

## **Program Policy Statement**

# **MS in Environmental Science and Management**

*College of Earth, Ocean, and Environment  
University of Delaware  
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## **I. Program History & Purpose**

### ***A. Statement of Purpose***

The College of Earth, Ocean and Environment is proposing an interdisciplinary master's of science degree in environmental science and management.<sup>1</sup> The degree focuses on the intersection of environmental science, policy, and management with the intention of training students from environmental science, environmental studies, or natural resource management backgrounds in a multidisciplinary style to address decision-making and management in a practical fashion using convergence principles. The degree is designed to be applied broadly to environmental issues, but the program's home in the College of Earth, Ocean and Environment offers strengths in climate change, earth resource, marine applications such as fisheries, offshore wind power, coastal land use, water quality, sea level rise, and weather extremes.

The program developed through a series of discussions among faculty in CEOE seeking to develop a professional master's program that meets the needs of students graduating in our undergraduate BS in Environmental Science and BA in Environmental Studies programs who are looking for a cross-disciplinary degree. The need for a graduate degree in Environmental Science or related fields in order to secure an environmental job beyond very low-level, entry positions has grown significantly over the past decade. We are also seeing an increase of students applying to CEOE graduate programs in Marine Studies, Geoscience, and Geography that are looking for professional training for entering the workforce as an environmental planner, environmental scientist, or project manager. These local trends are shown regionally as well as in the market study performed by the UD Office of Professional and Continuing Studies (PCS, described below). The market research memo produced by PCS also shows that the number of job postings in the field has nearly doubled in the past 10 years, indicating a growing need for more highly educated students in this field.

The proposed master's degree has foundations in environmental science and in management, with required courses in data analysis and science-policy connections, and specialized coursework in marine science, climate science, or earth resources and management, culminating in a decision-making course and a capstone project-based course. The capstone is a critical part of the student experience and is developed with input from faculty across CEOE. It is designed to address a specific real-world environmental science-management convergence problem and

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<sup>1</sup> A MS and PhD in Environmental Economics are also being proposed and shares some courses with the current program.

will be sponsored by an outside client. Students will work in small groups on an assigned project using skills and knowledge acquired in previous semesters. The outside sponsor can be at the local, national, or international level, will leverage faculty connections, and would include agencies such as Delaware's Department of Natural Resource and Environmental Control (DNREC), the U.S. Environmental Protection Agency (EPA), the World Bank, or the Food and Agriculture Organization, a specialized agency of the United Nations. The capstone experience is modeled after similar courses at [Duke](#), [Yale](#), and [UC Santa Barbara](#) and is designed to provide a real-world work experience that is sought by most employers. In special circumstances, a student may opt out of the capstone experience and instead write an analytical paper if they are interested in continuing on to a PhD and seeking a research experience. The degree is designed to be completed in two years.

Students graduating with the proposed Master's of Science degree in Environmental Science and Management will be prepared to become environmental planners, environmental scientists, project managers, and environmental compliance specialist at all levels of government and in the private sector (consulting, interest groups, think tanks, industry, etc.). They will gain a strong grasp of basic science concepts as they relate to managing the environment, quantitative analytical skills--including data handling, model estimation, and interpretation--and communication of analysis results to decision-makers and the public. Their understanding of management principles is coupled with background (coursework) in data analysis, the decision-making process, and the natural environment. Examples of job placements are in federal and state agencies such as EPA, the National Oceanic and Atmospheric Administration (NOAA), the US Bureau of Ocean Energy Management, DNREC, and New York's Department of Health & Mental Hygiene. Examples of private companies looking to employ graduates with these skills include ICF Incorporated, LLC, Leidos, and Stantec, Inc. See the market analysis below for more details. Universities also represent an important job sector for students seeking positions in this field.

