Geography

FACULTY

**Year of initial appointment at Binghamton*

Blumler, Mark, *Assistant Professor,* PhD, 1992, University of California at Berkeley: Biogeography, early agriculture, environmental history. (1991)*

Budin, Morris, *Professor Emeritus*, PhD, 1954, New School for Social Research: Statistical geography, urban planning analysis. (1964)

Butler, Joseph H., *Professor Emeritus*, PhD, 1960, Columbia University: Economic geography, water resources. (1963)

Frazier, John W., *Professor* and *Director of Graduate Program,* PhD, 1976, Kent State University: Urban geography, geographical theory, applications of geographic information systems. (1976)

Henry, Norah F., *Associate Professor and Associate Dean for Administration, Harpur College of Arts and Sciences,* PhD, 1976, Kent State University: Automated cartography, medical geography, social geography. (1976)

Hsu, Shin-yi, *Professor*, PhD, 1967, University of California at Los Angeles: Cartography, remote sensing and GIS, East Asia. (1970)

Margai, Florence, *Assistant Professor,* PhD, 1991, Kent State University: Spatial analysis, environmental planning, Africa. (1994)

Montz, Burrell E., *Professor*, PhD, 1980, University of Colorado: Natural hazards, resource management and planning. (1979)

Sheret, Gordon, *Adjunct Lecturer,* MA, 1997, Binghamton University: Geographic information systems. (1999)

Sweet, Robert, *Adjunct Lecturer,* MA., 1989, Binghamton University: Urban planning. (1992)

Tettey-Fio, Eugene, *Assistant Professor and Director of Undergraduate Studies,* PhD, 1996, Kent State University: GIS and advanced cartography, location allocation modelling. (1995)

Timofeeff, Nicolay P., *Associate Professor Emeritus*, PhD, 1967, Columbia University: Physical geography, quantitative geography, computer graphics. (1966)

Willis, Lucius S., *Lecturer*, MA, 1983, State University of New York at Binghamton: Geographic information systems. (1983)

UNDERGRADUATE PROGRAMS

The Geography Department offers students the opportunity to study a number of contemporary problems such as physical resource development, urban decay, business geography, pollution and other human problems. Geography stresses strategies for solving locational and environmental problems. Map design, computer mapping, GIS, statistics and the use of remotely sensed data are central to the field.

The department offers four tracks within its BA program. The general curriculum encourages interdisciplinary work; the analytic geography specialization emphasizes computers and related automated techniques used in geographic analysis; the urban planning track emphasizes the environmental, economic and institutional aspects of urban planning; the physical geography track emphasizes environmental analysis. All four tracks provide preparation for graduate work. The courses emphasize the problem approach, both theoretical and applied. Double majors are encouraged and special programs may be designed on request.

The Geography Department views the grade of D as passing but unsatisfactory. Courses passed with a grade of D, or P, do not fulfill requirements for the major.

Grievance procedure: resolution of student-faculty grievances should be worked out in accordance with the departmental grievance procedure, available from the department office.

Independent study courses (GEOG 497) will count toward the major tracks only with the approval of the director of undergraduate studies.

BA, Track 1: General Geography

GEOG 121. Physical Geography
GEOG 151. World Regional Geography
GEOG 261. Cartography
MATH 147. Statistics
Two cultural/regional courses
Four upper-division courses
TOTAL: 10 courses (40 hours). Credit is granted for equivalent courses.

BA, Track 2: Computer Applications in Human-Environmental Analysis

GEOG 103. Computer-Based Analysis in Geography
GEOG 261. Cartography
GEOG 361. Air Photo Interpretation
GEOG 432. Remote Sensing of the Environment
GEOG 463. Introduction to GIS

MATH 147. Statistics
CS 140 or 160. (preferred), Introduction to Computer Programming

Three courses to be selected from the following:

GEOG 221. (a course in physical geography) *or* GEOG 233. Urban Geography
GEOG 459. East Asia Settlements
GEOG 476. Environmental Analysis
GEOG 481. Special Topics (that are techniques-oriented)
GEOG 482. Applied Urban Research
GEOG 495. Internship
GEOG 497. Independent Study
GEOG 499. Honors Thesis
TOTAL: 10 courses (40 hours). Credit is granted for equivalent courses.

