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EFFECTS OF NITROGEN DEPOSITION ON GREENHOUSE GAS FLUXES FROM FOREST SOILS: RESULTS FROM AN INNOVATIVE EXPERIMENTAL DESIGN

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INTRODUCTION

The effect of nitrogen (N) deposition on forests has received much interest worldwide. Studies performed so far reported that N deposition can affect CO_2 emission, reduce CH_4 uptake and increase N_2O emission from soil.

However, most of the experiments studying the effect of N deposition on forests have been performed with N fertilizer directly applied to the forest floor. Nevertheless, tree canopy have shown to change both the amount and the chemical composition of the N deposition.

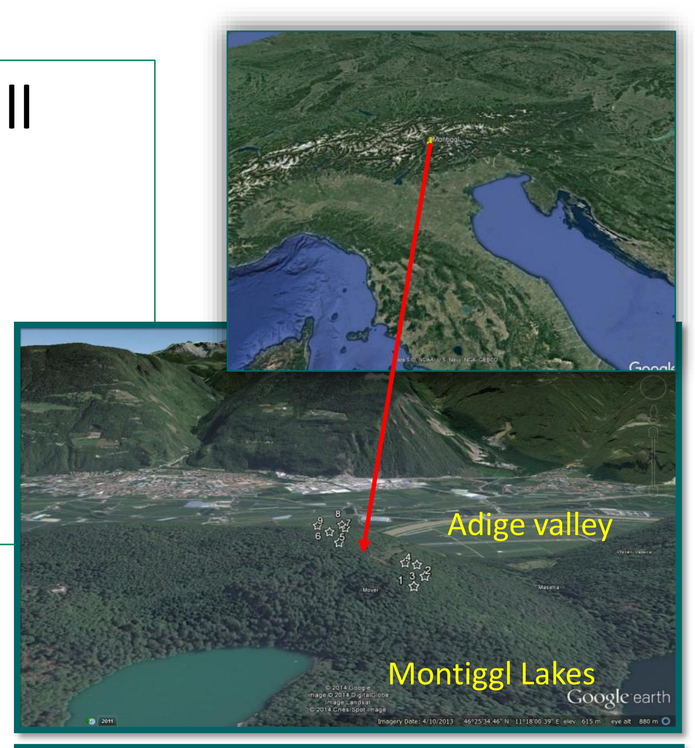
AIM OF THE STUDY

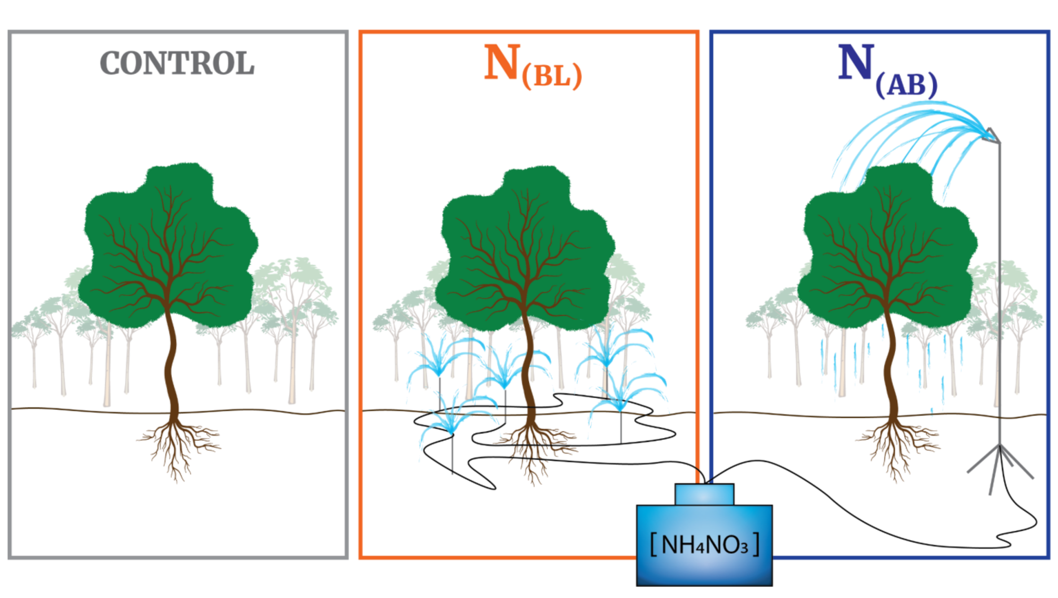
To assess how N deposition influences the greenhouse gases (GHGs) emission from soil, in an innovative experimental design that includes the effect of tree canopy.

