Possible MESM Coursework

**AFS 415: Fishery Science**
**LEC:** (3 crs.) Biology of aquatic resource animals, fisheries mensuration and assessment, fisheries ecology, fishing methods, aquatic resource management and conservation, fish and shellfish farming. (Lec. 3) Pre: AFS 315 and college mathematics; concurrent registration in 416.

**AFS 416: Fishery Science Laboratory**
**LAB:** (1 cr.) Practices and techniques of fisheries science. Field exercises in local model estuary and lake ecosystems; sampling methods; enumerating and documenting collections; measuring and reporting environmental attributes; estimating population parameters. (Lab. 2) Pre: concurrent registration in AFS 415.

**AFS 425: Aquaculture and the Environment**
**LEC:** (3 crs.) Impacts of aquaculture practices on the environment, including habitat alteration, release of drugs and chemicals, and interaction of cultured and wild organisms. Methods to reduce or eliminate those impacts: modeling, siting and monitoring of aquaculture facilities; use of polyculture and water reuse systems. (Lec. 3) Pre: AFS 102.

**AFS 432: Marine Finfish Aquaculture**
**LEC:** (3 crs.) Culture of non-salmonid marine fish worldwide, with emphasis on the hatchery phase. Broodstock, larval rearing, live and formulated feeds, grow-out systems, stock enhancement. Requires student project on facility design. Pre: AFS 102.

**AFS 481: Shellfish Aquaculture Laboratory**
**LAB:** (2 crs.) Detailed study of hatchery, nursery, and grow-out techniques for the production of bivalve mollusks. Culture of phytoplankton, conditioning of broodstock, spawning, larviculture, settlement, metamorphosis, nursery and grow-out methods. (Lab. 6) Pre: AFS 201 or permission of instructor. Offered in fall of odd-numbered years.

**AFS 486: Fish Physiology**
**LEC:** (3 crs.) Study of how fish function in the changing aquatic environment from the molecular to the organismal level. The major organ systems, regulation of physiological and biochemical functions, and interactions will be explored. (Lec. 3) Pre: BIO 201 or 242, or AVS 331, or permission of instructor.

**AFS 500: Diseases of Aquatic Organisms**
**LEC:** (3 crs.) Nature, causes, diagnosis, and spread of diseases limiting piscine freshwater and marine aquaculture projects. Emphasis on prevention, control, and treatment of more common diseases affecting hatchery management. (Lec. 3) Pre: AFS 102; BIO 201 or AVS 331.
AFS 531: Fisheries Stock Assessment  
LEC: (3 crs.) A quantitative approach to describing the processes of fish growth and mortality, the estimation of stock size, the prediction of stock yield, and management practices. Spreadsheets and other microcomputer applications will be used for analysis and modeling. (Lec. 2, Lab. 3) Pre: AFS 415, STA 409 or permission of instructor.

AFS 532: Experimental Design  
LEC: (3 crs.) Cross-listed as (STA), PSY, AFS 532. Application of statistical methods to biological and psychological research and experimentation. Experimental situations for which various ANOVA and ANCOVA designs are most suitable. (Lec. 3) Pre: STA 409 or equivalent.

AFS 581: Current Topics in Molluscan Aquaculture  
LEC: (3 crs.) Review and critical analysis of recent literature within the field of molluscan biology with emphasis on application to mariculture techniques. Student presentation of selected topics and field trips to state-of-the-art mariculture facilities. (Lec. 3) Pre: graduate standing or senior standing with permission of instructor.

AFS 584: Advanced Aquaculture Systems  
LEC: (3 crs.) Development of design criteria, operational analysis, and management of selected species in water reuse systems. (Lec. 2, Lab. 2) In alternate years.

BES 551: Ecosystem Science and Sustainability  
LEC: (3 crs.) Fundamental principles of systems ecology linking natural and human infrastructure, processes, ecosystem dynamics with focus on global change; creating innovative methods to frame the complexity of designing more sustainable systems. (Lec. 3) Pre: Graduate standing or permission of instructor.

BIO 455: Marine Ecology  
LEC: (3 crs.) Investigation of the structure and dynamics of various marine ecosystems. Includes mineral cycling, energy flow, community and population organization, and behavioral ecology in selected marine environments. (Lec. 3) Pre: 262 or permission of instructor.

BIO 500: Advanced Science Ethics  
LEC: (1 cr.) This course focuses on the ethics of scientific research using case studies to inform discussion on common ethical issues in science. (Lec. 1) Pre: graduate standing or permission from the instructor.

BIO 501: Advanced Scientific Communication  
LEC: (2 crs.) This course focuses on the process of writing and reviewing scientific manuscripts and grant proposals. (Lec. 1, Sem. 1) Pre: graduate standing or permission from the instructor.