BA, Track 3: Urban and Regional Planning

GEOG 121. Physical Geography
GEOG 261. Cartography
MATH 147. Statistics
GEOG 233. Urban Geography
One cultural/regional course
Two urban/economic courses
One physical/environmental course
One mapping course
One applications course
TOTAL: 10 courses (40 hours). Credit is granted for equivalent courses.

BA, Track 4: Physical and Environmental Geography

GEOG 121. Physical Geography
GEOG 261. Cartography
MATH 147. Statistics
One regional/cultural course
Four physical/environmental courses
Two courses from mapping and applications categories
TOTAL: 10 courses (40 hours). Credit is granted for equivalent courses.

Honors in Geography

Four credit hours are permitted for those geography majors interested in writing an honors thesis. Students must be declared geography majors, have a 3.5 grade-point average for geography courses attempted and be in the final year of undergraduate studies. Not more than one semester (total) in researching, writing and editing of the thesis is permitted. Requirements and guidelines are available in the Geography Department office.

Requirements for Geography Minors

CARTOGRAPHY

The six courses required for this minor are:
1. GEOG 261.
2. one course from: GEOG 101, 121, 151.
3. any four courses from: GEOG 361, 363, 463, 465 and 475.

ENVIRONMENTAL RESOURCE MANAGEMENT

The six courses required for this minor are:
1. GEOG 121, 151, 232.
2. any three courses from: GEOG 323, 330, 339, 341, 361, 421, 422 and 423.

PHYSICAL GEOGRAPHY

The six courses required for the minor are:
1. GEOG 121, 151, 261.
2. any three courses from: GEOG 321, 323, 325, 341, 361, 421, 422 and 423.

Joint Program: Geography BA/Master of Landscape Architecture

Geography majors are eligible for participation in a special joint program between Binghamton University and SUNY College of Environmental Science and Forestry in Syracuse. The program permits students to take the final year of undergraduate education in Syracuse while beginning the master of landscape architecture program. The undergraduate degree in geography is granted by Binghamton University; the MLA is granted by SUNY College of Environmental Science and Forestry. Contact Professor Eugene Tettey-Fio for details.

GRADUATE PROGRAMS

The department's master of arts program in geography educates qualified students for work toward the PhD degree, and for professional careers in government service, industry and regional or urban planning. There is a thesis option for each of the four tracks. Each track requires a total of 40 credits, as well as oral and written comprehensive examinations.

Admission

Undergraduate specialization in geography is not required. However, students lacking a suitable background in geography are required to take appropriate undergraduate work beyond course requirements for the MA degree. The deficiencies to be made up are determined by the department. All applicants are required to submit scores

of the Graduate Record Examination aptitude tests.

MA, Track 1: General Geography

The program provides disciplinary foundation along classical liberal arts lines that can lead to interdisciplinary work in scholarly areas such as conservation, environmental management, economic development and international studies. A total of 40 credits is required.

Required:
GEOG 500. Geographical Theory
GEOG 531. Advanced Geographic Field Study

Select two of the following:
GEOG 573. Seminar in Physical Geography
GEOG 575. Resource Management
GEOG 581. Applied Urban Research
GEOG 599. Thesis

Plus five electives, no more than three in any one area:

Area 1	Area 2	Area 3
GEOG 508	GEOG 502	GEOG 509
GEOG 535	GEOG 532	GEOG 511
GEOG 576	GEOG 533	GEOG 542
		GEOG 591

Electives are to be approved by adviser.

Language requirement: a foreign language.

MA, Track 2: Cartography and Geographical Information Systems

This track educates students as geographical spatial analysts, with emphasis on cartography, remote sensing and geographic information systems. Among the essential components of the program are theory, research methods and advanced statistics. The objective of this track is career preparation in the specified area. To fulfill this goal, practical experience obtained from internships and field research is integrated into the formal curriculum. This track also provides the option of pursuing the PhD degree at many institutions. A total of 40 credits is required.

Prerequisites include elementary statistics and GEOG 261. Cartography, or their equivalents.