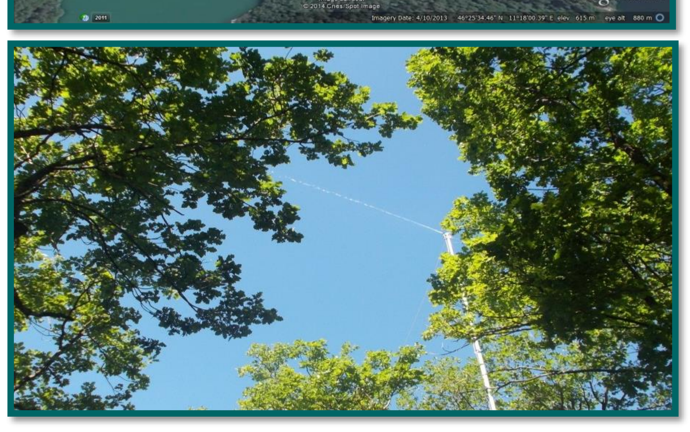
EXPERIMENT DESIGN

The experiment was established in 2015 in a sessile oak (*Quercus petraea*) forest located in Northern Italy (Bolzano province). The experimental design consisted in a set of three plots replicated three times. Each set included a control plot, a plot fertilized to the forest floor below-canopy: $N_{(BL)}$, and a plot fertilized above the canopy: $N_{(AB)}$. The total annual N addition was 20 kg N ha^{-1} (four times the natural N deposition) as NH_4NO_3.

- Forest type: old coppice turned to tall trees
- Age: 67 years
- Density: 1266 plants ha^{-1}
- Average height: 13 m
- Basal area: 30 m^2 ha^{-1}







