Fate of atmospheric nitrogen depositions

in two Italian temperate mountain forests assessed by isotopic analysis

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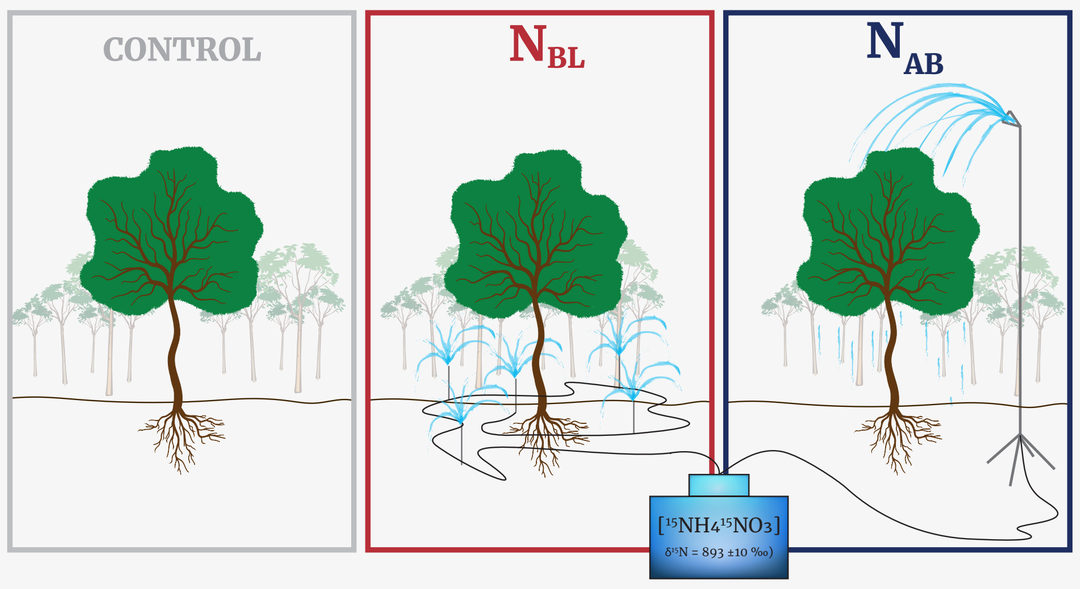
Introduction/

Increased atmospheric nitrogen (N) deposition could increase productivity of temperate forest ecosystems. However, excess of N could promote N saturation process (Aber et. al, 1998). Ecosystem response to increased N deposition depends in large share on the fate of N into its different compartments. Most of the studies performed so far simulated increased N availability by adding fertilizer directly to the forest ground, neglecting the role of canopy in regulating the N pathways trough the ecosystem. We propose the following methodology in which we compare *above-canopy fertilization* ($\mathbf{N_{AB}}$) with *ground fertilization* ($\mathbf{N_{BL}}$). To describe the fate of the applied N, stable isotope techniques have been adopted: $\delta^{15}N$ values permit to calculate the recovery of N-fertilizer in tree tissues, soil and litter, allowing us to understand how N allocation varies under these two fertilization strategies and how this affects C sequestration potential.

Hypothesis /

Adsorption of N by plants is higher when fertilization is applied on the canopies in comparison to ground application

Experimental desing /



In **Monticolo** fertilization treatment started on May 2015, providing **20 kg N ha^{-1} y^{-1}**, in 5 applications per vegetative season. On July 5th, 2016, a pulse labelling with 4 kg N ha^{-1} of $^{15}NH_4{}^{15}NO_3$ (**$\delta^{15}N$ = 893 ±10 ‰**) was perfomed. Three sampling of ecosystem compartments have been perfomerd: $\mathbf{T_0}$: 29/02/2016 / $\mathbf{T_1}$: 27/07/2016 / $\mathbf{T_2}$: 07/03/2017 to determine N content and $\delta^{15}N$. The recovery of applied N was calculated using an isotopic mass-balance:

$$f_N = \frac{\delta^{15}N_T - \delta^{15}N_C}{\delta^{15}N_F - \delta^{15}N_C}$$

