remedial coursework to make up the deficiency.

Master's Degree Program

All three masters' options are available to students in the RMP program. Although differing in format, the options have the common purpose of

bringing each student to a similar level of understanding and ability in his chosen field. Because each option emphasizes a different element of the total program goals, the choice of an option should be based primarily upon a student's career objectives.

In the case of option 2, Academic or Professional Experience, the RMP faculty has chosen to increase the coursework requirement to 30 credit hours. At the present time the use of this option is limited to situations where appropriate experience can be negotiated between a student and an outside institution.

Doctoral Degree Program

Requirements for the doctorate usually build upon a master's degree, and demand a substantial mastery of material related to the dissertation topic. At the same time, a number of other fields are chosen to support or integrate the selected central topic of doctoral study. There is no minimum credit requirement, but the normal course workload is 30 credits and a minimum of 12 credits of coursework must be taken within the School of Forestry. The field work for and the writing of a dissertation usually requires a minimum of 12 months.

The additional requirements for a doctoral program, beyond a master's degree are the passing of written and oral candidacy examinations which are intended to test the student's integration of subject matter, and the writing and successful defense of a dissertation. A preliminary examination may be required to make an early appraisal of the student's intellectual qualifications to determine levels of understanding of the scientific and technical disciplines he is studying, and to guide the development of an adequate program of study.

SILVICULTURE AND FOREST INFLUENCES

Concern for the forest ecosystem provides a major focus for graduate study in the Silviculture and Forest Influences Program. This ecosystem is viewed as a producer of goods and services and as a modifier of the physical environment in which man lives. It is in this context that translation of these concerns to broader questions of environmental quality is emphasized.

Silviculture in its functional sense is the bridge between fundamental, biological and physical relationships and the applications of these relationships in the forest environment. Thus, graduate study in the many aspects of silviculture can cover a broad spectrum of disciplines, and can be as basic or as applied as the objectives of the student indicate. Individual study programs are coordinated with various areas of specialization both within the School of Forestry and with other departments of the College, of the State University of New York, and with Syracuse University. A major strength is the close association of faculty scientists, representing a wide range of specialties, and the formal and informal cooperative arrangements they have developed with their counterparts in federal and state agencies, and in industry.

Physical facilities that are routinely used in graduate study within the Silviculture Program include well-equipped laboratories, specialized equipment, greenhouse facilities, and extensive College forests. On these 25,000 acres of forestlands are located natural and planted stands, seed orchards, a forest tree nursery, and two large micro-climate tower complexes with associated automated data acquisition systems and instrumentation. Major field installations include long-term northern hardwood stand improvement studies and the oldest continuous forest fertilization study in the United States. Cooperative arrangements also exist for work on corporate lands, private properties, and governmental ownerships.

Fields of Specialization

Included within the Silviculture and Forest Influences Program are five fields of specialization that, singly or in combination, provide the graduate student with a wide array of coursework, research activities, and faculty guidance all aimed at enhancing understanding of the forest ecosystem. These specializations are silvics, silviculture, forest soil science, tree improvement, and forest influences. Students in the program can direct their studies toward careers in professional practice, research, or education. Similarly, study in these specialty areas can emphasize any of a number of areas of professional application, such as public or private forest management, urban forestry, or international forestry, depending on the individual's interest.

SILVICS

Silvics has been defined as that branch of forestry which provides the scientific base for the cultural treatment of forest vegetation by (1) studying and defining interrelationships within forest ecosystems and (2) cataloging general intraspecific characteristics of tree species. In a sense, silvics is the ecology of managed forest ecosystems, although unmanaged and natural forests are often studied intensively to provide the benchmark conditions from which the silviculturist begins.

The specialist in silvics must maintain channels of communication with colleagues in the basic disciplines, including those in soil physics, soil chemistry, micro-meteorology and climatology, genetics and tree breeding, plant ecology and physiology, wildlife biology, entomology, and pathology. In addition, certain tools, including a comprehensive knowledge of probability and statistics, the ability to use modern computers effectively, and a familiarity with measurement and sampling theory, are required by specialists in most applied sciences including silvics.

The specialist in silvics is essentially at one focal point of much of what has been called fundamental forest research. His most useful function and worthwhile contribution to the field of forestry may very well depend on the ability to synthesize relevant material and, through experimentation, provide the silviculturist with information and possible techniques for use in the cultural treatment of forest vegetation.

SILVICULTURE

Classical silviculture can be defined as the theory and practice of the manipulation of forest ecosystems, including the control of vegetation establishment, composition, growth, and quality. The nature of cultural treatments, the theories upon which they are based, and the biological, physical, and social constraints to their implementation are stressed in this area of specialization. Elements of forest vegetation are intensively examined from the dual standpoints of fulfilling management goals for goods and services and maintaining or enhancing biotic productivity for the future.

Management goals are considered to include all the many and varied goods and services that the basic forest resource is capable of supplying. Forest productivity is of basic concern; the student specializing in this area progresses through formal coursework and research toward an understanding of the effect of various treatments on the continuous, balanced, and adequate supplies of wood, water, wildlife, recreation opportunities, and amenity values. One major area of emphasis within this specialization relates to treatment of tree stands for their continued production of wood products and other commodities. Another emphasis centers on the treatment of stands that are managed for several values simultaneously, where the harmonious integration of uses is of concern. A third emphasis focuses on evaluation and manipulation of vegetation systems primarily for their on-site values, such as in wilderness and recreation areas, highway and utility rights-of-way, mining and other wasteland reclamation, and urban greenspace. This involves a broad interpretation of forest ecosystems that includes herbaceous and shrub systems as well as silvics.

The Silviculture graduate specialization is aimed at preparing foresters to understand and evaluate forest ecosystems in whatever depth may be required, and to prescribe treatments or further experimentation to attain management objectives or increase knowledge toward this end.

FOREST SOIL SCIENCE

Graduate studies in this area of specialization may be directed toward aspects of soil science related to the quantity and/or quality of goods and services in the management of resources of nonagricultural lands, and the impact of management practices on environmental quality. These include soil moisture, soil temperature, and nutrient element status interrelationships in the evaluation of soil productivity; evaluation of ecosystems to quantify nutrient element balances and cycling; amelioration of soils for increased productivity; and impact of various land-use practices on soil productivity.

Modern well-equipped laboratories are available for graduate student use in plant, soil, and water chemical analyses; soil water-holding capacity and compaction; infiltration and runoff; and other chemical and physical property investigations. The extensive College properties noted previously permit forest soil research to be conducted under a wide variety of environments and ecological conditions.

Programs are coordinated with other areas of specialization through cooperation among school personnel, with other departments of the College, Syracuse University, and the U.S. Forest Service.

TREE IMPROVEMENT

Tree improvement is an important component of forestry, and as demands on the resource increase, it will become even more vital. The most common objective of a tree improvement program is to develop populations of trees that are well-adapted, rapid growing, and disease-free. Other possible objectives may be to increase the aesthetic or recreational value of forest trees through selection for other traits.

Modern, well-equipped laboratories and greenhouses are available for graduate student use. Many established test plantations are available for collection of materials and field evaluations. Graduate students will take formal coursework in plant biochemistry and physiology, statistical genetics, and plant breeding. This specialization prepares graduates for positions in seed orchard management, tree improvement, and forest genetics with private, state, and federal organizations.

FOREST INFLUENCES

Forest influences as an area of graduate study includes all the effects resulting from the presence of forest trees and associated vegetation on climate, the hydrologic cycle, erosion, floods, and soil productivity. Health considerations and human comfort have often been included in older definitions of forest influences, and are assuming greater importance today with our growing concern for the environment.

Included among the principal studies in this area are energy exchange between forest and atmospheres; moderation of urban environments by vegetation; soil and slope stability; and watershed hydrology, including snow.

Graduates fill a variety of positions in research, teaching, and public and private management as watershed management specialists, hydrologists, environmental officers, meteorologists, and ecologists.

Master's Degree Program

Candidates for the master of science degree are required to complete 30 semester hours of graduate work beyond the baccalaureate degree. From 6 to 12 semester hours of this total can be credited for writing and defending a thesis.

This graduate degree is intended for students seeking an intermediate level of education in a scientific, professional, or technological field. It provides an introduction to research and related scholarly or professional activities and requires the student to demonstrate competence in a selected field of study. Consideration may be given to the development of a study program that provides a foundation for continuation to the Ph.D. degree, or provides an advanced professional education in forestry and serves as preparation for a career requiring special technical ability, or familiarity with research techniques.

Most master's candidates will be expected to prepare a thesis to satisfy requirements for the completion of the Silviculture and Forest Influences program. The topic addressed by the student should be research oriented, and expand or clarify knowledge in a particular field with some opportunity

for generalizing the results. A student may, with the consent of the major professor and advisory committee, petition the School Executive Committee to elect a program of 42 credit hours of graduate coursework and a comprehensive examination. The petition must be submitted prior to completing 12 credits of graduate coursework.

Doctoral Degree Program

The Ph.D. program usually builds upon a master's degree and demands mastery of material in a specialized field as well as the integration of a number of supporting fields. It requires scholarship of a high order, and successful fulfillment of independent research that makes an original contribution to forestry science.

The degree provides for advanced scientific study and development of the capability to independently organize and conduct research. Graduates fill a variety of positions in research, research administration, teaching and consulting in public agencies, private corporations, universities and foundations.

Students must develop strong scientific capabilities and demonstrate a capacity to solve complex problems in research. They must demonstrate a capability for independent work, but must interact effectively with faculty and other scientists in their chosen field of specialization.

There is no minimum credit requirement, but the normal course workload is 30 graduate credits beyond the master's degree. In addition, the fieldwork for and the writing of the dissertation usually requires a minimum of 12 months.

Candidates for the Ph.D. degree must pass a written and oral candidacy examination, and write and defend a dissertation.

Doctoral candidates are required to demonstrate competency in one foreign language and statistics.

SCHOOLWIDE AREAS OF STUDY

INTERNATIONAL FORESTRY

Graduate education in international forestry as an area of emphasis is available to students under both the Forest Resource Management and Policy, and Silviculture and Forest Influences programs and is designed to assist individuals who are intent upon pursuing internationally-oriented careers in forestry and related fields.

Instruction is aimed at supplementing and enriching the student's technical forestry knowledge and providing the broad background deemed necessary for effective service in a variety of professional areas. These include forestry advisor, teacher, or research specialist with national and international agencies, private business and industrial firms, philanthropic foundations, and voluntary service organizations whose activities include the development and use of forest resources in other lands.

At the master's level, program emphasis is on the attainment of general competence in research methods, foreign languages, cultural anthropology,

world geography, and international affairs, plus a broad understanding of the world forestry situation. At the doctoral level, program concentration is on a specialized discipline area such as forestry economics, forest policy and administration, forest management, or silviculture. Orientation to the world forestry field is achieved in part through the selection of formal coursework, and in part through providing an opportunity for the student to conduct his thesis research in residence abroad.

A wide variety of course offerings are available to support the nonforestry elements of this area of study through Syracuse University. Opportunity for field training and research in tropical forestry and related fields is available to qualified candidates, especially at the doctoral level, under cooperative agreements maintained by the College with the Institute of Tropical Forestry in Puerto Rico and the University of the Andes, Merida, Venezuela.

URBAN FORESTRY

Graduate study in urban forestry allows the student to pursue either of two broad objectives. Professional Urban Forestry skills may be broadened in the many areas of information important to the practice of forestry in urban and urbanizing areas through advanced coursework and applied research. More specialized study may be pursued in scientific disciplines supporting the practice of urban forestry. Active areas of specialized research and study in the School includes soils, greenspace ecology, atmospheric science, tree improvement, forest resource inventory and evaluation, and resource economics and planning. There is strong interaction with other urban-related areas of study within the College, including remote sensing, botany, pathology, entomology, wildlife ecology, and landscape architecture. Academic departments in the Maxwell School of Public Affairs at Syracuse University such as Geography, Economics, Political Science and Sociology, cooperate with teaching and research programs in urban forestry. The U.S. Forest Service Northeastern Forest Experiment Station maintains a permanent staff of scientists in their Urban Forest Research Project on campus who are engaged in studies dealing with the planning and management of urban forest ecosystems. This work complements the College's participation as one of nine universities in the Consortium for Environmental Forestry Studies, an organization of scientists and graduate students studying a wide range of problems in urban forestry.

QUANTITATIVE METHODS

Study in the area of quantitative methods is designed to develop professionals skilled in mathematical and statistical problem solution and equipped to act as biometricians or mensurationists.

The program is designed primarily for students who have done their undergraduate work in areas such as biological sciences, forestry, wildlife, or agriculture. Others who lack background courses may take this material concurrently. Students may concentrate in statistics, operations research, biometry, or forest mensuration. Syracuse University's computer facility and a wide range of courses in mathematics, statistics, and quantitative methods give strong support to the program.

THE SCHOOL OF LANDSCAPE ARCHITECTURE

ROBERT G. REIMANN, *Dean*

FACULTY

GEORGE W. CURRY. *Professional Experience:* The Reimann-Buechner Partnership, Landscape Architects, Syracuse; The Curry-Paulo Partnership; Member, Syracuse Conservation Advisory Council, Syracuse Urban Cultural Parks Advisory Committee, and Chairman, Syracuse Landmark Preservation Board. Licensed Landscape Architect, New York State. *Fields of Specialization:* Site Planning, Urban Analysis and Design, Historic Preservation.

TIMOTHY R. DAY. *Professional Experience:* The Architects Collaborative Inc., Architects and Planners; EDAW, Inc. *Fields of Specialization:* Rural Planning, Solar Energy at the Community Scale, Visual Resource Management, Remote Sensing.

GEORGE F. EARLE. *Professional Experience:* School of Architecture, Syracuse University; Artist; President, World Affairs Council. *Fields of Specialization:* History of Art, Cultural History; Painting, Latin American Art; History of Landscape Architecture; Design; Pre-Colombian Art.

JOHN P. FELLEMAN. *Professional Experience:* Planning Engineer, Monroe County, N.Y.; Urban Planner, NYS Hudson River Valley Commission; Chief Planner, Bruce Howlett, Inc.; Partner, Impact Consultants; Licensed Professional Engineer, New York State; Designated Planner-in-Charge, New York State. *Fields of Specialization:* Site Systems Engineering; Route Location; Environmental Simulation.

CLAUDE C. FREEMAN. *Professional Experience:* Russell Bailey and Associates, Landscape Architects and Planners; Alfred Obrist, Landscape Architect and Civil Engineer. *Fields of Specialization:* Site Design, Plant Materials, Graphics.

DAVID L. HANSELMAN. *Professional Experience:* Ohio Department of Education, Ohio Department of Natural Resources, Ohio State University. *Fields of Specialization:* Communications Strategies and Message Design, Non-Print Communications.

RICHARD S. HAWKS. *Professional Experience:* EDAW, Inc., Cambridge Research Institute. *Fields of Specialization:* Regional Planning and Design, Facility Siting and Routing, Geographic Digital Data Banks.

ALLEN R. LEWIS. *Professional Experience:* Bucks County Planning Commission, Pennsylvania. Member, American Institute of Certified Planners. *Fields of Specialization:* Community Planning; Planning Theory; System Dynamics; Modeling and Simulation.

FRANK L. MARAVIGLIA. *Professional Experience:* Senior High School Teacher; Business and Management Consultant; President, Centre of

Applied Creativity, Baltimore, Maryland; Faculty, Annual Creative Problem Solving Institute, SUNY Buffalo, Organizational Communication. *Fields of Specialization*: Technical Graphics, Creative Problem Solving, Education, Communication, Video, Management.

JAMES F. PALMER. *Professional Experience*: Research Associate, The Environmental Institute, University of Massachusetts; Associate Social Scientist and Resource Planner, Carlozzi, Sinton & Vilkilis, Inc.; College Planner, Kresge College, University of California at Santa Cruz. *Fields of Specialization*: Landscape Perception, Design Evaluation, Social Impact Assessment, Environment and Behavior Research Methods.

HAMID SHIRVANI. *Professional Experience*: University of Southern California; University of California, Los Angeles; Southern California Institute of Architecture; Pennsylvania State University; Shirvani & Associates; The Planning Center; Technokam Regional Development Corporation; London Borough of Barnet, U.K.; Maidment & Brady, U.K.; Devereux and Partners, U.K. *Fields of Specialization*: Urban planning and design, environmental policy development, political economy and developing countries.

RICHARD C. SMARDON. *Professional Experience*: Wallace, Floyd, Ellenzweig, Inc., Cambridge, Mass.; Executive Office of Environmental Affairs, Commonwealth of Massachusetts; Oregon State University Extension Service; Institute for Urban and Regional Development, University of California; USDA Forest Service. *Fields of Specialization*: Landscape and Environmental Planning, Visual Resource Analysis, Environmental Assessment/Administration, Wetland Assessment.

KATHLEEN A. STRIBLEY. *Professional Experience*: Department of Landscape Architecture, The Ohio State University; Anderson-Lesniak and Associates, Inc.; Research Project, University of Michigan; Johnson, Johnson and Roy, Inc.; Colvin-Robinson Associates, Inc.; Dalton-Dalton-Little-Newport, Inc. *Fields of Specialization*: Design and Behavior; Public Participation; Urban Design, Parks and Recreation; Site Planning and Design.

DANIEL A. SUNDQUIST. *Professional Experience*: American Peace Corps; EDAW, Inc., University of New Hampshire. *Fields of Specialization*: Site Planning and Design, Environmental Impact Assessment, Siting and Routing, Synaesthetics.

Introduction

The alteration of the physical environment has been a product of human activity since the earliest times of human settlement. While environments of enduring beauty and vitality occasionally resulted, the history of environmental manipulation more often demonstrated degradation and abuse of the landscape. As the knowledge of natural and human processes has expanded,

environmental change has been transformed over the centuries from the casual efforts of many to that requiring skilled individual effort and often demanding multidisciplinary attention.

The School of Landscape Architecture offers curricula designed to educate students to contribute in varied ways to the wise use of land and landscape. Each degree program provides a basis for students to establish career directions in landscape architecture or in related disciplines. These curricula are offered at both the undergraduate and graduate levels.

UNDERGRADUATE PROGRAM

The School of Landscape Architecture offers two undergraduate degrees—the bachelor of science with a major in environmental studies (B.S.) and the Bachelor of Landscape Architecture (B.L.A.).

Both degrees share the ultimate purpose of providing senior level education for those concerned with the condition and form of the physical environment. The B.S. degree is basically designed for those students desiring a general undergraduate degree to be followed by an environmentally related graduate degree. The B.L.A. degree is basically designed for those students desiring to enter the profession of landscape architecture either directly after completing this degree or after completing a graduate degree. Students are urged to seek complete clarification of the two degree programs with regard to their own career goals by arranging an interview with the School.

All students apply for either the B.S. or B.L.A. degree upon application to the College.

BACHELOR OF SCIENCE IN ENVIRONMENTAL STUDIES

The Bachelor of Science in Environmental Studies (B.S./E.S.) program is primarily concerned with interrelationships among the natural environment, people, and the human environment, including society's institutions. Its focus is on the issues involving the condition and form of the physical environment. The goal of the program is to educate students to be more sensitive, articulate, and knowledgeable about the complex environmental issues facing contemporary society.

The B.S./E.S. degree is granted at the end of four years and requires the successful completion of 125 credit hours. Students typically enter the program with 62 lower division credits. During their junior and senior years, students are required to complete a group of core courses in the humanities, natural, and social sciences. The particular emphasis of an individual student's program is determined by the development of two concentration areas investigating specific environmental concerns directly related to the student's career purposes and goals. It is recommended that students engage some integrative academic experience during their senior year that provides an opportunity to synthesize their environmental studies education.

The complexity and scope of coursework required in the B.S./E.S. program demands both discipline and commitment from students seeking the degree. A clear sense of purpose and objectives is necessary to beneficially engage the curriculum. To successfully meet each student's objectives, a close-working relationship between faculty and student is also necessary. The program's flexibility makes it especially suited for advanced undergraduates desiring a general environmental background in preparation for either graduate training or environmental careers that may appropriately be entered with a baccalaureate degree.

Students receiving the B.S./E.S. degree have pursued graduate study in the disciplines of planning, landscape architecture, and other environmentally related areas such as business, education, and law. Students with academic standing in the top one-third of their class may apply at the end of their junior year for advanced standing admission to the School's M.L.A. program in community design and planning.

Prerequisites for Entry into the B.S./E.S. Program

Because of the wide range of opportunities available to students who enter the B.S./E.S. program, it is important that they prepare themselves with a broad range of lower division coursework. Understanding the issues involved in the condition and form of the physical environment requires a background in the humanities, natural, and social sciences. The following required and recommended prerequisite coursework will prepare the entering student to engage the B.S./E.S. curriculum.

Lower Division Courses

<i>Course Area</i>	<i>Credit Hours</i>
Written Communications	3
Required credit hours in this area should be taken in courses dealing with English comprehension, the basic skills of grammar and composition.	
Humanities	9
Required credit hours in this area should be taken in coursework in philosophy, literature, art, music, drama, and language.	
Social Sciences	9
Required credit hours in this area should be taken in coursework in history (preferably U.S.), cultural geography, sociology, psychology, political science (preferably U.S. institutions), social or cultural anthropology, or economics.	
Natural Sciences	6
Required credit hours in this area must include a course in general biology. Additional hours should be taken from coursework in ecology, physical geography, earth science, geology, biology, chemistry, and physics.	
Mathematics	3
Required credit hours in this area should be taken in computer programming, statistics, or mathematics at the level of college algebra, trigonometry, and calculus.	
Electives	32
TOTAL MINIMUM LOWER DIVISION CREDITS	
	62

Each applicant is required to submit a statement of program interest. This statement should describe how study in the B.S./E.S. program will contribute to the student's educational and career goals. It should reflect an understanding of the curriculum and represent the student's preparedness to take advantage of the special nature of the program.

Bachelor of Science in Environmental Studies Curriculum

I. CORE REQUIREMENTS

	<i>Credit Hours</i>
A. <i>WRITTEN COMMUNICATIONS</i>	4
Coursework intended to develop a professional-level skill in written communication. Required are three credit hours in report writing or equivalent and one credit hour in library research.	
B. <i>METHODS AND TECHNIQUES</i>	6
Coursework intended to develop methods and techniques useful for analyzing environmental information. Required are six credit hours, including a two- or three-credit-hour course in statistics or computer programming.	
C. <i>ENVIRONMENTAL CONCEPTS AND SYSTEMS THINKING</i>	6
Coursework intended to develop critical facilities and systems thinking useful for an appreciation of the holistic nature of environmental issues. Required are six credit hours, including EIN 300 Introduction to Environmental Studies.	
D. <i>NATURAL SCIENCES</i>	9
Coursework intended to provide a natural science foundation useful for understanding natural phenomena and processes. Required are nine credit hours, including EIN 311 Natural Processes in Planning and Design. It is recommended that the remaining courses have a laboratory or fieldwork component.	
E. <i>HUMAN-ENVIRONMENT INTERACTIONS</i>	9
Coursework intended to provide a foundation for understanding the interaction of humans and the environment from social, institutional, and historical perspectives. Required are nine credits, including EIN 390 Social/Cultural Influences and Environmental Form, EIN 451 Introduction to City and Regional Planning, and either EIN 371 History of American Landscape Attitudes, or EIN 471 History of Landscape Architecture.	
II. CONCENTRATION REQUIREMENTS	18
This coursework provides an opportunity to develop proficiency in two particular aspects of the interrelationship of the natural environment, people, society's institutions, and their influence on the condition and form of the physical environment. Two concentration areas of nine credit hours each are required. A maximum of three credit hours of independent study may be counted toward each concentration. Internship-type experience may not be counted toward a concentration. Concentrations are proposed by students after consultation with faculty and must be approved by the faculty advisor. Accepted coursework must be of grade C or better.	

III. DIRECTED ELECTIVES	11
<p>Eleven credit hours of coursework selected with the approval of the faculty advisor to complement core requirements or concentration areas. It may include a senior-year integrative academic experience.</p> <p>It is recommended that some integrative academic experience providing an opportunity to synthesize their environmental studies education be engaged by each student during their senior year. Possible alternatives include independent readings, a research project, an internship, a senior seminar, or an off-campus study. Each option has its own prerequisites and some have limited enrollments.</p>	
<hr/> TOTAL MINIMUM UPPER DIVISION CREDITS	
<hr/> 93	

A total of 125 credit hours is required to complete the B.S. degree in Environmental Studies.

BACHELOR OF LANDSCAPE ARCHITECTURE

The B.L.A. degree is a professional degree with an emphasis on the skills and knowledge required to qualify as a landscape architect. The degree is accredited by the American Society of Landscape Architects (ASLA) as the first professional degree offered at the School. The B.L.A. is granted at the end of five years of study and requires the successful completion of 160 credit hours. Students enter into the third year of the program with a minimum of 62 lower division credit hours and follow the prescribed curriculum.

The B.L.A. degree program consists of a core of courses involving the basic principles and skills of landscape architecture design, land manipulation and engineering, applied ecology, and communications. Additionally, students are required to participate in an independent study semester of the Off-Campus Program during the fall semester of the fifth year. The major objective of the B.L.A. program is the development of basic proficiency in design, engineering, and communication skills necessary for formal admission into the profession of landscape architecture.

When the prerequisite period of work experience has been completed, a person holding a B.L.A. degree may obtain a license to practice landscape architecture. At present, the State of New York requires those holding a 5th-year B.L.A. degree to complete a three-year period of internship in the field prior to applying for the licensing examination. Other states have varying requirements for obtaining a license.

As in any area of professional study, students seeking the B.L.A. degree are expected to demonstrate a high level of commitment and scholarship in their studies. This professional commitment is demonstrated by a desire to serve society in an objective, rational, and ethical manner in designing the form of the environment.

Students receiving a B.L.A. degree have entered the profession as employees in public agencies or in private offices offering landscape architectural services. Also, B.L.A. graduates have entered graduate schools

in landscape architecture, planning, urban design, regional design, and specific specialties including historic preservation, energy conservation, environmental policy management and research.

Prerequisites for Entry into the B.L.A. Degree Program

Because of the breadth of concern of the B.L.A. degree, it is imperative that entering students prepare themselves with a broad range of lower division coursework. The environmental efforts with which the students will be involved require a strong background in both the natural and social sciences. In addition, prior skill development in graphics, mathematics, and computer science is required. The following required prerequisite coursework must be met to prepare the entering student to engage the B.L.A. curriculum.

Lower Division Courses

<i>Course Area</i>	<i>Credit Hours</i>
Written and Oral Communication	6
Required credit hours in this area should be taken in courses dealing with English comprehension, the basic skills of grammar and composition, and public speaking.	
Graphics	3
A minimum of one semester's work preferably in a course in engineering drawing, mechanical drawing, or architectural drafting may be selected.	
Natural Sciences	6
Required credit hours in this area must include a course in botany or plant biology. Additional hours should be taken from coursework in ecology*, physical geography, earth science, geology, or environmental geology.	
Social Sciences	3
Required credit hours in this area are to be taken from coursework in U.S. history, sociology, social psychology, social or cultural anthropology, political science, or economics.	
Mathematics	6
Required coverage of college algebra and trigonometry. Students with prior coverage in math who can demonstrate proficiency at time of admission may substitute elective hours for this prerequisite. More advanced math is desirable but not required.	
Computer Science	3
Required course must include introduction to programming utilizing BASIC, FORTRAN, APL, or PASCAL.	
Electives	35
TOTAL MINIMUM LOWER DIVISION CREDITS	
	62

ELECTIVE GUIDELINES

Students planning to transfer to the School of Landscape Architecture should consider the following as guidelines in selecting their 35 credit hours of electives. The subject areas are considered *highly desirable* but are not required. Course areas marked (*) are required following transfer to the

School, but can be waived if completed prior to transferring. This will allow a student to take additional electives at ESF.

1. In addition to the required prerequisite credit hours listed, further subject coverage in Written and Oral Communications, Natural Sciences, and Social Sciences as listed above is recommended.

2. Art and Design

Courses in this category should preferably include Art History* and Studio Art. Studio courses in Drawing or Three-Dimensional Design, i.e., Sculpture, Ceramics, and Photography, are recommended.

3. Analytical Tools

Courses in this category should preferably include Elementary Plane Surveying*, Air Photo Interpretation*, or Elementary Physics. Additional work in computing technology is highly recommended, particularly in the realm of computer graphics and computer-assisted design (CAD).

Demonstration of academic excellence in environmental design and design graphics through submission of a portfolio is highly recommended as part of the admission's process to the B.L.A. program.

Bachelor of Landscape Architecture Curriculum

Third Year

Credit Hours

<i>First Semester</i>	LSA 320	Introduction to Landscape Architecture and Planning	3
	LSA 326	Landscape Architectural Design Studio I	3
	CMN 382	Graphic Communication	2
	EIN 311	Natural Processes in Planning and Design	3
	EFB 320	General Ecology or Elective	3
	Elective	. . . . .	2
			<hr/> 16
<i>Second Semester</i>	LSA 327	Landscape Architecture Design Studio II	3
	LSA 330	Site Research and Analysis	2
	EIN 371	History of American Landscape Attitudes	3
	EIN 390	Social/Cultural Influences and Environmental Form	3
	ERE 306	Elements of Map and Air Photo Interpretation or Elective .	1
	ERE 308	Elements of Plane Surveying or Elective	1
	ENG 406	Technical Writing	3
			<hr/> 16

Fourth Year

Credit Hours

<i>First Semester</i>	LSA 422	Landscape Design Studio III	4
	LSA 433	Plant Materials	2
	LSA 434	Design Materials	1
	LSA 442	Site Grading	2
	LSA 443	Site Drainage Systems	1
	EIN 451	Fundamentals of City and Regional Planning	3
	EIN 471	History of Landscape Architecture	3
			<hr/> 16

<i>Second Semester</i>	LSA 423	Landscape Design Studio IV	4
	LSA 425	Orientation for Experiential Studio	2
	LSA 444	Vehicular Circulation Design	1
	LSA 445	Introduction to Structures	1
	LSA 455	Professional Practice in Landscape Architecture	2
	EIN 470	Art History or Elective	3
	LIB 300	Library Research	1
	Elective	.....	3
			17
Fifth Year			<i>Credit Hours</i>
<i>Summer</i>	LSA 533	Plant Materials	2
<i>First Semester</i>	LSA 524	Experiential Landscape Design Studio V (Off-Campus Program)	16
<i>Second Semester</i>	LSA 522	Landscape Design Studio VI—Urban Design	4
	or		
	LSA 525	Landscape Design Studio VI—Site Design	4
	or		
	LSA 527	Landscape Design Studio VI—Regional Design	4
	LSA 545	Professional Practice Studio	2
	Architecture Elective		3
Elective		3	
Elective		3	
			15

A total of 160 credit hours is required to complete the B.L.A. degree.

NOTE: A number of the courses listed in the B.L.A. curriculum are in the process of being revised. Upon revision, new course descriptions will be available after approval by the College of Environmental Science and Forestry Faculty.

GRADUATE PROGRAM

MASTER OF LANDSCAPE ARCHITECTURE

The master's degree is open to those students who hold an undergraduate degree and meet the prerequisites for admission. The program is accredited by the American Society of Landscape Architects and focuses on community design and planning. The three-year course of study provides a strong foundation of design theory and process while emphasizing mastery of the skills associated with an individually selected area of concentration. The core curricula focus on processes of community design and planning. Students are required to integrate the core coursework with an elected area of concentration. The program requires cross-disciplinary study to prepare students to enter a variety of emerging positions in the public and private sectors. Illustration of these positions may be found in design research, community development, impact analysis, and environmental management. Although these positions require working knowledge of design, they tran-

scend the traditional skills normally associated with project design. Processes related to management, analysis techniques, technological application, and the social and natural sciences are considered necessary to undertake these and other similar positions. Graduates of the program are currently employed by government, educational institutions and private offices practicing environmental design and analysis across a broad and comprehensive scope or purview. The M.L.A. degree is granted upon the completion of 72 credit hours (42 graduate) in a prescribed curriculum.