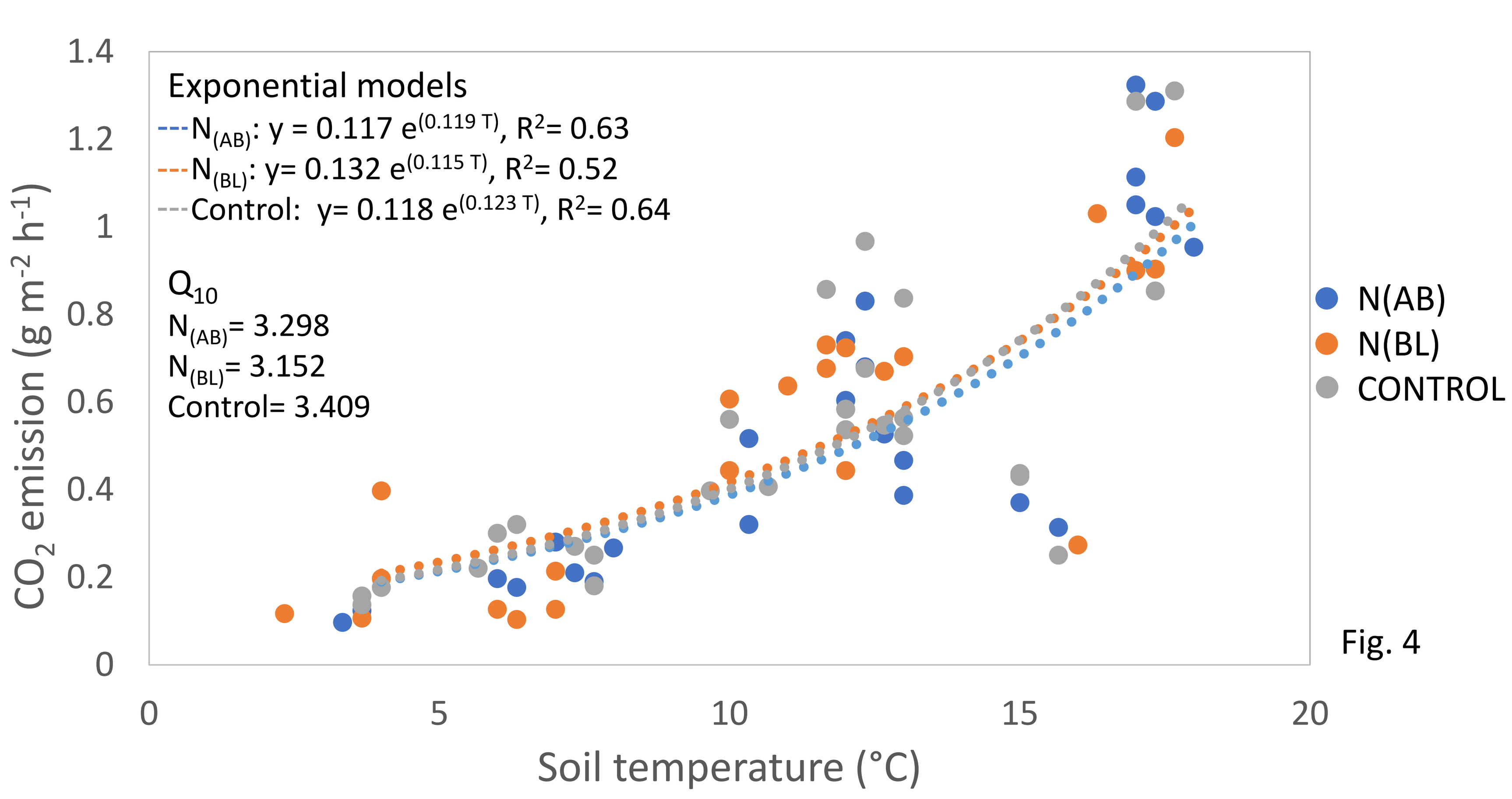


Fig. 4

MEASUREMENT OF GHGs EMISSIONS

GHGs emissions were measured in 27 points (three per plot). CO_2 emissions are measured monthly since March 2018, with a portable infrared gas analyser connected to a closed chamber. At the same time, soil temperature at 10 cm and soil humidity at 5 cm depth were measured. CH_4 and N_2O fluxes were measured monthly since May 2019 with the static chamber method: gas samples were collected at regular intervals (0, 10, 20, 30 minutes) from chamber enclosure and analysed with a gas-chromathograph.

GHGs fluxes were analysed using ANOVA and linear models. Sensitivity of CO_2 emission to temperature was analysed using exponential models and calculating the Q_{10} value, considering only measurements with a non-limiting soil water content. Comparison of CO_2 sensitivity between treatments was performed using ANCOVA, after linearization of the exponential relations.

PRELIMINARY RESULTS

Fertilisation treatments did not affect GHGs fluxes from soil (Fig. 1, 2 and 3). Also the sensitivity of CO_2 soil emissions to temperature was not affected by fertilization treatment (Fig. 4). The lack of significant effects after five years of fertilisation could be explained by the time needed by soil processes to react to increased inputs of N. Further measurements should be performed to examine the effects of fertilisation in the long term.

