ARCTIC BASECAMP

PRESENTS

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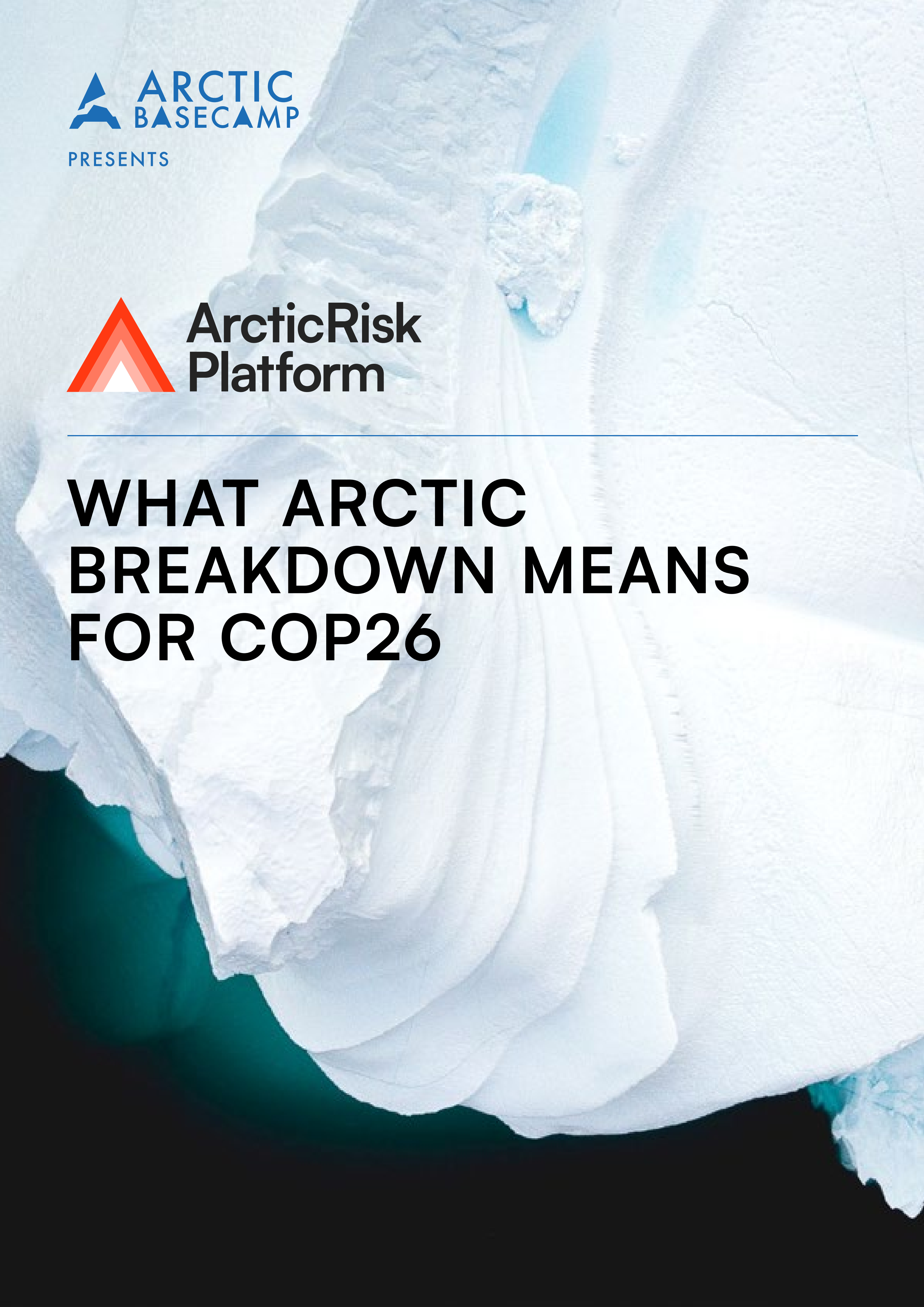
WHAT ARCTIC BREAKDOWN MEANS FOR COP26



WHAT ARCTIC BREAKDOWN MEANS FOR COP26:

SUMMARY:

- This report summarises the latest science on the rapidly warming Arctic and its impact on the rest of the globe. For a more detailed scientific review, please see the full report (COMING SOON).
- The dramatic changes in the Arctic provide early warning of the climate emergency. The latest analysis paints a picture of rapidly unfolding environmental breakdown as a direct result of increases in atmospheric greenhouse gas concentrations. In turn, this breakdown fuels further global warming.
- The Arctic is in crisis as its ice disappears. Sea ice continues to shrink in area and thickness, the Greenland ice sheet continues to melt and accelerate sea-level rise, and the permafrost continues to thaw, threatening communities, ecosystems and carbon feedbacks.
- The Arctic breakdown has direct implications for instability across the rest of the world. Sea levels rise as glaciers and ice sheets melt. Arctic warming favors increased extreme weather elsewhere - heatwaves, droughts, storms, and even cold spells.
- Arctic breakdown elevates risk far beyond its borders. This adds urgency to implementing near-term mitigation to prevent global temperature rises beyond 1.5°C and reduce the magnitude of rapid Arctic change. The COP26 UNFCCC meeting represents a critical moment for high-level recognition of these risks as well as the plans to mitigate them.

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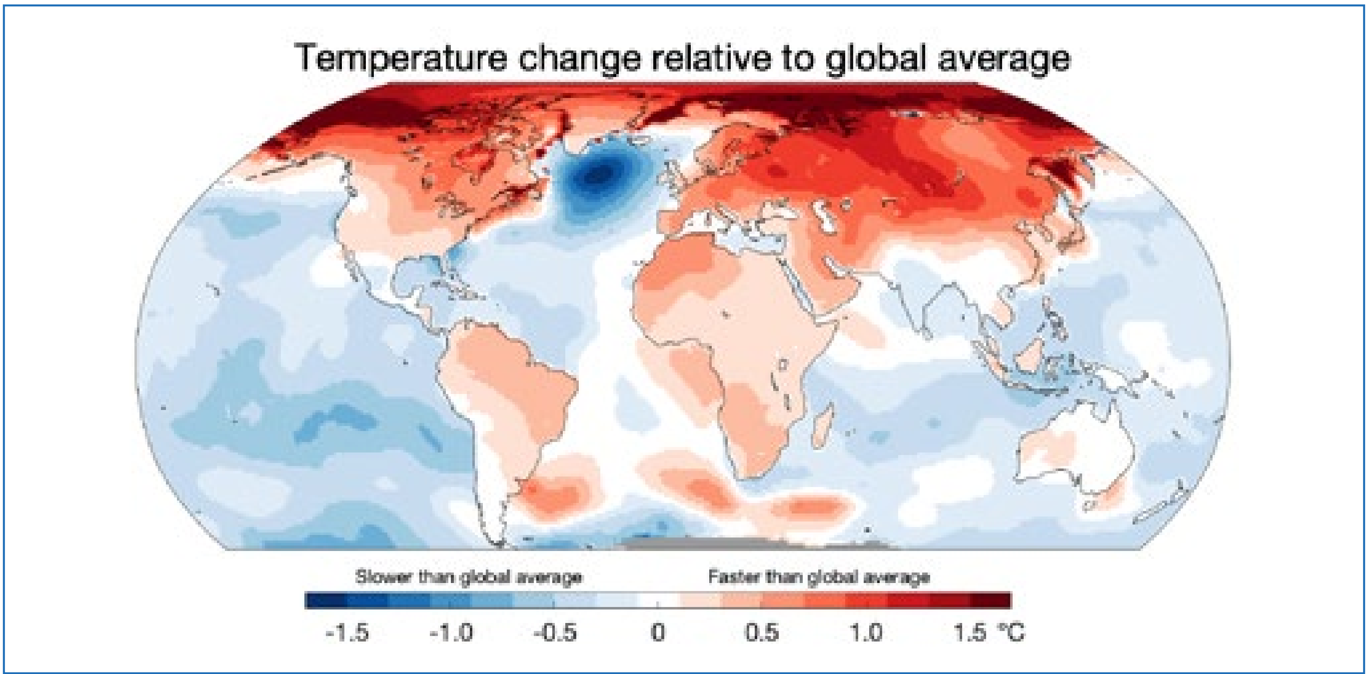
AN UNRAVELING ARCTIC:

THE FACTS

Arctic sea ice, land-based ice, persistent seasonal snow cover, and both ocean and atmospheric circulation all profoundly affect life across the entire planet. The Arctic helps regulate the world's climate, influencing a central part of the Earth's atmospheric and oceanographic circulation systems.