Required:
GEOG 500. Geographical Theory
GEOG 502. Introduction to Geographical Information Systems and Computer Mapping (GIS I)
GEOG 531. Advanced Geographic Field Study
GEOG 533. Advanced Statistical Techniques for Geographical and Spatial Analysis I
GEOG 545. Geographic Information Systems II
GEOG 564. Computer Cartography*

Select three of the following:**
GEOG 532. Remote Sensing of the Environment
GEOG 550. Photogrammetry
GEOG 555. Geographic Information Systems III
GEOG 566. Advanced Statistical Techniques for Geographical and Spatial Analysis II
GEOG 598. Internship in Geography, Cartography and Planning

Select one of the following (substitution is at the discretion of the director of graduate studies):

GEOG 570. Urban Planning Seminar
GEOG 574. Economic Geography Seminar
GEOG 597. Independent Study (in Cartography or GIS)
GEOG 599. Thesis Research

Language requirement: approved computer or foreign language.

*GEOG 502 must be taken before GEOG 564 and GEOG 545 before GEOG 555.
**Any three computer science graduate courses may be substituted for three of the four geography courses to be selected for completion of track.

MA, Track 3: Physical Environmental Systems

The program educates students in physical environmental systems, with particular emphasis on the integration of the environmental and institutional aspects of planning. Among the essential components of this concentration are geographic techniques, geomorphology, environmental concerns, community involvement and practical experience through internship programs. As with Track 2, graduates from this program might work for planning agencies or pursue an advanced degree. A total of 40 credits is required.

Prerequisite: elementary statistics or equivalent.

Required:
GEOG 500. Geographical Theory
GEOG 531. Advanced Geographic Field Study
GEOG 533. Advanced Statistical Techniques for Geographical and Spatial Analysis I
GEOG 573. Seminar in Physical Geography
GEOG 574. Economic Geography Seminar
GEOG 576. Advanced Environmental Analysis

Select four of the following:
GEOG 502. Introduction to Geographical Information Systems and Computer Mapping (GISI)
GEOG 509. Conservation of Natural Resources
GEOG 522. Biogeography
GEOG 523. Soils and Environment
GEOG 530. Natural Hazards
GEOG 542. Water Resource Planning and Management
GEOG 545. Geographic Information Systems II
GEOG 566. Advanced Statistical Techniques for Geographical and Spatial Analysis II
GEOG 575. Resource Management
GEOG 598. Internship in Geography
GEOG 599. Thesis Research

Language requirement: approved computer language.

MA, Track 4: Urban Planning

This program encompasses urban analysis and planning, with emphasis on the integration of the institutional, environmental and urban-economic aspects of both public and private planning. Essential components of the program are geographic techniques, urban development, community involvement, seminars in urban planning and practical experience through internship programs. As with Track 2, graduates from this program might work for planning agencies or pursue an advanced degree. A total of 40 credits is required.

Prerequisite: elementary statistics or equivalent.

Required:
GEOG 500. Geographical Theory
GEOG 502. Introduction to Geographical Information Systems and Computer Mapping (GIS 1)
GEOG 531. Advanced Geographic Field Study
GEOG 533. Advanced Statistical Techniques for Geographical and Spatial Analysis I
GEOG 508. Urban Planning Seminar I
GEOG 535. Urban Planing Seminar II
GEOG 574. Seminar in Economic Geography

Select three of the following:
GEOG 542. Water Resources Planning and Management
GEOG 564. Computer Cartography
GEOG 566. Advanced Statistical Techniques for Geographical and Spatial Analysis II
GEOG 573. Seminar in Physical Geography
GEOG 576. Advanced Environmental Analysis
GEOG 581. Applied Urban Research
GEOG 595. Research and Colloquium
GEOG 598. Internship in Geography, Cartography and Planning
GEOG 599. Thesis Research

Language requirement: approved computer language.

COURSE OFFERINGS/ UNDERGRADUATE

NOTE: Unless otherwise noted, all undergraduate courses carry 4 credits and are offered every year.

Introductory/Service
Note: None of these can count toward the major.

