



CLIMATE CHANGE AT THE ARCTIC'S EDGE



PLANNING CHECKLIST

PLANNING CHECKLIST

IMMEDIATELY

- Make sure you understand and agree to Earthwatch's **Terms and Conditions** and the **Participant Code of Conduct**.
- If you plan to purchase additional travel insurance, note that some policies require purchase at the time your expedition is booked.

6 MONTHS PRIOR TO EXPEDITION

- Log in at earthwatch.org to complete your participant forms.
- If traveling internationally, make sure your passport is current and, if necessary, obtain a visa for your destination country.
- Bring your level of fitness up to the standards required (see the Project Conditions section).

90 DAYS PRIOR TO EXPEDITION

- Pay any outstanding balance for your expedition.
- Book travel arrangements (see the Travel Planning section for details).
- Make sure you have all the necessary vaccinations for your project site.

60 DAYS PRIOR TO EXPEDITION

- Review the packing list to make sure you have all the clothing, personal supplies, and equipment needed.

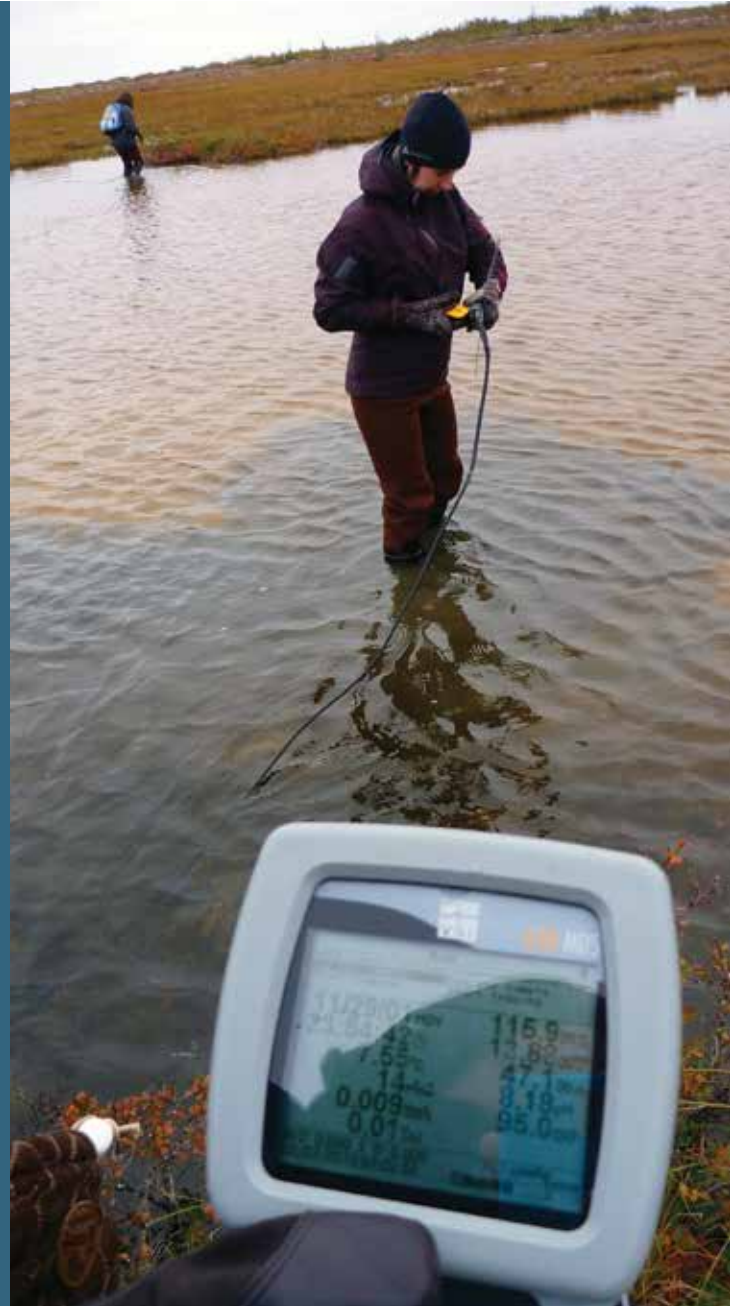
30 DAYS PRIOR TO EXPEDITION

- Leave the Earthwatch 24-hour helpline number with a parent, relative, or friend.
- Leave copies of your photo ID and flight reservation number with a parent, relative, or friend.

READ THIS EXPEDITION BRIEFING THOROUGHLY. It provides the most accurate information available at the time of your scientist's project planning, and will likely answer any questions you have about the project. However, please also keep in mind that research requires improvisation, and you may need to be flexible. Research plans evolve in response to new findings, as well as to unpredictable factors such as weather, equipment failure, and travel challenges. To enjoy your expedition to the fullest, remember to expect the unexpected, be tolerant of repetitive tasks, and try to find humor in difficult situations. If there are any major changes in the research plan or field logistics, Earthwatch will make every effort to keep you well informed before you go into the field.

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NOTE FROM THE PI

DEAR EARTHWATCHER

Welcome to the *Climate Change at the Arctic's Edge* expedition, a multidisciplinary research effort initiated in 1999. Results from research on these sites will be used to meet the long-term objective of quantifying environmental responses associated with climate change in the subarctic region of Canada. We direct our efforts at benchmarking current conditions in order to evaluate projected future changes. The studies are labor intensive, and Earthwatch teams provide the people-power that makes it possible to collect large amounts of data in relatively small windows of time. The outside work can be physically demanding, and participants have to be able to deal with the weather that comes with this environment. In what we prefer to call the thaw season (summer), it can be cold and wet with plenty of bugs. In the winter, it can be extremely cold as a result of sub-zero temperatures and wind-chill. Regardless of the conditions, we do our work and put up with the good, the bad, and the ugly weather, knowing that the Churchill Northern Studies Centre (CNSC) will offer comfort, food, and shelter at the end of the day. Between the long days of data collection and lab work, we make time for team members to take in some of the local attractions.

