



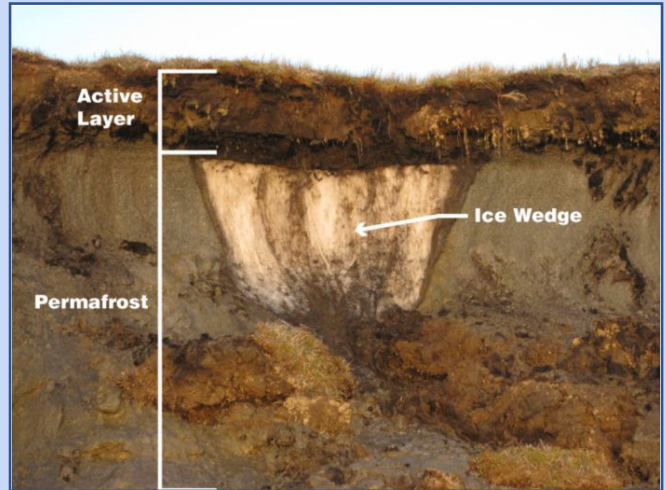
# Impacts of Climate Change: Permafrost



## Introduction

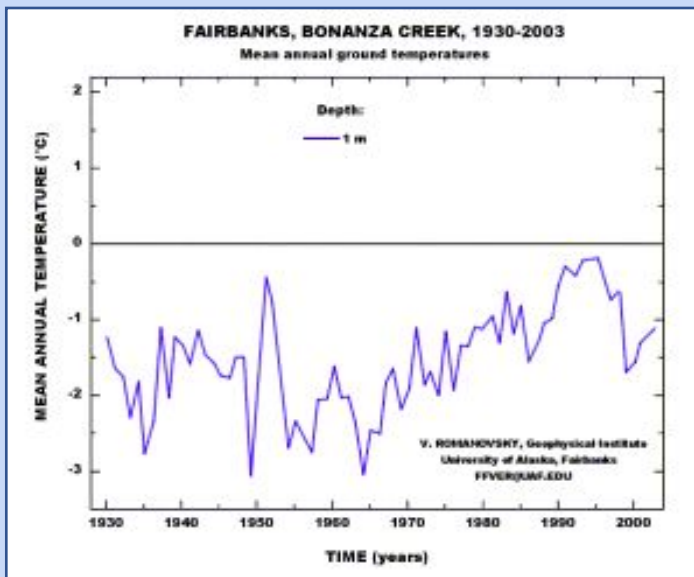
Permafrost is a thick subsurface layer of soil that remains frozen throughout the year, and occurs mostly in polar regions.

- Combination of soil, rocks, and sand held together with ice
- Ground has to have been frozen for **two years** straight to be called permafrost
- Organic material found in upper layers of permafrost and minerals found in lower.
- A **Quarter** of the Northern Hemisphere has permafrost under the land
- Be clear, and accurate
- **Active layer** of soil above the permafrost layer stays unfrozen all year long



The picture above shows the layers of permafrost and was created by Benjamin Jones, USGS. The link to this picture can be found here:

<https://climatekids.nasa.gov/permafrost/>



The picture above shows the surface temperatures 1 foot below the active layer in Fairbanks, Alaska. The ground has been frozen in this spot for hundreds of thousands of years and is now almost at melting point.

## How Current Global Change is Making This Worse

Rising temperatures are melting permafrost resulting in serious consequences for things living on and near it such as:

- Destroying homes, roads, and other infrastructure built upon it
- Restarting the decomposition of organic carbon in plants once frozen in the ground. This releases greenhouses such as CO<sub>2</sub> and methane.
- Unfreezing up to 400,000 year old bacteria and microbes which in turn could make the human race and animals very sick.

