



Polar Bears in a Warming World: A Climate Change Lesson

Grade Level: Grades 4-8

Time: 1.5–2 hours

Materials

For Activity 1:

- Climate Change: Is It True? Worksheet (one per student)

For Activity 2:

- Computer with Internet access
- Polar Bears in a Warming World PowerPoint found at polarbearsinternational.org/education/educational-tools-and-materials
- Projector

For Activity 3:

- Download seasonal ice maps (one per student)
- Computer(s) with Internet access
- Steve Amstrup—Four Ice Eco-regions Video: [youtube.com/watch?v=HtYI6HF7JIE&NR=1](https://www.youtube.com/watch?v=HtYI6HF7JIE&NR=1)
- Arctic maps
- Projector

Key Words

Albedo effect: Strength of reflection of the sun off the surface of the ocean water or sea ice.

Climate: Average weather conditions.

Climate change: Long-term change in average weather conditions.

Sea ice: Formed from sea water

that freezes. Sea ice supports the species within the Arctic ecosystem.

Sea ice eco-regions: Defined by how the sea ice forms and changes within each area and how this affects polar bears. There are four main eco-regions.

Objective

Students will locate and distinguish the four major sea ice eco-regions in the Arctic and explore the impacts of sea ice loss over time due to climate change and the ensuing threats these changes may have on the Arctic ecosystem and its inhabitants.

Background Information

Since the early 1980's, observations have recorded a steady decline in sea ice in the Arctic. Due to an increased frequency of warming temperatures, scientists are observing slower ice growth in winter and faster ice melt in summer. Scientists are studying the reasons behind the sea ice loss and the impact it has had and will continue to have on biodiversity in the Arctic and on global climate. The thinning sea ice affects the reflectivity of the sun's energy back into the atmosphere, called the albedo effect. With abundant sea ice coverage, much of the sun's energy is reflected back to space, but with increasing amounts of open water, more and more of the sun's energy is absorbed. Loss of sea ice leads to increased absorption of the sun's energy and further warming of our climate.

Loss of sea ice has impacts on the entire Arctic ecosystem. In the film we see the challenges the polar bear faces with thinning sea ice. Loss of sea ice affects where and how polar bears hunt, breed, and, in some cases, den. Changes in their distribution or numbers affect the entire Arctic ecosystem. Global climate change affects humans as well, both in the Arctic and throughout the rest of the world. Scientists believe that if we take action now, we can reduce, slow down, and stabilize greenhouse gases in sufficient quantity to save the sea ice and therefore the Arctic ecosystem that depends on the ice.

Teacher Prep Notes

This lesson contains several activities. All activities will take 1.5-2 hours. Make copies of Climate Change: Is It True? worksheet. Download the Polar Bears in a Warming World PowerPoint from polarbearsinternational.org/education/educational-tools-and-materials. Familiarize yourself with the Sea Ice Eco-regions video ahead of time at www.youtube.com/watch?v=HtYI6HF7JIE&NR=1.



Climate Change and the Arctic: Is it True?

To Do

Complete worksheet and keep in Arctic Notebook to revisit and revise at the end of this lesson.

Climate Change and the Arctic: Is it True?

Directions: Write T (true) or F (false) next to each statement below.

After the lesson, compare your answers with the information you learned in the film and in the activities.

Discuss any misconceptions as a class.

1. ____ The change in arctic sea ice coverage is due to natural changes.
2. ____ If polar bears become extinct, it will not impact the arctic ecosystem.
3. ____ Arctic sea ice coverage increases and decreases seasonally.
4. ____ Loss of sea ice leads to a warming climate.
5. ____ Greenhouse gases entering the atmosphere drive climate change.
6. ____ The greenhouse gas effect is a natural phenomenon.
7. ____ Sea ice reflects the sun's energy back into space.
8. ____ All populations of polar bears worldwide are in decline.
9. ____ Climate change is only affecting the arctic ecosystem.
10. ____ There is nothing I can do to prevent further climate change.
11. ____ Climate change is altering polar bear habitat.
12. ____ Every action I take affects the environment.