It has been our pleasure to work with Earthwatch participants, and their contributions have significantly and positively affected this research project. We also treasure the interactions, the camaraderie, and the opportunity to learn from the dedicated people who selflessly contribute to this project.

Yours Sincerely,

LeeAnn Fishback

Steve Mamet





THE RESEARCH

CLIMATE CHANGE AT THE ARCTIC'S EDGE



THE STORY

At the Arctic's edge we can measure the evidence of climate change: shrinking areas of polar sea ice, retreating glaciers, and less extensive winter snowpack that also melts earlier (ACIA, 2004; IPCC, 2013). Biological evidence of warming is also mounting. For example, more trees have begun to grow at the northern treeline and different plant communities are appearing. Northern ecosystems are changing (Bonan et al., 1992, Chapin III et al., 2005, Harsch et al., 2009). Over the next few decades, scientists expect to observe the greatest effects of global warming at high latitudes. Global warming estimates go as high as a 6°C (10.8°F) increase in average air temperature by 2100 relative to the 1986–2005 mean (Diffenbaugh and Field, 2013), and are predicted to increase by as much as 10°C (18.0°F) in the Arctic (IPCC, 2014). Churchill, on Canada's Hudson Bay, has warmed approximately 2°C (3.6°F) since record keeping began in the 1880s, though about 75% of that warming occurred since 1980.

On a global scale, the position of the circumboreal treeline is determined by temperature. However, local treeline positions are modified by frost damage, winter desiccation, and a host of other factors. It is necessary to assess the effects of site-specific variables, which could confound the influence of increasing temperatures.

Permafrost—ground that remains below freezing for more than a year—holds crucial clues to what global warming might entail. It underlies 24% of the surface of the earth, including vast areas of Russia, Canada, China, and Alaska. An estimated 50% of the world's terrestrial carbon is locked up in permafrost (Tarnocai et al., 2009).



RESEARCH AIMS

At the Churchill Northern Studies Centre (CNSC), our main research goal has been to establish an environmental monitoring program to collect baseline quantitative data on climate-related changes in northern ecosystems. Along with the long-term monitoring of environmental conditions, we also conduct experiments to more closely examine the processes occurring in these subarctic conditions. You help obtain large numbers of samples over a short time period and are vital to the success of the monitoring and experimental programs. People depend on the health and integrity of the natural world for food, income, and other resources, so collecting such data is vitally important. Locally, many of the residents of Churchill, our nearest neighbors, depend on ecotourism for their livelihood, and our research can inform better policy for preserving the ecosystem that supports them in addition to its global resonance.

This project focuses on three of the global warming related changes scientists have observed: thawing permafrost, shift of the treeline to the north, and wetland dynamics. We have established 11 long-term environmental monitoring sites along a line extending from the boreal forest into the arctic tundra to measure a set of key ecosystem components. These include components of the environment like snow conditions, ground temperature, depth of thawing, soil carbon as well the biological components of the ecosystem like trees, shrubs, and small mammals. At our monitoring sites, automated microclimate stations—which monitor the state of the permafrost and active layer—operate year round. We also monitor permafrost and the active layer as part of our fieldwork, through repeated probing and coring. We sample and analyze the snowpack in mid-winter. And in the lab, we analyze needle desiccation to determine the amount of damage to the cuticles on the needles during the harsh subarctic winter.

Monitoring the treeline by recording the presence of seedlings, saplings, and trees is another big component of this project. We focus on the treeline because minor changes in the environment can have big ecological impacts on it. For example, warmer growing seasons can lead to more viable tree seeds and higher germination success, which means that more trees grow further into the tundra—thus changing where the treeline lies. Within the forest-tundra zone, buds and leaves are exposed to colder temperatures and higher amounts of wind-blown snow abrasion. Wind-blown snow can thin or remove the waxy cuticle covering needles resulting in excessive water loss and needle mortality, which can reduce the plants' photosynthetic capability during the following growing season. Furthermore, insufficient maturation of the cuticle in the summer can lead to excessive winter moisture loss. Depending on the intensity, duration, and variability, cold and windy conditions impair vital functions and can set the distributional limits of plant species, though conflicting results from other studies warrant further research.

The research also focuses on isolated wetlands—bodies of water that have highly variable biological and hydrological characteristics and make up about 40% of the surface area in landscape of the Hudson Bay Lowlands (HBL). Because of the temporary character of some of these wetlands, the aquatic organisms differ from those of larger and deeper permanent bodies of water. One important difference is that they usually lack predators such as larger fish and invertebrates, which are a significant predatory component in aquatic systems. As a result, many organisms have developed specific life histories to take advantage of the characteristics of the wetland, and as the climate changes, so too does the character and species habitat within these wetlands.

HOW YOU WILL HELP

You'll get the chance to help with both field and lab research. The amount of time you will spend at each will vary with the season; however, you should expect to spend about 50% of your time at the research sites and the remainder in the lab. You will help set up and monitor equipment and collect data on features of the snowpack, permafrost, and soil; the occurrence of vascular plants, lichens, and mosses; wetland water quality; amphibian tadpole metamorphosis; and annual growth rings of trees.

TREELINE STUDIES—TEAMS 1 & 7

For this research you will focus on the physical and biological characteristics of the environment. You'll study 1) growth, sexual reproduction, and survivorship of treeline trees and 2) winter injury of evergreen needles. In addition to ongoing monitoring of natural seedling establishment and survival in the field, seeding experiments will be conducted as part of the Global Treeline Range Expansion Experiment (G-TREE). G-TREE is a globally distributed collaborative project aimed at testing the generality of mechanisms driving boundaries of tree distribution at the treeline (treelineresearch.com/). Soil sampling, permafrost coring, thaw depth measurements, and vegetation sampling could be on the task list of a given team. Equipment for air and ground temperature measurements will be maintained, and cover values for shrubs and trees will be estimated. On fall teams, the depth of thaw will be probed and the standard soil characteristics, including organic matter, moisture content, and pH may be determined. The teams could also be involved in sampling the total above-ground biomass from plots within each site.