***B. Date of Permanent Status***

Fall 2027

***C. Degree Offered***

Master's of Environmental Science and Management

***D. Term when first students may enroll***

Fall 2022

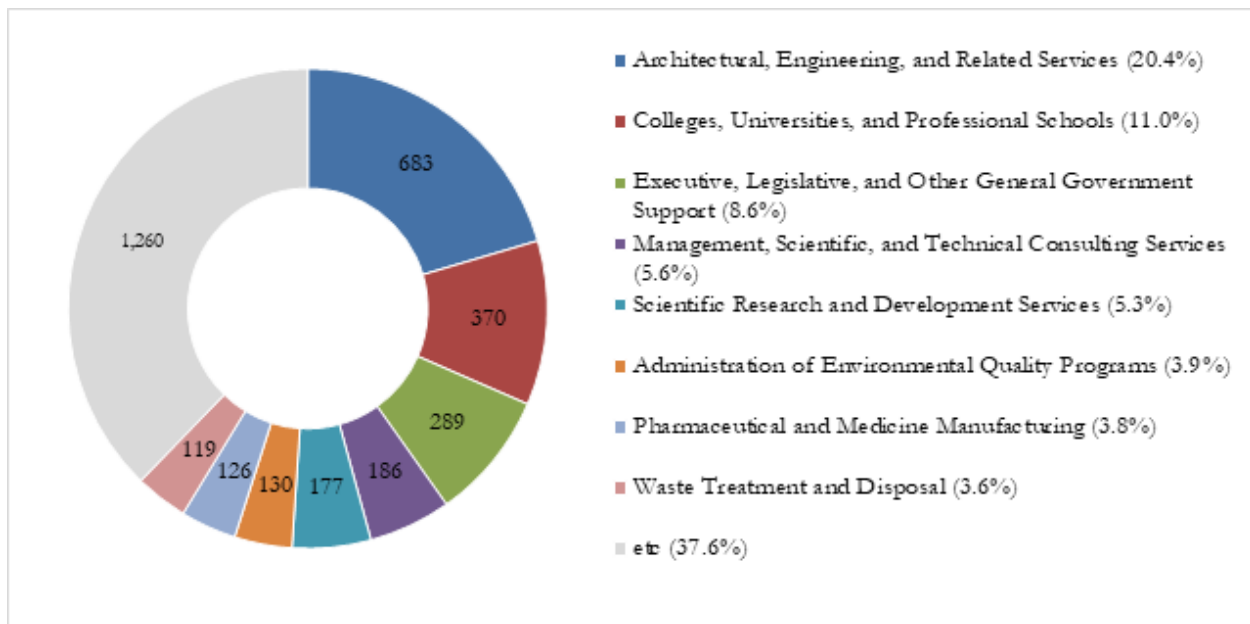
***E. Factors that identify student demand for the program***

The market for the degree is strong. The [Bureau of Labor Statistics](#) (BLS) makes annual projections of job prospects in different fields. For environmental scientists and specialists, the projected growth rate is 8%. For comparison, across all occupations the projected growth rate is 4% over the same period. [CareerOneStop](#) projects 9,400 job openings annually for

environmental scientists and specialists in the United States through 2029 with a similar growth rate of 8%. LinkedIn presently (2022) advertises 1,250 job openings that mention environmental science and management.

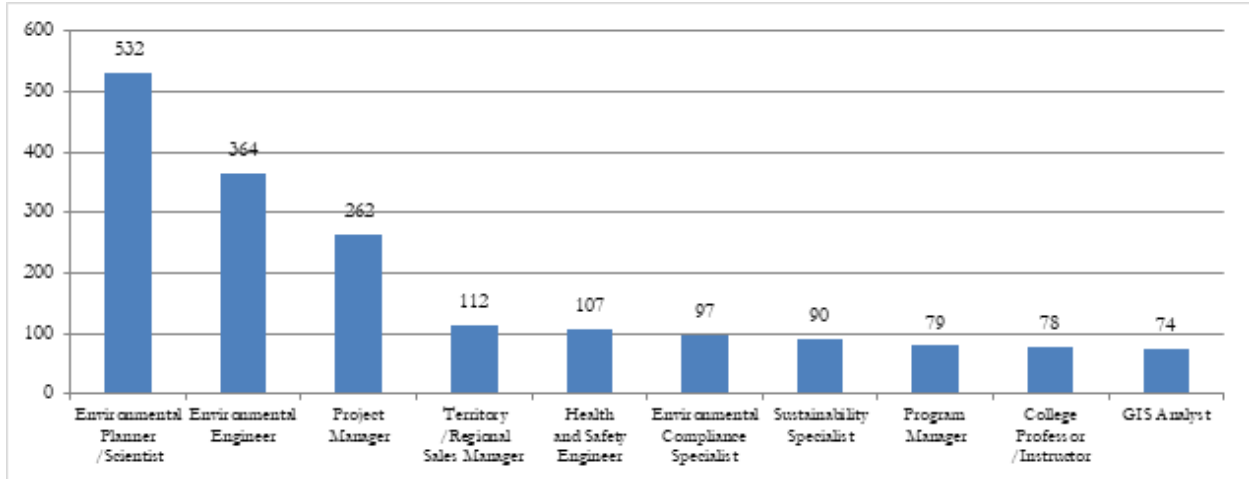
The analysis done by Professional and Continuing Studies (uploaded with this proposal) using the Burning Glass Technologies Labor Insight tool showed that, over the last ten years, the number of yearly job postings in the Mid-Atlantic region has grown from 3,147 to 5,819, a growth rate of 85%. The growth has continued over the last three years, despite pandemic impacts, indicating that there is a strong regional demand for skills in environmental science and management.