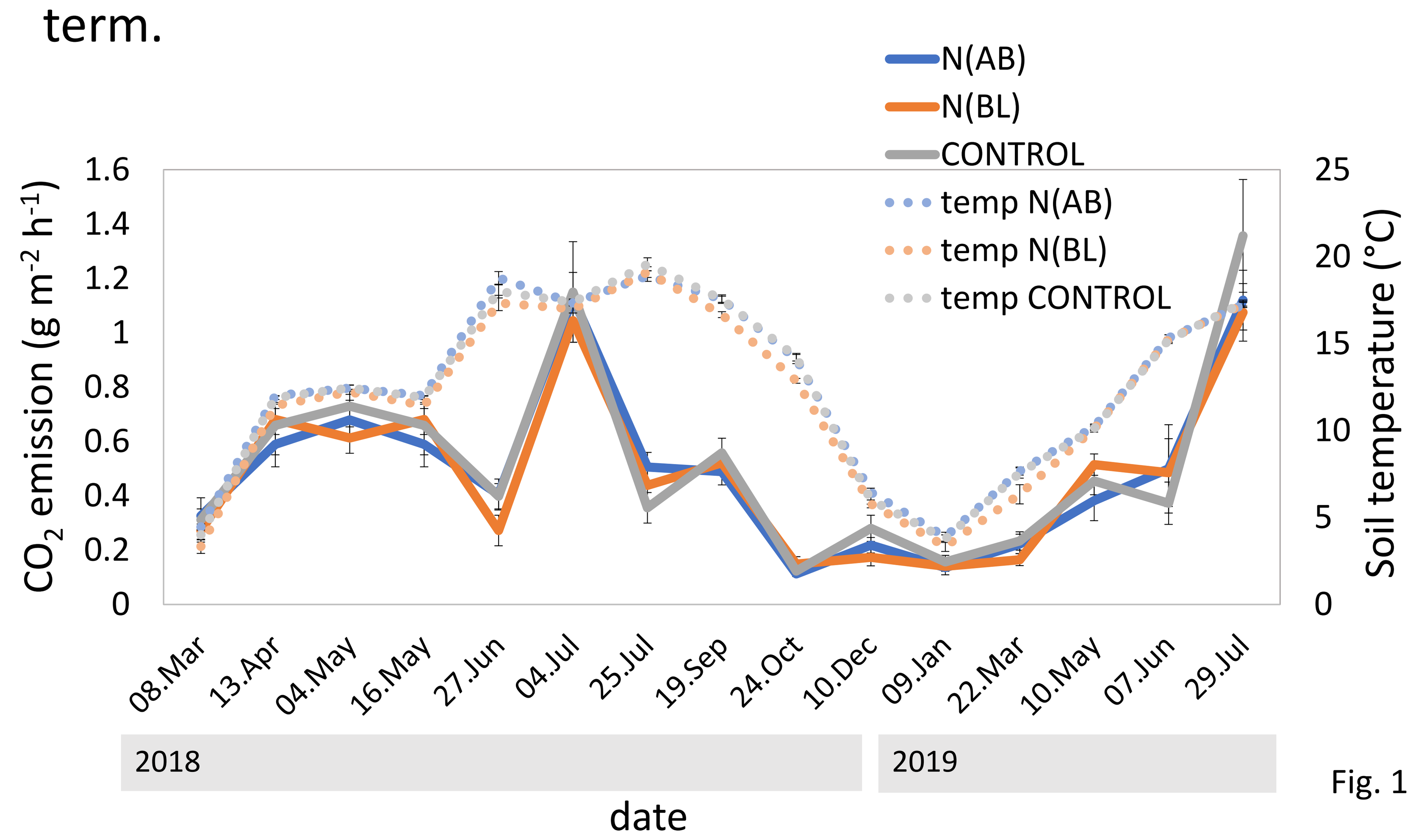


Fig. 1

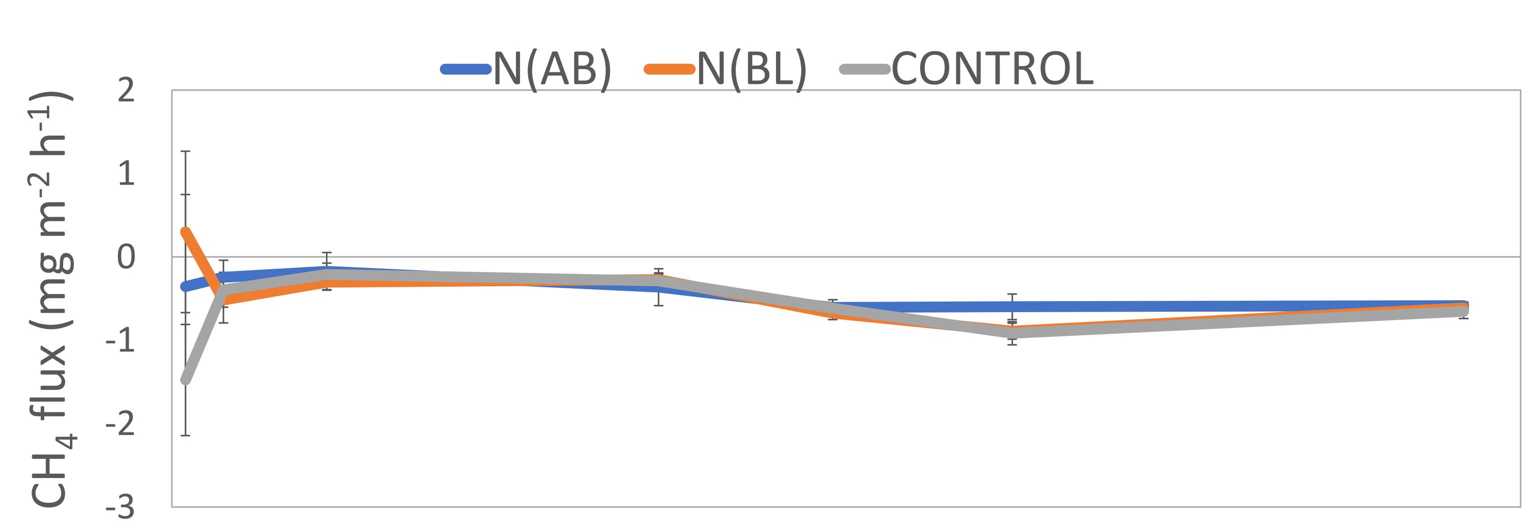