POST-FIRE RECRUITMENT AND SURVIVAL—TEAMS 1 & 7

Summer and fall teams will study the impact of stand-replacing fires near treeline. Seedlings were planted within the burned areas during 2000 to assess recruitment and survival in disturbed and undisturbed habitats. You will help monitor establishment and recruitment of seedlings by assessing plant species cover and measuring seedling height and number of branches.

WETLANDS STUDIES—TEAMS 2, 3, & 5

These teams will focus on the diverse wetland environments that make up 40% of the land cover in this region. The importance of hydroperiod in the wetlands to species compositions during the summer months has been highlighted by the continued long-term monitoring. The recent inclusion of experimental approaches to the wetland component of the research program has allowed for examination of processes that will assist in explaining the natural variation occurring on the landscape. You'll don waist-high neoprene waders to collect data on species and water quality from natural shallow tundra ponds and wetlands as well as participate in our mesocosm experiments in outdoor stock tanks. The project will provide the neoprene waders and gloves for the duration of the project.

SNOWPACK STUDIES—TEAMS 8 & 9

Assignments for the winter team will include snowpack descriptions, snow sampling, and lab processing of samples. Outdoor activities will depend on light and weather conditions; winter can be extremely physically demanding. CNSC can rent gear to participants, including parkas, pants, mitts, and boots, but participants will be required to bring their own liner gloves and headgear. Trips in the qamutiks (sleds pulled behind snowmobiles) can be rough, cold, and uncomfortable but the winter landscape will leave you breathless.





DAILY LIFE IN THE FIELD

PLANS FOR YOUR TEAM



You'll get plenty of learning opportunities on this expedition: you may hear talks on local permafrost landforms, the ecology of polar bears, whales, species migration, wetland diversity, the significance of the project to the community, and climate change monitoring in general.

Depending on your team's particular tasks, you'll also hear practical talks on snow pit measurements, plant species identification, wetland structure, sampling techniques, and monitoring and census techniques. You will also learn about the concepts behind the sampling methodology, and the use of various kinds of equipment.

While you'll spend most of your time on research tasks, you'll always have the chance to ask questions, enjoy the scenery, and take in the majesty of the northern treeline. In this pristine environment, there are endless opportunities to view rarely seen wildlife and plants. CNSC was established in 1976 to facilitate research, and you will have the opportunity to interact with many other scientists conducting research in the area. It is not uncommon for participants to sit at a cafeteria table with scientists and have a conversation directly with them about their studies. These researchers are also likely to give informal lectures during which in-depth discussions can carry on for hours. You will be in the midst of an intellectual environment unique to a center like CNSC.



ITINERARY & DAILY SCHEDULE

Weather and research needs can lead to changes in the daily schedule. We appreciate your cooperation and understanding.

ITINERARY

DAY 1

Introduction and orientation, getting off to a gradual start to enable participants to recover from travel. A meeting will be conducted to outline the objectives and methods of the team and guidelines for safety, and to provide a preliminary schedule. After this, the team will normally take a brief walk to become familiar with the site and test outdoor gear.

DAY 2

Demonstrations of equipment and training. If this is completed in the morning, the team will practice field methods in the afternoon.

DAYS 3-10

Each day will begin with a briefing to outline the day's activities. At least half of each day will be spent at the research sites collecting data, while the remainder of the day will be used for sample processing and data entry. Depending on the tasks, we might make an evening trip to catch the sunset or take other excursions. There will normally be an evening briefing to review the day's activities followed by a lecture or lab or data entry work. On the last evening we'll have a wrap-up seminar with an overview of the data, comments, recommendations, and discussion about the significance of your contributions to the overall research picture.

DAY 11

Travel day

TYPICAL DAY IN THE FIELD

7:00 a.m.	Breakfast and cleanup
7:45 a.m.	Morning briefing, review of assignment progress, new assignments outlined
8:00 a.m.	Prepare for daily field program
8:30 a.m.	Depart for field
12:00 noon	Lunch at CNSC
1:00 p.m.	Depart for field
3:30 p.m.	Return from field, begin laboratory work, data entry, etc.
5:30 p.m.	Dinner and cleanup
7:00 p.m.	Lab work, data entry, optional field or lab/recreational activities/lectures
9:00 p.m.	Relax, read, socialize, go to bed.

RECREATIONAL TIME: Usually, on the fifth or sixth day of the expedition, the team will have a recreational day (the exact day will depend on weather and research activities). The summer teams will have the opportunity to visit the town of Churchill, where you can participate in a number of organized activities, including whale watching (approx. \$120-180CAD, depending on the boat and number of people); a tour of Fort Prince of Wales, a national historic site (approx. \$115CAD, including the boat trip across the Churchill River); river kayaking (\$170CAD); browsing through the Eskimo Museum (\$10CAD donation); a regional natural history tour (approx. \$95CAD); or simply souvenir shopping. The winter teams will also have the opportunity to visit the town of Churchill and participate in an authentic dogsledding adventure tour (approx. \$100 CAD). All activities are seasonal and weather dependent and staff at the CNSC will help to coordinate these activities with the local operators.



ACCOMMODATIONS AND FOOD

ABOUT YOUR HOME IN THE FIELD



The Churchill region is polar bear country, and significant safety issues exist whenever we are out of doors. The CNSC is 23 kilometers (14 miles) east of the town of Churchill, and consequently, participants must be accompanied by a CNSC staff member or the scientist, who will carry bear deterrents, before being allowed to go out of doors during free time. When you arrive on site you will sign the Churchill Northern Studies Centre's Polar Bear Information Acknowledgement Form. CNSC is a non-smoking facility.

SLEEPING

You'll stay in dormitory rooms that house up to four people in bunk beds. Normally, rooms will be single gender. Depending on the bookings, it might be possible to arrange for single accommodations—contact your Earthwatch representative about this option.