GEOG 101. INTRODUCTION TO GEOGRAPHY: PEOPLE, LAND AND SPACE
Concepts basic to geographic inquiry, such as areal differentiation, environmental linkages, central place, human-environmental interaction, spatial organization, spatial interaction, spatial behavior. Problems of urban areas, population trends, economic development, human-land relationships.

GEOG 103. COMPUTER-BASED ANALYSIS IN GEOGRAPHY
Survey of major research themes of geography, environmental processes and patterns, human-environmental relationships, regionalization and spatial analysis. Introduces computer-based techniques and explains their use in research and understanding of geographical problems related to the aforementioned themes.

GEOG 120. WEATHER AND CLIMATE *2 credits*
A systematic study of processes that govern variations in atmospheric conditions over time and space. Elements of heat exchange, moisture exchange and dynamics of air movement examined in relation to causes for various climatic patterns on earth. Elements of applied climatology related to specific problems such as irrigation needs, wind erosion of soils, acid rain, water pollution, flood and storm prediction.

Core

GEOG 121. PHYSICAL GEOGRAPHY
Description, interpretation, human significance of major global patterns of climate, land forms and surface configurations, vegetation and soils. Energy flow processes in various subsystems of global earth-atmosphere system.

GEOG 261. CARTOGRAPHY
Map compilation, map design and reproduction. Cartographic methods for mapping discontinuous and continuous areal data.

Cultural/Regional

GEOG 151. WORLD REGIONAL GEOGRAPHY
The world is partitioned into major regions or realms for comparison. The geographic similarities and differences between them are examined. The central theme is the interrelationship between nature, society and location. The roles of human institutions and how they vary and affect each other across the world are discussed.

GEOG 211. CULTURAL GEOGRAPHY: SOCIETY, ENVIRONMENT AND CHANGE
Ecological/spatial expressions and processes of culture. Interrelationship between human and physical environments.

GEOG 212. HISTORICAL GEOGRAPHY OF THE UNITED STATES
A synthesis of the historical geography of the United States, beginning in the colonial era but with emphasis on the period after 1776. Specific topics include: migration to and within North America; the migrants' experience and creation of space and place in the New World; European and Native American interaction; land tenure, landscape, ecology, agriculture and rural settlements; and the geographic patterns of urban, economic and industrial development.

GEOG 253. PEOPLE, SPACE AND ENVIRONMENT IN LATIN AMERICA
Spatial and environmental aspects of economic, demographic, social conditions in Latin America. Population dynamics, resource analysis and urbanization. Potential of Latin American countries for industrial development.

GEOG 255. AFRICA: PEOPLE, ENVIRONMENT AND SPACE
Systematic study of environmental processes (landforms, climate, etc.) and their effect on development of Africa. Parameters of change, contemporary environmental problems in Africa. Population patterns, projections, policies, conservation practices.

GEOG 257. GEOGRAPHY OF THE MIDDLE EAST
Physical, environmental, social, historical and regional geography of the Middle East. Emphasis on the diversity of peoples in the region, and their interactions with environment, with each other and with the peoples of other regions, both historically and today.

GEOG 259 (also MDVL 279J). EASTERN ASIA: LAND AND PEOPLE
Systematic study of landforms, climate, their effect on development of early regional cultures in China and Japan; population, rural and urban settlements in relation to natural resource management. Natural disasters and coping process; regional planning in modern China.

GEOG 459 (also MDVL 459). SETTLEMENT OF EAST ASIANS IN THE U.S.
Designed as a follow-up course to GEOG 259 with emphasis on East Asian settlements in the U.S. from a migration perspective. Numbers of major metropolitan regions will be selected for population and socio-economic mapping using U.S. census data. Students expected to conduct analysis and write report. Prerequisite: GEOG 259/MDVL 259, junior/senior status or instructor approval.

Introductory Urban/Economic

GEOG 232. ECONOMIC GEOGRAPHY
Spatial patterns of economic activity. Relationship of land use to spatially variable environmental factors. Introduction to location theory. Resource management problems. Environmental consequences of production processes and population growth.

GE0G 233. URBAN GEOGRAPHY
Processes involved in organization of space within urban areas. Theoretical urban models; their application in empirical case studies in developed and underdeveloped countries.

