

Forest Nitrogen dynamics and Water-use Efficiency: insights from three european fertilization experiments



Alessandra Teglia¹, Sami Ullah², Carolina Mayoral³, Robert Grzesik², Andy Smith⁴, Dario Ravaioli¹, Federico Magnani¹, Rossella Guerrieri¹

⁽¹⁾University of Bologna, Department of Agricultural and Food Science (Distal), Bologna, Italy
⁽²⁾Birmingham Institute of Forest Research (BIFoR), School of Geography, Earth, and Environmental Sciences, University of Birmingham, Birmingham, United Kingdom
⁽³⁾Birmingham Institute of Forest Research (BIFoR), School of Biosciences, University of Birmingham, Birmingham, United Kingdom
⁽⁴⁾Environment Centre Wales, School of Natural Sciences, Bangor University, United Kingdom

Preliminary results from Quintus

Introduction

Elevated N deposition can affect forest ecosystems differently depending on the N status of the ecosystems. On N-limited sites, N deposition could stimulate growth. However, excess of N could induce N saturation, nutrient imbalances with negative implications on tree physiology. Here, we studied the effect of nutrient limitation on N and C cycle in European Oak and Beech forests. The present work investigates how N and P availability affect foliar N and water-use efficiency (WUE, the

ratio between CO₂ assimilation and stomatal conductance) in an UK mixed oak forest. Finally, the oak tree responses to N fertilization were compared with those of two Italian beech forests, where N fertilization are used to simulate an increase in N deposition.

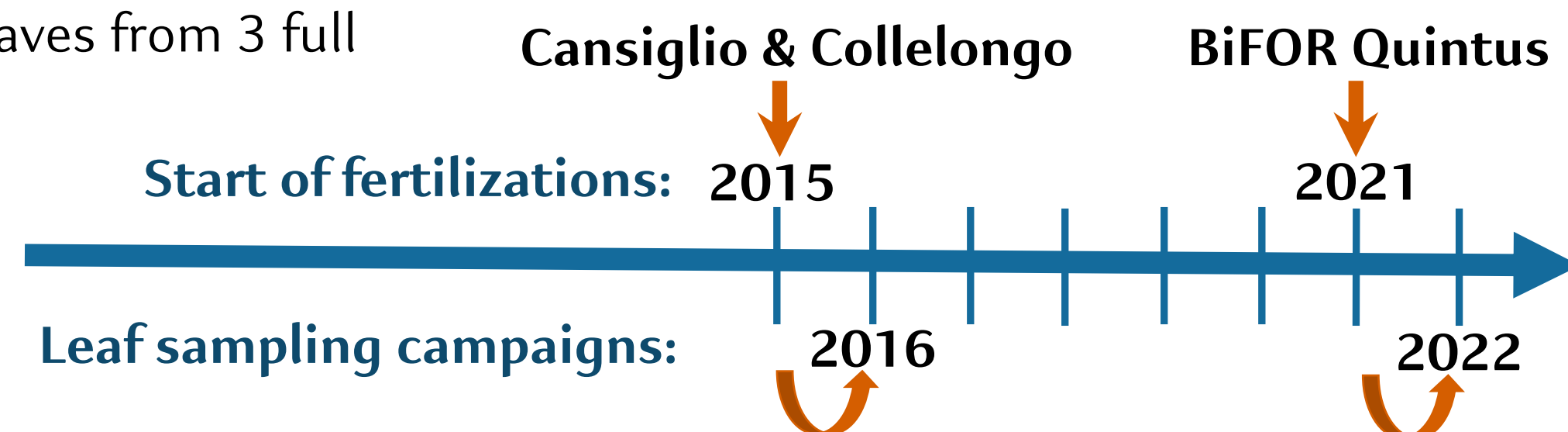


Research questions

- Does nutrient availability increase trees foliar N and WUE?
- Can we detect differences in physiological responses to N deposition in relation to tree species and climatic conditions?

