Increasing water availability accelerates soil respiration rates, while nitrogen availability increases soil nitric oxide production but has no effect on nitrous oxide emissions in desert soils

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Introduction

Drylands are the largest biome on Earth, representing ~40% of the global terrestrial surface. Soil microbial processes in drylands are limited by multiple abiotic factors, most important being water and macronutrients (nitrogen (N) and phosphorus (P). Understanding the relative importance of different abiotic factors (e.g. water and macronutrient availability) for soil microbial processes in drylands is crucial because drylands are important regulator of global C cycle and there is close connection between water, N, and C cycles While the effect of site-specific climatic conditions (i.e., temperature and moisture) on soil activity have been studied, the amount and the synergistic / neutral / antagonistic effects of water and nutrients availability on soil activity in the Mediterranean semi-arid climate still needs to be explored.

Objectives

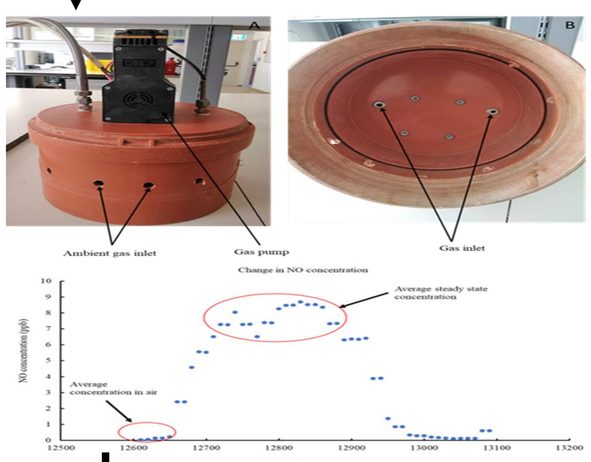
- ❑ To evaluate the effects of different water regimes and nutrient availability on soil respiration, N_2O, and NO emissions from loess soil.
- ❑ To assess the short-term effect of multiple drying-rewetting events on soil N dynamics, and trace gases emissions.