GEOG 235. INTRODUCTION TO URBAN AND REGIONAL PLANNING
Theories and practices of planning at urban and regional levels. Planning processes; environmental and ecological bases of planning; planning function in government; urban and regional dynamics; strategy and conflict theory; planner's approach to locational analysis; grantsmanship planning data; planning implementation, neighborhood as effective planning unit; comprehensive master plan.

Physical/Environmental

GEOG 321 (also GEOL 211). GEOMORPHOLOGY
Sculpting of earth's crust by exogenic forces, integration of classical and modern views in analysis of erosional and depositions landforms. Laboratory and field exercises; independent study. Three lectures, one three-hour laboratory per week. Prerequisites: GEOL 121 or introductory geology.

GEOG 323 (also ENVI 323). SOILS: PROPERTIES, PROCESSES AND DISTRIBUTION
Morphological properties of soils as natural bodies, factors in processes of development, systems of classification at topographic, regional and global scales. Soil fertility and its role in land use. Prerequisite: GEOG 121.

GEOG 330 (also ENVI 330). NATURAL HAZARDS
Analysis of physical, geographic, political and perceptual aspects of natural hazards. Evaluation of physical environments in which natural hazards occur, land use and development patterns in hazardous areas, tools and methods for evaluating hazardousness and vulnerability. Prerequisites: GEOG 121 or ENVI 201; junior or senior standing.

GEOG 337. NATURAL RESOURCE CONSERVATION: THEORY, POLICIES AND PRACTICES
Historic and contemporary examination of geographic, economic, environmental, cultural factors relating to natural resource use and management. Specific resources such as minerals, soil, water as related to conservation policy, practice, theory. Lectures and discussion. Prerequisite: GEOG 121 or 232.

GEOG 339 (also ENVI 339). ENVIRONMENTAL MANAGEMENT
Geographic, environmental, economic and cultural determinants of resource management. Policy goals and decision-making elements influencing management of environmental and natural resources. Management policy, practice and theory. Prerequisites: any one of GEOG 121, 232, 233 or 235, or ENVI 101 and 201.

GEOG 341. WATER RESOURCE PLANNING AND MANAGEMENT
Role of water in environmental planning. Hydrologic, engineering, economic, ecological and institutional aspects of water management. Runoff models. Flood hazard analysis. Water supply systems. Water quality management. Drainage basins as planning units. Field trips; research reports.

GEOG 421. ADVANCED PHYSICAL GEOGRAPHY SEMINAR
Detailed study of selected aspects of landforms, climates, soils. Field measurement techniques, qualitative record

analysis and interpretation. Prerequisite: GEOG 121 or GEOL 111.

GEOG 422 (also BIOL 368). BIOGEOGRAPHY
Ecological principles applied to the study of past, present and future distribution patterns of living organisms. Effects of earth history, spatial pattern, plate tectonics, climate and climate change and human impacts on biota. Prerequisites: GEOG 121 and/or an ecology course.

GEOG 476. ENVIRONMENTAL ANALYSIS
Problem-solving skills in environmental management based on research design, spatial analysis and modeling. Topics include hazards and risk management; attitudinal and behavior analysis; waste management; environmental equity; and valuation of environmental goods. Prerequisite: any one of GEOG 121, 235, 337, 339 or ENVI 101, 102. Junior standing.

Urban/Economic

GEOG 332. ECONOMIC GEOGRAPHY SEMINAR
Theoretical and applied topics relating to land use, economic development, resource analysis, waste management and location analysis. Special emphasis on international economic system and increasing integration of American business into the global economy. Prerequisite: GEOG 232 or equivalent.

GEOG 345. URBAN PLANNING ANALYSIS I
Basic analytical methods used by urban and regional planners. New conceptions of functions of urban areas, population analysis and forecasting, industrial location and methods for attracting firms, commercial growth, the housing sector. Prerequisite: any one of GEOG 232, 233, 235 or ECON 360 or 362.

GEOG 445. URBAN PLANNING ANALYSIS II
Continuation of study of analytical techniques introduced in GEOG 345. Urban renewal, reorganization of local services, planning for leisure and recreation, transportation, zoning, overall plan and methods of evaluation. Prerequisite: GEOG 345.

GEOG 481. SPECIAL TOPICS GEOGRAPHY
Special urban research topics.

