

## The Changing Arctic: Arctic Ecology in the 21<sup>st</sup> Century



The Arctic is Earth's most rapidly warming biome. It is also home to massive carbon reservoirs and diverse biological adaptations to extreme elements, as well as oil extraction and vanishing sea ice. We will examine how climate change is impacting the biodiversity, ecophysiology, and biogeochemistry of this crucial biome, and as a result, the rest of the world.

### COURSE LOGISTICS

**Instructor:** Prof. Mary Heskell; [mheskel@macalester.edu](mailto:mheskel@macalester.edu)\*

**Class:** MWF 1:10-2:10 PM; Theater 204

**Office Hours:** Thursday, 4-5PM in Olin Rice 220, or by appointment

**Texts:** Tundra-Taiga Biology by R.M.M. Crawford (Oxford Press); all other articles and media will be made available through Moodle.

**Email Policy:** I will respond to emails promptly between 9AM-5PM on weekdays; emails received after 5PM will be answered the following morning. I often cannot answer emails over the weekend, so plan accordingly.

**Out of class work expectations:** Readings and daily assignments should take ~1.5-3 hrs. Longer assignments and group work will require more time to be scheduled. If you are having trouble working in a group setting due to work or class scheduling conflicts, let me know.

**Developing your voice in science:** Science requires a balance of courage and humility – this is as true for undergraduates as it is for researchers at leading institutions. You need courage and confidence to pursue and develop new ideas and approaches, confidence to critique others' ideas, confidence to follow your curiosity. But science also requires humility – identifying limitations, asking for advice, help and guidance, accepting appropriate criticism from others, and reflecting on improvement. As you develop your thoughts and opinions in this class, be mindful that we are also collectively creating a community of learning.

### **LEARNING GOALS**

As an upper-level biology course, Arctic Ecology aims to challenge students to improve their science communication skills through varied written, spoken, and visual presentations. Students will also be challenged to synthesize content across systems and create novel hypotheses about current and future impacts of change at a species, community, ecosystem, and landscape scale.

1. Interpret, critique, and evaluate scientific and general audience articles.
2. Connect major drivers of environmental and ecological change in the Arctic and hypothesize outcomes based on theory, first principles, and experimental evidence from the literature.
3. Deeply consider and evaluate a topic of interest in Arctic Ecology through a targeted and analytical review of the literature.
4. Identify recent issues in Arctic and interpret for a general audience.
5. Write about complex scientific concepts in multiple tones and voices for different audiences.
6. Build confidence in discussing concepts in class, asking probing questions, and encouraging the engagement of peers.
7. Effectively communicate ideas through conceptual diagram, writings, visual and spoken presentations.

### **ASSESSMENTS**

**Mini-Quizzes:** MQs are 1-3 questions quizzes on Wednesdays. After completing the quiz (~10 min), students will work in small groups (2-4) to discuss answers, after which we will discuss them as a group. They are ungraded (C/NC) and questions may reappear on exams!

**Reading Responses:** Responses will be due by 10 AM the day of discussion. The prompts for discussion are outlined on the document "Reading Responses" on Moodle. These will include identifying major components of the factor, selecting a figure of interest to dissect, and providing a discussion question.

**Discussion Engagement:** For each discussion, two students will be randomly drawn as 'moderators', 1 student will be a 'recorder', and all other students will be 'participants'. Roles are outlined in a document on Moodle.

**Arctic Current Event Group Presentation:** Early in the semester, students will work in groups of 3 on a topic of Arctic Science that has been in the news in the past 1-2 years. Students will create a short 6-minute presentation together that will emphasize different perspectives on the issue. More details on Moodle.

**Analytical Perspective:** The analytical perspective will be based on a primary literature scientific article that we have covered (or one we will cover later on in the term), and translate this article into an accessible writing for a general, non-expert audience. Highlight major findings and potential controversies in a way that would relate this topic to a broader audience. (~500 words).

**Editorial Perspective:** The editorial perspective is based on a topic of interest in Arctic Ecology and will be a ~500-word argumentative/persuasive essay written in the style of a newspaper Op-Ed. Must refer to at least 2 primary research articles.

**Big Quizzes:** These ones are graded and not collaborative! A Big Quiz (BQ) will cover multiple weeks of content and should take approximately 45 minutes. Questions are in the same style as MQs.

**Literature Review:** The major independent assessment for this course is based on a Capstone style paper. The Literature Review (LR) will identify and focus on a narrow topic that need expanding...and you will expand it through a deeper dive into primary literature. Because this is a larger assessment, it is split into multiple smaller elements, including: Topic & Reference Identification; 1:1 meetings, Abstract & Visual Conceptual Diagram; Peer Review; a First Draft (for capstone option); and a Final Draft. The paper will follow guidelines outlines on the LR doc on Moodle.

Assessment	Due	Points	%
MiniQuizzes (MQ)	Weekly	50	5%
Reading Responses	10 AM day of discussion; 10 total	10 each; pts = 100	10%
Discussion Engagement	Weekly in class; ~10 total	100	10%
Current Event Group Presentation	February 13	50	5%
Analytical Perspective	March 6	100	10%
Editorial Perspective	April 5	100	10%
Big Quiz #1	February 27	125	12.5%
Big Quiz #2	April 15	125	12.5%
Literature Review		250	25%
- Topic & 3 Refs	March 29	C/NC	-
- Individual Meeting	April 1-5	C/NC	-
- Abstract & Conceptual Diagram	April 10	50	5%
- First draft (for Capstone)	April 24	C/NC	
- IGNITE Presentation		50	5%
- Final Draft	May 8	150	15%

Total Points Possible: 1000

**Learning environment and inclusivity.** My goal is to promote an inclusive learning environment where diverse perspectives are recognized, respected, and seen as a source of strength. Part of that effort includes a recognition that all humans have implicit biases, and it is our responsibility to do our best to identify them in ourselves and take actions to mediate them. If something in or about this class makes you feel unwelcome, please see me, your advisor, a professor you trust, or a college administrator.

