

NRTH 5009
FIELD COURSE IN CANADA'S NORTH
SUMMER TERM 2023

Instructor: Dr Chris Burn (DGES), 520-2600 ex. 3784; Christopher.burn@carleton.ca

This course is compulsory for all students completing Northern Studies degree programs. It is graded with a letter grade, awarded for assignments submitted during the course. The course has been developed in collaboration with several agencies in Yukon and western Arctic Canada.

Calendar description: Field observation and methods in a selected region of northern Canada on a group basis. Two or three weeks in summer term. A supplementary fee will apply.

Prerequisites: NRTH 5000; NRTH 5001; NRTH 5905 or concurrent registration in NRTH 5905; Permission of the Northern Studies Supervisor.

Fee: There is no supplementary course fee for full-time students in a Northern Studies degree program. Students must ensure the full fees due to Carleton University for the summer term 2022 have been paid before leaving for Whitehorse. Students will be responsible for their breakfast and some lunches while on the course.

COVID pandemic arrangements: The COVID pandemic has led to changes in many aspects of our normal life in Canada. The Yukon and NWT were closed to visitors in summer 2020. In 2022 these territories have been opened, and most restrictions have been lifted. Participants will be governed by the rules of public health in force at the time.

Activities: The course involves field activities, meetings, presentations, discussions, demonstrations, and surveys in SW Yukon and the western Arctic. The program includes interaction with several agencies in the region.

Purpose: The purpose of the course is to examine in the field issues and topics that have been encountered during the coursework elements of the degree programs. Students' reflection on their field experience in light of the program's course work will be a key component of the assignments.

Themes: The primary themes of the course concern: the role of research in management and development in Canada's North; the effects of climate change on northern life.

Academic program: The primary academic assignment during the course is to complete a daily academic reflection of 400-500 words, 26 May – 05 June inclusive. This should be a response to the activities, discussions, and observations you have made during the day, in the context of NRTH 5000 and NRTH 5001 and other courses that you have taken. It is an academic assignment, not a diary or piece of journalism. These short pieces should contain references to

literature you have encountered during the year and also material presented for reading on the course. These materials will be sent to you as pdfs in advance.

On June 6th you will be given a summary question for the course, and three hours to complete your response. This time-limited assignment will be completed under quasi-examination conditions.

Assignments: The daily reflections should be written each evening and submitted to the instructor every other day if possible, accumulating the reflections as a cumulative document (pdf). The first reflections are due on May 27th, the last on June 6th. The writing style must avoid colloquialisms and slang. The text should be single spaced and in 12 pt Times New Roman font. Each day's reflection should be on a separate page; a word count must be printed at the bottom of the page. The date for the day must be included at the top of the page. The cumulative compilation must be emailed to Christopher.burn@carleton.ca before 11:59 pm on the dates specified. References listed at the bottom of the reflection do not form part of the word limit. The reflections should demonstrate that you have integrated the academic materials you have encountered in the program into your thinking and into the approach you adopt to analysis of issues.

Requirements: You must bring a laptop computer and insect repellent. You will need field clothing, including rubber boots and hiking footwear. You will need waterproof rain gear. The weather may be as warm as the Ontario summer, or as cold as the Ontario fall. It may rain hard, and it may be sunny all day. It may be muddy or dusty. It may be still, with many mosquitoes, or it may be windy. Most of your meals will be provided, and you will stay in camp and motel style accommodation. You will be issued small field books but bring your own pencils and pens. You should bring a camera. You will be able to do your laundry in the accommodation in Inuvik.

Dates: Arrival in Whitehorse 25th May; Departure from Inuvik on 6th June.

Flight arrangements: You must book your own air ticket to arrive in Whitehorse on Thursday May 25th. You must book your own ticket for travel to Inuvik on 29th May and return to Whitehorse on 6th June. You may apply for a travel advance to cover the cost of the air ticket once you have purchased it. Davina Joseph will give full details and support your application for a travel advance. You will need to account for this advance when you return. You will not graduate if you do not clear the advance. **You will need to submit your boarding cards and ticket as part of this process.**

Accommodation: Nights of: May 26th Airport Chalet, Whitehorse; May 26th, 27th Kluane Lake Research Station; May 28th Airport Chalet, Whitehorse; May 29 – June 2 Aurora Research Institute, Inuvik; June 3rd Eagle Plains Motel, Dempster Highway; June 4, 5th Aurora Research Institute; June 6th Airport Chalet, Whitehorse. The rooms are a mixture of singles and doubles.

Travel: Travel will be in a rented vehicle. This is large, but please try to bring only **one piece of luggage** and a day pack. It will be much easier if this is a bag, not a suitcase.

Program:

May 25 Travel to Whitehorse.