Teacher's Answer Key with some additional information:

1. **F** The change in arctic sea ice coverage is due to natural changes. Humans are contributing to climate change by using fossil fuels which emit greenhouse gasses; i.e. gasoline, electricity, etc.
2. **F** If polar bears become extinct, it will not impact the arctic ecosystem.
3. **T** Arctic sea ice coverage increases and decreases seasonally.
4. **T** Loss of sea ice leads to a warming climate.
5. **T** Greenhouse gases entering the atmosphere drive climate change.
6. **T** The greenhouse gas effect is a natural phenomenon.
7. **T** Sea ice reflects the sun's energy back into space.
8. **F** All populations of polar bears worldwide are in decline. Of the 19 populations of polar bears, 1 is increasing, 3 are stable, 8 are in decline, 6 are data deficient.
9. **F** Climate change is only affecting the arctic ecosystem. Climate change is happening everywhere but is happening 40% faster in the Arctic.
10. **F** There is nothing I can do to prevent further climate change. There are simple things I can do every day to control the rate of climate change. I can change to Energy Star Lightbulbs, turn off the lights when I leave the room, recycle, buy recycled, not idle my car.
11. **T** Climate change is altering polar bear habitat.
12. **F** Every action I take affects the environment.

Activity 2: Polar Bears in a Warming World

To Do

Watch Polar Bears in a Warming World PowerPoint as a class. This PowerPoint gives an overview of climate change, sea ice coverage in the arctic and impact on polar bears.

Activity 3: Arctic Sea Ice Mapping Activity

To Do

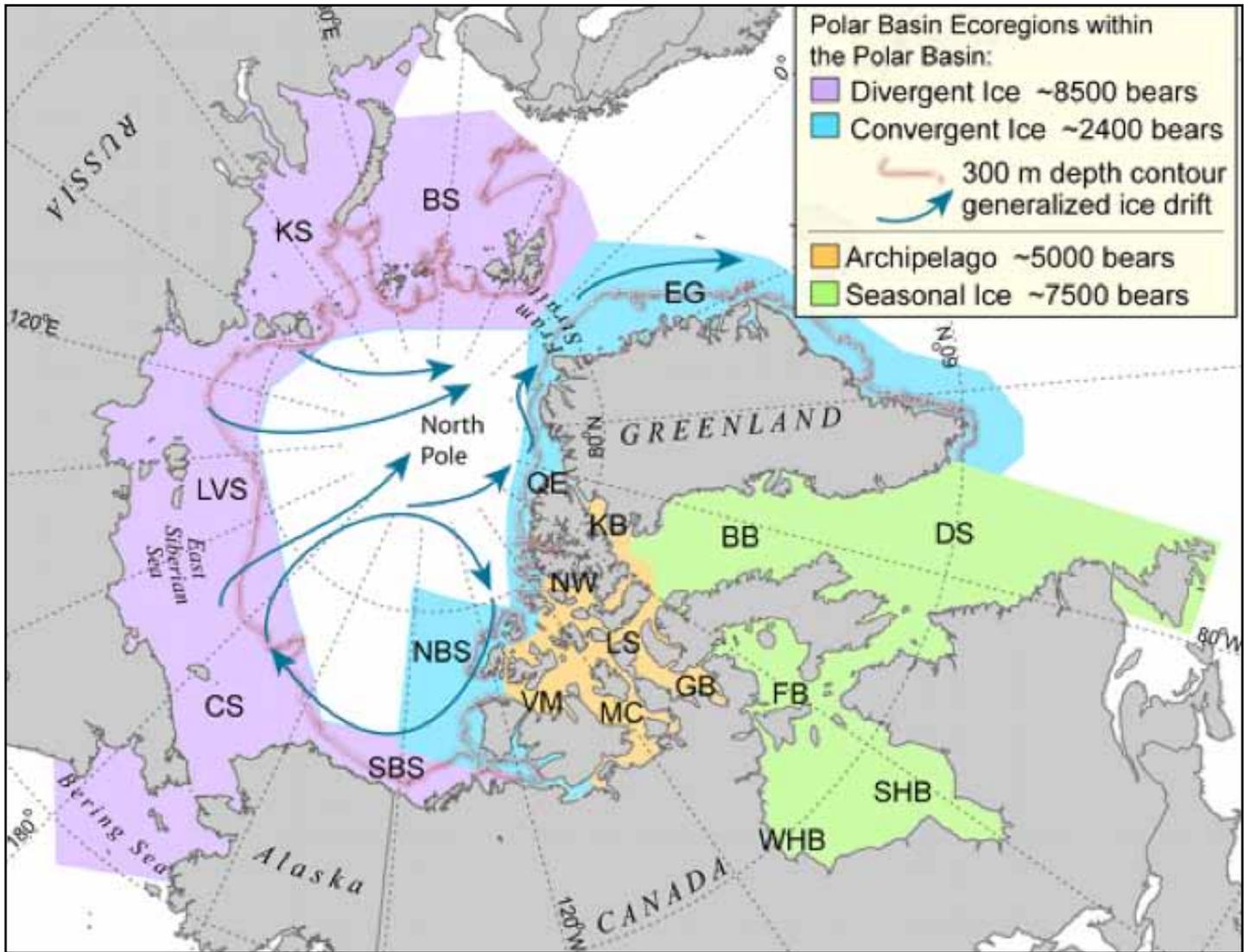
1. Scientists have identified four different sea ice eco-regions in the Arctic. Place the sea ice eco-region diagram on an overhead and have a copy available for each student.
2. Have students watch the video: *Steve Amstrup—Four Ice Eco-regions*. Dr. Steven C. Amstrup, a leading polar bear scientist introduces the four major ice eco-regions.
3. After watching the video, review vocabulary. Show students the ice loss by region and discuss how this impacts different bear populations.
4. Have students correlate the seasonal ice map with their Arctic maps. Students can place each of the types of seasonal ice on their maps with four distinct colors.
5. After looking at the four types of seasonal sea ice, have students examine decline of sea ice coverage over time.
6. Students can compare and contrast over several decades and see ice coverage extent between winter and summer months on the following website link: http://nsidc.org/cgi-bin/bist/bist.pl?config=seaice_index.
6. Now that students have observed the impact of decreasing sea ice coverage and impact on polar bear populations, have them brainstorm about how decline in sea ice impacts other organisms in the Arctic. How will this affect other animals featured in **To the Arctic**? How will a decline of sea ice coverage impact people who live in the Arctic and subarctic?
7. Have students return to their **Climate Change—Is it True?** worksheet and review their initial answers. Have any of their answers changed? What have they learned in this lesson?