The Market Research memo indicates that there is a diverse range of jobs, with the three largest industry demand areas being: 1) architectural, engineering and related services, 2) colleges, university and professional schools, and 3) executive, legislative and other general government support (see figure 2 in PCS Memo, copied below).



**Demand by Industry and the number of job postings (August 1, 2020 - July 31, 2021)  
(Source: PCS Memo, 8/2021)**

The most highly demanded occupation, representing close to 10% of all job postings, is for an environmental planner/scientist (see Figure 3 in PCS Memo, copied below). In the Mid-Atlantic region there is a higher geographic concentration of job postings for environmental compliance specialists, environmental program managers, and project managers (see Table 1 from PCS Memo, shown below). Within this region, New York, Pennsylvania, and Virginia have the highest numbers of job postings.



**Most demanded of specialized (August 1, 2020 - July 31, 2021) (Source: PCS Memo, 8/2021)**

Occupations	LQ	Extent of demand
Environmental Planner / Scientist	1.1	Average
Environmental Engineer	1.4	High
Project Manager	1.3	High
Territory / Regional Sales Manager	0.8	Low
Health and Safety Engineer	1.3	High
Environmental Compliance Specialist	1.5	High
Sustainability Specialist	1.3	High
Program Manager	1.4	High
College Professor / Instructor	1.2	Average
GIS Analyst	1.0	Average

**Table 1: The location quotient of the most demanded of specialized occupations (Location quotients present how concentrated demand is within a particular geography. US-wide average demand equals 1.0. An LQ of more than 1.4 is high and 1.6 is very high.)**

Roughly 85% of employers prefer to hire applicants with a degree level higher than a bachelor's degree (Figure 6), and 65% want at least 3 years of work experience (Figure 7). In terms of expected skills, employers have the greatest demand for specialized skills in environmental science, project management, and budgeting. These are skills at the core of the proposed interdisciplinary degree. In fact, the U.S. Bureau of Labor Statistics writes that "heightened public interest in the hazards facing the environment, as well as increasing demands placed on the environment by population growth, are projected to spur demand for environmental scientists and specialists." Top baseline skills include communication, research, and being detail-oriented. Most jobs expect some familiarity with the Microsoft Office suite of software, but programming skills in analysis software such as SAS, R, and Python are also preferred in some cases. The required data analysis skills in the proposed program will help graduates be more competitive for job postings.

Across the country, there are several universities offering master's degree programs similar to the one proposed here. The education market analysis performed by Professional and Continuing Studies included 13 competitors in Program Insight provided by Burning Glass Technologies that vary in terms of size, home college, focus, structure, and curriculum (see report). For example, the Masters in Environmental Science & Management in the [Bren School of Environmental Science and Management at UC Santa Barbara](#) offers specializations in Coastal Marine Resource Management and Energy and Climate. The [Forestry School at Yale University](#) offers a Masters of Environmental Management. American Public University, SUNY College of Environmental Science and Forestry, George Mason University, and Duquesne University are major competitors in terms of education market share in the Mid-Atlantic. The proposed program (36 credits) is similar in required number of credits to most of these major competitors (Figure 9), although lower than the average (42 credits) and is more affordable than most due to the recent decrease in UD graduate tuition.

Our program is distinct in that it offers interdisciplinary marine science, climate science, and earth resource tracks, leverages the convergence nature of the instruction and research in CEOE, and provides a professional development work experience as part of the capstone course. Like many of our peers, we are in the Mid-Atlantic with environmental issues of special concern to this area, such as sea level rise and clean air/water. We are in proximity to New York City and Washington D.C., where many government agencies, NGOs, and consulting firms who hire environmental specialists are located. The 85% job-posting growth over the last ten years and the desire for students with a graduate education suggests that the education market is not saturated, and there is a need for programs like that proposed providing a unique blend of environmental science and management skills.

Our long-term target is 10-20 master's students per incoming class (i.e., 20-40 at any given time). This is based on the sizes of peer programs, scaled by the size of our faculty.

## ***F. College and Department/School***

The degree will reside in the College of Earth Ocean and the Environment. There are faculty and resources on both the Newark and Lewes campuses.

## **II. Admission**

### ***A. Admission Requirements***

Admission is competitive. It is based on grades, letters of recommendation, and an application essay. A GPA of 3.0 or higher on a 4.0 scale is expected. The program admissions committee will evaluate each applicant for admission and may interview applicants over phone, zoom or in person.