IGLOOS

TEAMS 8 and 9 ONLY: The optional activity of building igloos requires cutting, lifting, and placing 20- to 30- kilogram (45- to 65-pound) blocks of snow that should not be dropped, and at 70 x 50 x 15 centimeters (28 x 20 x 6 inches), each block can be awkward to maneuver. This task requires a lot of energy. Fortunately, there are usually enough people participating to share the heavier tasks. Sleeping bags and pads can be rented from the Centre if you want to stay overnight in your newly constructed snow shelter.

BATHROOMS

The CNSC water is trucked to the facility, so we practice water-saving measures, including composting toilets and encouraging all visitors to take short showers. There is running water throughout the facility, which includes flush toilets and individual shower rooms. Coin operated laundry is available for a fee of \$6CAD per load (washing detergent is free).



ELECTRICITY

The CNSC has reliable electricity (outlet types A or B, 120 volts, 60 hertz). You should bring along any necessary converters and adapters.



PERSONAL COMMUNICATIONS

There is a cell phone booster located in the atrium of the CNSC for calls but it is best not to rely on there being cell coverage throughout the building or at field sites. . There is wireless internet throughout CNSC available at no additional charge, although internet speeds can sometimes be quite slow. There are a number of desktop computers in the quiet lounge available for participants to use in free time.

FACILITIES AND AMENITIES

CNSC has a library and reading room, a fully staffed cafeteria, a northern lights observation dome, movie- watching room, three classrooms, a herbarium, a research library, a computer room with Internet connection, a gift shop, a number of public telephones, and vending machines. In the office, there is access to fax and photocopy services. Mail is delivered to the post office daily. In the laboratory wing there are benches, drying ovens, and a variety other equipment. There is a workout room with a stationary bicycle, cross trainer, and weights.

DISTANCE TO THE FIELD SITE

All research sites are within 40 minutes of the CNSC. Transport is by van or SUV, except in winter, when participants are transported in qamutiks (sleds pulled behind snowmobiles).

FOOD AND WATER

The kitchen is run by accredited cooks who prepare all the meals. Food is served cafeteria style, and all users of CNSC share the dining area. Participants will assist with after meal cleanup. Meals are varied and usually include a choice of salads, desserts, and a vegetarian dish. We also have fresh bread and evening snacks.

The following are examples of foods you may find in the field. Variety depends on availability. We appreciate your flexibility.

TYPICAL MEALS

BREAKFAST	Eggs, bacon, toast, porridge, pancakes, French toast, sausages, fresh/dried fruit, yogurt, muffins, cold cereals, toast
LUNCH	Soup, sandwiches, macaroni and cheese, grilled cheese sandwiches, burgers, French fries, fruit
DINNER	Meatloaf, spaghetti, roast beef, turkey, lasagna, fish, potatoes, pork chops, pizza, chicken, salads, Jell-O, cake, pie, fresh fruit, cooked vegetables, stew
SNACKS	Leftovers, fruit, cookies, cereal, popcorn
BEVERAGES	Coffee, tea, hot chocolate, water
WATER	All water is drinkable. Cold, fresh water is available for free in the cafeteria at all times.

SPECIAL DIETARY REQUIREMENTS

Please alert Earthwatch to any special dietary requirements (e.g., diabetes, lactose intolerance, nut or other food allergies, vegetarian or vegan diets) as soon as possible, and note them in the space provided on your participant forms.

Accommodating special diets is not guaranteed. Vegetarian, lactose intolerance, gluten intolerance, and other allergies can generally be accommodated with prior notification.



PROJECT CONDITIONS

THE FIELD ENVIRONMENT

The information that follows is as accurate as possible, but please keep in mind that conditions may change.

The majority of the sites are gravel, peat over sand, or peat over permafrost. In general, the area ranges from flat to hummocky. The wetlands have standing surface water for the most part, and some have mucky bottom sediments. On average, temperatures at Churchill over the summer period range from -5 to 28°C (23°F to 82°F). There is very little humidity, except during periods of fog when the wind comes off the Bay, and the rainfall during the summer is usually around 2.5 inches (6 cm) per month. Spring begins in June with the end of snowfall and melt, while late August is the beginning of autumn and brings cooler temperatures. The average temperature, however, is often misleading since it can feel like autumn in the morning and the height of summer in the afternoon following a shift in the wind.

The winter (when Team 8 & 9 will be in the field) is long and dominated by extremely cold arctic air masses, often with strong winds. In mid-winter, temperature becomes irrelevant (it's usually just -40°C/-40°F) and wind chill values are used. In February the wind chill often exceeds -45°C (-50°F) and exposed skin will freeze in seconds. The upside is that at this time of year there are no insect pests, and the long nights provide an amazing opportunity to view the northern lights.

GENERAL CONDITIONS

The following are averages. Please check weather resources for your team dates for more accurate weather predictions. Projects have experienced unseasonable weather at all times of year.

HUMIDITY: low (except during fog), very dry in February

TEMPERATURE RANGE:

SUMMER TEMPERATURE RANGE:

-5° C / 23° F to 28° C / 82° F)

WINTER TEMPERATURE RANGE:

-55° C / -67° F to 15° C / 5° F)

ALTITUDE: 0 to 39 m. /130 ft. above sea level

RAINFALL: 0–6 cm/0–2.5 in per month

ESSENTIAL ELIGIBILITY REQUIREMENTS

All participants must be able to:

- Follow verbal and/or visual instructions independently or with the assistance of a companion.
- Wear all protective equipment recommended or required by industry standards; especially important for the winter team. If you bring gear that the staff feels is inappropriate, you may have to rent gear at your own expense. Please read the section for winter team in the Expedition Packing Checklist.
- Enjoy being outdoors all day in all types of weather, in the potential presence of wild animals and insects.
- Tolerate temperatures as high as 28°C (82°F) and as low as -55°C (-67°F) in winter.
- Carry personal daily supplies, such as lunch, water, and some small field equipment, of up to nine kilograms (20 pounds).
- Get low enough to undertake ground-level activities such as soil sampling, permafrost coring, frost probing, vegetation sampling, and fish and amphibian trapping, up to 12 hours per day.
- Traverse varying terrain from level hard surfaces to undulating, hummocky ground. Total time hiking is up to four hours per day.
- Promptly alert project staff about any injuries or discomfort (bruising, difficulty breathing, etc.) as soon as it occurs.
- **WINTER TEAM ONLY:** Travel in a seated, upright position within a qamutik sled during transit, which can sometimes be bumpy. This can be uncomfortable for individuals with back problems.
- **WINTER TEAM ONLY:** Maintain a high enough calorie intake to keep up with increased energy demands of working in frigid temperatures and deep snow.



