

Arctic Impacts

Climate change and its effects in the Arctic may be the most serious environmental issue threatening the Arctic environment. Average annual temperatures in the Arctic have increased by approximately double the increase in global average temperatures.¹ It is beyond dispute that human activities are causing global warming, as even the U.S. government now admits. The direct impacts of global warming include higher temperatures, sea-level rise, melting of sea ice and glaciers, increased precipitation in some areas and drought in others. Indirect social, environmental, economic and health impacts will follow, including increased death and serious illness in poor communities, decreased crop yields, heat stress in livestock and wildlife, and damage to coastal ecosystems, forests, drinking water, fisheries, buildings and other resources needed for subsistence.²

During the past several decades, the Arctic has warmed at an alarming rate, and it is projected to continue to warm by as much as 18 degrees Fahrenheit by 2100.³ This warming trend has had a devastating impact on Arctic ecosystems, including sea ice, permafrost, forests and tundra.⁴ Warming has contributed to increases in lake temperatures⁵, permafrost thawing, increased stress on plant and animal populations⁶ and the melting of glaciers⁷ and sea ice.⁸ Research has revealed decreases in both sea ice extent⁹ and cover.¹⁰

Melting Sea Ice

Melting sea ice affects populations of marine mammals, caribou, polar bears and the subsistence livelihoods of people that depend on them. Because sea ice forms a natural breakwater against storm wave action, ice melting allows larger storm surges to develop and causes erosion, sedimentation, and coastal inundation.¹¹

Various Arctic wildlife populations already have been forced to adapt to changes in their habitats. According to scientists, the retreat of sea ice has reduced the platform that seals and walruses traditionally use to rest between searches for fish and mussels. Caribou are falling through once solid sea ice. Polar bears live on sea ice while hunting their prey and reductions in sea ice due to warming have resulted in

¹ Union of Concerned Scientists, Fact Sheet, Early Signs of Global Warming: Arctic and Antarctic Warming, at <http://www.ucsusa.org/warming/gw<uscore>arctic.html>.

² Intergovernmental Panel on Global Warming, Global Warming 2001: Impacts, Adaptation and Vulnerability, Summary for Policymakers and Technical Summary of the Working Group Two Report (2001), at 26.

³ Climate Change Impacts on the United States: The Potential Consequences of Climate Variability and Change – Overview: Alaska, U.S. Global Change Research Program, 2000, pp. 74-75.

⁴ Potential Consequences of Climate Variability and Change for Alaska, USGCRP Foundation Report (1998), Chapter 10, p. 289.

⁵ See Rainforest Action Network, Fact Sheet 4A, Rainforests and Global Warming (1996), at <http://www.ran.org/ran/info<uscore>center/factsheets/04a.html>.

⁶ See Patrick Mazza & Rhys Roth, Global Warming Is Here: The Scientific Evidence (1999), <http://climate.solutions.org/global<uscore>warming<uscore>is<uscore>here/>.

⁷ See Lisa Mastny, Worldwatch Institute, News Brief, Melting of Earth's Ice Cover Reaches New High (Mar. 6, 2000), at <http://www.worldwatch.org/alerts/000306.html>.

⁸ See R. Monastersky, Icy Signs of Warming Emerge in Arctic, 153 Sci. News 116 (1998).

⁹ See Konstantin Y. Vinnikov, et al., Global Warming and Northern Hemisphere Sea Ice Extent, 286 Sci. 1934 (1999).

¹⁰ See O.M. Johannessen, et al., Satellite Evidence for an Arctic Sea Ice Cover in Transformation, 286 Sci. 1937 (1999).