Applicants must submit the following:

- All official undergraduate and (if applicable) graduate transcripts
- A resume or curriculum vitae that documents prior work experience, publications, honors and awards received, and a summary of educational credentials
- A personal statement laying out professional goals and reasons for applying
  - Statement of Interest – We are looking to admit graduate students who are passionate about learning and exploring environmental science and management. We would like to hear how students think the program will help them achieve their professional goals. We welcome applicants who have varied cultural, educational, and socioeconomic backgrounds.
  - The Statement of Interest should directly answer each of the following questions individually. Your statement should be no more than 2 pages.
    - Why are you seeking a graduate degree in CEOE at the University of Delaware?
    - What knowledge and skills do you hope to gain from the graduate program that will be useful to your long-term career goals? We are looking for evidence that you are passionate about environmental issues and see connections between those issues and the curriculum.
    - The Environmental Science and Management degree is interdisciplinary, asking you to engage with both natural and social sciences. How do you see the degree supporting your interests and goals?
    - The graduate student experience and life in general involves a range of challenges. Describe an example of how you have shown resilience and/or perseverance in the pursuit of your academic goals or in your personal life and how you have grown as a result.

- [Optional] Please add anything you would like to say in support of your application or anything that puts your application in a broader context that is not addressed by these questions (e.g., other relevant certifications or standardized examinations).
  
- Three letters of recommendation
- International student applications must include TOEFL, TOEFL Essentials, or IELTS scores or a waiver of proof of English Proficiency and certified English translation of all materials when applicable. International students must have a TOEFL score of 90 or higher, and TOEFL Essentials score of 9 or higher or an IELTS score of 7 or higher. Alternatively, international student applicants can show proof of having graduated from an undergraduate or graduate program in a country where English is the primary language. TOEFL or IELTS scores must be within the last two years.

***B. Prior Degree Requirements***

A four-year U.S. bachelor's degree (or its equivalent) in any academic field from an accredited college or university is required.

***C. Application Deadlines***

December 15 for priority fall admission (with April 15 as a final deadline)

***D. Special Competencies Needed***

Applicants may come from any undergraduate/graduate major. Majors in natural science, environmental science, environmental studies, mathematics, applied mathematics, economics, policy, or engineering are good backgrounds but not required. At least one course in each of environmental science or studies, and pre-calculus or statistics is expected.

***E. Admission Categories***

No categories other than regular admission

***F. Other Documents***

None.

***G. University Statement (required)***

Admission to the graduate programs is competitive. Those who meet stated requirements are not guaranteed admission, nor are those who fail to meet all of those requirements (except the English as a foreign language minimum) necessarily precluded from admission if they offer other appropriate strengths.

### III. Academic

#### A. Degree Requirements

1. *List course requirements according to categories such as core requirements, concentration requirements, electives, research credits and dissertation credit requirements. List number of credits in each category and include total credits required for degree.*

Courses requirements are listed in the table below. Please note that all students must choose either the Marine Science, Climate Science or Earth Resources track. In each track, a student selects two science courses and two management courses as electives.

<i>Area</i>	<i>Requirements</i>	<i>Credit Hours</i>
<i>Management Foundation</i>	Choose one: UAPP 707 Public Policy Analysis UAPP 690 Seminar: Public Administration  and MAST 675 Natural Resource Economics	6
<i>Environmental Science Foundation</i>	ENSC601 Fundamentals of Environmental Science	3
<i>Data Analysis</i>	Choose two: SPPA 704 Advanced Quantitative Methods SPPA 721 Data Science Tools for Evidence-based Policy GEOG 604 GIS for Environmental Research	6
<i>Science-Management Connections</i>	Choose one: MAST 610 Coupling Human to Natural Systems MAST 628 Offshore Wind Power	3
<i>Marine Science Track</i>	Pick two science courses: MAST602 Physical Oceanography MAST609 The Ocean and Climate Change MAST621 Coastal Field Biology MAST627 Biological Oceanography MAST637 Geological Oceanography MAST646 Chemical Oceanography  Pick two management courses: MAST619 Environmental Justice in Disasters (owned by SPPA) MAST628 Offshore Wind Power MAST662 Climate Change: Policy, Equity and Mitigation MAST674 Legal Aspects of the Coastal Zone MAST 676 Environmental Economics	12
<i>Climate Science Track</i>	Pick two science courses: MAST609 The Ocean and Climate Change GEOG612 Physical Climatology GEOG657 Climate Dynamics GEOG658 Paleoclimatology	12