BIO 580: Community Ecology  
LEC: (3 crs.) Explores community ecology, with an emphasis on interspecific interactions (competition, predation, mutualism), species diversity, succession, niche theory, and island biogeography. Format includes lecture, case studies, and discussion. (Lec. 3) Pre: BIO 262 or permission of instructor.
CPL 434: Introduction to Environmental Law
**LEC:** (3 crs.) Cross–listed as (CPL), LAR 434. Surveys issues arising out of laws designed to protect the environment and manage resources: right to a decent environment, government regulation versus private property rights, citizen participation in planning environmental controls. (Lec. 3) Pre: sophomore standing (45 credits completed) and above.

CPL 483: Land Development
**LEC:** (3 crs.) Study of land development including land acquisition, development and project effectiveness. Techniques focus on land suitability and project viability, as well as environmental considerations. Focus on coastal development. (Lec. 3) Pre: junior, senior, or graduate standing, or permission of instructor.

CPL 485: Environmental Planning
**LEC:** (3 crs.) Theories, methodologies, and substantive concerns of environmental resource analysis with attention given to coastal environmental issues. Focus on land, soils, watersheds, water quality, vegetation, air quality, wildlife, noise pollution. (Lec. 3) Pre: junior, senior, or graduate standing, or permission of instructor.

CPL 501: Introduction to Community Planning Practice
**LEC:** (3 crs.) The development of community planning in the United States, history of governmental planning and evaluation of the planning profession, and the elements of planning practice. (Lec. 3)

CPL 516: Seminar On The Urban Waterfront
**SEM:** (3 crs.) Cross–listed as (MAF), CPL 516. The urban environment and its evolution, structure, and function as it pertains to metropolitan waterfrotns and small recreational harbors. Emphasis on the permitting process, public participation, marine recreation, and management issues. Field trip and student project required. (Seminar)

CPL 523: Planning Theory
**SEM:** (3 crs.) Critical survey of planning theories and contemporary planning concepts. Values, assumptions, and processes of various planning paradigms as related to decisions in community planning. Specific emphasis on values and ethics in planning theory. (Seminar) Service Learning.

CPL 525: Introduction To Planning Methods
**LEC:** (4 crs.) Application of basic quantitative methods in planning: collection, analysis, and presentation of demographic, housing, and economic data. Introductory survey techniques. Introduction to computer applications in planning. (Lec. 3, Lab. 2) Pre: one course in statistics or permission of instructor.

CPL 526: Planning & Policy Analysis
**LEC:** (3 crs.) Elementary social science research methods. Introduction to methodological approaches, research design, quantitative and qualitative data collection, and computerized data analysis in community planning and related urban social science. (Lec. 3, Lab. 2) Pre: CPL 525.
**CPL 536: International Comparisons In Urban And Regional Planning**
**SEM:** (3 crs.) Urban and regional development issues and policies in advanced and developing countries. Emphasis on population growth, urbanization, and spatial development. (Seminar) In alternate years.

**CPL 537: Land Resource Economics**
**LEC:** (3 crs.) Cross-listed as (CPL), EEC 532. The study of economic relationships of human and scarce natural and human-made resources. Supply and demand, rent theory, resources conservation, and the impact of public policy and law. (Lec. 3)

**CPL 549: Seminar In Ecological Planning**
**SEM:** (3 crs.) Advanced seminar in ecological planning. Topics include hazardous waste, power plant siting, major transportation facilities, solid waste, aquifer protection, among others. Particular emphasis on wetlands and marine and coastal settings. (Seminar) Pre: CPL 511 or permission of instructor.

**EEC 410: Fish and Wildlife Economics**
**LEC:** (3 crs.) Institutional, biological, and economic factors affecting the use of fish and wildlife resources. Economic analysis is applied to problems of fish and wildlife management in both marine and terrestrial ecosystems. (Lec. 3) Pre: EEC 310 or ECN 328 or ECN 323 or permission of instructor.

**EEC 430: Water Resource Economics**
**LEC:** (3 crs.) This course will analyze the economics of valuation, management, and distribution of water resources using economic theory and case studies to evaluate water policies and their effect on society. (Lec. 3) Pre: EEC 105 or ECN 201 or permission of instructor.

**EEC 432: Environmental and Resource Economics and Policy**
**LEC:** (3 crs.) Economic analysis of policies that address environmental and natural resource problems. Topics include pollution-control policies, economic incentives, and the optimal use of renewable and nonrenewable natural resources. (Lec. 3) Pre: EEC 205 or ECN 201.

