

# ARCTIC CIRCLE

## Study Guide

Climate change is striking the Arctic faster and harder than any other place on Earth.

*Arctic Circle, 2009*, is a two-part documentary series on the dramatic effects climate change is having on the far North. Shot in HD in some of the world's most desolate and stunning locations, it chronicles the story of rapid changes to one of the world's most remarkable ecosystems.

### Synopsis

#### *Arctic Circle – Episode 1: “On Thin Ice”*

International teams of scientists are chronicling the effects of climate change on the land and its animal inhabitants. We see huge ice shelves crumbling into the sea, polar bears struggling to survive and torrents of water flowing where there should only be ice. (2009, 42 min 44 s)



#### *Arctic Circle – Episode 2: “Battle for the Pole”*

In the Norwegian village of Hammerfest, a massive new liquefied natural gas plant has sprung up that processes gas drilled from deep below the Arctic waters. For the engineers constructing ice-breaking tankers and the crew on the world's northernmost oil rig, this race is all about opportunity and new frontiers. As resource extraction accelerates, the more quickly the ice melts – locking us into a cycle whose effects are only starting to be felt. (2009, 42 min 59 s)



## Production Background

This project was a partnership and co-production between the National Film Board of Canada (NFB) and NHK Japan. The two organizations were brought together to collaborate on “themes of common interest in environmental and social issues,” drawing on the expertise of the NFB and NHK in quality high-definition productions. NHK took the lead on the production of the two-part series, directed by Takashi Shibasaki, which the NFB then adapted for a Canadian audience. The NFB version of **Arctic Circle** was produced and directed by Wally Longul, who has extensive background in international science programming.

## Notes to the Teacher

Today, research is often driven by societal and environmental needs and issues. As technological solutions emerge and evolve, there are additional social and environmental issues. These are increasingly becoming part of the political agenda. The two films in this documentary series, **Arctic Circle**, can be used either as a set or individually. The topic of climate change in the Arctic has diverse curricular connections, primarily in Science and Social Studies.

**Episode 1** focuses on a team of international scientists gathering information in a collaborative manner. In what ways will this scientific data be used? What can be done to address the issues of global warming?

**Episode 2** presents more of an economic and-political look at the various countries and businesses involved in the race to claim the oil and gas reserves in the Arctic. The narrator poses several questions: At what cost are Arctic gas and oil resources being explored and developed? What is the role of technology in Arctic exploration? Are attempts to “green” production procedures “too little, too late”? This documentary series encourages students to develop a critical sense of wonder and curiosity about the ecosystems in the north and challenges students to critically address science-related societal, economic, ethical and environmental issues.

The questions and activities in this Study Guide were developed for **students at the secondary level**. Students can view and discuss these films from many perspectives. Here are a few:

- ✚ scientific research and technological development – opportunities and challenges;
- ✚ energy flow in global systems;
- ✚ climate and weather change; interactions and ecosystems; effects of polar ice cap melting on polar bears and other Arctic wildlife; systems, equilibrium and change;
- ✚ globalization and responsibilities associated with global citizenship; stewardship – caring for the environment;
- ✚ social and environmental contexts; ethical and economic considerations; multiple perspectives
- ✚ Aboriginal/Indigenous peoples’ understandings of the land and their attitudes towards the environment and global warming issues.

## Before Screening the Films...

- Information about the **Arctic Circle** films can be found on the National Film Board of Canada (NFB) website at [onf-nfb.gc.ca/eng/collection/film/?id=56572](http://onf-nfb.gc.ca/eng/collection/film/?id=56572). After reading this information and related links, can you predict what perspective(s) these films will present? Check out the photo images too.
- In general terms, describe the distribution of freshwater and saltwater in Canada and the world.
  - How do water, land and climate interact?
  - Describe the processes of erosion and deposition resulting from wave action and water flow.
- Identify the countries that have territory in the Arctic Circle.
- In small groups or as a full class, brainstorm what you know about the effects of climate change in the Arctic Circle on such topics as global warming and ecosystems; melting of polar ice cap; effects on the lifestyles of Aboriginal

peoples; effects on the animal populations and the food chain; impact of oil and gas industries; conflicting claims for Arctic sovereignty related to competing national interests around resource exploitation; attempts to map the Arctic shelf to more clearly defined Arctic boundaries; energy flow.