	<p>Pick two management courses:            ENEP626 Climate Change: Science, Policies &amp; Political Economy            GEOG616 Climate Fiction, Science and Communication            GEOG619 Climate Change Adaptation            MAST639 Renewable Energy and Climate: Law, Regulation, and Environment            MAST662 Climate Change: Policy, Equity and Mitigation            MAST688 Climate Change Economics</p>	
<i>Earth Resources Track</i>	<p>Pick two science courses:            GEOL612 (1 credit) Geology of Strategic Mineral Deposits and            GEOL613 (2 credits) Analytics of Minerals for Risk Management            GEOL621 Environmental and Applied Geology            GEOL628 Hydrogeology            GEOG632 Environmental Hydrology            PLSC640 Field Methods in Soil-Water-Air            PLSC621 Nonpoint Source Pollution</p> <p>Pick two management courses:            MAST 676 Environmental Economics            GEOG 622 Resources Development and the Environment            UAPP 611 Regional Watershed Management            APEC 820 Experimental Economics            GEOG655 (1 credit) Certification Systems for Sustainable Development and            GEOG669 (2 credits) Minerals and Ecological Economics</p>	12
<i>Capstone Experience or Analytical Paper</i>	<p>Required:            MAST 663 Decision Tools for Policy Analysis</p> <p>and</p> <p><u>Capstone Experience</u>            MAST 664 Environmental Issue Capstone            or  <u>Analytical Paper</u>            MAST 865 MMP Analytical Paper</p>	6
<b>TOTAL CREDIT HOURS</b>		<b>36</b>

2. Give non-registered requirements in detail; includes residency requirements, qualifying examinations (number and format), portfolios, seminars, English proficiency, language requirements, teaching experience, internships, etc.

Residency

In-person students are expected to be in residence for the fall and spring semesters for two years.

Qualifying Exams

There is no qualifying exam.

Seminars

Students are expected to be active in group lunches and seminars on campus and off campus in a way that is beneficial to their graduate education. CEOE and the Graduate College have student travel funds that students may use for presentation of papers/posters off campus. Students apply for these funds. Students report their activity in professional development on their annual progress report.

English Proficiency

English proficiency is required. All written and oral communication is in English.

Other

There is no portfolio, language, teaching, or internship requirement.

**3. Give procedure for petitions for variance in degree requirements (e.g., course substitution policies, completions deadlines, etc.)**

All petitions for variances in the degree requirements are handled by the Academic Program Committee. Requests must be made in writing. The request should explain why the variance is sought and include written support from at least one CEOE faculty member. The committee reviews the request and issues a written determination for the student's record.

**4. Define any grade minimums in courses that are different from university policy.**

Minimums follow university policy.

**5. Identify any courses, which may not be used towards the degree (i.e., independent study, pre-candidacy study).**

Electives must be approved by the academic advisor.

**6. Identify expectations of facility of expression in English (oral and written) as part of the degree requirement.**

English proficiency is required. All written and oral communication is in English.

**B. Committees for exams, thesis, or dissertations**

**1. Identify initial procedure for advisor and advisement procedures.**

Students in the Master's in Environmental Science and Management Program are assigned an advisor at the time of admission. The advisor will be a core CEOE faculty. The faculty advisor meets at least once per semester with each student to help in course selection, outside professional engagement, and other matters deemed necessary to advance the student's career. Students taking the Analytical Paper option will declare their intention at least one year before graduation and will be assigned a research faculty advisor. Students in this option typically have more interaction with their faculty advisor, as that faculty member is also responsible for directing and grading the paper.

**2. Identify each student committee needed and procedures for selecting committee members.**

There is no committee unless the student selects the Analytic Paper option, in which case the committee will be composed of the research director, another faculty member of CEOE, and a

third member who may be internal or external to CEOE. The committee will include one natural scientist and one social scientist.

**3. *Give deadlines for establishing and preparation for comprehensive examinations***

There is no comprehensive exam.

**4. *Give policies for dates of examinations, grading of committee examinations and retake options.***

There is no committee and no comprehensive exam. The written Analytic Paper will be reviewed, and approved if and when it is acceptable to a majority of the committee. An oral presentation of the analytic paper will also occur.

**5. *Given guidelines for approving research proposals involving human or animal subjects.***

Students engaged in research involving human subjects are expected to complete the appropriate [Institutional Review Board](#) (IRB) training and follow IRB guidelines as they pertain to their research. Details for creating consent forms and submitting studies for review by the IRB can be obtained from the Office of Research. The research cannot proceed until an IRB exemption or approval has been obtained. IRB forms also require the approval of the student's advisor. Students will also be required to take and pass the Responsible Conduct of Research training.

**6. *Define procedures for thesis approval in the department (e.g., role of department chair, dean, etc.).***

A student may write an analytical paper in lieu of the capstone experience. If so, the student must secure the approval of a CEOE-affiliated faculty member, who will offer guidance, direction, and development of the paper. The analytical paper is an article-length paper targeting publication in an appropriate peer-reviewed journal. The paper is evaluated by the faculty research advisor. The paper is approved when the research advisor, in agreement with the analytic paper committee, submits a grade for MAST 865 Analytical Paper. The faculty member has the option of requiring a presentation of the analytical paper in a seminar or conference setting. Actual publication is not required.

