Curriculum Guide 2015

International Master's Program in Environmental Management and Sustainability

James Madison University & University of Malta
http://www.jmu.edu/mems-malta (JMU)
http://www.um.edu.mt/icp/courses/msc-environmental-management-and-sustainability (Malta)

The International Master's Program in Environmental Management and Sustainability is designed to build interdisciplinary, holistic thinking and problem-solving skills using systems perspectives on environmental and sustainability challenges. Students in the program have the opportunity to focus on natural resource conservation or sustainable technology management. Elective coursework builds depth through specialized classes in analytical methods and techniques, resource conservation and management, and policy analysis. This is a dual degree program; as such, students are enrolled in classes at both the University of Malta and at James Madison University. Degrees are awarded by both schools to those who successfully complete their studies. JMU and University of Malta faculty contribute equally to instruction and project (or thesis) supervision.

This guide provides an informal overview of our curriculum. It describes the logic of the curriculum structure, the classes that you will take, and the way you can tailor the program of study to your particular interests and needs through elective or self-defined coursework.

Program Coursework and Credits

Most of the classes that you will take have identical names and equivalent credit hours of time and work effort between both universities. However, because of slight differences between our schools, you will see some differences between JMU and UoM in terms of how credits are accounted for. JMU uses the conventional credit hour system of American and Canadian universities. The University of Malta uses the European System of ECTS (European Credit Transfer and Accumulation System). The program is 42 credit hours/90 ECTS total. Because the program is accelerated, you can complete it in one calendar year.

The overall curriculum has four basic components: (1) sustainability core courses, (2) specialized topic classes in resource conservation and management, (3) analytical methods and techniques, and (4) the capstone experience.

	Credit Hours[1]	ECTS[1]
Sustainability Core Courses	14	23
Earth Systems and the Sustainability of Natural Resources	2	6
Integrated Case Study Seminar	1	
Sustainability, Society, and Change	3	6
Introduction to System Dynamics	4	6
Sustainability Policy and Law	3	5
Special Topics in Policy and Governance	1	
Resource Conservation and Management	12	18
Freshwater Resources Management	4	6
Select 2 from the following (4 credit hours each): • Industrial Ecology • Energy Sustainability • Conservation Planning • Food Resources and Security	8	12
Analytical Methods and Techniques	10-12	19
Applications of GIS for Resource Management	3	6
Analytical Methods Modules (1 credit hour each) • Statistical analysis, required for all students • Select 2-4 electives from a menu of methods, techniques, and tools classes such as environmental impact assessment, survey methodology, life cycle analysis, software applications, advanced GIS, and so on.	3-5	8[2]
Mediterranean Field Study	3	5
Project Management in a Cross-Cultural Environment	1	— [2]
Capstone Experience	4-6	30
Capstone Project (4 credit hours) or Master's Thesis (6 credit hours). Students completing the thesis option take 2 analytical methods tutorials instead of 4.	4-6	30
Program/Course Total	42	90

[1] Credit hours represent earned class credits at James Madison University (U.S. degree system); ECTS represent earned class credits at the University of Malta (European Degree System).

[2] Earned credits for these elements is included in the accounting of the Capstone Project/Thesis ECTS.

Course Descriptions

THE SUSTAINABILITY CORE

The sustainability core curriculum is required of all students and forms the foundation for your program of study. It explores principles of sustainability science from Earth systems, natural resource, and societal perspectives. It also provides a historical context so that we can better understand the similarities and differences between traditional environmental protection, natural resource conservation, and emerging approaches to holistic sustainability management. Central to our program and core curriculum is a systems approach to problem-solving. You will gain insights into "systems thinking" and learn how to formally model and analyze environmental issues and challenges as dynamic system interactions. In addition, we provide an integrated case study seminar that allows you to apply what you are learning by exploring and analyzing a complex, real-life sustainability challenge.

The core curriculum represents a breadth of teaching and learning approaches. You will have traditional lectures, online studies, group work, field trips, and seminar discussions. An independent research class on *Special Topics in Policy and Governance* allows you to customize your program by selecting a topic of particular interest to you.

Earth Systems and the Sustainability of Natural Resources

A conceptual and descriptive scientific understanding of critical Earth systems and natural resources as they pertain to applied environmental and sustainability management. The course is intended to provide an integrative introductory foundation of knowledge, terminology, models, and concepts with respect to the physical, biological, and ecological processes that govern life on Earth, to explore the limits that these processes pose for human natural resource use and recovery, and to illustrate the power of humans to disturb the dynamics that support a living planet. Course substantive content is online, but applied through analysis and discussion in the semester-long integrated case study seminar.