POTENTIAL HAZARDS

CLIMATE CHANGE AT THE ARCTIC'S EDGE

HAZARD TYPE	ASSOCIATED RISKS AND PRECAUTIONS
Transportation	The road is gravel and its condition varies depending on the weather. In winter (Team 8 & 9), whiteouts and icy roads make driving conditions more difficult. The winter team will be transported into the field on qamutiks (sleds pulled behind snowmobiles). There are no safety belts on these sleds. The snow is quite hard, and the qamutiks offer no cushioning. You may wish to bring your own padding for travel while in the qamutiks (see the section for winter team in the Expedition Packing Checklist). All drivers hold licenses required by the Canadian government and vehicles meet provincial safety standards with the addition of shortwave radios to talk to the base.
Hiking	Hiking along the trails to the research sites varies from unstable ground with tall shrubs, to open hard ground. Trail sections can also be very wet with deep holes (at times the depth exceeds the height of participants' rubber boots). Teams working in wetlands will be wading in standing water that may be up to 75 cm in depth using neoprene waders. Waders and rubber boots are provided on site.
Terrain	All participants will be hiking in the field, and there is risk of strains, sprains, and breaks due to falls. Trails are well marked and the participants will be traveling as a group, but the footing can be slippery, especially with frost or light snow or rain. You must have rubber boots due to sections of wetlands at several sites and the tall shrubs that can restrict movement at some sites.
Animals	The Churchill region has a large concentration of polar bears. Consequently, the teams will have to be near a vehicle equipped with a radio and armed with suitable deterrents at all times. Project staff will have a number of polar bear deterrents, ranging from noisemakers to firearms. CNSC has thorough safety standards in place for the use and management of firearms. For safety considerations, it will not be possible to avoid being in the presence of firearms. Participants will not handle or use the firearms. The Earthwatch scientist and other field staff (NOT participants) will carry deterrents.
Insects	Mosquito and blackfly populations are very dense in July and August. They are present in in June and September as well, but less intense. There is no evidence of West Nile virus in the Churchill region, although it is present in southern Manitoba. Take precautions to prevent mosquito bites by using insect repellent and wearing long-sleeved shirts and bug jackets or head nets while in the field. Black flies bite and inject an anticoagulant and are generally very irritating. If you suspect you might have an allergic reaction to their bites, bring an antihistamine.
Climate/ Weather	<p>During winter (Teams 8 & 9), there are risk of hypothermia, frostnip, frostbite, extreme chapping and cracking of lips and hands, and other cold-related injuries, as well as cold-caused damage to personal gear. The risk of cold-related injury is increased in those with heart and lung disease and any other conditions that reduce or impair circulation to the skin and extremities. Certain medications can exacerbate risks of cold-related injury.</p> <p>In all seasons, the sun can be quite intense. Even on an overcast day, you are at risk of sunburn; bring plenty of good-quality sun block and lip sun and wind block. Also, the environment is dry year round, so drink plenty of water to avoid dehydration.</p>
Distance from Medical Care	The nearest hospital is 23 kilometers (15 miles) away from the project site, and it may take up to an hour to arrange transport and reach the hospital. If you have a chronic condition which could require immediate medical care (e.g., heart conditions, kidney problems, severe asthma, etc.), or if you are pregnant, please discuss your participation on this expedition with your physician.
Disease	<p>Traveler's diarrhea affects many international travelers. Please see the U.S. Centers for Disease Control and Prevention (cdc.gov) or the World Health Organization (who.int/) websites for more information on this condition and how to avoid it.</p> <p>A note on vaccinations and treatment:</p> <p>WEST NILE VIRUS: West Nile is a mosquito-transmitted virus. Several cases of West Nile virus are reported each year from southern Manitoba; however, as of the printing of this expedition briefing, no cases have been reported in northern Manitoba, where the Churchill teams take place.</p>



HEALTH & SAFETY

CLIMATE CHANGE AT THE ARCTIC'S EDGE



Project staff members are not medical professionals.

Field staff members carry handheld radios to communicate with CNSC, from where someone would call the hospital for guidance in an emergency. There is always a vehicle available in the field, and a number of first aid kits are maintained at CNSC. Anyone with a medical emergency will be evacuated directly to the hospital in Churchill. If the situation is severe, a helicopter can be used to transport the injured person. In the event of a dangerous encounter with a polar bear, the animal will be deterred using standard procedures, and the team will leave the area and report the incident to CNSC.

For emergency assistance in the field, please contact Earthwatch's 24-hour emergency hotline number on the last page of this briefing. Earthwatch is available to assist you 24 hours a day, 7 days a week; someone is always on call to respond to messages that come into our live answering service.

IMMUNIZATIONS & TRAVEL VACCINATIONS

Please be sure your routine immunizations are up-to-date (for example: diphtheria, pertussis, tetanus, polio, measles, mumps, rubella and varicella) and you have the appropriate vaccinations for your travel destination. Medical decisions are the responsibility of each participant and his or her doctor, and the following are recommendations only. Visit the [cdc.gov](https://www.cdc.gov) or [who.int](https://www.who.int) for guidance on immunizations.

]If traveling from countries or region where yellow fever is endemic, you must have a certificate of vaccination.