The snow and ice cover, which blanket much of the Arctic land and ocean, help to keep our planet cooler than it otherwise would be by reflecting much of the sun's energy back out to space. However, as the snow and ice melt, the bare ground and ocean are exposed, which absorb more of the sun's energy and warm up, helping to further melt more snow and ice, with immediate impacts. This positive feedback loop, once it is initiated, is difficult to slow down.

The Arctic is warming at least three times faster than the globe as a whole (Arctic Monitoring and Assessment Programme, 2021). This means it functions as a barometer of global risk and a threat multiplier. This is why the Arctic is currently affected first and worst by climate breakdown.



Air temperature change relative to average global warming since the mid-1990s. Credit: Ed Hawkins

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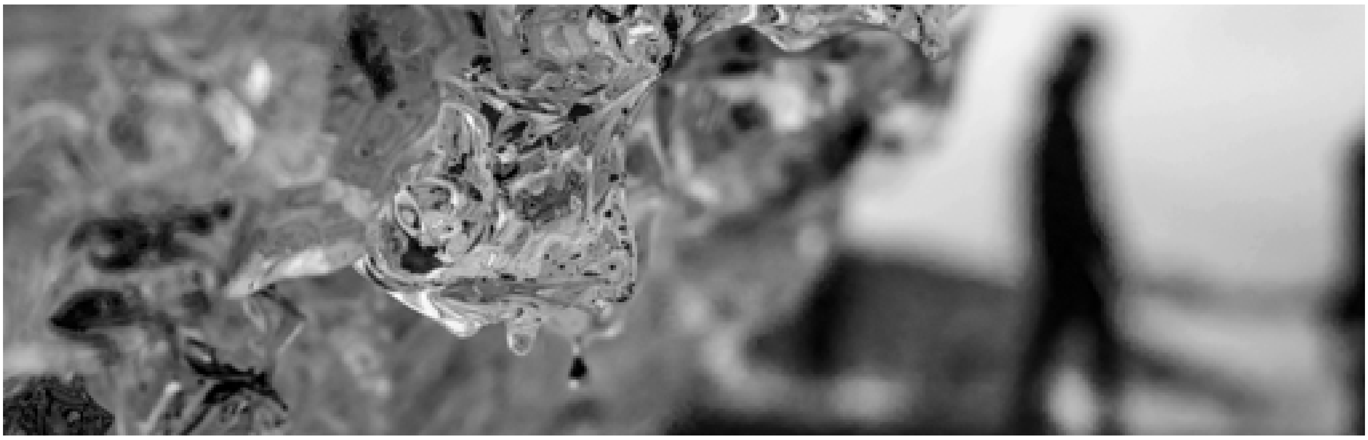
Because the Arctic plays a critical role in regulating the global climate, changes there have major implications for climate and weather systems around the world. In other words, what happens in the Arctic doesn't stay there: it has direct and indirect impacts on extreme heat and cold, storm surges, sea level rise, and precipitation patterns far beyond its borders.



Multi-year Arctic sea ice has reached a record low

Arctic sea ice is an indicator of climate stability in the Arctic, and it plays a critical role in reflecting solar energy away from the ocean.

Since 1979 the Arctic has been losing about 80,000 km^2 of summer sea ice each summer, or a total loss of 3.49 million km^2 of sea ice, nearly twice as much area as Germany, France, Spain and Italy combined. Today there is about 40% less sea ice coverage at the end of the melt season than in the 1980s. The last fifteen years recorded the fifteen lowest sea ice extents during the 43-year satellite data record. (Fetterer et al, 2017)

Modeled estimates suggest the thickness of the remaining ice is thinner than it ever has been. This is supported by satellite-derived maps of ice age, which show the fraction of the Arctic Ocean covered by perennial ice is currently the lowest on record (National Snow and Ice Data Center, 2020).

Under the current emissions trajectory, at least one ice-free summer will likely emerge before 2050, and ice-free conditions will begin extending across more months as we add more CO_2 to the atmosphere (Notz and Stroeve, 2016; Stroeve and Notz, 2018; SIMIP, 2020). Only drastically reduced future CO_2 emissions can avoid repeated summers without any sea ice. The loss of the summer sea ice cover will lead to the collapse of the Arctic marine ecosystem that depends on the ice.

Ice-free summers in the Arctic also will amplify climate change impacts elsewhere — this is a global threat multiplier. Estimates suggest that the loss of Arctic sea ice together with reductions in snow cover over the boreal land areas will exacerbate global warming by 25-40% as the darker Arctic surfaces on water and land absorb more solar energy (Duan, Cao, and Caldeira, 2019; Pistone, Eisenman, and Ramanathan, 2014).

