Alaska and the Arctic

The Changing Arctic Food Chain

In the Arctic, shrubs are slowly infiltrating territory where once there was only ice, snow, and lichens. Although these unassuming, stunted plants may not seem like much of a threat, their expansion—driven by warming temperatures across the Arctic—is causing a cascade of ecological impacts through the region's food chain.

Caribou—or wild reindeer—are a key species in the arctic ecosystem. They are a critical food source for bears, wolves, and a range of carrion feeders, as well as for indigenous peoples across the region. A warmer climate may help caribou in some ways: Warmer arctic summers tend to increase food availability and, as a consequence, survival of caribou calves. But these advantages are countered by other effects of climate change. Shrubs are crowding out lichens, a key winter food for caribou, and the deep snowdrifts that collect in the shrubs make it harder for caribou to reach the lichens hidden underneath. Additionally, cycles of thawing and refreezing are happening more and more throughout the winter, producing a buildup of ice on top of the snow that makes it difficult for caribou to access the food beneath.

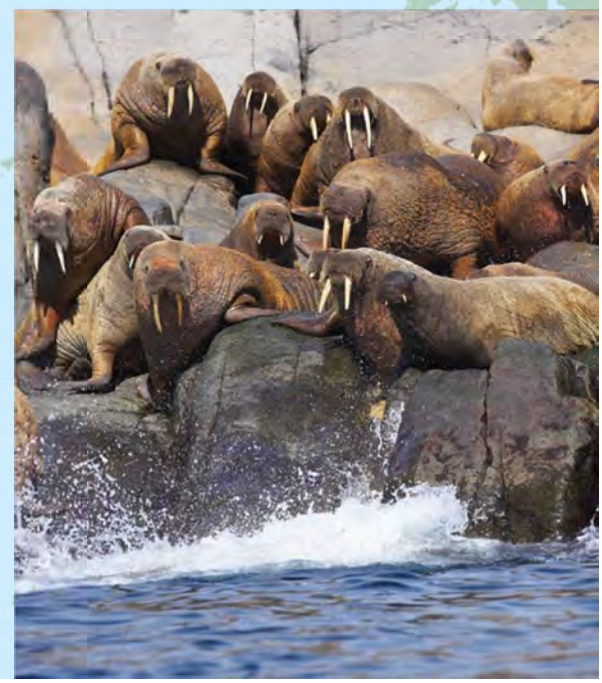
Climate change is affecting caribou (wild reindeer). Although they are enjoying more abundant food in summer, increased shrub growth makes it harder for them to find and reach lichens, their main food source during winter.
Image courtesy of Dean Briggins, U.S. Fish and Wildlife Service.

The increasing number of shrubs is also speeding up the region's rate of warming. Snow trapped by shrubs creates a thick blanket that insulates the soil, keeping it relatively warm over much of the winter. In response, arctic microbes increase their processing of organic matter in the soil, making the soil even more suitable for shrubs to grow, thus further increasing the shrubs' capacity to warm the soil.

Ice-Dependent Animals

Sea ice is a critical resource for some of the world's most beloved animals. Walruses, for example, use sea ice as nursing platforms for their young and as a hunting base from which they feed on clams and other bottom-dwellers. Each spring, walruses follow their sea ice perches northward as the ice melts off in the south.

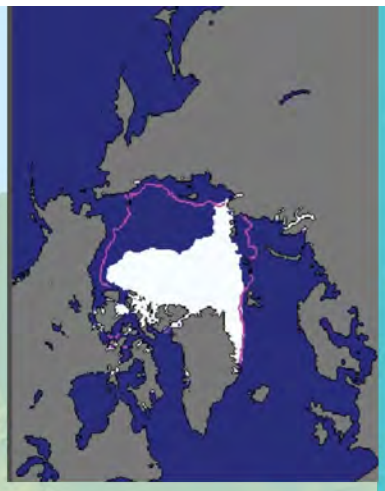
Because of climate change, the range of year-round sea ice is shrinking, leading walruses to move farther north each year. In 2007, the ice moved beyond the edge of the continental shelf, where the water becomes too deep for the walruses to feed. For the first time



Melting sea ice threatens ice-dependent animals, such as walruses and polar bears.

in recorded or oral history, thousands of walruses—seeking an alternate place to rest between feeding excursions—set up camp along the beaches near the village of Wainwright, Alaska. This dense aggregation of animals crushed many calves as adults moved to and from the ocean to feed; over time, such a densely packed population could also deplete bottom food resources along the coast.

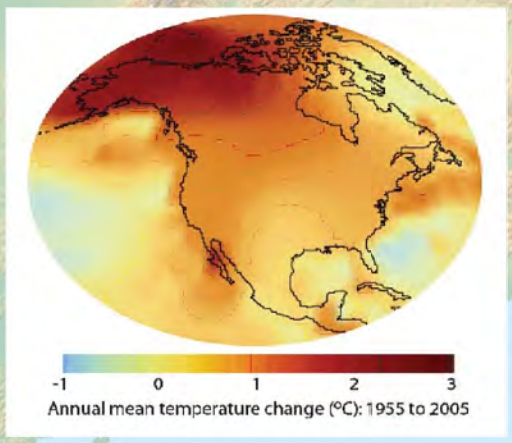
Polar bears also rely on sea ice for hunting. When the sea is covered with ice, bears can wait at openings in the ice for their favorite prey—ringed seals—to surface for air. Where sea ice has melted, leaving only open sea, seals can surface anywhere making it difficult for the polar bears to catch them.



This map shows the average arctic sea ice area for September 2007 (in white) and the average from 1979 to 2000 (pink outline). Image courtesy of the National Snow and Ice Data Center.

A Fast Defrosting Arctic

The Arctic is heating up about twice as rapidly as the rest of the planet. This is due in part to several "feedback loops" in which the consequences of arctic thawing drive temperatures even higher. For example, as sea ice and seasonal snow cover melt, previously reflective white surfaces are converted to darker ocean water or vegetation, respectively. These dark surfaces absorb more solar radiation, leading to higher air temperatures which leads to even more rapid melting, and so on.



Thawing permafrost represents another potential feedback loop. Permafrost, the permanently frozen ground found throughout cold regions, contains a great deal of carbon in the form of partially decomposed organic matter. As permafrost warms, the microbes that decompose this material become more active, releasing carbon dioxide and methane into the atmosphere.

The Arctic is warming about twice as fast as the rest of the planet as shown by the large area of dark red. If the scale were in °F, it would go from –1.8 to 5.4. Image created with data from the Goddard Institute for Space Studies.