**7. *Define the departmental and student obligations for finding committee members.***

Students who elect the analytical paper option will identify committee members in collaboration with the research and academic advisor.

**8. *Define departmental and student obligations and procedures for change in committee members.***

Changes in committee membership are submitted in writing to the program director. The requests are decided in collaboration with the academic program committee.

**C. *Timetable and definition of satisfactory progress toward degree***

**1. Academic load expectations. Define normal progress and evaluation of performance.**

A full-time academic load is 9 credits hours per semester for each semester. All required coursework is completed in two years. The program is described for full-time students, but students may participate in a part-time capacity, which would influence time-to-degree.

Normal, full-time progress (capstone option) follows the schedule:

<b>Year 1</b>	<b>Year2</b>
<b><u>Fall (9 credit hours)</u></b> MAST 675 Nat Res Economics MAST 610 Coupling Natural & Human Systems or MAST 628 Offshore Wind Power ENSC 601 Fundamentals of Env Science	<b><u>Fall (9 credit hours)</u></b> UAPP 707 Policy Analysis MAST 663 Decision Tools for Policy Analysis Track Elective 2 or Data Analysis Elective 2
<b><u>Spring (9 credit hours)</u></b> Data analysis elective 1 Track Elective 1 Track Elective 2 or Data Analysis Elective 2	<b><u>Spring (9 credit hours)</u></b> MAST 664 Environmental Issue Capstone Track Elective 3 Track Elective 4

Example course progression: Marine Science Track

<b>Year 1</b>	<b>Year2</b>
<b><u>Fall (9 credit hours)</u></b> MAST 675 Nat Res Economics MAST 610 Coupling Natural & Human Systems or MAST 628 Offshore Wind Power ENSC 601 Fundamentals of Env Science	<b><u>Fall (9 credit hours)</u></b> UAPP 707 Policy Analysis MAST 663 Decision Tools for Policy Analysis MAST621 Coastal Field Biology
<b><u>Spring (9 credit hours)</u></b> SPPA 704 Advanced Quantitative Methods GEOG 604 GIS for Policy Analysis GEOG 619 Climate Change Adaptation	<b><u>Spring (9 credit hours)</u></b> MAST 664 Environmental Issue Capstone MAST 609 The Ocean and Climate Change MAST 676 Environmental Economics

Example course progression: Climate Track

<b>Year 1</b>	<b>Year2</b>
<b><u>Fall (9 credit hours)</u></b> MAST 675 Nat Res Economics MAST 610 Coupling Natural & Human Systems or MAST 628 Offshore Wind Power ENSC 601 Fundamentals of Env Science	<b><u>Fall (9 credit hours)</u></b> UAPP 707 Policy Analysis MAST 663 Decision Tools for Policy Analysis MAST 609 The Ocean and Climate Change
<b><u>Spring (9 credit hours)</u></b> GEOG 604 GIS for Environmental Research GEOG 612 Physical Climatology GEOG 619 Climate Change Adaptation	<b><u>Spring (9 credit hours)</u></b> MAST 664 Environmental Issue Capstone ENEP626 Climate Change: Science, Policies & Political Economy SPPA 704 Advanced Quantitative Methods

Example course progression: Earth Resources Track

<b>Year 1</b>	<b>Year2</b>
<b><u>Fall (9 credit hours)</u></b> MAST 675 Nat Res Economics MAST 610 Coupling Natural & Human Systems or MAST 628 Offshore Wind Power ENSC 601 Fundamentals of Env Science	<b><u>Fall (9 credit hours)</u></b> UAPP 707 Policy Analysis MAST 663 Decision Tools for Policy Analysis PLSC621 Nonpoint Source Pollution
<b><u>Spring (9 credit hours)</u></b> GEOG604 GIS for Environmental Research GEOG632 Environmental Hydrology UAPP611 Regional Watershed Management	<b><u>Spring (9 credit hours)</u></b> MAST 664 Environmental Issue Capstone MAST676 Environmental Economics SPPA 704 Advanced Quantitative Methods

The student completes a progress report at the end of each academic year and submits it to the academic advisor and the graduate committee of the advising department. These two entities evaluate the progress of the student and communicate to the student if the progress is less than satisfactory. The advisor also communicates to the student the actions that must be taken to make progress satisfactory.

**2. *Grade requirements (general and specific). Include any special departmental expectations such as minimum grades in specific courses, limits on special problem courses, etc.***

Students are expected to maintain a 3.0 GPA. There are no specific departmental or course grade requirements.