TRAVEL TIPS

SUGGESTIONS FOR THE ROAD



YOUR DESTINATION

LANGUAGE: The two official languages of Canada are English and French, although the degree of fluency in each varies depending on the province. Manitoba is primarily English speaking.

TIME ZONE: Central Time Zone: GMT/UTC -6 (-5 Daylight Savings Time).

LOCAL CURRENCY: Canadian dollar (CAD)

COUNTRY AND PROJECT ENTRY REQUIREMENTS

Entry visa requirements differ by country of origin, layover, and destination, and do change unexpectedly. For this reason, please confirm your visa requirements at the time of booking and, again, 90 days prior to travel. Please apply early for your visa (we recommend starting 6 months prior to the start of your expedition). Refunds will not be made for participants cancelling due to not obtaining their visa in time to meet the team at the rendezvous. You can find up to date visa requirements via the following site:

www.travisa.com

NOTE: Canada has recently changed its entry requirements and citizens from several countries are now required to apply for an eTA prior to travel. Please check the Canadian government's website prior to traveling <http://www.cic.gc.ca/english/visit/visas-all.asp>

As of the printing of this expedition briefing, US citizens and permanent residents are not required to obtain a visa, but are required to show a passport/green card.

If a visa is required, participants should apply for a TOURIST visa. Please note that obtaining a visa can take weeks or even months. We strongly recommend using a visa agency, which can both expedite and simplify the process.

Generally, passports must be valid for at least six months from the date of entry and a return ticket is required.

CONTACT INFORMATION

You may be required to list the following contact information on your visa application and immigration form, or if your luggage does not make it to baggage claim at your destination:

LeeAnn Fishback

Churchill Northern Studies Centre
1 Launch Road, Churchill MB, R0B 0E0 Canada
+1 (204) 675-2307

fishback@churchillscience.ca



EXPEDITION PACKING LIST

WHAT TO BRING

EXPEDITION PACKING CHECKLIST

GENERAL

- This expedition briefing
- Your travel plans, rendezvous details, and Earthwatch's emergency contact information
- Photocopies of your passport, flight itinerary, and credit cards in case the originals are lost or stolen; the copies should be packed separately from the original documents
- Passport and/or visa (if necessary)
- Certification of vaccination (if necessary)
- Documentation for travel by minors (if necessary)
- Signed copy of your Polar Bear Acknowledgement Form

CLOTHING/FOOTWEAR FOR FIELDWORK

SUMMER AND FALL TEAMS ONLY

- Sturdy walking shoes (cross-trainers will do)
- Rain jacket
- Three or four different layers of clothing to adapt to the temperature range
- Warm layers of clothing (e.g., lightweight jacket or fleece for cool climate)
- Leggings, long underwear, and/or shorts to wear under the waders for wetland teams
- Wide brimmed hat or baseball cap for sun protection
- Beanie for warmth on cooler days
- Work gloves (neoprene can be good in cold weather, and mittens or insulated gloves come in handy during cooler days)
- Insect repellent *only limited use is recommended during wetland teams (Teams 2, 3, 4 & 5) due to the sensitive nature of amphibians.
- Bug jacket and/or head net (such as the fine-screened types or the ones you put repellent on) (optional as we do have these available on site)

WINTER TEAMS ONLY

- Thermal long underwear bottoms and long-sleeved top (synthetic or wool, first layer)
- Heavier synthetic, fleece, or wool thermal bottoms and top (second layer)
- Heavier long-sleeved shirt, preferably wool, down, synthetic insulation or fleece preferably with a hood (third top layer)
- Windproof jacket or anorak large enough to fit over outer layers (could be softshell), except your parka (fourth top layer)
- Insulated parka of down, synthetic, or other warm material (fifth top layer)—Can be rented from CNSC
- Windproof insulated trousers or a bib-type snowsuit (third bottom layer)—Can be rented from CNSC
- Stout, warm boots with good soles, rated to at least -40°C that are loose-fitted for winter, preferably with removable liners for drying.—Can be rented from CNSC
- Light Liner gloves (fleece is best)
- Thermal mittens with windproof covers or large insulated mitts that will fit easily over the light liner gloves
- Neck gaiter or warmer
- Hat (fur, wool, or fleece) and facemask or balaclava with eye and mouth openings (you'll be more prone to frostbite if you wear an open-faced mask)
- Thick, woolly outer socks (at least two pairs)
- Multiple pairs of lighter inner thermal socks
- Ski goggles (the wider the better)
- Heat pads (hand/foot warmers)
- Cushion for traveling in the qamutiks (sleds)—optional
- If you chose to sleep in an igloo, you will need a sleeping bag of at least 1.8 kilograms (4 pounds) or 15 centimeters (6 inches) of loft, rated to at least -35°C , and an insulated (closed cell) mat to place under your sleeping bag—Can be rented from CNSC
- Parka, insulated pants, winter boots, and/or sleeping bag can be rented from CNSC, but must be reserved ahead of time; to reserve email us at research@churchillscience.ca



CLOTHING/FOOTWEAR FOR LEISURE

- Clothing to wear indoors
- Footwear (e.g., sneakers/trainers or slippers) for use indoors
- One set of clothing to keep clean for recreational time and end of expedition

FIELD SUPPLIES

- Small/Medium daypack to keep your personal items together and dry
- Water bottle(s)—at least one-liter capacity (insulated bottles required for winter team)
- Sunglasses—summer teams
- Sunscreen lotion with SPF 30 or higher—summer teams

BEDDING AND BATHING

NOTE: all bedding, as well as a bath towel, is provided at the research station.

