

# ENVIRONMENTAL SCIENCE & POLICY (EVR)

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## **EVR 501. Political Ecology of Marine Management. 3 Credit Hours.**

Course provides a grounding in political ecology as an important theoretical approach to resource policy and management. The social analysis of resource use, social change, and development are discussed. Models of development and concepts of nature relate to resource use and policy formation are also included. Within this framework, ethnicity, class, and the politics of conservation are explored.

**Components:** LEC.

**Grading:** GRD.

**Typically Offered:** Spring.

## **EVR 502. Economics of Natural Resources. 3 Credit Hours.**

This course provides a comprehensive overview of the economics of national, international, and global natural resource problems. A unifying theme throughout is sustainable development, defined as maximizing the net benefits of economic development while maintaining the services and quality of natural resources over time. We will use economic reasoning to examine causes and consequences of natural resource problems, and measures for dealing with them.

**Components:** LEC.

**Grading:** GRD.

**Typically Offered:** Fall.

## **EVR 504. Fieldwork in Coastal Management: Tourism, Conservation, and Development. 3 Credit Hours.**

This course will select a coastal research site and explore its physical geography, culture, legal framework and institutions, and tourist development/conservation conflicts. In addition, we will examine different methodologies for diagnosing the site's socioeconomic, governance, and environmental characteristics. Participants will meet weekly throughout the semester in Miami to discuss background readings and develop a group research field project that course participants will carry out during a Spring Break trip to the research site. Upon return to the University of Miami, the class will prepare manuscripts and presentations based on the field data that course participants have collected during the trip.

**Components:** LEC.

**Grading:** GRD.

**Typically Offered:** Spring.

## **EVR 510. Environmental Planning and the Environmental Impact Statement. 3 Credit Hours.**

Course takes a broad view of environmental planning and analysis while focusing specifically on the preparation of environmental impact statements. Statutory requirements and procedures at the federal level are examined. Judicial opinions are studied that reflect environmental disputes and controversies. The course also considers some of the substantive requirements of environmental impact analyses such as the assessment of physical and biological environment and socioeconomic impacts.

**Components:** LEC.

**Grading:** GRD.

**Typically Offered:** Spring.

## **EVR 511. The Science of Actionable Knowledge. 3 Credit Hours.**

Today perhaps more than ever, societies are calling upon science to inform solutions ensuring environmental sustainability. But what makes knowledge actionable for societies? Through this course, students will understand the relationship between environmental knowledge production and use. They will explore the different ways in which science, research, policymaking, and societies interact. For environmental topics of interest, they will generate actionable knowledge.

Enrollment Condition: Senior Standing.

**Components:** LEC.

**Grading:** GRD.

**Typically Offered:** Spring.

## **EVR 514. Underwater Site Mapping and Visualization Techniques. 3 Credit Hours.**

This course is designed to provide students the practical and scientific tools necessary for underwater data acquisition, mapping, and modeling. Critical skills such as baseline mapping, trilateration, artifact illustration, photography, and photogrammetry are practiced, and ultimately applied over the course of the semester. The in-field practicum portions of the course will take place on nearby shipwrecks within Biscayne National Park. Please note that there is a significant amount of diving to complete this course.

Prerequisite: RSM 500 or RSM 600 and Requisite: Senior Status.

**Components:** LEC.

**Grading:** GRD.

**Typically Offered:** Offered by Announcement Only.

**EVR 515. Marine Geophysical Survey and Technology. 3 Credit Hours.**

This course is designed to provide students with an introduction to geophysical survey technology and marine remote sensing tools utilized in marine survey, specifically in archaeological context. Instruction in the use of technology such as the magnetometer, gradiometer, sidescan sonar, and other tools are covered. The use of data acquisition software and the post processing of data are also key elements of this course. The bulk of the course takes place at the Broad Key Research Station over the week of spring break. In addition to the week in the field, students meet several times throughout the semester in order to prepare for the week and also draft a final group report for submission to NOAA and the State of Florida. There is a significant component of this course utilizing GIS and a RSMAS small boat. Recommended Prerequisites: Marine GIS and MOCC.

Requisite: Senior Status.

**Components:** LEC.

**Grading:** GRD.

**Typically Offered:** Offered by Announcement Only.

**EVR 516. Ocean Policy Development and Analysis. 3 Credit Hours.**

This course shall examine the principles, goals, and strategies of ocean policy, focusing on the history of sectoral-based ocean policy in the US to the emerging national ocean policy. A primary course objective will be to develop a framework for the formulation and assessment of ocean issues legislation, policy, and practices as espoused in the various US acts, and their implications on the development and conservation of the ocean environment. A secondary course objective will be to evaluate the efficacy of the ocean policy strategies, their impacts, and future directions, thereby developing a foundation (comprised of qualitative objectives and landmarks and quantitative metrics and indicators) against which successes and failures in ocean policy can be measured.

**Components:** LEC.

**Grading:** GRD.

**Typically Offered:** Fall.

**EVR 518. Coastal Zone Management. 3 Credit Hours.**

Development of a framework for formulation and assessment of coastal zone policy. Analysis of issues and conflicts in coastal zone management (CZM), such as: zoning and planning, coastal and beach protection, ecosystem protection, the federal flood insurance program, adaptations to sea level rise, coastal pollution from land-based sources, and tourism impacts.

**Components:** LEC.

**Grading:** GRD.

**Typically Offered:** Spring.

**EVR 520. Environmental Law and Policy. 3 Credit Hours.**

This course will provide an overview of environmental law and its practical applications at the federal, state, and local level. The course will also include an introduction to the United States legal system, the administrative state, environmental regulations, and current issues in environmental law and policy. Finally, the course will focus on environmental themes that are of particular importance to marine professionals, such as marine mammal protection, marine protected areas, coastal wetland regulation, water pollution litigation, and environmental justice.

Enrollment Condition: Senior Standing.

**Components:** LEC.

**Grading:** GRD.

**Typically Offered:** Fall.

**EVR 521. Water Resources in China and Vietnam: Science and Policy. 3 Credit Hours.**

The course examines Water Resources from broad perspectives (water quality and quantity, ground water, international river management, watershed management, coastal issues). Additionally, it compares management strategies and problems in three countries: China, Vietnam, and the USA. The course is also highly interdisciplinary - combining natural science, policy, and the social sciences. We spend half of the time in Vietnam and the other half in China, and in both countries have long-term established cooperation with three universities: Hanoi University of Mining and Geology (HUMG), Hanoi University of Natural Resources and the Environment (HUNRE), and Yunnan University, Asian International Rivers Centre (AIRC). In both countries, we arrange lectures and discussions with local students at these universities for one week. The other week is dedicated to field work and travel.

**Components:** LEC.

**Grading:** GRD.

**Typically Offered:** Offered by Announcement Only.

**EVR 525. Fisheries Socioeconomics and Management. 3 Credit Hours.**

The course covers both conceptual and practical aspects dealing with the management of commercial and recreational fisheries. The first part of the course offers an introduction to micro-economic principles, focusing on efficient resource allocation. Building on these principles, we develop bio-economic models to illustrate the interactions between the resource, harvesting sector and environment. We also review the theory and practice of unregulated open access, limited entry and rights-based management. Last, we study the economics of the recreational sector and explore a number of contemporary fishery management challenges.

**Components:** LEC.

**Grading:** GRD.

**Typically Offered:** Fall.

**EVR 526. Submerged Cultural Resource Management. 3 Credit Hours.**

This course discusses various aspects and details of managing underwater cultural heritage/submerged cultural resources. Topics will include ethics, policies and procedures, marine protected areas, and federal, state, and international laws governing management of submerged archaeological sites. Specific focus is placed on examining the variety of management concepts and frameworks utilized both in the U.S. and internationally. Finally, the role and value of public archaeology in management is also presented and discussed.

**Components:** LEC.

**Grading:** GRD.

**Typically Offered:** Offered by Announcement Only.

**EVR 527. Exploration Science Field Studies. 3 Credit Hours.**

This course will focus on exploring the coastal and marine environments of South Florida. The field component will take place on select weekends throughout the semester. Attendance is mandatory. Students will be tasked with observing, documenting, and communicating discovery, which are the hallmarks of exploration. Coral reefs, seagrass beds, mangroves will be explored and there will be opportunities to use ROVs. Students submit one short research paper, an annotated bibliography, and an expedition report. The classroom component is virtual and meets throughout the semester. The field portion is on the Field School's R/V Garvin via day trips out of Miami, Florida.

