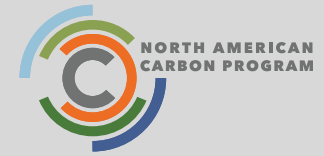


# Optimizing sampling designs for greenhouse gases from soils

Vargas, R. and Le, V. H.: The paradox of assessing greenhouse gases from soils for nature-based solutions, *Biogeosciences*, 20, 15–26, <https://doi.org/10.5194/bg-20-15-2023>, 2023.



## Science Question

- Can we optimize sampling designs for soil greenhouse gas (GHG)?
- Can we measure multiple GHG fluxes a few times annually to estimate annual fluxes?

## Analysis

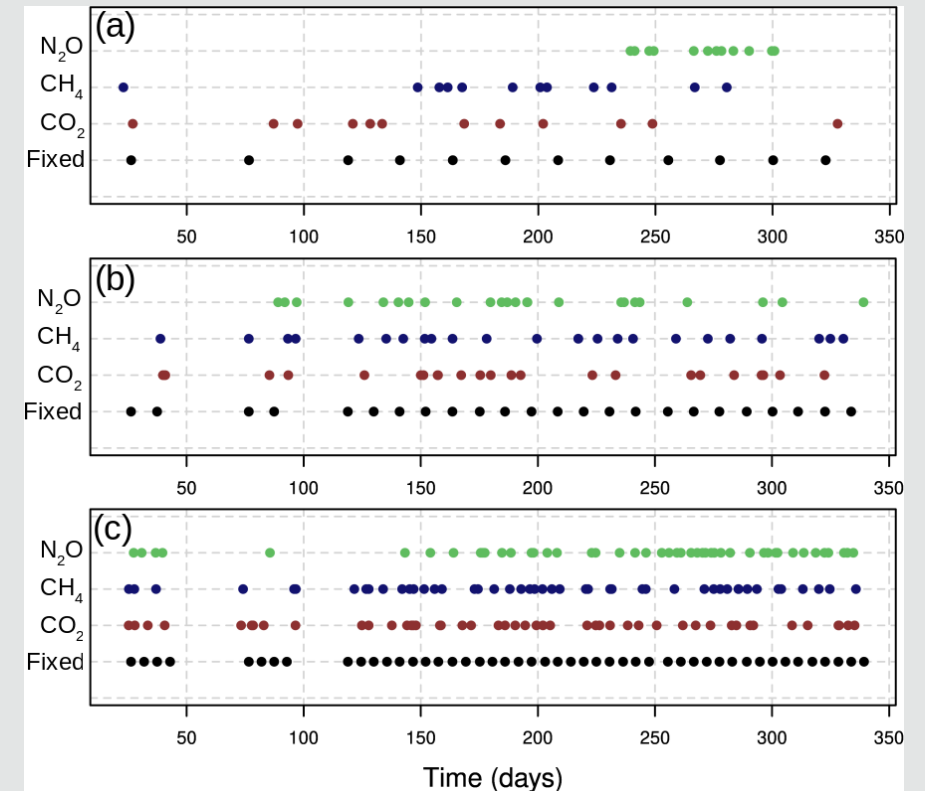
- Automated measurements of soil GHGs (i.e., CO<sub>2</sub>, CH<sub>4</sub>, N<sub>2</sub>O) were made in a temperate forest.
- Development of a new algorithm for optimizing sampling protocols (temporal univariate Latin hypercube sampling, *tuLHs*)

## Results

- Sampling campaigns based on a few fixed measurements (e.g., once or twice per month) produced annual budgets of GHG from soils with large errors.
- An improved sampling design can be done using the *tuLHs* resulting in accurate measurements of magnitudes, temporal variability, and annual budgets for soil GHG fluxes.

## Significance

The ideal time to measure a specific GHG flux may not be the ideal time to measure another. This is especially relevant when measurements are restricted to once a month for estimating annual fluxes. To minimize errors, an optimized sampling approach can be employed.



**Figure.** Example of recommended dates to sample different GHGs from soils derived using the *tuLHs*. For 12 (a), 24 (b), and 48 (c) measurements. Black dots represent fixed intervals. Note that the recommended sampling date for one GHG may differ from that of other GHGs.

## Acknowledgments

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