PERSONAL SUPPLIES

- Personal toiletries (biodegradable soaps and shampoos are encouraged)
- Antibacterial wipes or lotion (good for cleaning hands while in the field)
- Personal first aid kit (e.g., anti-diarrhea pills, antibiotics, antiseptic, itch-relief, pain reliever, bandages, blister covers, etc.) and medications
- Spending money (approx. CAD\$150 for optional recreational activities)
- Calamine lotion and antihistamines if you suspect you will react to insect bites—summer teams
- Hand moisturizer—winter teams

OPTIONAL ITEMS

- Flip-flops or sandals for the shower
- Earplugs for light sleepers
- Binoculars
- Ceramic mug from your hometown to donate to the CNSC mug collection
- Pencil and notebook for note taking during lectures or journaling
- Flashlight or headlamp
- Camera, memory card(s), extra camera battery
- Hardware for sharing digital photographs at the end of the expedition
- Dry bag or plastic sealable bags (e.g. Ziploc) to protect equipment like cameras from dust, humidity, and water or to put dirty clothes in
- Books, games, journal, art supplies, etc. for free time

NOTE: Do not bring more luggage than you can carry and handle on your own. If traveling by air and checking your luggage, we advise you to pack an extra set of field clothing and personal essentials in your carry-on bag in case your luggage is lost or delayed.

The flight from Winnipeg to Churchill has a restriction of three checked bags (maximum weight of any bag is 23 kilograms/50 pounds) plus two carry-on bags (combined weight of 10 kilograms/ 23 pounds). The combined weight allowance, including carry-on luggage, is 32 kilograms/ 70 pounds. You can pay for additional bags, but they might end up on another flight and therefore run an increased risk of delay or getting lost. If you check more than one bag, you must identify one bag as priority to ensure that critical items are in this bag.



PROJECT STAFF

YOUR RESOURCES IN THE FIELD



NOTE: The specific staff scheduled to run your team is subject to change.

DR. LEEANN FISHBACK (Western) is an environmental geochemist focusing on freshwater lake and pond water chemistry in arctic and subarctic regions. She lives in Churchill, Manitoba full time as a northern field research scientist. Her passion for the north has grown over the past 25 years, and she enjoys living in the remote areas of the country. LeeAnn has been the Scientific Coordinator at CNSC for the last fifteen years. She is also an adjunct professor in the Department of Geography at the University of Winnipeg in Manitoba, where she teaches and supervises students.



DR. STEVE MAMET (Alberta) is a Research Associate at the University of Saskatchewan in Saskatoon. Steve specializes in the expansion of tree line in a number of subarctic and alpine environments in northern Canada, and has worked with Earthwatch projects in Churchill throughout the duration of studies over the last 15 years.

Several students and interns working at CNSC will also support the fieldwork component of these Earthwatch teams. All students and interns will be introduced on site.

An **EARTHWATCH TEEN TEAM FACILITATOR** (TEEN team only) will accompany the teen team from the time you step off the plane for the rendezvous until the end of the expedition. If you have any questions or problems, such as issues with another volunteer, homesickness, or an emergency back home, please talk to your facilitator. Follow your facilitator's advice on safety and personal conduct. All facilitators have experience teaching and leading groups of teenagers. Remember, your facilitator is there for you. (Teen: Facilitator ratio is approx. 6:1)



RECOMMENDED READING

YOUR RESOURCES AT HOME

RESOURCES

ARTICLES

- Huntington, H., G. Weller, E. Bush, T.V. Callaghan, V. Kattsov, and M. Nuttall. "Chapter 1: An Introduction to the Arctic Climate Impact Assessment." In Arris, L. (ed.),
- Arctic Climate Impact Assessment: Scientific Report, 2-19. Fairbanks: ACIA Secretariat and Cooperative Institute for Arctic Research. Available at: <http://www.acia.uaf.edu/pages/scientific.html>
- Overpeck, J.T., K. Hughen, D. Hardy, R. Bradley, R. Case, M. Douglas, B. Finney, K. Gajewski, G. Jacoby, Jennings, S. Lamoureux, A. Lasca, G. MacDonald, J. Moore, M. Retelle, S. Smith, A. Wolfe, and G. Zielinski. "Arctic environmental change of the last four centuries." *Science* 278 (1997): 1251-1256.

BOOKS

- Alley, R. *The Two-Mile Time Machine: Ice Cores, Abrupt Climate Change, and Our Future*. Princeton: Princeton University Press, 2002.
- McGhee, R. *Ancient people of the Arctic*. Vancouver: UBC Press, 1996.
- Stirling, I. *Polar Bears: The Natural History of a Threatened Species*. Markham, ON: Fitzhenry and Whiteside, 2011.
- Brandson, L.E. *Churchill, Hudson Bay: A Guide to Natural and Cultural History*. Churchill: The Eskimo Museum, 2011.
- Bennett, J. *A Global Warming Primer*. Boulder: Big Kid Science, 2016.

FIELD GUIDES

- Jehl, J.R. *Birdlife of the Churchill Region: Status, History, Biology*. Victoria, B.C.: Trafford Publishing, 2004.
- Johnson, K.L. *Wildflowers of Churchill and the Hudson Bay Region*. Winnipeg: Manitoba Museum of Man and Nature, 1987.

PROJECT-RELATED WEBSITES

- **SCIENTIST STEVE MAMET:** <http://www.stevenmamet.com/>
- **CHURCHILL NORTHERN STUDIES CENTRE:** www.churchillscience.ca
- **EARTHWATCH PROJECT FACEBOOK PAGE:** <https://www.facebook.com/arcticsedge>
- **CLIMATE SCIENCE INFORMATION:** www.realclimate.org

EARTHWATCH SOCIAL MEDIA

- **FACEBOOK:** [facebook.com/Earthwatch](https://www.facebook.com/Earthwatch)
- **TWITTER:** twitter.com/earthwatch_org
- **INSTAGRAM:** [instagram.com/earthwatch](https://www.instagram.com/earthwatch)
- **BLOG:** <https://blog.earthwatch.org/>
- **YOUTUBE:** [youtube.com/earthwatchinstitute](https://www.youtube.com/earthwatchinstitute)