**3. & 4. *Thesis/dissertation progress timetable and defense guidelines.***

The capstone course is taken and completed in the spring semester of the student's second year. If the student takes the analytical paper (AP) option, the research faculty advisor for the AP is identified no later than the end of spring semester in the first year and may be different than the academic program advisor. If a new advisor is selected, that advisor assumes all advising responsibilities. The paper is due in the spring semester of the second year. There is no defense of the analytical paper but the advisor may require a public presentation for fulfillment of the AP.

**5. *Forms required.***

- Annual Progress report submitted to the Graduate Committee ([Link](#))
- Application for Advanced Degree ([Link](#))

**6. *Identify consequences for failure to make satisfactory progress.***

A student who is not making satisfactory progress will be issued a written warning by the CEOE Assistant Dean for Graduate Services. The warning will identify steps to make satisfactory progress and indicate the consequences of unsatisfactory progress. After a second semester of unsatisfactory progress, the student is issued a second warning, again with steps required to make satisfactory progress. After two semesters of unsatisfactory progress, the student will be

recommended for dismissal. All graduate students are subject to the University of Delaware Graduate Probation and Dismissal Policy, as stated in the University Catalog.

7. *Protocol for grievance procedure if a student has been recommended for termination for failure to make satisfactory progress.*

A student that has been recommended for dismissal for failure to make satisfactory progress may file a grievance based on Graduate College policies.

## **IV. Program Educational Goals**

Governance structure:

The Environmental Science and Management program has a Faculty Director and an Academic Program Committee which handle program evaluation, revision and administration. The Faculty Director is responsible for providing information about program-related seminars and professional development opportunities, and approving students who want to take the Analytical Paper option after they select a research advisor. Admissions will be handled by a committee made up of the graduate program directors from the Department of Earth Sciences and the Department of Geography and Spatial Sciences, and the Graduate Committee from the School of Marine Science and Policy. Student recruitment, and advice on student course selection, and general student services and professional development will be provided by the CEOE Assistant Dean for Graduate Services. The Faculty Director and the CEOE Assistant Dean for Graduate Services will assess student progress toward degree completion.

The objective of the degree is to train environmental scientists and managers with a practical orientation and an ability to provide data-based information that is rigorous and useful in the environmental management process. Students who successfully complete the program will be able to:

- Demonstrate fundamental interdisciplinary knowledge of environmental science, management, data analysis, policy, and economics to apply in response to real-world environmental science challenges.
- Integrate natural and social science data, perspectives, and knowledge to advance the management of coupled human and natural systems
- Synthesize the key insights from new research within their track to develop and implement management improvements of an environmental system.
- Categorize and assess relevant physical processes and implement appropriate quantitative metrics for addressing critical environmental challenges within their track.
- Apply organizational, collaborative, and critical thinking skills in real-world scenarios based on experience gained in a group capstone research project.
- Communicate scientific concepts and knowledge in oral and written form

These goals are manifest in the requirements for the master's degree. They are measured directly in the courses through assignments and oral presentations, project reports, and final examinations (see table below for specific goals).

The capstone course provides student teams with the opportunity to apply their learned knowledge and skills to environmental problems for real clients. Clients will include businesses, government agencies, and non-profit organizations that have a real-world problem they would like a team of students to help solve. Examples of potential clients are the Northeast Fisheries Science Center, and DNREC. Clients and projects are identified annually by the faculty instructor with assistance from the Academic Program Committee. The capstone is designed to help the client decide what to do on a policy problem. The

student teams will develop a work plan, work as a team, apply appropriate decision tools, and communicate with stakeholders through formal written and oral presentations. Success in the capstone course is measured by the external sponsor, the faculty instructor selected core CEOE faculty, and students in self- and peer- evaluations. External sponsor and faculty evaluations are based on a rubric that assesses clarity of problem definition and criteria selection, appropriate evaluation of evidence, relevant cost-benefit and tradeoff analyses, correct report preparation, and clear presentation of conclusions and recommendations. Since the capstone course is a real-world project experience, this assessment is critical. Self- and peer-evaluations will be completed on Canvas and will include metrics on quality and quantity of work, teamwork and leadership skills, and provide space for open-ended feedback.

Each year the Academic Program Committee relevant program faculty, composed of both natural sciences and social scientists, along with the faculty instructors of the courses where the ESM students are together (MAST675, ENSC601, MAST610, and MAST664) will meet at the end of the spring semester to evaluate strengths and weaknesses of the capstone experience and the curriculum leading to the capstone to prepare for the next year. Focus will be placed on the work plan and final project of the capstone course, along with the self- and peer-evaluations. Faculty teaching in other courses in the curriculum will be asked to provide feedback on the metrics listed below as part of this assessment. Through that learning process, the capstone experience, and the curriculum more generally, can be continually updated and improved to meet the goals of the degree. As part of the review process, we will also communicate and collaborate with other programs, internal and external to UD, using an environmental capstone approach to refine the program and this culminating experience.