**EEC 435: Aquacultural Economics**
**LEC:** (3 crs.) Economics of international and domestic development of aquaculture, environmental and resource regulations on aquaculture, and management of and decision making in aquacultural enterprises. Analysis of public and private aquaculture production and marketing. (Lec. 3) Pre: EEC 105 or ECN 201 or permission of instructor.

**EEC 440: Benefit–Cost Analysis**
**LEC:** (3 crs.) Basic concepts in benefit–cost analysis. Measurement, comparison of benefits and costs over time, and criteria for evaluation of projects and public policies. Problems and case studies in evaluation of current natural resources issues. (Lec. 3) Pre: EEC 105 or permission of instructor.
**EEC 441: Markets, Trade, and Natural Resources**

**LEC:** (3 crs.) Analysis of the role of markets in the valuation, management, and distribution of natural resources (esp. fish); price analysis; international trade; channels of distribution; commodity futures and options markets; marketing information; regulations and controls; cooperative marketing. (Lec) Pre: EEC 105 or ECN 201 or permission of instructor.

**EEC 524: Quantitative Techniques in Natural Resource Research**

**LEC:** (3 crs.) Cross-listed as (NRS), EEC 520. Research design, database management, and analysis and interpretation of natural resource data. Emphasis on hands-on experience of quantitative and computerized techniques commonly used by natural resource scientists. (Lec. 2, Lab 2) Pre: STA 308 and permission of instructor.

**EEC 532: Land Resource Economics**

**LEC:** (3 crs.) Cross-listed as (CPL), EEC 532. The study of economic relationships of human and scarce natural and human-made resources. Supply and demand, rent theory, resources conservation, and the impact of public policy and law. (Lec. 3)

**EEC 534: Economics of Natural Resources**

**LEC:** (4 crs.) Microeconomic theory applied to problems of natural resource allocation. The rationale for government intervention in the market's provision of natural resources and alternative techniques for optimally allocated natural resources are investigated. (Lec. 4) Pre: EEC 528 or permission of instructor.

**EEC 535: Environmental Economics**

**LEC:** (3 crs.) Theory of externalities; incentive-based and regulatory policy instruments for addressing market failure; theory and methods for valuing natural resource and environmental services; other environmental topics. (Lec. 3) Pre: EEC 528 or equivalent.

**EEC 540: Applied Resource Economics**

**LEC:** (3 crs.) Examines issues in agricultural and natural resource policy through applications of theoretical and empirical tools. Applications include pollution control, fisheries management, water, and agricultural policy. (Lec. 3) Pre: EEC 528 or permission of instructor.

**EEC 542: Conservation Biology And Resource Economics**

**SEM:** (2 crs.) Cross-listed as (NRS), EEC 542. Examination of different components of conservation of biological diversity. Topics include minimum viable populations, ecology and economics of reserve design, reintroductions, causes of extinction, and the ecosystem conservation strategies. (Seminar) Pre: BIO 262, EEC 105 or permission of instructor.

**EEC 543: Economic Structure of the Fishing Industry**

**LEC:** (3 crs.) Analysis of fishing industries from the standpoint of activity and efficiency. Problems related to common property resources, government policy, labor, and legal and institutional factors. (Lec. 3) Pre: 514 or permission of instructor. In alternate years.
**EEC 595: Environment and Development Economics**  
**LEC:** (3 crs.) Cross–listed as (EEC), MAF, PSC, SOC 595. Application of economic principles and research methods to understand the economics of environmental and natural resource management and poverty alleviation. (Lec. 3) Pre: EEC 528 or permission of instructor.

**EEC 634: Advanced Economics of Natural and Environmental Resources**  
**LEC:** (4 crs.) Concepts of economic efficiency applied to natural resources with emphasis on intertemporal allocation of nonrenewable and renewable resources. Application of welfare and institutional economics to resource management and development; analysis of optimum allocation among users. (Lec. 4) Pre: EEC 534 and 624 or permission of instructor.

**EEC 635: Marine Resources Policy**  
**LEC:** (3 crs.) Analysis of public policy problems relating to estuarine and marine resources, including natural resource damage assessment, environmental issues, coastal zone concerns, and other selected topics. (Lec. 3) Pre: EEC 534. In alternate years.

**EVS 501: Development of Learning Outcomes for MESM**  
**SEM:** (1 cr.) Formulate learning outcomes and develop professional internships for new MESM students through interaction with URI faculty involved in the MESM tracks, develop skills in environmental communication, leadership, and ethics. (Seminar) Pre: enrollment in MESM graduate program.