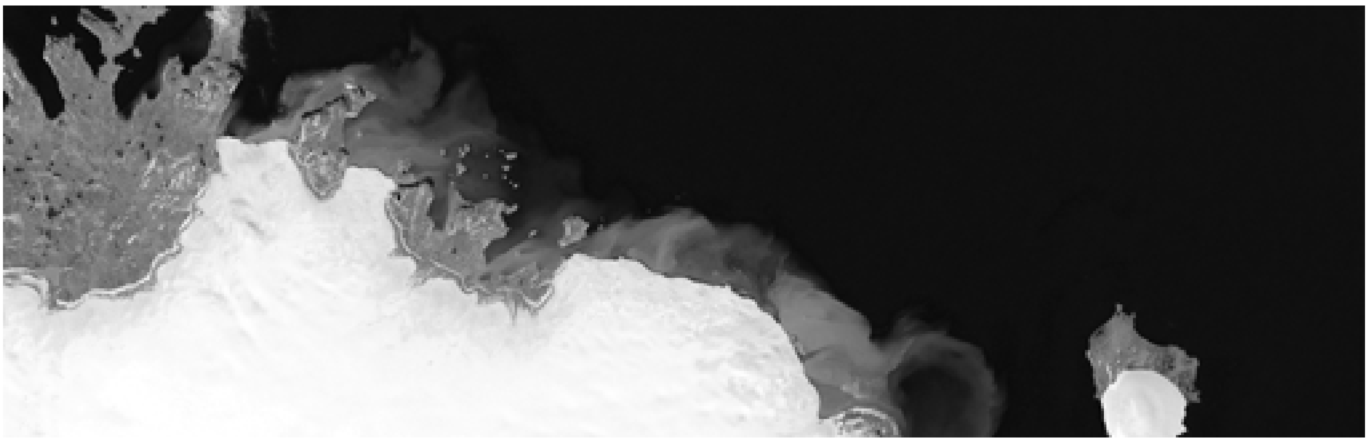
Record-breaking rainfall and high temperatures in Greenland are speeding up melting of the ice sheet, resulting in rising sea levels

The Greenland ice sheet is the second largest on Earth and holds the equivalent of 7.4m of potential sea level rise (BedMachine v3.- Morlighem et al., 2017). This means its stability — or lack of it — has critical consequences for global sea levels and coastal communities.

The Greenland ice sheet is rapidly losing mass, which contributes directly to rising sea levels. After a period of stability in the 1990s, the ice sheet began losing mass at an increasing rate (Mouginot et al., 2019). Record-breaking losses — the biggest since monitoring began in the 1950s — occurred in 2012 and 2019 (IMBIE et al., 2020).

Averaged surface air temperature within the Arctic Circle is rising more than twice as fast as the rate of the globally averaged temperature (Labe, 2020). As a result of unusually warm temperatures, the ice sheet experienced two major episodes of surface melt in 2021. Multiple record-breaking temperatures since observations began in 1978 were observed across Greenland's eastern coast: a weather station in northeast Greenland attained 19.8°C/67.6°F — its highest air temperature ever recorded — and air temperatures at another eastern weather station peaked at 23.2°C/73.76°F (Programme for monitoring of the Greenland ice sheet). For the first time ever, rainfall was observed at the summit of the ice sheet in August 2021. Rain is significant because it increases surface melt that runs off into the ocean.

Nearly 600 million people live in coastal zones worldwide. If sea levels rise, they will be increasingly vulnerable to dislocation from these areas which generate approximately US$1 trillion of global wealth (Kirezci et al. 2020).



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The persistence of wildfires has worsened in recent years

In 2019 and 2020 the Arctic Circle experienced unusually large-scale and persistent wildfires that resulted in significant carbon emissions and air pollution. Climate anomaly data shows that the majority of the observed fires were driven by warmer and drier conditions. In 2021 wildfire emissions were lower within the Arctic Circle but at record high levels in the subarctic regions of Siberia, especially in the Sakha Republic of Russia. Wildfire emissions are a toxic mix of direct smoke and greenhouse gases released from the permafrost that fires thaw.