Senior Standing.

**Components:** LEC.

**Grading:** GRD.

**Typically Offered:** Spring.

**EVR 529. Biology, Ecology, and Management of Mangrove Ecosystems. 3 Credit Hours.**

This course is intended to introduce students to mangrove ecosystems, one of the most productive, and biologically diverse, ecosystems in the world, and one of South Florida's key coastal ecosystems. The principal objective is to explain how our scientific understanding of mangrove ecosystems has been unfolding and how today they are considered paramount not only for their organic carbon contributions to coastal areas, but as protectors of the coast, mitigators of global climate change, reservoirs of biodiversity, and supporters of the livelihoods of millions of inhabitants throughout the world. The course will consist of lectures, class discussions, and presentations of student assignments. The lectures will follow an open seminar format in which all students are expected to actively participate in the discussion of the presented material. Two lectures will take place during field trips to local mangrove areas.

**Components:** LEC.

**Grading:** GRD.

**Typically Offered:** Spring.

**EVR 530. Port Operations and Policy. 3 Credit Hours.**

The course will include: Introduction to ports; port geography; port operations; port administration; Federal port policy; free ports/free zones; port investment/tariffs; port marketing; Coastal Zone Management and ports; case studies, CZM; fostering economic development; and Port planning and development.

**Components:** LEC.

**Grading:** GRD.

**Typically Offered:** Offered by Announcement Only.

**EVR 531. Marine and Coastal Protected Area Theory, Planning, Management, and Issues. 3 Credit Hours.**

This course shall present the study and analysis of marine and coastal protected areas in an interdisciplinary manner, commencing with an overview of conservation biology and protected area principles (ex. island biogeography), a survey of coastal and marine protected area (MPA) theory, ranging from MPA size, population and spillover benefits, and biodiversity protection potential, and the influence of ecological parameters on MPA design (including the maintenance of biodiversity, spillover, and connectivity). Another critical component of the course will be a historical review on MPAs and MPA management, how the concept developed and proliferated, and its present status. Included as part of this discussion will be an overview on the typology and diversity of MPAs, comparing a variety of inter-governmental organization (IUCN, UNCLOS, UNEP, etc.) and national institution (ex. US National MPA Center) frameworks, demonstrating the variety in uses and restrictions and critically evaluating the overall and regional success of MPAs. The course will next address human dimensions and socioeconomic impacts of MPAs, including the economic performance and financing mechanisms of MPAs, stakeholder engagement, participation, and conflicts, and management approaches. Finally, the course will review a series of MPA case studies, which incorporate the aforementioned topics in a 'real world' environment and demonstrate how the concept has been applied across the world.

**Components:** LEC.

**Grading:** GRD.

**Typically Offered:** Spring.

**EVR 532. Theory and Method in Underwater and Maritime Archaeology. 3 Credit Hours.**

This course covers archaeological theory and methodologies used to interpret underwater and maritime sites in both prehistoric and historic contexts. The interconnection of theoretical constructs with submerged archaeological remains is emphasized, providing a broad toolset that can be used to better understand and explain the archaeological assemblage and associated data sets acquired from the investigation of these sites.

**Components:** LEC.

**Grading:** GRD.

**Typically Offered:** Fall.

**EVR 533. Decision Analysis: Natural Hazards and Catastrophes. 3 Credit Hours.**

This course addresses the behavioral factors (cognitive biases, heuristics, risk perception, social influences, and past experiences) that together help explain why people tend to underprepare for potential natural and man-made disasters. Implications for science communication and public policy are emphasized.

**Components:** LEC.

**Grading:** GRD.

**Typically Offered:** Fall.

**EVR 534. Shark Behavioral Ecology and Conservation. 3 Credit Hours.**

Within a semester, students will learn core concepts in shark behavioral ecology and key aspects of shark biology needed for the holistic understanding and study of shark behavioral ecology and conservation, including shark sensory, reproductive, physiological, movement and foraging ecology. These concepts will be used to link shark behavioral ecology to its consequences for conservation and management. Students will also be given the unique opportunity to interact with and be trained in advanced technologies used to study shark behavioral ecology, such as biotelemetry (acoustic and satellite tags). Through demonstrations and in-class exercises, students work with real shark biotelemetry data and be taught basic spatial analyses of shark satellite tracking data, such as home range analysis. Students will also participate on a shark research trip out of Miami with UM's Shark Research and Conservation Program, where they will be shown shark research survey, sampling and tagging techniques as well as gain hands-on experience participating in ongoing research.

Pre or Corequisite: MSC 460 or EVR 560 or EVR 660 and Requisite: Senior Status.

**Components:** LEC.

**Grading:** GRD.

**Typically Offered:** Spring.

**EVR 535. Oceans of Thought: Exploring Marine and Environmental Literature. 3 Credit Hours.**

Making connections across disciplines is important in understanding our complex and connected world. This course exposes students to a wide body of multi-disciplinary marine and environmental literature to link together complex ideas for creative and critical thinking. The emphasis is on understanding these works and expressing this through writing and discussion. Topics include climate change, conservation, natural history, exploration, and research. Students will read a work or group of works every 2 weeks and write a response paper every 2 weeks. A final summary paper synthesizing opinions will conclude the class. This course has a significant reading and writing requirement.

Senior Standing.

**Components:** LEC.

**Grading:** GRD.

**Typically Offered:** Fall.

**EVR 536. Economics and Politics of the Environment. 3 Credit Hours.**

The objective of the class is to discuss the main economic and political concepts associated with environmental policy in the US and elsewhere. In particular, the class focuses on how economic thinking, methods, and data relate to conservation, environmental, and natural resource policy and management problems. The class will draw on marine, terrestrial, climate, weather, and other inter-dependent domains to illustrate similarities and differences from an economic and political perspective. Students interested in enrolling in this class should have a basic background in economics. Enrollment Condition: Senior Standing.

**Components:** LEC.

**Grading:** GRD.

**Typically Offered:** Spring.

**EVR 540. Power, Propaganda, & Accountability: The Past, Present, and Future of Climate Change Obstructionism. 3 Credit Hours.**

Climate scientists are unanimous that climate change is real, human-caused, serious, and solvable. So why have the public and policymakers taken so long to catch up, at what cost, and can anything be done about it? This first-of-its-kind course will address these questions by unraveling the 60-year history of climate denial, propaganda, and lobbying by fossil fuel interests, political ideologues, and the PR firms that enable them. Students will be introduced to seminal literatures of history of science, communication science, sociology, and beyond, as well as to cutting-edge data-driven research and journalism that is peeling back history and precipitating Congressional investigations, lawsuits, and grassroots activism. From Big Oil's early climate knowledge in the 1950s, to their Big Tobacco-style climate disinformation campaigns in the 1990s, to their greenwashing on social media today, students will be challenged to reevaluate their conceptions of how our understanding of climate change has been constructed and confused. Guest speakers will include some of the world's leading scholars, journalists, lawyers, and activists who are pioneering efforts to confront past and present climate propaganda.

Requisite: Senior Standing.

**Components:** LEC.

**Grading:** GRD.

**Typically Offered:** Fall.

**EVR 541. Wild Animal Welfare & Marine Conservation. 3 Credit Hours.**

What happens when we no longer allow commercial whaling, but anthropogenic change continues to impact the daily lives and mortality of whales? How many individual animals are affected by aquaculture? Do sharks prefer no-take protected areas or no-entry areas? Can acoustic enrichment help restore degraded coral reefs? Conservation science and policy typically aims to conserve species or populations to prevent biodiversity loss. What if conservation efforts took seriously the direct and indirect effects of human activity, including conservation research, on individual animals? What if we also considered animal agency, behaviors, and preferences when designing conservation policies? This novel approach will be the focus of this class – the first of its kind. We will analyze marine conservation science and policy, with a particular emphasis on individual animals, which may have promise for thinking about conservation and protection differently. We will review recent peer-reviewed about anthropogenic impacts (e.g., overexploitation, pollution, invasive species, and climate change), proposed and tested marine conservation measures, the concept of compassionate conservation, what welfare means in the wild, as well as popular articles, to familiarize ourselves with the latest research and debates.