Mapping

GEOG 361. AERIAL PHOTO INTERPRETATION
Elementary photogrammetry; linear, area, height measurements on vertical photos. Interpretation of agricultural land use patterns, urban-industrial settings and landforms. Applications in regional planning, forestry, environmental pollution, etc., pursued by students. Prerequisite: GEOG 121 or 261.

GEOG 363. THEMATIC CARTOGRAPHY: SURVEYING AND MAPPING
Science and art of graphics, applied to mappable data. Methods of graphic representation; map compilation, design, reproduction techniques. Prerequisite: GEOG 261.

GEOG 463. INTRODUCTION TO GEOGRAPHICAL INFORMATION SYSTEMS AND COMPUTER MAPPING
Fundamentals of geographic information systems (GIS), from data acquisition to final reports and maps, with particular emphasis on their role in geographic analysis. Projects cover environmental topics (with IDRISI) and urban-economic topics (with MapInfo). ARC/Info will be introduced. Prerequisites: GEOG 261 and declaration of a major or minor in geography.

GEOG 465. REMOTE SENSING
Fundamentals of remote sensing, various satellites and methods of data acquisition and processing, applications in land use mapping. Prerequisite: GEOG 361 or permission.

GEOG 475. COMPUTER CARTOGRAPHY
Principles of digital mapping. Topics include: the character of geographic data in a digital environment; automated generalization of data; topological models and operations (ARC/node, quad-tree, DLG, etc.); digital terrain models; geographic data exchange formats (ARC/generate, DXF, MBI, etc.); interface design; structure of commercial GIS software; graphics libraries and their application to mapping. Projects in C. Prerequisites: GEOG 261 and CS 140 (Pascal) or 160 (C, preferred), or their equivalents; and junior standing.

Applications

GEOG 495. INTERNSHIP IN GEOGRAPHY: PLANNING *variable credit*
Internship in agencies such as planning and engineering departments, consulting firms. Prerequisites: two upper-level geography courses and consent of instructor.

Research

GEOG 497. INDEPENDENT STUDY *variable credit*
Meets special needs and interests of advanced students on tutorial or seminar basis. Prerequisites: consent of instructor and department chair.

GEOG 499. HONORS THESIS *variable credit*

COURSE OFFERINGS/ GRADUATE

**Pending Graduate Council approval.*

GEOG 500. GEOGRAPHIC THEORY
Theoretical foundations of modern geography.

GEOG 502. INTRODUCTION TO GEOGRAPHICAL INFORMATION SYSTEMS AND COMPUTER MAPPING (GIS I)
The fundamentals of geographic information systems (GIS), from data acquisition to final reports and maps, with particular emphasis on their role in geographic analysis. Projects cover environmental topics (with ARC/INFO) and urban-economic topics (with MapInfo). Limited to geography students. Prerequisite: GEOG 261.

***GEOG 503. SPECIAL TOPICS—GIS IN A VISUAL BASIC** *2 credits*
Explores the use of map objects in a Visual Basic environment for the purpose of creating mapping output and conducting spatial analysis in a Windows environment. Prerequisite: GEOG 502 or equivalent.

GEOG 505. ADVANCED AIR PHOTO INTERPRETATION
Advanced photogrammetry, manual, semiautomatic and automatic photo interpretation techniques; their applications in urban and natural resources analysis.

GEOG 508. URBAN PLANNING SEMINAR I
Basic theory and techniques used in urban and regional planning analysis. Topics for papers include population

analysis and forecasting, uses of planning data, regional analysis and balances, labor force policies, role of models in planning and cost-benefit analysis.

GEOG 509. CONSERVATION OF NATURAL RESOURCES
Historic and contemporary analysis of trends in conservation thought and practice. Geographic, environmental, cultural, economic factors relating to natural resource use and management. Specific resources such as minerals, soil, water as related to conservation policy, practice, need.

GEOG 511 (also GEOL 511). ADVANCED GEOMORPHOLOGY *fall*
Application of surface processes in solving problems of environmental and human significance. Course will emphasize a case-study approach, using examples of effects from landslides, surface hydrology, coastal zone preferences, subsidence.