Wildfires in Siberia burned six million hectares (about the size of Lithuania) and released 800 million metric tons of carbon dioxide in 2021, which is approximately equivalent to the yearly emissions of Germany. The majority of these fires occurred in permafrost terrain. Smoke emissions from the Siberian fires led to severely degraded air quality in Yakutsk, for example, and was also subject to long-range transport across the Pacific and Arctic Oceans.

Permafrost thaw is accelerating, adding to greenhouse gas emissions

Huge amounts of carbon are locked up in permafrost. When permafrost thaws, it can release vast quantities of greenhouse gases. The permafrost is now more vulnerable to thaw because of topsoil degradation, rising temperatures, and wildfires.

Permafrost thaw is widespread but erratic, sometimes subject to abrupt thaw and wildfire-triggered thaw. The relationship between permafrost release of CO_2 and rising temperatures is still poorly known and thus represents a major emissions risk.

IMPACTS OF ARCTIC CHANGE:

OCEAN CURRENTS, WEATHER PATTERNS, AND ECOSYSTEMS

A warmer Arctic triggers a series of powerful feedback loops that speed up global heating. This makes Arctic breakdown a global risk multiplier for climate change, allowing its effects to cascade faster through the world's climate systems.

Melting land ice (glaciers and ice sheets) contributes to sea level rise. It also can affect ocean temperatures and circulation. The continuous circulation of the world's oceans is driven by the production of dense water in the Arctic as a by-product of surface cooling and sea-ice formation. As sea ice disappears and the Greenland ice sheet experiences more surface melt, this adds freshwater to the North Atlantic. The more buoyant freshwater surface layer inhibits dense-water formation and disrupts normal ocean circulation with potentially catastrophic results. If that circulation were to be further disturbed, as it was during the last ice age, northern Europe could eventually become 5-10°C/41-50°F cooler than today, driving huge environmental changes with profound impacts on people and fisheries.

The latest science links Arctic climate change with extreme weather elsewhere with more certainty than ever before.

Perversely, Arctic warming appears to lead to more extreme winter cold spells in Northern Hemisphere continents, such as the severe U.S. freeze in February 2021 and the "Beast from the East" that brought unusual cold and snow to parts of Europe (Cohen, et al, 2021, Cohen, et al 2018).

Amplified global warming leads directly to more intense heatwaves, like the record-breaking events over northwestern North America, Europe, and the Middle East in summer 2021 (Mann, et al, 2018). Reduced spring snow cover on high-latitude land areas may favor 'split' jet streams that can lead to more persistent summer heatwaves, droughts, and rainy periods.

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IMPACTS OF ARCTIC CHANGE:

SOCIETY, ECONOMICS AND NATIONAL SECURITY

The loss of Arctic ice and permafrost is already triggering significant economic losses. By 2300, the Arctic breakdown is expected to contribute to total economic costs of >$66 trillion (aggregated discounted net present value) under mitigation levels consistent with national pledges at the time of research (Yumashev et al., 2019). Changing precipitation patterns are reducing crop yields, and extreme weather events risk food and water security (Kornhuber et al., 2019).

The disruption of weather patterns in the Northern Hemisphere associated with Arctic warming is raising the likelihood of more extreme weather events and consequent risks to global food production, water security, infrastructure, commerce, transportation, social stability, and forced migration. The cost of extreme weather events during 2020 was about $190 billion globally (Swiss Re, 2021).

As its impact worsens, it also means states faced with multiple climate impacts at the same time: for example, the 2021 heatwave and wildfires in the Pacific Northwest occurred nearly simultaneously with flooding in Tennessee, Louisiana and New York.

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IMPACTS OF ARCTIC CHANGE NOT FULLY CAPTURED IN FUTURE PROJECTIONS

Today's best estimate is that permafrost contains twice the carbon content of today's atmosphere (Arctic report card, 2019). Most of this is stored in frozen soils less than three metres deep (Hugelius et al. 2014; Schuur et al. 2015). As warming continues and permafrost thaws, this carbon will be released, contributing to greenhouse gas concentrations in the atmosphere and causing further warming.

This has an enormous impact on the carbon budget, significantly reducing the amount of carbon we can afford to emit while limiting global warming to 1.5°C above pre-industrial times. Despite this, emissions owing to permafrost thaw, especially those caused by abrupt and fire-induced thaw, are neglected in most climate model projections and not typically considered in mitigation decision-making.