May 26 Travel to Kluane Lake research Station. Permafrost in Takhini valley, threats to infrastructure stability; visit to thaw slump near Alaska Highway; seismic hazard in Yukon.

May 27 Alaska Highway, Kluane – Beaver Creek. Kluane. Seismic hazards, highway stability above degrading permafrost.

May 28 Coast Mountains. Haines Road. Climate change effects. Travel to Whitehorse.

May 29 Travel to Inuvik.

May 30 In Inuvik; Aurora Research Institute, Inuvialuit Land Administration.

May 31 Mackenzie delta area

June 1 Mackenzie delta area, and catch up day.

June 2 Mackenzie delta area

June 3 To Eagle Plains. Ground ice and climate change. The Dempster Highway

June 4 Eagle Plains to Inuvik. Highway operations in a remote setting

June 5 Inuvik to Tuktoyaktuk Highway

June 6 Final assignment and departure for Whitehorse

June 7 Departure from Whitehorse to home destinations

Meals: You are responsible for breakfast on May 26, 29, June 4. For lunch on May 26, 29, June 4. and all meals on June 7th. Breakfast is available where we are staying on all days.

Reading: You should examine the following for parts of the course (these will be provided):

May 25.

Schetselaar, A.B., Andersen, T.S., and Burn, C.R. 2023. Performance of climate projections for Yukon and adjacent Northwest Territories, 1991-2020. *Arctic*, **76**(3): in press.

<https://doi.org/10.14430/arctic77263>

Burn, C.R., Cooper, M., Morison, S.R., Pronk, T., and Calder, J.H. 2021. The CFES Scientific Statement on Climate Change – its impacts in Canada, and the critical role of Earth scientists in mitigation and adaptation. *Geoscience Canada*, **48**(2): 59-72. DOI: 10.12789/geocanj.2021.48.173

May 26

Burn, C.R. 1998. The response (1958 to 1997) of permafrost and near-surface ground temperatures to forest fire, Takhini River valley, southern Yukon Territory. *Canadian Journal of Earth Sciences*, **35**(2): 184-199.

Wong, C. *et al.* 2020. Towards reconciliation: 10 Calls to Action to natural scientists working in Canada. *Facets*, **5**: 769–783. doi:10.1139/facets2020-0005

May 27

Lerbekmo, J.F. 2008. The White River Ash: largest Holocene Plinian tephra. *Canadian Journal of Earth Sciences*, **45**: 693-700.

Dominie, S. *et al.* (draft) The cost of thawing permafrost, Alaska Highway, southwest Yukon, Canada

May 28

Shugar, D.H. *et al.* 2017. River piracy and drainage basin reorganization led by climate-driven glacier retreat. *Nature Geoscience*, **10**: 370-375.

Burn, C.R. 1994. Permafrost, tectonics, and past and future regional climate change, Yukon and adjacent Northwest Territories. *Canadian Journal of Earth Sciences*, **31**(1): 182-191.

May 29

Burn, C.R., and Kokelj, S.V. 2009. The environment and permafrost of the Mackenzie Delta area. *Permafrost and Periglacial Processes*, **20**(2): 83-105. doi: 10.1002/ppp.655

Burn, C.R. 1994. Permafrost, tectonics, and past and future regional climate change, Yukon and adjacent Northwest Territories. *Canadian Journal of Earth Sciences*, **31**(1): 182-191.

May 30

Cooke, S., *et al.* 2020. On “success” in applied environmental research – What is it, how can it be achieved, and how does one know when it has been achieved? *Environmental Reviews*, **28**(4): 357-372. doi: 10.1139/er-2020-0045

May 31

Nguyen, T-N., Burn, C.R., King, D.J., and Smith, S.L. 2009. Estimating the extent of near-surface permafrost using remote sensing, Mackenzie Delta, Northwest Territories. *Permafrost and Periglacial Processes*, **20**(2): 141-153. doi: 10.1002/ppp.637

Burn, C.R. 2017. Mackenzie Delta: Canada’s Principal Arctic Delta. Ch. 23 in *Landscapes and landforms of western Canada*. O. Slaymaker (ed.). Springer: Dordrecht; 321-334.

June 1

Catch up day.

June 2

Burn, C.R. *et al.* (draft) Landslides in continuous permafrost and climate, North Caribou Hills, Mackenzie Delta area, western Arctic Canada

Kokelj, S.V., *et al.* 2010. Permafrost and terrain conditions at northern drilling-mud sumps: Impacts of vegetation and climate change and the management implications. *Cold Regions Science and Technology*, **64**:46-56.

