

# **Climate change impact on soil microbial communities of the West Antarctic Peninsula**

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The West Antarctic Peninsula is one of the fastest warming regions of the planet, and may be fast approaching a climatic tipping point [1,2]. Measurements and climate models indicate vulnerabilities to the prevalence and stability of frozen ground and permafrost. Microorganisms are key players in the mobilization of carbon and nutrients in global soils - especially in Antarctica where there is an almost complete absence of higher-order plants. While the role of microorganisms in contributing to and regulating greenhouse gas fluxes in the Arctic has been extensively investigated, less is known about their role and activity in thawing Antarctic permafrost. Here we present data from 8 terrestrial sites along the West Antarctic peninsula, where the past 7 years have been the seven warmest on record [2]. We measured soil surface temperatures of between 2.3 and 17.1 °C, with an average of 8.5 °C. We characterized soil microbial taxonomic and functional diversity using shotgun metagenomics correlated with geological settings and soil geochemistry, as well as the interstitial soil gas composition. We found pronounced differences in soil microbial communities between the different sample areas, and a correlation between soil temperatures. We reveal that the microbial communities inhabiting soils on the Antarctic peninsula are capable of degrading complex refractory organic matter, potentially contributing to greenhouse gas emission. Our co-characterization of soil microbial communities with their geochemical and geological settings provides important insights into anticipated climate change-induced developments of Antarctic soil microbial ecosystems, revealing their possible future contribution to greenhouse gas emission and biogeochemical cycling in a warming Antarctica.

1. Masson-Delmotte, V. et al. (eds) IPCC (Cambridge University Press, 2021).
2. Gorodetskaya, I.V., Durán-Alarcón, C., González-Herrero, S. et al. *npj Climate and Atmospheric Science* 6, 202 (2023).