**EVS 502: Seminar in Environmental Science and Management**  
**SEM:** (1 cr.) Presentation of proposed, ongoing and completed major projects by MESM graduate students. Discussion among graduate students, faculty, and other mentors on project design, methods, analysis, and presentation. (Seminar) Pre: enrollment in MESM graduate program.

**EVS 550: Advanced Ecology**  
**LEC:** (4 crs.) This course provides a survey of physiological, population, and community ecology. It encourages thinking and learning about key ecological concepts through primary literature, discussion, analytical writing, and problem sets. (Lec. 4) Pre: graduate standing; must have completed introductory biology and ecology or courses that included significant introduction to ecology.

**EVS 582: Innovative Subsurface Remediation Technologies**  
**LEC:** (4 crs.) Cross–listed as (GEO), EVS 582, NRS 583. Innovative remediation technologies for treating contaminated groundwater and sediments: theory, applications, and limitations of selected methods. Discussion of case studies. Offered alternate years (Lec. 4) Pre: permission of instructor.

**EVS 584: Environmental Hydrogeology**  
**LEC:** (4 crs.) Cross–listed as (GEO), EVS, NRS 584. Develop an understanding of the physico–chemical principles and fundamental relationships that describe the fate and transport of contaminants in the hydrologic system. (Lec. 3, Lab 2) Pre: GEO 483 or CVE 588 or NRS 510 or permission of instructor.
**EVS 597: Professional Internship in Environmental Science and Management**

**PRA:** (1–3 crs.) Supervised work performed with an environmental agency, nongovernmental organization, or private firm as part of the requirements of the Master of Environmental Science and Management degree program. (Practicum) Pre: enrollment in MESM degree program.

**EVS 598: Professional Master's Research**

**IND:** (3 crs.) Independent investigation to satisfy the research requirement for the Master of Environmental Science and Management degree. Substantial paper required. (Independent Study) Pre: enrollment in MESM degree program.

**GEO 483: Hydrogeology**

**LEC:** (4 crs.) Study and interpretation of groundwater flow systems and the interaction between groundwater and the geologic framework, including: groundwater flow, aqueous geochemistry, groundwater resource evaluation, and groundwater in geologic processes. (Lec. 3, Lab. 2) Pre: GEO 103, 210, and MTH 131 or 141, or permission of instructor.

**GEO 535: Geospatial Watershed Modeling**

**LEC:** (3 crs.) Cross-listed with (GEO) NRS, CVE 535. Tools to simulate the water quantity and quality of a complex watershed; development of models for examining the water quantity and quality issues that are associated with watershed management. (Lec. 2, Lab. 2) Pre: NRS 461 or GEO 483 or CVE 475 or equivalent, or graduate standing, or permission of instructor.

**GEO 577: Coastal Geologic Hazards**

**LEC:** (3 crs.) Geologic hazards in the coastal zone and their impact on people. Includes waves, storm-surge, mass-wasting, and sea-level rise. Geologic effectiveness of engineering structures and management techniques. Emphasis on field study. (Lec. 2, Lab. 3) Pre: graduate or advanced undergraduate standing in environmental, resource, or engineering major.

**MAF 461: Coastal Zone Management**

**LEC:** (3 crs.) Examination of activities and management efforts in the coastal zone of both developed and developing countries and their impacts on the environment. Resolution of use conflicts. (Lec. 3)

**MAF 465: GIS Applications in Coastal and Marine Management**

**LEC:** (3 crs.) The use of geographical information systems (GIS) technology in coastal and marine settings. Database acquisition and management are emphasized. Case application in coastal zone management, artificial habitat, and fisheries management. (Lec. 3)

**MAF 471: Island Ecosystem Management**

**LEC:** (3 crs.) An ecosystem approach to the sustainable development and environmental management of mid-oceanic islands in the Caribbean and the Pacific Ocean. Topics include tourism, reef fishery, cultural heritage and marine conservation. Simulation game on island-wide management process. (Lec. 3)
MAF 472: Marine Recreation and Tourism Management Seminar
SEM: (3 crs.) Analysis of domestic and international case studies emphasizing identification of and solutions to problems of coastal recreation and tourism. Use of experiential learning. Emphasis placed on presentation, leadership, and negotiation skills. (Seminar)

MAF 475: Human Responses to Coastal Hazards and Disasters
LEC: (3 crs.) Examines the impact of hazards and disasters on human population inhabiting the coastal zone. Sets human adaptations to coastal hazards and disasters in an historical context. Extracts lessons learned for comparative analysis. (Lec. 3)

MAF 482: Quantitative Methods in Marine Affairs
LEC: (3 crs.) Introduction to descriptive and inferential statistics in geography and marine affairs. Emphasis on the spatial application of statistical tests with particular utility to the geographer and marine affairs students. (Lec. 3) Pre: STA 220 or equivalent for undergraduate students.

