

# Our breathing Earth: A review of soil respiration science

February 27 2024, by Aaron Sidder

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Earth scientist Stephanie Pennington measures soil respiration at the Smithsonian Environmental Research Center near Edgewater, Md. Credit: Ben Bond-Lamberty

The ground beneath our feet is exhaling. Steadily and without pause, through a process called soil respiration, plant roots and microbes release carbon dioxide (CO<sub>2</sub>) into the atmosphere.

The amount of CO<sub>2</sub> that passes from the soil to the air is significant—almost an order of magnitude greater than human emissions. Computing this flow for the whole planet, and understanding how it may be changing, is complicated and uncertain because of gaps in [observational data](#). Yet the calculation is essential for understanding the [global carbon cycle](#) and climate change feedbacks.

In a new [review paper](#) published in the *Journal of Geophysical Research: Biogeosciences*, Ben Bond-Lamberty and colleagues summarize the past two decades of progress in [soil respiration](#) science.

In one cited study, researchers evaluated how respiration responds to soil wetted by rainfall. In another, researchers girdled trees, or removed their outer layers, to mimic the effects of insects and tracked how tree stress influenced respiration.

The synopsis recounts laboratory approaches and findings, explores the refinement of measurement strategies in natural settings, and chronicles methods for simulating and documenting soil respiration.

Looking ahead, the authors emphasize how taking advantage of advances in areas such as [machine learning](#) and mechanistic modeling must proceed alongside efforts to diversify the global research community. Improving representation from lower-income regions will have the added benefit of bolstering data coverage and improving global soil respiration estimates muddled by uncertainty.

**More information:** Ben Bond-Lamberty et al, Twenty Years of Progress, Challenges, and Opportunities in Measuring and Understanding Soil Respiration, *Journal of Geophysical Research: Biogeosciences* (2024). [DOI: 10.1029/2023JG007637](https://doi.org/10.1029/2023JG007637)

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Citation: Our breathing Earth: A review of soil respiration science (2024, February 27) retrieved 27 April 2024 from <https://phys.org/news/2024-02-earth-soil-respiration-science.html>

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