- Solar energy sustains life and drives the global climate systems on Earth. The absorption and transfer of thermal energy at and near the Earth's surface results in a variety of climate zones with characteristic weather patterns and biomes. The *United Nations Intergovernmental Panel on Climate Change* (IPCC) has stated that the balance of evidence suggests a human influence on global climate. Find out more about the statements made by this panel.
- Note: There are scenes of polar bears capturing and eating animals in this film, which may be unsuitable for sensitive viewers.

## After Screening – Episode 1 “On Thin Ice”

Discussion Questions and Possible Activities:

1. Scientific development takes place within a social context. Research is sometimes driven by societal and environmental needs and issues.
  - a. As a class, identify and discuss some of the scientific testing that the researchers were conducting in this film.
  - b. Working cooperatively in small groups, identify questions to investigate and analyze some of the needs and issues driving the researchers, as presented in this film. Re-view sections of the film if needed.
  - c. How does/can this scientific research help explain, interpret and predict warming trends?
2. Ecosystems develop and are maintained by natural processes and are affected by human actions. How have humans affected the ecosystems in the Arctic?
  - a. Describe the food web that is illustrated in the film. Interpret the food web and predict the effects of changes already impacting parts of the web.
  - b. Compile and display the data in a variety of formats (e.g. diagrams, flow charts, tables, bar graphs, line graphs). Discuss any discrepancies from your sources and suggest explanations for these discrepancies. Interpret patterns and trends and explain relationships among the variables.
  - c. Identify factors that affect glacial action and analyze factors that affect the growth and attrition of glaciers and polar icecaps.
3. Discuss and identify the effects that climate change is having on various species in the Arctic. What evidence suggests that our climate may be changing more rapidly than living species can adapt?
4. The narrator (in chapter 4) identifies some changes in conditions in the Arctic from 1980 to 2007. Interested in finding out more about evidence of gradual/incremental change in the Arctic? Using a variety of sources, investigate changes in water levels and plant/animal life during an identified time span.
  - a. What are some of the most dramatic changes that have occurred over time? Display and interpret your information.
  - b. The *United Nations Intergovernmental Panel on Climate Change* (IPCC) has stated that the balance of evidence suggests a human influence on global climate. Find out more about the statements made by this panel.
  - c. The National Film Board of Canada has several older films that present the life and landscape of the Arctic. Some examples include: *The Face of the High Arctic* (1958); *High Arctic: Life on the Land* (1958); *Arctic Mission* (2003). View these films or others and analyze the similarities and differences between such elements as the scientific data available, lifestyles of Aboriginal peoples, etc. in 1958–60 to the most current information available. The link for other NFB films on the Arctic Circle is in the list of [Additional Resources](#) found at the end of this study guide.