GEOG 512 (also GEOL 512). ADVANCED GEOMORPHOLOGY II—GLACIAL *every other spring*
Historical and geological importance of glaciation periods. Analysis of vast landform changes created by glacial, periglacial, glaciofluvial processes. Reference paper, independent study project, field trips. Two lectures, one three-hour laboratory per week.

GEOG 516 (also GEOL 516). HYDROGEOLOGY *spring*
A survey of hydrogeology: hydrologic cycle; properties of rocks and soils; fluid flow in porous media (Darcy's Law, diffusion equation); hydrological boundary conditions, numerical techniques; groundwater chemistry; case studies. Prerequisites: calculus and introductory geology, or consent of instructor.

GEOG 522. BIOGEOGRAPHY
Interrelationships between physical geography and ecology. Study and explanation of distribution patterns of living organisms.

GEOG 523. SOILS AND ENVIRONMENT
Study of basic properties of soils and pedogenic processes operating in environments. Survey of major types of soils and their world distributions, uses of soils, their basis of land capability assessment. Material presented in a structured modular format, highlighting the complexity of soils, their interaction with physical and environmental systems. Local field trips will consist of examining and mapping soil development, collecting field measurements and samples, and performing mechanical and chemical tests.

GEOG 530. NATURAL HAZARDS
Analysis of physical, geographic, political and perceptual aspects of natural hazards. Evaluation of physical environments in which natural hazards occur, land use and development patterns in hazardous areas, tools and methods for evaluating hazardousness and vulnerability. Prerequisite: GEOG 121 or ENVI 201.

GEOG 531. ADVANCED GEOGRAPHIC FIELD STUDY
Application of field research techniques in geography to analysis and evaluation of human use of physical environment. Field research problems requiring reconnaissance, intensive and multiple data gathering techniques, quantitative and nonquantitative analytic methods. Written research reports.

GEOG 532. REMOTE SENSING OF THE ENVIRONMENT
Remote electromagnetic sensing, including photographic infrared and radar imagery. Geographic research through manual and automated analysis of physical and cultural data. Prerequisite: consent of instructor.

GEOG 533. ADVANCED STATISTICAL TECHNIQUES FOR GEOGRAPHIC AND SPATIAL ANALYSIS I
Multivariate analysis that includes correlation and regression analysis, analysis of variance, chi-square tests. Prerequisite: introductory course in statistics.

GEOG 535. URBAN PLANNING SEMINAR II
Planning commercial development, industrial location planning, planning housing development, public and private sectors, planning reorganization of public services, transportation, urban renewal and zoning.

GEOG 536. LAND USE ANALYSIS
Analysis of urban, suburban and rural land and water use as basis for spatial planning, resource and environmental management. Application of remote sensing, air photo interpretation, surveying, field techniques, other tools to land use problems. Classification methods and cartographic representation. Field experience. Prerequisite: prior or concurrent courses in physical, economic and urban geography and remote sensing.

GEOG 542. WATER RESOURCE PLANNING AND MANAGEMENT
Hydrologic, engineering, economic, ecological and institutional aspects of water planning and management. Urban industrial water quality, flood plain management and river basin planning. Governmental and private water decision-making systems and processes.

GEOG 544. SAMPLING AND MEASUREMENT OF ELEMENTS OF PHYSICAL ENVIRONMENT
Field measurement, variable selection, numerical taxonomy, computer mapping of physical land systems. Sampling techniques, variable ordination and coding, measurement procedures, data bank structure and retrieval, variable association, clustering and computer mapping of soils, topography, vegetation and micro climate. Prerequisite: GEOG 501 or consent of instructor.

GEOG 545. GEOGRAPHIC INFORMATION SYSTEMS II
This course focuses on theoretical and applied issues in desktop Geographical Information Systems. The data acquisition, portrayal and analysis functions of GIS are explored through research topics. Desktop GIS and ARC/INFO UNIX are applied in a laboratory and project basis. Prerequisites: GEOG 261 and 502; limited to geography students; permission of instructor.