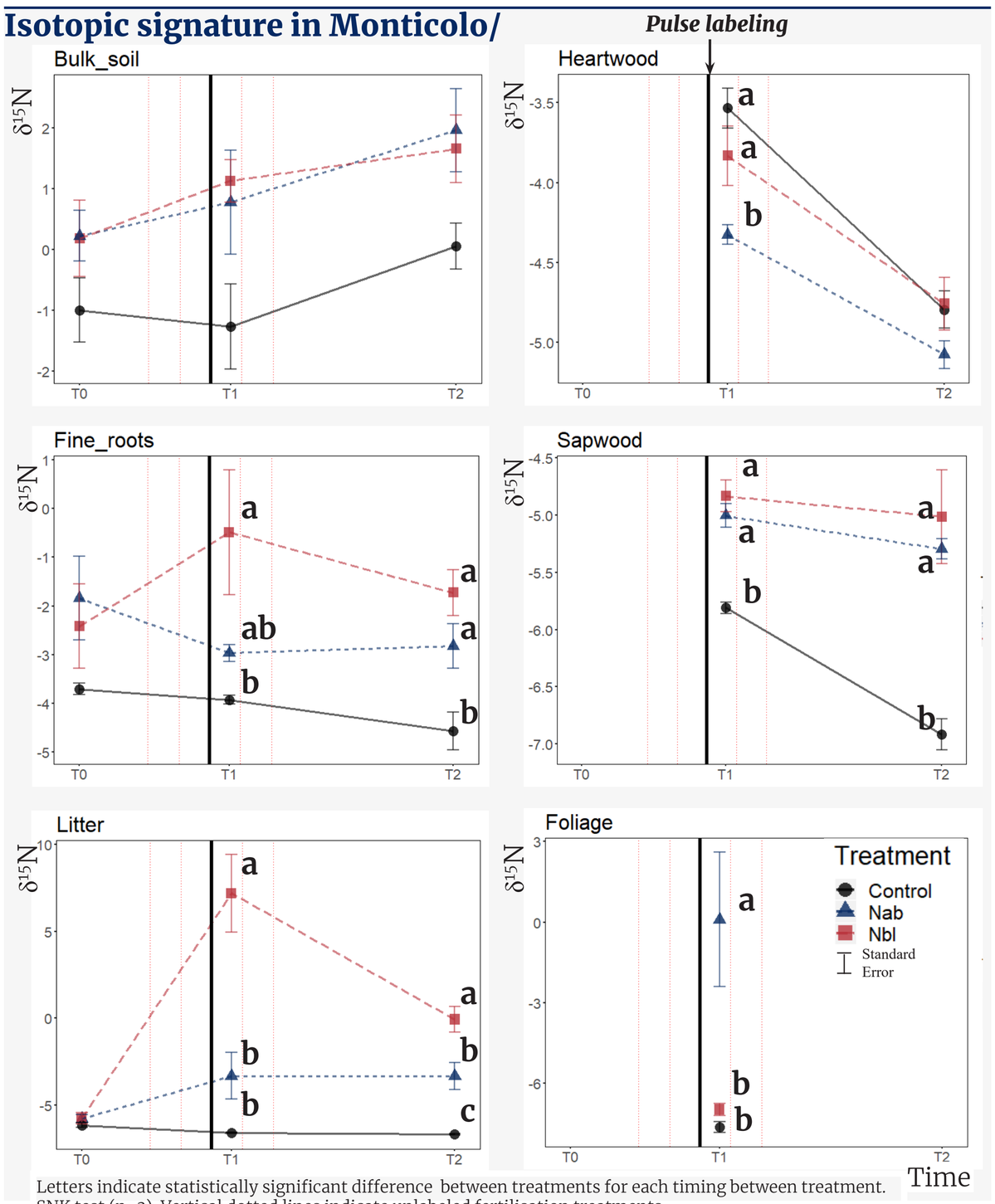
In **Cembra** fertilization started in summer 2017. No labelling was added so far.

Sites characterization/

Caracteristic	Experimental site	
	Monticolo	***Cembra***
Latitude	46°25'36''N	46°12'9''N
Longitude	11°17'53''E	11°12'35''E
Forest type	Oak stand *(Quercus petraea)*	Beech stand *(Fagus sylvatica)*
Annual rainfall (mm)	824	1200
Annual temperature (°C)	11.4*	10
Altitude (m)	530*	1200
Exposure	South	North-West
*Bulk deposition (kg*ha^{-1} *y^{-1})*	6.65	n.a.
Soil type classification (WRB)	acid brown soil*	brown earth
Lithology	porphyritic quartz*	porphyry (Rhyolite)
Forest age (years)	67	40 - 55
Stand density (tree ha-1)	1266	1000
Mean DBH (cm)	16	20
Mean tree height (m)	13	15