Fig. 2

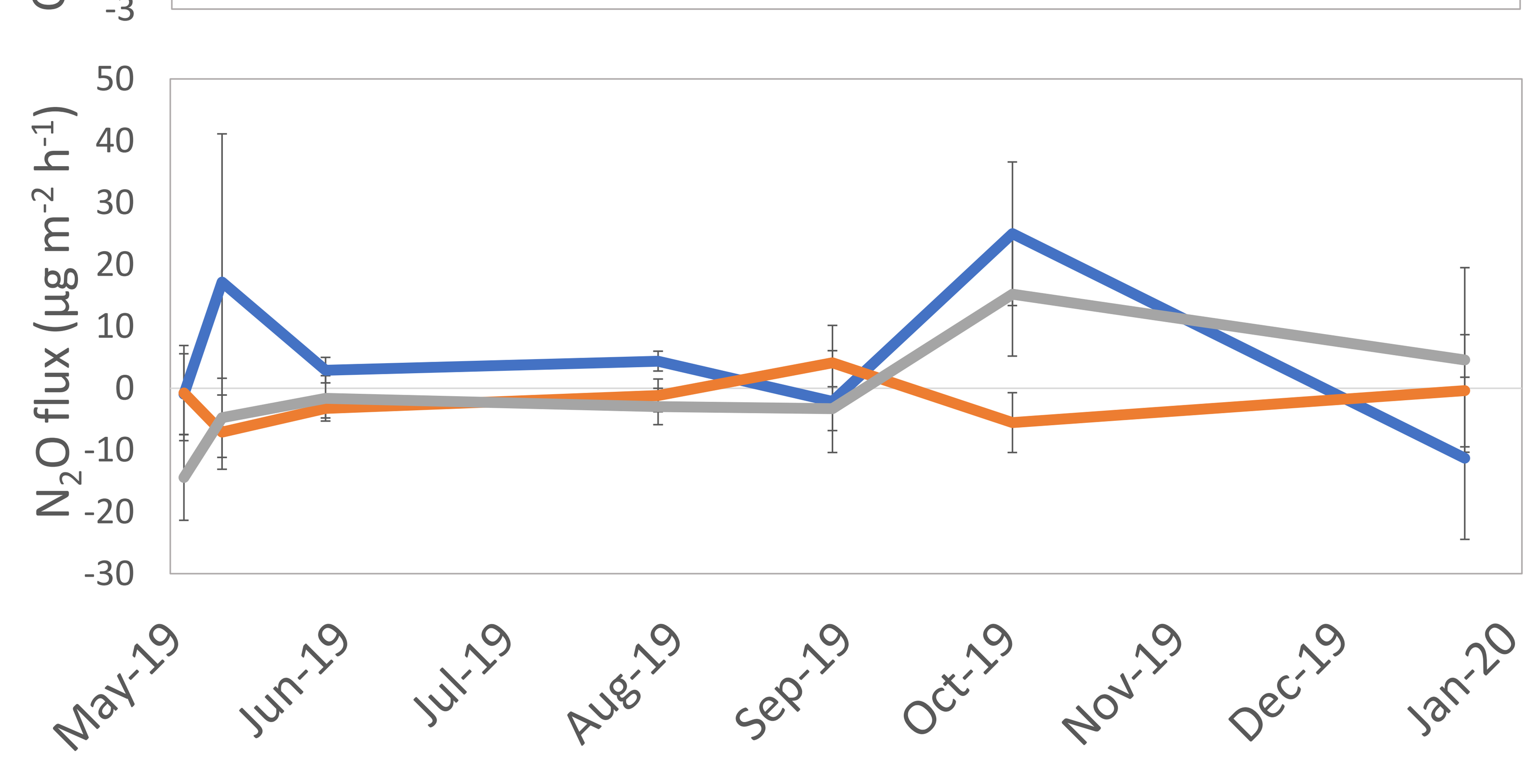


Fig. 3