Canopy nitrogen fertilization of two temperate mountain forests:
an isotopic approach to quantify the fate of atmospheric nitrogen depositions

Luca Da Ros[1,2], Maurizio Ventura[1], Mirco Rodeghiero[2,3], Damiano Gianelle[2], Giustino Tonon[1]

[1]Libera Università di Bolzano/Bozen, Bolzano, Italy
[2]Fondazione Edmund Mach, San Michele all'Adige, Italy
[3]Università di Trento, C3A, San Michele all'Adige, Italy

linkedin.com/in/luca-daros

luca.daros@natec.unibz.it

Introduction /

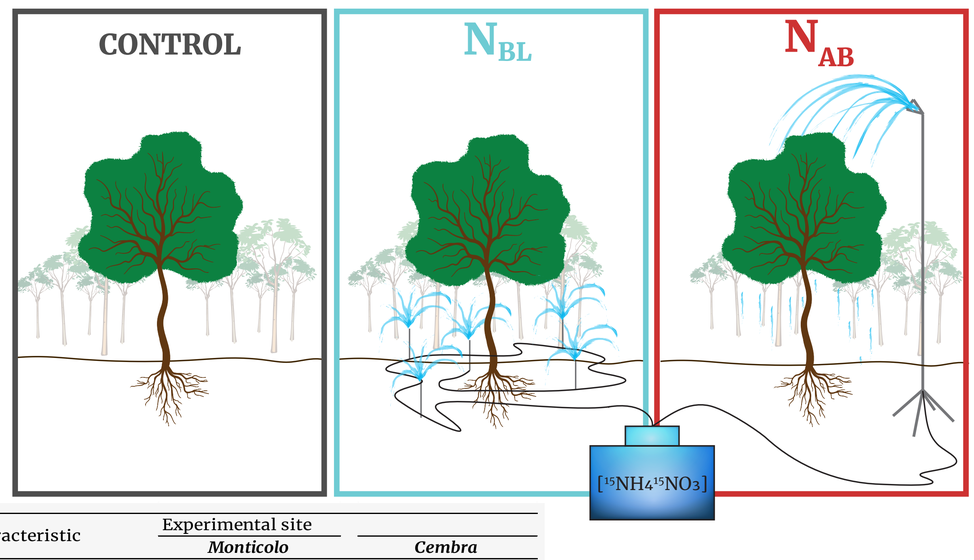
Humans have more than doubled the amount of reactive nitrogen (Nr) added to the biosphere through atmospheric deposition. Yet, most of what is known about its accumulation and ecological effects on temperate forest ecosystems is derived from studies where simulated high-level of Nr were provided directly to the forest floor (N_{BL}). The present field-scale manipulative experiment is proposed to understand if the **fate of atmospheric Nr deposition** is different, when the fertilizer solution is provided **above the canopy layer** (N_{AB}). This layer could indeed intercept, transform and assimilate Nr molecules.

