# ECS Capstone Guide: 2022-2023 Academic Year

*Key contacts*:
Undergraduate Coordinator: Alice Doughty, alice.doughty@maine.edu
ECS Administrative Assistant: Linda Cappuccio, linda.cappuccio@maine.edu

## 1. Introduction

A Capstone Experience is an essential part of undergraduate education at the University of Maine. The university guidelines state that the aim is "to draw together the various threads of the undergraduate program that bear directly upon the academic major in an experience that typifies the work of professionals within the discipline. Normally, the Capstone would conclude at the end of the student's senior year. Students should consult closely with their academic advisor to explore the range of options available for meeting this requirement."

Below are specific guidelines and unique opportunities for students majoring in Earth and Climate Sciences (ECS). Depending on the option chosen, the capstone experience can help students develop research skills, gain field or laboratory experience, connect with professional geoscientists, and/or build understanding and awareness of the role of Earth and Climate sciences in sustainability solutions and natural resources management. We recommend that you read these guidelines carefully and consult with your mentors to determine which experience would work best for you.

## 2. Capstone Overview

Students completing a Capstone experience in Earth and Climate Sciences will:

- Develop problem-solving skills while working within a natural system. Natural systems include complex, variable, and non-ideal behavior. We expect ECS majors to work within those systems to (a) define the relevant types of observations necessary to solve a given problem, (b) execute and record those observations, and (c) synthesize those observations to solve the problem.

- Apply spatial cognition and reasoning skills and/or computational techniques to develop an understanding of a natural system.
- Discuss their topic/research within local, regional, and global Earth and climate science contexts.

The Capstone requirement can be satisfied by completing ONE of the following:

- ERS 410: Sea-to-Sky
- ERS 499: Field/Research Experience
- ERS 498: Senior Thesis in Earth and Climate Sciences (x 2 semesters)
- HON 498 & HON 499: Honors College Thesis on an Earth or Climate Science topic

Students MUST inform the Undergraduate Coordinator (Alice Doughty) of Capstone plans by the end of the third semester *prior* to their planned completion of Capstone (e.g., in December of your third academic year if you plan to graduate in spring or summer of your fourth academic year). In ERS 320, a required course for all ECS majors, students will write a brief statement on their capstone plans and receive guidance on how to achieve them.

# 3. Options

| Summary Table | **ERS 410: Sea to Sky** | **ERS 499: Field Camp** | **ERS 499: Independent Project** | **ERS 498: Senior Thesis** | **HON 498 + 499: Honors Thesis** |
|---|---|---|---|---|---|
| **Prerequisites** | None | Acceptance into a field program | Acceptance into an REU program or research opportunity with a faculty mentor, approval of research proposal | Support of a faculty mentor and approval of thesis proposal | Enrollment in the Honors College |
| **Credits** | 3 credits (+3 credit prerequisite) | 4-6 credits | 6 credits (3 + 3, two semesters) | 6 credits (3 + 3, two semesters) | 6 credits (3 + 3, two semesters) |
| **Funding opportunities** | Subsidized by ECS Golden Fund 2022-2032 | ECS Field Camp Scholarships, AGI Scholarships, CUGR … | NSF REU program, UMaine CUGR funds … | UMaine CUGR funds | UMaine CUGR funds |
| **Time commitment** | Spring semester course plus two-week trip in May. | Varies. Usually 4-6 weeks. | Varies. | Typically a year-long project. | Typically a year-long project. |
| **Additional comments** | Opportunity to travel and learn with ECS cohort. | Opportunity to study Earth sciences at a location outside of Maine with students from other programs. | Opportunity to conduct research. Requires strong motivation and organization. | Opportunity to conduct research. Requires strong motivation and organization, written thesis, and oral defense. | Requires strong motivation and organization, written thesis, and oral defense. |

These experiences prepare students for several professional pathways, including (but not limited to): 1) Academic teaching and/or research, 2) field science, 3) laboratory science, 4) science writing and communication, 5) natural resources management. A thesis is particularly good preparation for graduate research programs.

# ERS 410: Sea-to-Sky

Many critical processes in the Earth and climate sciences occur at interfaces among the atmosphere, cryosphere, hydrosphere, biosphere, oceans, solid earth, and society. Using an interdisciplinary systems-based approach, as well as the ability to make direct observations, are essential to understanding these processes. ERS 410 will visit a region where a wide range of environments - everything from open ocean ("sea") to glaciers ("sky") - can be experienced. During this travel study course, we will focus on a range of professional and practical skills, including global impact/local relevance research, proposal development, science planning and logistics, risk assessment and mitigation, safety, group dynamics and collaboration, field-based and remote observations, cultural knowledge, and science communication.

# ERS 499: Field Camp or Independent Project (non-thesis)

## Field Camp

If you choose this option, you will complete an approved four- to six-week field camp (in field preferred, remote option available with approval). ERS 499 augments lecture- and laboratory-based learning by providing real-world field, laboratory, and/or computational experience. The skills developed in a field course are highly valued in many geoscience professions. Because this course combines academic and experiential learning with problem solving and refining of earth and climate science skills, the course also serves as the Capstone course for our undergraduate degrees.

