

Climate Change: Thawing the Permafrost Discourse Surrounding Climate Change

Introduction: The Gap in Permafrost Science

In order to calculate the extent of damage that climate change will create, it is essential that governments, industries, scientists, and the general public are aware of how climate change currently effects and will affect the arctic.¹ Without this information it is difficult to form realistic plans that will effectively and strategically help with climate change mitigation and adaptation.² Therefore, it is necessary to continue researching and analyzing one of the key features of the arctic ecosystem, permafrost.³

permafrost⁴ is a key aspect of the arctic system and is increasingly being recognized as a crucial aspect of climate change mitigation by the general public.⁵ However, the data on this subject is primarily collected by smaller groups and scientists working alone.⁶ This issue impairs the amount of data that is available and creates a gap in climate change science that will hinder mitigation efforts until governments and activists begin to put more resources into permafrost science.

¹ Romanovsky, V. E., et al. "Thermal State of Permafrost in Russia." *Permafrost and Periglacial Processes*, vol. 21, no. 2, 2010, p. 136. pp. 136–155., <https://doi.org/10.1002/ppp.683>.

² Romanovsky, V. E., et al. "Thermal State of Permafrost in Russia." *Permafrost and Periglacial Processes*, vol. 21, no. 2, 2010, p. 136. pp. 136–155., <https://doi.org/10.1002/ppp.683>.

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⁴ According to National Geographic "Permafrost is a permanently frozen layer on or under the Earth's surface. It consists of soil, gravel, and sand, and is usually bound together by ice. Permafrost usually remains at or below 0 degrees Celsius for at least 2 years.

⁵ Romanovsky, V. E., et al. "Thermal State of Permafrost in Russia." *Permafrost and Periglacial Processes*, vol. 21, no. 2, 2010, p. 136. pp. 136–155., <https://doi.org/10.1002/ppp.683>.

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Part I: Permafrost Problems; Site Specific or Generally Lacking

The main discourse about permafrost and climate change is that the science surrounding it is argued to be site specific.⁷ . Therefore, it is argued that it is more effective to work towards climate change mitigation by studying other areas that are more globally relevant. The reason for this is that while permafrost can be found across 11 percent of the global surface, a much larger area remains that may not yield any benefits from investing in permafrost science.⁸

According to Trevor Nace,⁹ science suggests that permafrost is unlikely to affect climate change.¹⁰ Nace's reasoning behind this is that studies on gas bubbles from previous eras and paleoclimatology from the last glacial period to now indicate that permafrost did not affect climate change rates in historical times.¹¹ In addition, Nace argues that studies show only small methane gas signatures, and that it is likely most of the gas released from permafrost was CO₂ gas which is not as big of a factor in climate change as methane.¹²

This argument about permafrost being unlikely to affect climate change is supported by the National Science Foundation (NSF).¹³ NSF claims that while some methane may be released

⁷ Romanovsky, V. E., et al. "Thermal State of Permafrost in Russia." *Permafrost and Periglacial Processes*, vol. 21, no. 2, 2010, p.137. pp. 136–155., <https://doi.org/10.1002/ppp.683>.

⁸ Obu, J. "How Much of the Earth's Surface Is Underlain by Permafrost?" *Journal of Geophysical Research: Earth Surface*, vol. 126, no. 5, 2021, <https://doi.org/10.1029/2021jf006123>.

⁹ Trevor Nace is a senior writer for Forbes magazine who received a PHD in climate and geology from Duke University.

¹⁰ Nace, Trevor. "Thawing Permafrost Is Unlikely to Increase Global Warming, Scientists Find." *Forbes*, Forbes Magazine, 25 Feb. 2020, <https://www.forbes.com/sites/trevornace/2020/02/25/thawing-permafrost-is-unlikely-to-increase-global-warming-scientists-find/?sh=5ffa6615666e>.

¹¹ Nace, Trevor. "Thawing Permafrost Is Unlikely to Increase Global Warming, Scientists Find." *Forbes*, Forbes Magazine, 25 Feb. 2020, <https://www.forbes.com/sites/trevornace/2020/02/25/thawing-permafrost-is-unlikely-to-increase-global-warming-scientists-find/?sh=5ffa6615666e>.

¹² Nace, Trevor. "Thawing Permafrost Is Unlikely to Increase Global Warming, Scientists Find." *Forbes*, Forbes Magazine, 25 Feb. 2020, <https://www.forbes.com/sites/trevornace/2020/02/25/thawing-permafrost-is-unlikely-to-increase-global-warming-scientists-find/?sh=5ffa6615666e>.

¹³ "Warming Climate Unlikely to Cause Major Methane Release." NSF, National Science Foundation, 28 Feb. 2020, <https://beta.nsf.gov/news/warming-climate-unlikely-cause-major-methane>.

as a result of melting permafrost, most of it will not enter the atmosphere.¹⁴ However, NSF acknowledges that because permafrost is made up of decomposing plant matter, soil, and ice, as the ice melts into the soil with warmer temperatures and water logs it. This process creates a perfect environment for microbes which can then consume the generated carbon and produce a methane gas.¹⁵

Therefore, while the NSF acknowledges that methane can build up in permafrost especially as temperatures warm, both Nace and NSF believe that permafrost will still be unlikely to affect climate change. The difference between their positions is that NSF believes it is unlikely the methane will reach the atmosphere while Nace believes that because the methane in permafrost has not affected other warming periods it will not affect the current climate change crisis.¹⁶

The other side of the discourse surrounding permafrost and climate change takes a look at the bigger picture. Even though permafrost science is primarily site specific, and permafrost only covers 11 percent of the global surface, the amount of methane that will be put into the atmosphere as a result of permafrost melting will affect the Earth as a whole.¹⁷

According to a policy report by the United Nations Environment Programme (UNEP) climate predictions have set major permafrost degradation at 2100 or earlier.¹⁸ Permafrost is

¹⁴ "Warming Climate Unlikely to Cause Major Methane Release." *NSF*, National Science Foundation, 28 Feb. 2020, <https://beta.nsf.gov/news/warming-climate-unlikely-cause-major-methane>.

