Climate-Induced Melting of Arctic Ice Threatens the Reemergence of Toxic Chemicals

By Beyond Pesticides

Theme: Environment

Global Research, March 24, 2022
Beyond Pesticides 23 March 2022

***

A study published in Nature Reviews Earth & Environment warns that thawing of permafrost (a ground that remains completely frozen for two or more years) in the Arctic region can prompt the reemergence of greenhouse gases (e.g., methane and carbon dioxide), microbes, and chemicals (e.g., banned pesticides like DDT). Past research finds gases, microbes, and chemicals drift near the poles, becoming entrapped in ice under the accumulating snowfall. As the global climate continues to rise and the climate crisis worsens, studies like this show significant effects, as ice encapsulating these toxic chemicals is melting. Upon melting, some chemicals can volatilize back into the atmosphere, releasing toxicants into the air and aquatic systems, with the ensuing consequences. Microbes frozen for thousands to millions of years can also emerge from thawing permafrost, with unknown implications on human, animal, and ecosystem health. The melting permafrost is already beginning to impact infrastructure, creating sinkholes that damage roads, trees, and utility poles. Moreover, mixtures of chemicals, microbes, and greenhouse gases (GHGs) in permafrost are difficult to assess. Therefore, studies like this highlight the need to evaluate the health and ecological effects of melting arctic permafrost (and glaciers) from anthropogenic (human)-induced climate change. [For related pieces, see Silent Snow: The unimaginable impact of toxic chemical use and DDT in Glacial Melt Puts Alaskan Communities at Risk.]

Approximately 1,700 billion metric tons of carbon, including GHGs like carbon dioxide and methane, are present in permafrost, over 51 times more than the amount of carbon released from 2019 fossil fuel emissions. The remaining organic matter, frozen in permafrost, will decay after thawing, further increasing atmospheric carbon emissions. Although current models predict an increase in carbon released from permafrost in the coming decades to hundreds of years, scientists lack knowledge on how much, how long, and the specific carbon source. Therefore, researchers in this study used ground, air, and satellite data to evaluate the effects of subsequent permafrost melting.

Using ground measurements, researchers can monitor changes in specific areas, while airborne and space-based (satellite) measurements monitor changes over broader areas. Airborne and ground measurements represent time-specific monitoring data, and satellite measurements monitor data continuously. Moreover, ground measurements mainly focus on microbial communities in thawing permafrost. Airborne measurements focus on GHG emission with satellite and airborne data mapping GHG hotspots. The combination of data forms a holistic (complete) overview of changes in the arctic region.

The study determines that Earth's polar regions are warming the fastest, approximately two to four times faster than average, and these changes can have a cascading adverse impact on lower and higher latitudes. The scientists note that the polar regions (Arctic and Antarctic) stabilize Earth's climate and drive heat transfer, powering jet streams and other fluxes/currents. Researchers cannot identify specific microbes encased in permafrost, nor whether GHGs emissions will be gradual or rapid. Thus, polar warming has future consequences that threaten regular weather, climate, and chemical exposure patterns.

Many scientists consider Arctic environments "pristine," void of direct chemical inputs from chemicals used in more temperate and industrial climates. However, the Arctic has become a sink for these toxic chemicals, as studies find evidence that airborne Arctic chemical concentrations are comparable to that of industrialized regions in the U.S., Europe, and Asia. Additional investigations find the presence of chemicals and microbes in soil and ice samples taken from Arctic regions. The Arctic is highly susceptible to global pollution, as warmer air contaminated with industrial and agricultural chemicals from manufacturing regions move poleward toward cooler air. Environmental pollutants can condense into snowflakes high in the atmosphere and deposit onto the Arctic surface. Although deposition of these chemicals via long-range atmospheric transport and condensation are significant contributors to Arctic contamination, the chemical properties allowing these substances to persist in the environment so long are concerning. Some of these long-lived chemicals include regionally banned pesticides like DDT, heptachlor, and lindane, which are highly toxic to humans and animals, causing a range of adverse effects, from respiratory issues to nervous system disorders and birth deformities to various common and uncommon cancers. Although banned chemicals remain a global issue, as much of the developing world still report usage, banned/past-use compounds are not the only contaminants in the Arctic. Current-use chemicals like chlorpyrifos, dacthal (DCPA), and *trans*-nonachlor (a component of the banned insecticide chlordane) readily contaminate the arctic, and continued use will result in an increased probability of atmospheric transportation and deposition of chemicals on Arctic glacier tops via precipitation. According to Brettania Walker, Ph.D., toxics officer at World Wildlife Fund's Arctic Program, "Not only is chemical contamination increasing in the Arctic but also modern chemicals are now appearing in many Arctic species alongside older chemicals, some of them banned for over [30] years."