The steps you should follow to get credit for ERS499 via this path are:

1. At least six months before field camp (Winter or Summer term), discuss with your academic advisor places you are considering applying. They will be able to give you guidance and identify the kinds of programs that are approved as a Capstone experience. Here is a website with a list of programs (https://geology.com/field-camp.shtml) and previous students recommend South Dakota School of Mines; Juneau Icefield Research Program; Lehigh University. There are also a growing number of programs that are striving to

make field experiences more accessible to all students, including those who identify as disabled (for example., The GeoSPACE Project, https://sites.google.com/ufl.edu/geospace-field-program/home).

2. Apply for field camps (deadline is typically in January for summer camps).
3. Once you are accepted, email Alice Doughty (alice.doughty@maine.edu) and Linda Cappuccio (linda.cappuccio@maine.edu) with the name and location of the camp you will be attending.
4. Check the field camp medical requirements, such as a COVID vaccine well before your travel date.
5. If you are staying in the United States
    a. Complete the domestic study away form (on Student Records website under forms) and send it to Alice Doughty and Linda Cappuccio.
    b. Work with Financial Aid regarding the transfer of scholarship money (see below)
    c. File a detailed travel itinerary via email to Alice Doughty and Linda Cappuccio. Information required:
        i. Name of Camp
        ii. Sponsoring University
        iii. Camp Director's Name
        iv. Camp's address and email for official business
        v. Travel plans to, from, and while at camp:
            - Dates
            - Flight/bus details. If driving, route and planned stops
            - Field camp schedule (can be copied from camp syllabus)
            - Emergency contact info:
                - Yours (phone and email)
                - Your In-Case-Of-Emergency Person contact details (name, relationship, phone and email)
6. If you are traveling internationally, see International Programs immediately (https://umaine.edu/international/home/about-oip/contact-oip/). Also work with Financial Aid (https://umaine.edu/stuaid/ ) to be sure credit from field camp can transfer to UMaine for ERS 499.
7. Check the registration and travel costs; apply for funding as needed.
8. If you need a Brunton, we have some available for loan. See Linda Cappuccio. You will need to give her a $200 deposit (by check) that will only be cashed if the compass is lost or damaged.

9. Final Step: Once you receive a grade, contact your field camp host and request that they send a transcript to the UMaine Office of Student Records. Please email Alice Doughty once the credits have transferred into your MaineStreet account. Let Alice know if you would recommend the camp to others.

# Independent Project

Students may pursue ERS 499 as an independent study through the University of Maine School of Earth and Climate Sciences or a NSF-sponsored Research Experience for Undergraduates if the following conditions are met:

1. The student is working on a field related project with a UMaine School of Earth and Climate Sciences faculty member OR as a participant in a field related project in a NSF REU program.

2. The work accomplished is the equivalent of a full-time, 4 week academic course. (1 credit = 45 hours…4 credits = 180 hours)

3. Prior to departure for the field or the beginning of the project, the student has received permission from the Undergrad Coordinator to register for 4-6 credits in the semester in which they are completing the course.

Permission will be based on:

- a. Preparation of a document by the student and the faculty or REU advisor that lists the tasks to be completed as part of ERS 499. These include:
    - A demonstrated understanding of the background geology of the region to be investigated.
    - Collection and recording of field data (or familiarity with techniques used in the case of existing data) using spatial and written formats (ex. Notation on air photos and published maps, GIS coverages, field notes)
    - Reduction of field data in appropriate format (graphic or written)
    - Interpretation and presentation of field data in a graphical and/or written format.
- b. Preparation of a rubric explaining how the student will be graded in the completion of the above tasks.

Both documents will be signed by the student, advisor, and the field camp committee.

4. After the above steps are completed, the student registers for ERS 499 prior to beginning the project or departure for the field. If international travel is part of the project, students must contact the UM International Program Office to make arrangements for permission to travel abroad as a UMaine student.

5. Finally, the student should plan to present a poster or oral presentation on their work at one or more of the following venues:

- University of Maine Research Exposition
- Climate Change Institute Borns Symposium
- Geological Society of Maine Annual Spring Meeting (Student Meeting)
- Other professional meeting

*Specific steps for each Independent Project option (Research Experience at UMaine and NSF REU) are provided below.*

# Research Experience at UMaine (non-thesis)

This may be a good option for students who are interested in devoting significant time to research and gaining first-hand experience with the scientific process. This option does not involve a written thesis and defense before an advisory committee, but still requires synthesis and presentation of results – for example, presenting a poster at the UMaine Student Symposium, typically held in April each year.

*Definitions:*
**Academic advisor** – The person at UMaine who regularly advises you on academic matters and approves your class schedule each semester.
**Research mentor** – The person who, if they agree to work with you on a project, mentors you through the research process.

To pursue this option:

1. Work with your ECS research mentor to produce a high-quality proposal. You will need to present your research at a conference or at UMaine, please include where and when you intend to present your work in the proposal.