A variety of joint degree program opportunities exists for applicants wishing to develop a unique career track. Concurrent professional degrees in Law, Public Administration, Public Communication, or Business Management may simultaneously be pursued at Syracuse University. Ph.D. programs for careers in teaching and research are available within the College's Graduate Program in Environmental Science, and with a variety of programs at Syracuse University, such as geography. Applicants interested in dual degree programs are encouraged to contact the College's Graduate Admissions Office at an early date.

M.L.A. DEGREE PROGRAM

The M.L.A. curriculum has four components: a foundation year, a sequence of required core courses, a series of elected courses in an area of concentration, and a terminal experience. The foundation coursework provides the skill and knowledge basis for engaging environmental design. The required core courses have as their focus the development, enhancement, and refinement of understanding of landscape architectural philosophy, theory, skills, and techniques, as focused on community design and planning. Emphasis is placed on the refinement of proficiency in design analysis skills, concepts, and objectives.

Each student is required to select and complete nine credit hours of directed graduate electives in a declared area of concentration within the major of community design and planning. The specific concentration is the responsibility of each student and must be approved by the student's faculty advisor or major professor prior to the end of the first year. Illustrative concentrations include: physical, cultural, communication/public participation, urban design, visual analysis, and environmental simulation.

Three terminal experience options are available: thesis or project, coursework, academic, or professional experience. A project consists of the critical application of professional knowledge and skills to a landscape architectural problem. A thesis consists of research which expands or clarifies basic knowledge related to community environmental design. The coursework option involves selected electives in the designated area of concentration. The academic/professional experience is typically a semester-long internship with a public agency, private firm, or nonprofit institution.

The following describes the broad sequential linkages of the six-semester program:

First Year: Foundation courses in design analysis, physical factors, graphics, history, and theory, and start of graduate elective sequence, or engagement of additional undergraduate technical subjects. The scale focus is human, site, and neighborhood.

Second Year, Fall Semester: The third semester of study is intended to provide an introduction to decisionmaking processes, including computer applications in community design and planning. An examination of the impact of physical factors on the environment is provided. Scale focus includes municipal and site in rural/suburban scenarios.

Second Year, Spring Semester: The fourth semester of study is intended to investigate community design and planning through a variety of projects focusing on the form and condition of environments supporting human behavior. Methods of research and analysis relevant to social determinants at the scale of an urban district are introduced.

Third Year: This year is individually designed, with the assistance of a major professor, to meet the student's career objectives while satisfying the requirements of the selected concentration area, and terminal experience. Study and research opportunities exist both at the Syracuse Campus and throughout the world. Often, all or a portion of the fall semester involves off-campus pursuits, while the spring semester entails final coursework and project documentation.

Research and community service play a significant role in the graduate program, primarily through funded projects and projects/thesis. Not only does research provide new knowledge and applications for the profession, but it enriches the curriculum, enhances faculty expertise and develops student skills in rigorous observation, clear thinking, and lucid writing.

By the nature of a profession which exists on evolving frontiers of human interaction with natural and built environments, much of the research in landscape architecture deals with issues in an exploratory way. Faculty members and graduate students usually work together on research projects in an atmosphere of mutual learning. Approaches may vary from rigorously quantitative analysis of data, to highly qualitative evaluation of broad problems, to application of design and planning methods to specific cases.

The College library and the several libraries on the Syracuse University campus offer reference material to support study programs. Facilities at the School include adequate studio and office space as well as three research laboratories. The School also has reproduction, model making, photographic, audio-visual, micro-computer, video, noise, solar, and visual simulation equipment. The College's Computer Center is fully interfaced with Syracuse University to provide a complete range of academic and research capabilities. The College also has a fully-equipped video tape recording (VTR) studio, photogrammetric labs and micro-computer based image processing capability for LANDSAT tape interpretation.

The School is unique in its location within the College of Environmental Science and Forestry. This situation provides the M.L.A. candidate with the opportunity to draw upon information and knowledge in ecology, natural sciences, resource management, forestry and many other related environmental disciplines. The U.S. Forest Service Urban Forestry unit located at the College provides a unique opportunity to promote interdisciplinary environmental design research. In addition, the relationship with Syracuse University provides the School with an extensive intellectual as well as physical resource basis.

The Syracuse area has the largest concentration of landscape architectural firms in the state, outside New York City. With a metropolitan population of nearly 500,000, the city has many opportunities for urban-oriented study. Also, the city's central location in Upstate New York provides easy access to a rich variety of community design and planning contexts throughout the northeastern U.S. and the major metropolises of Canada.

Students seeking admission to the M.L.A. program may apply to enter in either the first or second year based on education and experience. Admission to the first year requires:

1. An undergraduate degree.
2. Graduate Record Examination scores.
3. Undergraduate transcript.
4. Three letters of recommendation.
5. A completed course in each of three areas:
 - a. botany, biology, or ecology;
 - b. geology, geomorphology, or earth science;
 - c. anthropology, psychology, or sociology;
 - d. computer application or programming course.

In addition, students seeking admission to the second year must have:

6. Accredited design degree or equivalent;
7. Design and engineering portfolio;
8. TOEFL scores required for all applicants whose native language is not English. Applications should be made prior to March 1 for the following fall.

M.L.A. Program Sequence

The M.L.A. program is established as a three-year sequence of courses. The following sequence illustrates a typical three-year program.

First Year	<i>Credit Hours</i>
LSA 520 Design Analysis Studio I	3
CMN 382 Graphic Communication	2
LSA 671 History of Landscape Architecture	3
¹ LSA 697 Topics and Issues of CDP	2
LSA 521 Design Analysis Studio II	3
LSA 330 Site Research and Analysis	2
ERE 306 Air Photo Interpretation	1
LSA 445 Elements of Structures	1
LSA 496 Site Grading	2
² Directed Electives	5

Second Year

Credit Hours

LSA 620	Community Design and Planning Studio I	3
LSA 652	Community Development Process	3
LSA 656	Environmental Factors, Community Response, and Form	3
³ LSA 433	Plant Materials	2
³ LSA 434	Design Materials	1
LSA 621	Community Design and Planning Studio II	3
LSA 650	Behavioral Factors of Community Design	3
Directed Electives	.....	6
		24

Third Year

⁴Typical Options for Integrative Experience:

	<i>Academic/</i>					
	<i>Thesis/Project</i>		<i>Professional Experience</i>		<i>Coursework</i>	
	<i>Fall</i>	<i>Spring</i>	<i>Fall</i>	<i>Spring</i>	<i>Fall</i>	<i>Spring</i>
LSA 898	Academic/Professional		12			
LSA 899	Thesis/Project					
LSA 641	3	6				
LSA 641	Formal Organization			1		1
LSA 642	Project and Program					
	Scheduling		1	1		1
LSA 643	Ethical Issues in Community					
	Design and Planning			1		1
Directed Electives	9	3		9	12	9
	12	12	12	12	12	12

¹Also required for students who enter with advanced standing.

²Directed electives are selected in consultation with the student's advisor. They are designed to augment the student's undergraduate preparation, to develop the required concentration.

³Usually not required for students who enter with advanced standing.

⁴The precise number of credit hours taken by a student during a given semester in LSA 899, LSA 898, or in directed electives is determined in consultation with the student's advisor.

DUAL UNDERGRADUATE PROGRAM IN ENVIRONMENTAL AND FOREST BIOLOGY AND RESOURCES MANAGEMENT

This dual curriculum is designed to provide students with a strong background in basic biology and forestry. In doing so it meets the core course requirements in two undergraduate curricula: Environmental and Forest Biology, and Resources Management. The Dual Program is one level in a continuum of Biology and Forestry study opportunities at the College:

- Environmental and Forest Biology
- Environmental and Forest Biology with Forestry Electives
- Dual Program
- Resources Management with Biology Electives
- Resources Management

Upon completion of the Dual Program, graduates will be highly qualified to work professionally in forested ecosystems. The breadth of training received by students who elect this option will prepare them for a career in forestry and other aspects of environmental science in the federal, state, and private sectors. Exposure to diverse courses and extensive field experience enhances their employment opportunities in multidisciplinary programs that are characteristic of contemporary approaches to forestry management and other environmental problems.

The Dual Program requires a minimum of five semesters at the upper division level. Six semesters may be necessary for those students who lack appropriate lower division courses, or who wish to develop specific interests in forest biology or forestry. A total of 147 credit hours, 62 of them prior to matriculation, is required for this Bachelor of Science degree. In addition to the 58 credit hours of upper division core courses listed below, six of the elective credit hours must be in Plant Science, six in Animal Science, six in FOR (Forestry) and three in WPE (Wood Products Engineering) or FEG (Forest Engineering), exclusive of the six-hour summer camp experience.

There is less opportunity to take free electives in the Dual Program than in the two curricula which it combines. It is recommended that elective requirements in plant science and animal science address critical support areas such as forest pathology, plant ecology, fish and wildlife management, and forest entomology. Similarly, forestry electives in silviculture, hydrology, or tree improvement are examples of elective opportunities in important forestry support areas. In all cases, choice of electives depends on the student's professional goals. Course selection is made after consultation with each of two advisors; one from the School of Environmental and Forest Biology and one from the School of Forestry.

To facilitate transfer at the junior level, it is important that students satisfy the lower division course requirements prior to matriculation at the College of Environmental Science and Forestry.

Students entering at the junior level should have successfully completed a minimum of 62 credits which include:

Lower Division Courses

Course Area	Credit Hours
General Chemistry with Laboratory	8
Organic Chemistry with Laboratory	8
General Physics with Laboratory	8
Mathematics, through Integral Calculus	6-8
English	6
General Botany and Zoology OR General Biology with Laboratory	8
*Social Sciences	6
*Political Science (U.S. Institutions)	6
*Biology Electives OR Economics (Macro- and Microeconomics)	6
	62

Upper Division Courses

Junior Level			Credit Hours
<i>Fall</i>	EFB 320	General Ecology	3
<i>Semester</i>	EFB 336	Dendrology I	3
	**EFB 352	Elements of Forest Entomology	3
	***ECN 201	Microeconomics	3
	****Elective		3
			15
<i>Spring</i>	ABM 391	Statistics	3
<i>Semester</i>	FBL 330	Physiology	3
	FOR 360	Principles of Management	3
	****Elective		3
	**ECN 202	Macroeconomics	3
	Computer Application		1
			16
Summer:	FOR 301, 302, 303, 304	Field Forestry Program at Warrensburg	8
<i>Fall</i>	FOR 331	Introduction to Physical Environment	6
<i>Semester</i>	FOR 332	Silvics/Silviculture	8
	FOR 322	Mensuration	1
			15
Senior Level			Credit Hours
<i>Spring</i>	FOR 370	Management of Forest Enterprise	3
<i>Semester</i>	FBL 470	Genetics	3
	FBL 471	Genetics Laboratory	1
	****Electives		9
			16

Fall	APM 492	Biometrics	3
Semester	FOR 400	Social Environment of Resource Management	3
	FOR 461	Management Models	3
	****Electives	.....	6
			15

*Students may be admitted with 3 credit hours in each of these subject areas. Deficiencies must be removed as early as possible in the student's program.

**A spring course, EFB 351, may be substituted if scheduling problems conflict with EFB 352. This will open up 3 hours of electives during the fall semester rather than in the spring.

***If the economics requirement is satisfied in the freshman and sophomore years, biology or forestry electives may be substituted and vice versa.

****These electives should include at least 3 credits in WPE or FEG, 6 credits in FOR, 6 credits in plant sciences, and 6 credits in animal science.

GRADUATE PROGRAM IN ENVIRONMENTAL SCIENCE

MOHAN K. WALI, *Director*

The collegewide Graduate Program in Environmental Science (GPES) offers M.S. and Ph.D. degrees in environmental science through a trans-disciplinary program which draws upon faculty from across the College as well as selected faculty participants from Syracuse University. Concurrent degree programs are also offered between GPES and Syracuse University's Maxwell School of Citizenship and Public Affairs, S.I. Newhouse School of Public Communications, School of Management, and College of Law.

A PERSPECTIVE

Amid the phenomenal advances in engineering technology in this century, there arose an unprecedented demand for materials and processing. Concomitantly, a burgeoning human population, coupled with increasing demands for food, fiber, and fuel resulted in large scale disturbance of the environment, overexploitation of natural resources and insensitive land use practices. Polluted air and water, land areas made derelict by mining, energy-intensive agricultural practices, increased use of pesticides, large scale industrial growth with its attendant waste products, unprecedented numbers of automobiles, networks of roadways, and expanding urbanization brought to the fore the political, economic, and some recently-acquired social-cultural realities.

The understanding of and solutions to contemporary environmental problems transcend disciplinary boundaries; they must not only integrate the traditional scientific disciplines but also the problems of technological development, of generated residuals and the risk of environmental hazards, of economic and social choices.

ENVIRONMENTAL SCIENCE is the field of enquiry in which the knowledge and principles of physical, biological, and social sciences flow

as systems processes within the contextual framework of unifying policies. These policies, in turn, determine the design, the plan and the regulation seeking mitigation of environmental problems. While the emphasis in some cases may be on immediate environmental problem-solving, understanding the problem must be the key for effective and long-term resolution. Additionally, the study of environmental problems in many cases affords great opportunities for the enrichment of the basic knowledge of traditional disciplines and the testing of some of their basic tenets.

MISSION

The central mission of GPES is transdisciplinary education and research for effective resource use, resource conservation, and environmental enhancement and protection. Future environmental scientists, while often grounded in traditional disciplines, must possess understanding and knowledge of a number of ancillary disciplines. Their effectiveness will be demonstrated through technology transfer that brings the science from the experimental to real world situations. The challenge lies in the translation of environmental awareness and concerns into well informed, scientifically-based action. It is here that the central role of a program like GPES resides: *Transdisciplinary education and research to foster the effective use of natural resources while protecting the environmental base from which all resources flow.*

Therefore, the Graduate Program in Environmental Science engenders the following approaches to prepare the student to scientifically deal with environmental problems, and to perform as an effective environmental professional:

- (a) *multidisciplinary approach*—recognition of the necessity to approach environmental problems with input from several disciplines and professions;
- (b) *holistic philosophy*—awareness of and deference to the interdependence of elements (including physical, biological, and social systems, human behavior, and cultural values) within ecosystems;
- (c) *sound grounding in at least one concentration*—competency to understand and apply the principles of an environmental discipline, and with that strength interact with other disciplines;
- (d) *realistic experience*—through internships or other focused projects which provide direct interaction in social, economic, political, and social institutions which underlie decisionmaking; and
- (e) *nontraditional problem solving tools* to permit a student to go beyond traditional paths.

PROGRAM OF STUDY

Within the framework of POLICY, PLANNING, and REGULATION, there are six areas of concentration: ENERGY, LAND USE, WATER RESOURCES, URBAN ECOSYSTEMS, WASTE MANAGEMENT and ENVIRONMENTAL COMMUNICATION. These concentrations are

designed to be broad-based; are not mutually exclusive and intergrade into each other to form a continuum; and some areas of pursuit belong to several concentrations, e.g., environmental assessment and impact analysis. Similarly, faculty interests are diverse and encompass more than one area of concentration.

A. Policy, Planning, and Regulation

FACULTY: BEHREND, DALL, FREY, GEIS, GRATZER, HENNIGAN, LAMBRIGHT, MONTEITH, NAKATSUGAWA, E. PALMER, J. PALMER, PORTER, REIMANN, ROWNTREE, SHIRVANI, SMARDON, YAVORSKY

Policy study, defined as the study of the nature, causes, and effects of alternative public policies, is the integrating force bringing all concentration study areas together in pursuit of the common goal of meaningful and effective research and education in environmental science.

Hence, the examination of policy by decomposition into its components and the design and synthesis of new alternatives, or *policy analysis*, forms a central core of the program. Policies formulated on the basis of contemporary scientific knowledge together with the societal, economic, and cultural values, pave the way for planning and regulation for environmental issues.

Through the study of public policy, students gain an understanding of the causes and consequences of policy decisions which will help integrate environmental knowledge with the scholarship of public administration and political science. This integration is necessary because the careers of graduates will either be directly in the public sector, or closely linked with government agencies. Second, an understanding of the causes and consequences of public policy assists students to solve practical problems. Such understanding is valuable in developing strategies and tactics to accomplish desired objectives. Third, the knowledge of public policy causes and consequences creates political awareness, a virtual necessity for any professional irrespective of the sector of employment.

An excellent example wherein policy and scientific knowledge are intended to be brought together for decisionmaking is the National Environmental Policy Act of 1969. By this Act, environmental impact statements which consider alternative courses for every stipulated development that has the potential for adverse environmental impact have become institutionalized. The Act provided for active citizen participation; any decisions that invoked the spirit of the Act could be challenged.

Students can opt to specialize in environmental assessment analyses through studies in any one of the GPES concentrations. In practice, such analyses are team efforts, and the program is intended to ensure that potential team members are conversant with, and operationally adapted to, the language and procedures of the disciplines involved. Starting with students who have an in-depth background in an established discipline or

profession (e.g., chemistry, biology, engineering, ecology, forestry), the program seeks to build upon existing strengths while broadening the student's ability to deal effectively with the complex, interdisciplinary problems which arise in studies of environmental impact.

B. Areas of Concentration

ENERGY

FACULTY: HAWKS, HERRINGTON, MONTEITH, NAKAS, D. PALMER, REIMANN, TANENBAUM, YAVORSKY

The Energy Concentration provides for study of fuel energy-environment-economy relationships with a focus in three areas: (1) *Conventional and Alternate Energy Sources*—the distribution, politics, and development of conventionally known sources (gas, oil, hydropower, coal, etc.) together with a search for strategies of exploring alternate sources; (2) *Conservation*—efficient use in industry, public and private sectors; and (3) *Reclamation of Disturbed Lands*—the rehabilitation of land mined for coal, tar sands, oil shales, and other materials and minerals. As an example, surface mining for coal is directly related to the overall energy scenario, and the use of coal will be intensified worldwide. This aspect of study is directly related to land use, water resources, air pollution, and waste management.

Recommended areas of study include, from (1) physical and engineering sciences: geology, chemistry, hydrology, engineering systems; (2) biological sciences: ecology, range management, forestry, agriculture; (3) social sciences: environmental law, sociology, and economics.

LAND USE

FACULTY: BEHREND, BROCKE, BURGESS, CHAMBERS, DINDAL, ESCHNER, FELLEMAN, GEIS, GRATZER, JOHN HASSETT, HAWKS, MCCLIMANS, MONTEITH, J. PALMER, PAYNE, PORTER, RAYNAL, REIMANN, ROWNTREE, SANDERS, SHIRVANI, SMARDON

The Land Use Concentration develops an understanding of present and future trends in the magnitude and patterns of land use and estimates future availability of land for multiple uses. It provides opportunity for economic, sociological, political, policy, planning, and ecological foci. It brings together an interdisciplinary mix of coursework, internship experience or research to address land use value conflict situations, ecologically-based land use considerations of carrying capacity, and appropriate means to anticipate and plan for existing and new land development technologies and processes. The following objectives are important: (a) to foster appropriate use of policy, planning, economic and legal devices for encouraging socially responsible use of the land; (b) to clarify the behavioral and perceptual sources of environmental problems and land use decisions; and (c) to develop, test, and refine methods for evaluating land use proposals with

important environmental consequences. Options for specialization include: (1) *Land Use Planning*, and (2) *Managed Land Use Patterns*.

Recommended areas of study include, from (1) physical sciences: energy exchange, soils, remote sensing, visual landscape analysis, meteorology, and soil and water conservation; (2) biological sciences: terrestrial community ecology, wildlife management, and silviculture; (3) social sciences: land use economics, environmental impact, transportation systems, environmental law, and environmental communications.

WATER RESOURCES

FACULTY: M. ALEXANDER, BLACK, BRANDT, BURGESS, ESCHNER, FELLEMAN, JAMES HASSETT, JOHN HASSETT, HENNIGAN, JOHNSON, McCLIMANS, MITCHELL, NAKAS, RINGLER, SCRUDATO, SMARDON, TULLY, WERNER

The Water Resources Concentration develops an understanding of both the technical information and transdisciplinary relationships of various *water-related* issues. Individual programs may emphasize scientific or social subject areas but all students acquire preparation in both areas. Scientific aspects include the basic physical, chemical, and biological interactions occurring in aquatic ecosystems under natural conditions, as well as under modified conditions that result from changes in water quality or quantity. The social aspects are concerned with planning, regulation, law and institutions, and management of water resources. Both as a resource for many human benefits and uses, and as a critical environmental element, water serves as a focus for graduate study in pollution and water quality control, and water and related land resources management. The transdisciplinary nature of the program requires a balance of depth, breadth, and synthesis of studies drawing together many diverse components.

Recommended areas of study include, from (1) physical sciences: civil engineering, geology, geomorphology, hydrology, meteorology, sanitary engineering, soils, and water chemistry; (2) biological sciences: ecology, entomology, fishery biology, forestry, microbiology, water quality, wildlife management, and zoology; (3) social sciences: administration, economics, government, history, law, and policy.

URBAN ECOSYSTEMS

FACULTY: BURGESS, HAWKS, HERRINGTON, J. PALMER, ROWNTREE, SANDERS, SHIRVANI, SMARDON, VANDRUFF

The Urban Ecosystems Concentration focuses on urban system structure and function using both analytic and synthetic techniques. Faculty expertise in soils, meteorology and hydrology, wildlife, energy and reclamation, forestry, design, and human attitudes and behavior combine to facilitate the systemic approach to the study of Urban Ecosystems. Three types of systems are available to the students for field work: (a) the nonmetro-

politan community typical of Upstate New York rural areas, (b) the metropolitan central city surrounded by suburbs and agricultural lands, and (c) the megalopolitan seaboard extending from Boston to Washington, D.C.

Recommended areas of study include, from (1) physical and engineering sciences: microclimate, water management, soils, remote sensing; (2) biological sciences: urban forestry, wildlife, greenspace silviculture, and botany; (3) social sciences: land economics, geography, human and cultural geography, and ecology.

WASTE MANAGEMENT

FACULTY: J. ALEXANDER, DINDAL, DURKIN, ESCHNER, FREY, HARTENSTEIN, JAMES HASSETT, JOHN HASSETT, HENNIGAN, JOHNSON, McCLIMANS, MITCHELL, MONTEITH, NAKAS, NAKATSUGAWA, SCRUDATO, TANENBAUM,

The Waste Management Concentration encompasses three subject areas: (1) *Toxic Waste Disposal*—Research into natural detoxification is an active and valuable component of waste management studies, and the nature, amounts and disposal/destruction in land fills, or by incineration, chemical neutralization, deep well injection, and ocean dumping are considered thoroughly. (2) *Biomass Utilization*—Includes the use of forest and agricultural wastes and other forms of biomass that have a vast potential for energy production and as biochemical feedstock. (3) *Biogeochemical Management of Wastes*—Waste materials may have unique features due to their specific chemical and physical composition, their temporal and spatial location, and their possible contamination by toxic substances. These waste materials may have useful nutrient and energy attributes which make them amenable for use through biogeochemical processes associated both with natural and man-made systems. They include wood product residuals, wastepaper, wastewater effluents, and sewage sludge.

Depending on subject areas chosen, students obtain an understanding of processes that generate waste; of community, chemical and microbial ecology; environmental chemistry including toxicology; wood chemistry; and implementation considerations including engineering and management components.

ENVIRONMENTAL COMMUNICATION

FACULTY: J. ALEXANDER, M. ALEXANDER, BRANDT, BURGESS, CHAMBERS, DINDAL, EHLING, ELY, HANSELMAN, NAKATSUGAWA, PAYNE, PORTER, STITELER, YAVORSKY

The Environmental Communication Concentration recognizes four general paths; (1) *Environmental Education and Interpretation*—Effective communication is a necessary element for fulfilling the social contract in democratic societies. A growing concern in the U.S. public for environmental quality reveals a new interest in the historic, cultural, and natural values associated with our environment. Education and interpretation provides

a continuum of environmental knowledge from awareness and appreciation to scientific concept understanding. (2) *Environmental Journalism and Media*—Students who choose this path share the same general objective as in (1) above; however, they specialize in presentation through mass media. (3) *Public Participation*—More interactive roles in decisionmaking must emphasize the skills and techniques of public participation. Tasks usually start with soliciting public comprehensions and opinions concerning specific environmental issues, and then employing information dissemination and public interaction. Skills and knowledge in social psychology, public relations, message design and presentation, law and government must be applied. (4) *Environmental Mediation*—The purpose here is to effect conflict resolution by avoiding legal action. The public's growing awareness of environmental values leads to increased conflict concerning their use. This new role of trained individuals is to understand the technical issues that underlie the dispute, identify affected groups, and apply various techniques for conflict resolution and group problem-solving.

Recommended areas of study include, from (1) physical sciences: environmental and organic chemistry, environmental geology, mineral resources, energy systems, and soil and water management and conversation; (2) biological sciences: ecology, entomology, and taxonomy; and (3) social sciences: planning, policy, information systems, and instructional technology, journalism, and law.

REQUIREMENTS

The general requirements of the program constitute a framework which encompasses the specific requirements of each area of concentration. In every case, the program of each student must meet the needs for *depth* in one area of concentration, *breadth* across at least two ancillary areas of concentration, and *analysis* and *synthesis* of information for evaluating environmental situations within the context of policy, planning, and regulation.

Each student must be adequately prepared in such fields as biology and chemistry, earth sciences and engineering, forestry and agriculture, social sciences and humanities, quantitative methods, and communications. Where preparation for entrance is found inadequate, admission may be made on a provisional basis pending the successful completion of deficiencies.

For students seeking a Master of Science degree, the following requirements apply: (a) 9 to 12 hours of general GPES courses at least 3 hours of which are in the policy studies areas; (b) 12 to 15 hours in the specific area of concentration in which specialization is chosen; and (c) 6 to 12 hours of research or study project resulting in a document which clearly demonstrates the graduate level independent accomplishments of the student, which is successfully defended in an oral examination and found acceptable. Study projects in the past have included paid internships with such organizations as the National Wildlife Federation, New York State (NYS) Legis-

lature, NYS Department of Environmental Conservation, NYS Energy Research and Development Authority, Agway, Inc., and Cablesystems of Syracuse. Additional coursework and a comprehensive examination may be substituted for research and study projects. Although a minimum of thirty graduate level credit hours are required by the College, the student's graduate committee (consisting of a Major Professor and two other members) may require additional credit hours.

Students seeking a Doctor of Philosophy degree must (a) pass a Preliminary examination, (b) satisfactorily complete the Candidacy examination administered upon the completion of coursework, and (c) prepare and successfully defend a doctoral dissertation. Although a definite number of credit hours is not stipulated, the Ph.D. in most cases requires thirty or more hours beyond the master's degree. The student's graduate committee (consisting of a Major Professor and three other members) determines the credit hours required, as well as the need for scholarly (e.g., foreign languages) and analytical tools.

Details on courses offered in this program and in the different Schools may be found in the College Catalog. Students seeking concurrent degrees with Syracuse University are advised to state that desire clearly in their applications; in such cases, students must also meet the entrance and degree requirements of the appropriate Syracuse University Colleges and Schools. However, students may not apply for the concurrent degree option until they have completed at least one semester of graduate level coursework and earned grades at a superior level.

FOREST TECHNICIAN PROGRAM

History and Description

In 1912, some 1,800 acres of land in the Adirondack Mountains were donated to the College as a site for the development of a Ranger School. Since that time, the Forest Technician Program has trained over 3,000 graduates, most of whom are now working in a variety of forest activities, and it has earned the Wanakena Campus a national reputation for excellence. The Program is administered by and is an integral part of the School of Forestry. This relatively unique model of a single professional School offering all levels of work from the technician through post-doctoral emphasizes the teamwork approach to forest resource science and management espoused by the School.

The two-year curriculum trains students as forest technicians. The degree of Associate in Applied Science in Forest Technology (A.A.S.) is awarded. The objectives of the curriculum are to provide students with a knowledge of the field practice of forestry as related to forestry managerial needs; the ability to work and communicate effectively with professional and paraprofessional forestry personnel; and an understanding of the sciences and practices of forestry with some emphasis on ecological applications.

Graduates are generally classified as forest technicians or forestry aides in initial employment positions. Forestry agencies and wood-using industries employ forest technicians as an important part of their forest management teams, usually as the "people on the ground" who plan and execute the field practice of forestry, normally under the supervision of a professional forester.

The curriculum is designed to allow graduates immediate job entry at the technician level. Students interested in a professional degree in forestry and resource management should investigate the School of Forestry's bachelor's degree curriculum described on page 131. However, it should be understood that transfer into the School's professional forestry curriculum, and other ESF bachelor's degree programs, is possible upon completion of the A.A.S. degree at Wanakena. There is also a transfer package agreement with the University of Michigan, School of Natural Resources, Forest Resources Program.

If a student feels transfer to a baccalaureate program is a possibility after graduation from the Forest Technician Program, he or she should pay close attention to the footnotes under "Freshman Year" on page 131.

The freshman year forest technology curriculum consists of general studies courses which may be taken at any accredited four-year college, community or junior college, or agricultural and technical institute except Farmingdale or Alfred (although transfer credits from these schools are acceptable otherwise).

The second year of the curriculum is offered at the School of Forestry's Forest Technician Program on the Wanakena Campus. Presented in a varied forest environment, the curriculum's emphasis is on fundamental forestry knowledge and applied field training as well as the relationships between forest technology and managerial needs. Fifty percent of the studies are devoted to field exercises, most of which are held on the School's forest. This managed forest, containing both hardwood and coniferous species, covers an area some $3\frac{1}{2}$ miles long with widths varying up to $2\frac{1}{4}$ miles. On two sides, the forest is bounded by State Forest Preserve lands. The forest is also adjacent to several square miles of virgin timber within the Adirondack Forest Preserve. This excellent forest backdrop for the technology program provides a diverse laboratory for instructional purposes.

Since the Program is situated within a forest environment, some applicants may mistakenly believe that the forest technology program is one of forest lore and wilderness survival. It is, therefore, strongly emphasized that the forest technician curriculum demands high quality academic achievement. Students cannot complete the program without concentrated and consistent study. Classes are scheduled from 8 a.m. to 5 p.m., Monday through Friday, with classroom and laboratory or field time equally divided. The intensity of the program normally requires a minimum of 70 hours a week of evening and weekend study, daily classes, and laboratory/field exercises. Several short trips, at no additional expense to the student, are made during the year in connection with courses in dendrology, silviculture, forest management, forest recreation, wildlife ecology, and surveying.

LIFE AT WANAKENA

The Wanakena Campus of the College of Environmental Science and Forestry is located on the banks of the Oswegatchie River near the hamlet of Wanakena, approximately 65 miles northeast of Watertown, and 35 miles west of Tupper Lake. The Program's buildings and its surrounding forest border on the river which flows directly into Cranberry Lake.

The main Program building consists of a central service unit with dormitory wings on either side. The central unit contains classrooms, laboratories, a student lounge, faculty offices, the library, a kitchen, dining room and 47 student rooms, each housing two students.

Faculty houses are nearby on the campus. Other buildings include a maintenance shop, garages, a sugar house, and storage buildings.

The close proximity of faculty offices and student quarters and the intensive field-work pattern enables students to consult easily and frequently with the faculty. The Program considers this traditional close student-faculty association to be of major benefit in its training program.

A small library of approximately 1,500 volumes consists of highly specialized materials required for the teaching and study programs of the curriculum.

Students taking the second year of the forest technician curriculum at the Wanakena Campus are required to live in the campus's dormitories. An exception may be made for married students who bring their families and rent their own private accommodations in the vicinity. Such accommodations are not plentiful. Each married student should make rental arrangements well in advance of the registration date.