Requisite: Senior Standing.

**Components:** LEC.

**Grading:** GRD.

**Typically Offered:** Fall.

**EVR 542. Ocean Justice. 3 Credit Hours.**

This course explores an emerging field of environmental justice research and activism in marine and coastal environments. Students will learn about the different ways to conceptualize ocean justice, and they will develop practical communication, analytical, and problem-solving skills for incorporating justice into ocean conservation, governance, development, and science. The course bridges theory and practice by training students to identify ocean (in)justice, evaluate potential solutions, and effect change.

Requisite: Senior Standing.

**Components:** LEC.

**Grading:** GRD.

**Typically Offered:** Fall.

**EVR 560. Introduction to Marine Geographic Information Systems. 3 Credit Hours.**

This class introduces students to the fundamental principles and concepts in using Geographic Information Systems (GIS) for marine science and marine resource management applications. The class section will cover lectures and discussions. The lab section will entail hands on computer-based GIS exercises on marine related issues. Students will learn how to use ArcGIS Pro and ArcGIS Online, and create simple GIS models primarily using vector data. Students will also learn how to create Web Applications using ArcGIS Online.

Co-requisite: EVR 561.

**Components:** LEC.

**Grading:** GRD.

**Typically Offered:** Fall & Spring.

**EVR 561. Introduction to Marine Geographic Information Systems - Laboratory. 0 Credit Hours.**

This class introduces students to the fundamental principles and concepts in using Geographic Information Systems (GIS) for marine science and marine resource management applications. The class section will cover lectures and discussions. The lab section will entail hands on computer-based GIS exercises on marine related issues. Students will learn how to use ArcGIS Pro and ArcGIS Online, and create simple GIS models primarily using vector data. Students will also learn how to create Web Applications using ArcGIS Online.

Co-requisite: EVR 560.

**Components:** LAB.

**Grading:** SUS.

**Typically Offered:** Fall & Spring.

**EVR 562. Intermediate Spatial Analysis. 3 Credit Hours.**

This is an advanced GIS course and is intended for students who have taken an introductory course in GIS. The course will consist of spatial analysis and geostatistics, introductory concepts in remote sensing introduction to ArcPy. Additionally, we will be using modules or scripts for more GIS functionality. The course will have a lecture part and laboratory part to advance the student's knowledge in spatial analysis. Students will also be assigned journal readings showing practical applications of raster data modeling. The students will use ArcGIS Pro and with several extensions to complete the lab exercises and the required GIS project.

Requisite: Senior Status. Prerequisite: EVR 660 and EVR 661.

**Components:** LEC.

**Grading:** GRD.

**Typically Offered:** Spring.

**EVR 564. Citizen and Participatory Science. 3 Credit Hours.**

The Citizen and Participatory Science course will focus on preparing students for designing and implementing citizen and participatory science projects aimed at addressing questions and problems around specific environmental issues. As social networks grow, open data comes online and mobile technologies proliferate and advance, the opportunity to tap into eager and interested citizens to collect data for research and documentation purposes is quickly rising. This program will look at history of citizen science, which is over 100 years old, and will analyze current and past projects. Students will be exposed to how citizen science projects are designed and implemented and how they can be best leveraged to gain useful data for research. Guest lecturers will be invited for virtual and in-person presentations. A key component of the course will be for students to design a citizen science project using best practices. These projects can provide the baseline for launching real projects with organizations interested in applying citizen science to their work. The course will look at both technology driven projects as well as low-tech projects to expose students to the range of work being done in this rapidly evolving area.

**Components:** LEC.

**Grading:** GRD.

**Typically Offered:** Fall.

**EVR 565. Science and Natural History Media Production. 3 Credit Hours.**

The emphasis of this course is on documentary video production using a variety of technologies and methods. As video becomes increasingly used in communication, this course will provide an overview of the production process (pre-production, production, post-production) for those with backgrounds in science, education, and outreach. A variety of films will be reviewed and the process of science storytelling will be examined. In addition, the course will touch on mobile, mapping, imaging, ROV and UAV (drone) technologies as they relate to media production.

Senior Standing.

**Components:** LEC.

**Grading:** GRD.

**Typically Offered:** Spring.

**EVR 570. Conservation and Management of Marine Mammals. 3 Credit Hours.**

This course explores current and pressing threats to large marine vertebrates, particularly mammals, and the relative legislation in place to protect them. Additionally, we will explore the methods and tools used to assess, manage, and conserve marine mammal populations, including case studies that exemplify both successes and failures. Discussions will include anthropogenic impacts, the Marine Mammal Protection Act/IWC/ESA/Florida Manatee Sanctuary Act/IUCN, a stock as a management unit, OSP/PBR, mark-recapture and other methodologies integral to wild population management, marine mammal strandings response, and the ethics of human intervention as it relates to the management of marine ecosystems as a whole. Emphasis will also be placed on the acquisition of relevant skill sets, such as communication of conservation messages using social media, advocacy with integrity, grant writing, and stranding and rehabilitation procedures and certifications.

**Components:** LEC.

**Grading:** GRD.

**Typically Offered:** Fall.

**EVR 571. Marine Conservation Biology. 4 Credit Hours.**

This course introduces students to critical concepts in Marine Conservation, exploring aspects of the biology and ecology of marine organisms and ecosystems and how they impact human management of marine resources. Through a combination of lectures, primary literature discussions, case studies, and debates, students will learn how science informs conservation and management and understand the strategies and tools available to managers. By the end of the course, students should have a good understanding of the following: ecological principles, basics of marine species, threats to biodiversity, fisheries effects on species, habitats, and ecosystems, place-based management (MPAs, marine reserves, etc.), and human dimensions (culture, economics, and competing interests).

Requisite: Senior Standing.

**Components:** LEC.

**Grading:** GRD.

**Typically Offered:** Fall.

**EVR 572. The Archaeology of Seafaring. 3 Credit Hours.**

Ships and seafarers have had considerable influences on civilization throughout history. The ship typically represents the pinnacle of a society's understanding of many disciplines: astronomy, geography, metallurgy, physics, warfare, et cetera. No other process similarly spread the delights and devastation of the world so effectively. This course studies man's evolutionary relationship with the sea from early civilization through the 20th century. Emphasis will be on archaeological and ethnographical investigations concerning shipwrecks and maritime epicenters supporting maritime culture. This will be a lecture course supported by visual, audible, and hands-on presentations.

**Components:** LEC.

**Grading:** GRD.

**Typically Offered:** Spring.

**EVR 573. Marine Conservation Outreach. 3 Credit Hours.**

This course explores concepts, theories and practices to design and evaluate conservation outreach projects and programs. Techniques for developing conservation outreach projects are examined through case study analysis and issue paper development. In addition, students build their understanding of conservation outreach planning, implementation, and evaluation while designing real-world project proposals. When possible, an optional field trip component exposes students to see first-hand the challenges and opportunities related to marine conservation outreach.

**Components:** LEC.

**Grading:** GRD.

**Typically Offered:** Spring.

**EVR 574. Theoretical & Practical Issues in Exploration Science. 3 Credit Hours.**

This course will address changes in motivation and approaches to exploration with a focus on risk perception, physiological concerns, and socio-cultural context, including how the past colonial legacy is still influencing the current generation of scientists, explorers, and the groups they interact with. Major components of the course will include discussions of ethical considerations, logistics planning, budgeting, proposal development, practical skills, role of the media, and critical analysis of historical and current exploration events along various dimensions covered in the class. Depending on the interest of the cohort of students, the class may include a final field component project.

Enrollment Condition: Senior Standing.

**Components:** LEC.

**Grading:** GRD.

**Typically Offered:** Fall.

**EVR 577. Management and Conservation of Marine Ecosystems. 3 Credit Hours.**

In this course students will learn how marine ecosystem management operates to achieve its objectives of sustainable use, optimization and allocation of resources. The primary focus is on how fisheries interactions with marine ecosystems are monitored, assessed and regulated. It examines how fisheries management achieves its objectives through different operational strategies. As the ecosystem-based approach to fisheries management requires seeing fisheries as integrated systems within the broader ecosystem, the course puts management in the context of impacts of all human activities not just fisheries. Particular attention is given to management of habitats, harvested and protected species. Impacts of marine transport, tourism, and mineral extraction are also considered albeit in less detail. The course includes individual chapter introductions to all components of ecosystem management and policy including, ecological sustainability, governance, social, economics and legal aspects.