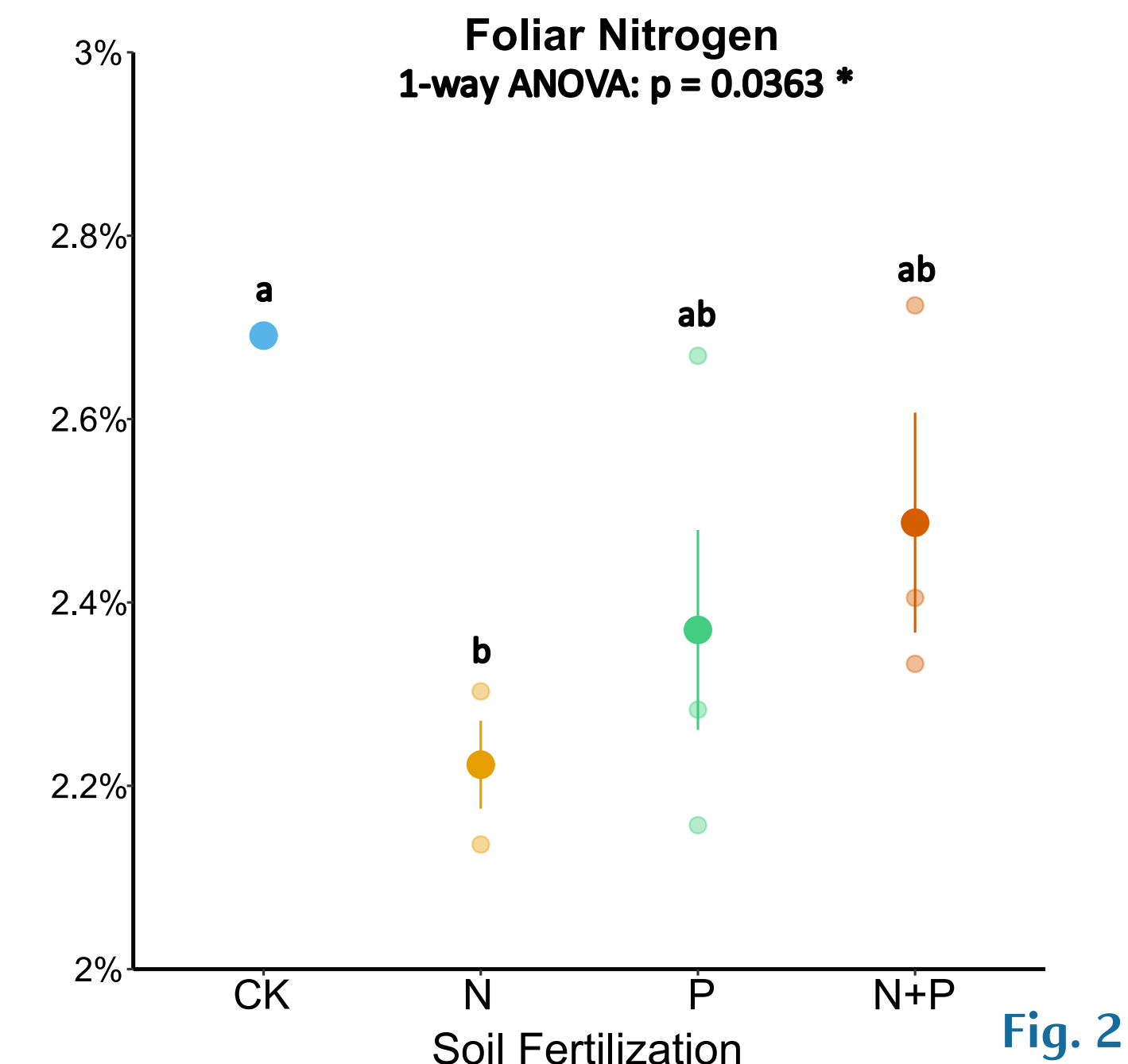
Material and Methods

- Experimental sites are described in Fig. 1 and Tab. 1.
- 1 plant and 3 plants per plot were identified in the BiFOR Quintus and in the Italian sites, respectively.
- We collected 20 leaves from 3 full light branches.