The Wanakena Campus does not maintain an infirmary, nor does it employ a physician or nurse. There are two excellent physicians and a dentist as well as an excellent Community Hospital in nearby Star Lake, New York. In emergency situations, the Program transports sick or injured students to the local physician of their choice or to the hospital. A student accident or sickness insurance plan is available through the Wanakena Campus, and it is strongly suggested that the student consider such coverage before reporting to the Campus.

Because of the comparatively isolated location of the Wanakena Campus, a stock of books and supplies used in connection with the second year of the program is maintained on campus for sale to students.

During the first year of the program, College-enrolled students will be guided by the rules and regulations that govern attendance at their local campus. During the second year of the program, students will be guided by the general rules and regulations for College of Environmental Science and Forestry students and an additional set of Wanakena Campus "house rules."

ADMISSION

Admission Requirements

Requirements for entrance into the forest technician curriculum require a minimum of high school units consisting of: English; history (social science); science (including biology); mathematics (including trigonometry or Math

11); and electives. Mechanical drawing, technical report writing, and computer science are suggested electives.

In addition to the academic requirements, the following must also be met by all applicants:

1. The applicant must be strongly motivated toward a career as a forest technician.
2. The applicant must be willing and able to meet the physical requirements of the program which include pole and tree climbing, walking 2 to 6 miles through forest areas often carrying 15-20 pounds of equipment, and using a wide array of hand tools and power equipment.
3. The applicant's parents (if the applicant is under 18 years of age) must be fully aware of the field nature of the study program; its rigorous study-work regime and supporting academic facilities.
4. A full medical examination report must be submitted.

Questions concerning any of these requirements should be referred to the Director of Admissions who may, under special circumstances, waive some of them.

Admission Procedures

The decision to admit any student to the Forest Technician Program rests solely with the College of Environmental Science and Forestry. Most openings in the program are filled by students who received conditional acceptances while still seniors in high school, contingent on successful completion of the first year of college. Remaining openings are filled by transfer students who have already attended college. Therefore, it is suggested that the potential forest technician student apply while still a high school senior.

Here is the procedure:

1. Seniors in high school must submit a regular SUNY freshman application for the College of Environmental Science and Forestry, using a Curriculum Code 620 (Forest Technology). These applicants should indicate entry date to be one year in advance of the current year.
2. Submit a regular application to that school selected for the first year of study, using Curriculum Code 620. It is important that students gain entry on their own for the first year of studies. The College will request information at a later date concerning what institution the student will be attending.

Transfer Students

Students with previous college experience, or students who are currently enrolled at another college, may apply for transfer. However, courses transferred for credit can be applied only to the freshman year course of studies, and they must be appropriate to those courses and comparable in

subject matter, content, and level. All second year courses must be taken at the Wanakena Campus and, therefore, a student cannot transfer any previously earned credit toward the second year. Transfer applicants must submit a recent official copy of their college transcript and a list of courses they anticipate completing prior to enrollment.

EXPENSES

Cost of the first year will vary with the specific institution attended.

Estimated costs of the second year program on the Wanakena Campus are as follows:

	<i>Tuition</i>	<i>Board & Room</i>	<i>Books & Supplies</i>
New York Resident	\$1,350	Approx. \$2,455	Approx. \$700
Nonresident	\$2,650	Approx. \$2,455	Approx. \$700

An additional estimated expense of \$200 will likely be incurred to cover the cost of laundry and clothing. There is also a \$20 graduation fee and a \$13 student activity fee, plus a \$25 residence deposit and a \$25 equipment deposit. The latter two fees are fully or partially refundable, depending on breakage charged to a student during the year.

FOREST TECHNOLOGY CURRICULUM (Associate of Applied Science Degree)

Freshman Year	<i>Credit Hours</i>
<i>(Completed at a college of the student's choice)</i>	
¹ General Biology	8
English (A technical report writing course is highly recommended.) ..	6
² Math	6
Economics	3
³ Electives	7
	30

¹Courses selected may be in general biology, but at least one course in introductory botany is preferred.

²Competency in plane trigonometry and college algebra is required. If demonstrated, credits become electives. If a student feels transfer to a baccalaureate program is a possibility, he would be well advised to take calculus.

³If a student feels transfer to a baccalaureate program is a possibility, general chemistry and physics should be taken as electives. Otherwise, courses in sociology, psychology, political science, geology, soils, accounting, business, computer science, etc. are desirable electives.

Senior Year (Wanakena Campus)	<i>Credit Hours</i>
<i>First Semester</i> FTC 200 Dendrology I	2
FTC 202 Plane Surveying I	4
FTC 204 Forest Mensuration and Statistics I	3½
FTC 206 Forest Ecology	3
FTC 207 Aerial Photogrammetry	2
FTC 208 Forest Installations	3
FTC 213 Forest Protection I	2
FTC 223 Graphics	1
	20½

Second Semester	FTC 203	Plane Surveying II	1
	FTC 205	Forest Mensuration and Statistics II	2
	FTC 209	Forest Roads	2
	FTC 211	Silviculture	2½
	FTC 214	Personnel Management	1½
	FTC 215	Timber Harvesting	2
	FTC 217	Forest Management	2½
	FTC 218	Forest Recreation	1½
	FTC 219	Elements of Wildlife Ecology	1½
	FTC 221	Soil and Water Measurements	1½
	FTC 227	Forest Protection II	2
	FTC 228	Structure and Growth of Trees	1½
	FTC 229	Silviculture II	
		or	2
	FTC 230	Plane Surveying III	
			23½

A total of 74 credit hours is required. Upon satisfactory completion, an Associate of Applied Science (A.A.S.) degree in Forest Technology will be awarded.

FINANCIAL ASSISTANCE

Financial aid is available upon acceptance to the College of Environmental Science and Forestry. There are three basic loans, scholarships or grants, and part-time employment.

More detailed information on these financial aid opportunities can be found on pages 32-38 of this catalog and the publication *Financial Assistance at ESF*.

The student must file an application with the Office of Financial Aid at the Syracuse Campus and submit a *Family Financial Statement* to ACT, Iowa City, Iowa 52243.

PLACEMENT

The School assists in placement of graduates. The reputation of the School of Forestry's Forest Technician Program assists graduates to find employment. Employment is common with local, state and federal forestry, and land resource agencies, private forestry enterprises, and surveying firms. Positions most frequently filled by recent graduates include: state forest ranger, state forest technician, forest aide, industrial forest district supervisor, timber inventory specialist, timber sales supervisor, forest surveyor, forest engineering aide, forest protection technician, forest research technician, forest equipment salesman, tree service technician and urban park ranger.

Graduate Exchange Programs

INTERCAMPUS DOCTORAL EXCHANGE

There is an opportunity for doctoral students at ESF to study for one or two semesters at the following schools: State University Centers at Albany, Binghamton, Buffalo, or Stony Brook; City University of New York; or New York University.

This exchange program provides students with an opportunity to take advantage of over 160 faculty, specialized research laboratories and equipment, technical libraries, and field study areas which complement the extensive programs and resources at ESF which are discussed throughout this catalog.

This fellowship provides a grant-in-aid of up to \$5,000 a year and may include a tuition waiver. For further information, please contact the Office of Academic Programs.

COLLEGE OF AGRICULTURE AND LIFE SCIENCES AT CORNELL UNIVERSITY

The State University of New York College of Environmental Science and Forestry and the New York State College of Agriculture and Life Sciences at Cornell University provide an opportunity to exchange graduate students so they can take advantage of special courses, faculty, and research facilities.

There are a number of programs on both campuses which complement one another. The following research and instructional areas at the College of Agriculture and Life Sciences appear likely to be of greatest interest to ESF students:

Agricultural Economics—Land Economics; Resource Economics; Resource Investment and Environmental Quality; Agricultural Land Policy.

Agricultural Engineering—Physical Analysis of Plant and Animal Materials; Soil and Water Engineering; Environmental Systems Analysis; Drainage Engineering; Soil and Water Conservation.

Agronomy—Identification, Appraisal and Geography of Soils; Soil Fertility Management; Soil and Water Conservation; Aquatic Plant Management; Forest Soils; Soil Microbiology; Microbial Ecology; Use of Soil Information and Maps as Resource Inventories; Soil Organic Matter; Soil Chemistry; Weed Science; Dynamic Climatology; Physics of Clouds, Rain, and Rainmaking.

Natural Resources—Wildlife and Fisheries Management; Environmental Conservation; Resource Analysis and Planning; Woodland Management; Forest Ecology; Maple Syrup Production.

Floriculture—Woody Plant Materials; Herbaceous Plant Materials; Plants and Design.

Entomology—Insect Pest Management; Arthropod Pests of World Importance; Biological Control; Insect Pathology; Environmental Biology; Pesticides in the Environment.

Plant Breeding and Pathology—Plant Cell Genetics; Methods of Plant Breeding; Genetics and Breeding for Disease and Insect Resistance; Plant Pathology; Advanced Disease Control; Dendropathology; Pest Management for Plant Protection; Advanced Mycology; Plant Virology; Plant Nematology; Bacterial Plant Pathogens; Disease Physiology; Philosophy of Plant Pathology; Taxonomy of Fungi; Pathology of Trees and Shrubs.

Pomology—Tree Fruits; Orchard Management; Growth and Development of Woody Plants.

Rural Sociology—Rural Development and Cultural Change; Political Structure and Development; Social Power and Community Change; Political Economy of Rural and Regional Development.

For detailed information please contact the Office of Academic Programs.



Course Offerings

Students at the College of Environmental Science and Forestry have not only the academic and research resources of their own institution, but also the resources of nearby Syracuse University and State University Upstate Medical Center.

COLLEGE OF ENVIRONMENTAL SCIENCE AND FORESTRY COURSE DESCRIPTIONS

The courses offered by the College are grouped by general subject areas, and the number of credit hours appears after the course title. A credit hour means one recitation (or lecture) hour per week. Three laboratory hours are equivalent to one lecture hour.

The semester(s) after each course indicates when it is normally offered. The College reserves the right to alter the scheduled offering of a course when its enrollment is too small, or when there is no qualified faculty member available to teach it.

Courses listed in this catalog are subject to change through normal academic channels. New courses, course deletions, and changes in courses are initiated by the cognizant departments or programs, approved by the appropriate academic dean, faculty committee, and the college faculty.

Course Numbering System

Code Levels:

- 100-299 Lower-division undergraduate courses for which no graduate credit may be given.
 300-499 Upper-division undergraduate courses for which no graduate credit may be given.
 500-599 Graduate courses designed expressly for areas of specialization in post-baccalaureate programs or in the professional program leading to the Bachelor of Landscape Architecture. Undergraduate students with superior academic records may register for these courses.
 600-699 Graduate courses which permit undergraduate students to enroll only by petition with a well-documented justification approved by the undergraduate advisor, curriculum director, and course instructor.
 700-999 Graduate courses for which no undergraduate may enroll.

General Subject Areas

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APM—APPLIED MATHEMATICS

360. Introduction to Computer Programming (3)

The basic course in computer use offered by the College. It is intended to provide the student with the skill and understanding needed to utilize digital computer languages for problem solving. The course will cover instruction in APL, FORTRAN IV, use of operating systems, and some background material in general hardware/software designs. Fall and Spring.

391. Introduction to Probability and Statistics (3)

Two hours of lecture, three hours of laboratory. Elementary probability, theoretical and sampling distributions, hypothesis testing, statistical estimation, analysis of variance, regression and correlation, nonparametrics and sampling concepts. Spring.

Prerequisite: Two semesters of calculus.

492. Forest Biometrics (3)

Two hours of lecture, three hours of laboratory. Analysis of variance including nested and cross-classification. Matrix approach to multiple linear regression and weighted least squares. Nonlinear regression. Sampling methods and design. Applications to forestry problems. Fall.

Prerequisite: APM 391 or equivalent.

500. Introduction to Computer Programming for Graduate Students (3)

A basic course in computer usage. Provides the skill needed to utilize digital computer languages for problem solving. Includes a study of FORTRAN IV and APL with a discussion of an Assembly Language. Other topics include representation of information, management of files, error control, operational systems and job control. Fall and Spring.

510. Statistical Analysis (3)

Two hours of lecture and three hours of laboratory. A treatment of statistical inference, including paired design, group design, linear regression and correlation, one way analysis of variance and some applications of chi-square. Calculation of statistics, test of hypotheses and proper interpretation of calculated statistics. Fall.

605. Theory of Probability Distributions (1-3)

Three hours of weekly sessions over five to 14 weeks. Statistical problems and mathematical models; random experiments, random variables, probability, frequency and distribution functions of discrete, continuous and mixed random variables; functions of random variables and the probability distributions; mathematical expectation and its applications; discussion of the main theoretical distributions such as binomial, Poisson, negative binomial, normal, Gamma, Beta, exponential and others; applications of this framework to the model construction problem in the statistical, operations research and forest mensuration areas. Fall or Spring.

Prerequisites: Two semesters of differential and integral calculus and an introductory course in statistics, or permission of the instructor. The course can be taken in conjunction with APM 651—Operations Research I (for one credit hour) or independent of it for one to three credit hours.

620. Analysis of Variance (3)

Three hours of lecture and recitation and three hours of laboratory. Multiway classifications in the analysis of variance, with emphasis on the development of models, including randomized blocks, latin squares, split plots, and factorial designs with fixed effects, random effects, and mixed effects; multiple and partial regression and correlation (including curvilinear), using matrix methods; analysis of covariance. Fall.

Prerequisites: Graduate standing and an introductory course in statistics covering material through the one-way analysis of variance.

625. Introduction to Sampling Techniques (3)

Two hours of lecture and three hours of laboratory. Introduction to the scientific basis of sampling: selecting an appropriate sampling unit; choosing an efficient design; calculating sampling error; determining a sample size to meet stated objectives. Fall.

Prerequisite: APM 391 or equivalent.

630. Regression Techniques with Applications to Forestry (3)

Two one and one-half hours of lecture. Review of matrix algebra, probability theory and statistical methods. Basic concepts in regression analysis. Classical linear regression model. Least and weighted least squares method. Dummy variables and their uses in regression and covariance analysis. Applications to problems of statistical prediction and estimation from the field of forestry in general and forest mensuration and inventory in particular. Fall.

Prerequisite: APM 391 or equivalent.

635. Multivariate Statistical Methods (3)

Estimation and inference for the multivariate normal distribution. Multivariate analysis of variances, factor analysis, principal components analysis, canonical correlation, discriminant analysis, cluster analysis. Spring.

Prerequisite: One semester of statistics.

651. Operations Research I (3)

Two one and one-half hours of lecture. Stochastic OR models applicable to managerial process or systems analysis. Elements of probability theory, theory of games and decision theory, queuing model, simulation techniques with applications to queuing and inventory problems, and, if time permits, Markov chains. Fall.

Prerequisites: APM 391 and MAT 227 or equivalent.

652. Operations Research II (3)

Two one and one-half hours of lecture. Deterministic OR models applicable to managerial problems or systems analysis. Elements of Matrix Algebra, solving simultaneous linear equations, mathematical programming, classical optimization techniques, Lagrange multipliers. Linear programming transportation and allocation models, dynamic programming, network analysis and, if time permits, quadratic, parametric and integer programming. Spring.

Prerequisites: APM 391 and MAT 227 or equivalent.

CMN—COMMUNICATIONS (LANDSCAPE ARCHITECTURE)

(See also courses listed below under EIN and LSA.)

380. Technical Drawing I (1)

One three-hour drafting room period. Elements of perspective, isometric, oblique, and orthographic projection. Practice in freehand and instrument drawing. Fall.

381. Technical Drawing II (2)

Two three-hour drafting room periods. Elements of perspective, isometric, oblique, and orthographic projection. Practical applications of these principles in machine and architectural drawing, including piping and electrical drawings. Spring.

382. Graphic Communication (2)

Two three-hour studios with up to one hour of studio per week devoted to group presentation meetings, instruction, and review of new techniques such as diagramming, drafting, perspective, and plan graphics. Drawings, examinations, and a final portfolio constitute the basis for grades. Fall.

482. Advanced Graphic Media (1-3)

Three hours of studio. Discussions, demonstrations, critiques and individual study. Study oriented toward perception and self-expression, use and possibilities of various media, as selected by student and instructor. Fall and Spring.

Prerequisites: Prior art media training or experience and permission of the instructor.

530. Environmental Communications Studio (2)

Three-hour studio and one-hour discussion. For seniors and graduate students, this course offers the opportunity for students to apply communications theory and strategies through the planning, production, and display of media projects developed around the student's area of professional interest. Enrollment limited to 20 students. Fall.

Prerequisite: CMN 531 or permission of the instructor.

531. Environmental Communications (3)

Three hours of lecture/discussion. An introductory course for seniors and graduate students which presents techniques and processes in education and communications applicable in environmental science, management, planning, and design. Topics include basic teaching, learning and communications theory and strategy, working with the press, electronic media, gaming and simulation, public address techniques, slide/tape production and use, film production and use. Spring.

637. Environmental Communications Project (1-3)

This course is designed to give graduate students an opportunity to work as a team in identifying, developing, administering, and evaluating a communications project related to an environmental issue. Typically, a workshop or shortcourse will be developed and offered for some targeted public through the School of Continuing Education. The nature of the topic and format of the project will be determined according to experience background of students enrolled. Task responsibilities and time commitments are correlated with number of hours for which student has registered. Spring.

682. Video Communications (3)

Three hours of studio plus lecture. This course will provide students with instruction and experience in the skills necessary to provide video tape programs. Each student will prepare and develop a video script for production of a program on an assigned topic. Completed programs will be tested and evaluated. Class size is limited. Fall and Spring.

Prerequisite: Permission of the instructor.

738. Environmental Education Programs of Agencies and Institutions (1-3)

One three-hour seminar session. An analysis of contemporary environmental education objectives, methodologies, and philosophies employed by various public and private institutions. Attendance, readings, and short paper required for one-hour credit. For two or three hours credit, and individual investigation of the environmental education and communications activity of an agency or organization is also required. Fall.

EIN—ENVIRONMENTAL INFLUENCES (LANDSCAPE ARCHITECTURE)

(See also courses listed under CMN and LSA.)

300. Introduction to Environmental Studies (3)

Three hours of lecture and discussion per week on the interrelationships among the natural environment, people, and the human environment. Emphasis is placed on developing critical facilities and systems thinking useful for assessing environmental issues. Fall.

Prerequisite: Permission of the instructor.

311. Natural Processes in Planning and Design (3)

Section 1: Landform and Soils

Section 2: Hydrology, Climate and Energy

Section 3: Plant, Animal, and Human Ecology

Three hours of lecture. This course presents an overview of the basic principles governing the dynamics of natural resources and processes which should be understood in planning and designing the human landscape. In each section, sources of reference data application to planning and project scale design will be discussed. Occasional local field trips will be utilized. Fall.

Prerequisite: Permission of the instructor.

371. History of American Landscape Attitudes (3)

Three hours of lecture-discussion. This course presents, through lectures, readings, and slides, uniquely American historical attitudes toward land and nature as shown through various cultural activities and disciplines, such as painting, architecture, landscape architecture, religion, philosophy, utopianism, exploration and recreation, land development and economics, and certain technological developments. Cultural expressions of the 19th century will be of primary interest, but formative attitudes from the Colonial period and certain 20th century results will be included. One-third to one-half of lecture periods are given over to student reports, criticism, and discussion. Spring.

Prerequisite: Permission of the instructor.

390. Social/Cultural Influences and Environmental Form (3)

Three hours of lecture. This course provides an introduction to an interdisciplinary social science analysis of human settlements. The course introduces the basic concepts, vocabulary, theories, and units of analysis for an interdisciplinary social perspective of the environmental form of human settlements. As such, it focuses upon developing an understanding of the context for the planning and design of human settlements. Course requirements include readings, examinations, and reports. Field trips may be scheduled. Spring.

451. Fundamentals of City and Regional Planning (3)

Three hours of lecture. An introductory survey course in planning. The historical development of American City and Regional Planning, theories of the planning process, the role of planning in public decisionmaking, landmark legislation and judicial decision related to planning, and approaches to controlling land use will be presented. Fall.

452. Simulated Planning in Metropolitan Systems: Theory and Practice (3)

Three hours of laboratory, two hours of lecture/discussion. A computerized simulation designed to provide an understanding of the decisionmaking environment of metropolitan planning. Each participant is assigned a role consistent with his/her background. Lectures provide a theoretical framework for the activities in the simulation; a discussion section provides for evaluation. Computer experience is not necessary. Spring.

470. Art History (3)

Three hours of lecture. Informal lectures will emphasize and review assigned text and other readings and handout notes. Slides will be shown regularly; reports, quizzes and examinations. Evolutionary nature of the main cultural periods of Western man and fine art as man's selected environment will be the course emphasis. Spring.

Prerequisite: Permission of the instructor.

471. History of Landscape Architecture (3)

Three hours of lecture. Informal lectures and class participation, reports, assigned text and assigned reserve shelf reading, optional text and handout notes, quizzes and exams. Slides. Historical study and style analysis of Western man's efforts to design his environment and his changing attitudes and relationships to environment. Also, non-Western coverage where significant or influential on Western Man. Study of historical personalities as well as periods that are of environmental concern up into the modern period. Fall.

Prerequisite: Permission of the instructor.

510. Creative Problem Solving Seminar (3)

Three hours of lecture and discussion. A course designed to extend the student's understanding and application of creative problem solving processes. One requirement will be to select and carry out an application of the techniques to a particular problem, with consultation and guidance from the instructor. Critique and survey of the literature on creativity, in-depth analysis of the synectics process, and various procedures which have been developed for nurturing creative behavior comprise the essence of the program. Spring.

Prerequisite: Undergraduate degree or permission of the instructor.

ENS—ENVIRONMENTAL SCIENCE**796. Special Topics in Environmental Science and Policy (1-3)**

Lectures and discussion, seminars, conferences and group research on topics of special or current interest, in fields related to environmental science and policy. See schedule of classes for current offerings. Fall and Spring.

797. Environmental Science Seminar (1-2)

Discussion of current topics and research related to environmental science. Fall and Spring.

798. Problems in Environmental Science and Policy (Credit hours to be arranged)

Individualized, special study of environmental science and policy subjects and issues. Comprehensive oral or written report required for some problems. Fall, Spring, and Summer.

898. Professional Experience (1-12)

Professional experience which applies, enriches, and/or complements formal coursework. Graded on an "S/U" basis. Fall, Spring, and Summer.

899. Master's Thesis Research (Credit hours to be arranged)

Research and independent study for the master's degree and thesis. Fall, Spring, and Summer.

999. Doctoral Thesis Research (Credit hours to be arranged)

Research and independent study for the doctoral degree and dissertation. Fall, Spring, and Summer.

The following courses offered by the College and Syracuse University are especially useful to graduate students in GPES:

School of Forestry

RMP 587	Environmental Law
RMP 588	Law of Natural Resources Administration
RMP 602	Resource Economics
RMP 603	Research Methods
RMP 629	Environmental Impact
RMP 643	Urban Water Resources
RMP 664	Soil and Water Conservation
RMP 753	Resources Policy

School of Environmental and Resource Engineering

ERE 612	Energy
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Syracuse University

GEO 558	Environmental Quality Analysis
GEO 613	New York State: Problems and Prospects
GEO 790	Economic Growth and the Natural Environment
PLA 626	Planning and Policy Analysis
PPA 631	Advanced Public Administration
PPA 701	Washington Seminar: Public Policy and Administration
PPA 707	National Planning
PPA 743	Administrative Law
PPA 745	Intergovernmental Relations
SOC 704	Science, Technology and Society
PTS/NAS 532	Progress and Technology
PTS/NAS 551	Alternative Futures for Technological Society
LPP 675	Environmental Issues in Management

ERE—ENGINEERING (ENVIRONMENTAL AND RESOURCE ENGINEERING)**306. Elements of Map and Air Photo Interpretation (1)**

Two hours of lecture and three hours of laboratory per week for five weeks of a semester. Introduction to map and photograph interpretation to extract information useful to site inventory, analysis, planning, and design activities. The physical and geometric properties of maps and photographs, the characteristics of information contained in them, and the principles and procedures of interpretation are discussed. Spring.

Prerequisite: Junior standing in Landscape Architecture.

308. Elements of Plane Surveying (1)

Two hours of lecture and three hours of laboratory per week for the last five weeks of the semester. Introduction to the principles and procedures of plane surveying for mapping and construction layout purposes. Topics briefly discussed include the basic mathematical principles of surveying, the types and uses of surveying, horizontal and vertical distance measurement, angle measurement, traversing and computations, construction layout, tacheometry, and surveying errors (and their treatment). Spring.

Prerequisites: Junior standing in Landscape Architecture and college level plane trigonometry.

320. APL for Engineers and Scientists (2 or 3)

Programming and operation of time-sharing digital computer systems via the APL language. Analysis, modeling, and solution of basic problems in environmental science and engineering. Students desiring three credits will complete an original, substantial term project. Spring.

Prerequisites: Calculus and physics or permission of the instructor.

321. Analog Computation for Engineers and Scientists (1 or 2)

Programming and operation of electronic analog computers. Analysis, modeling, and simulation of dynamic phenomena and systems in environmental science and engineering. Students desiring two credits will complete an original term project. Fall or Spring.

Prerequisites: Calculus and physics or permission of the instructor.

342. Hydraulics in Construction (4)

Three hours of lecture, three hours of laboratory. The physical, mechanical, thermal, and hydraulic properties of fluids relevant to the construction industry. A study of solutions to hydraulic problems in contemporary construction activities. Not open for credit to forest engineering students. Spring.

Prerequisites: Physics and differential calculus.

350. Wood Preservation (2)

Two hours of lecture with some demonstrations. A survey of basic wood-water relationships, shrinking and swelling, elementary wood structure, wood permeability, capillary forces, heat transmission, agencies of wood deterioration, wood preservation processes, wood fire performance, fire tests, and fire retardant treatments. Not open to WPE students. Fall.

351. Basic Engineering Thermodynamics (2)

Principles of energy conservation and conversion: first and second laws. Relation to PVT behavior, property functions, equilibria, and heat and mass transfer. Introduction to engineering problem analysis and computer methods. Spring.

Prerequisites: Physics, general chemistry, and calculus. Not open for credit to students who have completed successfully FCH 360 or equivalent.

352. Applied Engineering Thermodynamics (2)

Classical principles applied to devices and systems. Emphasis on efficient design of manufacturing equipment and processes. Power and refrigeration cycles; energy conversion; materials recovery. Environmental case studies and design project. Computer-aided data correlation and system simulation. Spring.

Prerequisites: ERE 351, FCH 360, or equivalent.

362. Mechanics of Materials (3)

Three hours of lecture. Theories of stress, deformation, and stability of common structural materials subjected to various force systems. Fall.

Prerequisites: Integral calculus and statics.

364. Engineering Materials (3)

Two hours of lecture and one three-hour laboratory per week. An introduction to the study of materials science emphasizing the structure and properties of materials used in the construction industry in general. Lab work includes fabrication, testing, and evaluation of actual systems. Spring.

Prerequisites: Junior standing, physics, chemistry, and engineering mechanics.

371. Surveying for Engineers (3)

Two hours of lecture and recitation and three hours of laboratory. The principles of plane surveying for engineers. Subject matter areas include introduction to the theory of measurement and errors. Linear and angular measurements in both the horizontal and vertical planes, traversing and computations, horizontal and vertical control and associated computations, areal and volumetric computation, circular and parabolic curves, state plane coordinates, public land surveys, and the analysis and treatment of systematic and random errors. Laboratory field work and computations culminate in a topographic map. Fall.

Prerequisites: Differential and integral calculus.

375. Elementary Corrosion**(1)**

One hour of lecture. Basic electro-chemistry, film formation and passivation, galvanic corrosion and pitting, cathodic and anodic protection, protective coatings and inhibitors. Application of the above in the home, car, field, at sea, and in industrial plants. Spring.

377. Process Control**(3)**

Three hours of lecture. The study of the principles of process control both with and without electronic computers. The emphasis is on sensing and control elements, signal transmission, non-computerized controllers, conversion of signals to digital input for computer programs, control problems such as lag and errors, and applications with emphasis on the paper industry. Spring.

Prerequisite: College level physics.

420. Computer Applications in Science and Engineering**(3)**

Principles and methods of mathematical modeling for analog and digital computer solution. Applications to data reduction and correlation, statistical analysis, process and equipment simulation, optimization and control, and computer-assisted instruction. Typical examples, class problems and student projects. Current status and future projection of computation equipment, software and operating techniques. Fall.

Prerequisites: Calculus and computer programming, or permission of the instructor.

440. Water Pollution Engineering**(3)**

Two hours of lecture and three hours of laboratory. Introduction to the physical, chemical, and biological parameters of waste water treatment processes and to the principles of the unit operations involved. Study of the design parameters and design procedures of waste water treatment systems. Spring.

Prerequisites: Physics and CHE 356 or equivalent.

441. Air Pollution Engineering**(3)**

Three hours of lecture and discussions. Study of the chemical, physical and meteorological principles of air pollution and its control. Local and global effects of air pollution. The atmospheric survey. Examination of the operating principles and design parameters of the various air pollution control systems. Air quality and emission standards. Fall.

Prerequisites: Physics and CHE 356 or equivalent.

488. Engineering Economics**(1)**

One hour of lecture and three hours of laboratory; first half of semester. This course provides students with the tools to understand the economic aspects of engineering and to evaluate engineering proposals in terms of worth and cost. Coverage extends through alternatives analysis, using rate of return, present worth, average annual cost and other methods, and evaluation of public activities, focusing on benefit-cost analysis. Spring.

496. Special Topics**(1-3)**

Lectures, readings, problems, and discussions. Topics as announced in the areas of environmental or resource engineering. Fall and/or Spring.

563. Photogrammetry I**(3)**

Two hours of lecture and discussion, three hours of laboratory and discussion. Basic photogrammetric and photo interpretation concepts as a means of acquiring reliable data for engineering and management planning. Potentials, limitations, instrumentation and unique requirements are considered. Fall and Spring.

Prerequisite: ERE 371 or equivalent.

585. Microscopy and Photomicrography**(3)**

Two hours of lecture, one hour of demonstration, and three to five hours of laboratory. Principles of light microscopy and photomicrography with extensive laboratory practice. Introduction to scanning and transmission electron microscopy. Fall.

Prerequisite: Permission of the instructor.

596. Special Topics**(1-3)**

Lectures, conferences, discussions, and laboratory. Topics in environmental and resource engineering not covered in established courses. Designed for the beginning graduate student or selected upper division undergraduate. Fall and/or Spring.

610. Energy: Alternate Systems (3)

Three hours of lecture. An introduction to alternate energy resources and conversion processes. Focus is on relatively small-capacity, decentralized systems and means for judging appropriateness, costs, and impacts of application under varying conditions and needs. Fall.

611. Energy: Production and Conservation (3)

Three hours of lecture. An introduction to the technology, impacts, hazards, and costs of large-scale, centralized power generation, with emphasis on opportunities for resource conservation. Spring.

640. Water Resource Systems (3)

Three hours of lecture and discussion. Fundamentals of the systems approach to complex water resource problems. Characteristics of water resource systems, related to systems engineering methodologies. Quantitative and qualitative subsystems are considered in a technical nature which exposes the socio-legal-political interfaces of water resource decisionmaking. Spring.

Prerequisite: FEG 340 or equivalent.

642. Water Quality Modeling (3)

Two hours of lecture and three hours of laboratory per week. An analysis of the biological, chemical, and physical factors of receiving waters governing the action of wastes and their reactions in receiving waters. Introduction to modeling techniques applicable to water quality management issues. Fall.

Prerequisite: ERE 440 or equivalent as evaluated by the instructor.

643. Water Pollution Engineering (3)

Two hours of lecture and three hours of laboratory. Introduction to the physical, chemical, and biological parameters of waste water treatment processes and to the principles of the unit operations involved. Study of the design parameters and design procedures of waste water treatment systems. Spring.