Integrated Case Study Seminar

An in-depth exploration of a complex, existing real-world sustainability problem using formal case study analysis. Designed to illustrate the challenges of managing complex socio-ecological systems and to foster integrated problem-solving through the application of systems thinking and structured problem analysis techniques. The course is taught in a discussion and seminar format.

Sustainability, Society, and Change

An introduction to defining principles of environmental management and sustainability in the context of complex coupled social-ecological systems (SES) and the interdependence of people and nature at a variety of nested scales. Through examples, students analyze interactions between humans and their landscapes over time using different SES frameworks and related concepts, including planetary boundaries, resilience, robustness, ecosystem services, and panarchy. The crucial role of personal ethical decision-making frameworks will be further analyzed, exploring the moral dimensions of a number of sustainability-related decision-making situations.

Introduction to System Dynamics

This unit introduces the science of systems modeling as practiced in the field of system dynamics. Students will learn how to apply causal feedback analysis in order to describe problems and challenges in sustainability using the language and tools of system dynamics. Students will learn how to develop and evaluate a dynamic hypothesis for the behavior of a system over time, with applications taken from fisheries, farming practices, economics, and climate change. Students will also be introduced to stock and flow modeling as a method for accounting for system states, inertia, and delays in system behavior.

Sustainability Policy and Law

This course introduces students to the basic principles of international and national environmental law, policy, and regulation as it pertains to sustainability. Critical distinctions in environmental policy and sustainability policy are made, and the issues of governance for each are explored. Common problem domains of law and policy are analyzed, including externalities and pollution, common pool resources and resource overharvesting, and biodiversity loss and landscape functioning. Transboundary environmental problems are addressed in depth.

Special Topics in Policy and Governance

An independent research study that enables students to explore the policy dimensions of an environmental sustainability problem of their choice in greater depth. Students research and write an analytical paper that critiques the legal, policy, and regulatory issues associated with a particular problem and recommends appropriate policy designs, remedies, and options.

RESOURCE CONSERVATION AND MANAGEMENT

The resource conservation and management coursework gives you knowledge, principles, models, and practices to steward the Earth's resources more effectively. These represent our specialized environmental management classes. All students must take the Freshwater Resources Management class because water issues are central to sustainability problems throughout the world. You select two other elective classes to build your expertise broadly in resource conservation or sustainable technology management. All of these classes make extensive use of case studies, in-class applications, and field work to supplement traditional lectures; some incorporate the occasional laboratory experience as well.

Freshwater Resources Management

An exploration of the need for sustainable water policies and practices around the world. The course develops an understanding of the state of water resources, introduces concepts of water chemistry and techniques relating to chemical analysis of water, and evaluates water pollution and water treatment technologies. Watersheds and watershed management are addressed, including geomorphological connections between freshwater, riverine, coastal and marine environments; the effects of river damming; water pollution and human health; and water-related policies. Connections between water sustainability and key areas such as agriculture and food, energy, waste management, and coastal resources are made.

Conservation Planning

An emphasis on biodiversity conservation as an essential element of sustainability. The course reviews the current state of biodiversity worldwide, highlighting patterns and trends in relation to genetic, species, and ecosystem diversity. Options for mitigating the driving forces of biodiversity loss are critically discussed in terms of their feasibility. Key topics include *in situ* and *ex situ* conservation options, planning strategies for terrestrial and aquatic/marine ecosystems, and conservation within urban environments. This class also introduces students to the science of taxonomy and to biodiversity analysis techniques, and enables class participants to apply conservation biology principles using scientific data for making conservation management decisions.

Food Resources and Security

An agricultural ecology approach to the challenge of meeting a growing global demand for food while remaining within the boundaries of environmental systems. Soils, nutrient loads and their management, and erosion control represent course fundamentals. Food production systems are compared and contrasted, including (i) dominant monoculture and chemically based agriculture systems, (ii) corporate control of seed, mechanization, chemicals, and GMO crops, and (iii) permaculture. Options for alternative agriculture are examined in terms of maintaining biodiversity and ecosystem services without compromising food production, holistic resource management, and restoration of agro-ecosystems. The various facets of food security are discussed, and global food consumption and trade patterns are explored.