Hypothesis /

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

Materials & Methods /

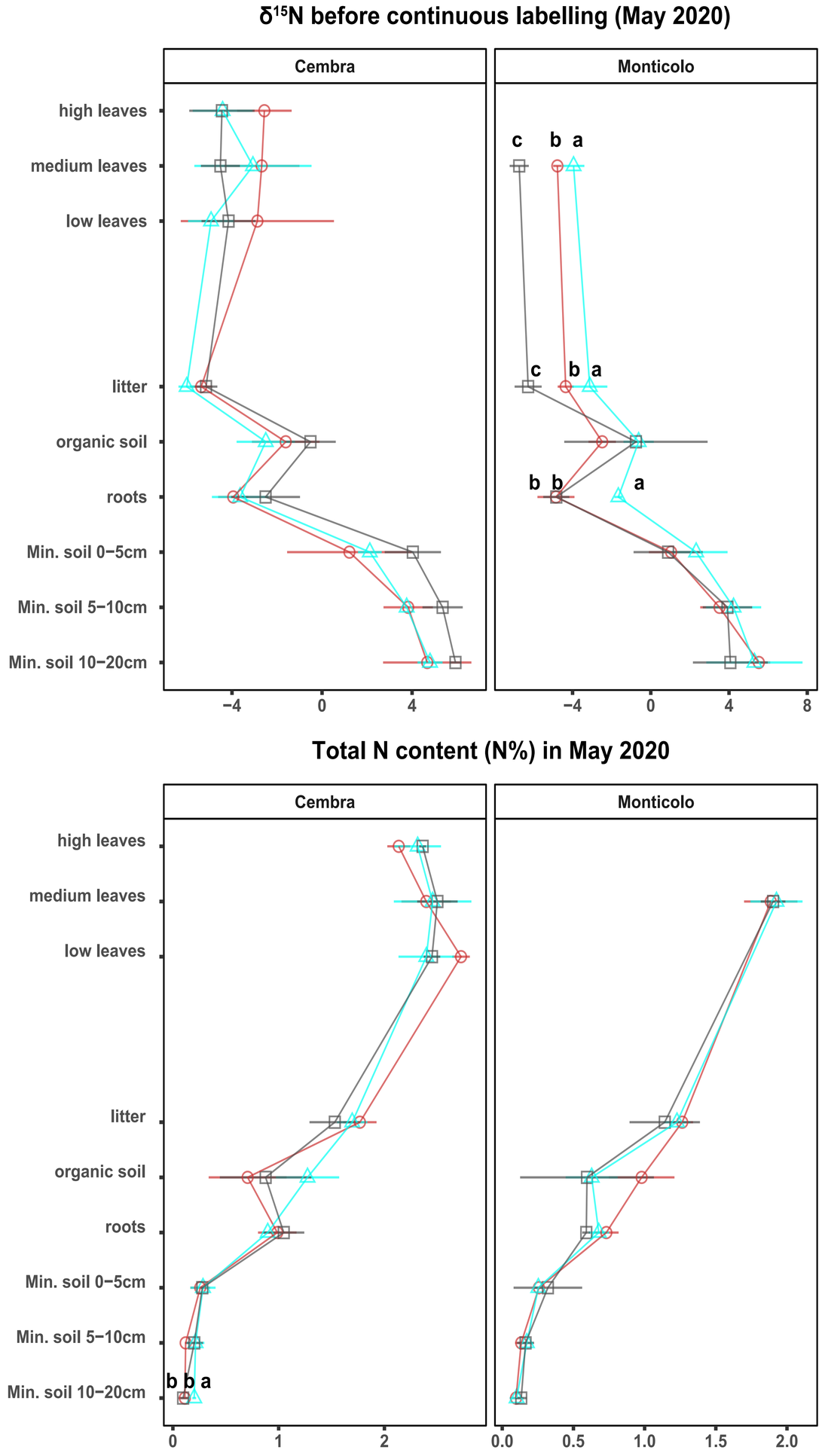
Fertilization treatment consists of **20 kg N ha^{-1} y^{-1}** since spring 2015 in Monticolo and spring 2016 in Cembra. Pulse labelling with $^{15}NH_4{}^{15}NO_3$ ($\delta^{15}N$ = **+893±10 ‰**) was provided in July 2016 in Monticolo.
Continuous labelling with enriched $^{15}NH_4{}^{15}NO_3$ ($\delta^{15}N$ = **+30±3 ‰**) started in both sites in spring 2020.