Prerequisites: Physics and CHE 356 or permission of the instructor.

Note: A student may not enroll in or receive credit for both ERE 440 and ERE 643.

652. Remote Sensing Interpretation (3)

Two hours of lecture and three hours of laboratory. Introduction with a qualitative emphasis on the fundamentals of acquiring, analyzing, and utilizing remote sensing data in the performance of natural resource inventories, environmental quality surveys, site development studies and land use analyses. Oriented for multidisciplinary participation. Fall and/or Spring.

Prerequisites: Physics and calculus or permission of the instructor.

Note: Not open to students having previous credit for FEG 352.

655. Remote Sensing Measurements (3)

Two hours of lecture comprising an in-depth coverage of the theory, design, and application of remote sensing systems and techniques employed to obtain precise spectroradiometric measurements to map and monitor natural resources. Photographic and non-photographic systems are considered. Laboratory experiments in the form of an assignment using remote sensing data. Fall or Spring.

Prerequisites: ERE 572 and FEG 363 or ERE 563 or consent of the instructor.

658. Geometric Geodesy (3)

An introductory graduate level course for those without previous background in theoretical geodesy. Topics covered include position determination for short and long lines on the ellipsoid, the ellipsoidal triangle, the parametric equations, three-dimensional geodesy, and mappings of the ellipsoid. Fall.

Prerequisite: Permission of the instructor.

659. Astronomic and Gravimetric Geodesy (3)

An introductory graduate level course in geodetic astronomy and the gravity field of the earth. Topics covered include updating star positions; precise time keeping; position determination by natural and artificial satellites; the fundamental concepts of gravimetric geodesy, including the potential function; attraction; undulations of the geoid and deflections of the vertical. Fall.

Prerequisite: ERE 658.

660. Theory of Errors and Adjustments (3)

The theory of errors and adjustments, of observations oriented toward geodesy and photogrammetry. Topics include error definitions, weighted observations, method of least squares, matrix algebra in adjustments, variance-covariance matrix, the error ellipse and the general case of adjustment. Fall or Spring.

Prerequisites: Calculus and a beginning course in statistics.

664. Photogrammetry II (3)

Two hours of lecture and three hours of laboratory. General analytic photogrammetry including interior and exterior orientation systems, intersection, space resection and orientation. Correction of photo coordinates for film deformation, lens distortions, atmospheric refraction and earth curvature. Introduction to photogrammetric plotters. Planning photogrammetric projects, and designing optimum procedures for selected photogrammetric tasks. Fall.

Prerequisite: ERE 563 or equivalent.

670. Principles of Pulping and Bleaching (3)

Two hours of lecture and three hours of laboratory plus literature study of assigned topics, independent project planning and/or laboratory study. Discussion of pulping and bleaching processes. Effects of chemical and physical variables on the wood components and pulp properties; chemistry involved. Experiments in pulping and bleaching and pulp evaluation. Fall.

Prerequisites: Organic, physical, and analytic chemistry.

Note: A student may not enroll in or receive credit for both PSE 461 and ERE 670.

671. Chemistry of Pulping and Bleaching (3)

Three hours of lecture. Discussion of the chemistry underlying the commercial pulping and bleaching processes, designed to assist in interpreting the phenomena observed in these operations. Emphasis is placed on those reactions which contribute to delignification and the removal of chromophoric groups in lignin and extractives. Spring.

Prerequisite: FCH 572 or permission of the instructor.

672. Selected Topics in Colloid and Surface Science (3)

Three hours of lecture, discussions, and problem solving. The following topics will be covered: 1) viscosity of dilute dispersions, 2) osmotic and equilibrium, 3) light scattering, and 4) surface tension. Fall.

Prerequisites: Two semesters of physical chemistry and permission of instructor.

673. Selected Topics in Colloid and Surface Science (3)

Three hours of lecture, discussions, and problem solving. The following topics will be covered: 1) absorption from solution and at Gas-Solid interface, 2) electrical double layer, 3) Van der Waals attraction and flocculation, and 4) electrophoresis, zeta potential, and electro-osmosis. Fall.

Prerequisites: Two semesters of physical chemistry and permission of the instructor.

675. Principles of Unit Operations (4)

Three hours of lecture and discussion and one two-hour computation period. Fundamentals of fluid dynamics, heat and mass transfer, appropriate analogies and process applications. Stage operations and computation methods. Application to distillation, extraction, gas absorption, evaporation, crystallization and drying. Design, operation, and computer simulation of equipment. Fall.

Prerequisites: Calculus and physical chemistry or permission of the instructor.

677. Paper Properties (4)

Three hours of lecture, three hours of laboratory, and discussion plus evaluation of literature, independent project planning and/or laboratory study. Evaluation and study of the physical, optical, and chemical properties of paper and the interrelationships existing between paper manufacturing methods, papermaking additives, test results and the ultimate properties desired in the finished paper. Fall.

Prerequisite: Permission of the instructor.

Note: A student may not enroll in or receive credit for both PSE 465 and ERE 677.

678. Paper Coating and Converting (2)

Two hours of lecture plus evaluation of literature, independent project planning, and/or laboratory study. Evaluation and study of the various coating materials and processes used by the paper industry. Introduction to polymers and their use in converting operations. Study of materials and equipment used in converting operations, fundamentals and parameters which control their use, effects on final properties of papers. Spring.

Prerequisite: PSE 465 or permission of the instructor.

Note: A student may not enroll in or receive credit for both PSE 466 and ERE 678.

680. The Anatomy and Ultrastructure of Wood (2)

Two hours of lecture and/or demonstration and discussion. The gross, microscopic and submicroscopic structure of wood including organization of the cell wall, distribution of chemical constituents and abnormalities in wood. Fall.

682. Transport Processes (3)

Two hours of lecture and three hours of laboratory. The relationship between wood structure and wood permeability, moisture movement, and heat transfer. Fire retardant and wood preservation treatments. Wood drying. Unsteady-state transport processes. An advanced laboratory problem with report in wood-moisture relationships, wood drying, the relationship between wood permeability and treatability, or wood preservative treatments. Spring.

Prerequisite: Permission of the instructor.

Note: A student may not enroll in or receive credit for WPE 326 or WPE 327 and ERE 682.

683. Structure and Properties of Engineering Materials (3)

Three hours of lecture and discussion. Study of the mechanical, thermal, electronic, and magnetic behavior of metals, ceramics, polymers, and composite materials relating internal structure and engineering properties. "Internal structure" may range from subatomic, atomic, and molecular levels through the structure of crystals and amorphous solids up to the macro-structure of multiphase and composite materials. Spring.

Prerequisite: Permission of the instructor.

684. Mechanical Properties of Wood (3)

Two hours of lecture and three hours of laboratory. The effect of the anatomical and chemical nature of wood on its response to static and dynamic force systems. The theory of elasticity as applied to wood and wood-based composites. Spring.

Prerequisite: Permission of the instructor.

685. Applied Electron Microscopy (5)

Two hours of lecture, two hours of laboratory/demonstration, minimum of ten hours of individual laboratory. The theory and operation of the transmission electron microscope including specimen preparation, photographic technique and interpretation of micrographs. Fall.

Prerequisite: Consultation with the instructor.

686. Wood-Water Relationships (3)

Two hours of lecture and three hours of laboratory. Relationship between wood moisture content and the environment, electrical and thermal properties, theories of moisture sorption, hygroscopic swelling and shrinking, thermodynamics of moisture sorption, mechanism of moisture movement as it relates to activation theory. Laboratory exercises will complement the theoretical topics discussed in the lecture. Fall.

Prerequisite: Permission of the instructor.

688. Tropical Timbers in Commerce (2)

Two hours of lecture. Introduction to the commercial use of tropical timbers; the factors of forest conditions, stand types and wood qualities influencing their utilization and the development of trade. Sources of information. Spring.

Prerequisite: Permission of the instructor.

689. Tropical Wood Anatomy (1)

Anatomical characters, identification and taxonomy of tropical woods important in commerce. Spring.

Prerequisite: WPE 387 or ERE 360. Recommended that ERE 688 be taken concurrently or previously.

691. Air Pollution Engineering (3)

Three hours of lecture and discussion. Study of the chemical, physical, and meteorological principles of air pollution and its control. Local and global effects of air pollution. The atmospheric survey. Examination of the operating principles and design parameters of the various air pollution control systems. Air quality and emission standards. Fall.

Prerequisites: Physics and CHE 356 or permission of the instructor.

Note: A student may not enroll in or receive credit for both ERE 441 and ERE 691.

760. Analytical Photogrammetry I (3)

Two hours of lecture and three hours of laboratory. Mathematical theory of photogrammetry including space resection, orientation, intersection and aerial triangulation. Spring.

Prerequisites: FEG 363, APM 360 and FEG 464 or equivalent.

762. Instrumental Photogrammetry I (3)

Two hours of lecture and three hours of laboratory. The theory and practice of extracting information from photographs with the aid of photogrammetric plotters. Fall or Spring.

Prerequisite: FEG 363 or equivalent.

775. Applied Thermodynamics (3)

The study and application of thermodynamics, including the first and second law, phase relationships, thermochemistry, the production of work and equilibrium relationships. Spring.

Prerequisites: FCH 360, FCH 361 or equivalent.

785. Scanning Electron Microscopy (3)

Two hours of lecture, demonstration and laboratory. Six hours of independent laboratory experience. The theory and operation of the scanning electron microscope including specimen preparation, photographic technique, and interpretation of micrographs. Spring.

Prerequisite: Permission of the instructor.

796. Advanced Topics (1-3)

Lectures, conferences, discussions, and laboratory. Advanced topics in Forest Engineering, Paper Science and Engineering, and Wood Products Engineering. Fall and/or Spring.

Prerequisite: Permission of the instructor.

797. Seminar (1-3)

I. Forest Engineering topics. II. Paper Science and Engineering topics. III. Wood Products Engineering topics. Fall and Spring.

798. Research in Environmental and Resource Engineering (Credit hours to be arranged)

I. Independent research topics in Forest Engineering. II. Independent research topics in Paper Science and Engineering. III. Independent research topics in Wood Products Engineering. Fall, Spring, and Summer.

880. Interpretation of Cellular Ultrastructure (2)

One hour of lecture and two hours of demonstration and discussion. The organization and sculpturing of the walls of plant cells; the cellulose microfibril, matrix and incrusting substances, and the warty layer. The ultrastructure and function of cytoplasmic organelles in cells. The nucleus, the mitochondrion, the chloroplast, the endoplasmic reticulum, microtubules, the gap junction and the tight junction. The tools and techniques used for light and electron microscopic study of cells, and the interpretation of structural evidence. Directed study and discussion of the latest (current) literature on pertinent topics. Spring.

Prerequisite: Permission of the instructor.

899. Master's Thesis Research (Credit hours to be arranged)

Research and independent study for the master's degree and thesis. Fall, Spring, and Summer.

999. Doctoral Thesis Research (Credit hours to be arranged)

Research and independent study for the doctoral degree and dissertation. Fall, Spring, and Summer.

EFB—ENVIRONMENTAL AND FOREST BIOLOGY

The Department of Environmental and Forest Biology offers a diverse array of courses at both undergraduate and graduate levels. Based on student interest, curricula can be designed to accommodate a degree of specialization in one or more subdisciplines of biology. In the following list, courses numbered from ()00 - ()25 (at each level) are General Biology offerings; those from ()26 - ()50 are Plant Sciences, those from ()51 - ()75 are Entomology; and those from ()76 - ()95 are Animal Science courses.

NOTE: All EFB courses require a minimum prerequisite of one year of college biology or equivalent. A course at an appropriate level may be taken with permission of the instructor.

303. Introductory Environmental Microbiology (4)

Three hours of lecture and three hours of laboratory. An introduction to the biology of microorganisms and viruses and a study of their interactions with other microbes and macroorganisms. Fall.

320. General Ecology (3)

Two hours of lecture, three hours of field trips during the first half of the semester. Three hours of lecture during the second half of the semester. Introduction to ecosystem ecology stressing the dynamic interrelationships of plant and animal communities with their environments, ecological factors, energy flow and trophic levels in natural communities, plant responses and animal behavior, population dynamics, biogeography, and representative ecosystems. The ecological impact of man is reviewed. Fall.

325. Cell Physiology (3)

Three hours of lecture. Introduction to the dynamics of living systems with emphasis on the universality of the biological world. Spring.

Prerequisite: One semester of organic chemistry.

326. Plant Structure, Function and Morphology (4)

Three hours of lecture and three hours of laboratory. An exposition of plant biology with emphasis on the structure and function of the life forms, reproduction, and adaptations of major groups of plants. Fall and Spring.

327. Classification of the Plant Kingdom (3)

Two hours of lecture and three hours of laboratory. Introductory study of the plant kingdom with emphasis on the angiosperms. Spring.

330. Plant Nutrition (3)

Three hours of lecture. Descriptive aspects of the fundamental activities of plants. Subjects covered include cell structure, water and mineral metabolism, organic nutrition, and a brief introduction to biological control mechanisms. Spring.

Prerequisite: EFB 326 or equivalent.

335. Dendrology (2)

One hour of lecture and one three-hour laboratory/field trip. Field study, identification, and major characteristics of important forest trees of North America. Open only to students in the Forest Engineering curriculum. Fall.

336. Dendrology I (3)

Two hours of lecture and one three-hour laboratory/field trip. Field study, identification, natural history, and elementary silvics of important forest trees of North America. Fall.

340. Forest and Shade Tree Pathology (3)

Two hours of lecture and three hours of autotutorial laboratory. Major diseases of forest, shade, and ornamental trees and deterioration of forest products, with emphasis on disease identification, principles of disease development, effects of disease on the host, and practical control measures. Spring.

351. Principles of Forest Entomology (3)

Two hours of lecture, three hours of laboratory. Elements of insect classification, morphology and physiology; introduction to the role of insects in forested ecosystems; insect surveys, hazard rating, impact, control and other aspects of applied forest pest management. Designed for students in Resources Management. Spring.

352. Elements of Forest Entomology (3)

Two hours of lecture, three hours of laboratory/field work. General classification of insects, morphology, physiology, ecology, behavior, and basic principles of population control. Emphasis through illustration is on the role of insects in the forest environment. Fall.

382. Wildlife Conservation (3)

Two hours of lecture, one hour of recitation. Introduction to the biological principles of conservation including the relationship of natural resources to modern society. The wildlife resource and its conservation will be emphasized. It is not designed for students concentrating in the area of Forest Wildlife Management. Fall.

385. Comparative Vertebrate Anatomy (4)

Three hours of lecture and three hours of laboratory per week. Analysis of vertebrate structure, with emphasis on comparative study of organ systems. Includes evolution of form and function, major adaptive patterns, and phylogenetic relationships in vertebrates. Spring.

386. Vertebrate Histology (3)

Two hours of lecture and three hours of laboratory. A study of tissues from protochordates, fishes, amphibians, reptiles, birds, and mammals, with emphasis on evolution, environment, and function, and with introduction to histopathologies. Spring.

387. Vertebrate Physiology (3)

Three hours of lecture. A study of functional responses of vertebrates to internal and external environmental conditions. Fall.

405. History of Natural Science (1)

One hour of lecture. A review of the history of western science from pre-Ionian times to Darwin, with evaluation of the impact of culture and religion on scientific progress. Spring.

407. Principles of Genetics (3)

Three hours of lecture and discussion. A general course covering concepts of genetics and evolution base to upper division biology and biochemistry courses. Includes the inheritance and analysis of Mendelian and quantitative traits, the chemical nature of the gene and its action, the genetic structure of populations and their evolution. Numerical methods for characterizing and analyzing genetic data are introduced. Spring.

408. Principles of Genetics Laboratory (1)

Three hours of autotutorial laboratory. Experiments with plants and animals and computer simulation exercises demonstrate the basic principles of inheritance of Mendelian and quantitative traits and changes in populations caused by major forces in evolution or by breeding procedures. Numerical methods for characterizing quantitative traits and for testing hypotheses are introduced. Spring.

Co-requisite: EFB 407.

409. Introduction to Quantitative and Population Genetics (1)

Ten lecture-discussions and four autotutorial laboratories the second half of the semester (incl. Lecture-Lab Modules 5 and 6 of FBL 470 and 471). Basic genetic concepts of quantitative inheritance, the structure of populations and evolution. Laboratory experiments and computer simulations are used to demonstrate these concepts. Numerical methods for characterizing and analyzing genetic data are introduced. Spring.

Prerequisite: An introductory genetic lecture-laboratory course deficient in these areas of genetics and permission of the instructor.

Note: Not open to students taking EFB 407 and 408.

420. Field Experience—Internship (5)

Full-time for at least five weeks, or equivalent, of employment with an agency or professional involved in field activity. A resident faculty member is required to serve as course evaluator. Approval of curriculum director is necessary. See advisor for detailed procedural information. Summer.

421. Ecology of Freshwaters (2)

Half-time for four weeks. Cranberry Lake Biological Station. Experimental and observational studies of environmental and biotic interactions influencing productivity of freshwaters. Basic concepts at the organismic, population, and community level. Summer.

426. Plant Propagation (1)

One combined lecture-demonstration laboratory plus supervised greenhouse assignments. Instruction in principles and practices of plant propagation and in related greenhouse operations. Fall and Spring.

Prerequisite: Senior status in Environmental and Forest Biology curriculum.

Note: Cannot be used to satisfy the 6-hour biology curriculum requirement in the plant sciences.

430. Fungal Physiology (3)

Three hours of lecture and discussion. Principles of growth, morphogenesis, and reproduction of the fungi emphasizing the role of the environment in controlling fungal processes. Spring.

Prerequisite: EFB 325 or equivalent.

431. Fungal Physiology Laboratory (1)

Three hours of laboratory. Selected experiments in the quantitative study of fungal growth, nutrition, sporulation, and spore germination. Spring.

Co-requisite: EFB 430.

435. Adirondack Flora (2)

Half-time for four weeks. Cranberry Lake Biological Station. Field study of the summer flora of the Adirondack Mountains. Summer.

436. Dendrology II (1)

One three-hour field trip/laboratory. A continuation of Dendrology I emphasizing trees and shrubs ecologically important in the Central New York region and economically important in North America. Fall.

440. Principles of Forest Pathology (3)

Three hours of lecture, discussion or laboratory. Concepts and principles of tree diseases in relation to forest practices and practical experience in disease diagnosis and impact evaluation. Fall.

Prerequisite: EFB 340.

441. Field Problems in Forest Pathology (1)

Full-time for one week. Cranberry Lake Biological Station. Field study of important tree diseases in the Adirondacks, including heart-rots, root-rots, cankers, rusts, foliage diseases, mistletoe, and physiological diseases. Also field study of mycorrhizae and other tree-root mutualisms. Summer.

442. Field Mycology (2)

Half-time for four weeks. Cranberry Lake Biological Station. An introduction to the collection and identification of the Adirondack fungal flora. Field techniques and laboratory identification of the major fungi found in selected ecosystems. Summer.

445. Plant Ecology (3)

Two hours of lecture and discussion and one laboratory session. A first course in plant community ecology dealing with the dynamics of community development and change and the process of community analysis and description. Spring.

Prerequisite: EFB 320.

446. Bryoecology

(3)

Two hours of lecture and one three-hour laboratory or field trip. A study of the taxonomic diversity and ecological adaptations of Bryophytes in regional ecosystems. Spring.

447. Wetland Plant Ecology

(1-2)

Full-time for one week. Cranberry Lake Biological Station. Study of wetland plant community dynamics and environmental relationships in the Adirondack Mountain Region. Summer.

448. Physiological Ecology of Plants

(3)

Three hours of lecture. Examination of the interactions between plants and their environment. Emphasis will be given to the physiology of plants as it is modified by fluctuating external conditions and the mechanisms of plant adaptation. Students completing EFB 448 should not enroll in EFB 330. Fall.

Prerequisites: An introductory course in physics, EFB 320 and EFB 326.

451. Pest Management—Theory and Practice

(2)

Two hours of lecture for nine weeks; then one lecture hour and one three-hour laboratory for four weeks. A review of history and governmental policy of pest management, as well as basic instruction in theory and practicum. Spring.

Prerequisite: EFB 352 or equivalent.

452. Principles of Chemical Control

(3)

Two hours of lecture; one three-hour laboratory. A study of the chemistry, toxicology, handling and application of chemicals used to manage pest populations. A primer for the State Pesticide Application examinations. Fall.

Prerequisite: EFB 451.

453. Forest and Aquatic Insects

(2)

Half-time for four weeks. Cranberry Lake Biological Station. The forest and aquatic insects of Cranberry Lake Region and their role in these environments and habitats. Insect collection required. Summer.

454. Wood Deterioration by Insects

(3)

Three hours of lecture, discussion, and demonstration. Biology, identification, ecology of insect and wood interrelations; prevention of injury and control of insects injurious to forest products and wood in use. Spring.

Prerequisite: EFB 352 or equivalent.

460. Insect Behavior and Ecology

(2)

Half-time for four weeks. Cranberry Lake Biological Station. Descriptive, comparative, and experimental behavior of aquatic and terrestrial insect species of the Cranberry Lake Region. Field project, involving field study and paper required. Ecology of forest insects and field techniques used in their study. Emphasis on functional roles played by insects in forest ecosystems. Summer.

Prerequisites: EFB 320 and EFB 352 or equivalents.

476. Vertebrate Ecology

(2)

Half-time for four weeks. Cranberry Lake Biological Station. Utilization of unique Adirondack forms and communities to study population dynamics, behavior, systematics, and ecological role of vertebrates; standard field and laboratory techniques. Summer.

478. Microcommunity Ecology

(2)

Half-time for four weeks. Cranberry Lake Biological Station. Study of terrestrial invertebrate microcommunities; descriptive and comparative assay of microhabitats incorporating experimental and field techniques. Summer.

479. Field Ornithology

(2)

Half-time for four weeks. Cranberry Lake Biological Station. Field study of the ecology, distribution and behavior of birds of the Adirondack region. Techniques used in conducting field studies in avian biology will be emphasized. Summer.

- 480. Principles of Animal Behavior** (4)
Three hours of lecture, one hour of recitation per week. A study of the basic principles of animal behavior, stressing exogenous and endogenous mechanisms of control, with emphasis on the evolution of behavior. Spring.
- 481. Behavioral Ecology** (2)
Half-time for four weeks. Cranberry Lake Biological Station. Study of the behavioral adaptations of animals to their environment. Emphasis will be placed on animal orientation and social behavior. Habitat selection and interspecific interactions will also be considered. Summer.
Prerequisite: EFB 480.
- 482. Invertebrate Zoology** (4)
Three hours of lecture, three hours of laboratory. Structure, function, classification, and evolution of invertebrates. Emphasis on ecological role of invertebrates in specific habitats. Fall.
- 483. Biology of Birds and Mammals** (4)
A course surveying the taxonomy, anatomical-behavioral-physiological adaptations and natural history of birds and mammals. Techniques for the field study of a vertebrate species will be discussed. Fall.
- 485. Herpetology** (3)
Two hours of lecture and three hours of laboratory. An introduction to the structure, function, ecology, behavior, development, and distribution of amphibians and reptiles as they relate to the systematics of the various groups. Spring.
- 486. Ichthyology** (3)
Two hours of lecture, three hours of laboratory. An introduction to the anatomy, physiology, ecology, behavior, and taxonomy of fishes. Spring.
- 487. Fishery Biology** (4)
Three hours of lecture and three hours of laboratory. Introduction to models of growth, mortality, production, and exploitation; aspects of fish ecology and behavior related to the dynamics and management of fish populations. Fall.
Prerequisite: EFB 486 or equivalent.
- 488. Ecology of Adirondack Fishes** (2)
Half-time for four weeks. Cranberry Lake Biological Station. Study of the ecology of fishes, with detailed individual investigation of the ecology of Adirondack fishes. Summer.
- 490. Wildlife Ecology and Management** (3)
Three hours of lecture. A study of the ecological principles governing wild animal populations and their habitats and the relationship of these principles to management programs and decisions. Spring.
Prerequisites: EFB 320 or equivalent.
- 491. Wildlife Ecology and Management Practicum** (2)
One hour discussion, three hours laboratory. Practical contact and experience with wildlife management techniques and programs; relates practices to principles of management. Designed for biology students wishing to pursue careers as wildlife biologists. Spring.
Co-requisite: EFB 490; *Pre- or co-requisite:* LIB 300.
- 496. Topics in Environmental and Forest Biology** (1-3)
Experimental, interdisciplinary, or special coursework in biology for undergraduate students. Subject matter and method of presentation varies from semester to semester. May be repeated for additional credit. Fall or Spring.
- 497. Seminar in Environmental and Forest Biology** (1)
Literature surveys and seminars on topics of biological interest and importance. Subject to be generated by faculty and students and to be announced prior to registration. Fall and Spring.

498. Research Problems in Environmental and Forest Biology (1-3)

Independent research in topics in Forest Biology for the superior undergraduate student. Selection of subject area determined by the student in conference with appropriate faculty member. Tutorial conferences, discussions and critiques scheduled as necessary. Final written report required for departmental record. Fall, Spring, and/or Summer.

500. Forest Biology Field Trip (1-3)

A five- to ten-day trip to (1) agencies engaged in biological research, management, and administration, or (2) regions or areas of unusual biological interest. A final report is required. Estimated student expense, \$75. Fall or Spring.

505. Microbial Ecology (3)

Two hours of lecture and three hours of laboratory. Applied and environmental aspects of microbiology with emphasis on biochemical interactions. Examining microbial processes and interrelationships in aquatic and terrestrial ecosystems. Spring.

512. Chemical Ecology (3)

Two hours of lecture and one hour of discussion. A treatment of biological phenomena incorporating elements of ecology, physiology, and chemistry as a basis for development, behavior, and survival. Emphasis is on the intra- and inter-specific relationships involving chemical messengers at the organismal, population, and community levels. Spring.

Prerequisites: Organic chemistry, EFB 320, EFB 325.

Note: Also listed as FCH 540.

515. Population Ecology (3)

Two hours of lecture and three hours of laboratory. Description, analysis, evolution, interactions and stability of natural and experimental populations. Spring.

Prerequisite: EFB 320 or equivalent.

524. Limnology (3)

Three hours of lecture. An introduction to the physics, chemistry, and biology of inland waters, with particular emphasis on lakes. The course focuses on lakes as integrated ecosystems, and analyzes perturbations in this environment on the structure and function of the biological communities contained therein. Fall.

Prerequisites: Introductory courses in physics and chemistry, and EFB 320.

525. Limnology Laboratory (1)

One laboratory or field trip. An introduction to limnological techniques and the procedures for empirically analyzing ecological relations in aquatic ecosystems. Field trips to local aquatic habitats. Fall.

Co- or Prerequisite: EFB 524.

530. Plant Physiology (3)

Three hours of lecture. Internal processes and conditions in higher plants with emphasis on physiological and biochemical concepts. For students majoring in the biological sciences. Spring.

Prerequisites: EFB 325, EFB 326.

Note: EFB 531 also required for Plant Sciences Concentration students.

531. Plant Physiology Laboratory (1)

One laboratory session. Introduction to methods and procedures of physiological research. Spring.

Co-requisite: EFB 530.

532. Plant Anatomy (3)

Two hours of lecture and three hours of laboratory. An introductory course in plant anatomy designed to familiarize the student with the organization and development of the primary and secondary plant body of higher plants. Spring.

Prerequisite: EFB 326.

533. Chemical Defenses of Plants (3)

Three hours of lecture/discussion about the ways in which plants defend themselves chemically against microorganisms, insects, herbivores, and other plants. Fall.

Prerequisite: A course in physiology or biochemistry.

535. Systematic Botany (3)

Two hours of lecture and three hours of laboratory. Identification, nomenclature, and classification of flowering plants with special emphasis on local flora and on developing the ability to classify the plants of any region. Fall.

Prerequisites: EFB 326, EFB 327.

540. Mycology (3)

Two hours of lecture and three hours of laboratory. Fundamentals of the morphology, taxonomy, cytology, life histories, and ecology of fungi. Fall.

541. Wood Microbiology (3)

Two hours of lecture and three hours of laboratory/field trip. Major types of fungus defects of wood and its products and principles of control. Special emphasis on chemistry of wood decay, wood durability, toxicants, lumber discolorations, heart-rots and decay in forest products. Fall.

Prerequisites: Organic chemistry, EFB 340.

551. Forest and Shade Tree Entomology (2)

Two hours of lecture. Important forest and shade tree insects, detection, evaluation, prevention, and control of their damage; their relation to silviculture and management of forests and shade trees. Spring.

Prerequisite: EFB 352 or equivalent.

552. Forest and Shade Tree Entomology Laboratory (1)

Three hours of laboratory/field trip. Identification of important forest and shade tree insects and their damage. Spring.

Pre- or Co-requisite: EFB 551.

553. Biological Control (2)

Two hours of lecture. Theory and practice of biological control of insect pests and weeds. Emphasis on the ecology and utilization of major groups of predators, parasitoids, and pathogens used in pest management and interpretation of mortality. Fall.

Prerequisite: EFB 352 or equivalent.

554. Aquatic Entomology (3)

Two hours of lecture and three hours of laboratory. The biology, ecology, and identification of fresh water insects, with emphasis on the role of aquatic insects in the hydrobiome. Fall.

Prerequisite: EFB 352 or equivalent.

555. Arachnology (3)

Two hours of lecture and discussion and three hours of laboratory. Introduction to biology and ecology of spiders, mites, scorpions, and other arachnid groups. Laboratories emphasize classification and identification of specimens. Spring (even years).

Prerequisite: EFB 352 or EFB 482 or equivalent.

560. Environmental Toxicology of Insecticides (2)

Two hours of lecture. Basis of action of insecticides in living systems, behavior of insecticides and microtoxics in environment, interaction of insecticides and biological systems. Fall.

Prerequisite: EFB 325 or equivalent course in physiology or biochemistry.

561. Medical Entomology (3)

Three hours of lecture and recitation. Study of arthropods affecting man, domestic animals, and wildlife with emphasis on their biology, control, and relationship to vertebrate disease. Spring (even years).

Prerequisite: EFB 352 or equivalent.

565. Insect Morphology (3)

Two hours of lecture and three hours of laboratory. A comparative study of the external morphology of insects emphasizing evolutionary trends, especially modifications of homologous structures. Topics of special importance include intersegmental relationships, feeding, sensory mechanisms, locomotion, and reproduction. Spring.

Prerequisite: EFB 352.

570. Insect Physiology (3)

Two hours of lecture and three hours of laboratory. Study of the life processes in insects; introduction to modern physiological instrumentation and laboratory methods. Spring.

Prerequisite: EFB 325.

578. Terrestrial Community Ecology (3)

Three hours of lecture. Relation of terrestrial vertebrates and invertebrates to their physical, chemical, and biological environment. Emphasis on community principles, structural quantification, and evolutionary processes of terrestrial animals. Fall.

Prerequisite: EFB 320 or equivalent.

590. Wilderness Wildlife Management (2)

Two hours of lecture followed by one hour of group discussion. Students will participate in a two-day field trip at Huntington Forest. Completion of a term paper will be required for graduate credit. Fall.

610. Ecological Energetics (3)

Two hours of lecture and three hours of laboratory or one hour of discussion. Investigation of the principles of energy flow in biological systems. Emphasizing understanding of energy transformations, energy budgets and energy structures of individual organisms, populations, and ecosystems. Spring.

Prerequisite: EFB 320 or equivalent.

620. Wetland Ecology (2)

One hour of lecture and one field trip or discussion session. A study of the status, ecology, value, use and regulation of wetlands in the Northeast and emphasis on freshwater areas. Fall.

Prerequisite: EFB 320 or equivalent.

625. Membranes and Biological Transport (3)

Two hours of lecture and one hour of discussion. Composition, structure, and physical properties of membranes. Membrane functions including transport, bioelectricity, and cell compartmentalization. Specific transport processes in biological systems. Fall (even years).