MAF 484: Environmental Analysis and Policy in Coastal Management
LEC: (3 crs.) Analysis of environmental policy strategies as applied in federal and state coastal management programs. Emphasis on coastal environmental assessment and program evaluation techniques, hazards management, regulatory frameworks, and environmental ethics. (Lec. 3)

MAF 494: Cases In Marine Policy
SEM: (3 crs.) A single, current problem drawn from areas such as coastal management, ports, or fisheries is examined through detailed analysis of alternatives and decision processes. (Seminar) Pre: permission of instructor or chairperson.

MAF 502: Research Methods in Marine Affairs
LEC: (3 crs.) Emphasis on the application of alternative research methods utilized in a typical interdisciplinary study. Development of specific research projects. (Lec. 3) Pre: MAF 482 or permission of instructor.

MAF 511: Ocean Uses and Marine Sciences
LEC: (3 crs.) Introduction to selected ocean uses focusing on the interplay of public policy and marine science. Emphasis on policy implications of uses such as resource and energy extraction. (Lec. 3)

MAF 515: Marine Pollution Policy
LEC: (3 crs.) Introduction to management techniques for marine pollutants (biodegradable materials, nutrients, petroleum, metals, synthetic organics, radioactive materials, plastics, heat, and dredge spoils) with emphasis on strategies to limit environmental impacts. (Lec. 3) Pre: graduate standing only.

MAF 521: Coastal Zone Law
LEC: (3 crs.) Examination of the authority of different levels and agencies of government to make decisions affecting coastal regions. Survey of existing and proposed state and national legislation affecting coastal regions. (Lec. 3)
MAF 523: Fisheries Law and Management
LEC: (3 crs.) Examination of the relationship between law and fisheries policy on the international and national levels, law relating to fisheries, jurisdictional levels, function of law in implementing fisheries management policy. (Lec. 3)

MAF 526: Management of Marine Protected Areas
LEC: (3 crs.) Examination of ecological, political, legal and social factors in establishing and managing marine protected areas. Case studies of MPA efforts highlight interrelationships among interest groups, institutions, and legislation. (Lec. 3)

MAF 527: Marine Protected Areas: An Interdisciplinary Analysis
LEC: (3 crs.) Cross–listed as (MAF), NRS 527. Examination of the ecological, political, social, cultural, and economics factors influencing the use of MPAs (Lec. 3) Pre: permission of instructor.

MAF 530: Marine Environmental History
SEM: (3 crs.) Cross–listed with (MAF) HIS 530. Provides background on the history of human interactions with the marine environment with insight into historical methodologies. (Seminar) Pre: Graduate standing of permission of instructor.

MAF 545: Environmental Thought and Behavior
LEC: (3 crs.) Introduction to environmental behavior, including factors such as values, knowledge, risk perceptions, and social pressure. Attention is given to the role of attitudes and values in coastal and marine management. (Lec. 3) Pre: Graduate standing or permission of instructor.

MAF 563: Maritime Transportation
LEC: Passenger and commodity transportation. Analysis of the relationship between transportation services and the spatial distribution of activities. Emphasis on multimodel transport and bulk commodities. (Lec. 3) Pre: Senior or graduate standing or permission of instructor.

MAF 564: Port Planning and Policy
LEC: (3 crs.) Examination of U.S. and international port issues. Special emphasis on port stakeholders, role of ports in society, and climate change challenges. Field trips and guest speakers. (Lec. 3)

MAF 577: International Ocean Law
LEC: (3 crs.) Cross–listed as (MAF), PSC 577. Principles of international law as they relate to ocean management problems. Jurisdiction in zones, such as territorial seas, exclusive economic zones, and the high seas will be examined, as well as the problems posed by zonal approaches to ocean–use management.

MAF 578: International Ocean Organizations
LEC: (3 crs.) International organizations involved in marine–related activities, including their planning, management, regulatory, and assistance functions. Attention to the impact of organizations on ocean management efforts in the developed and developing world, (Lec. 3) Pre: MAF 577 or permission of instructor.
MAF 582: Coastal Ecosystem Governance  
**SEM:** (3 crs.) This course links human impacts on coastal environments with existing or proposed governance solutions. Management regimes for individual sectors, coastal regions, and land/estuarine ecosystems are introduced and compared. (Seminar)

NRS 406: Wetland Wildlife Management  
**LEC:** (4 crs.) Introduction to management of wetland wildlife. Emphasis on management techniques used for major wetland types, waterfowl, furbearers and nongame wildlife. (Lec. 2, Lab 4) Pre: NRS 223 and permission of instructor.