**Components:** LEC.

**Grading:** GRD.

**Typically Offered:** Spring.

**EVR 581. Special Topics. 1-3 Credit Hours.**

Lectures, research projects, or directed readings in special topics related to Environmental Science and Policy.

**Components:** LEC.

**Grading:** GRD.

**Typically Offered:** Fall, Spring, & Summer.

**EVR 582. Special Topics. 1-3 Credit Hours.**

Lectures, research projects, or directed readings in special topics related to Environmental Science and Policy.

**Components:** LEC.

**Grading:** GRD.

**Typically Offered:** Fall, Spring, & Summer.

**EVR 583. Special Topics. 1-3 Credit Hours.**

Lectures, research projects, or directed readings in special topics related to Environmental Science and Policy.

**Components:** LEC.

**Grading:** GRD.

**Typically Offered:** Fall, Spring, & Summer.

**EVR 591. Maritime Archaeology Field Study. 3 Credit Hours.**

This field-based course focuses on the acquisition of data from shipwreck sites and subsequent interpretation and analysis. Topics of study include shipwrecks from the 16th century to World War II era. Students will learn about historic maritime activity and be exposed to analyzing both the archaeological and historical record in examination of these sites. This course will be taught in collaboration with partners at the National Park Service and/or NOAA, and dives will take place in Biscayne National Park, Dry Tortugas National Park, or the Florida Keys National Marine Sanctuary. Students must be approved UM divers to take this course.

**Components:** FLD.

**Grading:** GRD.

**Typically Offered:** Summer.

**EVR 592. Archaeological Study of Submerged Pre-Contact Sites. 3 Credit Hours.**

This is a field-based course with a focus on submerged pre-contact or prehistoric archaeological sites within North America, Latin America, and the Caribbean. Students will learn about the past human activity, settlement patterns, and habitation of various regions and sites, while conducting fieldwork. Focus will be placed on topics such as the peopling of the Americas over 13,500 years ago, human adaptation to environmental change, and the location and investigation of now-inundated coastal sites and submerged caverns and caves. Techniques and methods of data acquisition relevant to these site types will be taught, and students will receive hands-on experience in specific methodologies. Students must be approved UM divers to take this course.

**Components:** FLD.

**Grading:** GRD.

**Typically Offered:** Summer.

**EVR 593. Maritime Archaeology and the Conquest of Mexico. 3 Credit Hours.**

This course will allow students to experience firsthand the archaeological and historical sites associated with the conquest of Mexico and to participate in archaeological fieldwork investigating maritime archaeological sites associated with this seminal historic event. Site-based learning experiences will include world-renowned museums and very significant archaeological sites, both prehistoric and historic, which will provide perspective on cultural transition and conflict over time within the prehistoric societies in Mesoamerica and the eventual collision of cultures and civilizations at the height of the Aztec empire and the advent of Spanish colonialism. The fieldwork portion of the course will take place in the town of Villa Rica de la Vera Cruz and will be conducted from a borderlands/landscape lens, incorporating both terrestrial and underwater efforts. Students will participate in the archaeological study of and search for ships scuttled by Hernán Cortés in 1519 and 1520.

Prerequisite: RSM 500 or RSM 600.

**Components:** FLD.

**Grading:** GRD.

**Typically Offered:** Summer.

**EVR 601. Political Ecology of Marine Management. 3 Credit Hours.**

Course provides a grounding in political ecology as an important theoretical approach to resource policy and management. The social analysis of resource use, social change, and development are discussed. Models of development and concepts of nature relate to resource use and policy formation are also included. Within this framework, ethnicity, class, and the politics of conservation are explored.

**Components:** LEC.

**Grading:** GRD.

**Typically Offered:** Spring.

**EVR 602. Economics of Natural Resources. 3 Credit Hours.**

This course provides a comprehensive overview of the economics of national, international, and global natural resource problems. A unifying theme throughout is sustainable development, defined as "maximizing the net benefits of economic development while maintaining the services and quality of natural resources over time". We will use economic reasoning to examine causes and consequences of natural resource problems, and measures for dealing with them.

**Components:** LEC.

**Grading:** GRD.

**Typically Offered:** Fall.

**EVR 603. Interdisciplinary Environmental Research: Introduction to the Why and the How. 3 Credit Hours.**

The why and the how of developing and implementing interdisciplinary environmental research; research objectives and design choices informed by philosophies of knowledge and policy relevance. Assignments include development of research questions, a preliminary literature review, a draft research proposal (e.g., for thesis or dissertation), and oral communication of research. Course is structured around peer critique and discussion of work in progress.

**Components:** LEC.

**Grading:** GRD.

**Typically Offered:** Fall.

**EVR 604. Fieldwork in Coastal Management: Tourism, Conservation, and Development. 3 Credit Hours.**

This course will select a coastal research site and explore its physical geography, culture, legal framework and institutions, and tourist development/conservation conflicts. In addition, we will examine different methodologies for diagnosing the site's socioeconomic, governance, and environmental characteristics. Participants will meet weekly throughout the semester in Miami to discuss background readings and develop a group research field project that course participants will carry out during a Spring Break trip to the research site. Upon return to the University of Miami, the class will prepare manuscripts and presentations based on the field data that course participants have collected during the trip.

**Components:** LEC.

**Grading:** GRD.

**Typically Offered:** Spring.



**EVR 610. Environmental Planning and the Environmental Impact Statement. 3 Credit Hours.**

Course takes a broad view of environmental planning and analysis while focusing specifically on the preparation of environmental impact statements. Statutory requirements and procedures at the federal level are examined. Judicial opinions are studied that reflect environmental disputes and controversies. The course also considers some of the substantive requirements of environmental impact analyses such as the assessment of physical and biological environment and socioeconomic impacts.

**Components:** LEC.

**Grading:** GRD.

**Typically Offered:** Spring.

**EVR 611. The Science of Actionable Knowledge. 3 Credit Hours.**

Today perhaps more than ever, societies are calling upon science to inform solutions ensuring environmental sustainability. But what makes knowledge actionable for societies? Through this course, students will understand the relationship between environmental knowledge production and use. They will explore the different ways in which science, research, policymaking, and societies interact. For environmental topics of interest, they will generate actionable knowledge.

**Components:** LEC.

**Grading:** GRD.

**Typically Offered:** Spring.

**EVR 614. Underwater Site Mapping and Visualization Techniques. 3 Credit Hours.**

This course is designed to provide students the practical and scientific tools necessary for underwater data acquisition, mapping, and modeling. Critical skills such as baseline mapping, trilateration, artifact illustration, photography, and photogrammetry are practiced, and ultimately applied over the course of the semester. The in-field practicum portions of the course will take place on nearby shipwrecks within Biscayne National Park. Please note that there is a significant amount of diving to complete this course.

Prerequisite: RSM 500 or RSM 600.

**Components:** LEC.

**Grading:** GRD.

**Typically Offered:** Spring.

**EVR 615. Marine Geophysical Survey and Technology. 3 Credit Hours.**

This course is designed to provide students with an introduction to geophysical survey technology and marine remote sensing tools utilized in marine survey, specifically in archaeological context. Instruction in the use of technology such as the magnetometer, gradiometer, sidescan sonar, and other tools are covered. The use of data acquisition software and the post processing of data are also key elements of this course. The bulk of the course takes place at the Broad Key Research Station over the week of spring break. In addition to the week in the field, students meet several times throughout the semester in order to prepare for the week and also draft a final group report for submission to NOAA and the State of Florida. There is a significant component of this course utilizing GIS and a RSMAS small boat. Recommended Prerequisites: Marine GIS and MOCC.

**Components:** LEC.

**Grading:** GRD.

**Typically Offered:** Spring.

**EVR 616. Ocean Policy. 3 Credit Hours.**

This course shall examine the principles, goals, and strategies of ocean policy, focusing on the history of sectoral-based ocean policy in the US to the emerging national ocean policy. A primary course objective will be to develop a framework for the formulation and assessment of ocean issues legislation, policy, and practices as espoused in the various US acts, and their implications on the development and conservation of the ocean environment. A secondary course objective will be to evaluate the efficacy of the ocean policy strategies, their impacts, and future directions, thereby developing a foundation (comprised of qualitative objectives and landmarks and quantitative metrics and indicators) against which successes and failures in ocean policy can be measured.