Prerequisites: One semester of biochemistry and an advanced physiology course.

630. Fungus Physiology (3)

Two hours of lecture and one hour of discussion. Principles of growth, reproduction, and differentiation of the fungi emphasizing the role of the environment in controlling fungal processes. Spring.

Prerequisite: Two semesters of physiology or biochemistry.

632. Plant Growth Regulation (3)

Three hours of lecture/discussion on topics concerned with the biochemistry and physiology of plant hormones and synthetic growth regulators. Fall.

Prerequisite: A course in plant physiology or biochemistry.

635. Topics in Plant Nutrition (2)

Two hours of lecture, discussion, and seminars. Advanced course dealing with selected topics of mineral and organic nutrition of plants. Fall (odd years).

Prerequisites: Completion of one or more physiologically-oriented plant science courses.

640. Principles of Forest Pathology (3)

Four hours of lecture, discussion, and laboratory. Concepts and principles of tree diseases in relation to forest practices and practical experience in disease diagnosis and impact evaluation. Fall.

Prerequisites: EFB 340, EFB 641.

641. Phytopathology (3)

Two hours of lecture and discussion and three hours of autotutorial laboratory. Principles and concepts of plant pathology. Major diseases of ornamental plants, vegetable crops, fruit crops, field crops, and trees. This is an introductory plant pathology course for graduate students in all departments. Spring.

642. Principles and Practices of Tree Disease Control (3)

Two hours of lecture and three hours of laboratory or discussion. An advanced course considering the major chemical, cultural, and biological practices and integrated disease management strategies for tree disease control. Spring.

Prerequisites: EFB 440, EFB 540.

643. Plant Virology (3)

Three hours of lecture. The structure function, and replication of virus particles. Transmission mechanisms, vector relationships, symptomatology, and disease control strategies are covered in detail. Spring.

Prerequisite: Organic chemistry.

644. Plant Virology Laboratory (2)

Four hours of laboratory. Methodologies necessary to manipulate viruses and to identify and fully characterize virus unknowns will be presented. Spring (even years).

Prerequisite: EFB 643.

645. Plant Ecology (3)

Two hours of lecture and discussion and one laboratory/discussion. A first course in plant community ecology for beginning graduate students focusing on dynamics of community development and change and the processes of community analysis and description. Spring.

Prerequisite: EFB 320 or equivalent.

651. General Insect Taxonomy (3)

Two hours of lecture and three hours of laboratory. Identification and classification of the important orders and families of insects; acquaintance with pertinent taxonomic literature and use of keys; and understanding of evolutionary principles and concepts and a knowledge of systematic theory and practice. Insect collection required. Fall.

Prerequisite: EFB 565.

660. Insecticide Toxicology Laboratory (2)

One hour of discussion and three hours of laboratory. Laboratory experiments in mode of action and behavior of insecticides, biological and instrumental analysis of insecticides including tracer analyses. Spring (odd years).

Prerequisites: EFB 560 or equivalent and permission of the instructor.

678. Practicum in Terrestrial Community Ecology (3)

One hour of lecture, one hour TBS, and three hours of laboratory. Intensive practical application of ecological principles to the study of terrestrial animal communities. Includes experimental and field collection of data, quantifications, synthesis, and final reporting. Fall.

Pre- or Co-requisite: EFB 578 or equivalent.

680. Behavioral and Physiological Ecology (3)

Two hours of lecture and one hour of discussion. An examination of the concepts of animal adaptations to ecological change from a behavioral point of view. Particular emphasis will be placed on the role the environment plays in shaping the behavior of a given species. Behavioral and physiological responses to environmental conditions will be treated as a continuum. Spring (odd years).

Prerequisites: One course in ecology, behavior, and physiology.

682. Invertebrate Symbiosis (3)

Two hours of lecture and one three-hour laboratory. An introduction to the ecology and evolution of interspecific relationships of invertebrates. Spring (even years).

Prerequisites: EFB 320, EFB 482.

690. Management of Wildlife Habitats and Populations (4)

Three hours of lecture and three hours of laboratory; some weekend field trips. For graduate students intending to enter professions in natural resource management, especially fish and wildlife and forestry. Focus is on the application of ecological principles and management techniques in the planning of habitat and harvest management programs for wildlife. Extensive independent work required. Fall.

Prerequisite: EFB 491.

691. Habitat Inventory and Evaluation (3)

Four hours of lecture and discussion. For students intent on careers in natural resource management, environmental planning or environmental impact analysis. Focus is on methods for investigation of species-habitat relationships, and construction of models for the inventory and evaluation of habitat. State-of-the-art habitat evaluation procedures are explored. Spring.

Pre- or Co-requisite: Multivariate Statistics.

692. Biology and Management of Waterfowl (2)

A consideration of the identification, life history, ecology, and economic importance of waterfowl of the Atlantic Flyway. The management of local, flyway, and continental waterfowl populations, including the establishment of hunting seasons, will be discussed. One Saturday field trip. Fall (odd years).

695. Urban Wildlife (2)

Three hours of lecture and discussion with field trips. A study of the occurrence, adaptations, and values of wildlife in urbanized areas, with emphasis on current research and agency programs. Spring (even years).

720. Topics in Soil Invertebrate Ecology (3)

Two one-hour lecture and discussion periods and a three-hour laboratory. Study of literature relating to soil invertebrate microcommunities; taxonomy, culturing, and collection methods of soil fauna; student will conduct an individual research problem. Spring (odd years).

724. Seminar in Aquatic Ecology (1)

Two hours of lecture and discussion. A seminar to explore in some depth areas of current research in aquatic ecology. Fall (even years).

Prerequisite: Six credits in aquatic ecology.

733. Techniques in Plant Physiology (1-3)

Comprehensive study of techniques essential for research in plant physiology. Students may choose the instructors they wish to work with, and should consult the instructors for further details. May be repeated for credit in different specialties. Fall and Spring.

Prerequisites: EFB 531 or equivalent, biochemistry with laboratory.

740. Mycorrhizae (3)

Two hours of lecture and three hours of laboratory/discussion. A basic background course covering structural, functional, and ecological aspects of mycorrhizae; their methods of field and laboratory study; and applications in forestry practice. Fall (odd years).

741. Topics in Phytopathology (3)

Two two-hour lectures and discussions. Discussions of specific subjects in phytopathology and wood microbiology. Topic selection is based on availability of expertise and will be announced in advance. This course may be repeated for credit in different specialties. Fall or Spring.

745. Topics in Plant Ecology (2)

Two hours of seminar and discussion. An advanced course dealing with current research in plant community dynamics. May be repeated for additional credit. Fall.

Prerequisite: EFB 445 or EFB 645.

790. Topics in Wildlife Biology (1-3)

Hours to be arranged. Group study of a wildlife management topic. Fall or Spring.

Prerequisite: Six credits of wildlife management courses.

- 796. Topics in Environmental and Forest Biology (1-3)**
Special instruction, conference, advanced study, and research in selected subject areas. Typewritten report required. Check *Schedule of Courses* for details. Fall and Spring.
- 797. Seminar in Environmental and Forest Biology (1)**
Seminar discussions of subjects of interest and importance in environmental and forest biology. Seminar offerings are available in most subdisciplinary areas. Check *Schedule of Courses* for details. Fall and Spring.
- 798. Research Problems in Environmental and Forest Biology (Credit hours to be arranged)**
Individual advanced study of selected special problems in environmental and forest biology. Offered by arrangement with individual faculty. Typewritten report required. Fall and Spring.
- 830. Physiology of Growth and Development (2)**
Lecture. A study of the growth and development of plants and the physiological and biochemical processes that influence the development of form and structure in higher plants. Fall (even years).
Prerequisites: EFB 530, EFB 532, and organic chemistry.
- 840. Advanced Mycology, Homobasidiomycetes (3)**
Review of selected literature as well as laboratory training in identification and research techniques. Fall.
Prerequisite: EFB 540.
- 841. Advanced Mycology, Heterobasidiomycetes (3)**
Review of selected literature as well as laboratory training in identification and research techniques. Spring (even years).
Prerequisite: EFB 540.
- 842. Advanced Mycology, Ascomycetes (3)**
Review of selected literature as well as laboratory training in identification and research techniques. Spring (odd years).
Prerequisite: EFB 540.
- 843. Advanced Mycology, Myxomycetes, Phycomycetes, Fungi Imperfecti (3)**
Review of selected literature as well as laboratory training in identification and research techniques. Fall (even years).
Prerequisite: EFB 540.
- 851. Advanced Insect Taxonomy (3)**
Two hours of lecture and three hours of laboratory. Methods, procedures, and concepts of systematics. Examples and material will be drawn from among important groups of forest insects. Fall.
Prerequisite: EFB 651.
- 898. Professional Experience (1-12)**
Professional experience which applies, enriches, and/or complements formal coursework. Graded on an "S/U" basis. Fall, Spring, and Summer.
- 899. Master's Thesis or Project Research (1-12)**
Investigation leading to the completion of a research-oriented thesis or to an application-oriented project. Graded on an "S/U" basis. Fall, Spring, and Summer.
- 980. Topics in Animal Behavior (2)**
Two hours of lecture and discussion. A seminar-type course designed to explore in depth selected and controversial subject areas in animal behavior. Fall or Spring.
- 999. Doctoral Thesis Research (1-12)**
Investigation leading to the completion of the doctoral thesis. Graded on an "S/U" basis. Fall, Spring, and Summer.

ESF—NONDEPARTMENTAL

332. Seminar for New Transfer Students (No Credit)

One hour of weekly lectures and discussions designed to introduce the transfer student to the College and its academic and social environs. Fall and Spring.

FCH—CHEMISTRY

222. Organic Chemistry Laboratory I (1)

One three-hour laboratory. Laboratory techniques in organic chemistry. Melting points, distillation, recrystallization, extraction, column and thin layer chromatography, natural product isolation. Qualitative functional group analysis. Fall.

223. Organic Chemistry II (3)

Two hours of lecture, one hour of recitation. A study in depth of the reactivity characteristics of the various classes of carbon compounds. The relation of chemical reactivity and physical properties to electronic and three-dimensional characteristics of carbon compounds. Spring.

Prerequisite: One semester of organic chemistry.

224. Organic Chemistry Laboratory II (1)

One three-hour laboratory. Continuation of FCH 222. Simple physical, quantitative, and instrumental techniques applied to organic chemistry. Gas chromatography, polarimetry, kinetics. Introduction to synthesis. Spring.

Prerequisite: FCH 222 or equivalent.

Co-requisite: FCH 223 or equivalent.

225. Organic Chemistry I (3)

Two hours of lecture, one hour of recitation. A survey of representative classes of carbon compounds with emphasis on structure, fundamental reactivity, and other important properties and characteristics relevant to biological systems. Fall.

226. Organic Chemistry II (3)

Three hours of lecture and discussion. The structure and reactivity of organic compounds, utilizing natural products as examples, will be studied in order to develop an organic chemical background for further study of biological chemistry. Spring.

Prerequisite: FCH 225 or equivalent.

325. Organic Chemistry III (4)

Two hours of lecture, one six-hour laboratory. Classical and recent literature synthesis or organic compounds, employing advanced techniques. Fall.

Prerequisite: Two semesters of elementary organic chemistry.

360. Physical Chemistry I (3)

Three hours of lecture. Includes discussion on the properties of gases and liquids, laws of thermodynamics, solutions and colligative properties, and electrochemical cells. Fall.

Prerequisites: One year of college physics, differential and integral calculus.

361. Physical Chemistry II (3)

Three hours of lecture. Includes discussion on the structure of matter, principles of quantum mechanics, spectroscopy, and chemical kinetics. Spring.

Prerequisite: Physical Chemistry FCH 360 or the equivalent.

380. Instrumental Methods of Analysis (3)

Two hours of lecture and one three-hour laboratory. Lecture includes theory, applicability, and limitations of a number of current methods of instrumental analysis. Laboratory sessions provide practice with several of these techniques. Spring.

Prerequisites: General chemistry and quantitative analysis.

384. Spectrometric Identification of Organic Compounds (1-2)

Two hours of lecture and discussion. The first half semester (1 credit) will deal with common classes of organic compounds; the second half semester (1 credit) will deal with more complex structures. The use of complementary information from mass, infrared, nuclear magnetic resonance, and ultraviolet spectrometry will be applied to identification of organic natural products. Spring.

Prerequisites: Organic chemistry; one semester of advanced organic chemistry for second credit.

410. Topics in the Chemistry of Pollution (1-3)

Three hours of lecture. Discussion of some specific areas of current concern to the environmental chemist. Lectures by staff members supplemented by outside speakers from industry and governmental agencies. This course is taught in modules. Spring.

Prerequisites: Organic chemistry and permission of the instructor.

495. Introduction to Professional Chemistry (1)

The professional chemist and his relationships with industry, government, and universities. Employment opportunities for the chemist, professional organizations, and unions will be discussed. The selection of a senior research topic and a literature survey will be required. Fall.

Prerequisite: Senior status.

496. Special Problems in Chemistry (1-3)

An opportunity for a special problem, technique development, independent or unstructured study in an area related to the chemical profession. The work may be technical, professional, or interdisciplinary. Advisors outside this department may be solicited. A brief proposal must be presented for approval with specific arrangements outlined including faculty advisor and objectives of the study. Evidence of competence and appropriate effort is required for credit. A written report will be expected. Fall and Spring.

Prerequisite: Upper division status.

497. Undergraduate Seminar (1)

One hour per week. Literature surveys and seminars on topics of current research interest and recent advances in chemistry. Spring.

498. Introduction to Research (5)

Eighteen hours of laboratory, library search and report writing. Solution of a selected research problem using special laboratory techniques. Typewritten report on data, procedures, results, and conclusions. Spring.

510. Environmental Chemistry I (3)

Three hours of lecture. Introduction to the processes that control chemical behavior in aquatic environments, including precipitation, gas exchange, acid-base, redox, complexation, and adsorption reactions. Emphasis will be on explanation and prediction of chemical behavior, using computer models where appropriate. Examples will be from the areas of water and wastewater treatment, pollutant fates and geochemistry. Fall.

Prerequisites: An introductory course in physical chemistry is required and a shortcourse in computer programming is recommended.

511. Environmental Chemistry II (3)

Three hours of lecture. Includes a detailed chemical explanation of current topics of concern in environmental chemistry and the chemistry of pollution. Lectures will cover topics relating to air, soil and biota pollutional impact. Spring.

Prerequisite: Chemistry through physical chemistry, or consent of the instructor.

515. Methods of Environmental Chemical Analysis (3)

One hour of lecture and six hours of laboratory. An introduction to sampling, analytical and quality control procedures necessary to obtain reliable water quality data. All analyses will be performed on a single aquatic system with the purpose of developing a final report characterizing the water quality of that system. Fall.

Prerequisite: A course in quantitative chemical analysis.

519. Environmental Chemistry Seminar (1)

One hour of lecture. Seminars on current research and issues in environmental chemistry and related areas. Spring.

520. Nuclear and Radiation Chemistry (2)

The two one-hour lectures will cover the information required for the basic understanding of nuclear reactions, the types of radiation emitted, the instrumentation necessary to detect and measure this radiation, the principles of radioisotope tracer techniques, and radiation chemistry which is the effect of radiation on organic systems. Visits to the Cornell Reactor and the Nuclear Medicine Department of the Upstate Medical Center will be arranged. Spring.

Prerequisites: Physical, organic and inorganic chemistry or by permission of the instructor.

Note: This course can be taken independently of FCH 521.

521. Nuclear Chemical Techniques (1)

The laboratory will consist of one four-hour laboratory class every two weeks, with one hour to be made up at the student's discretion to accommodate counting periods which extend over several weeks. A short movie by the AEC each week will be required for the sixth hour. The laboratory will give each student the opportunity to use the individual counting instruments, gain experience in the handling and preparation of radioactive samples and the use of the 1000-curie-cobalt source in radiation chemistry. Spring.

Prerequisite: Physical, organic, and inorganic chemistry or permission of the instructor. Advanced tentative registration is required.

Co-requisite: FCH 520.

524. Topics in Natural Product Chemistry (3)

Three hours of lecture and discussion each week. A course intended to introduce the student to various types of secondary metabolites including several of past and current interest because of their pronounced biological activities. Modes of chemical reactivity and means of structure determination and syntheses are covered. Spring.

530. Biochemistry I (3)

Three hours of lecture. General biochemistry with emphasis on cellular constituents and metabolic reactions. The chemical, physical, and biological properties of amino acids, proteins, carbohydrates and their intermediary metabolism will be discussed. The chemistry of enzymes, energy transfers, and biological oxidations will also be covered. Fall.

Prerequisites: One year of organic chemistry and one year of physical chemistry.

531. Biochemistry Laboratory (2)

Six hours of laboratory. This course will stress techniques used in biochemical research. Techniques used include various types of chromatography, electrophoresis, and spectrophotometry and methods involved in the isolation, purification, and assay of enzymes. Fall.

Prerequisite: One semester of quantitative analysis with laboratory.

532. Biochemistry II (3)

Three hours of lecture. Topics discussed are: application of tracer techniques to biochemistry, the chemical and biochemical properties of lipids, theories on the origin of life, photosynthesis and the biosynthesis of steroids and terpenes, plant aromatics, amino acids, porphyrins and other aspects of nitrogen metabolism. Spring.

Prerequisites: FCH 530 and its prerequisites.

539. Principles of Biological Chemistry (3)

Three hours of lecture. Principles of biochemistry with emphasis on their relationship to biology. Topics include basic metabolic pathways, structure, and function of proteins, enzymes, and nucleic acids, energy relationships and biochemical control mechanisms. Nonchemistry majors. Fall.

Prerequisite: A two-semester course in organic chemistry is desirable, but a one-semester course is acceptable.

540. Chemical Ecology

This course is the same as EFB 512. Refer to description on page 152.

Note: Credit cannot be received for both FCH 540 and EFB 512.

550. Introduction to Polymer Science I: Polymer Synthesis and Mechanisms (3)

Three hours of lecture. Introduction to the synthesis of polymers and the mechanism of polymerization processes. Addition homopolymerization and copolymerization by radical, ionic and coordination type catalysts. Synthesis of block and graft copolymers. Stepwise polymerization, network formation and gelation. Structure of polymers and stereoregular polymerization. Degradation of polymers, reaction on polymers, polyelectrolytes. Fall.

Prerequisites: One year of organic chemistry and one year of physical chemistry.

551. Polymer Techniques (2)

One hour of lecture and discussion and three hours of laboratory; lab reports. Techniques of polymer preparation: free radical solution and emulsion polymerization, gel permeation. Molecular weight determination by light scattering, osmometry, viscosity, gel chromatography. Structure characterization by X-ray diffraction, electron microscopy, nuclear magnetic polarized microscopy, stress-strain and swelling equilibrium and thermal analysis. Fall.

Prerequisites: One year of organic and one year of physical chemistry.

552. Introduction to Polymer Science II: Polymer Properties and Technology (3)

Three hours of lecture. Introduction to the physical chemistry, physics, processing and technology of synthetic polymers. Polymer solutions, including molecular weight determinations and chain statistics. Polymer solid states, including rubber elasticity, viscoelasticity, the glassy state and the crystalline state. Properties, processing and technology of films, fibers, elastomers and foams. Spring.

Prerequisites: One year of organic chemistry and one year of physical chemistry.

555. Natural and Synthetic Polymers: An Overview (2)

Two hours of lecture. A series of 24 introductory lectures on all aspects of polymer science. The material covered will include: types of natural and synthetic polymers; molecular size and shape; molecular weight determinations; chemical synthesis and reactions; polymer type vs. properties; properties in the liquid state; properties in the solid state; rubber and elastomers; crystallinity and morphology; mechanical and thermal characteristics; manufacturing and polymer technology. Fall.

Prerequisites: Organic chemistry. Some knowledge of physical chemistry is helpful, although not required.

571. Wood Chemistry I: General Wood Chemistry (2)

Two hours of lectures. Introduction to carbohydrate chemistry. Chemistry of cellulose, hemicelluloses, and lignin. Cellulose derivatives. Distribution of polysaccharides and lignin in wood. Wood extractives. Chemistry of bark. Formation of heartwood. Wood as a chemical raw material. Fall.

Prerequisite: One or two semesters of a three-credit undergraduate course in organic chemistry.

572. Wood Chemistry II: Wood and Pulping Chemistry (3)

Three hours of lectures. Introduction to carbohydrate chemistry. Chemistry of cellulose, hemicelluloses, and lignin. Cellulose derivatives. Distribution of polysaccharides and lignin in wood. Wood extractives. Chemistry of bark. Formation of heartwood. Wood as a chemical raw material. Chemistry of the industrial pulping processes with emphasis on sulfite and kraft pulping of wood. Chemistry of the major bleaching agents. Chemical byproducts in the pulping industry. Complete tree utilization in the manufacture of pulp and paper. Fall.

Prerequisite: One or two semesters of a three-credit undergraduate course in organic chemistry.

573. Wood Chemistry III: Biosynthesis of Wood (2)

Two hours of lecture. Chemistry of pectin and starch. Photosynthesis with emphasis on the chemical phase. Chemistry of the primary cell wall in plants. Biosynthesis of cellulose, hemicelluloses, pectin, and starch. Biosynthesis of aromatics, including lignin. Biodegradation of wood. Fall.

Prerequisite: FCH 571 or an equivalent course in general wood chemistry.

574. Wood Chemistry IV: Wood Chemistry Laboratory (1)

Three hours of laboratory. Reports. Gravimetric and spectrophotometric determinations of lignin. Determination of the number-average molecular weight of ethylcellulose by osmometry. Estimation of the weight-average molecular weight of ethylcellulose by viscometry. Calibration of a gel permeation chromatography (GPC) column. Separation and characterization of larch arabinogalactans A and B by GPC. Fall.

Prerequisite: FCH 571 Wood Chemistry I or an equivalent course in general wood chemistry.

630. Plant Biochemistry (3)

Three hours of lecture and discussion. Includes the biochemistry of photosynthetic electron transport and phosphorylation, photosynthetic carbon fixation, photorespiration, nitrogen fixation, nitrate reduction, photochrome, and plant hormones. The economic, ecological, and environmental aspects of plant biochemistry will also be discussed. Spring.

Prerequisites: FCH 530—532 or FCH 539 or equivalent.

650. Physical Chemistry of Polymers I (3)

Three hours of lecture. Includes: thermodynamics of polymer solutions, phase equilibria, fractionation, structure-property relationships, elementary chain statistics, molecular geometry, network elasticity, polyelectrolyte theory, and viscosity. Fall.

Prerequisites: One year of organic chemistry and one year of physical chemistry.

651. Physical Chemistry of Polymers II (3)

Three hours of lecture. Viscoelasticity. The glassy state and glass transition temperature. The crystalline state and crystallization kinetics. Characterization of structure and morphology of polymer solid states. Survey of structure and properties of native polymers. Spring.

Prerequisites: One year of organic and one year of physical chemistry.

652. Organic Chemistry of Polymers I (3)

Three hours of lecture. A broad survey of the chemistry of polyfunctional molecules and methods for their conversion to high molecular weight materials. Synthesis of a variety of specialty polymers and chemical reactions on natural and synthetic polymers. Some relations between molecular structure and useful properties. Spring.

Prerequisite: One year of organic chemistry.

653. Organic Chemistry of Polymers II (3)

Three hours of lecture. Kinetics and mechanism of polymerization processes, with emphasis on addition polymerization reactions initiated by radical, cationic and anionic initiators. Mechanism of stereospecific polymerization. Structure of polymers. Reactions on polymers and their modification for specific end uses. Block and graft polymers. Spring.

Prerequisites: One year of organic chemistry and one year of physical chemistry.

681. Principles of Physical Chemistry (2)

Two hours of lecture on chemical kinetics. Collision theory in the gas phase, transition state theory, kinetics in liquid solutions, ionic reactions including electron transfer reactions, rate equations near equilibrium, enzyme kinetics, and photochemical reactions. Spring.

Prerequisites: CHE 656 (Chemical Thermodynamics) or permission of the instructor.

682. Principles of Organic Structure and Synthesis (3)

Three hours of lecture and discussion. A broad survey of strategies for constructing organic molecules and of physical and chemical methods for the elucidation of structure. Emphasis on material relevant to different chemical disciplines. Fall.

Prerequisite: One year of organic chemistry.

**796. Special Topics in Chemistry (1-3)
(Credit hours arranged according to nature of topic)**

Lectures, conferences, and discussion. Advanced topics in physical chemistry, organic chemistry, or biochemistry. Fall and Spring.

798. Research in Chemistry**(Credit hours arranged according to nature of problem)**

Independent research in physical and organic chemistry of synthetic polymers, physical and organic chemistry of natural polymers, organic chemistry of natural products, ecological chemistry and biochemistry. One typewritten report required. Fall, Spring, and Summer.

884. Organic Natural Products Chemistry**(3)**

Three hours of lecture. The chemistry of terpenoids, steroids, and alkaloids with an emphasis on the determination of structure by both modern instrumental methods and chemical degradation. Biogenetic considerations and the confirmation of structure by synthesis are covered. Fall or Spring.

Prerequisite: One semester of advanced organic chemistry.

899. Master's Thesis Research**(Credit hours to be arranged)**

Research and independent study for the master's degree and thesis. Fall, Spring, and Summer.

997. Seminar**(1)**

Seminars scheduled weekly; an average of twenty to thirty seminars are given annually. Discussion of recent advances in chemistry. Credit is given only once to a student. Fall and Spring.

999. Doctoral Thesis Research**(Credit hours to be arranged)**

Research and independent study for the doctoral degree and dissertation. Fall, Spring, and Summer.

FEG—FOREST ENGINEERING**300. Introduction to Forest Engineering and Design****(2)**

One hour of lecture and three hours of laboratory. An introduction to the design process with emphasis on the application of engineering fundamentals to the analysis and design of systems useful in resource manipulation and development. Fall.

340. Engineering Hydrology, and Flow Controls**(4)**

Three hours of lecture and three hours of laboratory and discussion. Analysis of the waters of the earth, their occurrence, circulation, and distribution; physical properties and their interaction with their environment. Principles of hydrologic budgeting and routing; and basic hydraulics of open channel, conduit, groundwater and overland flow. Applications of probability as a basis for the design of solutions to groundwater, surface runoff, flooding and water supply problems. Spring.

Prerequisites: CIE 327, IOR 326, and APM 360.

350. Introduction to Remote Sensing for Engineers**(2)**

Two hours of lecture. The fundamentals of acquiring, analyzing, and utilizing remote sensing data in the performance of natural resource inventories, environmental quality surveys and site development analyses. Oriented for multidisciplinary participation. Spring.

Prerequisite: Junior standing and FEG 363 (which may be taken concurrently with FEG 350).

352. Introduction to Remote Sensing**(3)**

Two hours of lecture and three hours of laboratory. Qualitative and quantitative introduction to the fundamentals of acquiring, analyzing, and utilizing remote sensing data in the performance of natural resource inventories, environmental quality surveys, site development studies, and land use analyses. Oriented for multidisciplinary participation. Spring.

Prerequisites: Physics and calculus or permission of the instructor.

363. Photogrammetry**(3)**

Two hours of lecture and discussion, three hours of laboratory. Basic photogrammetric and photo interpretation concepts as a means of acquiring reliable data for engineering and management planning. Potentials, limitations, instrumentation, and unique requirements are considered. Fall and Spring.

Prerequisite: ERE 371 or equivalent.

410. Structures

(4)

Three hours of lecture, three hours of computation laboratory and discussion. Engineering principles in the analysis, planning design and construction of components and framed structures under various types of loadings. The proportioning of wood, steel and concrete members and the design of statically determinate structural systems. Emphasis is placed on the relationship between theoretical stress analysis and codes and specifications for appropriate materials and structural design practices. Fall.

Prerequisites: ERE 362, APL Computing.

422. Production Systems Engineering

(4)

Four hours of lecture. An introduction to concepts and procedures for planning, designing, and managing production and large-scale physical systems with focus on forest resources and products. Systems analysis and quantitative techniques are introduced as design tools. Fall.

Prerequisites: IOR 326 and senior standing in forest engineering.

437. Transportation Systems

(4)

Three hours of lecture and three hours of laboratory. Interrelationships among natural features, transportation types, design, and management objectives to provide the most effective system within the given framework. Basic engineering principles in the planning location, design, construction, and maintenance of suitable transportation systems to serve various aspects of forest resource management. Spring.

Prerequisites: CIE 437, FEG 422.

447. Hydrologic and Quality Controls

(3)

Two hours of lecture and three hours of laboratory. A continuation of FEG 340 coupled with principles and practices of water quality control for forested sites and low density areas. Design of facilities and systems for water, sewerage and waste water treatment and for the abatement of pollution from nonpoint sources. Planning and analysis for water resources development. Spring.

Prerequisites: FEG 340, ERE 488 and CIE 437 or equivalent as evaluated by instructor.

464. Photogrammetry II

(3)

Two hours of lecture and three hours of laboratory. General analytic photogrammetry including interior and exterior orientation systems, intersection, space resection, and orientation. Correction of photo coordinates for film deformation, lens distortions, atmospheric refraction, and earth curvature. Introduction to photogrammetric plotters. Planning photogrammetric projects and designing optimum procedures for selected photogrammetric tasks. Fall.

Prerequisite: FEG 363.

477. Survey Systems Design

(3)

Three hours of lecture and discussion. Land survey systems including the U.S. Public Land System, plane coordinate systems, and land use and resource systems—Specifications for Surveying and Mapping Projects. The design of future systems. Spring.

Prerequisites: FEG 371 and FEG 363.

489. Forest Engineering Planning and Design

(3)

Two hours of lecture and three hours of laboratory. A curriculum capstone course designed to integrate other coursework with a systematic approach to real life engineering problems. Semester-long laboratory projects are selected to provide experience in dealing not only with technical and economic constraints, but also with environmental, social, legal, and political aspects of the planning process. Spring.

Prerequisite: Senior standing in forest engineering.

498. Research Problem in Forest Engineering

(1-3)

Independent research in topics in Forest Engineering for the highly motivated undergraduate student. Selection of subject area determined by the student in conference with appropriate faculty member. Tutorial conferences, discussions and critiques scheduled as necessary. Final written report required for departmental record. Fall, Spring, and Summer.

Prerequisite: Permission of the instructor.

FOR—FORESTRY (RESOURCES MANAGEMENT)

301. Field Dendrology (1)

Approximately one half-day lecture, five eight-hour field study, presented as the first portion of the Summer Program in Field Forestry held at Pack Demonstration Forest, Warrensburg, N.Y. Field Identification and ecology of common woody species of the southeastern Adirondack area. Natural and cultural history of the area as it affects the growth and development of these species. Summer.

302. Forest Surveying and Cartography (2½)

Course consists of approximately thirteen, eight-hour class days, combining lectures and practical field applications. The course stresses development of functional ability in the areas of cartography, overland navigation, and land measurement. It is part of the Summer Program in Field Forestry held at Pack Demonstration Forest, Warrensburg, N.Y. Summer prerequisite for FOR 303, 322, 332.

Prerequisite: FOR 301.

303. Introduction to Forest Mensuration (3½)

Lecture and field practice on methods and procedures for measuring trees, forest stands, and forest products. Descriptive statistics and sampling are introduced as they relate to the measuring process. Emphasis is placed upon field procedures and performance. The course is part of the Summer Program in Field Forestry held at Pack Demonstration Forest, Warrensburg, N.Y. Summer.

Prerequisites: FOR 301 and FOR 302.

304. Introduction to Forestry (1)

Approximately one day of lecture and at least four all day field trips, presented as an integral part of the Summer Program in Field Forestry. Students will be introduced to the diversity of forestry and the activities of a professional forester, and will visit forestry field operations and wood-using industries. Summer.

