

CLIMATE CHANGE AND THE CIRCUMPOLAR WORLD

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COURSE DESCRIPTION

Climate change is more dramatic in northern systems compared to other locations globally, creating unique challenges and responses for regions in the circumpolar world. This course includes broad themes including lands, wildlife, and people of the circumpolar north that are impacted by climate change. This course begins with an overview of climate change as an issue, the historical evidence and scientific basis, and evidence from multiple cultural lenses. Further topics include the current and projected impacts of climate change on the circumpolar north, including the land, its biota, northern communities, and drivers that shape these interactions, cumulative impacts of climate change with anthropogenic land use changes, and changes to the socio-economy. Climate change impacts will be examined using traditional knowledge principles from multiple cultures with long histories in the circumpolar world.

Development of this course followed the guidelines of Circumpolar Studies curriculum development in striving to maintain a multidisciplinary approach, incorporating local First Nations knowledge, employing First Nations methods of learning and sharing, learning on the land, incorporating Elder or Knowledge-holder participation, and will cover contemporary issues, by nature of the rapidly changing climate in Northern terrestrial regions and the impacts of people living in the North.

This course could be an essential part of learning for students planning to live and work in the North and contribute to mitigation and adaptation to the impacts of climate change. Students may be professionals and practicing managers and have hands on information to share regarding developing strategies and management objectives for their communities. The classroom atmosphere and style of dissemination for this course encourages sharing of ideas.

COURSE MODULES

The following modules are divided into sections serving as a lecture topic. Each section has a set of learning objectives and a set of resources. Instructors are encouraged to modify the learning objectives to suit the level and interests of their students. The resources may be used to construct full lecture content, following any required copyright requirements. Instructors may select and share the resources as student readings as they see fit for their

course. Instructors are also encouraged to seek additional resources for case studies of interest.

Module	Module Topics
1: Introduction to Climate Change in the Circumpolar World	1.1: Introduction to Climate Change and the Circumpolar World
	1.2: Climate Change Evidence Through Multiple Lenses
	1.3: Climate Change, Western Scientific Knowledge
2: Understanding the Climate System	2.1: What is Climate?
	2.2: Essentials of Radiation on Earth
	2.3: The Global Energy Balance
	2.4: The Carbon Cycle and Greenhouse Gases
	2.5: Climate Forcing and Feedbacks
3: Climate Modelling	3.1: Climate Models
	3.2: Future Climate Projections
4: Environmental Responses to Climate Change	4.1: Climate Change and the Atmosphere
	4.2: Climate Change and the Oceans
	4.3: Climate Change and the Cryosphere
5: Ecosystem Responses to Climate Change	5.1: Vegetation Responses to Climate Change
	5.2: Wildlife Responses to Climate Change
	5.3: Climate Change and Extinction
	5.4: Climate Change and Interactions with Humans
	5.5: Modeling the Ecological Impacts of Climate Change on Species
6: Looking Forward	6.1: Human Responses to Climate Change
	6.2: Climate Leadership

LEARNING OUTCOMES

1. Discuss and appreciate the many dimensions of climate change; including perspectives from other cultures and from Indigenous Knowledge sources from around the circumpolar region.

This learning objective will be met with module 1 and will include discussions of Western knowledge, Indigenous knowledge, and Two-eyed seeing. The course could incorporate less linear styles of learning and doing in reflection of Indigenous learning styles.

2. Describe and analyze the governing factors that define climate and climate change globally and in the circumpolar region.

This learning objective will be met with modules 2, 4, 5 and will explore what is climate? What is circumpolar – does climate care how we define circumpolar? What are some key differences (and a few similarities) of climate change in North America, Europe, and Russia? What are some key differences between terrestrial and marine indicators of climate change? There are opportunities for group activities and discussions.

3. Evaluate and explain the evidence regarding climate change, both current and past. Evaluate and explain the evidence regarding climate change, both current and past, including the challenges and uncertainty of predicting climate change under multiple future scenarios.

This learning objective will be met with modules 1-4; northern climate cannot be easily separated from the globe and how changes from equilibrium lead to rapid change. This learning objective would be accompanied effectively with some stories from an Elder. Stories of permafrost change, drying ponds, and ice changes, and resiliency of people living in the North would be illustrative and memorable.

Students will explain climate models (globally and regionally), the parameters of models (under various emission scenarios), and discuss uncertainty and variability of these predictions.