5. Decisions regarding scientific and technological development involve a variety of considerations, including social, environmental, ethical and economic. What is the role of science to inform and empower decision-making by individuals, and by local, national and global communities?  
**Extension Activity:** If possible, invite an expert scientific source (either in person or via such technologies as video conferencing or Skype) to talk on this topic to the students in your class/school.
6. Global stewardship involves finding a balance between the needs of humans and a sustainable environment. Analyze a local environmental issue based on evidence from a variety of sources. Draw conclusions based on evidence derived from research. Try to identify possible actions and consequences.
7. What are some of the perspectives of Northern youth who live near the Arctic Circle? Consult a variety of digital resources. Some are identified on International – Circumpolar World on the Aboriginal Canada Portal at <[aboriginalcanada.gc.ca/acp/site.nsf/eng/index.html](http://aboriginalcanada.gc.ca/acp/site.nsf/eng/index.html)> including **The Arctic Youth Network, Circumpolar World – The Canadian North**, and **Ookpik – Sharing the Pride and Vision of Arctic Youth**. The National Association of Friendship Centres has an Aboriginal Youth Council; information can be found at <http://www.nafc.ca/ayc.htm> . Consider contacting a member of the Youth Council to discuss topics and/or perspectives. Are these similar to or different from those of students in your class?  
**Extension Activity:** Develop and conduct a survey at your school and share the results with students in other provinces and territories via technologies such as video conferencing, Skype, blogs.
8. In small groups, consult a wide variety of media resources that reflect varied perspectives on an issue related to scientific research in the Arctic. What activities are currently going on? What countries are involved? Are there examples of international collaboration? What universities have research institutes, programs and newsletters that focus on the Arctic? Or identify another issue of interest. See the list of **Additional Resources** at the end of this study guide. Use appropriate presentation software to share your evidence and findings.
9. Find out about the first Earth Day held in 1970. What changes have occurred since that first Earth Day? What does Earth Day mean to you? In small groups, students can use a variety of technologies to research and identify a variety of Earth Day activities locally, provincially, nationally and internationally. Present these findings to the class using a multi-media approach. Here are two websites to get you started:  
 <[www.cbc.ca/world/story/2010/04/21/earthday-first.html](http://www.cbc.ca/world/story/2010/04/21/earthday-first.html)>; <[www.cbc.ca/photogallery/news/2169/](http://www.cbc.ca/photogallery/news/2169/)>.
10. **Extension Activity:** The Oscar-winning documentary **An Inconvenient Truth**, narrated by former US Vice President Al Gore, made global warming a topic of conversation around the world. “With an emphasis on hope, **An Inconvenient Truth** ultimately shows us that global warming is no longer a political issue, but rather, the biggest moral challenge facing our civilization today.” More information about the film can be found at <http://www.climatecrisis.net/an-inconvenient-truth.php>. Students who are interested in pursuing this topic could do a compare/contrast between the information and perspectives presented in **The Arctic Circle** documentaries and this movie. There are some good teacher resources available at <[stopglobalwarming.org/sgw\\_classroom.asp](http://stopglobalwarming.org/sgw_classroom.asp)>. Another resource, “AIT in the Classroom,” at <[dev.climatecrisis.net/pdf/AIT\\_Classroom.pdf](http://dev.climatecrisis.net/pdf/AIT_Classroom.pdf)>, contains a series of lessons designed for science classrooms as a companion to the movie. This resource also contains tips in “Take Action at School!” – a series of social action activities for individual classes or the entire school to do. Students can also calculate their impact on the environment with a carbon calculator at <[climatecrisis.net/calculate-your-impact.php](http://climatecrisis.net/calculate-your-impact.php)>. For more teacher and student resources, see the list of **Additional Resources** found at the end of this study guide.

## After Screening – *Episode 2 “Battle for the Pole”*

Discussion Questions and Possible Activities:

1. Investigate and explain how evaporation, condensation, freezing and melting transfer thermal energy. Describe how thermal energy transfer through the atmosphere and hydrosphere affects climate.
2. Identify and explain the procedures used at the Statoil Norwegian Petroleum Company plant to cool and liquefy the gas. What challenges did the company face when developing these procedures?
3. Describe and explain the greenhouse effect and the role of gases such as carbon dioxide in determining the scope of the greenhouse effect. What efforts is Statoil Hydro making to help reduce their “carbon footprint”?
4. Some technological developments in the oil and gas industry have given rise to debates concerning complex social and environmental issues.
  - a. Decisions regarding scientific and technological development involve a variety of considerations, including social, environmental, ethical and economic. In small groups, identify and analyze some of the ethical issues related to extracting oil and gas from *Episode 2 “Battle for the Pole.”*
  - b. What role does technology have in measuring, modelling and interpreting climate and climate change? Do changes in technology benefit or harm society?
5. Multiple perspectives exist with respect to the relationships among politics, economics, the environment and globalization.
  - a. Working cooperatively in small groups, use a variety of media resources to assess the risks and benefits of human activity and its impact on the biosphere and the climate from different perspectives (e.g. researcher, Inuit, Planet Earth, oil company, political/country, consumer). Develop a position and present a case for or against continued exploration in the Arctic. The list of **Additional Resources** at the end of this study guide has some suggestions.
  - b. Assess the authority, reliability and validity of the information you find.
  - c. **Extension Activity:** Host a global debate. If possible, invite representatives from a variety of organizations (either in person, or via such technologies as video conferencing or Skype) to present their multiple perspectives to the students in your class/school.
6. What is the role of science in furthering the understanding of climate and climate change? In small groups, and using a variety of research tools, research some related international programs such as the Intergovernmental Panel on Climate Change (IPCC), Global Atmosphere Watch, World Meteorological Organization, and World Weather Watch. Analyze your findings, and identify patterns and trends. Do these organizations have balanced perspectives? Present your findings to the class using a multimedia approach.
7. Not all scientists and sources agree with how and why the polar ice cap melting is occurring. Consult a variety of media sources to identify the areas of disagreement and to analyze and evaluate the validity of the various points of view. Do these sources make sound generalizations? Balanced perspectives? Misleading oversimplification? One perspective is available at [articlesbase.com/environment-articles/global-warming-is-not-melting-polar-ice-caps-521748.html](http://articlesbase.com/environment-articles/global-warming-is-not-melting-polar-ice-caps-521748.html). Find additional sources on this topic and see the list of **Additional Resources** at the end of this Study Guide for ideas.
8. Compile and organize weather and climate data, which includes both historic and current data, for Canadian lands close to the Arctic Circle. Using a variety of technologies, identify and interpret patterns and trends.
9. What impact will Arctic exploration have on Canada?
  - a. How will global warming affect Canada’s northern biomes?
  - b. Does Canada have a national position on exploration in the Arctic?
  - c. What is the perspective of the Canadian Petroleum Institute?

- d. Do Canada’s Aboriginal peoples have a position on exploration in the Arctic? Consult a variety of sources to include Inuit perspectives. See the list of **Additional Resources** at the end of this study guide.
  - e. How is the race for Arctic exploration challenging Canada’s claims to Arctic sovereignty?
10. Near the end of the film, the narrator talks about a chain reaction – “the more oil used, the more heat generated; the more heat, the less ice; the less ice, the less life.” Science has the potential to inform and empower decision-making by individuals, communities and society.
- a. How can this chain reaction be modified to preserve life in the Arctic?
  - b. What evidence is there that human activity is causing climate change? Using a variety of technologies, consult a wide range of sources that reflect diverse viewpoints on this topic. Look for a number of perspectives, including **anti-global warming perspectives**, on some of the websites listed in **Additional Resources** at the end of this study guide. Evaluate the validity of these viewpoints against other sources.
  - c. How can we reduce our impact (at the local, national and international levels) on the biosphere and on global climate while still meeting human needs?

## Additional Resources

- ✚ Many other NFB films on the Arctic Circle are available at: <http://www.nfb.ca/>. Type “The Arctic Circle” into the search feature to find an interesting list. Many of them are available for viewing online.
  - **Films for Change** is a bilingual NFB production designed to integrate documentary films on the environment into secondary level education at [nfb.ca/playlist/films-change](http://nfb.ca/playlist/films-change). A comprehensive **Teacher's Guide** is available to help students develop media literacy and environmental skills as well as to create an opportunity for students to implement environmental action projects in the classroom. The **Films for Change Teacher's Guide** has quick links to curricula in provinces and territories across Canada and provides teachers with options for assessment strategies.
  - Other free online NFB resources for teachers include the **Footprints** website, which addresses the environment and the way we live at [www3.nfb.ca/footprints](http://www3.nfb.ca/footprints) and the **Waterlife** website, which tells the story of the Great Lakes at [waterlife.nfb.ca](http://waterlife.nfb.ca).
  - Are you smarter than a 5th grader? Some students might want to check out **Arctic Mission: An Interactive Adventure** educational quiz game for children 9–12 to learn more about the impact of climate change at [onf-nfb.gc.ca/eng/collection/film/?id=53241](http://onf-nfb.gc.ca/eng/collection/film/?id=53241).
- ✚ General links:
  - Government of Canada: Aboriginal Canada Portal – International – Circumpolar World at [aboriginalcanada.gc.ca/acp/site.nsf/eng/ao35100.html](http://aboriginalcanada.gc.ca/acp/site.nsf/eng/ao35100.html)
  - Arctic Portal at [arcticportal.org](http://arcticportal.org)
  - Arctic Youth Network at [taiga.net/ayn/home.html](http://taiga.net/ayn/home.html)
  - Arctic Future: The Circumpolar International Internship Newsletter at [iisd.org/publications/pub.aspx?pno=1247](http://iisd.org/publications/pub.aspx?pno=1247)
  - Inuit Circumpolar Council at [inuit.org](http://inuit.org)
  - Inuit Tapiriit Kanatami (ITK) is the national Inuit organization in Canada, representing four Inuit regions at [itk.ca](http://itk.ca)
  - Foreign Affairs and International Trade Canada—Canada and the Circumpolar World at [international.gc.ca/polar-polaire/index.aspx?lang=en](http://international.gc.ca/polar-polaire/index.aspx?lang=en). There is a library section about Canada’s role in the Arctic that contains six interviews at [international.gc.ca/cip-pic/video/arctic-arctique/index.aspx/arctic-arctique/index](http://international.gc.ca/cip-pic/video/arctic-arctique/index.aspx/arctic-arctique/index)