Energy Sustainability

Sustainable energy policies and practices around the world. The course introduces basic concepts related to energy and its importance as well as fundamentals of energy science. The range of potential energy resources, including non-renewable (fossil fuels and nuclear) and renewable (solar, wind) sources is examined. The relevance of building design to energy is discussed, as are general issues relating to energy policy, planning, and market transformations to sustainable energy. The class helps students understand fundamental concepts associated with energy discovery, production, and use, technologies that are used to convert energy from one form to another and produce useful work, and complex issues that arise when energy procurement, production, and consumption and their impacts are treated on a regional and global scale.

Industrial Ecology

Industrial ecology, the science of sustainability, seeks to encourage the development of a sustainable industrial society. This course introduces and examines this relatively new field of inquiry and practice. The course addresses various practical topics which are associated with industrial ecology, including life cycle assessment, design for environment, and environmentally-conscious manufacturing. The course enables students to learn how to describe problems and challenges in sustainability and industrial society using concepts related to materials and energy flows, understanding how the concept of ecology can represent both natural and technological systems, critically evaluating both current and proposed technological approaches to the production and delivery of goods and services in an industrial society with respect to their environmental impacts, and proposing alternative approaches to technological activity which more nearly close the cycle of materials and energy than is typical at present.

Analytical Methods and Techniques

Our analytical methods and techniques curriculum is one of the most innovative in higher education. This component of the program is designed to let you build a suite of analytical competencies for quantitative and qualitative data analysis. The coursework heavily emphasizes scientific, evidence-based decision-making. Everyone shares required coursework in GIS, cross-cultural project management, field techniques, and statistics. From there on, you design your own set of additional methods, tools, and techniques relevant to your professional interests. You do so by selecting and completing four instructional modules from a wide variety of options related to environmental assessment, field techniques, spatial analysis, data visualization, system dynamics, economics, modeling, simulation, instrumentation and measurement, participatory learning and decision techniques, and qualitative research methods.

Applications of GIS for Resource Management

This course focuses of the use of GIS as a decision support tool in managing natural resources and promoting sustainable development practices. Applications and spatial problem-solving in the areas of energy, air, water, waste management, agriculture, and coastal resources are emphasized.

Analytical Methods and Techniques

This course enables students to focus in-depth on specialized analytical methods, techniques, and instruments involving quantitative and qualitative data analysis, simulation, and modeling relevant to scientific, technical, and environmental analysis. Students select and complete structured instructional modules from a menu of topics offered by faculty in the degree program; each module is equivalent to 1 credit hour of graduate coursework. Examples of topics include data visualization, environmental impact assessment, survey design principles, advanced applications in GIS, water quality measurement techniques, thermal infrared imaging, and so on.

Mediterranean Field Study

This course comprises a field trip to one or more sites within the Mediterranean Basin. Selected study areas combine a variety of natural, semi-natural, and anthropogenic dimensions, and face several urgent management issues, many of which are also characteristic of the region. Site work combines lectures, hands-on projects, and

analytical presentations. The experience reinforces techniques for evidence-based policy formation, environmental appraisal, impact assessment, and protected area management, among others. It provides a unique opportunity to apply the knowledge acquired through other program components to real-world sustainability challenges.

Project Management in A Cross-Cultural Environment

An introduction to the basic principles of project management and its key processes including initiating, planning, and scheduling a project. The course also explores work collaboration in cross-cultural environments and international settings, where interpersonal communication, organizational cultures, and societal norms can affect productive and collegial project collaboration. Important cultural competencies are explained and practiced. The class is conducted in a blended learning environment that incorporates online tutorials, group work, seminar discussions, and guided learning exercises.

The Capstone Experience

Students complete a 4 credit hour Capstone Project; in exceptional circumstances, students may opt to complete a master's research thesis, subject to approval by the Program's Board of Studies. The capstone experience allows for in-depth exploration of a specific subject area of your choice, with a focus on applying the knowledge and skills acquired throughout the program to practical management challenges or to extended analysis of a topic. The capstone experience will be facilitated through guidance provided by faculty members from both universities.

Capstone Project

The required capstone project for all non-thesis graduate students. The project involves applying an integrated, interdisciplinary approach to a problem in the student's area of interest and specialization. Students are expected to demonstrate project management skills, produce a written technical report or analysis, and provide a presentation summarizing the scope and results of their work. The project can be an investigation or development undertaken by the student individually or as part of a larger effort conducted by a project team.

Research Thesis Option

The research thesis option is intended for students who would like to develop a research project with a more traditional academic focus. In this case, the emphasis is primarily on furthering understanding of a specific subject area through scientific research and extended analysis of a topic. Since this ordinarily requires a longer timeframe than an applied capstone project, students pursuing this option should expect to complete the program in 16 months rather than 12.