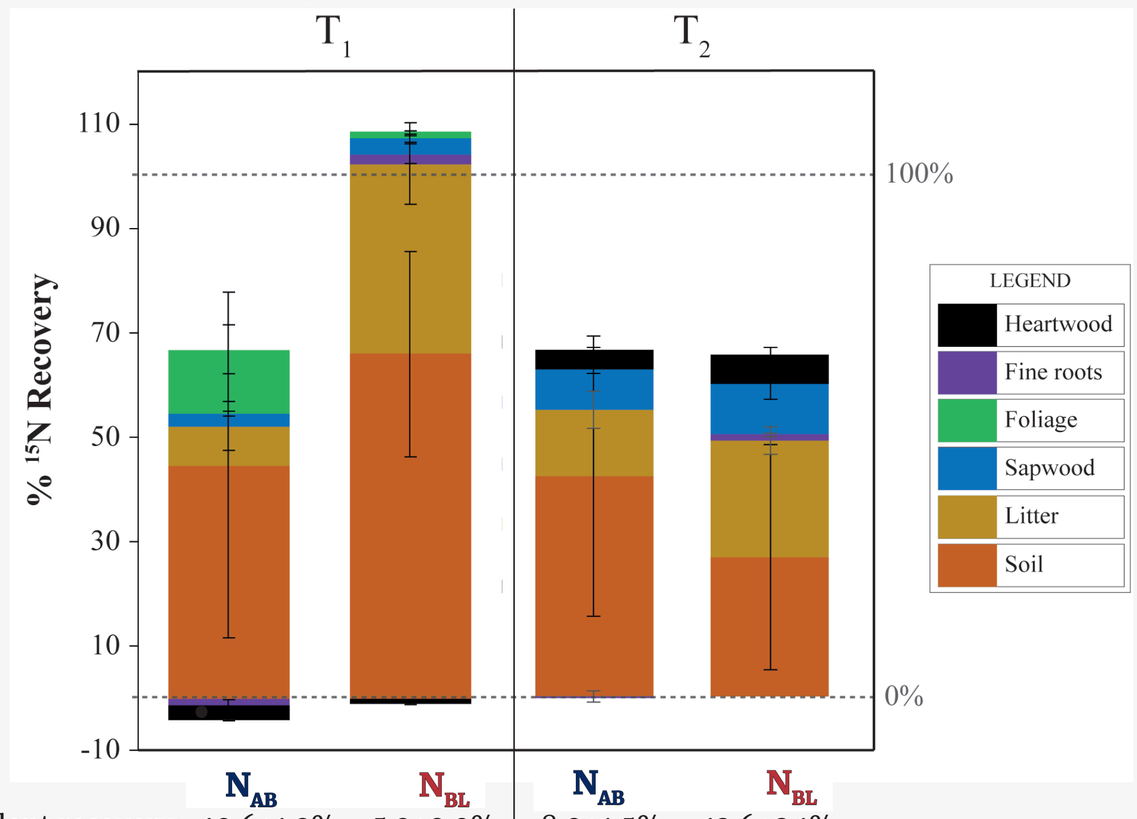
*Marchetti et Al. (2002)

Isotopic signature in Monticolo/



Letters indicate statistically significant difference between treatments for each timing between treatment. SNK test (n=3). Vertical dotted lines indicate unlabeled fertilisation treatments.

Fertilizer recovery in Monticolo/



	N_{AB}	N_{BL}	N_{AB}	N_{BL}
Plant recovery:	10.6±1.2%	5.2±2.0%	8.9±1.5%	13.6±3.1%
Total recovery:	63±34%	108±21%	64 ± 27%	63 ± 22%
Missing N:	37%	0%	36%	37%

Preliminary results/

The fate of the applied N was different according to the fertilisation approach. In fact, at T1 plant N recovery was 10.6% in $\mathbf{N_{AB}}$ treatment, almost the double than in $\mathbf{N_{BL}}$ (vs. 5.2%). However at T2 plant N recovery was higher in the $\mathbf{N_{BL}}$, possibly due to loss of foliage (becoming litter) in the $\mathbf{N_{AB}}$, that accounted for most of the plant recovery at T1. The soils and the litter on the forest floor were the most important sink for N in both treatments.

References/

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