June 3

Burn, C.R., Moore, J.L., O’Neill, H.B., Hayley, D.W., Trimble, J.R., Calmels, F., Orban, S.N., Idrees, M. 2015. Permafrost characterization of the Dempster Highway, Yukon and Northwest Territories. Paper 705. *Proceedings, 68th Canadian Geotechnical Conference and 7th Canadian Permafrost Conference*, 21-23 September 2015, Quebec City, QC, Canadian Geotechnical Society, Richmond, BC. 8 p.

Kokelj, S.V., *et al.* 2017. Climate-driven thaw of permafrost preserved glacial landscapes, northwestern Canada. *Geology*, **45**: 371-374.

June 4

Humphries, J., Burn, C.R., MacDougall, S., and Brais, C. 2019. Storm wind frequency and direction, Dempster Highway, Richardson Mountains, Yukon and Northwest Territories. In *Cold Regions Engineering 2019: Proceedings of the 18th International Conference on Cold Regions Engineering and the 8th Canadian Permafrost Conference, 18-22 August 2019, Quebec City, QC*. Edited by J-P. Bilodeau, D.F. Nadeau, D. Fortier and D. Conciatori. American Society of Civil Engineers: Reston, VA: 137-145.
<https://doi.org/10.1061/9780784482599.016>

Stockton, E.J., Burn, C.R., Idrees, M., Calmels, F., and Elmer, K. 2019. Monitoring Ground Temperatures in Permafrost Along the Dempster Highway, Yukon and NWT. In *Cold Regions Engineering 2019: Proceedings of the 18th International Conference on Cold Regions Engineering and the 8th Canadian Permafrost Conference, 18-22 August 2019, Quebec City, QC*. Edited by J-P. Bilodeau, D.F. Nadeau, D. Fortier and D. Conciatori. American Society of Civil Engineers: Reston, VA: 92-101.
<https://doi.org/10.1061/9780784482599.011>

June 5

Palmer, M.J., Burn, C.R., and Kokelj, S.V. 2012. Factors influencing permafrost temperatures across tree line in the uplands east of the Mackenzie Delta, 2004-2010. *Canadian Journal of Earth Sciences*, **49**(8): 877-894. doi: 10.1139/e2012-002.

Kokelj, S.V., Palmer, M.J., Lantz, T.C., and Burn, C.R. 2017. Ground temperatures and permafrost warming across the forest-tundra transition, Tuktoyaktuk Coastlands and Anderson Plain, NWT, Canada. *Permafrost and Periglacial Processes*, **28**(3): 543-551. doi:10.1002/ppp.1934

Other material will be provided as the course progresses.

Instructor's role: The instructor is responsible for all logistical arrangements, and for coordinating activities. The instructor will lead directly some of the elements of the course.

Evaluation: Evaluation will be based on two components: (1) Daily reflections (50%); (2) the final question (50%). If the daily reflections are late for a second time, there will be a penalty reduction of one grade point in the overall grade; a third late assignment (journal entries) will lead to loss of a further grade point in the overall grade. If the journal is not completed before departure, it will be marked out of a reduced total, proportional to the number of days completed. The summary question will be collected on June 6th.

Waiver: All participants are required to fill out and sign a waiver and emergency contact form before departure. The form will be emailed to you by the Program Administrator. You will grant Carleton staff and other students the right to take photographs of you that may be published for

the professional purposes of the program.

Academic Accommodation: You may need special arrangements to participate in this field course because of disability, pregnancy or religious obligations. Please review this course outline promptly and forward any requests for academic accommodation to the Instructor. Due to the nature of the course, the terrain to be encountered, and the logistical arrangements for bush travel, we are unable to provide accommodation for certain physical disabilities in NRTH 5009. This is for safety reasons. Students will be walking over rough terrain and using boats for some portions of the course.

Cell phones and social media: There is cell phone service in Yukon communities and Inuvik. Cell phone coverage does not extend to many parts of the highway network, especially along the Dempster Highway. Students must recognize that cell phones may disrupt meetings with hosts, and therefore these devices must be turned off before workshop sessions. Consultation of social media, checking email, and dealing with personal issues during field course instructional activities is similarly inappropriate. Such interference will prevent full participation in field course activities. A grade point will be deducted from the course grade each time a cell phone interrupts a student's participation in course activities. This includes interruptions during workshops and at other times when instructional activities are occurring.

Internet: There is wifi internet at most of the places where we shall be staying. You will be responsible for any supplementary fees required to access the wifi service.

Uploading of course materials: Classroom teaching and learning activities, including lectures, discussions, presentations, etc., by both instructors and students, are copy protected and remain the intellectual property of their respective author(s). All course materials are also protected by copyright and remain the intellectual property of their respective author(s). Students registered in the course may take notes and make copies of course materials for their own educational use only.

Visitor presentations: The course includes presentations and other activities guided by guests to the course.