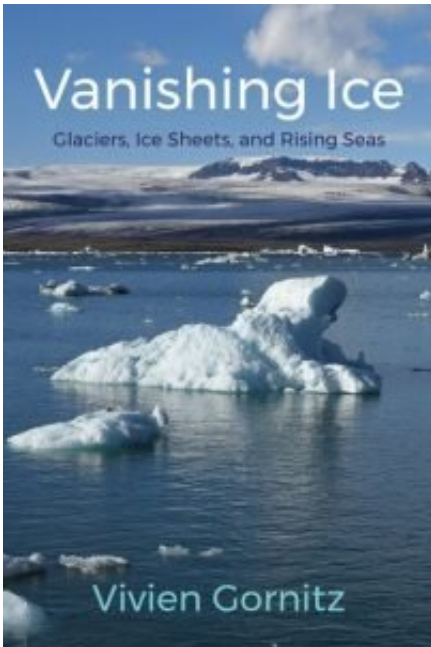


# Why Cry for the Cryosphere?

June 11 2019, by Kevin Krajick

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The headline is actually a sentence that comes toward the end of *Vanishing Ice*, a new book that answers the question in encyclopedic detail. For those unfamiliar with the term, the cryosphere is the earth's natural ice in all its forms. Author Vivien Gornitz, a NASA science collaborator and retired special research scientist at Columbia University's Center for Climate Systems Research, takes readers through the basic physics of them: glaciers, ice sheets, ice shelves, sea ice, icebergs, permafrost and methane hydrates. Then she dives deep into the ongoing retrenchment of all of them, brought on by warming of the

planet. She paints a daunting and detailed picture, ranging from the dramatic collapse of great Antarctic ice fronts into the Southern Ocean, to the insidious and poorly charted workings of under-glacier river systems and sudden blooms of sun-fed algae spreading across the surface of the Greenland ice sheet.

As Gornitz points out, what happens in the Arctic (or any other cold place) doesn't stay in the Arctic. Rising sea levels driven in part by melting ice are lapping at the shores of New York City, and flooding farmers in Bangladesh and Vietnam. Ecosystems from the Canadian Arctic to the equatorial Andes are threatened. So are cities and farms that depend on seasonal meltwater from distant mountain glaciers, and native communities that depend on wildlife hunted on fast-declining northern sea ice.

We recently spoke with Gornitz about the fate of the cryosphere, and what she hopes readers will take away from *Vanishing Ice*.

## **Which parts of the cryosphere are in most immediate danger and why?**

At highest risk are the tropical glaciers, and Arctic sea ice and permafrost.

Andean tropical glaciers are endangered, as are those in Patagonia and Papua New Guinea. At current rates, the snows of Kilimanjaro will be gone within a few decades, except in Ernest Hemingway's novel. Although tropical glaciers may be the first to go, the retreat of glaciers is a worldwide phenomenon that has been speeding up in recent decades.

The area covered by Arctic sea ice has steadily declined since the early 1980s, and if current trends continue, some scientists predict an open

summertime Arctic Ocean by mid-century. The sea ice has also grown thinner and younger, leaving very little of the thicker, stronger, multi-year sea ice. Thinner ice melts faster. An open Arctic Ocean would intensify climate warming by absorbing more of the sun's energy and melting more sea ice, exposing more open water. Increasing evaporation would also bring more water vapor, which is also a powerful greenhouse gas, into the atmosphere.

Permafrost is thawing in Alaska, Canada and Siberia. Ice acts as a cement, holding loose mud and silt sediment together, so roads buckle, buildings sag, and trees tilt at crazy angles. Permafrost-bonded sediments line over 65 percent of the Arctic shoreline and are vulnerable to storm surges, wave attack and rising seas. Carbon dioxide and methane, also a potent greenhouse gas, will be released from newly exposed carbon-rich wetlands and thawing permafrost. Depending on soil wetness and oxygenation, bacteria can generate either gas, but which one will dominate in the future is still unclear. Either way, thawing permafrost adds to the planet's growing greenhouse gas burden.

## **Given the pace and scale of human-induced climate change, are any forms of ice likely to survive in coming centuries?**

In spite of global warming, not all forms of ice will likely disappear in the near future. But they will be sharply reduced in extent. Most of the Antarctic Ice Sheet, large parts of the Greenland Ice Sheet, and very high-elevation glaciers in the Himalayas and Alps will probably survive. Sea ice at the North Pole, and off northern Greenland and the high Arctic islands may also endure. Of course regions where [winter temperatures](#) still dip below freezing can expect snowstorms, and frozen ponds and streams.

## **Is the disappearance of ice all bad?**

The vanishing cryosphere has many negative consequences, but some positive ones as well. The disappearance of mountain glaciers in South America alone would imperil water, food and hydroelectric energy supplies for a region currently populated by 77 million people. Coastal populations worldwide will be threatened from rising sea levels. On the other hand, the opening up of Arctic seaways in summer will sharply cut shipping distances for many oil tankers and container vessel. It would also open the area to tourism. It would also open greater access to mineral wealth. An estimated 30 percent of the world's undiscovered natural gas and 13 percent of its undiscovered oil lie north of the Arctic Circle, largely offshore in relatively shallow water. The Arctic also holds potential motherlodes of metals. Mining of nickel, copper, cobalt, platinum and other metals is already underway in Russia, while zinc, lead, silver and gold are mined in Alaska. Greenland awaits development of its rich mineral potential. Yet, all these activities are fraught with many hazards, and their full benefits await the future.

## **Do we have much hope of reversing any of this?**

We can halt or at least slow down further losses if we begin now by reducing our greenhouse gas emissions. But our window of opportunity is rapidly narrowing. Even if we succeed in curbing further CO<sub>2</sub> emissions by mid-century, the CO<sub>2</sub> already present and likely to be added within the next few decades will remain in the atmosphere, where it will linger for centuries to millennia. This commits us to more melting of ice and higher sea levels. The decisions we make today and in the next few decades will affect many future generations to come. The approaching meltdown is going to ignore political boundaries, and will touch us all.

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