LITERATURE CITED

YOUR RESOURCES AT HOME

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- ACIA, 2004. Arctic Climate Impact Assessment: Impacts of a Warming Arctic. Cambridge University Press, Cambridge, UK, 1042 pp.
- Bonan, G.B., Pollard, D. and Thompson, S.L., 1992. Effects of boreal forest vegetation on global climate. *Nature*, 359: 716-718.
- Chapin III, F.S. et al., 2005. Role of land-surface changes in Arctic summer warming. *Science*, 310: 657-660.
- Diffenbaugh, N.S. and Field, C.B., 2013. Changes in Ecologically Critical Terrestrial Climate Conditions. *Science* 341: 486-492.
- Harsch, M.A., McGlone, M.S. and Duncan, R.P., 2009. Are treelines advancing? A global meta-analysis of treeline response to climate warming. *Ecology Letters*, 12: 1040-1049.
- IPCC 2013 Climate change 2013: the physical science basis. Contribution of Working Group I to the fifth assessment report of the Intergovernmental Panel on Climate Change." New York: Cambridge University Press. Available at: www.ipcc.ch/report/ar5/wg1
- IPCC, 2014. Climate Change 2014: Synthesis Report. Contribution of Working Groups I, II and III to the Fifth Assessment Report of the Intergovernmental Panel on Climate Change [Core Writing Team, R.K. Pachauri and L.A. Meyer (eds.)]. IPCC, Geneva, Switzerland, 151 pp.
- Overpeck, J.T., Huguken, K., Hardy, D., Bradley, R., Case, R., Douglas, M., Finney, B., Gajewski, K., Jacoby, G., Jennings, A., Lamoureux, S., Lasca, A., MacDonald, G., Moore, J., Retelle, M., Smith, S., Wolfe, A., and Zielinski, G., 1997. Arctic environmental change of the last four centuries. *Science* 278: 1251-1256.
- Smith, W. K., Germino, M.J., Johnson, D.M., and Reinhardt, K., 2009. The altitude of alpine treeline: A bellwether of climate change effects. *Botanical Review* 75:163-190.
- Tarnocai, C., Canadell, J.G., Schuur, E.A.G., Kuhry, P., Mazhitova, G., and Zimov, S., 2009. Soil organic carbon pools in the northern circumpolar permafrost region. *Global Biogeochemical Cycles* 23: doi:10.1029/2008GB003327.
- Vavrus, S.J., Holland, M.M., Jahn, A., Bailey, D.A., and Blazey, B.A., 2012. Twenty-First-Century Arctic Climate Change in CCSM4. *Journal of Climate* 25: 2696-2710.



POLAR BEAR ACKNOWLEDGEMENT FORM

Welcome to the Churchill Northern Studies Centre (CNSC). The Centre is located in an area of high polar bear concentration along the Hudson Bay coast, where bears congregate in the fall, awaiting ice formation. You should expect and be prepared to encounter a polar bear at any time of the year. Polar bears are inquisitive and unpredictable animals, and not afraid of people, so it is unwise to put yourself in a situation where you might encounter a bear. In an effort to reduce human-bear contact, the Centre has bear safety protocols in place. Following are several precautionary measures to reduce your risk in polar bear country. You are asked to read the following information carefully and sign the waiver if you understand all statements.

I have read the above statements, and agree that the CNSC has provided me with proper information about polar bear safety. I am aware of the risk in visiting an area of high polar bear concentration and I agree that the CNSC is not responsible for any human-bear conflict. I absolve the CNSC from any and all liability should I have a polar bear encounter. I understand that if I do not follow the aforementioned instructions, or those given to me by CNSC staff members, I may be asked to leave immediately.

- The CNSC will provide bear safety information for you to read. It is for your protection and benefit that you read it carefully.
- The CNSC will instruct you on bear safety precautions soon after your arrival. It is important that you notify a CNSC staff member prior to leaving the building for any reason.
- Smoking is not allowed inside the building. Individuals who choose to smoke can do so just outside the main entrance at their own risk.
- All outside doors must be kept closed at all times. Bear bars are on outside windows. These are for your protection, and we ask that you do not deface them.
- If polar bears are seen outside, do not leave the building and please notify a staff member immediately.
- There is to be no camping of any kind and hiking or walking will be dependent upon the season and previous polar bear sightings.
- Researchers are expected to participate in additional polar bear safety training and are required to coordinate their activities with CNSC science staff.
- Bear deterrents are available from the CNSC office. At the discretion of the staff, they may be available for personal use.
- It is unlawful to feed or harass polar bears. The placement of food with the purpose of attracting, feeding, or holding polar bears is strictly prohibited. It is not permitted to approach a polar bear or active polar bear den closer than 100 meters. I have read the above statements, and agree that the CNSC has provided me with proper information about polar bear safety. I am aware of the risk in visiting an area of high polar bear concentration and I agree that the CNSC is not responsible for any human-bear conflict. I absolve the CNSC from any and all liability should I have a polar bear encounter. I understand that if I do not follow the aforementioned instructions, or those given to me by CNSC staff members, I may be asked to leave immediately.

Signature _____

Date _____

Print Name _____ CNSC Staff _____

Parent/Guardian Signature (for minors only) _____

Revised May 2010



EMERGENCY NUMBERS

AROUND-THE-CLOCK SUPPORT



MESSAGE FROM EARTHWATCH

DEAR EARTHWATCHER,


Thank you for joining this expedition! We greatly appreciate your decision to contribute to hands-on environmental science and conservation. It is volunteers like you who fuel our mission and inspire our work.

While at Earthwatch, I've had the opportunity to field on a few expeditions, most recently in Kenya with one of my daughters. Each expedition has touched me deeply, and made me proud to be able to roll up my sleeves alongside my fellow volunteers and contribute to such meaningful work.

As an Earthwatch volunteer, you have the opportunity to create positive change. And while you're out in the field working toward that change, we are committed to caring for your safety. Although risk is an inherent part of the environments in which we work, we've been providing volunteer field experiences with careful risk management and diligent planning for nearly 45 years. You're in good hands.

If you have questions as you prepare for your expedition, we encourage you to contact your Earthwatch office. Thank you for your support, and enjoy your expedition!

Sincerely,



Scott Kania
President and CEO, Earthwatch





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