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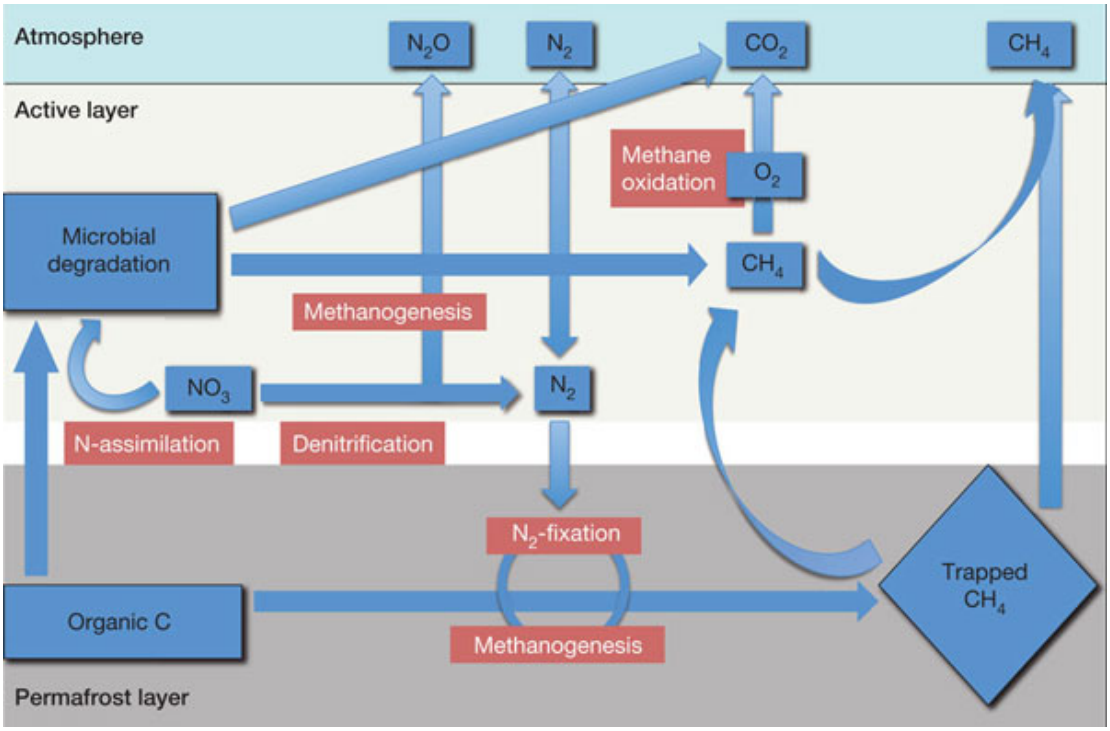
As Permafrost Melts, Methane-Munching Soil Bacteria Come to Life



There's a lot going on in Arctic permafrost as it melts and soil bacteria become more active. A new study explores how these bacteria may help or hinder our efforts to control the greenhouse gasses in the atmosphere.

What's the News: Melting permafrost in a warming world could mean lots of greenhouses gasses, especially methane, released into the atmosphere. But it also means an unusual community of soil bacteria coming out of hibernation, so to speak. A new study looks at what those permafrost microbes do, exactly, as their environment warms up.

How the Heck:

- The researchers took cores of frozen soil from Alaska and started melting them in the laboratory. As the permafrost melted, they used a technique called metagenome sequencing, harvesting and sequencing DNA from the samples, to identify the permafrost denizens and to see what kinds of proteins they were manufacturing.

- By performing this step while the samples were frozen and at two points during the melting process, they were able to see how the bacterial makeup of the soil changed over the course of the melt, as some bacteria reproduced like crazy and others did not.
- They also monitored the amount of methane, carbon dioxide, and other gasses released by the thawing soil and were able to link changes in the gas levels to the activities of the bacteria. Specifically, they found that methane spiked when melting began, but that it quickly dropped, apparently thanks to methane-munching soil bacteria that absorbed the potent greenhouse gas.
- Don't celebrate yet, though—those bacteria then excrete carbon dioxide, which, though 25 times less harmful as a greenhouse gas than methane, is still not something we'd like more of in the atmosphere.
- The researchers also looked to see whether any of the bacteria that had enzymes that could digest nitrous oxide, which is also released by melting permafrost and is an even worse greenhouse gas than methane, grew in numbers as the melting progressed. Unfortunately, they did not.

What's the Context:

- Permafrost—soil that's below the freezing temperature of water for at least two years—exists at both poles and in other cold regions and contains about 1,400 gigatons of trapped carbon in total. That's more than there is in the atmosphere now. As global warming melts that permafrost, scientists fear that methane, carbon dioxide, and other greenhouse gasses will escape and accelerate massive climate change.
- How permafrost bacterial life will play into that process isn't clear, and studies like this will help us get a more complete picture of what the effects of melting will be. The researchers also assembled a rough genome for a methane-eating bacterium in the permafrost, which should provide insight into how the bacterium works.

Reference: Mackelprang, et al. Metagenomic analysis of a permafrost microbial community reveals a rapid response to thaw. *Nature* (2011) doi:10.1038/nature10576