**Components:** LEC.

**Grading:** GRD.

**Typically Offered:** Fall.

**EVR 618. Coastal Zone Management. 3 Credit Hours.**

Development of a framework for formulation and assessment of coastal zone policy. Analysis of issues and conflicts in coastal zone management (CZM), such as: zoning and planning, coastal and beach protection, ecosystem protection, the federal flood insurance program, adaptations to sea level rise, coastal pollution from land-based sources, and tourism impacts.

**Components:** LEC.

**Grading:** GRD.

**Typically Offered:** Spring.

**EVR 620. Environmental Law and Policy. 3 Credit Hours.**

This course will provide an overview of environmental law and its practical applications at the federal, state, and local level. The course will also include an introduction to the United States legal system, the administrative state, environmental regulations, and current issues in environmental law and policy. Finally, the course will focus on environmental themes that are of particular importance to marine professionals, such as marine mammal protection, marine protected areas, coastal wetland regulation, water pollution litigation, and environmental justice.

**Components:** LEC.

**Grading:** GRD.

**Typically Offered:** Fall.

**EVR 621. Water Resources in China and Vietnam: Science and Policy. 3 Credit Hours.**

The course examines Water Resources from broad perspectives (water quality and quantity, ground water, international river management, watershed management, coastal issues). Additionally, it compares management strategies and problems in three countries: China, Vietnam, and the USA. The course is also highly interdisciplinary - combining natural science, policy, and the social sciences. We spend half of the time in Vietnam and the other half in China, and in both countries have long-term established cooperation with three universities: Hanoi University of Mining and Geology (HUMG), Hanoi University of Natural Resources and the Environment (HUNRE) and Yunnan University, Asian International Rivers Centre (AIRC). In both countries, we arrange lectures and discussions with local students at these universities for one week. The other week is dedicated to field work and travel.

**Components:** LEC.

**Grading:** GRD.

**Typically Offered:** Offered by Announcement Only.

**EVR 622. Principles and Practices of Marine Social Science Research. 3 Credit Hours.**

This course will introduce students to the theory of marine social science methods, focusing on how the methods relate to the design, planning, implementation, analysis, and reporting of marine social science research. The course will be divided into three sections: theory, design, and planning; statistical analysis; and spatial data construction and analysis.

**Components:** LEC.

**Grading:** GRD.

**Typically Offered:** Fall.

**EVR 623. Applied Environmental Economics. 3 Credit Hours.**

The objective of this course is to familiarize students with economic decision-making arguments and methods applied to environmental problems, such as environmental quality, natural resource management, and conservation. The course will cover theory, application, and computer programming, but the emphasis will be set on developing synthesis and communication skills to inform policy making. The class is intended for graduate students seeking to develop intuition and the skills necessary in environmental policy-making.

Prerequisite: EVR 624 Or RSM 612.

**Components:** LEC.

**Grading:** GRD.

**Typically Offered:** Spring.

**EVR 624. Statistics and Data Analysis for Environmental Science and Policy. 3 Credit Hours.**

The objective of this class is to provide students with applied skills that will allow them to understand, discuss, and perform general quantitative analyses related to environmental science and policy. The course will cover required statistical background and methods, as well as an introduction to advanced topics and challenges in population and causal inference. Students will also be trained on how to use computing programming tools to manipulate data and perform analyses. The class is intended for graduate students seeking to learn the foundation of modern methods and techniques for quantitative analysis of environmental problems, as well as their application in science and policy making. Students should have a background in undergraduate statistics and algebra or permission of the instructor.

**Components:** LEC.

**Grading:** GRD.

**Typically Offered:** Fall.

**EVR 625. Fisheries Socioeconomics and Management. 3 Credit Hours.**

The course covers both conceptual and practical aspects dealing with the management of commercial and recreational fisheries. The first part of the course offers an introduction to micro-economic principles, focusing on efficient resource allocation. Building on these principles, we develop bio-economic models to illustrate the interactions between the resource, harvesting sector and environment. We also review the theory and practice of unregulated open access, limited entry and rights-based management. Last, we study the economics of the recreational sector and explore a number of contemporary fishery management challenges.

**Components:** LEC.

**Grading:** GRD.

**Typically Offered:** Fall.

**EVR 626. Submerged Cultural Resource Management. 3 Credit Hours.**

This course discusses various aspects and details of managing underwater cultural heritage/submerged cultural resources. Topics will include ethics, policies and procedures, marine protected areas, and federal, state, and international laws governing management of submerged archaeological sites. Specific focus is placed on examining the variety of management concepts and frameworks utilized both in the U.S. and internationally. Finally, the role and value of public archaeology in management is also presented and discussed.

**Components:** LEC.

**Grading:** GRD.

**Typically Offered:** Fall.

**EVR 627. Exploration Science Field Studies. 3 Credit Hours.**

This course will focus on exploring the coastal and marine environments of South Florida. The field component will take place on select weekends throughout the semester. Attendance is mandatory. Students will be tasked with observing, documenting, and communicating discovery, which are the hallmarks of exploration. Coral reefs, seagrass beds, mangroves will be explored and there will be opportunities to use ROVs. Students submit one short research paper, an annotated bibliography, and an expedition report. The classroom component is virtual and meets throughout the semester. The field portion is on the Field School's R/V Garvin via day trips out of Miami, Florida.

**Components:** LEC.

**Grading:** GRD.

**Typically Offered:** Spring.

**EVR 629. Biology, Ecology, and Management of Mangrove Ecosystems. 3 Credit Hours.**

This course is intended to introduce students to mangrove ecosystems, one of the most productive, and biologically diverse, ecosystems in the world, and one of South Florida's key coastal ecosystems. The principal objective is to explain how our scientific understanding of mangrove ecosystems has been unfolding and how today they are considered paramount not only for their organic carbon contributions to coastal areas, but as protectors of the coast, mitigators of global climate change, reservoirs of biodiversity, and supporters of the livelihoods of millions of inhabitants throughout the world. The course will consist of lectures, class discussions, and presentations of student assignments. The lectures will follow an open seminar format in which all students are expected to actively participate in the discussion of the presented material. Two lectures will take place during field trips to local mangrove areas.

**Components:** LEC.

**Grading:** GRD.

**Typically Offered:** Spring.

**EVR 630. Port Operations and Policy. 3 Credit Hours.**

The course will include: Introduction to ports; port geography; port operations; port administration; Federal port policy; free ports/free zones; port investment/tariffs; port marketing; Coastal Zone Management and ports; case studies, CZM; fostering economic development; and Port planning and development.

**Components:** LEC.

**Grading:** GRD.

**Typically Offered:** Offered by Announcement Only.

**EVR 631. Marine and Coastal Protected Area Theory, Planning, Management, and Issues. 3 Credit Hours.**

This course shall present the study and analysis of marine and coastal protected areas in an interdisciplinary manner, commencing with an overview of conservation biology and protected area principles (ex. island biogeography), a survey of coastal and marine protected area (MPA) theory, and the influence of ecological parameters on MPA design. Another critical component of the course will be a historical review on MPAs and MPA management, how the concept developed and proliferated, and its present status. The course will next address the human dimensions and socioeconomic impacts of MPAs, including the economic performance and financing mechanisms of MPAs, stakeholder engagement, participation, and conflicts, and management approaches. Finally, the course will review a series of MPA case studies, which incorporate the aforementioned topics in a 'real world' environment and demonstrate how the concept has been applied across the world.

**Components:** LEC.

**Grading:** GRD.

**Typically Offered:** Spring.

**EVR 632. Theory and Method in Underwater and Maritime Archaeology. 3 Credit Hours.**

This course covers archaeological theory and methodologies used to interpret underwater and maritime sites in both prehistoric and historic contexts. The interconnection of theoretical constructs with submerged archaeological remains is emphasized, providing a broad toolset that can be used to better understand and explain the archaeological assemblage and associated data sets acquired from the investigation of these sites.