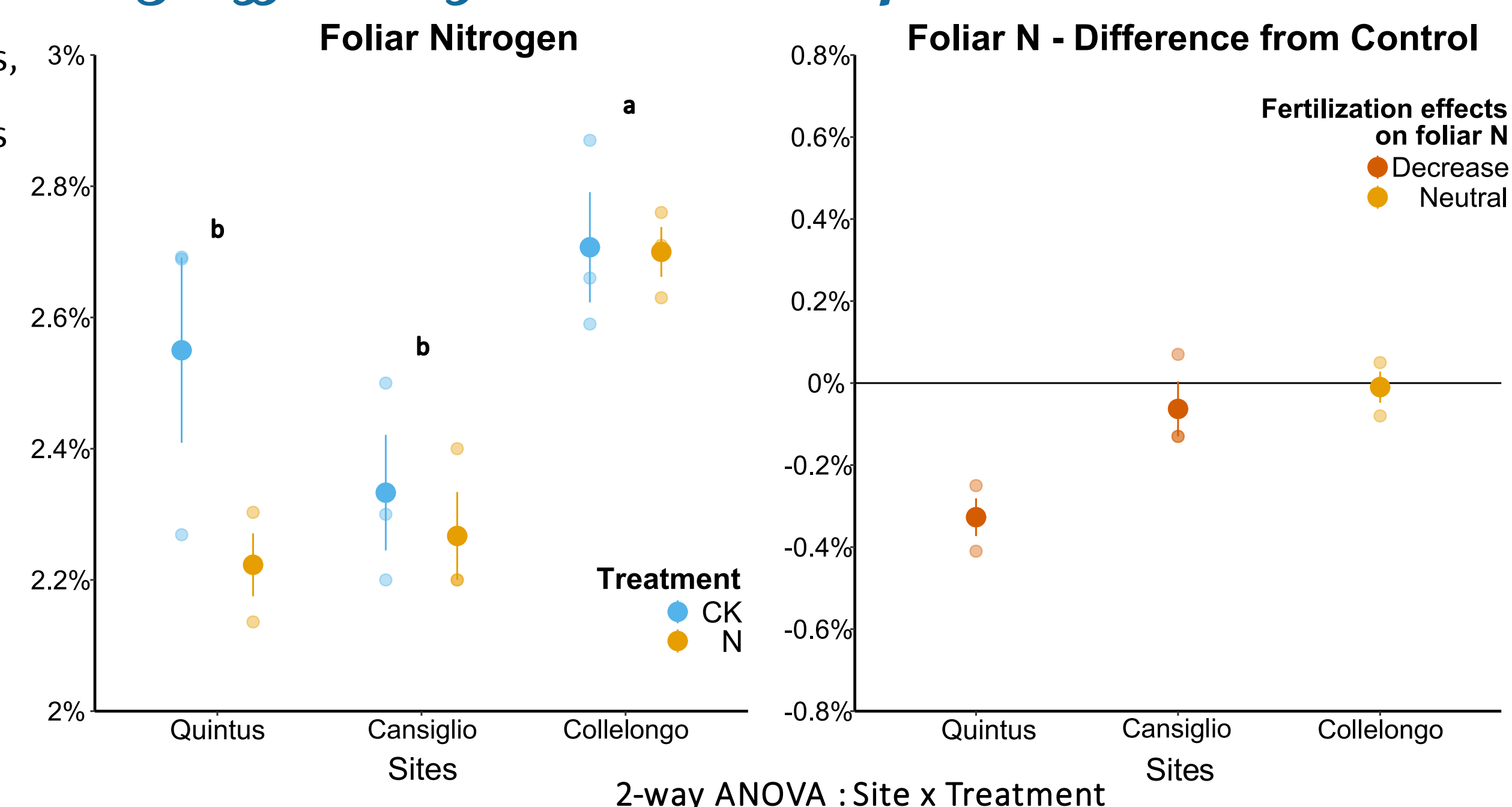
	BiFOR Quintus	Cansiglio & Collelongo
Tree species	<i>Quercus robur</i>	<i>Fagus sylvatica</i>
Compared treatments (3 replicate plots for each treatment)	<ul style="list-style-type: none"> •Untreated control [CK] •N fertilization 50 kg N ha⁻¹ yr⁻¹ [N] •P fertilization 20 kg P ha⁻¹ yr⁻¹ [P] •N+P fertilization 50+20 kg N+P ha⁻¹ yr⁻¹ [N+P] 	<ul style="list-style-type: none"> •Untreated control [CK] •N fertilization 60 kg N ha⁻¹ yr⁻¹ [N]
Measurements	% C, % N, δ ¹³ C and δ ¹⁵ N	% C, % N

- Unexpected negative response in foliar N concentration in N fertilized plots.
- The negative effect of N addition decreased with the combined N+P treatment
- The fertilization did not significantly affect the foliar δ¹⁵N and WUE, likely due to the high variability of the data.
- In the short-term, none of the treatments resulted in a positive response in WUE.



Comparing different fertilization experiments

- Regardless the treatments, foliar N concentration was comparable between the sites with mesic climate condition: Cansiglio and Quintus.
- Beech stands resulted to have a greater homeostasis in foliar N concentration, respect to the Oak stand



Factor site: p 0.0011 ** (different small letters indicate significant difference among sites)
 Factor treatment: p 0.0768 (ns)
 Site x Treatment: (ns)

Take-home message

- The limited responses can be attributed to the short duration of the experiment (1 year after the fertilization started).
- Climate and species can significantly affect the response to N deposition in forests
- Leaf data should be integrated with soil analysis to get a better understanding of the treatment effects on N availability and nutrient imbalances at the investigated sites

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