NRS 407: Endangered Species Conservation  
**LEC:** (3 crs.) Programs for the protection of species under the Endangered Species Act and global approaches to conservation of biodiversity in human–dominated landscapes. (Lec. 3) Pre: BIO 101 and NRS 100.

NRS 410: Fundamentals of GIS  
**LAB:** (3 crs.) Emphasis on using a geographic information system (GIS) to create a geographically referenced spatial database, spatial topology, data visualization, computer-assisted map making, and spatial data query and analysis. (Lab. 3, Online 2) Pre: past or concurrent enrollment in NRS 409 or 509.

NRS 412: Soil–Water Chemistry  
**LEC:** (3 crs.) Biogeochemistry of soil–water interactions. Soil composition, the exchange and sorption of elements, trace element behavior, redox reactions and control of these factors on availability and loss. (Lec. 3) Pre: NRS 212 and CHM 124 and 126 or permission of instructor. In alternate years.

NRS 415: Remote Sensing Of The Environment  
**LEC:** (3 crs.) Introduction to fundamentals of airborne and space–borne remote sensing. Emphasis on remote sensing applications in terrestrial environmental and natural resources studies. (Lec. 2, Lab. 2)

NRS 423: Wetland Ecology  
**LEC:** (4 crs.) Formation, development, and distinguishing features of inland and coastal wetlands. Topics include classification, geology, hydrology, soils, plant ecology, vegetation dynamics. Primary emphasis on wetlands of the glaciated Northeast. Capstone. (Lec. 2, Lab. 4) Pre: BIO 262, GEO 103, NRS 223, concurrent enrollment in NRS 425 or 525, and permission of instructor.

NRS 424: Wetlands and Land Use  
**LEC:** (4 crs.) Survey of wetland values, exploitation, current status, and legal protection. Emphasis on critical issues including wetland evaluation, impact assessment, mitigation procedures. Field trips provide examples of wetland use conflicts. Capstone. (Lec. 2, Lab. 4) Pre: NRS 423 or permission of instructor.
NRS 426: Soil Microbiology  
LEC: (3 crs.) Occurrence, metabolism and ecology of soil microorganisms, with emphasis on nutrient cycling, soil pathogens, transformation of organic and inorganic pollutants, and soil biotechnology. (Lec 3) Pre: NRS 212 or permission of instructor.

NRS 450: Soil Conservation and Land Use  
LEC: (3 crs.) Application of soil survey interpretation as a tool in soil and water conservation and land use planning. Implications of soil properties and problems for land use considered with emphasis on urbanizing situations. Capstone. (Lec. 3) Pre: NRS 212 or permission of instructor.

NRS 452: Soil, Water, And Land Use Investigations  
PRA: (1 cr.) Independent field and laboratory study of soil and water topics related to land use issues. (Practicum) Capstone. Pre: concurrent enrollment in NRS 450.

NRS 461: (361) Watershed Hydrology and Management  
LEC: (4 crs.) Detailed study of the watershed processes that govern the hydrology and quality of surface water. Emphasis on methods and analyses employed for watershed management. (Lec. 3, Lab. 3) Pre: NRS 212, STA 308 or 409 or permission of instructor.

NRS 471: Soil Morphology and Mapping  
LEC: (4 crs.) A detailed study of the morphological properties of soils and their distribution on the landscape. Practical experience in describing soil profiles and preparing soil maps. (Lec. 2, Lab. 4)

NRS 501: Foundations of Restoration Ecology  
LEC: (4 crs.) Overview of factors involved with implementing an ecological restoration. Will synthesize the physical, biological and human factors that determine restoration success. Includes weekly field/lab sessions. (Lec. 3/Lab. 3) Pre: NRS 223 or BIO 262, or permission of instructor.

NRS 503: Wildlife Biometrics Field Investigations  
PRA: (1 cr.) Independent field study of wildlife populations using modern quantitative measurements and data analyses. Emphasis on experimental design, data collection and recording, statistical analysis, data interpretation, and reporting. (Practicum) Pre: concurrent enrollment in 402.

NRS 505: Biology and Management of Migratory Birds  
SEM: (2 crs.) Current programs, problems, and techniques for managing migratory game and nongame birds. Emphasis on basic biology of the species, habitat management, and harvest management. (Seminar) Pre: NRS 305 or permission of instructor. In alternate years.