The climate crisis adds another level of concern, especially regarding passive pesticide and microbial exposure from snowmelt. Pesticide contamination is already an issue in the U.S., as results of the United States Geological Survey's (USGS) and National Water-Quality Assessment (NAWQA) show that pesticides and their breakdown products are present in all U.S. streams and widespread in groundwater throughout the country. For instance, a Chicago-based 2020 study shows black women who consume more tap water per day have higher bodily residues of the DDT metabolite (DDE). Permafrost and glacial melting will only add to water source contamination as volatile chemicals can enter waterways at the same concentration levels as before ice entrapment, even after several decades. Moreover, several banned chemicals are not soluble in water (e.g., DDT, lindane, chlordane) but bioaccumulate in the fatty tissue of many Arctic species, such as polar bears, seals, whales, and some fatty fish like salmon, herring, and catfish. The level of DDT in Arctic penguins' blubber is similar to levels during initial banning more than 30 years ago. Unfortunately, some indigenous tribes in Arctic regions rely on these very mammals and fish for sustenance, and ingesting these pollutants is inevitable, putting their health at risk. Higher bodily concentrations of chemicals are evident in those who consume contaminated meat with associated health risks, including immune system disorder, increased susceptibility to disease, central nervous system disorders, learning disabilities among children, reproductive issues, and cancer. Studies find that adults and children who regularly consume fish from contaminated streams are at increased risk of cancer from dietary and cumulative exposure, in many cases above EPA thresholds.

This study adds to the growing body of literature demonstrating disproportionate warming in arctic regions. Arctic thawing has implications for carbon release and landscape changes that are difficult to predict, including alternations in arctic vegetation and density. The combination of data measurements (e.g., ground, airborne, satellite) can aid in monitoring the carbon system, from microbial decay of organic matter to volatilization of chemicals from permafrost and glacier ice. As global warming progresses, exposure concerns will increase significantly, especially for children who are more vulnerable to the toxic effects of chemical exposure. To mitigate the risks associated with chemical exposure from toxic pesticides, advocates say the manufacturing and use of pesticides need addressing, first and foremost. It falls to global leaders to curtail the continued manufacturing of chemical pollutants that readily contaminate polar regions. Recently, agrochemicals like pesticides and fertilizers overtook the fossil fuel industry as the leading contributor to environmental sulfur emissions. If pesticide use and manufacturing are amplifying the impacts of the climate crisis, advocates argue that it is essential to incite change by enhancing pesticide policy and regulation that eliminates use. The study concluded, "Scientific cooperation across diverse fields has already increased the modeling accuracy and data integration for carbon transport, permafrost thaw, and climate scenarios. However, further international collaboration, monitoring, and exploration is needed to determine the areas of greatest change. All efforts to quantify carbon release expand scientific understanding of complex, changing and emergent dynamics of a warming Arctic."

Lack of adequate persistent pesticide regulations highlights the need for better policies surrounding pesticide use, especially when a toxic pesticide is banned for use in the U.S., but not for production and export to other countries. A switch from chemical-intensive agriculture to regenerative organic agriculture can significantly reduce the threat of the climate crisis by eliminating toxic, petroleum-based pesticide use, building soil health, and sequestering carbon. The Intergovernmental Panel on Climate Change (IPCC) finds that agriculture, forestry, and other land use contributes about 23% of total net anthropogenic emissions of greenhouse gases, while organic production reduces greenhouse gas emissions and sequesters carbon in the soil. Learn more about how it is possible to sequester more than 100% of current annual CO_2 emissions by switching to organic management practices by reading *Regenerative Organic Agriculture and Climate Change: A Down-to-Earth Solution to Global Warming*. For more information about organic food production, visit the Beyond Pesticides *Keep Organic Strong* webpage. Learn more about the adverse health and environmental effects chemical-intensive farming poses for various crops and how eating organic produce reduces pesticide exposure.

*

Note to readers: Please click the share buttons above or below. Follow us on Instagram, @globalresearch_crg and Twitter at @crglobalization. Feel free to repost and share widely Global Research articles.

Source: *Nature Reviews Earth & Environment*, NASA

Featured image is from Beyond Pesticides

The original source of this article is Beyond Pesticides

Comment on Global Research Articles on our Facebook page

Become a Member of Global Research

Articles by: **Beyond Pesticides**