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

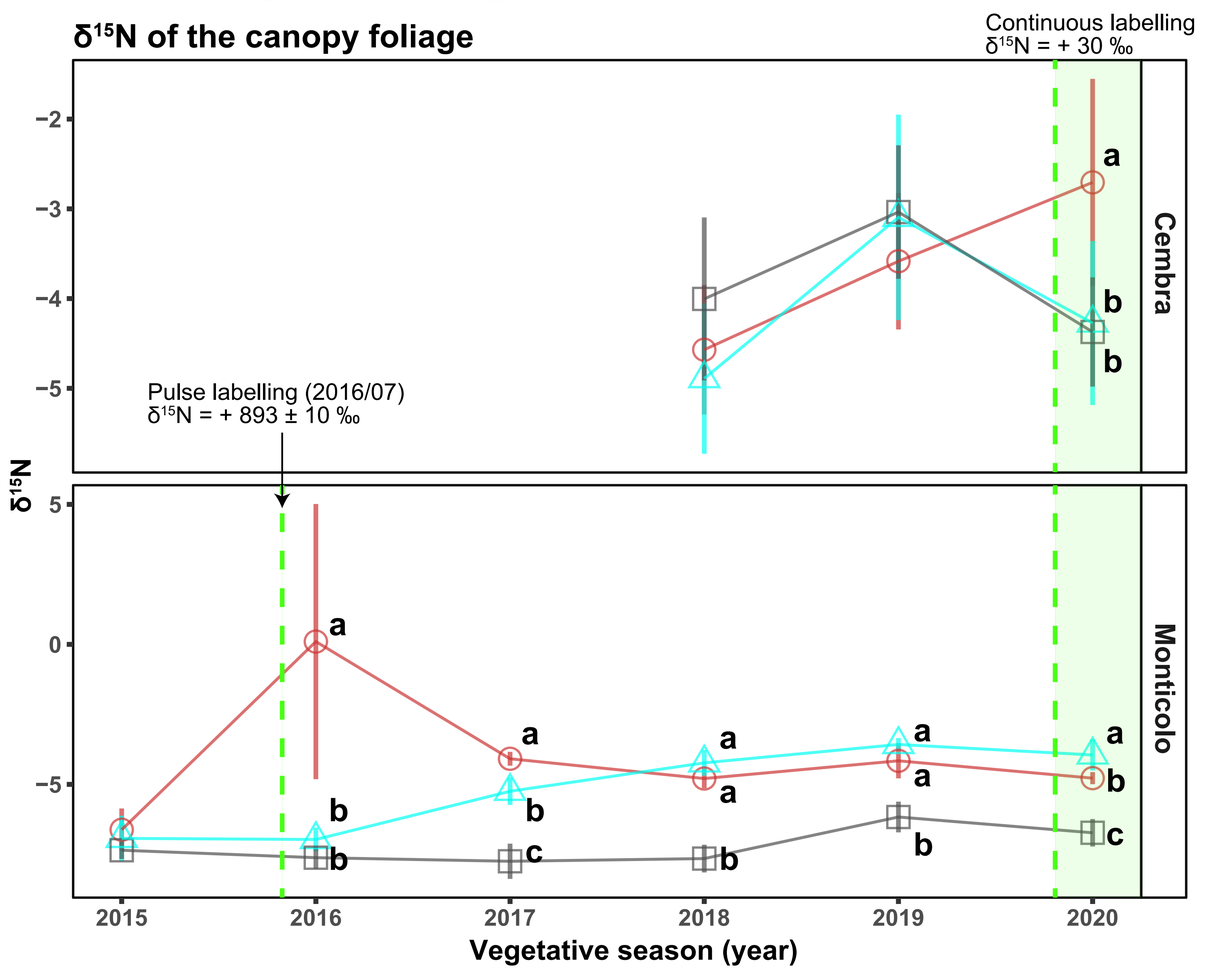
*Marchetti et Al. (2002)

Results / Ecosystem compartments ^{15}N signature and N content



different letters indicates significantly different values, SNK test (n=3)

Results / Ecosystem ^{15}N signature and total N content



Conclusion/

- **Pulse labelling** of July 2016, in Monticolo, is still visible in **foliage, litter and roots**, by spring 2020.
- Continuous labelling in **Cembra** indicates a foliage recovery of **the fertilizer of 24.26±4.66% in the N_{AB}**, and less than 1% in the N_{BL}. However, the fertilizer recovery in the **litterfall** of 2020 was only 11.53±1.28% in the **N_{AB}** and 3.09±0.61% in the **N_{BL}**.
- Final recovery of remaining ecosystem components will be calculated with new samples, recenlty obtained, one year after treatment started.

References/

* Marchetti, F., Tait, D., Ambrosi, P., Minerbi, S., 2003. Atmospheric deposition at four forestry sites in the Alpine region of trentino-South Tyrol, Italy. J. Limnol. 61, 148–157. https://doi.org/10.4081/jlimnol.2002.s1.148