321. General Silviculture (3)

Two hours of lecture and one three-hour laboratory first half of semester, three hours of lecture last half of semester. Survey of silvical principles and concepts and practice of silviculture for the production of goods and services from the forest. Designed for students in curricula other than resources management. Not available for resources management majors. Fall.

322. Forest Mensuration (1)

Lecture, field, and laboratory work blocked in time and subject matter with FOR 331 and 332. Principles and methods used in the measurement of the trees and forest stands, the use of aerial photos for mapping and inventory, and the theory and application of compound interest to forestry decisions. Fall.

331. Introduction to the Physical Environment (6)

Lectures, discussions, field, and laboratory work blocked in time and subject matter with FOR 332 and 322. Study of the environmental media: air, soil, and water, through examination of the flow of energy and matter within and between these components of the environment. Drawing together information from geology, physical geology, soil science, water science, and meteorology, this course provides understanding of these areas, their interactions, and the interface with the biological system. Fall.

Prerequisite: Junior year standing in FOR curriculum or equivalent. Course should be taken concurrently with FOR 332 Silvics-Silviculture, because of the blocking of these two courses.

332. Silvics-Silviculture (8)

Three one-hour lectures and five three-hour labs or field trips. Fundamentals of silvics and practices of silviculture enabling manipulation of forests to attain objectives of the forest owner. Emphasis is placed on the biological interrelationships within the forest community, including site factors and forest stand dynamics, and the consideration of these in silvicultural operations. Fall.

Prerequisites: Summer Program in Field Forestry, and FOR 331 (taken concurrently) or permission of the instructor.

335. Regional Silviculture (3)

Three hours of classroom study. Topics cover regional factors that influence silvicultural methods commonly used in different forest types. Provides study of various silvicultural systems used in operating forest properties in various regions, with attention to geographical differences in land use, market opportunities, species characteristics, and economic conditions. Spring.

Prerequisite: FOR 332 or FOR 321.

345. Soils (3)

Two hours of lecture and three hours of laboratory. Introduction to the fundamentals of soil science with particular reference to forestry, but including other land uses. Spring.

351. Meteorology and Fire Behavior (3)

Lectures and recitations in atmospheric physics and the physics and chemistry of combustion lead to discussions of fire behavior and the strategy and tactics of fire suppression. Fall.

Prerequisites: PHY 103 and 104 (Calculus helpful but not required).

360. Principles of Management (3)

Three hours of lecture and recitation. Basic principles and concepts of management which are universally applicable to any organization, business enterprise, or public agency. The various approaches to management including the classical, behavioral and quantitative concepts with emphasis upon the integrative approach, now required to meet modern society's changing life styles and values and the new awareness of the public regarding environmental matters and natural resources management. Spring.

364. Soil and Water Conservation (3)

Three hours of lecture. An integrated historical survey of water and related land resource conservation in the United States. Interrelationships of planning, administration, and evaluation of policies, programs and projects by all levels of government and private units. Spring.

370. Management of the Forest Enterprise (3)

Two hours of lecture and one hour of discussion and laboratory. This course is concerned with the management alternatives, both of a technical and social nature, that are available in the planning for and the production of timber, recreation, wildlife, forage, and water from the forest and with the criteria for choice to meet management objectives. Spring.

371. Range Management (3)

Three hours of lecture and discussion covering range ecology, inventory and evaluation; animal husbandry and grazing management; multiple-use of rangelands; range improvement practices; and range policy and administration. Spring.

Prerequisite: Upper division status in Resource Management or Biology, or by permission of the instructor.

373. Timber Harvesting (3)

Two hours of lecture and one three-hour laboratory and discussion. Harvesting as a production system including equipment, equipment mixes, costs and manpower in serving and logmaking and primary and secondary transportation. Evaluation of various systems as to environmental impacts. Wood as a raw material to the primary processing system and trees as inputs to the harvesting system. Spring.

400. The Social Environment of Resource Management (3)

Three hours of lecture and discussion. This course describes the institutional framework within which the resource manager practices his profession. It intends to show how economics, law, public policy, pressure groups and financial considerations constrain the professional judgment of the resource manager and the goals and objectives of the institution employing him. Fall.

Prerequisites: FOR 332, 360, 461, 322 and one hour of computer science; Senior standing.

404. Economics of Wood-Using Industries (3)

Three hours of lecture and discussion. Structure and organization of selected wood-using industries. Analysis of decisionmaking by the firm. Principles of production and marketing including demand and cost analysis and pricing. Special issues and current problems of the industries, and introduction to the newer mathematical and statistical tools for meeting them. Spring.

Prerequisite: Microeconomics.

405. World Forestry Resources: Problems and Prospects (3)

Three hours of lecture and discussion plus guided readings, pertaining to world forest resources and the problems and opportunities associated with their use and development. Major topics include: world forest resources; production and trade; principal wood-producing countries; forestry and the problems of underdevelopment; and special areas and topics of interest to world forestry. Spring.

Prerequisite: Senior status preferred.

433. Commodity Production Silviculture (3)

Six hours of lecture and study, or field work classroom instruction and exercises will introduce topics, followed by field exercises stressing application of silvicultural methods for growing wood products, mostly in hardwood stands. Topics will cover concepts, techniques, diagnostic methods, and field application of silvicultural prescriptions in both even- and uneven-aged management. Offered one day per week as a block of instruction and exercise. Spring.

Prerequisites: FOR 331-332, and one mensuration course beyond Summer Program in Field Forestry; Senior standing.

434. Greenspace Silviculture (3)

Two hours of lecture, one to three hours seminar or field trip. Concepts, techniques, and field practice of evaluating and manipulating vegetation systems, including site conditions, woody and herbaceous vegetation, and use impacts, primarily for on-site values in park, recreation, wildlife and multiple-use lands, roadsides, utility rights-of-way, protection areas, etc. Fall.

Prerequisites: At least one silviculture course and senior status or permission of the instructor.

435. Integrated Use Silviculture (3)

Four hours of lecture and seminar during first half of semester; six hours of field practice thereafter each week. Development of silvicultural decisions in management of woodlands to achieve results under various integrated use objectives. Trips to forest areas. Several technical reports and a cultural plan prepared prescribing treatment to attain various ownership objectives. Spring.

Prerequisites: FOR 331 and 332 or permission of the instructor. Senior standing.

446. Forest Soil Classification, Survey, and Interpretation (3)

Two hours of lecture and discussion, one three-hour laboratory. Detailed examination of soil genesis and classification, and the survey and description of the soilscape. Interpretations are made for various land uses, especially forestry. Fall.

Prerequisites: FOR 331 or 345 or an introductory soils course.

452. General Meteorology (3)

Three hours of lecture. Examination of the physical processes of the atmosphere as they relate to the exchange of heat, moisture, and momentum in the earth-atmosphere system. Emphasis on the meteorological and micrometeorological basis of climate and its interaction with the biological world. Spring.

455. Forest Tree Improvement (3)

Two hours of lecture, three hours of laboratory or field work. General principles and methods of tree improvement practiced in this country and abroad. Tree selection, techniques of vegetative propagation, hybridization, polyploidy, establishment of seed orchards, clonal and offspring testing and other problems. Spring.

Prerequisites: FBL 470, or Introduction to Mendelian Genetics or Population Genetics.

456. Management of the Forest Business (3)

Three hours of discussion. Overview of major business management principles and methods of operation in forestry enterprises. Emphasis is on general business concepts which forest managers must use. Actual case studies are basis of instruction. Complementary to RMP 611. Fall or Spring.

461. Management Models (3)

Three hours of lecture. Introduction to the various models used in managerial decisionmaking. Emphasis is on the characteristics of the various models: their formulation, assumptions, uses, and limitations. The major topics covered will include: the role of models in management; simple optimization; constrained optimization; multi-valued choices; time adjustment of value; simulation; and models in nondeliberated decisions. Integration of the deliberative and intuitive models is stressed. Fall.

465. Managerial Economics (3)

Three hours of lecture and discussion. Analysis of decisionmaking by the firm. Review of principles employed in modeling, predicting, risk assessment, evaluation and selection of alternative actions. Emphasis on economic and financial decisions and on the delineation of systematic processes of decision. Spring.

Prerequisite: Not available to Resource Management undergraduates except with permission of the instructor.

472. Fundamentals of Outdoor Recreation (3)

Three hours of lecture. Introduction to the programs and practices of federal, state, and local agencies and private organizations involved in planning, administration, and management of outdoor recreation areas. Emphasis is on major recreational issues and conflicts faced by area managers, and how they integrate solutions into their plans. Spring.

473. Planning and Development of Forest Recreation Areas (3)

Three hours of lectures or equivalent laboratory and assignments. Planning and designing forest recreation areas, structures, and facilities. Development of construction plans for camp and picnic sites, for waterfront areas and for trails. Emphasis is on the functional relationship between planning and design, management, and maintenance. Field trips required. Fall.

Prerequisite: FOR 472.

475. Sociology and Psychology of Leisure Behavior (3)

Three hours of lecture and discussion. Introduction to theory and research findings dealing with the sociological and psychological aspects of leisure behavior; field work and lectures demonstrate applications, particularly with regard to leisure behavior. Spring.

Prerequisites: FOR 472, and an introductory course in sociology or psychology, or permission of the instructor.

477. Resource Policy and Management (3)

Three hours of lecture supplemented by one hour of discussion and/or lecture. Public and private forest policy formation; principles of modern management; overall management and operation of a productive forest property. Primarily for forest engineers. Not available to Resource Management undergraduates. Fall.

Prerequisites: Mensuration and silviculture, senior standing in Forest Engineering, or by permission of the instructor.

480. Urban Forestry (3)

Two hours lecture and three hours of laboratory or field trip. Introduction to urban forestry: its professional status and potentials. Elements of urban physical geography. Nature and functions of various kinds of urban greenspace; their physical and social interactions as an integrated system, and management within the broader context of urban processes. Field practice in evaluating urban greenspace resources. Spring.

Prerequisites: Senior status. FOR core courses or permission of the instructor. For students in other schools FOR 434 is desirable.

496. Special Topics in Environmental and Resource Management (1-3)

Guided readings, lectures, discussions, tutorial conferences, or special coursework designed to help the undergraduate student apply scientific analysis of a social, biological, or physical nature to questions within his area of interest. Questions and analyses would include those dealing with forest resources management and administration; forest cultural practices; land use and land use planning; hydrology and watershed management; outdoor recreation; resource economics; world forestry; and others. Fall and Spring.

Prerequisite: Permission of the instructor.

498. Special Studies in Environmental and Resource Management (1-3)

Independent research in environmental and resource management for selected undergraduate students. Selection of subject areas determined by the student in conference with appropriate faculty member. Final written report is required for departmental record. Fall, Spring, and Summer.

Prerequisite: Permission of the instructor and department chairman.

499. Independent Study in Resources Management (7-17)

Independent study of some significant aspect of environmental and resources management. The selection of the topic will be determined by the student in consultation with his advisor. Guidance will be provided by a faculty committee. Limited to Spring semester seniors in Resources Management. Spring.

FTC—FOREST TECHNOLOGY**200. Dendrology I (2)**

Twenty-five hours of lecture and 34 hours of field time. A study of the distinguishing characteristics, growth features, distribution, associates and importance of the major tree species of North America. Seasonal field identification and on-the-spot discussion of habitats, associates, and the place in succession of the predominant forest trees and shrubs as found in the Adirondack area of the Northeast, plus a limited number of introduced species. Fall.

202. Plane Surveying I (4)

Fifty-four hours of lecture and 100 hours of field and laboratory time. An introduction to the theory and practice of plane surveying. Emphasis is on individual skill development through small crew projects, handling typical surveying equipment in typical field situations. Lecture topics include the theory of measurements and errors, mathematics for plane surveying, introduction to field problems and introduction to map use and preparation. Field projects include traversing, methods, and proficiency projects in handling typical surveying instruments. Fall.

203. Plane Surveying II (1)

Twelve hours of lecture and 32 hours of field time. A continuation of FTC 202 with emphasis on small crew field projects introducing the use of the engineer's level and the theodolite. Classroom work is directed at explaining the United States Public Land Survey system and introducing the concepts of modern deed descriptions and recordkeeping procedures. A trip to the County Court House is scheduled for a first hand look at a modern deed and record keeping operation. Spring.

Prerequisite: FTC 202.

204. Forest Mensuration and Statistics I (3½)

Sixty-seven hours of lecture and 36 hours of field time. A classroom and field study of the basic principles and skills required for timber measurements. Volume tables, their use and construction are studied. Cruise reports are required in which the student presents cruise results. Various methods of forest sampling are studied including methods of calculating necessary sampling intensities and sampling errors. Fall.

205. Forest Mensuration and Statistics II (2)

Four hours of lecture and 44 hours of field and laboratory time. A field problem of practical nature utilizing methods for collecting, analyzing, and presenting data dealing with timber volumes. Spring.

Prerequisite: FTC 204.

206. Forest Ecology (3)

Forty-two hours of lecture and 50 hours of field time. Study of weather and weather data collection; students manning a forest weather station. Study of weather and soil factors as to how they affect trees and forests, plus the interactions within the forest community and with the environment. Introduction to cover type mapping. Final field problem and report on detailed measurement and analysis of a belt transect. Fall.

207. Aerial Photogrammetry (2)

Seventeen hours of lecture and 55 hours of laboratory. Development of the ability to interpret important ground features by viewing aerial photos singly and in pairs, using stereoscopic techniques and equipment. Work scale problems and make reliable horizontal and vertical measurements. Use radial line plotter and zoom transfer scope for transfer of detail to base map. Forest type mapping and forest cruising using photos. Fall.

208. Forest Installations (3)

Thirty-six hours of lecture and 60 hours of field time. This course provides the student with the technical competence necessary to use, plan, construct, and maintain such typical forest improvements as telephone lines, radio systems, trails, and light frame structures. Fall.

209. Forest Roads (2)

Twenty-two hours of lecture and 32 hours of laboratory time. This course provides the student with the technical competence necessary to administer, locate, and design the construction and maintenance of a typical forest gravel road. Spring.

Prerequisite: FTC 202.

211. Silviculture (2½)

Thirty hours of lecture and 40 hours of laboratory and field work blocked with forest management. Lectures based on text study cover orientation, terminology and present a framework of the various treatments used in many common stand conditions to bring the forest into a more productive state in accord with the objectives of management. Emphasis on thinning in computer simulation and field practice. Exercises in planting and pruning. Demonstrations in chemical silviculture. Spring.

Prerequisite: FTC 206.

213. Forest Protection I (2)

Thirty-eight hours of lecture and 36 hours of laboratory/field time. A study of the insect and disease agents that damage trees and their role in the total forest community. The course covers identification of local forest insects and disease-causing organisms, study of the major pest groups of other forest regions, and control measures including the effects of pesticides on the environment. Field trips cover local pests and the damage caused, while laboratory work covers major groups of pests likely to be encountered elsewhere. Fall.

214. Personnel Management (1½)

Fourteen hours of lecture and 12 hours of laboratory. A study of company and agency organization functions, including selection of and placement of personnel, training of personnel and performance evaluations, planning for and administering crew responsibilities, human relations in the working situation and special personnel problems of the forest are covered. Techniques of foremanship are applied in various field exercises in other courses, along with the duty of safety hazards, accident prevention, accident classification and accident reporting. Spring.

215. Timber Harvesting (2)

Sixteen hours of lecture and 36 hours of field time. This course acquaints the student with the basic harvesting methods and techniques, with emphasis on the Northeast, along with the knowledge of how and where harvesting fits in with other forest uses. Students gain technical competence in timber sale contract administration and basic timber appraising. Spring.

217. Forest Management (2½)

Thirty-six hours of lecture and 40 hours of laboratory and field work blocked with silviculture. Coverage of the common problems met in organizing a forest property to approach the goals of ownership. Study and practice in techniques of growth measurement and the gathering and use of forest records in general. Summary application of pertinent information from many other courses in a work plan involving management decisions for an assigned forestry property. Spring.

Prerequisite: FTC 206.

218. Forest Recreation (1½)

Fifteen hours of lecture and 32 hours of laboratory or field time. This course acquaints the student with the forest recreational resources—its present and future needs. Principles of recreation development and management are discussed with special emphasis placed on the technical aspects. Spring.

219. Elements of Wildlife Ecology (1½)

Twenty-eight hours of lecture and four hours of field time. A study of the principles of wildlife ecology with fundamentals related to the actions of the preservationist, conservationist, and particularly those of the forest manager. Spring.

Prerequisite: A course in biology or its equivalent.

221. Soil and Water Measurements (1½)

Thirteen hours of lecture and 30 hours of laboratory or field time. A basic introduction to precipitation and streamflow measurements taken at weather stations, snow courses, and streamgaging stations. Includes field and lab measurements for determining physical properties of soils related to land management. Discusses forest management practices commonly used to control erosion and water quality. Spring.

223. Graphics (1)

Sixteen hours of lecture. An introduction to lettering and drafting with emphasis on the skills needed by the forest or surveying technician. Individual skill development is achieved through several projects. The concept behind each project is explained in handout material and lecture, and each student is then expected to complete the project on his/her own time. Freehand and mechanical lettering plates are produced in addition to precision and pictorial drawings. Fall.

227. Forest Protection II (2)

Twenty-three hours of lecture and 24 hours of field and laboratory time. The basic principles of fire ecology, forest fire behavior, fire danger and fire danger rating, forest fire prevention and control, and prescribed burning are covered. Handtool fire suppression techniques are demonstrated and practiced. Spring.

Prerequisite: FTC 213.

228. Structure and Growth of Trees (1½)

Nineteen hours of lecture and twelve hours of laboratory. A study of the various tissues of forest trees and how their growth and development are affected by internal and external factors. Differences in stem structures of some of the more important commercial tree species of the United States are studied in the laboratory, and these differences are related to the commercial uses of these species. Spring.

Prerequisite: An introductory course in general botany or biology.

229. Silviculture II (2)

Twenty-six hours of lecture and 28 hours of field and laboratory. Continuation of FTC 211 dealing mainly with the handling of the more complex hardwood and mixed stands common to the Northeast. Special coverages will be offered on current practices of regional importance beyond the Northeast where graduates are likely to be employed. Spring.

230. Plane Surveying III (2)

Twenty-six hours of lecture and 28 hours of field time. A continuation of FTC 202 and FTC 203 with emphasis on small crew projects using the theodolite. Advanced field techniques are discussed and practiced, such as the determination of the true meridian by the method of direct solar observation, layout of highway curves and simple triangulation procedures. Each topic is developed in detail in the classroom before each field project is completed. Spring.

Prerequisites: FTC 202 and FTC 203.

298. Independent Study in Forest Technology (1-6)

Independent study in forest technology to apply, enhance, or supplement forest technology or related natural resource education. Objectives and scope of the project are negotiated in a learning contract between the student and instructor(s), with course admission based on permission of the instructor(s). Limited to those who have attended the complete regular SFT program, or those who have graduated from another forest technology program or a related natural resource program, or to students enrolled in any ESF program other than that of the SFT. A maximum of 6 credit hours may be taken by any student in total. Semesters as arranged. Fall, Spring, or Summer.

LIB—LIBRARY (COLLEGE OF ENVIRONMENTAL SCIENCE AND FORESTRY COURSE)**300. Library Research (1)**

Fifteen hours of class time per semester (usually the first five weeks). Introduction for students at all levels to basic library material and the research process leading to preparation of a bibliography. Fall and Spring.

LSA—LANDSCAPE ARCHITECTURE

(See also courses listed under EIN and CMN.)

320. Introduction to Landscape Architecture and Planning (3)

Three hours of lecture. The course presents an overview of the professions of landscape architecture and planning. It surveys the historic and contemporary situations of environmental design and planning. The course introduces the socio-cultural and natural factors which influence the form and condition of the physical environment. It will introduce issues, personality, and projects. Fall.

326. Landscape Architecture Design Studio I (3)

Six hours of studio and one hour of lecture. The first in a sequence of studios focusing on the concepts, skills, and methods of design. This course introduces students to the basic vocabulary, concepts, and principles of design; the application and operation of these in the physical environment, development of three-dimensional spatial concepts. The requirements for this course include readings, examinations, field trips, design exercises, and projects. (Student field trip expense \$125-\$150.) Fall.

Prerequisite: Permission of the instructor.

327. Landscape Design Studio II (3)

One hour of lecture and six hours of studio. The second in a sequence of studios focusing on the concepts, skills, and methods of design. This course continued the development of design abilities through study of the interrelationship between the requirements of a design established in a program, the visual character of the site and the development of a designed result. The development of spatial concepts which meet principles of composition organization and a given set of requirements. The requirements for this course include readings, examinations, field trips, design exercises, and projects. (Student field trip expense \$125-\$150.) Spring.

Prerequisites: LSA 326, with a minimum grade of C, and CMN 382.

330. Site Research and Analysis (2)

One hour of lecture and three hours of studio. This course will require those enrolled to apply principles of natural resources and processes to assess the land use and development potentials and limitation of a site. The principles will include landforms, soils, hydrology, climate, energy, and plant, animal, and human ecology. A variety of manual and computer techniques for data collection, analysis and synthesis of natural systems information will be explored. The course will concentrate on the comparison of synthesis techniques and their implications for land use and design decisionmaking. Occasional local field trips will be utilized. Spring.

Prerequisite: EIN 311 or permission of the instructor.

422. Landscape Design Studio III (4)

Twelve hours of studio. This course is a continuation of skill development, theory, and strategies as they relate to design issues and process. Emphasis is placed on in-depth investigation on projects of a direct scale illustrating form derivation and the man-made and natural form. Occasional field trips to illustrate various design solution. Fall.

Prerequisites: LSA 327, with a minimum grade of C, and LSA 330.

423. Landscape Design Studio IV (4)

Twelve hours of studio. This course emphasizes skill development, theory, and strategy as they relate to large-scale site design situations. Continues prior courses emphasis on design process and form manipulation. Occasional field trips to illustrate and inspect design form. Spring.

Prerequisite: LSA 422, with a minimum grade of C.

425. Orientation for Experiential Studio (2)

Three hours of lecture and recitation. Investigation and documentation of an area of specialty, discussion, readings, and research. Fall and Spring.

Prerequisite: Permission of the instructor.

433. Plant Materials (2)

Three hours of lecture and field work for first one-third of semester. Two hours of lecture for second one-third of semester. This course concentrates on woody plant materials used in landscape architecture, the ecological relationships of plants, ornamental plant materials use and identification, plant culture propagation, transplanting, planting plans and specifications. Fall.

Prerequisite: Permission of instructor.

434. Design Materials (1)

Three hours of lecture for last one-third of semester. An introduction to wood, concrete, masonry, asphalt, stone, and synthetic materials intended to provide students with an understanding of the basic visual, structural, and maintenance principles of each, in order to both use the materials in design and prepare written specifications. Fall.

442. Site Grading (2)

Two hours of lecture and three hours of studio during first two-thirds of semester. Lectures, projects, and assigned readings. The study of grading as the primary means of landform modification in landscape architectural design. Primary emphasis will be given to principles of grading, including contour manipulation, sections, profiles, and computations. Concepts of establishing acceptable slopes and positive surface drainage will be introduced. Enrollment limited to BLA or MLA students. Fall.

Prerequisite: LSA 330, Site Research and Analysis.

443. Site Drainage Systems (1)

Three hours of lecture for last one-third of semester. Lectures, projects, and assigned readings. Provides a basis for the design of drainage systems. Coverage includes concepts relevant to understanding precipitation, methods of run-off quantification, open channel flow, systematic pipe network analysis. Enrollment limited to BLA or MLA students. Fall.

Prerequisite: LSA 330, Site Research and Analysis.

444. Vehicular Circulation Design (1)

Three hours of lecture for first one-third of semester. Lectures, projects, and assigned readings. Must be taken concurrently with LSA 423. Introduces the circular geometry of horizontal curves and the parabolic geometry of vertical curves, curve coordination based on safety and aesthetic relationships, road grading. Enrollment limited to BLA or MLA students. Spring.

Prerequisites: Computer Programming and Surveying.

445. Elements of Structures (1)

Three hours of lecture during the second one-third of the semester. Lectures, projects, and examinations. An introduction to the concepts of assembling engineering materials into structure. All common building systems will be surveyed and emphasis will be placed on fundamentals rather than on detailed mathematical design procedures.

Prerequisite: Non-School of Landscape Architecture students by permission of the instructor. Not open to engineering majors. Spring.

455. Professional Practice in Landscape Architecture (2)

Two hours of lecture. This course examines the historic and contemporary modes of landscape architectural practice including practice types, ethics, operations, and client systems. Particular emphasis is given to the projected trends of professional practice and with impact on future roles for the landscape architect. Professional development is reviewed as it relates to internship, licensing, and continuing education. Occasional field trips will be utilized. Spring.

Prerequisites: Senior status in landscape architecture or permission of instructor.

495. Selected Readings in Environmental Studies (1-3)

Exploration of selected readings in depth with individual independent study upon a plan submitted by the student and related to credit hours assigned. Upon approval of the instructor, the student may systematically investigate some subject area encountered in regularly scheduled courses or may initiate research on a variety of subject areas of determined relevance. Fall and Spring.

Prerequisite: Permission of the instructor.

496. Special Topics in Landscape Architecture (1-3)

One to three hours of class meetings. Special topics of current interest to undergraduate students in landscape architecture and related fields. A detailed course subject description will be presented as a topic area is identified and developed. Fall and Spring.

Prerequisite: Permission of the instructor.

498. Introductory Research Problem (1-3)

Guided study of a selection of problems relating to landscape architecture and environmental design. Emphasis on study procedure and methods employed. Enrollment at periodic intervals throughout the semester. Fall, Spring, and Summer.

Prerequisite: Permission of the instructor.

520. Design Analysis Studio I (3)

Six hours of studio and one hour of lecture-discussion. The first in a sequence of studios focusing on the concepts, skills, and methods of design. This course introduces students to the basic vocabulary of theoretical design principles, to the application and operation of these in the physical environment, and to the development of three-dimensional spatial concepts in community scale patterns. The requirements for the course include readings, examinations, field trips, design exercises, and projects, Fall.

Prerequisites: First-year MLA standing or permission of the instructor. Not open to BLA students.

521. Design Analysis Studio II (3)

Six hours of studio and one hour of lecture. The second in a sequence of studio applying the concepts, skills, and methods of design in a critical analysis of various natural and human systems in community scale environments. Concentration is on the evaluation of options in the ordering of a variety of land use activities, with special emphasis on the functional and spatial quality of built environments. The requirements for this course include readings, examinations, field trips, design exercises, and projects. Spring.

Prerequisites: LSA 520, CMN 382, or permission of the instructor.

522. Landscape Design Studio VI (4)

Twelve hours of studio. Studio problems, research, drafting and field trips. Concentration on complex urban problems. Concern for social and psychological considerations of the individual and large groups of people, their interaction and resultant forms of the environment. Spring.

Prerequisite: Permission of the instructor.

524. Experiential Landscape Studio Design (16)

Forty-eight hours per week. The articulation of the study proposal established in LSA 425, as approved by faculty, through research, readings, field study with graphic and written documentation, and group discussion. Academic study in an off-campus location in an area of landscape architectural significance, as described and delineated in a student-prepared proposal approved by the faculty. Fall or Spring.

Prerequisites: LSA 425 and LSA 423, with a minimum grade of C.

525. Landscape Design Studio VI (4)

Twelve hours of studio. Investigation of a problem in landscape architecture as proposed by the student and conducted in conjunction with faculty advisor. Spring.

Prerequisite: Permission of the instructor.

527. Landscape Design Studio VI (4)

Twelve hours of studio. Studio problems, research, reports, and field trips. Concentration on regional landscape problems, the techniques of their analysis and derivation of their significance to the practice of landscape design. Spring.

Prerequisite: Permission of the instructor.

529. The Major Elements of Environmental Design (3)

Lectures, readings, discussions, and studios. The course presents an introductory survey of environmental design methods and associated skills and techniques. While studio work is part of the course, no design background is required. Fall.

533. Plant Materials (2)

Field trips and discussion. Ornamental woody plant identification. Observation and sketches of outstanding examples of planting design. Two weeks. Summer.

Prerequisite: Permission of the instructor.

545. Professional Practice Studio II (2)

Three hours of studio, one hour of recitation. Studio problems, research, discussion and recitation sessions on the processes and methods of office practice. Emphasis on all aspects of site development. Spring.

Prerequisite: Permission of the instructor.

547. Principles of Professional Practice (2)

Two hours of lecture. Lectures, assigned readings, reports, cost estimates, specifications, contracts, professional ethics, registration laws, professional practice. Spring.

595. Selected Readings in Landscape Architecture (1-3)

Exploration of selected readings in depth with individual independent study upon a plan submitted by the student and related to credit hours assigned. Upon approval of the instructor, the student may systematically investigate some subject area encountered in regularly scheduled courses or may initiate research on a variety of subject areas of determined relevance. Fall and Spring.

Prerequisite: Fifth-year status or permission of the instructor.

596. Special Topics in Landscape Architecture (1-3)

Experimental or special coursework in landscape architecture for graduate and undergraduate students. Subject matter and method of presentation vary from semester to semester. Fall and Spring.

Prerequisite: Permission of instructor.

598. Research Problem (1-3)

Independent study of selected areas of environmental interest. Emphasis on a self-disciplined study, development of procedures and techniques to be employed in environmental design and planning. Engagement with specific sites and problems as proposed for study by individual communities. Enrollment at periodic intervals throughout the semester. Fall, Spring, and Summer.

Prerequisite: Permission of the instructor.

620. Community Design Studio I (3)

Six hours of studio and one lecture-seminar hour. An examination and evaluation of the landscape architectural design process with an emphasis on the methodological variations which occur in its definition and application. A variety of projects, scales, and programs are employed as a vehicle for study of the design process. Fall or Spring.

Prerequisite: Permission of the instructor.

621. Community Design Studio II (3)

Six hours of studio and one lecture-seminar hour. An examination and evaluation of the landscape architectural design process with an emphasis on the methodological variations which occur in its definition and application. A variety of projects, scales, and programs are employed as a vehicle for study of the design process. Fall or Spring.

Prerequisite: Permission of the instructor.

641. Formal Organizations (1)

Three hours of lecture-discussion for one-third of semester. This course presents basic functional concepts of formal organizations for landscape architects who intend to work at the community scale. Three types of organization arenas are presented: private, public, and non-profit organizational characteristics of division of work, hierarchy, authority, and communications are introduced. Comparisons are made between traditional bureaucracies and interdisciplinary teams. Each student will prepare an organizational description. Fall or Spring.

Prerequisites: MLA status or permission of the instructor.

642. Project and Program Scheduling (1)

Three hours of lecture-discussion for one-third of semester. The course presents an introduction to alternative scheduling methods for design projects, including bar charts, critical path, and program evaluation review techniques. Fall or Spring.

Prerequisites: MLA status or permission of the instructor.

643. Ethical Issues in Community Design and Planning (1)

Three hours of lecture-discussion for one-third of a semester. Status and role of the profession in society, standards of professional conduct and responsibility, ethical responses to a variety of professional situations is the focus of the course. Fall or Spring.

Prerequisites: MLA status or permission of the instructor.

650. Behavioral Factors of Community Design (3)

Three hours of lecture and discussion. An introduction to the contribution of the behavioral sciences to community design and planning is provided. Readings and discussions concern both theoretical and methodological aspects. Case studies are used to illustrate a variety of current behavioral science applications. Course assignments to familiarize the student with basic behavioral science methods including questionnaires, observations, and interviews. A final project provides an opportunity to synthesize course materials. Fall.

Prerequisites: MLA status or permission of the instructor.

651. Process of City/Regional Planning (3)

Three hours of seminar. The purpose of this course is the introduction of planning as a process of decisionmaking and to familiarize graduate students with its scope and content. The course relies upon lectures and readings to develop introductory knowledge as well as seminars and discussions to cover the constitutional basis, tools, and techniques and the current directions of planning. Fall or Spring.