Methodology

Inserting core chambers

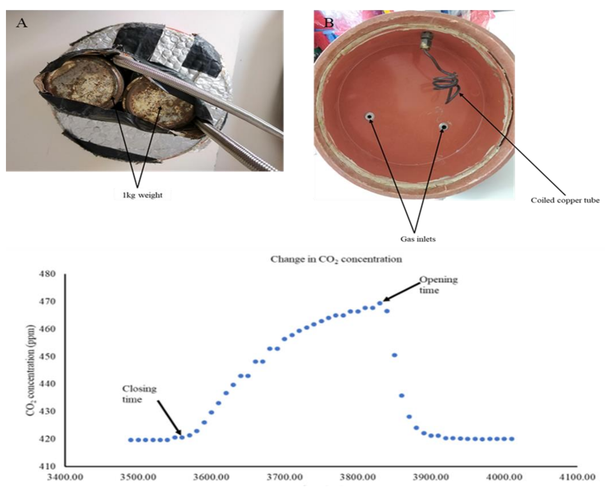
Typical measurement day

Treatment application



Dynamic headspace and NO flux calculation

Soil samples collected for lab incubation

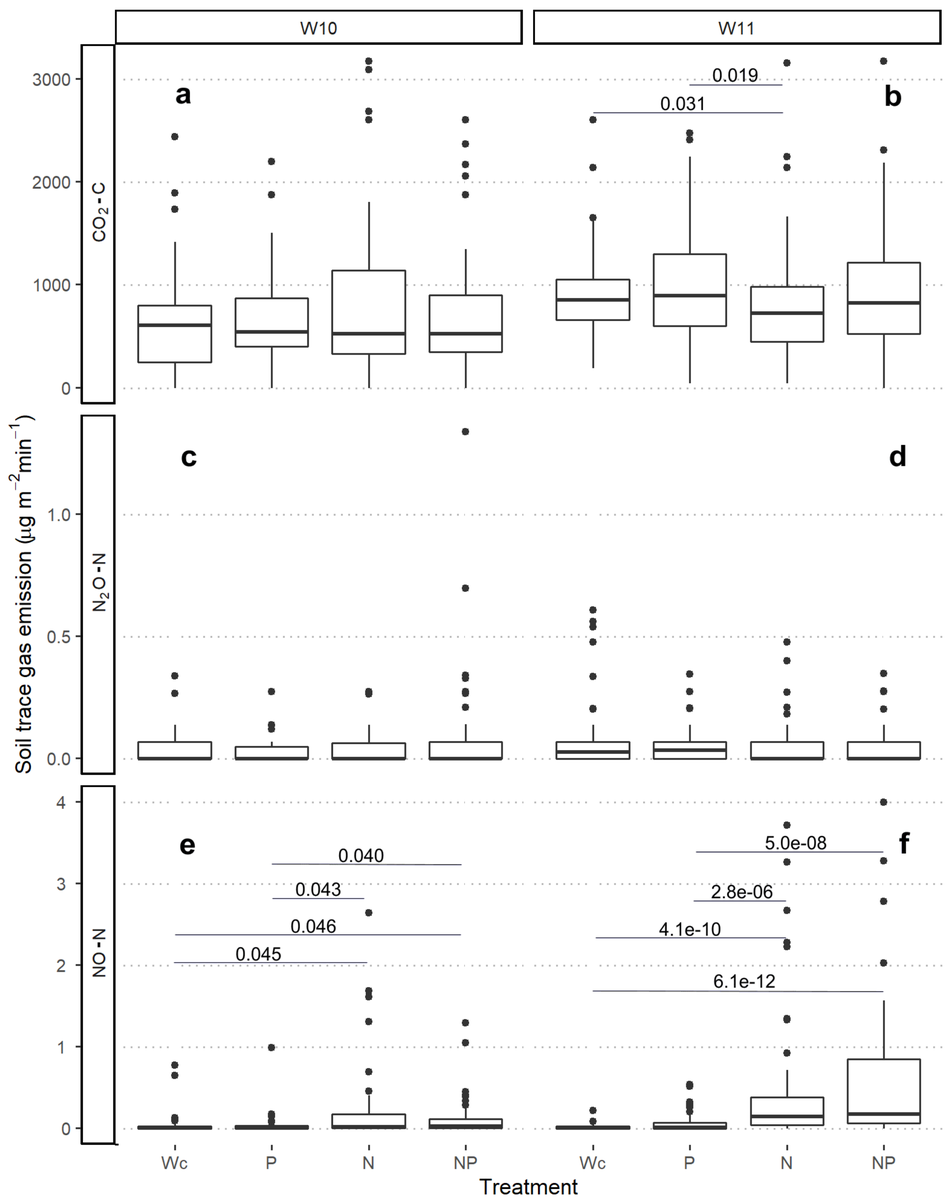


Static chamber headspace and N_2O, CO_2 flux calculation

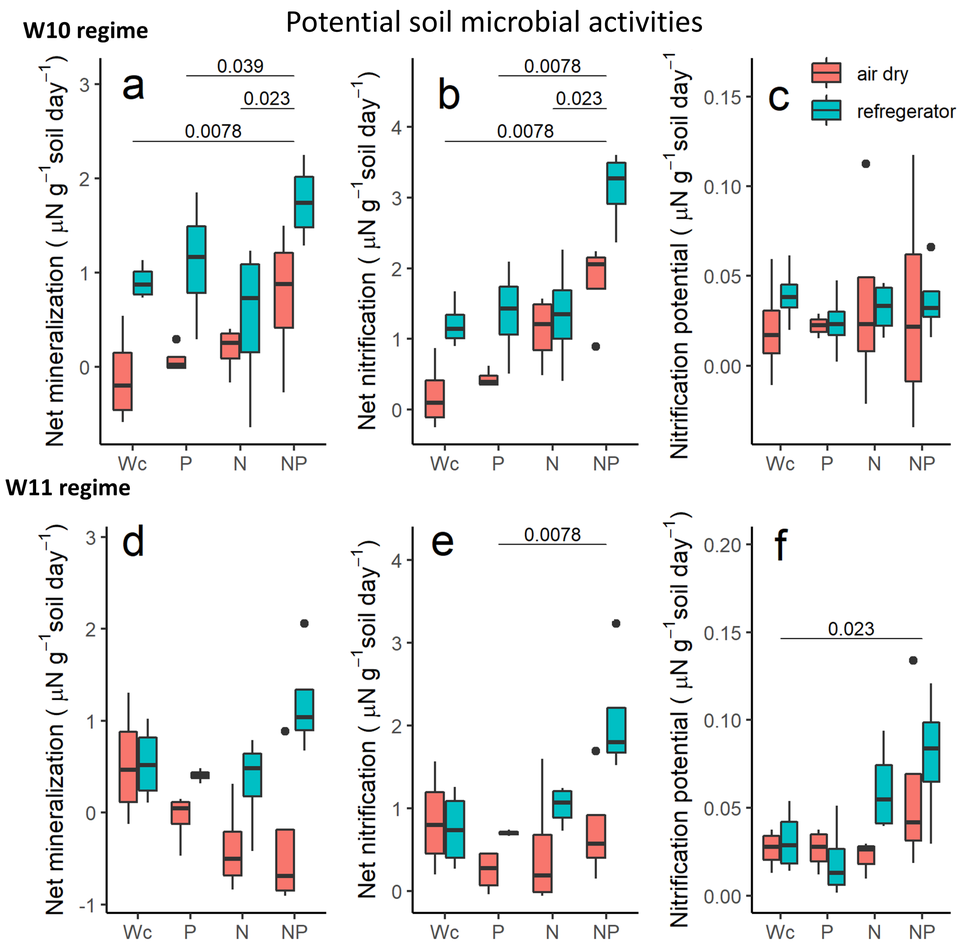
Results

Here we show the effects of water and nutrients application on soil activity related to the N and C cycles and potential soil activity. We present the effect of water application (i.e., W10 and W11 cycles) and the effects of nutrients addition on soil activity.

Soil trace gas emissions



Potential soil microbial activities



Conclusion

- ❑ Removal of multiple limitations (water and nitrogen) increases soil respiration (under W11 regime) and NO emissions but has no effect on soil N_2O emissions.
- ❑ Negev desert soils are mainly limited by N in both dry and frequently wetting regimes.
- ❑ The potential microbial activity were inhibited by frequent rewetting. The sudden change of the water availability significantly decreased the potential microbial activity.

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