The lack of certainty about permafrost emissions represents a major barrier to reaching current emissions reductions targets, many of which do not account for emissions from thawing permafrost. Research by Woodwell indicates that emissions from permafrost thaw this century could be on par with continued emissions by Japan or as high as continued emissions by the United States (Natali, Rogers, 2021). This means that permafrost thaw emissions could use up 25-40% of the remaining carbon budget to stay below 2°C (Natali, Rogers, 2021).

SOLUTIONS:

DECISION-MAKERS IN POLICY, FINANCE AND BUSINESS

At COP26, policymakers must recognise threats to the Arctic and their implications for the rest of the world.

Better understanding of the Arctic can improve the effectiveness, urgency and ambition of climate mitigation and adaptation decisions. The magnitude of Arctic climate risks is a blind spot for many working in and around climate-related policy. Access to scientific monitoring of early warning signs of Arctic change would improve the effectiveness of key global policy makers and business leaders, and improve the understanding of local communities and citizens.

There is no silver bullet to target special protection of the Arctic. Minimizing disruption of the Arctic environment — and recognising its role as a risk multiplier for climate change — means taking immediate action to limit global warming to no more than 1.5°C.

TO ADDRESS THE ARCTIC CLIMATE CRISIS, POLICYMAKERS SHOULD:

1. **Include Arctic climate science in public policy and corporate decisions.** Increase access to and use of relevant, real-time risk analytics for decision-makers in government and industry, journalists and engaged citizens.
2. **Account for emissions from thawing permafrost** in the carbon budget and policies to mitigate climate change.
3. **Raise the ambition of Nationally Determined Contributions.** Near-term targets (halving emissions before 2030) are especially important because of the immediate warming effect of losing the Arctic's reflective snow and ice. Commit to achieve net-zero emissions no later than 2050. Publish near-term and long-term strategies detailing pathways to 2030 and 2050 as soon as possible.
4. **Prohibit all new investment in infrastructure and activities supporting fossil fuel industries.** Follow the International Energy Agency's recommendation for no new investment in fossil fuel supply projects starting immediately.
5. **Discontinue subsidies to fossil-fuel industries** and related activities, ideally by 2025.
6. **Exit from coal**, the most damaging fossil fuel. Commit to end coal financing and licensing for new mining operations. Adopt plans to phase out coal-fired power generation by 2030 for advanced economies, and 2040 for other countries.
7. **Recognise the Arctic region as a climate-vulnerable region**. Impacts of global warming are amplified in the Arctic, disrupting Indigenous ways of life, infrastructure, fisheries, and terrestrial ecosystems. The Climate Vulnerable Forum should recognise and include contributions from the Arctic region.
8. **Align finance with climate protection.** Ensure COVID-19 recovery spending and fiscal policies are consistent with a 1.5°C warming limit while ensuring adequate support for adaptation and resilience measures. Deliver on the $100 billion climate finance commitment. For finance and corporate entities, ensure appropriate pricing signals by putting a meaningful price on carbon that reflects the full costs of damage caused by carbon emissions and by mandating climate-related financial disclosure of risks, opportunities and impacts.

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AUTHORS

CO-ORDINATING AUTHOR:

Professor Gail Whiteman, University of Exeter and founder of Arctic Basecamp

CONTRIBUTING AUTHORS:

Arctic Sea Ice — Summary of 2021
Professor Julienne Stroeve, UCL, Dr. Zachary Labe, Colorado State University

Greenland
Professor Alun Hubbard, UiT — The Arctic University of Norway & University of Oulu

Arctic Fires
Dr. Mark Parrington, senior scientist in the Copernicus Atmosphere Monitoring Service (CAMS), European Centre for Medium-Range Weather Forecasts

Permafrost
Natalie Baillargeon, **Brendan Rogers**, **Anneka Williams**, **Sue Natali**, and **Rachael Treharne**, Woodwell Climate Research Center.

Extreme Weather in 2021: Connections with the Arctic
Dr. Jennifer Francis, Acting Deputy Director and Senior Scientist, Woodwell Climate Research Center

ABOUT ARCTIC BASECAMP

Arctic Basecamp is a registered not-for-profit organization headquartered in the Netherlands. Our mission is to "speak science to power" and communicate how the Arctic is a critical barometer for, and a driver of, global risk. We support urgent low carbon action based on insightful analysis that is supported by robust, rigorous and cutting-edge science.

By sharing knowledge and science, Arctic Basecamp works with partners to call for urgent action from global leaders to mitigate, adapt and build resilience to global risks from climate change.

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