

4 Arctic Ice and Climate Change

Objective of this lesson:

- To understand the effects of climate change on the Arctic and how this affects the world

Time:

60-90 minutes

Age:

KS2 Years 4-6

Materials:

- Inflatable globe
- Hand-held legends
- Map scramble starter activity
- Arctic ice cards
- Coloured chains (different colours)
- NASA sea ice images
- Stacking blocks

National Curriculum Objectives KS2:

- Use maps, globes to locate countries and describe features studied
- Understand geographical similarities and differences through the study of physical geography of [...] a region within North America

Starter

If students have not been on the Giant Floor Map in a previous lesson, allow them time to explore the map and make their own connections. Encourage them to look for familiar place names and geographic features. Ask students to determine the type of map they are looking at (physical) and what they think each colour represents.

Explain that the Giant Floor Map is a circumpolar map. Distribute the hand-held legends and allow students time to explore the map again and draw new conclusions.

Using the inflatable globe as a demonstration tool, have students name and locate the continents and find the United Kingdom. Then, turn the globe so that the North Pole is facing students (circumpolar view). Identify some of the countries and points of interest on the globe and have students find these places on the Giant Floor Map.

Next, have students form pairs or small groups and complete the map scramble activity to help increase their geographical knowledge and understanding. Ensure groups start at different numbers.

Climate change

Explain to students that although the Arctic is often portrayed as a frozen and barren place, it is actually full of life. It is home to millions of people and comprised of more than fifteen ecosystems that support thousands of plant and animal species. It is also a place of remarkable change.

Have students line up along the border of the Giant Floor Map and, using the red chains from the trunk, outline the Arctic sea ice labelled on the map. Explain that the sea ice cover shown on the map is from July 2012. Ask students how the ice may look different in the winter, autumn and spring.

Explain that there are many types of ice in the Arctic, and they are formed in many different ways. By studying different types of ice, including the location and speed at which it forms, researchers can learn more about the Arctic's climate and how it is changing. Researchers can also learn how climate changes in the Arctic affect other parts of the world.

Cold water at the northern and southern poles plays a huge part in global temperatures and is a major driving force of ocean currents. These currents transfer heat around the world and, in doing so, warm or cool our climate.



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Mapping sea ice cover

In the same groups as before, distribute one Arctic ice card and some stacking blocks to each pair/group. Have students read the information on the back of their card and use the blocks to build small models of their ice type at possible locations in the Arctic on the Giant Floor Map. For example, ice shelves can be found attached to Ellesmere Island and above 82 degrees north. After the different types of ice have been constructed on the map, have each pair/group describe their ice to the class and explain where it is found. Discuss the patterns and trends that arise between many different types of ice. Have students estimate which type of ice they think is oldest (glaciers) and explain why.

Remove the stacking blocks and cards from the map and have students line up along the map's border. Divide your class in half and give one group the 1979 NASA sea ice image and the other group the 2003 sea ice image, explaining that both images were taken in July. Have each group use a different coloured chain to label the extent of the sea ice in their image on the map.

When both groups have finished, discuss what they notice between the summer sea ice extent in 1979, 2003 and the ice shown on the map from 2012. Ask students what they think might be causing the vast differences in sea ice cover over the past 30 years? Some students are likely to mention global warming. Ask students what they think this term means. Do they have any idea what is causing global warming?

Global warming

Explain that global temperatures have been rising because of an increase in human activities that release carbon dioxide (CO₂) and other greenhouse gases into the atmosphere. Explain that CO₂ is a colourless, odourless gas that naturally occurs in our environment, however too much of it is bad and traps heat in the Earth's atmosphere, causing the planet to warm. Ask students what sorts of human activities may increase the amount of CO₂ in the atmosphere and discuss various possibilities. Explain that since the Industrial Revolution in the 18th century, CO₂ emissions — including the burning of carbon-based fossil fuels and land use changes (primarily deforestation) — have rapidly increased in the atmosphere.

The Arctic is one of the places where these warming effects are the most prominent and can be observed through dwindling multi-year sea ice. Highlight the white ice and snow on the NASA images and explain that they reflect heat back into the atmosphere, while the blue (from oceans) and green (from forests) reflect less. Therefore, less white means less heat reflection and more heat absorption. Consequently, the effects of greenhouse gases are magnified in the Arctic as the sea ice melts and even more heat is absorbed.



An illustration of an Arctic scene with various ice floes of different shapes and sizes floating on a dark blue sea. A black whale tail is visible, breaking the surface of the water. The background is a light blue gradient.