#### ✚ Arctic research links:

- Arctic Institute of North America at <[arctic.ucalgary.ca](http://arctic.ucalgary.ca)>
- The John Sloan Dickey Center for Understanding at Dartmouth – The Institute of Arctic Studies <[dickey.dartmouth.edu/content/view/9/17/](http://dickey.dartmouth.edu/content/view/9/17/)>
- University of the Arctic at <[uarctic.org/Frontpage.aspx?m=3](http://uarctic.org/Frontpage.aspx?m=3)>
- Canadian Circumpolar Institute at <[uofaweb.ualberta.ca/CCI](http://uofaweb.ualberta.ca/CCI)>

#### ✚ Websites and articles – A sampling of perspectives from various environmental organizations:

- NRDC: [nrdc.org/globalwarming/gthinice.asp](http://nrdc.org/globalwarming/gthinice.asp)
- NASA: [nasa.gov/centers/goddard/news/topstory/2003/1023esuice.html](http://nasa.gov/centers/goddard/news/topstory/2003/1023esuice.html)
- New York Times: [nytimes.com/library/national/science/081900sci-climate-pole.html](http://nytimes.com/library/national/science/081900sci-climate-pole.html)
- Time: [time.com/time/magazine/article/0,9171,1176980,00.html](http://time.com/time/magazine/article/0,9171,1176980,00.html)
- BBC: [news.bbc.co.uk/2/hi/uk\\_news/4228411.stm](http://news.bbc.co.uk/2/hi/uk_news/4228411.stm)
- National Geographic: [news.nationalgeographic.com/news/2004/11/1109\\_041109\\_polar\\_ice.html](http://news.nationalgeographic.com/news/2004/11/1109_041109_polar_ice.html)
- Natural Resources Defense Council at [nrdc.org](http://nrdc.org)
- Environment Support and related organizations: [environment-support.org/global-warming/articles/polar-ice-caps-melting.html](http://environment-support.org/global-warming/articles/polar-ice-caps-melting.html)
- UN Radio: [unmultimedia.org/radio/english/detail/70108.html](http://unmultimedia.org/radio/english/detail/70108.html)
- CBC: [cbc.ca/quirks/archives/05-06/dec03.html](http://cbc.ca/quirks/archives/05-06/dec03.html)
- Globe and Mail: [v1.theglobeandmail.com/servlet/story/LAC.20091029.CLIMATEANALYSIS29ART02232/TPStory/TPComment/](http://v1.theglobeandmail.com/servlet/story/LAC.20091029.CLIMATEANALYSIS29ART02232/TPStory/TPComment/)
- The Edmonton Journal: [edmontonjournal.com/staking-claims](http://edmontonjournal.com/staking-claims)  