**Components:** LEC.

**Grading:** GRD.

**Typically Offered:** Fall.

**EVR 633. Decision Analysis: Natural Hazards and Catastrophes. 3 Credit Hours.**

This course addresses the behavioral factors (cognitive biases, heuristics, risk perception, social influences, and past experiences) that together help explain why people tend to underprepare for potential natural and man-made disasters. Implications for science communication and public policy are emphasized.

**Components:** LEC.

**Grading:** GRD.

**Typically Offered:** Fall.

**EVR 634. Shark Behavioral Ecology and Conservation. 3 Credit Hours.**

Within a semester, students will learn core concepts in shark behavioral ecology and key aspects of shark biology needed for the holistic understanding and study of shark behavioral ecology and conservation, including shark sensory, reproductive, physiological, movement and foraging ecology. These concepts will be used to link shark behavioral ecology to its consequences for conservation and management. Students will also be given the unique opportunity to interact with and be trained in advanced technologies used to study shark behavioral ecology, such as biotelemetry (acoustic and satellite tags). Through demonstrations and in-class exercises, students work with real shark biotelemetry data and be taught basic spatial analyses of shark satellite tracking data, such as home range analysis. Students will also participate on a shark research trip out of Miami with UM's Shark Research and Conservation Program, where they will be shown shark research survey, sampling and tagging techniques as well as gain hands-on experience participating in ongoing research.

Pre or Corequisite: MSC 460 or EVR 560 or EVR 660.

**Components:** LEC.

**Grading:** GRD.

**Typically Offered:** Spring.

**EVR 635. Oceans of Thought: Exploring Marine and Environmental Literature. 3 Credit Hours.**

Making connections across disciplines is important in understanding our complex and connected world. This course exposes students to a wide body of multi-disciplinary marine and environmental literature to link together complex ideas for creative and critical thinking. The emphasis is on understanding these works and expressing this through writing and discussion. Topics include climate change, conservation, natural history, exploration, and research. Students will read a work or group of works every 2 weeks and write a response paper every 2 weeks. A final summary paper synthesizing opinions will conclude the class. This course has a significant reading and writing requirement.

**Components:** LEC.

**Grading:** GRD.

**Typically Offered:** Fall.

**EVR 636. Economics and Politics of the Environment. 3 Credit Hours.**

The objective of the class is to discuss the main economic and political concepts associated with environmental policy in the US and elsewhere. In particular, the class focuses on how economic thinking, methods, and data relate to conservation, environmental, and natural resource policy and management problems. The class will draw on marine, terrestrial, climate, weather, and other inter-dependent domains to illustrate similarities and differences from an economic and political perspective. Students interested in enrolling in this class should have a basic background in economics.

**Components:** LEC.

**Grading:** GRD.

**Typically Offered:** Spring.

**EVR 637. Topics in Ocean Economics and Policy. 3 Credit Hours.**

The course evaluates topics affecting ocean health and use via an economic lens and policy perspectives to gain insights on changes in the ocean economy and governance structures from impacts on the ocean environment via marine pollution, energy extraction, fisheries and aquaculture, marine habitat modification and use, and globalization, among other factors. The main emphasis is to gain an understanding on emerging and dominant factors and how these are being addressed (or not) to achieve sustainable uses of the ocean.

**Components:** LEC.

**Grading:** GRD.

**Typically Offered:** Spring.

**EVR 638. Fisheries and Wildlife: Law and Policy. 3 Credit Hours.**

This course will provide an overview of fisheries and wildlife law, including practical applications at the federal, state, and local level. The course will also include an introduction to statutes, rules, regulations, and emerging issues in fisheries and wildlife law and policy. This course will focus on themes that are of particular importance to environmental professionals, such as sustainable fisheries, marine mammal protection, aquaculture, fish and wildlife management, criminal enforcement, and conservation of public lands/waters.

**Components:** LEC.

**Grading:** GRD.

**Typically Offered:** Spring.

**EVR 640. Power, Propaganda, & Accountability: The Past, Present, and Future of Climate Change Obstructionism. 3 Credit Hours.**

Climate scientists are unanimous that climate change is real, human-caused, serious, and solvable. So why have the public and policymakers taken so long to catch up, at what cost, and can anything be done about it? This first-of-its-kind course will address these questions by unraveling the 60-year history of climate denial, propaganda, and lobbying by fossil fuel interests, political ideologues, and the PR firms that enable them. Students will be introduced to seminal literatures of history of science, communication science, sociology, and beyond, as well as to cutting-edge data-driven research and journalism that is peeling back history and precipitating Congressional investigations, lawsuits, and grassroots activism. From Big Oil's early climate knowledge in the 1950s, to their Big Tobacco-style climate disinformation campaigns in the 1990s, to their greenwashing on social media today, students will be challenged to reevaluate their conceptions of how our understanding of climate change has been constructed and confused. Guest speakers will include some of the world's leading scholars, journalists, lawyers, and activists who are pioneering efforts to confront past and present climate propaganda.

**Components:** LEC.

**Grading:** GRD.

**Typically Offered:** Fall.

**EVR 641. Wild Animal Welfare & Marine Conservation. 3 Credit Hours.**

What happens when we no longer allow commercial whaling, but anthropogenic change continues to impact the daily lives and mortality of whales? How many individual animals are affected by aquaculture? Do sharks prefer no-take protected areas or no-entry areas? Can acoustic enrichment help restore degraded coral reefs? Conservation science and policy typically aims to conserve species or populations to prevent biodiversity loss. What if conservation efforts took seriously the direct and indirect effects of human activity, including conservation research, on individual animals? What if we also considered animal agency, behaviors, and preferences when designing conservation policies? This novel approach will be the focus of this class – the first of its kind. We will analyze marine conservation science and policy, with a particular emphasis on individual animals, which may have promise for thinking about conservation and protection differently. We will review recent peer-reviewed about anthropogenic impacts (e.g., overexploitation, pollution, invasive species, and climate change), proposed and tested marine conservation measures, the concept of compassionate conservation, what welfare means in the wild, as well as popular articles, to familiarize ourselves with the latest research and debates.

**Components:** LEC.

**Grading:** GRD.

**Typically Offered:** Fall.

**EVR 642. Ocean Justice. 3 Credit Hours.**

This course explores an emerging field of environmental justice research and activism in marine and coastal environments. Students will learn about the different ways to conceptualize ocean justice, and they will develop practical communication, analytical, and problem-solving skills for incorporating justice into ocean conservation, governance, development, and science. The course bridges theory and practice by training students to identify ocean (in)justice, evaluate potential solutions, and effect change.

**Components:** LEC.

**Grading:** GRD.

**Typically Offered:** Fall.

**EVR 645. Marine Population Assessment Surveys and Analysis. 3 Credit Hours.**

In spite of global conservation efforts, marine animal populations show increasingly critical low levels of abundance. Marine population assessment techniques are mostly based on fishery-dependent data for those species that are commercially exploited. Population assessment techniques based on these types of data usually lack spatial resolution and they do not provide spatial-temporal patterns of species diversity and community structure. Conversely, direct resource surveys aim to provide representative estimates of the relative abundance and population structure of the species (and community) of interest. These surveys can generate multi-species population databases that are fundamental for the modeling and understanding of important ecosystem-wide mechanisms of resource conservation. Multi-species indices of relative abundance are also important in the "tuning" of modern stock assessment and conservation methods. In this course students will learn about experimental sampling concepts and designs, instrumentation, survey implementation and statistical methods to directly assess size-structured population abundance (i.e., density estimates scaled to survey area), and of exploited and non-target species (e.g. sea turtles, marine mammals, etc.) in the ecosystem. Students will analyze real data from various surveys carried out in the past using statistical techniques to estimate valid population parameters and variances. Comparative analyses of survey designs are discussed based on an ample literature on the subject matter, which will be made available to the students.

**Components:** LEC.

**Grading:** GRD.

**Typically Offered:** Offered by Announcement Only.

**EVR 660. Introduction to Marine Geographic Information Systems. 3 Credit Hours.**

This class introduces students to the fundamental principles and concepts in using Geographic Information Systems (GIS) for marine science and marine resource management applications. The class section will cover lectures and discussions. The lab section will entail hands on computer-based GIS exercises on marine related issues. Students will learn how to use ArcGIS Pro and ArcGIS Online, and create simple GIS models primarily using vector data. Students will also learn how to create Web Applications using ArcGIS Online.