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Ask students why it is so dangerous for the world to become warmer? Explain that even a seemingly slight average temperature rise is enough to dramatically transform our planet. Ask students if they are familiar with the effects of climate change? Explain that this is a complicated topic, but some of the following will, or has already, started to happen:

- Sea levels will rise as ice melts, especially at the Earth's poles.
- More wildlife will become extinct as their habitat changes (gets warmer) and/or is lost (deforestation, urbanization).
- Species that depend on one another may become out of sync. For example, plants could bloom earlier than their pollinating insects become active.
- Precipitation (rain and snowfall) has increased across the globe, on average.
- Floods and droughts will become more common. Less fresh water will be available.
- Some diseases will spread, such as malaria carried by mosquitoes.
- Hurricanes and other storms are likely to become stronger

Finally, ask students to contemplate how the sea ice in the Arctic will change in the next few decades. Have students use the final coloured chain to map where they think the Arctic sea ice will be in 2050. Ask students what would happen if all CO₂ emissions stopped tomorrow. Explain to students that even if CO₂ emissions stopped, it does not mean that the sea ice would immediately come back.

What is the United Kingdom doing to help?

At the Paris Climate Conference (COP21) in December 2015, the United Kingdom was one of 195 countries to sign a legally binding global climate deal. The agreement sets out a global action plan to put the world on track to avoid dangerous climate change by limiting global warming to well below 2 C. The agreement is due to enter into force in 2020.

According to the gov.uk website:

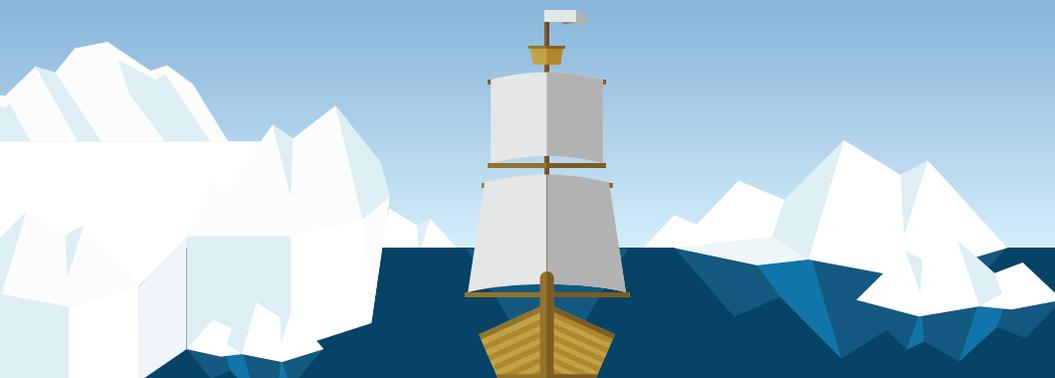
“The government is working at home and abroad to adapt to the effects of climate change and reduce greenhouse gas emissions by investing in low-carbon energy sources, improving fuel standards in cars and increasing energy efficiency wherever possible.”

“The UK has also committed up to £720 million to the Green Climate Fund, joining other major economies to help developing countries adapt to climate change and go low-carbon.”

Plenary

In pairs, have students summarize the topic of global warming in five sentences and share their summaries with the class.





5 Exploring the Arctic

Ask students how today's explorers might overcome these challenges with modern technology. Ask them to share their ideas using the Giant Floor Map.

Explain that the challenges for modern explorers also remain much the same. Technology has helped humankind overcome some of the past challenges; heating and insulation technology has improved; dietary knowledge and understanding, as well as food preservation techniques have improved; cartography of the Arctic is much more precise due to aerial and satellite surveillance. However, sustaining life within the Arctic Circle remains fraught with danger.

Future exploration

Arctic exploration will continue, although the changing environment reveals new avenues of exploration. Global warming is causing the ice in the Arctic to recede, which may lead to an increase in sea traffic through the Arctic. For example, throughout the summer of 2016, a luxury tourist cruise liner traversed the Northwest Passage. Although it has historically been too expensive to send cargo ships through the Northwest Passage, if the ice continues to recede, tankers and other ships could ply the Arctic waters with increasing frequency.

Plenary

Play a classroom version of the BBC Radio 4 show "Just a Minute" on the topic of Arctic explorers. Choose a student to start as the speaker. Have them speak on the topic for a length of time (start with 30 seconds). Once the speaker is finished, other students may challenge him/her (by putting up their hand) for any of the following reasons:

- Hesitation - the easiest challenge, awarded if the speaker "ums" and "ahs." You can decide as a group how lenient to be at first.
- Repetition - the speaker is not allowed to repeat any words or phrases which are not contained in the topic title itself, although pronouns, prepositions, etc., can be repeated.