**Names and pronouns.** You should be addressed in the manner that you prefer. If you want to make sure I address you with a particular name and/or pronoun please let me know.

**Title IX.** Macalester College is committed to providing a *safe learning environment* for all students that is free of discrimination, sexual harassment, sexual assault, domestic violence, dating violence, and stalking. Further details are explained in the college's Title IX regulations (<https://www.macalester.edu/titleix>). If you, or someone you know, experiences a Title IX violation, know that Macalester has staff trained to support you. Macalester faculty members are "responsible employees," which means that if you tell me about a Title IX violation, I must share that information with the Title IX Coordinator. Still, you will control how your case is handled, including whether or not you wish to pursue a formal complaint. Our goal is to make sure you are aware of the range of options available to you and have access to the resources you need (Title IX Office, 651-696-6258) including, if you wish, confidential sources on campus who are not subject to the mandatory reporting requirement (see list of "Confidential On-Campus Support" at <https://www.macalester.edu/violenceprevention/support/>).

**Accessibility.** I want all students to have fair and equitable access to the learning opportunities in this course. If there are aspects of the instruction or design of this course that result in barriers to your inclusion or to accurate assessment of achievement, please notify me as soon as possible. Students are also welcome to contact the disability service office to discuss a range of options to removing barriers in the course, including accommodations (contact Disability Services, 651-696-6275 or [disabilityservices@macalester.edu](mailto:disabilityservices@macalester.edu)). Once you have a letter of accommodations, please see me so that we can implement an action plan. Furthermore, I know that at times personal issues, stress, health problems or life circumstances may impact your ability to perform academically. Please contact the Office of Student Affairs at 651-696-6220 ([studentaffairs@macalester.edu](mailto:studentaffairs@macalester.edu)) for support and ask them to get in touch with your instructors.

**Other helpful information to support your experience in the class:**

- **Concerns on content or experience in the class** → find me before/after class; attend office hours; email to set up a time to meet in person.
- **Need additional writing support** → Check out MAX Center for writing tutors or Works in Progress peer review program (Kagin Commons, first floor)
- **Are you absent due to an unexpected event (sickness, family issue)** → Contact me as soon as possible to set up a time to talk about options.
- **Absence due to religious observance** → Please let me know you will be observing ahead of time, so that you can obtain course materials ahead of the absence.
- **Do you need to sleep? Of course you do. Take care of yourself. If you are feeling overwhelmed about the scheduling or pace of this course, please let me know.**

All readings, assignment descriptions, and other information about the course will be on Moodle. Moodle will be updated frequently, so please check regularly.			
Week: Topic	Monday	Wednesday	Friday
			1/25 Driving Questions & Course Overview
1: Climate & Cryosphere	1/28 The Cryosphere	1/30 Climate & Feedbacks	2/1 <a href="#">Discussion (MH)</a>
2: Paleo Arctic	2/4 Glacial Periods	2/6 Glacial to Present <a href="#">MQ</a>	2/8 <a href="#">Discussion</a>
3: Arctic Ecosystems	2/11 Tundra, Coastal, & Boreal systems	2/13 <a href="#">Arctic Current Events Group Presentations</a>	2/15 <a href="#">Discussion</a>
4: Humans in the Arctic	2/18 No Class Today	2/20 The Last Days of Shishmaref <a href="#">Discussion</a>	2/22 Humans in the Arctic w Prof. Scott Legge
5: Ecophysiology: Plants*	2/25 <a href="#">Big Quiz #1 (Wks 1-4)</a>	2/27 Metabolism & Adaptation	3/1 <a href="#">Discussion</a>
6: Ecophysiology: Animals	3/4 Big Animals	3/6 Small Animals <a href="#">MQ</a> ;	3/8 <a href="#">Discussion</a>
7: Trophic Systems	3/11 Trophic interactions	3/13 Migration & Trophic mismatch <a href="#">Analytical Perspective due</a>	3/15  <a href="#">MQ</a>
SPRING BREAK			
8: Arctic Carbon	3/25 Carbon Cycle I	3/27 Carbon Cycle II <a href="#">MQ</a>	3/29 <a href="#">Discussion</a> ; <a href="#">Topic &amp; Refs due</a>
9: Changing Landscapes <a href="#">1:1 Meetings</a>	4/1 <i>Dr. Mike Anderson Guest Lecture</i>	4/3 Arctic "Greening" & Shifting Phenology <a href="#">MQ</a>	4/5 <a href="#">Discussion</a> ; <a href="#">Editorial Perspectives due</a>
10: Arctic Fire	4/8 Creating Diagrams	4/10 <b>Mary out of town</b> <a href="#">Big Quiz #2 (Wks 5-10)</a>	4/12 Arctic Fire
11: Navigation & Extraction	4/15 In Class Peer Review of Abstract & Diagrams	4/17 Big Oil & Navigation	4/19 <a href="#">Discussion</a>
12: Topics in Arctic Ecology	4/22 TBA	4/24 Boreal tree line dendrochronology <a href="#">1<sup>st</sup> draft due (Capstone)</a>	4/26 <a href="#">Discussion</a> Ackerman et al. 2017
13: Presentations	4/29 <a href="#">IGNITE TALKS I</a>	5/1 <a href="#">IGNITE TALKS II</a>	5/3 The Future of the Arctic <a href="#">Last Discussion</a>
14: Final Week!	5/6 Onward & Upward; Student Surveys	<a href="#">Literature Reviews will be due Thursday, May 8<sup>th</sup> by midnight.</a>	