Prerequisite: Permission of the instructor.

656. Environmental Factors, Community Response, and Form (3)

Two and one-half hours of lecture and six studios per semester. The course presents an introduction to a comprehensive process for the integration of environmental phenomena, such as solar access, visual access, noise, and wind into community design. The process includes data gathering and analysis, prediction methods, objective criteria, and implementation. Fall.

Prerequisites: Second year MLA status, or permission of the instructor.

671. History of Landscape Architecture (3)

Three hours of lecture-seminar. Regular use of slides and other projected lecture material; assigned texts as a basis for lecture; supplemental readings, assigned and individually researched; class discussion from readings and lecture; and student presentations and term paper. Historical study and style analysis of Western man's efforts to design his environment and his changing attitudes and relationships to environment. Also, non-Western coverage where significant or influential on Western man. Study of historical personalities as well as periods that are of environmental concern up into the modern periods. Fall.

Prerequisites: MLA standing or permission of the instructor.

696. Special Topics in Landscape Architecture (1-3)

Experimental or special coursework in landscape architecture for graduate and undergraduate students. Subject matter and method of presentation vary from semester to semester. Fall and Spring.

Prerequisite: Permission of the instructor.

697. Topics and Issues of Community Design and Planning (2)

Two hours of lecture and discussion. Topics for discussion are selected to acquaint the entering graduate student with a generalized view of current issues facing landscape architects in community design and planning. Readings and papers are regularly assigned. Fall.

Prerequisites: MLA students or permission of the instructor.

752. Urban and Regional System Dynamics (3)

Lectures and workshop. The major concerns of this course are application of system dynamics; basic principles of system dynamics; and system dynamics modeling. This method is investigated as a useful tool in modeling many landscape architectural and planning problems. No prior computer experience is necessary. Spring.

Prerequisite: Permission of the instructor.

796. Special Topics in Landscape Architecture (1-3)

One to three hours of class meetings. Special topics of current interest to graduate students in landscape architecture and related fields. A detailed course subject description will be presented as a topic area is identified and developed. Fall and Spring.

Prerequisite: Permission of the instructor.

797. Seminar (2)

Two hours of seminar. Discussion of current topics, trends, and, research related to landscape architecture, planning, and management. Fall and Spring.

Prerequisite: Permission of the instructor.

**798. Research Problem
(Credit hours to be arranged according to nature of problem)**

Special study of assigned problems relating to landscape architecture or planning, with emphasis on critical thinking. Fall, Spring, and Summer.

Prerequisite: Permission of the instructor.

799. Thesis Project Proposal Development (1)

One hour of lecture and workshop. During this course, a student will prepare a proposal for a thesis/project in the MLA program. Fall.

Prerequisites: LSA 699 and permission of the instructor.

899. Master's Thesis Research (Credit hours to be arranged)

Research and independent study for the master's degree and thesis. Fall, Spring, and Summer.

PSE—PAPER SCIENCE AND ENGINEERING**300. Introduction to Papermaking (3)**

Three hours of lecture. Historical and commercial consideration of the paper industry. Technology of papermaking with emphasis on stock furnish, stock preparation and paper machine operation. Introductory discussions of papermaking materials and formation and reactions of a fibrous web. Fall.

301. Pulp and Paper Processes (3)

Three hours of lecture. Technological consideration of pulping and bleaching of woody raw material. Includes consideration of wood procurement and preparation, pulping and bleaching processes, recovery of secondary fibers, pollution abatement and other ancillary operations. Spring.

Prerequisites: FCH 571 and 572, PSE 300 (or concurrent).

302. Pulp and Paper Processes Laboratory (1)

One three-hour laboratory. Study and practice in the techniques of laboratory procedures normally encountered in the pulp and paper industry. Laboratory exercises selecting and using standard testing methods. Field trips to observe commercial equipment of the pulp and paper industry. Spring.

Prerequisite: PSE 301 (or concurrent).

304. Mill Experience (2)

Twelve weeks full-time pulp or paper mill employment approved by the department between the junior and senior years. The student must submit a comprehensive report to fulfill this requirement. Summer.

370. Principles of Mass and Energy Balance (3)

Three hours of lecture. Conservation of mass and energy applied to steady-state and dynamic process units and systems. Problem analysis and solution; computational techniques. Thermodynamic data and their use; real vs. perfect gases; steam properties; psychrometry. Fall.

Prerequisites: Calculus, physics, and FCH 360 (or concurrent).

371. Fluid Mechanics (3)

Three hours of lecture and/or demonstrations. The study of momentum transfer. Steady and unsteady flow of liquids and gases in pipelines, ducts, open channels, and porous media. Movement of particles in fluid media. Newtonian and non-Newtonian flow and flow of suspensions. Filtration, sedimentation, centrifugation, agitation and mixing. Characteristics and selection of pumps, blowers, agitators and other equipment. Flow measurement and flow system design with economic considerations. Fall.

Prerequisites: College level physics and chemistry, calculus.

372. Heat Transfer (2)

Two hours of lecture and/or demonstration. The study of heat transfer including conduction, convection, radiation and their applications in industry. Heater and heat exchanger design and selection, and industrial evaporation. Spring.

Prerequisites: PSE 370 and 371 or equivalent.

461. Pulping Technology (3)

One hour of lecture and six hours of laboratory. Discussion of pulping and bleaching processes: effect of chemical and physical variables on the wood components and pulp properties; chemistry involved. Experiments in pulping and bleaching, and pulp evaluation. Fall.

Prerequisites: PSE 301, CHE 346 and CHE 356.

Note: A student may not enroll in or receive credit for both PSE 461 and ERE 671.

465. Paper Properties (4)

Three hours of lecture, three hours of laboratory and discussion. Evaluation and study of the physical, optical, and chemical properties of paper and the interrelationships existing between paper manufacturing methods, papermaking additives, test results and the ultimate properties desired in the finished paper. Fall.

Prerequisites: PSE 301 and PSE 302.

Note: A student may not enroll in or receive credit for both PSE 465 and ERE 677.

466. Paper Coating and Converting (2)

Two hours of lecture. Evaluation and study of various coating materials and processes used by the paper industry. Introduction to polymers and their use in converting operations. Study of materials and equipment used in converting operations, fundamentals and parameters which control their use, effects on final properties of papers. Spring.

Prerequisite: PSE 465.

Note: A student may not enroll in or receive credit for both PSE 466 and ERE 678.

468. Papermaking Processes (3)

Two hours of lecture and three hours of laboratory. Study of the papermaking process, featuring operation of the pilot paper machine. Emphasis is on the fundamentals of stock preparation, paper machine operation, evaluation of the finished product and the collection and analysis of data to develop material and energy balance. Results of each paper machine run are evaluated in seminar-type discussions. Spring.

Prerequisites: PSE 461 and PSE 465.

473. Mass Transfer (3)

Three hours of lecture. The study of mass transfer, humidification, air conditioning, drying, gas absorption, distillation, leaching, washing, and extraction. Fall.

Prerequisites: PSE 370, 371, and 372 or equivalent.

491. Paper Science and Engineering Project I (1)

Student makes a systematic survey of all available literature on the problem assigned him and incorporates it in a formal, typewritten report. An essential part of this report is a detailed outline of a research project which the student proposes to undertake during the next semester (PSE 492). Fall.

Prerequisites: PSE 300 and PSE 301.

492. Paper Science and Engineering Project II (3)

The analysis of a problem, the synthesis of a solution and the basic design of the facilities needed to solve a problem. Laboratory research, field work, and consulting as needed in addition to the literature survey completed in PSE 491. Progress reports and a final report and seminar-style presentation. Spring.

Prerequisite: PSE 491.

496. Special Topics (1-3)

Lectures, conferences, and discussions. Specialized topics in chemistry, chemical engineering, and physics as well as topics pertaining to management as related to the pulp, paper, paperboard, and allied industries. Fall and Spring.

498. Research Problem (1-4)

The student is assigned a research problem in pulping, bleaching, refining, additives, quality control of paper or paper products, or chemical engineering. The student must make a systematic survey of available literature on the assigned problem. Emphasis is on application of correct research technique rather than on the results of commercial importance. The information obtained from the literature survey, along with the data developed as a result of the investigation, is to be presented as a technical report. Fall, Spring, and Summer.

Prerequisites: PSE 461 and PSE 465.

RMP—RESOURCE MANAGEMENT AND POLICY**529. Environmental Impact: Principles and Strategies (3)**

Three hours of lecture and discussion. Principles and theory of environmental impact and statements of impact as required by federal law. Administrative procedures for review and evaluation. Procedural strategy and effective constitution of statements for various governmental levels. Means of obtaining sources of authoritative information. Fall.

560. Nonindustrial Private Forest Management (3)

Three hours of lecture and discussion. Resource conditions and management issues associated with private nonindustrial private forest lands. Special attention is given to owner characteristics and objectives, public and private programs which directly or indirectly influence management decisions and the role of foresters in relation to the above. Spring.

Prerequisite: Senior or graduate student standing in forestry.

561. Land Use Economics (3)

Three hours of lecture-discussion. Study of the theory and methods of land use economics and the application of economic analysis to open space and regional planning. Emphasis is on understanding basic concepts; development of operational methods and data sources. Case studies, outside readings, and guest speakers are utilized. Spring.

Prerequisites: One course in macroeconomics and one in microeconomics and permission of the instructor.

562. International Timber Trade (3)

Three hours of lecture. Basic principles of international trade. Structure and procedures of international timber trade. Major trade regions and their relationships. Economic context of timber trade. Emphasis is placed upon methods of analyses for understanding both opportunities and limitations of timber products exports and imports. Fall.

Prerequisites: Two semesters of undergraduate economics, and senior standing in forestry or wood products engineering.

587. Environmental Law (3)

Three hours of lecture and discussion. Studies in Environmental Law designed for resource managers. Review of structure and processes of American legal system, constitutional framework of environmental law, The National Environmental Policy Act, legal framework for management of federal lands, focus on legal aspects of common property resource management, land, water, and air. Fall.

588. The Law of Natural Resource Administration (3)

Three hours of lecture and discussion. An introduction to the law concerning the procedures, powers, and judicial review of public agencies responsible for the management of natural resources. Topics will include the extent of an agency's rule-making power and the rights of aggrieved parties to appeal from agency decisions. Spring.

Prerequisite: FOR 360 or equivalent course in public administration.

602. Resource Economics (3)

Three hours of lecture and discussion. Economic theory and analysis in resource management and use decisions. Study and application of economic models to land, water, forest, wildlife, and recreational resources. Relationships and interactions of public and private sector in resource management. Fall.

Prerequisite: Two semesters of undergraduate economics.

603. Research Methods in Resource Management and Policy (3)

Three hours of lecture and discussion. Study of the elements of research methodology including statistics and their application to analyzing and resolving problems both basic and applied in the managerial and policy sciences. Fall.

Prerequisite: Undergraduate statistics course.

664. Soil and Water Conservation (3)

Three hours of lecture and discussion. An integrated examination of the many aspects of the field of water and related land resource conservation in the United States. Topics include the evaluation and present status of planning, organizational, economic and legal constraints on the development of policies and programs of the federal agencies, state and local government and private units. Fall.

Prerequisite: Permission of the instructor.

670. Economics of Nonmarket Goods (3)

Group discussion, lectures, guided readings, case studies, and student projects on the economic aspects of watershed management, fish and wildlife management, and outdoor recreation. Major topics include theories of valuation and application to nonmarket goods, cost analysis for nonmarket goods, and measurement of regional impacts. Spring.

Prerequisites: Microeconomics, knowledge of basic statistical analysis, and six hours or more of resource management coursework.

672. Open Space Planning (Recreation) (3)

Three hours of lecture and discussion; one overnight field trip required. Study of methods and techniques applicable to open space planning in nonurban areas. Survey of literature and current research. Open space standards, classification systems, and inventory methods. Development of plans for large scale recreation areas, and inclusion of recreation into regional plans. The interrelationship and conflicts between resource utilization/development and recreation/aesthetics reviewed through case studies. Fall.

675. Psychology of Leisure Behavior (3)

Three hours of lecture and discussion. Introduction to theory and research findings dealing with the sociological and psychological aspects of leisure behavior: field work and lectures demonstrate applications, particularly in outdoor recreation. Fall.

751. World Forestry (3)

Three hours of lecture and discussion. World forest distribution and types; regional production and consumption of forest products; international trade in timber and related products; the role of forest resources in development; and special topics; tropical forestry, comparative forest policies and programs, forestry education, the problems of developing countries, international cooperation in forestry development, the role of the United States in world forestry, etc. Spring.

753. Resources Policy (3)

Three hours of lecture and seminar. Evaluation of basic environmental and resource issues and their involvement in public and institutional policies. Exploration of alternative resource goals, policies, and program approaches and their implications. Analysis of processes for policy delineation and modification. Fall.

754. Advanced Forest Administration (3)

Critical appraisal of existing public, semipublic and private forestry agencies in the United States, and the comparative study of major administrative organizations and practices. Occasional inspection trips to forestry headquarters and field units and discussion of internal administrative problems with forest officers. Fall or Spring.

Prerequisite: FOR 360 or equivalent.

796. Special Topics in Resource Management and Policy (1-3)

Lectures, seminars, and discussion. Advanced topics in resource management and policy. Check schedule of classes for details of subject matter. Fall and/or Spring.

797. Seminar (1)

Group discussion and individual conference concerning current topics, trends, and research in management. Fall and Spring.

**798. Research Problems in Resources Management and Policy (1-12)
(Credit hours arranged according to nature of problem)**

Special investigation and analysis of resources management problems where integrative relationships of several subject aspects of forestry are a major consideration. Fall, Spring, and Summer.

898. Professional Experience (1-12)

Professional experience which applies, enriches, and/or complements formal coursework. Graded on an "S/U" basis. Fall, Spring, and Summer.

899. Master's Thesis or Project Research (1-12)

Investigation leading to the completion of a research-oriented thesis or to an application-oriented project. Graded on an "S/U" basis. Fall, Spring, and Summer.

999. Doctoral Thesis Research (1-12)

Investigation leading to the completion of the doctoral thesis. Graded on an "S/U" basis. Fall, Spring, and Summer.

SCE—SCHOOL OF CONTINUING EDUCATION**510. Creative Problem Solving Seminar (3)**

Three hours of lecture and discussion. A course designed to extend the students' understanding and application of creative problem solving processes. One requirement will be to select and carry out an application of the techniques to a particular problem, with consultation and guidance from the instructor. Critique and survey of the literature on creativity, in-depth analysis of the synectics process and various procedures which have been developed for nurturing creative behavior comprise the essence of the program. Fall.

Prerequisite: Undergraduate degree or permission of the instructor.

Note: Also listed as EIN 510.

530. (FEN) Pest Identification, Biology and Management (3)

A study of the life history and management practices for pests common to the home, landscape and recreational areas. Suggested for pest control personnel and teachers of primary and secondary science areas. Not open to College of Environmental Science and Forestry students. Summer.

Prerequisite: One course in biology.

576. Special Topics Course: Environmental Education Processes and Strategies (3)

Lectures, discussions, field problems, and structured outdoor laboratory assignments in environmental education processes and strategies for professional educators in elementary and secondary schools who are part-time, nonmatriculated at ESF. Summer.

Prerequisite: Permission of the instructor. Not acceptable for credit in graduate programs of the School of Forestry.

596. Special Topics in Resource Management (1-3)

Lectures, field exercises, guided readings and discussions, in a shortcourse format. The study of recent developments and applications in resource management. Illustrative topics include management of forest stands, resource economics, land planning or recreation planning and site development. Not acceptable for credit in graduate programs of the School of Forestry. Summer.

Prerequisite: Permission of the instructor.

SIL—SILVICULTURE

520. Application of Ecology (3)

Two hours of lecture and discussion and one to three hours seminar, workshop, or field trip. Exploration of use and implications of ecological concepts for practices modifying terrestrial ecosystems for human benefit. Discussion of ecological writings in relation to applied problems; workshops, field trips and student presentations exploring ecological implications of specific situations. Course designed for interdisciplinary participation. Spring (even years).

535. Advanced Forest Soils (3)

Three hours of lecture-discussions concerning the current state-of-the-art in forest soils. Effect of intensive forest management on soil, soil-site-species relationships, forest fertilization tree nutrition. Application of forest soils information to silviculture. Spring.

Prerequisite: Forestry 331, 332 or beginning courses in soils and silviculture.

540. Forest Hydrology (3)

Two hours of lecture and three hours of laboratory. The relation of forest and range vegetation to its environment, and its effect upon soil and water. Measurement of precipitation, runoff, erosion, and other variables. Fall and Spring.

542. Practice of Watershed Management (3)

Two hours of lecture and three hours of laboratory. The impact of the multiple use of forest and range lands on water yield and soil stability. Regional problems and potential solutions. Spring.

Prerequisite: SIL 540.

553. Energy Exchange at the Earth's Surface (3)

Two hours of lecture and three hours of laboratory. A comprehensive study of the physical processes taking place in the lowest layer of the atmosphere. Primary emphasis on the turbulent transfer of heat, momentum, and water vapor and the expression of these fluxes in the microclimate. Spring.

Prerequisites: FOR 452, physics, and calculus.

620. Silvicultural Concepts and Applications (3)

Six hours of lecture, study, or field work. Classroom instruction and exercises introduce topics important to silvicultural practice. Students explore these in depth through independent study and the solving of assigned problems. Field exercises will serve as a means to apply concepts, primarily in hardwood stands. Topics include concepts, techniques, diagnostic methods, and formulation and application of silvicultural prescriptions. Offered one day per week as a block of instruction. Spring.

Prerequisite: Previous undergraduate study of silviculture.

625. Productivity of Forest Stands (3)

In two hours of lecture and three hours of laboratory, whole tree, stand, and forest community productivity are studied from an ecophysiological viewpoint. Quantitative techniques and methods used to evaluate biological as well as economic forest production are learned and utilized. From the perspective established, new trends and developments in silvicultural practice are critically examined. Spring.

Prerequisite: Permission of the instructor.

635. Forest Soils and Their Analyses (3)

One hour of lecture, one hour of recitation, four hours of field and laboratory study of forest soils, emphasizing plant-soil relationships. Stress on quantification of plant-soil diagnostic techniques and their interpretation. Spring (odd years).

Prerequisites: FOR 446; background in physical and biological sciences recommended.

640. Advanced Wildland Hydrology (3)

Lecture, discussion, and laboratory sessions in advanced problems of forest and range hydrology, watershed management methods, and techniques and evaluation of new methods of hydrologic data collection and analysis. Fall.

Prerequisite: SIL 540 or FEG 340.

- 642. Snow Hydrology** (3)
 Three one-hour lectures and two three-day field trips. Physical characteristics of snow and the energy relations important in its accumulation and dissipation. Problems of measurement and prediction of runoff and melt. Potentials for management. Spring.
Prerequisite: SIL 540 or FEG 340.
- 677. Advanced Forest Tree Improvement** (3)
 Two hours of lecture and discussion and three hours of laboratory. A study of advanced principles and techniques for genetic improvement of forest trees. Special emphasis is placed on selection and breeding for growth rates, wood quality, and insect and disease resistance. Problems of tree hybridization, racial variations, sexual reproduction, and quantitative genetics in forest trees. Laboratory training in cytology and cytogenetics, pollen germination, vegetative propagation and other problems. Independent research problems will be undertaken by the student. Fall.
Prerequisites: FBL 470 and 471, FOR 455.
- 730. Research Methods in Silviculture** (3)
 Three hours of lecture or discussion. Research concepts and methodology with particular application to silviculture and its related sciences. More appropriate to beginning students or before taking thesis work. Fall.
Prerequisite: Permission of the instructor.
- 735. Forest Soil Fertility (Applied Studies)** (2-4)
 Two hours of lecture and one hour of discussion. Up to six hours of laboratory depending on number of credit hours. Influence of soil fertility on development and growth of seedlings and trees, and techniques involved to determine this influence. Chemical and biological analysis to determine levels of soil fertility. Nutrient element deficiencies and their correction by soil amendments and fertilizers. Term projects by the student will be undertaken. Spring (even years).
Prerequisites: CHE 332 and 333, FBO 530, FOR 446 and SIL 635, or equivalent.
- 737. Forest Soil Physics** (4)
 Three hours of lecture and discussion and three hours of laboratory. Presentation of principles of soil physics including water flow, storage and availability, soil permeability, heat transfer, and their consideration as root environmental factors. Analytical procedures are introduced and evaluated. Applications of soil physics to silvics, soil fertility, watershed management and hydrology, soil biology and land-use. Spring.
Prerequisites: FOR 345, 446, or their equivalents. Physical chemistry and integral calculus strongly recommended.
- 796. Special Topics in Silviculture** (1-3)
 Lectures, seminars, and discussion. Advanced topics in silviculture. Check schedules of classes for details of subject matter. Fall and/or Spring.
- 797. Graduate Silviculture Seminar** (1)
 Three-hour class discussion. Assigned reports and discussion of silvicultural topics. Spring.
- 798. Research Problems in Silviculture** (1-12)
(Credit hours arranged according to nature of problem)
 Fall, Spring, and Summer.
- 899. Master's Thesis or Project Research** (1-12)
 Investigation leading to the completion of a research-oriented thesis or to an application-oriented project. Graded on an "S/U" basis. Fall, Spring, and Summer.
- 999. Doctoral Thesis Research** (1-12)
 Investigation leading to the completion of the doctoral thesis. Graded on an "S/U" basis. Fall, Spring, and Summer.

WPE—WOOD PRODUCTS ENGINEERING

300. Properties of Wood for Designers (2)

Two hours of lecture. An introduction to the basic structure and properties of wood for the designer. Discussion of the effects of wood structure and properties on practical woodworking techniques. Fall.

322. Mechanical Processing (3)

Two hours of lecture and three hours of laboratory. Primary log reduction methods and industry practices. Lumber grading. Wood cutting principles. Machining practice in secondary wood-using industries. Experience in the operation of certain primary and secondary machining equipment. Spring.

326. Fluid Treatments (2)

Two hours of lecture. An introduction to wood-moisture relationships, wood permeability and pressure treatments, thermal conductivity, water-vapor movement, and drying and fire retardancy. The flow of fluids, heat and water vapor are treated as analogous phenomena and are related to the cellular structure of wood. Unsteady-state flow of gases, heat and water vapor are introduced. Spring.

327. Fluid Treatments Laboratory (1)

Three hours of laboratory. Laboratory studies in relative humidity measurement, wood-moisture relationships, the relationship between permeability and treatability, wood-preservative treatments, wood drying and flame testing. Spring.

Prerequisite: WPE 326 (or concurrent).

343. Introduction to Structural Design (3)

Three hours of lecture. The concepts of structural design are introduced with fundamental strength of materials. There are practical applications of steel, timber, and concrete in contemporary structural designs. Systems such as trusses, arches, and frames are introduced. Spring.

361. Engineering Mechanics—Statics (3)

Three hours of lecture. Forces and vectors, moments, equivalent force systems, free bodies, structures, section properties. Fall.

Prerequisites: Integral calculus and general physics.

386. Structure and Properties of Wood (3)

Two hours of lecture and three hours of laboratory. Structure of wood in relation to defects, properties and uses. The variability of wood. Identification of major U.S. timber by gross features. Spring.

387. Wood Structure and Properties (3)

Three hours of lecture. Structure of wood and its relation to physical properties and uses. The normal variability of wood, abnormal growth, defects, deterioration of wood and their influence on properties and uses. Fall.

Prerequisite: FBO 300 or equivalent is recommended.

388. Wood and Fiber Identification Laboratory (2)

Six hours of laboratory. Wood and papermaking fiber identification using both gross and microscopic features. Fall.

Prerequisite: WPE 387 to be taken concurrently or previously.

389. Wood Identification Laboratory (1)

Three hours of laboratory. Identification of principal commercial timbers of United States on gross characteristics. Spring.

Prerequisite: WPE 387.

390. Fiber Identification Laboratory (1)

Three hours of laboratory. Identification of woody and nonwoody papermaking fibers. Spring.

Prerequisite: WPE 387.

399. Field Trip (2)

Two weeks supervised study and reporting of representative wood products industries. Required of all students in WPE. Estimated individual expenses are \$200-\$250 while on the trip. Spring.

400. Introduction to Forest Products (2)

Two hours of lecture. Characteristics of the products of the forest tree and manufacture of wood products. Spring.

404. Design of Wood Structural Elements (3)

Lectures. A development of the principles involved in designing structural elements in wood and practice in their application. Fall or Spring.

420. Adhesives, Sealants, and Coatings (3)

Two hours of lecture and three hours laboratory. An introduction to adhesives, sealants, and coatings used in the wood products and building construction industries. All three types of materials, based upon polymers, will be evaluated in terms of their properties and respective technologies when used with wood systems. Emphasis will be placed on knowing how to apply this knowledge to understand current practice and to solve problems that may occur. Laboratory demonstrations to identify materials, methods of application, and methods of evaluating these materials. Fall.

Prerequisite: Junior standing.

422. Composite Materials (3)

Two hours of lecture and three hours of laboratory. Manufacturing methods, physical and mechanical properties, and major uses of each of the following products will be examined—decorative plywood, construction and industrial plywood, particleboards, waferboards, fiberboards, laminated beams, laminated-veneer lumber, wood polymer composites, and paper overlays. Laboratory exercises will be patterned after ASTM standard tests to evaluate the physical and mechanical properties of these materials with written reports to be submitted by each student. Spring.

Prerequisites: WPE 320. Concurrent or prior registration in ERE 362.

442. Light Construction (3)

Two hours of lecture and two hours of discussion. Elements of light frame construction, blueprint reading, and estimating. Fall.

444. Materials Marketing (3)

Three hours of lecture and discussion. Marketing functions, agencies and management in the wood products and related industries. Principles of salesmanship and their application. Spring.

450. Construction Equipment (3)

Three hours of lecture. Principles of selection, operation, and maintenance of construction equipment. Primary types of site preparation, handling and assembly devices and their efficient utilization will be examined. Spring.

Prerequisite: Senior standing.

454. Construction Management (3)

Three hours of lecture. Fundamental concepts of construction management activities. Topics include construction contracts, scheduling, project planning, estimating and bidding. Fall.

Prerequisite: OPM 365 or permission of the instructor.

497. Senior Seminar for Wood Products Engineering Majors (2)

Discussion and assigned reports in current problems and new developments in Wood Products Engineering. Spring.

498. Research or Design Problem (1-3)

Conferences, library, laboratory and/or field research on a specific problem in Wood Products Engineering. Typewritten report (original and one copy) required. Fall, Spring, and Summer.

Prerequisite: Permission of the instructor and advisor.



State University of New York

STATE UNIVERSITY OF NEW YORK

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State University's 64 geographically dispersed campuses bring educational opportunity within commuting distance of virtually all New York citizens and comprise the nation's largest, centrally managed system of public higher education.

When founded in 1948, the University consolidated 29 State-operated, but unaffiliated, institutions. In response to need, the University has grown to a point where its impact is felt educationally, culturally, and economically the length and breadth of the state.

More than 380,000 students are pursuing traditional study in classrooms or are working at home, at their own pace, through such innovative institutions as Empire State College, whose students follow individualized and often nontraditional paths to a degree. Of the total enrollment, more than 100,000 students are 24 years or older, reflecting State University's services to specific constituencies, such as refresher courses for the professional community, continuing educational opportunities for returning service personnel, and personal enrichment for the more mature persons.

State University's research contributions are helping to solve some of modern society's most urgent problems. It was a State University scientist who first warned the world of potentially harmful mercury deposits in canned fish, and another who made the connection between automobile and industrial smoke combining to cause

changes in weather patterns. Other University researchers continue important studies in such wide-ranging areas as immunology, marine biology, sickle-cell anemia, and organ transplantation.

More than 1,000 Public Service activities are currently being pursued on State University campuses. Examples of these efforts include: special training courses for local government personnel, State civil service personnel, and the unemployed; participation by campus personnel in joint community planning or project work, and campus-community arrangements for community use of campus facilities.

A distinguished faculty includes nationally and internationally recognized figures in all the major disciplines. Their efforts are recognized each year in the form of such prestigious awards as Fulbright-Hayes, Guggenheim, and Danforth Fellowships.

The University offers a wide diversity of what are considered the more conventional career fields, such as engineering, medicine, literature, dairy farming, medical technology, accounting, social work, forestry, and automotive technology. Additionally, its responsiveness to progress in all areas of learning and to tomorrow's developing societal needs has resulted in concentrations which include pollution, urban studies, computer science, immunology, preservation of national resources, and microbiology.

SUNY programs for the educationally and economically disadvantaged have become models for delivering better learning opportunities to a once-forgotten segment of society. Educational Opportunity Centers offer high school equivalency and college preparatory courses to provide young people and adults with the opportunity to begin college or to learn marketable skills. In addition, campus based Educational Opportunity Programs provide counseling, developmental education and financial aid to disadvantaged students in traditional degree programs.

Overall, at its EOC's, two-year colleges, four-year campuses and university and medical centers, the University offers 3,600 academic programs. Degree opportunities range from two-year associate programs to doctoral studies offered at 12 senior campuses.

The 30 two-year community colleges operating under the program of State University play a unique role in the expansion of educational opportunity, by:

Providing local industry with trained technicians in a wide variety of occupational curricula;

Providing transfer options to students who wish to go on and earn advanced degrees, and;

Providing the community with yet another source for technical and professional upgrading as well as personal enrichment.

During its brief history, State University has graduated more than 855,000 alumni, the majority of whom are pursuing their careers in communities across the state.

State University is governed by a Board of Trustees, appointed by the Governor, which directly determines the policies to be followed by the 34 State-supported campuses. Community colleges have their own local boards of trustees whose relationship to the SUNY board is defined by law. The State contributes one-third to 40 percent of their operating cost and one-half of their capital costs.

The State University motto is: "To Learn—To Search—To Serve."

STATE UNIVERSITY OF NEW YORK

UNIVERSITY CENTERS

State University of New York at Albany	State University of New York at Buffalo
State University of New York at Binghamton	State University of New York at Stony Brook

COLLEGES OF ARTS AND SCIENCES

Empire State College	State University College at Old Westbury
State University College at Brockport	State University College at Oneonta
State University College at Buffalo	State University College at Oswego
State University College at Cortland	State University College at Plattsburgh
State University College at Fredonia	State University College at Potsdam
State University College at Geneseo	State University College at Purchase
State University College at New Paltz	

COLLEGES AND CENTERS FOR THE HEALTH SCIENCES

Downstate Medical Center at Brooklyn	Health Sciences Center at Buffalo University Center*
Upstate Medical Center at Syracuse	Health Sciences Center at Stony Brook University Center*
College of Optometry at New York City	

AGRICULTURAL AND TECHNICAL COLLEGES

Agricultural and Technical College at Alfred	Agricultural and Technical College at Delhi
Agricultural and Technical College at Canton	Agricultural and Technical College at Farmingdale
Agricultural and Technical College at Cobleskill	Agricultural and Technical College at Morrisville

SPECIALIZED COLLEGES

College of Environmental Science and Forestry at Syracuse
 Maritime College at Fort Schuyler
 College of Technology at Utica/Rome
 Fashion Institute of Technology at New York City**

STATUTORY COLLEGES***

College of Agriculture and Life Sciences at Cornell University
 College of Ceramics at Alfred University
 College of Human Ecology at Cornell University
 School of Industrial and Labor Relations at Cornell University
 College of Veterinary Medicine at Cornell University

COMMUNITY COLLEGES

(Locally-sponsored, two-year colleges under the program of State University)

Adirondack Community College at Glens Falls	Mohawk Valley Community College at Utica
Broome Community College at Binghamton	Monroe Community College at Rochester
Cayuga County Community College at Auburn	Nassau Community College at Garden City
Clinton Community College at Plattsburgh	Niagara County Community College at Sanborn
Columbia-Greene Community College at Hudson	North Country Community College at Saranac Lake
Community College of the Finger Lakes at Canandaigua	Onondaga Community College at Syracuse
Corning Community College at Corning	Orange County Community College at Middletown
Dutchess Community College at Poughkeepsie	Rockland Community College at Suffern
Erie Community College at Williamsville, Buffalo and Orchard Park	Schenectady County Community College at
Fulton-Montgomery Community College at Johnstown	Suffolk County Community College at Selden, Riverhead and Brentwood
Genesee Community College at Batavia	Sullivan County Community College at Loch Sheldrake
Herkimer County Community College at Herkimer	Tompkins Cortland Community College at Dryden
Hudson Valley Community College at Troy	Ulster County Community College at Stone Ridge
Jamestown Community College at Jamestown	Westchester Community College at Valhalla
Jefferson Community College at Watertown	

*The Health Sciences Centers at Buffalo and Stony Brook are operated under the administration of their respective University Centers.