This is a seven-part series of articles called “Staking Claims, Who owns the Arctic?” by Ed Struzik. The articles also include photos and videos, as well as links to related stories around the web.
- Pembina Institute: [climate.pembina.org/controversies](http://climate.pembina.org/controversies)
- Nunatsiaq News: [nunatsiaqonline.ca/archives/2009/901/90123/news/nunavut/90123\\_1844.html](http://nunatsiaqonline.ca/archives/2009/901/90123/news/nunavut/90123_1844.html)
- [france24.com/en/20090225-icecaps-around-north-south-poles-melting-faster-expected-scientists-international-polar-year-survey](http://france24.com/en/20090225-icecaps-around-north-south-poles-melting-faster-expected-scientists-international-polar-year-survey)
- Anti-global warming perspectives: [capitalismmagazine.com/index.php?news=4470](http://capitalismmagazine.com/index.php?news=4470); [articlesbase.com/environment-articles/global-warming-is-not-melting-polar-ice-caps-521748.html](http://articlesbase.com/environment-articles/global-warming-is-not-melting-polar-ice-caps-521748.html)
- National Wildlife Federation: [nwf.org](http://nwf.org)
- Earth Day: : <http://www.cbc.ca/world/story/2010/04/21/earthday-first.html> and [cbc.ca/photogallery/news/2169/](http://cbc.ca/photogallery/news/2169/)

#### ✚ Curriculum links:

- **An Inconvenient Truth** ultimately shows us that global warming is no longer a political issue, but rather, the biggest moral challenge facing our civilization today.” More information about the film can be found at <http://www.climatecrisis.net> and click on the link to the film.
- A sampling of Teacher resources: The web site <http://www.climatecrisis.net/help-the-cause.php> contains several sections including “Become Carbon Neutral,” “Reduce Your Impact at Home,” “Reduce your Impact on the Move,” “12 Tips,” and “Curriculum.” Also see the related link at <[dev.climatecrisis.net/education-guide.php](http://dev.climatecrisis.net/education-guide.php)>. “AIT in the Classroom” at <[dev.climatecrisis.net/pdf/AIT\\_Classroom.pdf](http://dev.climatecrisis.net/pdf/AIT_Classroom.pdf)> contains a series of lessons designed for grades 9–12 science classrooms as a companion to the movie. This resource also contains tips to “Take Action at School!” a series of social action activities for individual classes or the entire school to do. Other sites: <[stopglobalwarming.org/sgw\\_classroom.asp](http://stopglobalwarming.org/sgw_classroom.asp)> presents classroom activities to take action at school; <[theClimateproject.org](http://theClimateproject.org)>.
- A sampling of Student resources: The film’s website at <[climatecrisis.net/an-inconvenient-truth.php](http://climatecrisis.net/an-inconvenient-truth.php)> contains a number of resources for students. The movie trailer under “Photos and Videos” provides

information about the movie if it is not possible to access the full-length documentary. Students can also calculate their impact on the environment with a carbon calculator at <[climatecrisis.net/calculate-your-impact.php](http://climatecrisis.net/calculate-your-impact.php)>, and you can check out the reading list on the same link.

- The SEEDS Foundation site has two sections - the “Energy Literacy Program” and “Creating a Climate of Change” at <[seedsfoundation.ca/greenschools.html](http://seedsfoundation.ca/greenschools.html)>. The mission statement of SEEDS is “to support Canadian educators in promoting student literacy and active personal and societal responsibility for energy, sustainability, and the environment.”
- <[greenlearning.ca](http://greenlearning.ca)> contains a teacher resource link called “Real World Energy” for Alberta’s Science 24 program at <[greenlearning.ca/science24](http://greenlearning.ca/science24)> and one called “Sustainable Futures for a Small Planet” for Alberta’s Social Studies 20 program at <[greenlearning.ca/social20](http://greenlearning.ca/social20)> .
- Explore a section on “Earth News” on the Discovery Channel web site at <http://news.discovery.com/earth/> .
- Science News for Kids is a web site devoted to science news for students ages 9 to 14. It has a section on earth at <http://sciencenewsforkids.org/pages/search.asp?catid=6> and one on environment at <http://sciencenewsforkids.org/pages/search.asp?catid=7>
- Information and Communication Technology (ICT) outcomes identified for Alberta senior high school students can be found at <http://education.alberta.ca/teachers/program/ict/programs/division/div4.aspx>

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