NRS 509: Concepts of GIS and Remote Sensing in Environmental Science  
LEC: (4 crs.) Unique properties of geospatial data, accessing existing GIS and remote sensing data, and applications of GIS and remote sensing in the environmental sciences. Uses in ecology, conservation, soil science, geohydrology, and conservation biology. (Lec. 3, Rec. 1) Pre: graduate standing or permission of instructor.
NRS 514: Climate Change Science and Policy
LEC: (3 crs.) Overview and analysis of the science and policy issues concerning climate change and global warming. (Lec. 3) Pre: for graduate students, none; for undergraduates GEO 305 or permission of instructor.

NRS 516: Remote Sensing in Natural Resources Mapping
LEC: (3 crs.) Digital remote sensing in environmental and natural resource studies. Emphasis on satellite remote sensing image rectification, georeferencing, classification, and integration with GIS. (Lec. 2, Lab. 2) Pre: NRS 415 or permission of instructor.

NRS 517: Herpetology
LEC: (4 crs.) Cross-listed as (NRS), BIO 517. This course provides an in-depth background on the biology, ecology, conservation, and management of reptiles and amphibians, including field methods for studying amphibians and reptiles of northeastern North America. (Lec. 2, Lab. 4) Pre: graduate student in biological and environmental sciences and permission of instructor.

NRS 518: Ecohydrology
LEC: (3 crs.) Relationships between hydrology and the diversity, structure, and function of ecosystems. Topics include methods of study; interaction of watershed dynamics and flow regimes upon wetlands and fluvial systems. (Lec. 3) Pre: NRS 361 or NRS 461 or permission of instructor.

NRS 520: Quantitative Techniques in Natural Resource Research
LEC: (3 crs.) Cross-listed as (NRS), EEC 520. Research design, database management, and analysis and interpretation of natural resource data. Emphasis on hands-on experience of quantitative and computerized techniques commonly used by natural resource scientists. (Lec. 2, Lab 2) Pre: STA 308 and permission of instructor.

NRS 522: Advanced Gis Analysis Of Environmental Data
LEC: (3 crs.) Discussion and application of terrain modeling, spatial statistics, proximity analysis, remote sensing/GIS linkages, and environmental data integration. Emphasis on ecological data at watershed/landscape scales. Capstone. (Lec. 1, Lab. 6) Pre: NRS 410 or permission of instructor.

NRS 524: Application Of Advanced Spatial Analysis
PRA: (1 cr.) Independent application of spatial data analysis to derive solutions to environmental problems, with emphasis on GIS data integration, vector and raster modeling, and visualization of analytical and quantitative results. Capstone. (Practicum) Pre: concurrent enrollment in NRS 522.

NRS 525: Wetland Field Investigations
PRA: (1 cr.) Independent field study of a diverse freshwater wetland ecosystem, with emphasis on aerial photo-interpretation, wetland classification, and in-depth examination of glacial geology, hydrology, plant ecology and soils. (Practicum) Pre: concurrent enrollment in 423.
NRS 526: Microbial Ecology of Soils and Sediments
LEC: (3 crs.) Occurrence and activity of microorganisms in soils and sediments, including wetlands. Environmental physiology of microbes; habitat interactions; methods of study; importance of microbial processes to ecosystem productivity, pollutant degradation, and atmospheric chemistry. (Lec. 3) Pre: NRS 212, CMB 211, or permission of instructor.

NRS 527: Marine Protected Areas: An Interdisciplinary Analysis
LEC: (3 crs.) Cross–listed as (MAF), NRS 527. Examination of the ecological, political, social, cultural, and economics factors influencing the use of MPAs (Lec. 3) Pre: permission of instructor.

NRS 532: Conservation Biology And Resource Economics
SEM: (2 crs.) Cross–listed as (NRS), EEC 542. Examination of different components of conservation of biological diversity. Topics include minimum viable populations, ecology and economics of reserve design, reintroductions, causes of extinction, and the ecosystem conservation strategies. (Seminar) Pre: BIO 262, EEC 105 or permission of instructor.

NRS 533: Landscape Pattern And Change
LEC: (3 crs.) Remote sensing perspective of landscape characterization; landscape dynamics; spatiotemporal land–use and land–cover change; modeling and analysis of landscape by integration of remote sensing, GIS, GPS, and in situ data. (Lec. 2, Lab. 2) Pre: NRS 415 or permission of instructor.

NRS 534: Ecology of Fragmented Landscapes
LEC: (2 crs.) Presentation of the concepts of landscape ecology with emphasis on populations of plants and animals in fragmented habitats. Topics discussed include habitat corridors, fluxes of energy and species along habitat edges, shape analysis, and stability of populations in habitat patches. (Lec. 2) Pre: BIO 262 or permission of instructor. In alternate years.