Find more information about Fairbanks, Alaska at this link where the picture and data are from:

<https://www.pmel.noaa.gov/arctic-zone/detect/land-permafrost.shtml>



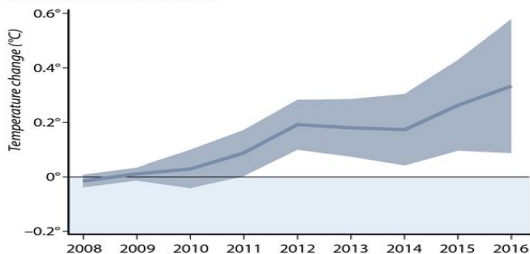
Permafrost has effects that can not be seen until the ground has thawed out. The thing our society wants to see are the repercussions of another pandemic, except with thousands of year old viruses, or the destruction of infrastructure.

### Permafrost Is Warming Up

As global temperatures rise, permafrost zones are also warming quickly. Scientists found that in the past decade, temperatures at dozens of permafrost test sites at least 30 feet deep had risen on average about half a degree Fahrenheit (0.3°C).

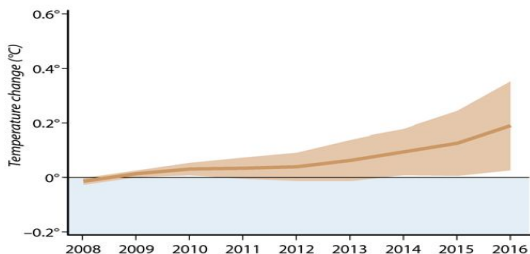
#### CHANGE IN ANNUAL AVERAGE CONTINUOUS ARCTIC PERMAFROST TEMPERATURE

Relative to 2008-2009 baseline



#### CHANGE IN ANNUAL AVERAGE HIGH MOUNTAIN PERMAFROST TEMPERATURE

Relative to 2008-2009 baseline



SOURCE: Biskaborn et al., Nature Communications, 2019 InsideClimate News

<- The chart to the left shows changes in average permafrost temperature in both mountains and arctic settings. We can see that the temperatures in both locations have been increasing steadily.



The picture above shows an Alaska home sinking into the ground as a result of melting permafrost. An estimated 70% of infrastructure, such as hospitals, homes, and public roadways, is built on permafrost at risk for thawing in the next 30 years. 3.6 million people are predicted to be affected by this damage. (6)



The picture above shows permafrost melting in the arctic region of Svalbard, Norway. (1)

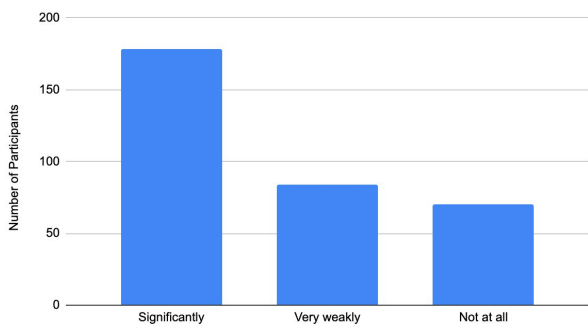
(5)

### How will this change impact humans &/or wildlife in the near future

- Bacteria from hundreds of thousands of years ago can resurface
- Bacteria could cause many forms of life to go extinct.
- Lakes and ice cliffs disappear due to melting permafrost
- Rise in sea levels and erosion from flowing water in the land going to sea.
- Collapsing infrastructure leaves communities destroyed and forced to migrate.

### Public Perception of Permafrost Loss

#### Permafrost Loss



Results of 333 respondents conducted in Spring 2020 to the query that permafrost will be intensified in the future by global climate change.

### References

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4. Romanovsky, V., M. Burgess, S. Smith, K. Yoshikawa, and J. Brown, Permafrost Temperature Records: Indicators of Climate Change, EOS, AGU Transactions, Vol. 83, No. 50, 589-594, December 10, 2002.
5. Berwyn, Bob. "Permafrost Is Warming Around the Globe, Study Shows. That's a Problem for Climate Change." InsideClimate News, 10 Apr. 2019, [insideclimatenews.org/news/16012019/permafrost-thaw-climate-change-temperature-data-arctic-antarctica-mountains-study](http://insideclimatenews.org/news/16012019/permafrost-thaw-climate-change-temperature-data-arctic-antarctica-mountains-study).
6. Anonymous. 11 December 2018. "Melting Permafrost Could Damage Infrastructure for 3.6 Million People". Yale Environment 360. 18 April 2020.