¹¹ *Supra* n.4, at 292.

shorter feeding periods and decreased accessibility to the seals that they hunt.¹² The Peary caribou of the high Canadian Arctic suffered a dramatic decrease in population during a period of unusually warm winters.¹³ They were not able to reach the tundra vegetation that they feed on as it was covered by a layer of crusty snow and ice that formed as a result of warming.¹⁴ Walrus populations are also suffering from the retreat of the sea ice and changes in food supply as is evident by their recently low juvenile survival rates.¹⁵ Killer whales have been reported as feeding on sea otters since their prey of choice, sea lions and harbor seals, have followed changes in fish migration patterns and moved out of the killer whales' habitat range.¹⁶

Thawing Permafrost

Thawing permafrost in the Arctic has damaged houses, roads, airports and pipelines, and caused landscape erosion, slope instability, and landslides. Local coastal losses to erosion of up to 100 feet per year have been observed in some locations in the Siberian, Alaskan and Canadian Arctic.¹⁷

In Shishmaref, Alaska, a small Inuit village in the Chukchi Sea, seven houses have had to be relocated, three have fallen into the sea, and engineers predict that the entire village of 600 houses could disappear into the sea within the next few decades. Shishmaref's airport runway has almost been met by rising seawater, and its fuel tank farm, which seven years ago was 300 feet from the edge of a seaside bluff, is now only 35 feet from the bluff. The town dump, which has seawater within 8 feet of it, could pollute the nearby marine environment for years if inundated. Advancing seawater has contaminated Shishmaref's drinking water supply.¹⁸

Damage to Forest and Tundra Ecosystems

Forest and tundra ecosystems are important features of the Arctic environment. In Alaska, substantial changes in patterns of forest disturbance, including insect outbreaks, blowdown, and fire, have been observed in both the boreal and southeast coastal forest.¹⁹ Rising temperatures have allowed spruce bark beetles to reproduce at twice their normal rate.²⁰ A sustained outbreak of the beetles on the Kenai Peninsula has caused over 2.3 million acres of tree mortality, the largest loss from a single outbreak recorded in North America.²¹ Outbreaks of other defoliating insects in the

¹² See Ian Stirling, et al., Long-term Trends in the Population Ecology of Polar Bears in Western Hudson Bay in Relation to Climate Change, 52 *Arctic* 294 (1999).

¹³ See Greenpeace, Fact Sheet, Climate Change and Arctic Wildlife (Feb. 2000), at <http://www.greenpeace.org/<diff>climate/arctic99/reports/html/content/factsheets/arcticwildlife.htm>.

¹⁴ *Id.*

¹⁵ See Greenpeace, Climate Press Release, Greenpeace Expedition Finds New Evidence of Climate Change Impacts in the Arctic (Aug. 5, 1999), at <http://greenpeace.org/pressreleases/arctic/1999aug5.html>.

¹⁶ See David Suzuki Foundation, Fact Sheet, Climate Change: Imperiled Ecosystems (1999), at <http://www.davidsuzuki.org/campaigns<uscore>and<uscore>Programs/Climate<uscore>change/Climate<uscore>Science/Climate-Damage/Imperilled<uscore>Ecosystems.asp>.

¹⁷ *Supra* n.4, at 293.

¹⁸ *Close-up Amid Global Warming Debate, Alaska's Landscape Shifts*, Kim Murphy, L.A. Times, Jul. 8, 2002.

¹⁹ *Supra* n.4, at 296.

²⁰ In Alaska, Hotter Weather Provokes Startling Changes, Egan, Timothy, *The New York Times*, June 18, 2002.

²¹ This figure constitutes 70-80% of the trees in the entire area. The federal government has given the Kenai Borough \$10 million for forest regeneration and to protect communities from beetle-induced fires. The spruce bark beetle has destroyed more than 2 billion board feet of timber in Alaska in the last 25

boreal forest, such as spruce budworm, coneworm, and larch sawfly, also have increased sharply in the past decade.

Climate warming and insect infestations make forests more susceptible to forest fire. Since 1970, the acreage subjected to fire has increased steadily from 2.5 million to more than 7 million acres per year. A single fire in 1996 burned 37,000 acres of forest and peat, causing \$80 million in direct losses and destroying 450 structures, including 200 homes. As many as 200,000 Alaskan residents may now be at risk from such fires, with the number increasing as outlying suburban development continues to expand. The increase in forest fires also harms local wildlife, such as caribou.²²

years. *Battling the Bark Beetle: As Global Warming Rises, so do Tree-Killing Infestations*, Emagazine.com November/December 2001

²² *Id.*