Co-requisite: EVR 661.

**Components:** LEC.

**Grading:** GRD.

**Typically Offered:** Fall & Spring.

**EVR 661. Introduction to Marine Geographic Information Systems - Laboratory. 0 Credit Hours.**

This class introduces students to the fundamental principles and concepts in using Geographic Information Systems (GIS) for marine science and marine resource management applications. The class section will cover lectures and discussions. The lab section will entail hands on computer-based GIS exercises on marine related issues. Students will learn how to use ArcGIS Pro and ArcGIS Online, and create simple GIS models primarily using vector data. Students will also learn how to create Web Applications using ArcGIS Online.

Co-requisite: EVR 660.

**Components:** LAB.

**Grading:** GRD.

**Typically Offered:** Fall & Spring.

**EVR 662. Intermediate Spatial Analysis. 3 Credit Hours.**

This is an advanced GIS course and is intended for students who have taken an introductory course in GIS. The course will consist of spatial analysis and geostatistics, introductory concepts in remote sensing introduction to ArcPy. Additionally, we will be using modules or scripts for more GIS functionality. The course will have a lecture part and laboratory part to advance the student's knowledge in spatial analysis. Students will also be assigned journal readings showing practical applications of raster data modeling. The students will use ArcGIS Pro and with several extensions to complete the lab exercises and the required GIS project.

Prerequisite: EVR 660 and EVR 661.

**Components:** LEC.

**Grading:** GRD.

**Typically Offered:** Spring.

**EVR 664. Citizen and Participatory Science. 3 Credit Hours.**

The Citizen and Participatory Science course will focus on preparing students for designing and implementing citizen and participatory science projects aimed at addressing questions and problems around specific environmental issues. As social networks grow, open data comes online and mobile technologies proliferate and advance, the opportunity to tap into eager and interested citizens to collect data for research and documentation purposes is quickly rising. This program will look at history of citizen science, which is over 100 years old, and will analyze current and past projects. Students will be exposed to how citizen science projects are designed and implemented and how they can be best leveraged to gain useful data for research. Guest lecturers will be invited for virtual and in-person presentations. A key component of the course will be for students to design a citizen science project using best practices. These projects can provide the baseline for launching real projects with organizations interested in applying citizen science to their work. The course will look at both technology driven projects as well as low-tech projects to expose students to the range of work being done in this rapidly evolving area.

**Components:** LEC.

**Grading:** GRD.

**Typically Offered:** Fall.

**EVR 665. Science and Natural History Media Production. 3 Credit Hours.**

The emphasis of this course is on documentary video production using a variety of technologies and methods. As video becomes increasingly used in communication, this course will provide an overview of the production process (pre-production, production, post-production) for those with backgrounds in science, education, and outreach. A variety of films will be reviewed and the process of science storytelling will be examined. In addition, the course will touch on mobile, mapping, imaging, ROV and UAV (drone) technologies as they relate to media production.

**Components:** LEC.

**Grading:** GRD.

**Typically Offered:** Spring.

**EVR 670. Conservation and Management of Marine Mammals. 3 Credit Hours.**

This course explores current and pressing threats to large marine vertebrates, particularly mammals, and the relative legislation in place to protect them. Additionally, we will explore the methods and tools used to assess, manage, and conserve marine mammal populations, including case studies that exemplify both successes and failures. Discussions will include anthropogenic impacts, the Marine Mammal Protection Act/IWC/ESA/Florida Manatee Sanctuary Act/IUCN, a stock as a management unit, OSP/PBR, mark-recapture and other methodologies integral to wild population management, marine mammal strandings response, and the ethics of human intervention as it relates to the management of marine ecosystems as a whole. Emphasis will also be placed on the acquisition of relevant skill sets, such as communication of conservation messages using social media, advocacy with integrity, grant writing, and stranding and rehabilitation procedures and certifications.

**Components:** LEC.

**Grading:** GRD.

**Typically Offered:** Fall.

**EVR 671. Marine Conservation Biology. 4 Credit Hours.**

This course introduces students to critical concepts in Marine Conservation, exploring aspects of the biology and ecology of marine organisms and ecosystems and how they impact human management of marine resources. Through a combination of lectures, primary literature discussions, case studies, and debates, students will learn how science informs conservation and management and understand the strategies and tools available to managers. By the end of the course, students should have a good understanding of the following: ecological principles, basics of marine species, threats to biodiversity, fisheries effects on species, habitats, and ecosystems, place-based management (MPAs, marine reserves, etc.), and human dimensions (culture, economics, and competing interests).

**Components:** LEC.

**Grading:** GRD.

**Typically Offered:** Fall.

**EVR 672. The Archaeology of Seafaring. 3 Credit Hours.**

Ships and seafarers have had considerable influences on civilization throughout history. The ship typically represents the pinnacle of a society's understanding of many disciplines: astronomy, geography, metallurgy, physics, warfare, et cetera. No other process similarly spread the delights and devastation of the world so effectively. This course studies man's evolutionary relationship with the sea from early civilization through the 20th century. Emphasis will be on archaeological and ethnographical investigations concerning shipwrecks and maritime epicenters supporting maritime culture. This will be a lecture course supported by visual, audible, and hands-on presentations.

**Components:** LEC.

**Grading:** GRD.

**Typically Offered:** Spring.

**EVR 673. Marine Conservation Outreach. 3 Credit Hours.**

This course explores concepts, theories and practices to design and evaluate conservation outreach projects and programs. Techniques for developing conservation outreach projects are examined through case study analysis and issue paper development. In addition, students build their understanding of conservation outreach planning, implementation, and evaluation while designing real-world project proposals. When possible, an optional field trip component exposes students to see first-hand the challenges and opportunities related to marine conservation outreach.

**Components:** LEC.

**Grading:** GRD.

**Typically Offered:** Spring.

**EVR 674. Theoretical & Practical Issues in Exploration Science. 3 Credit Hours.**

This course will address changes in motivation and approaches to exploration with a focus on risk perception, physiological concerns, and socio-cultural context, including how the past colonial legacy is still influencing the current generation of scientists, explorers, and the groups they interact with. Major components of the course will include discussions of ethical considerations, logistics planning, budgeting, proposal development, practical skills, role of the media, and critical analysis of historical and current exploration events along various dimensions covered in the class. Depending on the interest of the cohort of students, the class may include a final field component project.

**Components:** LEC.

**Grading:** GRD.

**Typically Offered:** Fall.

**EVR 677. Management and Conservation of Marine Ecosystems. 3 Credit Hours.**

In this course students will learn how marine ecosystem management operates to achieve its objectives of sustainable use, optimization and allocation of resources. The primary focus is on how fisheries interactions with marine ecosystems are monitored, assessed and regulated. It examines how fisheries management achieves its objectives through different operational strategies. As the ecosystem-based approach to fisheries management requires seeing fisheries as integrated systems within the broader ecosystem, the course puts management in the context of impacts of all human activities not just fisheries. Particular attention is given to management of habitats, harvested and protected species. Impacts of marine transport, tourism, and mineral extraction are also considered albeit in less detail. The course includes individual chapter introductions to all components of ecosystem management and policy including, ecological sustainability, governance, social, economics and legal aspects.

**Components:** LEC.

**Grading:** GRD.

**Typically Offered:** Spring.

**EVR 678. Field Research for Conservation Science and Management. 3 Credit Hours.**

This course introduces students to the role of field research in marine conservation planning and management. Through a combination of readings, structured discussions of primary literature, lectures, and field experience, students will develop professionally relevant skills around the science-management interface, including understanding the role of data from multiple disciplines and methodologies. Students will build an understanding of best practices for science-based marine conservation management including the technical, administrative, and practical aspects of operating at the science-management interface.

**Components:** FLD.

**Grading:** GRD.

**Typically Offered:** Fall.

**EVR 681. Special Topics. 1-3 Credit Hours.**

Lectures, research projects, or directed readings in special topics related to Environmental Science and Policy.

**Components:** LEC.

**Grading:** GRD.

**Typically Offered:** Fall, Spring, & Summer.

**EVR 682. Special Topics. 1-3 Credit Hours.**

Lectures, research projects, or directed readings in special topics related to Environmental Science and Policy.

