Scientific Facts on

Global Impacts of climate change in the Arctic

Source document:
AMAP (2017)

Summary & Details:
GreenFacts

Context - The Arctic is warming faster than the rest of the planet, and in a region where ice and snow are so present, this has deep impacts.

How will environments and populations worldwide adapt to these changes?

This is a faithful summary of the leading report
produced in 2017 by the Arctic Monitoring and Assessment Programme (AMAP):
"Snow, Water, Ice and Permafrost in the Arctic, AMAP "

The full Digest is available at: https://www.greenfacts.org/en/global-impact-arctic-climate/

This PDF Document is the Level 1 of a GreenFacts Digest. GreenFacts Digests are published in several languages as questions and answers, in a copyrighted user-friendly Three-Level Structure of increasing detail:

- Each question is answered in Level 1 with a short summary.
- These answers are developed in more detail in Level 2.
- Level 3 consists of the Source document, the internationally recognised scientific consensus report which is faithfully summarised in Level 2 and further in Level 1.

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1. How is the Arctic climate changing?

The Arctic is undergoing what is known as a 'state shift', which means that it is going through a phase of rapid changes towards a new stable state. With each additional year of data, it becomes increasingly clear that the Arctic as we know it is being replaced by a warmer, wetter, and more variable environment. In all likelihood the warming that will continue to happen in the coming decades is unavoidable, and the Arctic of the end of the 21st century will be a very different place. Many of the changes underway are due to a simple fact: ice, snow, and frozen ground (permafrost)— the components of the Arctic cryosphere—are sensitive to heat and over the past 50 years, the Arctic's temperature has risen by more than twice the global average.

2012 saw the ice cover of the Arctic Ocean reach a record minimum, and changes in ice thickness, snow cover and permafrost warming and melting have continued since then. Land-based ice is melting, and glaciers, ice caps and ice sheets are all retreating, adding large amounts of freshwater to the Arctic Ocean, and contributing to global sea levels rise.

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2. What changes in the Arctic are expected in the future?

Three points in particular deserve special emphasis:

- The Arctic Ocean could be largely free of sea ice in summer as early as the late 2030s, only two decades from now ;
- The recent recognition of additional melt processes affecting Arctic and Antarctic glaciers, ice caps, and ice sheets suggests that low-end projections of global sea-level rise made by the Intergovernmental Panel on Climate Change (IPCC) were underestimated ;
- Changes in the Arctic may be affecting weather in mid-latitudes, even influencing the Southeast Asian monsoon

Changes will continue through at least mid-century, due to warming that already integrated the climate system.

More specifically:

- Models project that before mid-century autumn and winter temperatures in the Arctic will increase by 4–5°C above late 20th century values ;
- Declines in snow and permafrost will continue ;
- The melting of land-based ice will contribute significantly to sea-level rise.
- Arctic ecosystems will face significant stresses and disruptions.
- Arctic changes will affect sources and sinks of important greenhouse gases (methane in particular).

3. Can those future changes in the Arctic climate be prevented?

In the most part, no, since the warming over the next few decades is already locked into the climate system. However, substantial cuts in GHG emissions can stabilize the impacts to occur after mid-century.

Compliance with the Paris Agreement should stabilize snow and permafrost losses, but there will still be much less snow and permafrost than today. Under the scenarios that are under consideration, the Arctic will not return to previous conditions this century. The near-future Arctic will thus be a substantially different environment from that of today, and by the end of this century Arctic warming may exceed thresholds for the stability of sea ice, the Greenland ice sheet, and possibly boreal forests.

4. What are the impacts of Arctic climate changes on human communities and ecosystems?

Climate change is only one of many factors contributing to change in the Arctic. Oil and gas activities, mining, tourism, shipping, fisheries, economic development, and pollutants are just some of the other stressors faced by the Arctic today. The rapid changes underway affect lives, livelihoods, and ecosystems throughout the region, with both positive and negative consequences.


Arctic communities, such as Tromsø in Norway, are facing important changes

For instance:

- The Arctic Ocean's increased open water (without ice cover) season creates more opportunities for marine shipping, commercial fisheries, tourism, and access to resources;
- In contrast, losses and decreases in the thickness of lake and river ice and changes in permafrost conditions affect or threaten ice roads, restricting access to remote communities;
- Communities and infrastructure built on frozen soils are significantly affected by thawing permafrost, one of the most economically costly impacts of climate change in the Arctic.

For wildlife and ecosystems, the impacts are also severe:

- Reductions in snow cover change the availability of habitat for microorganisms, plants and animals;
- Winter thaws and rain-on-snow events can damage vegetation, while refreezing creates a layer of ice over the vegetation that affects the conditions for grazing animals such as caribou, reindeer, and musk ox;
- The thinning and loss of sea ice has many impacts on Arctic life, from promoting the growth of marine phytoplankton and creating more habitat for open- water species, to loss of ice-associated algal species and disrupting the feeding platforms and life cycles of seals, polar bears and, in some areas, walrus;
- These changes in the structure of ecological communities and shifts in the geographic ranges of species also affected the food webs.

5. How does the Arctic climate affect the global climate system?

Compared with mid-latitudes and the tropics, the Arctic receives relatively little energy from the Sun. Because most of its surface is covered in reflective snow and ice, much of the energy that it does receive is reflected back to space. The Arctic acts as a global refrigerator by drawing warm ocean water from the south, cooling it, and ultimately sinking it toward the ocean bottom. This movement of warmer ocean waters to the north has a major influence on climate; via the Gulf Stream, it accounts for northern Europe's relatively mild climate compared for example with that of Canadian provinces at the same latitude and it keeps the tropics cooler than they would be otherwise.

Melt water from Arctic glaciers, ice caps, and the Greenland ice sheet also influences climate by flooding the ocean with freshwater, affecting ocean water circulation and weather patterns. The melting of land ice (glaciers and ice sheets) in the Arctic, which is projected to increase the rate of sea-levels rise throughout the world and will affect their coastal communities, low-lying islands, and ecosystems.

The Arctic is also both a source and sink for greenhouse gases. New estimates indicate that Arctic soils hold about 50% of the world's soil carbon. Changes in the quantities of greenhouse gases such as carbon dioxide and methane stored or released in the Arctic region can thus have a long-term impact on the global climate.

6. How can people adapt to those changes?

The near inevitability of these accelerating impacts between now and mid- century reinforces the urgent need for local and regional adaptation strategies that can reduce vulnerabilities and take advantage of opportunities to reinforce the resilience of the systems.

However, stabilizing Arctic warming and its associated impacts require substantial near-term cuts in net global greenhouse gas emissions. If emissions continue to increase, future changes would be even more substantial and long-lasting.

Full implementation of the Paris Agreement under the United Nations Framework Convention on Climate Change (UNFCCC) would cause Arctic temperatures to stabilize—but at a higher level than today—in the latter half of this century. At national level his will require much larger cuts in global greenhouse gas emissions than those planned under current determined contributions to the fulfillment of the UNFCCC.

But if emissions continue to increase, future changes would be even more substantial and long-lasting.