This regular review of the capstone course and the educational program upon which it is based, including the metrics set out below, may lead to discussion and evaluation of other courses and activities and the disciplinary tracks that are intended to prepare students to successfully complete the capstone and prepare them for the world beyond.

<b>Program-Level Educational Goal</b>	<b>Skills</b>	<b>Course(s), metric</b>
<i>Non-disciplinary specific</i>		
Demonstrate professional skills in simulated workplace project	Coordinate and collaborate on complex project, requiring ordering of multiple sequential and overlapping tasks	MAST/UAPP663, MAST664, work plan and final project evaluation
<i>Disciplinary - breadth</i>		
Apply knowledge of critical environmental issues through analysis of case studies	Critical thinking. Reason scientifically. Analyze information.	ENSC601, literature annotation and case study project
Structure problems, understand context, and explore alternative policy and management solutions	Develop problem-solving and decision-making competencies. Analyze arguments and information. Critically evaluate ethical implications.	UAPP707, POSC818, UAPP690, readings and discussion, MAST/UAPP663, assignments and final project

Apply skills in natural resource economics to environmental management issues	Reason qualitatively, quantitatively and computationally.	MAST675, problem sets and exams on optimal extraction/management of resources
Develop and apply data analysis skills for application to environmental problems	Reason scientifically, computationally.	SPPA704, SPPA721, GEOG604, final projects
<i>Disciplinary - integration</i>		
Integrate natural and social science data, perspectives and knowledge to advance the management of coupled systems	Analyze arguments and information. Critically evaluate ethical implications. Reason qualitatively, quantitatively and computationally. Work in teams.	MAST610, MAST628, final project presentation and paper
Demonstrate professional oral and written communication skills and organizational and critical thinking skills through a group capstone project developed in response to a real-world scenario.	Analyze arguments and information. Critically evaluate ethical implications. Reason qualitatively, quantitatively and computationally. Work in teams.	MAST664 (MAST628)
<i>Disciplinary - specific (conc)</i>		
Acquisition and demonstration of knowledge depth in one area through 12 credits related to disciplinary track.	Critical assessment and synthesis of written information	See course list for tracks, assessed through course deliverables

## V. Financial Aid

### A. Financial Awards

#### 1. *Types of awards, policy for granting awards, summer appointments, and number of years of support.*

Most MS students in the ESM program do not receive funding. Some highly qualified applicants may receive a fellowship or research assistantship if they choose to participate in a research project.

#### 2. *Responsibilities of students on contract.*

Students receiving full funding are expected to work 20 hours per week on faculty projects.



**3. *Evaluation of students on contract.***

The CEOE Assistant Dean for Graduate Services, and the faculty member providing funding (typically the student's research advisor) review a student after each semester in terms of progress toward degree and performance on the project. Students are given feedback if progress and/or performance is not satisfactory. After two semesters of unsatisfactory progress or performance, the contract may be terminated.

**VI. Departmental Operations**

***A. General student responsibilities***

It is the student's responsibility to satisfy all University requirements described in the Academic Regulations for Graduate Students section in the Graduate Catalog, as well as any additional requirements established by the faculty in the academic program in which the student is enrolled. All students enrolled at the University of Delaware are subject to student life policies set by the University and documented in the University publication, [Student Guide to University Policies](#).

***B. Student government and organizations (both student and professional)***

Students may participate in graduate student governments for the School and the University. Students may also participate in the National Association of Environmental Professionals, the Association for Environmental Studies and Sciences, or the many other national and international professional organizations related to their track.

***C. Travel for professional meetings and presentations***

Participation in professional meetings and training workshops is strongly encouraged. CEOE often provides travel funds for students in conjunction with grants from the Graduate College.

**Resolution:**

Graduate program in Environmental Science and Management Resolution

WHEREAS, the stewardship of the environment is a critical responsibility for current society,

WHEREAS, there is a significant and growing demand for applicants with postgraduate interdisciplinary professional education in environmental science and management, and

WHEREAS, graduate students are attracted to the University of Delaware because of the opportunity to participate in its long tradition of engaged learning, applying knowledge, and developing solutions to the critical challenges facing communities in Delaware, across the nation, and around the world, and

WHEREAS, the proposed course of study contributes to the University's strategic goals of developing marketable and adaptive graduate programs, enhancing the success of our students, strengthening interdisciplinary learning, and fostering a culture of innovation, be it therefore

RESOLVED, that the Faculty Senate of the University of Delaware approves the Master's of Science graduate program in Environmental Science and Management, effective September 1, 2022.