2. At least two months before your planned experience, you must submit a letter of commitment from your research advisor and a 1-2 page proposal to Alice Doughty which: describes the planned experience AND explains how the experience meets the expectations of ERS 499 AND satisfies the expectations of the Capstone requirement. See detailed guidelines in Section 9 below.
3. Alice Doughty and the Scholarship Committee must approve your proposal.
4. Register for ERS 499. (Two semesters are required for a capstone, so plan ahead.)
5. To get credit for ERS 499 as a capstone, you must complete research, synthesize your results, and present your research to some audience, either at UMaine or at a professional geosciences meeting.
6. The research advisor will need to email Alice Doughty before grades are due to confirm that the project has been satisfactorily completed.

# Research Experience – NSF REU

This could be a good option for students who wish to travel and pursue research opportunities at other institutions. Students pursuing this option must be prepared to participate in a competitive application process, and it is a good idea to have a backup option in mind in case the student is not admitted into an REU program. There are many exciting programs available; details are provided below.

*Definitions*:
**Academic advisor** – The person at UMaine who regularly advises you on academic matters and approves your class schedule each semester.
**Research mentor** – The person who, if they agree to work with you on a project, mentors you through the research process.

The steps you should follow to get credit for ERS 499 via this path are:

1. Several months to a year in advance, explore options on the NSF Research Experience for Undergraduates website: https://www.nsf.gov/crssprgm/reu/reu_search.jsp and/or at UMaine.
2. Discuss options with your *academic advisor* at UMaine and contact individual programs if you have specific questions or need more information.

3. Inform Alice Doughty of your plans to make sure that your target programs would be suitable for an ECS capstone should you be admitted to the program.
4. Check deadlines and apply for REU programs that can be completed by the time you plan to graduate. These programs are highly competitive, and it is a good idea to apply to multiple programs and also plan for a back-up, non-REU path. Some programs pay a stipend and also cover travel costs; check listings for details.
5. Work with an ECS *academic advisor* to produce a high-quality application.
6. Once accepted to a program, discuss your project with your *research mentor*. Submit a brief letter of commitment from your *research mentor* and a 1–2-page proposal *that you have written*, describing how the project will meet capstone requirements, to Alice Doughty (see detailed instructions below in section 3).
7. Alice Doughty and the Scholarship Committee must approve your proposal.
8. Register for ERS 499.
9. The *research mentor* will need to email Alice Doughty before grades are due to confirm that the project has been completed. If a final presentation of some kind was not part of your research experience, then you'll be required to present your work at UMaine either at the annual student symposium (typically held in April of each year) or some other public event.

# ERS 498: Senior Thesis

This can be a good option for students who are passionate about research and are willing to put considerable time and effort into a focused project. A senior thesis can be particularly helpful preparation for graduate school and/or careers that involve independent research.

*Definitions*:
**Academic advisor** – The person at UMaine who regularly advises you on academic matters and approves your class schedule each semester.
**Research mentor** – The person who, if they agree to work with you on a project, mentors you through the research process.

The steps you should follow to earn Capstone credit via this path are:

1. At least a year in advance, consider what type(s) of research interest you the most and would assist you in attaining your career goals.
2. Start contacting potential research mentors to discuss opportunities. *Understand that faculty are not under any obligation to take on an undergrad research project.*
3. Submit a letter of commitment from your *research mentor* and a 1-2 page proposal to Alice Doughty (see detailed instructions below).
4. Alice Doughty and the Scholarship Committee must approve your proposal.
5. Register for ERS 498 (you will need two semesters of ERS 498, so if graduating in the spring or summer, sign up for ERS 498 in both the fall and spring of your final year = total of 6 credits).
6. In consultation with your primary thesis advisor, invite at least two other faculty or staff members to serve on your thesis committee. There is no minimum or maximum number of committee members, however, three is a good target.
7. Submit and defend your final thesis to your thesis committee. Complete revisions as needed.
8. Submit a final, approved, written thesis to Linda Cappuccio so that it may be added to our digital thesis library.

## HON 498 & 499: Honors College Thesis

This option is available to students enrolled in the Honors College. Please check their webpage for details and prerequisites:

https://honors.umaine.edu/current-students/academics/thesis/

# 4. Instructions: Letter of Commitment & Research Proposal

Selection of NSF REU or senior thesis requires students to be proactive in identifying a path to satisfy the Capstone requirements. Recognize that not all REU supervisors

or faculty members may be able to serve as advisors in any given year; *agreeing to supervise a project is at their discretion.*

At least two months before your planned experience, you must submit a letter of commitment from your faculty advisor and a 1–2-page proposal to Alice Doughty which:

- describes the planned experience
- explains how the experience meets the expectations of ERS 499 or ERS 498 AND satisfies the expectations of the Capstone requirement.

More specifically, a proposal must demonstrate how the experience:

a. draws together the various threads of the School's undergraduate program
b. typifies the work of professionals within the discipline
c. develops problem-solving skills while working within a natural system
d. develops spatial cognition and reasoning or develops significant laboratory or computational skills.

There is no length minimum or maximum for the research proposal, however, the document must clearly address the elements listed above and include an abstract as well as references. Relevant sections may include introduction or background, methods, results of prior work, and/or discussion. Any figures or tables must also be accompanied by captions.