4. Examine how circumpolar regions have changed climatically, ecologically, culturally, and characterize some of the socio-economic impacts and challenges associated with adaptation to and mitigation of climate change impacts.

This learning objective will be met with modules 4-6 and includes with case studies of extreme weather events, melting, sea level rise, changes to species and practices that are culturally important, and climate justice. Various reconciliation and decolonization efforts can be used as examples.

5. Evaluate and explain some of the ecological responses to climate change and how this will impact human populations living in the circumpolar world.

This learning objective will be met with module 5 and will bring in examples of indigenous-led conservation initiatives, co-management models for wildlife, as well as discussion on limits to adaptation and mitigation. The course will conclude with ecological responses; how will carbon storage and photosynthesis patterns be impacted by climate change? How will essential species be impacted (keystone species) and how will this impact humans living in Northern ecosystems (Ecosystem Services)? How does the resiliency of people and wildlife living in Northern regions inspire future responses and adaptation to climate change?

TEXTBOOKS & LEARNING MATERIALS

There is no specific textbook for this course. Information will be used from online resources and peer-reviewed articles (either available online or provided). Key resources include the following:

- Intergovernmental Panel on Climate Change Reports e.g.: <https://www.ipcc.ch/report/sixth-assessment-report-cycle/>
- Arctic Report Card: <https://arctic.noaa.gov/report-card/>
- A. E. Dessler, 2021. An Introduction to Modern Climate Change 3rd Edition

Readings from these materials and other online resources will be assigned during the course.

SUGGESTED PREREQUISITES

Prerequisite(s): There are no specific prerequisites for this course, however, students are expected to be at a second-year level. For example, students should have at least one semester of first-year English and one first-year Science course completed. Expectations are set accordingly. Students can also discuss preparedness and obtain permission from the instructor (for example for professionals working in a related field).

SUGGESTED COURSE FORMAT

The course format includes 3 hours of lecture per week in one semester (13 weeks). Discussion, group work, and outdoor (on-the-land) activities are integral parts of learning for students. Students are expected to fully participate in discussions and activities as appropriate, and in the manner that they feel comfortable. Students can access the lecture content of the course online, synchronously, if they have access to computing and internet equipment that would allow online participation in discussions. Students will need to be

available in person for on-the-land learning activities. Although it will vary from individual to individual, it is expected that this course will require approximately 4 - 5 hours of work outside of class time per week.

SAMPLE TIMETABLE

Week	Day	Module	Lecture Topic
1	5 Jan	1: Introduction to Climate Change in the Circumpolar World	1.1: Introduction to Climate Change and the Circumpolar World Introduce Assignment #1: Climate Change Stories
	7 Jan		1.2: Climate Change Evidence Through Multiple Lenses
2	12 Jan	2: Understanding the Climate System	1.3: Climate Change, Western Scientific Knowledge
	14 Jan		2.1: What is Climate?
3	19 Jan		2.2: Essentials of Radiation on Earth
	21 Jan		2.3: The Global Energy Balance Introduce Assignment #2: Energy Balance Models
4	26 Jan		2.4: The Carbon Cycle and Greenhouse Gases
	28 Jan		2.5: Climate Forcing and Feedbacks
5	2 Feb	3: Climate Modelling	3.1: Climate Models
	4 Feb		3.2: Future Climate Projections
6	9 Feb	4: Environmental Responses to Climate Change	4.1: Climate Change and the Atmosphere
	11 Feb		4.2: Climate Change and the Oceans
7	16 Feb	Midterm	Midterm review
	19 Feb		Midterm
8	23 Feb		Reading Week
9	2 Mar	5: Ecosystem Responses to Climate Change	4.3: Climate Change and the Cryosphere
	4 Mar		5.1: Vegetation Responses to Climate Change Introduce Assignment #3: Climate Figures
10	9 Mar		5.2: Wildlife Responses to Climate Change
	11 Mar		5.3: Climate Change and Extinction
11	16 Mar		5.4: Climate Change and Interactions with Humans
	18 Mar		5.5: Modeling the Ecological Impacts of Climate Change on Species

12	23 Mar		Group Discussion Based on Assignment #3
	25 Mar	6: Looking Forward	6.1: Human Responses to Climate Change
13	30 Mar		6.2: Climate Leadership
	1 Apr		Field trip and outdoor activities, exact date TBA
14	6 Apr		Space for guest lecture (e.g., invite a local elder or climate change expert) , exact date TBA
	8 Apr		Course summary and reflection
	13 Apr	Course Review	Course review for final exam