**While authorized to offer such baccalaureate and master's degree programs as may be approved pursuant to the provisions of the Master Plan, in addition to the associate degree, the Fashion Institute of Technology is financed and administered in the manner provided for community colleges.

***These operate as "contract colleges" on the campuses of independent universities.

College of Environmental Science and Forestry

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<i>Director, Institute of Environmental Program</i>	
<i>Affairs (IEPA)</i>	JAMES W. GEIS
<i>Coordinator of Demonstration and Information, IEPA</i>	ROLLA W. COCHRAN
<i>Vice President for Student Affairs</i>	HARRISON H. PAYNE
<i>Director of Financial Aids</i>	JOHN E. VIEW
<i>Registrar</i>	ROBERT S. NORTH
<i>Advisor, Foreign Student Exchange Visitor Programs</i>	VIRGINIA T. TORELLI
<i>Vice President for Administration and Services</i>	DAVID G. ANDERSON
<i>Director of Business and Fiscal Affairs</i>	HARRY J. CORR
<i>Librarian</i>	DONALD F. WEBSTER
<i>Director of Educational Communications</i>	BERNARD L. HOLTMAN
<i>Director of Computer Services</i>	CHARLES N. LEE
<i>Director of Personnel and Affirmative Action</i>	PETER F. WILTSIE
<i>Director of Physical Plant</i>	BRUCE E. REICHEL
<i>Director of Public Safety</i>	BRIAN M. SPEER
<i>Director of Analytical and Technical Services</i>	ROWENA V. KATHER
<i>Director of Administrative Data Processing</i>	
<i>and Institutional Research</i>	SHEILA M. CROWLEY
<i>Director of Forest Properties</i>	RICHARD A. SCHWAB
<i>Dean, School of Biology, Chemistry and Ecology</i>	STUART W. TANENBAUM
<i>Dean, School of Continuing Education and</i>	
<i>Assistant Vice President for International Programs</i>	JOHN M. YAVORSKY
<i>Dean, School of Environmental and Resource Engineering</i>	WILLIAM P. TULLY
<i>Dean, School of Forestry</i>	JOHN V. BERGLUND
<i>Director, Forest Technician Program</i>	WESLEY E. SUHR
<i>Dean, School of Landscape Architecture</i>	ROBERT G. REIMANN
<i>Director, Graduate Program in Environmental Science</i>	MOHAN K. WALI
<i>Director, Adirondack Ecological Center</i>	WILLIAM F. PORTER
<i>Director, Empire State Paper Research Institute</i>	BENGT LEOPOLD
<i>Acting Director, Polymer Research Institute</i>	ISRAEL CABASSO
<i>Director, Ultrastructure Studies Center</i>	WILFRED A. CÔTÉ, JR.
<i>Director, Tropical Timber Information Center</i>	ROBERT W. MEYER
<i>Director, Cellulose Research Institute</i>	TOR E. TIMELL
<i>Project Leader, U.S. Forest Service Cooperative Research Unit</i>	ROWAN A. ROWNTREE
<i>Director, Renewable Materials Institute</i>	WILFRED A. CÔTÉ, JR.

COLLEGE FACULTY AND PROFESSIONAL STAFF

DISTINGUISHED TEACHING PROFESSOR

EDWIN H. KETCHLEDGE, *Distinguished Teaching Professor*, Department of Environmental and Forest Biology

THEODORE J. STENUF, *Distinguished Teaching Professor*, Department of Paper Science and Engineering

DISTINGUISHED ADJUNCT PROFESSOR

HARRY L. FRISCH, *Distinguished Adjunct Professor*, Department of Chemistry

DISTINGUISHED PROFESSOR EMERITUS

CONRAD SCHUERCH, *Distinguished Professor Emeritus*, Department of Chemistry

MICHAEL M. SZWARC, *Distinguished Professor Emeritus*, Polymer Research Institute

This listing represents an official record of the State University of New York College of Environmental Science and Forestry faculty and professional staff for 1983. It is designed for use in 1983-84.

The date in parentheses after each name denotes the first year of service, two or more dates, the term of service.

LAWRENCE P. ABRAHAMSON (1977), *Senior Research Associate*, School of Forestry and Department of Environmental and Forest Biology; B.S., Michigan Technological University, 1964; M.S., University of Wisconsin, 1967; Ph.D., 1969

SCOTT ALDRIDGE (1983), *Instructor*, Forest Technician Program of the School of Forestry; A.A.S., Mohawk Valley Community College, 1977; A.A.S., Forest Technician Program, SUNY College of Environmental Science and Forestry, 1978; B.S., SUNY College of Environmental Science and Forestry, 1980; M.S., 1982

JUDD H. ALEXANDER (1979), *Adjunct Professor*, Graduate Program in Environmental Science; B.A., Carleton College, 1949; P.M.D., Harvard Business School, 1967

DOUGLAS C. ALLEN (1968), *Professor*, Department of Environmental and Forest Biology; B.S., University of Maine, 1962; M.S., 1965; Ph.D., University of Michigan, 1968

WAYNE ALLEN (1979), *Technical Assistant*, Forest Technician Program of the School of Forestry

IRA H. AMES (1972), *Adjunct Professor*, Department of Environmental and Forest Biology; B.A., Brooklyn College, 1959; M.S., New York University, 1962; Ph.D., 1966

DAVID G. ANDERSON (1959), *Vice President for Administration and Services; Professor*; A.A.S., State University of New York College of Forestry (Ranger School), 1950; B.S., State University of New York College of Forestry, 1953; M.S., University of Utah, 1958; M.P.A., Syracuse University, 1977

ROBERT E. ANTHONY (1953), *Technical Specialist*, Department of Environmental and Forest Biology; A.A.S., State University of New York Agricultural and Technical College at Morrisville, 1952

ROBERT W. ARSENEAU (1972), *Programmer/Analyst*, Administrative Data Processing; A.A.S., Mohawk Valley Community College, 1967; B.S., Syracuse University, 1978

CAROLINE B. BAILEY (1978), *Technical Assistant*, School of Landscape Architecture

JAMES P. BAMBACHT (1967), *Professor*, Department of Paper Science and Engineering; A.B., Kalamazoo College, 1954; M.S., The Institute of Paper Chemistry, 1956; Ph.D., State University of New York College of Environmental Science and Forestry, 1973

C. ELLISON BECK (1970), *Technical Specialist*, Analytical and Technical Services, Office of the Vice President for Administration and Services

DONALD F. BEHREND (1960-67) (1968), *Vice President for Program Affairs; Professor*, Department of Environmental and Forest Biology; Graduate Program in Environmental Science; B.S., University of Connecticut, 1958; M.S., 1960; Ph.D., State University of New York College of Forestry, 1966

JOHN D. BENNETT (1960), *Associate Professor*, School of Forestry; B.A., Ohio Wesleyan University, 1954; Ph.D., Syracuse University, 1968; *Chancellor's Award for Excellence in Teaching* (1973)

CAMILLO A. BENZO (1975), *Adjunct Associate Professor*, Department of Environmental and Forest Biology; B.A., Utica College of Syracuse University, 1964; Ph.D., University of Pennsylvania, 1969

JOHN V. BERGLUND (1965), *Dean and Professor*, School of Forestry; B.S., Pennsylvania State University, 1962; M.S., 1964; Ph.D., State University of New York College of Forestry, 1968

DONALD H. BICKELHAUPT (1969), *Research Assistant*, School of Forestry; B.S., State University of New York College of Forestry, 1969; M.S., State University of New York College of Environmental Science and Forestry, 1980

PETER E. BLACK (1965), *Professor*, School of Forestry; Graduate Program in Environmental Science; B.S., University of Michigan, 1956; M.F., 1958; Ph.D., Colorado State University, 1961; *Executive Chairman of the Faculty* (1976-78)

RAYMOND W. BLASKIEWICZ (1982), *Assistant Registrar*, Registrar's Office; B.S., State University of New York College of Environmental Science and Forestry, 1979

CONSTANCE H. BOBBIE (1982), *Associate Librarian*, F. Franklin Moon Library; B.S., Bemidji State College, 1956; M.A., University of Minnesota, 1962

DENNIS A. BOGYO (1981), *Research Associate*, Chemistry Department; B.A., Earlham College, 1966; Ph.D., University of Buffalo, 1975

WILLIAM R. BORGSTEDE (1971), *Technical Assistant*, Department of Environmental and Forest Biology; A.A.S., Miner Institute, 1966; A.A.S., State University of New York College at Delhi, 1970; B.S., State University of New York College of Environmental Science and Forestry, 1975; M.S., Syracuse University, 1978

STEPHEN B. BRANDT (1983), *Research Associate*, Department of Environmental and Forest Biology; Graduate Program in Environmental Science; B.A., University of Wisconsin, 1972; M.S., 1975; Ph.D., 1978

BRUCE W. BREITMEYER (1983), *Forest Property Manager*, Newcomb Campus; B.S.F., University of Michigan, 1975; M.F., 1982

JEROME BREZNER (1961), *Professor*, Department of Environmental and Forest Biology; A.B., University of Rochester, 1952; A.M., University of Missouri, 1956; Ph.D., 1959; Post-doctoral, Dartmouth Medical School, 1960; *Executive Chairman of the Faculty*, (1974-76)

KENNETH W. BRITT (1971), *Senior Research Associate*, Department of Paper Science and Engineering; B.Chem., Cornell University, 1929

ROBERT H. BROCK, JR. (1967), *Chairman and Professor*, Department of Forest Engineering; B.S., State University of New York College of Forestry, 1958; M.S., 1959; Ph.D., Cornell University, 1971

RAINER H. BROCKE (1969), *Senior Research Associate*, Department of Environmental and Forest Biology; B.S., Michigan State University, 1955; M.S., 1957; Ph.D., 1970

DAVID F. BRODOWSKI (1977), *Technical Assistant*, Department of Environmental and Forest Biology; B.S., Cornell University, 1975

ALTON F. BROWN (1963), *Technical Specialist*, Empire State Paper Research Institute

THOMAS E. BROWN (1977), *Adjunct Assistant Professor*, Department of Environmental and Forest Biology; B.S., Niagara University, 1957; M.S., State University of New York College of Forestry, 1968

ROBERT L. BURGESS (1981), *Chairman and Professor*, Department of Environmental and Forest Biology; Graduate Program in Environmental Science; B.S., University of Wisconsin (Milwaukee), 1957; M.S., University of Wisconsin (Madison), 1959; Ph.D., 1961

KENNETH F. BURNS (1970), *Technical Assistant*, School of Forestry; A.A.S., Paul Smith's College, 1969

HARRY W. BURRY (1962), *Senior Research Associate*, School of Forestry; *Associate Professor*; B.S., New York State College of Forestry, 1941; M.F., State University of New York College of Forestry, 1964

ISRAEL CABASSO (1981), *Professor*, Department of Chemistry; *Acting Director*, Polymer Research Institute; B.S., Hebrew University, 1966; M.S., 1968; Ph.D. Weizmann Institute of Science, 1973

PAUL M. CALUWE (1969), *Associate Professor*, Department of Chemistry; *Associate Member*, Polymer Research Institute; Ph.D., University of Leuven, Belgium, 1967

WILBUR H. CAMPBELL (1975), *Associate Professor*, Department of Chemistry; A.A., Santa Ana College, 1965; B.A., Pomona College, 1967; Ph.D., University of Wisconsin, 1972

HUGH O. CANHAM (1966), *Associate Professor*, School of Forestry; B.S., State University of New York College of Forestry, 1960; M.S., 1962; Ph.D., 1971

LAEL S. CARTER (1979), *Administrative Manager*, Syracuse Pulp and Paper Foundation; B.A., Mount Holyoke College, 1966

COSTAS A. CASSIOS (1978), *Adjunct Professor*, School of Landscape Architecture; B.S., University of Thessaloniki, 1965; M.S., Graduate Industrial School, 1969; M.S., University of Wisconsin, 1972; Ph.D., 1976

JOHN D. CASTELLO (1978), *Assistant Professor*, Department of Environmental and Forest Biology; B.A., Montclair State College, 1973; M.S., Washington State University, 1975; Ph.D., University of Wisconsin, 1978

THOMAS M. CATTERSON (1982), *Senior Research Associate*, Office of Research Programs; B.S., State University of New York College of Forestry, 1967; M.S., State University of New York College of Environmental Science and Forestry, 1973

ROBERT E. CHAMBERS (1967), *Professor*, Department of Environmental and Forest Biology; Graduate Program in Environmental Science; B.S., Pennsylvania State University, 1954; M.S., 1956; Ph.D., Ohio State University, 1972

ROLLA W. COCHRAN (1964), *Assistant to the President for Community Relations*, Office of the President; *Associate Professor*, *Coordinator of Demonstration and Information*, Institute of Environmental Affairs; B.A., Denison University, 1949; M.S., Ohio State University, 1951

JOHN C. COFFEY (1982), *Assistant Facilities Program Coordinator*, Maintenance and Operations; B.S., Rensselaer Polytechnic Institute, 1971; B. Architecture, 1972; M.R.P., Syracuse University, 1977; Registered Architect, New York State

ETHEL M. COMP (1978), *Personnel Associate*, Office of the Vice President for Administration and Services

HARRY J. CORR (1967), *Director of Business and Fiscal Affairs*, Office of the Vice President for Administration and Services; B.S. Siena College, 1957

WILFRED A. CÔTÉ, JR. (1950), *Professor*, Department of Wood Products Engineering; *Director*, Renewable Materials Institute and N.C. Brown Center for Ultrastructure Studies; B.S., University of Maine, 1949; M.F., Duke University, 1950; Ph.D., State University of New York College of Forestry, 1958; *Executive Chairman of the Faculty* (1970-72)

JAMES E. COUFAL (1965), *Professor and Curriculum Coordinator*, School of Forestry; State University of New York College of Forestry (Ranger School), 1957; B.S., State University of New York College of Forestry, 1960; M.S., 1962; Ed.S., State University of New York at Albany, 1976

PHILLIP J. CRAUL (1968), *Professor*, School of Forestry; B.S.F., Pennsylvania State University, 1954; M.S., 1960; Ph.D., 1964

JAMES O. CREVELLING (1970), *Forest Property Manager*, Southern Properties, Wana-kena and Cranberry Campuses; A.A.S., Paul Smith's College, 1965; B.S., University of Massachusetts, 1967

CLAY M. CROSBY (1964), *Research Assistant*, Empire State Paper Research Institute; B.S., State University of New York College of Forestry, 1964; M.S., 1970

SHEILA M. CROWLEY (1977), *Director*, *Administrative Data Processing and Institutional Research*, Office of the Vice President for Administration and Services; A.B., Albertus Magnus College, 1967; M.S., Syracuse University, 1979

JUSTIN F. CULKOWSKI (1978), *Director of Alumni Affairs*, B.S., State University of New York College of Environmental Science and Forestry, 1973; M.B.A., Syracuse University, 1983

- TIBERIUS CUNIA (1968), *Professor*, School of Forestry; Forest Engineer, Ecole Nat. des Eaux et Forets, 1951; M.S., McGill University, 1957
- GEORGE W. CURRY (1966), *Professor*, School of Landscape Architecture; B.A., Michigan State University, 1962; B.S., 1965; M.L.A., University of Illinois, 1969
- MIROSLAW M. CZAPOWSKYJ (1979), *Adjunct Professor*, School of Forestry; Diplom-forstwirt, Ludwig-Maximilians University, 1949; M.S., University of Maine, 1958; Ph.D., Rutgers University, 1962
- ANDREA CZERKIES (1981), *Technical Assistant*, Department of Paper Science and Engineering; B.S., State University of New York College of Environmental Science and Forestry, 1981
- BENJAMIN V. DALL (1975), *Professor*, School of Forestry; Graduate Program in Environmental Science; B.S., Yale University, 1955; M.F., 1956; J.D., University of Virginia, 1959; Ph.D., Pennsylvania State University, 1972
- ROBERT W. DAVIDSON (1957), *Professor*, Department of Wood Products Engineering; B.S., Montana State University, 1948; M.S., State University of New York College of Forestry, 1956; Ph.D., 1960
- ARNOLD C. DAY (1947), *Technical Specialist*, N.C. Brown Center for Ultrastructure Studies
- TIMOTHY R. DAY (1981), *Assistant Professor*, School of Landscape Architecture; B.S.L.A., California Polytechnic State University, 1976; M.L.A., Harvard Graduate School of Design, 1980
- LOUIS D. DE GENNARO (1980), *Adjunct Professor*, Department of Environmental and Forest Biology; B.S., Fordham University, 1948; M.S., Boston College, 1950; Ph.D., Syracuse University, 1959
- SALVACION DE LA PAZ (1973), *Associate Librarian*, F. Franklin Moon Library; B.S.L.S., University of the Philippines, 1956; M.S.L.S., Simmons College, 1962
- CARLTON W. DENCE (1951), *Professor*, Empire State Paper Research Institute; B.S., Syracuse University, 1947; M.S., State University of New York College of Forestry, 1949; Ph.D., 1959
- ARTHUR G. DILLON (1976), *Technical Specialist*, Department of Paper Science and Engineering; B.S., State University of New York College of Environmental Science and Forestry, 1974; M.S., 1983
- DANIEL L. DINDAL (1966), *Professor*, Department of Environmental and Forest Biology; Graduate Program in Environmental Science; B.S. Ed. and B.S. Agri., Ohio State University, 1958; M.A., 1961; Ph.D., 1967; *Chancellor's Award for Excellence in Teaching* (1974)
- JULIA O. DOMINGUE (1980), *Technical Specialist*, Department of Forest Engineering; B.A., University of Illinois, 1975; M.S., 1979
- ALLAN P. DREW (1980), *Assistant Professor*, School of Forestry; B.S., University of Illinois, 1965; M.S., University of Arizona, 1967; Ph.D., Oregon State University, 1974
- MICHAEL J. DUGGIN (1979), *Professor*, Department of Forest Engineering; B.Sc., Melbourne University, 1959; Ph.D., Monash University, 1965
- PATRICK R. DURKIN (1980), *Adjunct Assistant Professor*, Graduate Program in Environmental Science; B.S., State University of New York College at Fredonia, 1968; M.S., Fordham University, 1972; Ph.D., State University of New York College of Environmental Science and Forestry, 1979
- RONALD EBY (1968), *Research Associate*, Chemistry Department; B.S., State University of New York College of Forestry, 1969; M.S., State University of New York College of Environmental Science and Forestry, 1972; Ph.D., 1974
- ANDREW L. EGGERS (1967), *Technical Specialist*, Educational Communications Section, Office of the Vice President for Administration and Services
- WILLIAM P. EHLING (1983), *Adjunct Professor*, Graduate Program in Environmental Science; B.A., Syracuse University, 1943; M.A., 1952; Ph.D., 1954
- ELIZABETH A. ELKINS (1973), *Associate Librarian*, F. Franklin Moon Library; B.A., Hartwick College, 1968; M.L.S., State University of New York at Geneseo, 1970; *Chancellor's Award for Excellence in Librarianship* (1980)

- DONALD P. ELY (1980), *Adjunct Professor*, Graduate Program in Environmental Science; B.A., State University College for Teachers, Albany, 1951; M.A., Syracuse University, 1953; Ph.D., 1961
- ARTHUR R. ESCHNER (1961), *Professor*, School of Forestry; Graduate Program in Environmental Science; B.S., State University of New York College of Forestry, 1950; M.S., Iowa State College, 1952; Ph.D., State University of New York College of Forestry, 1965
- AMINUR EUSUFZAI (1977), *Research Assistant*, Empire State Paper Research Institute; B.Sc. (Hons.), Dacca University, 1957; M.Sc., 1960; B.Sc. (Hons.) Forestry, Peshawar University, 1962; M.S., West Virginia University, 1969; M.S., State University of New York College of Environmental Science and Forestry, 1982
- MILDRED FAUST (1976), *Adjunct Professor*, School of Biology, Chemistry and Ecology; A.B., Penn College, 1921; M.S., University of Chicago, 1923; Ph.D., 1933
- JOHN P. FELLEMAN (1973), *Professor*, School of Landscape Architecture; Graduate Program in Environmental Science; B.C.E., Cornell University, 1966; M.E.C., 1966; N.D.E.A. Fellow, University of North Carolina, 1967; D.P.A., New York University, 1973
- JOHN S. FISHLOCK (1965), *Technical Assistant*, Department of Environmental and Forest Biology; A.A.S., State University of New York College of Forestry (Ranger School), 1965
- CLAUDE C. FREEMAN (1959), *Associate Professor*, School of Landscape Architecture; B.S., State University of New York College of Forestry, 1959
- ROBERT H. FREY (1977), *Assistant Vice President for Academic Programs*, *Associate Professor*, Graduate Program in Environmental Science; B.A., Valparaiso University, 1965; M.Ed., Springfield College, 1966; Ed.D., Indiana University, 1973
- ROBERT L. FRIEDMAN (1967), *Director of Admissions*, Office of the Vice President for Program Affairs; A.B., Syracuse University, 1952; M.A., 1954
- HARRY L. FRISCH (1980), *Adjunct Distinguished Professor*, Department of Chemistry; Associate Member, Polymer Research Institute; A.B., Williams College, 1947; Ph.D., Polytechnic Institute of Brooklyn, 1952
- DOUGLAS H. FROST (1982), *Assistant Director of Business Affairs*, Office of the Vice President for Administration and Services; A.A., College of San Mateo, 1962; B.S., Wagner College, 1967
- TAMMY J. FULLER (1982), *Senior Programmer/Analyst*, Administrative Data Processing; A.O.S., Powelson Business Institute, 1981
- JOHN E. GANNON (1980), *Adjunct Associate Professor*, Department of Environmental and Forest Biology; B.S., Wayne State University, 1965; M.S., University of Michigan, 1967; Ph.D., University of Wisconsin, 1972
- JAMES W. GEIS (1968), *Assistant Vice President for Research Programs*, *Executive Director of the Institute of Environmental Program Affairs*, *Professor*, Department of Environmental and Forest Biology; Graduate Program in Environmental Science, B.S.F., University of Illinois, 1965; M.S., 1967; Ph.D., State University of New York College of Environmental Science and Forestry, 1972
- RONALD J. GIEGERICH (1977), *Technical Assistant*, Department of Environmental and Forest Biology; A.A.S., State University of New York Agricultural and Technical College at Cobleskill, 1976; B.S., State University of New York College of Environmental Science and Forestry, 1978
- SERGE N. GORBATSEVICH (1956), *Associate Professor*, Department of Paper Science and Engineering; B.S., State University of New York College of Forestry, 1954; M.S., 1955
- RICHARD H. GRANT (1983), *Research Assistant*, School of Forestry; B.S., Duke University, 1974; M.F.S., Yale University, 1977; Ph.D., State University of New York College of Environmental Science and Forestry, 1982
- STEPHEN GRANZOW (1969), *Technical Specialist*, Empire State Paper Research Institute
- MIKLOS A. J. GRATZER (1973), *Professor*, School of Forestry; Graduate Program in Environmental Science; B.Sc., University of British Columbia, 1959; M.S.R.C., University of Montana, 1965; Ph.D., 1971

- PAUL F. GRAVES (1947), *Professor*, School of Forestry; B.S., New York State College of Forestry, 1939; M.F., 1941; Ph.D., Syracuse University, 1949
- CHARLES GREEN, JR. (1979), *Adjunct Professor*, Department of Paper Science and Engineering; B.S., University of Iowa, 1956
- DAVID H. GRIFFIN (1968), *Professor*, Department of Environmental and Forest Biology; B.S., State University of New York College of Forestry, 1959; M.A., University of California, 1960; Ph.D., 1963
- NEAL J. GRUBER (1983), *Research Associate*, School of Environmental and Resource Engineering; B.S., University of Colorado, 1972; M.E., University of Florida, 1973
- JAMES P. HALLIGAN (1979), *Technical Assistant*, School of Forestry; B.S., State University of New York College of Environmental Science and Forestry, 1974
- JUDITH C. HAMILTON (1979), *Financial Aid Advisor*, Financial Aid Office; B.S., State University College at Brockport, 1967; M.S., State University of New York at Albany, 1968
- ROBERT B. HANNA (1977), *Assistant Director*, N.C. Brown Center for Ultrastructure Studies; *Associate Professor*, Department of Wood Products Engineering; B.S., University of Michigan, 1967; M.S., State University of New York College of Forestry, 1971; Ph.D., State University of New York College of Environmental Science and Forestry, 1973
- DAVID L. HANSELMAN (1963), *Professor*, School of Landscape Architecture; Graduate Program in Environmental Science; B.S., Cornell University, 1957; M.S., 1958; Ph.D., Ohio State University, 1963
- DAVID B. HARPER (1972), *Senior Research Associate*, Office of Program Affairs; Graduate Program in Environmental Science; B.S., Bates College, 1959; M.R.P., University of Pennsylvania, 1969
- ROY C. HARTENSTEIN (1959-65) (1967), *Professor*, Department of Environmental and Forest Biology; Graduate Program in Environmental Science; B.S., State Teachers College at Buffalo, 1953; M.S., Syracuse University, 1957; Ph.D., State University of New York College of Forestry, 1959
- ALAN R. HARVEY (1977), *Technical Specialist*, Analytical and Technical Services, Office of the Vice President for Administration and Services
- JAMES M. HASSETT (1981), *Assistant Professor*, Department of Forest Engineering; Graduate Program in Environmental Science; A.B., Cornell University, 1970; M.S., Syracuse University, 1979
- JOHN P. HASSETT (1980), *Research Associate*, Chemistry Department; Graduate Program in Environmental Science; B.S., University of Maryland, 1971; M.S., University of Wisconsin, 1973; Ph.D., 1979
- RICHARD S. HAWKS (1979), *Associate Professor*, School of Landscape Architecture; Graduate Program in Environmental Science; B.L.A., State University of New York College of Environmental Science and Forestry, 1972; M.L.A., Harvard University, 1978
- GORDON M. HEISLER (1973), *Adjunct Associate Professor*, School of Forestry; B.S., Pennsylvania State University, 1961; M.F., Yale University, 1962; Ph.D., State University of New York College of Forestry, 1970
- ROBERT D. HENNIGAN (1967), *Professor*, Department of Forest Engineering; Graduate Program in Environmental Science; B.C.E., Manhattan College, 1949; M.A., Syracuse University, 1964, P.E., New York State
- LEE P. HERRINGTON (1965), *Professor and Coordinator*, Research and Graduate Studies, School of Forestry; Graduate Program in Environmental Science; B.S., University of Maine, 1959; M.F., Yale School of Forestry, 1960; Ph.D., Yale University, 1964
- ROBERT A. HOLM (1982), *Associate Professor*, Department of Paper Science and Engineering; B.S., University of Illinois, 1958; M.S., University of Delaware, 1961; Ph.D., 1962
- BERNARD T. HOLTMAN (1968), *TV/Motion Picture Producer-Director*, *Director*, Educational Communications Section, Office of the Vice President for Administration and Services; B.A., Siena College, 1950; M.S., Syracuse University, 1972

- MARY O'BRIEN HOOVEN (1980), *Food Service Supervisor*, Wanakena and Cranberry Lake Campuses, B.A., State University of New York at Buffalo, 1972
- PAUL F. HOPKINS (1979), *Assistant Professor*, Forest Engineering; B.S., University of Maine, 1977; M.S., State University of New York College of Environmental Science and Forestry, 1979
- GEORGE HOPKINS-ROWNTREE (1979), *Research Associate*, School of Forestry; B.A., University of California, 1964; M.S., 1978
- ALLEN F. HORN, JR. (1957), *Professor*, School of Forestry; B.S., Michigan State University, 1950; M.S., 1951; Ph.D., State University of New York College of Forestry, 1957; L.L.B., Syracuse University, 1967
- STEPHEN B. HORSLEY (1979), *Adjunct Associate Professor*, School of Forestry, B.S., Pennsylvania State University, 1965; M.S., University of Massachusetts, 1968; Ph.D., 1970
- JOEL R. HOWARD (1974), *Instructor*, School of Forestry; *Director*, Summer Program in Field Forestry; *Manager*, Pack Demonstration Forest; B.S., State University of New York College of Environmental Science and Forestry, 1973; M.S., 1978
- JOHN J. HOWARD (1978), *Adjunct Associate Professor*, Department of Environmental and Forest Biology; B.A., University of New Hampshire, 1966; M.P.H., Yale University, 1970, Dr. P.H., 1973
- VIRGINIA HUDAK-DAVID (1982), *Assistant for Sponsored Research*, Office of Research Programs; B.A., University of Maine, 1980; M.S., Syracuse University, 1981
- JEFFREY J. JAHNKE (1982), *Assistant Professor*, Forest Technician Program of the School of Forestry; B.S., Michigan Technological University, 1970; M.S., Washington State University, 1981
- ROBERT V. JELINEK (1972), *Professor*, Department of Paper Science and Engineering; B.S., Columbia University, 1945; M.S., 1947; Ph.D., 1953
- HAZEL S. JENNISON (1965), *Research Associate*, Analytical and Technical Services, Office of the Vice President for Administration and Services; B.S., Western Kentucky State University, 1941; M.S., Syracuse University, 1966
- DAVID L. JOHNSON (1975), *Associate Professor*, Department of Chemistry; Graduate Program in Environmental Science; B.S., Antioch College, 1965; Ph.D., University of Rhode Island, 1973
- DIANNE M. JUCHIMEK (1967), *Associate Librarian*, F. Franklin Moon Library; B.S., University of Illinois, 1965; M.S.L.S., Syracuse University, 1967
- RONALD R. KARNS (1965), *Editorial Associate*, Office of Publications; B.S., Ohio State University, 1954
- ROWENA V. KATHER (1974), *Director*, Analytical and Technical Services, Office of the Vice President for Administration and Services; B.A., Syracuse University, 1979; M.P.A., 1981
- EDWIN H. KETCHLEDGE (1955), *Distinguished Teaching Professor*, Department of Environmental and Forest Biology; B.S., State University of New York College of Forestry, 1949; M.S., 1950; Ph.D., Stanford University, 1957
- JUDITH J. KIMBERLIN (1981), *Personnel Associate* for Compliance and Development, Office of the Vice President for Administration and Services; A.A.S., Pennsylvania State University, 1964; B.A., State University of New York College at Cortland, 1975
- DONALD E. KOTEN (1961), *Associate Professor*, School of Forestry; B.A., North Central College, 1951; B.S., Oregon State College, 1957; Ph.D., State University of New York College of Forestry, 1966
- STELLA D. KROFT (1973), *Technical Assistant*, F. Franklin Moon Library
- FRANK E. KURCZEWSKI (1966), *Professor*, Department of Environmental and Forest Biology; B.S., Allegheny College, 1958; M.S., Cornell University, 1962; Ph.D., 1964
- GEORGE H. KYANKA (1967), *Chairman and Professor*, Department of Wood Products Engineering; B.S., Syracuse University, 1962; M.S., 1966; Ph.D., 1976; *Chancellor's Award for Excellence in Teaching* (1973)

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