**Components:** LEC.

**Grading:** GRD.

**Typically Offered:** Fall, Spring, & Summer.

**EVR 683. Special Topics. 1-3 Credit Hours.**

Lectures, research projects, or directed readings in special topics related to Environmental Science and Policy.

**Components:** LEC.

**Grading:** GRD.

**Typically Offered:** Fall, Spring, & Summer.

**EVR 691. Maritime Archaeology Field Study. 3 Credit Hours.**

This field-based course focuses on the acquisition of data from shipwreck sites and subsequent interpretation and analysis. Topics of study include shipwrecks from the 16th century to World War II era. Students will learn about historic maritime activity and be exposed to analyzing both the archaeological and historical record in examination of these sites. This course will be taught in collaboration with partners at the National Park Service and/or NOAA, and dives will take place in Biscayne National Park, Dry Tortugas National Park, or the Florida Keys National Marine Sanctuary. Students must be approved UM divers to take this course.

**Components:** FLD.

**Grading:** GRD.

**Typically Offered:** Summer.

**EVR 692. Archaeological Study of Submerged Pre-Contact Sites. 3 Credit Hours.**

This is a field-based course with a focus on submerged pre-contact or prehistoric archaeological sites within North America, Latin America, and the Caribbean. Students will learn about the past human activity, settlement patterns, and habitation of various regions and sites, while conducting fieldwork. Focus will be placed on topics such as the peopling of the Americas over 13,500 years ago, human adaptation to environmental change, and the location and investigation of now-inundated coastal sites and submerged caverns and caves. Techniques and methods of data acquisition relevant to these site types will be taught, and students will receive hands-on experience in specific methodologies. Students must be approved UM divers to take this course.

**Components:** FLD.

**Grading:** GRD.

**Typically Offered:** Summer.

**EVR 693. Maritime Archaeology and the Conquest of Mexico. 3 Credit Hours.**

This course will allow students to experience firsthand the archaeological and historical sites associated with the conquest of Mexico and to participate in archaeological fieldwork investigating maritime archaeological sites associated with this seminal historic event. Site-based learning experiences will include world-renowned museums and very significant archaeological sites, both prehistoric and historic, which will provide perspective on cultural transition and conflict over time within the prehistoric societies in Mesoamerica and the eventual collision of cultures and civilizations at the height of the Aztec empire and the advent of Spanish colonialism. The fieldwork portion of the course will take place in the town of Villa Rica de la Vera Cruz and will be conducted from a borderlands/landscape lens, incorporating both terrestrial and underwater efforts. Students will participate in the archaeological study of and search for ships scuttled by Hernán Cortés in 1519 and 1520.

Prerequisite: RSM 500 or RSM 600.

**Components:** FLD.

**Grading:** GRD.

**Typically Offered:** Summer.

**EVR 710. International Ocean Law and Governance. 3 Credit Hours.**

This course shall track the history and development of international ocean law, from a series of bi-lateral and multi-lateral treaties, the evolving customary law framework, and coastal and maritime state claims to the codification and proliferation of international legal agreements addressing the panoply of ocean use and management issues. Applying a chronological approach, the course shall identify and discuss key developments in international ocean law, leading to the drafting of the Third United Nations Law of the Sea Convention (UNCLOS III). By evaluating the multifold themes addressed under the convention, the course will analyze the effects of convention in a post UNCLOS III world, especially in the fields of environmental protection, the management of marine fisheries and living resources, the allocation of seabed and subsoil resources, issues affecting the high seas, and polar regions.

**Components:** LEC.

**Grading:** GRD.

**Typically Offered:** Spring.



**EVR 714. Population Modeling, Risk Assessment and Management. 3 Credit Hours.**

Population Modeling, Risk Assessment and Management is an advanced graduate-level course that presents a synthesis of mathematical and computer-intensive models to monitor, assess and manage responses of marine populations (i.e., fish, shellfish, marine mammals and sea turtles) to exploitation and environmental changes. This rigorous quantitative course involves exposition and development of modeling concepts and stock assessment techniques to include: (1) principles of resource management; (2) stock production models and surplus yield; (3) structured (age- & length-based) analytical yield models; (4) stock and recruitment models; (5) analytical modeling and parameter estimation; and, (6) dynamic structured assessments. Equilibrium, non-equilibrium and data-limited approaches will be evaluated with respect to data assimilation and parameter estimation. Simulation modeling tools will be used to highlight and reinforce concepts in decision theory, adaptive control, and risk assessment. Specific population modeling and resource allocation case studies from regional, federal and international fishery management institutions will be illustrated. Lecture and computer-based laboratory using R Project for Statistical Computing, Excel, FORTRAN (or C++), AD Model Builder and other software packages.

**Components:** LEC.

**Grading:** GRD.

**Typically Offered:** Fall.

**EVR 715. Machine Learning & Predictive Analytics in Marine Science. 3 Credit Hours.**

An introduction to machine (statistical) learning with primary emphasis on applications in the assessment and dynamics of populations in marine biology, fishery management science, environmental and policy science, aquaculture, oceanography, and conservation biology. Course includes supervised statistical learning topics in generalized linear and multiple linear regression, probability and estimation theory, analysis of covariance, generalized linear models, logistic regression, nonlinear regression and optimization. Predictive analytics explores generalized additive models, penalized regression (ridge, lasso), neural networks, classification, and decision trees (i.e., bagging, boosting, random forests). Unsupervised statistical learning topics includes multivariate statistics (e.g., clustering, principal components analysis) and classification. Data science, exploratory analyses and statistical modeling using the R Project for Statistical Computing; but also, SAS and MATLAB.

**Components:** LEC.

**Grading:** GRD.

**Typically Offered:** Fall.

**EVR 720. Coastal Law and Policy. 3 Credit Hours.**

This judicial case-based course examines competing interests in the U.S. coastal zone, problems of public and private ownership rights in the coastal zone, conflicts in legal jurisdiction between federal and state laws, regulation of coastal development, and management of the coastal zone and coastal resources.

**Components:** LEC.

**Grading:** GRD.

**Typically Offered:** Fall.

**EVR 774. Advanced Studies in Environmental Science and Policy. 1-4 Credit Hours.**

Supervised study in areas of special interest to graduate students.

**Components:** LEC.

**Grading:** GRD.

**Typically Offered:** Offered by Announcement Only.

**EVR 805. MPS Internship. 1-6 Credit Hours.**

The MPS internship is an approved, supervised internship project with an organization engaged in activities associated with the student's degree track. The internship results in a collaborative project, written report, and oral presentation on a topic approved by the student's advisory committee. Up to 6 credits are necessary for graduation.

**Components:** PRA.

**Grading:** SUS.

**Typically Offered:** Fall, Spring, & Summer.

**EVR 810. Master's Thesis. 1-6 Credit Hours.**

The student working on their master's thesis enrolls for credit, in most departments not to exceed six, as determined by their advisor. Credit is not awarded until the thesis has been accepted.

**Components:** THI.

**Grading:** SUS.

**Typically Offered:** Fall, Spring, & Summer.

**EVR 820. Research in Residence. 1 Credit Hour.**

Used to establish research in residence for the master's degree, after the student has enrolled for the permissible cumulative total in appropriate thesis research. Credit not granted. May be regarded as full-time residence as determined by the Dean of the Graduate School.

**Components:** THI.

**Grading:** SUS.

**Typically Offered:** Fall, Spring, & Summer.

**EVR 830. Doctoral Dissertation. 1-12 Credit Hours.**

Required of all candidates for the Ph.D. The student will enroll for credit as determined by their advisor, but for not less than a total of 12 hours. Up to 12 hours may be taken in a regular semester, but not more than six in a summer session. Where a student has passed their (a) qualifying examinations, and (b) is engaged in an assistantship, they may still take the maximum allowable credit stated above.

**Components:** THI.

**Grading:** SUS.

**Typically Offered:** Fall, Spring, & Summer.

**EVR 850. Research in Residence. 1 Credit Hour.**

Used to establish research in residence for the Ph.D., after the student has been enrolled for the permissible cumulative total in appropriate doctoral research. Credit not granted. May be regarded as full-time residence as determined by the Dean of the Graduate School.

**Components:** THI.

**Grading:** SUS.

**Typically Offered:** Fall, Spring, & Summer.