¹⁵ "Warming Climate Unlikely to Cause Major Methane Release." *NSF*, National Science Foundation, 28 Feb. 2020, <https://beta.nsf.gov/news/warming-climate-unlikely-cause-major-methane>.

¹⁶ "Warming Climate Unlikely to Cause Major Methane Release." *NSF*, National Science Foundation, 28 Feb. 2020, <https://beta.nsf.gov/news/warming-climate-unlikely-cause-major-methane>.

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¹⁷ Obu, J. "How Much of the Earth's Surface Is Underlain by Permafrost?" *Journal of Geophysical Research: Earth Surface*, vol. 126, no. 5, 2021, <https://doi.org/10.1029/2021jf006123>.

¹⁸ Schaefer, Kevin et al. *Policy Implications of Warming Permafrost*, February 2013, UNEP

calculated to contain approximately 1672 gigatons of carbon in the form of plant matter.¹⁹ If this plant matter decomposes and releases carbon and methane into the air, then it can not only accelerate the rate at which climate change is changing the Earth, but it can also create long term effects on arctic ecosystems.²⁰

The point made by UNEP is countered by the arguments made by Nace and the NSF who argue that the release of gas would never reach the atmosphere, and if it did it would not accelerate climate change because the main gas is not methane.²¹ However, according to Sergay Zimov the arguments by Nace and NSF fail to consider all the possibilities, and may prove incorrect.²² Zimov proposes that Nace's argument that previous permafrost melting did not affect past warming periods may be incorrect because of two warming events during the last deglaciation.²³ These warming events were attributed to ocean venting, but the analysis on this failed to include the possibility of a "terrestrial pool that could readily release ancient carbon."²⁴ In addition, Zimov notes another incident during the late glacial maximum where scientists could have wrongly concluded the results of a different permafrost thawing period.²⁵ By pointing out the flaws in the logic concerning melting permafrost and carbon reservoirs of the past Zimov concludes that even if the carbon and gases released by permafrost do not go directly into the

¹⁹ Schaefer, Kevin et al. *Policy Implications of Warming Permafrost*, February 2013, UNEP

²⁰ Schaefer, Kevin et al. *Policy Implications of Warming Permafrost*, February 2013, UNEP

²¹ "Warming Climate Unlikely to Cause Major Methane Release." *NSF*, National Science Foundation, 28 Feb. 2020, <https://beta.nsf.gov/news/warming-climate-unlikely-cause-major-methane>.

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²² Zimov, Sergey A., et al. "Permafrost and the Global Carbon Budget." *Science*, vol. 312, no. 5780, 2006, p.1613, pp. 1612–1613., <https://doi.org/10.1126/science.1128908>.

²³ Zimov, Sergey A., et al. "Permafrost and the Global Carbon Budget." *Science*, vol. 312, no. 5780, 2006, pp. 1612–1613., <https://doi.org/10.1126/science.1128908>.

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atmosphere, they will still release enough gas into the active cycle of carbon reservoirs to require direct mitigation efforts of warming in the arctic.²⁶

Therefore, if you examine the arguments that permafrost will not matter in climate mitigation and compare them to the arguments opposing that viewpoint it is not clear whether either side is completely accurate in their predictions.

Part II: Analysis and Conclusion

It is a common saying that one should be prepared for the worst even if they expect the best, and this should include climate change precautions. Already permafrost is melting faster than scientists had initially predicted, causing natural disasters such as landslides near permafrost areas.²⁷ While these local issues may call for smaller short-term solutions, they should also encourage additional permafrost research worldwide. The reason for this is that there are still questions revolving around how much the melting permafrost will actually affect climate change, but there is an agreement that there will be at least some detriment to the global carbon budget.²⁸

Therefore because of this acknowledged detriment, and the fact that scientists still aren't sure how much previous warming periods were affected by melting permafrost, precautions should be taken. With the rate at which global warming is occurring it would be a mistake to not grant extra resources to permafrost science. If the gases within permafrost do act as a catalyst in global warming it will already be too late to invest in the research once the gases are released. In conclusion, more research should be directed towards protecting arctic environments and the mitigation of permafrost degradation as a prevention measure.

²⁶ Zimov, Sergey A., et al. "Permafrost and the Global Carbon Budget." *Science*, vol. 312, no. 5780, 2006, p.1613, pp. 1612–1613., <https://doi.org/10.1126/science.1128908>.

²⁷ McGee, David, and Elizabeth Gribkoff. "Permafrost." *MIT Climate Portal*, 4 Aug. 2022, <https://climate.mit.edu/explainers/permafrost>.

²⁸ McGee, David, and Elizabeth Gribkoff. "Permafrost." *MIT Climate Portal*, 4 Aug. 2022, <https://climate.mit.edu/explainers/permafrost>.