NRS 535: Geospatial Watershed Modeling
LEC: (3 crs.) Cross–listed with (GEO) NRS, CVE 535. Tools to simulate the water quantity and quality of a complex watershed; development of models for examining the water quantity and quality issues that are associated with watershed management. (Lec. 2, Lab. 2) Pre: NRS 461 or GEO 483 or CVE 475 or equivalent, or graduate standing, or permission of instructor.

NRS 538: Physiological Ecology of Wild Terrestrial Vertebrates
LEC: (3 crs.) Relationships between animal physiology and the ecology and dynamics of wild vertebrate populations, including birds, mammals, reptiles, and amphibians. (Lec. 3) Pre: NRS 305 or permission of instructor.

NRS 543: Public Engagement with Science
LEC: (3 crs.) Theoretical and practical aspects of public engagement with science, policy, and management, with an emphasis on communication. (Lec. 3) Pre: Graduate Standing or permission of instructor.
NRS 545: Invasive Species Research, Management, and Policy
LEC: (4 crs.) Overview of the major invasive alien species issues in the research, management, and policy arenas. Includes weekly field/lab sessions. (Lec. 3, Lab. 3) Pre: BIO 262 or NRS 223, or permission of instructor.

NRS 555: Applied Coastal Ecology
LEC: (2 crs.) Resource management problems in coastal national parks. Topics include air and water pollution, barrier island erosion, deer overpopulation, Lyme disease, and ecosystem restoration. Examples of conflicting land–management mandates and research needs discussed. Optional field trips. (Lec. 2) Pre: advanced course work or experience in topical fields or permission of instructor. Offered in even-numbered years.

NRS 563: Biology and Ecology of Fishes
LEC: (4 crs.) Cross-listed as (BIO), NRS 563. Exploration of the functional biology and ecology of marine and freshwater fishes through lecture and discussion of primary literature. Laboratory involves specimen study, field trips, and a research project. (Lec. 3, Lab. 3) Pre: BIO 366 or equivalent, or permission of instructor.

NRS 583: Innovative Subsurface Remediation Technologies
LEC: (4 crs.) Cross-listed as (GEO), EVS 582, NRS 583. Innovative remediation technologies for treating contaminated groundwater and sediments: theory, applications, and limitations of selected methods. Discussion of case studies. Offered alternate years (Lec. 4) Pre: permission of instructor.

NRS 584: Environmental Hydrogeology
LEC: (4 crs.) Cross-listed as (GEO), EVS, NRS 584. Develop an understanding of the physico-chemical principles and fundamental relationships that describe the fate and transport of contaminants in the hydrologic system. (Lec. 3, Lab 2) Pre: GEO 483 or CVE 588 or NRS 510 or permission of instructor.

NRS 585: Salt Marsh Ecology
LEC: (4 crs.) Cross-listed as (BIO), NRS 585. Structure and function of salt marsh ecosystems, including biogeochemistry, in the context of global change. Seminar–style discussions, weekly assignments, written and oral presentations of independent proposal and research project. (Lec. 2, Lab. 4) Pre: permission of instructor. Prior undergraduate coursework equivalent to a course in ecology and 2 semesters of chemistry is expected.

OCG 513: Ocean Renewable Energy
LEC: (3 crs.) Cross-listed as (OCE), OCG 513. Introductory topics related to global ocean renewable energy, including fundamentals of hydrokinetic, tidal, and wave energy, leading energy devices, and more advanced topics including resource assessment and environmental interactions. (Lec. 3) Pre: MCE 354 or permission of instructor.

STA 520: Fundamentals of Sampling and Applications
**LEC**: (3 crs.) Simple random sampling; properties of estimates, confidence limits. Sample size. Stratified random sampling; optimum allocation, effects of errors, and quota sampling. Regression and ratio estimates; systematic and multistage sampling. (Lec. 3) Pre: STA 308 or 409.

**STA 532: Experimental Design**
**LEC**: (3 crs.) Cross–listed as (STA), PSY, AFS 532. Application of statistical methods to biological and psychological research and experimentation. Experimental situations for which various ANOVA and ANCOVA designs are most suitable. (Lec. 3) Pre: STA 409 or equivalent.

**STA 550: Ecological Statistics**
**LEC**: (3 crs.) Application of statistical methodology to the following topics: population growth, interactions of populations, sampling and modeling of ecological populations, spatial patterns, species abundance relations, and ecological diversity and measurement. (Lec. 3) Pre: STA 409 or permission of instructor.

**SUS 460: Environmental Communication: Local & Global**
**LEC**: (3 crs.) Cross–listed as (COM) SUS 460. Address local and global environmental issues through communication. Target key audiences and move them towards sustainable change and active involvement, improved environmental conditions and quality of life. (Lec. 1, Seminar 2) Pre: junior standing. (C1) (B4)