GEOG 550. PHOTOGRAMMETRY
Systematic study of measuring data recorded on photographs; geometric relationship between physical objects and their images. Geometry of aerial photography, its relationship with terrain height, depression angle, flight height, other camera parameters. Emphasis on numerical solutions rather than instrument solutions. Relationship with modern remote sensing, traditional photo interpretation. Available to undergraduates by petition.

***GEOG 555. GEOGRAPHIC INFORMATION SYSTEMS III**
Emerging theories of GIS; GIS and the quantitative revolution; policy issues of GIS; increasing role of GIS in society; issues of mathematical examination of spatial analysis and

GIS; advanced and new research areas; diffusion of GIS and component areas across world; GIS and educational training.

GEOG 564. COMPUTER CARTOGRAPHY
Principles of digital mapping. Topics covered include: the character of geographic data in a digital environment; automated generalization of data; topological models and operations (ARC/node, quad—tree, DLG, etc.); digital terrain models; geographic data exchange formats (ARC/generate, DXF, MBI, etc.); interface design; structure of commercial GIS software; graphics libraries and their application to mapping. Projects in C. Prerequisite: GEOG 261.

GEOG 566. ADVANCED STATISTICAL TECHNIQUES FOR GEOGRAPHIC AND SPATIAL ANALYSIS II
Advanced variance analysis, covariance analysis, future analysis, survey sampling techniques.

GEOG 569. ADVANCED CARTOGRAPHY
Mapping and analyzing the statistical surface. Effect of class interval systems and interpolating schemes on choropleth and isopleth maps. Map perception. Automatic pattern recognition. Prerequisite: GEOG 261.

GEOG 573. SEMINAR IN PHYSICAL GEOGRAPHY
Processes shaping physical environmental base for human use. Techniques of sampling and inventorying aspects of soils and climate. Students prepare climatic and soil maps both at micro and macro scales, perform mechanical analyses of soils, use both heat and water budgets quantitatively. Prerequisite: physical geography.

GEOG 574. ECONOMIC GEOGRAPHY SEMINAR
Intensive study of selected problems in economic geography.

GEOG 575. RESOURCE MANAGEMENT
Decision-making methods used by administrators of public agencies concerned with environmental issues. Public policy objectives and administration; alternative environmental management systems; implications of alternative methods of control; applied administrative methods for directing operations.

GEOG 576. ADVANCED ENVIRONMENTAL ANALYSIS
An analytical examination of selected environmental problems and issues. Fundamental aspects of planning including research design, analysis, and implementation of environmental policies will be covered.

GEOG 581. SPECIAL TOPICS—GEOGRAPHY
Design and execution of a contemporary urban/environmental/policy research problem. Requires directed reading, discussion in seminar format and written analysis.

GEOG 591. SEMINAR IN TEACHING METHODS IN GEOGRAPHY *1-4 credits*
Philosophy of teaching, course preparation and presentation, source materials, tools, problems associated with college teaching. Graduate students only. One hour per week, one credit hour.

GEOG 595. RESEARCH AND COLLOQUIUM
Geography faculty provides topic(s); research team of faculty and students completes project and presents findings in Geography Colloquium Series. Examination and attempted solution of geographical problems that exist in Binghamton SMSA. Applied problems include monitoring of environmental systems, transportation planning and urban planning. Students apply geographical and planning theory and techniques obtained in other courses and work closely with faculty members. Community experts invited to participate where appropriate.

GEOG 597. INDEPENDENT STUDY *variable credit*
Research under direction of faculty member. Consent of instructor and chairperson required.

GEOG 598. INTERNSHIP IN GEOGRAPHY—CARTOGRAPHY AND PLANNING
One formal meeting per week with instructor, plus eight hours of interning in an agency. Students undertake real-world problems approved by agency and faculty member. Evaluation on basis of project performance at agency, judged by agency sponsor and faculty. Consent of instructor required.

GEOG 599. THESIS RESEARCH *1-4 credits*

GEOG 700. CONTINUOUS REGISTRATION *1 credit/semester*
Required for maintenance of matriculated status in graduate program. No credit toward graduate degree requirements.

GEOG 707. RESEARCH SKILLS *1-4 credits*
Development of research skills required within graduate programs. May not be applied toward course credits for any graduate degree. Prerequisite: approval of relevant graduate program directors or department chairs.