ARCTIC MAP



POLAR BEAR ECOREGIONS MAP



Nature, December 2010

Seasonal Ice Eco-region—Seasonal ice areas occur at the southern extreme of the polar bear’s range and include places like Canada’s Hudson Bay, where the ice melts each summer and the bears must wait for freeze-up in the fall until they can hunt again. Polar bears in these seasonal areas are the most endangered, with longer and longer ice-free seasons testing the limits of their fat reserves.

Polar Basin Divergent Ice Eco-region—In these areas, sea ice forms along the shore but then retreats, especially in summer. As the sea retreats farther and farther from shore in a warming Arctic, these polar bears are faced with a choice of coming ashore—fasting until the ice returns in the fall—or swimming long, exhausting distances to reach the remaining pack ice. Ice located far offshore, however, often covers unproductive parts of the sea, so bears in these areas may successfully complete a marathon swim but still not find any seals to hunt. Polar bears that live in these areas

are at great risk: From longer and longer swims, prolonged fasting periods, or encounters with humans on shore.

Polar Basin Convergent Ice Eco-region—Sea ice formed in other parts of the Arctic collects along the shore of these habitats, providing polar bears with access to seals. Polar bears in these areas are faring well now, but scientists predict that ice in these areas will disappear within 75 years—and, with it, resident polar bear populations—unless action is taken to reduce CO₂.

Archipelago Ice Eco-region—Islands in the Canadian High Arctic and Greenland are far enough north that sea ice remains along the coast even in summer, providing hunting for the bears. This eco-region is predicted to be the last stronghold for polar bears, but it, too, is expected to melt within 100 years unless greenhouse gas emissions are greatly reduced.

Climate Change and the Arctic: Is it True?

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