

Background to Earthwatch research at BIFoR

Earthwatch is an international charity that seeks to empower people to save our planet. We work in partnership with the public, businesses, scientists and educators to address key environmental challenges. Through environmental engagement and hands-on science, we *create knowledge and inspire action*.

- We have been in partnership with BIFoR FACE since 2015, setting up two experiments across the FACE rings to account for changes in carbon flows in response to CO₂.
- A unique aspect of our science is our use of corporate volunteers, who collect data with us as part of their sustainability training.

Objectives

1. How does CO₂ enrichment influence within season tree growth?

Elevated CO₂ has the potential to alter tree growth rates in response to climate through CO₂ fertilisation and changes to tree water use efficiency, which may influence the impact of water stress during periods of drought. The data we collect will be used alongside weather, CO₂ and soil data to create a coherent analysis of the response levels of the trees in relation to elevated CO₂.

We will measure within season changes in tree growth using dendrometer bands. This allows us to:

- Detect CO₂ fertilisation growth response;
- Quantify the impact of altered tree water use efficiency on growth during times of drought and at different times during the growing season;
- Investigate species-specific responses to enhanced CO₂, e.g. do opportunistic species such as hazel to respond faster than oak which has a longer term growth strategy?

This experiment is the first time that such measurements have been taken in a deciduous forest under conditions of elevated CO₂.

2. How does CO₂ enrichment influence leaf litter decomposition rates?

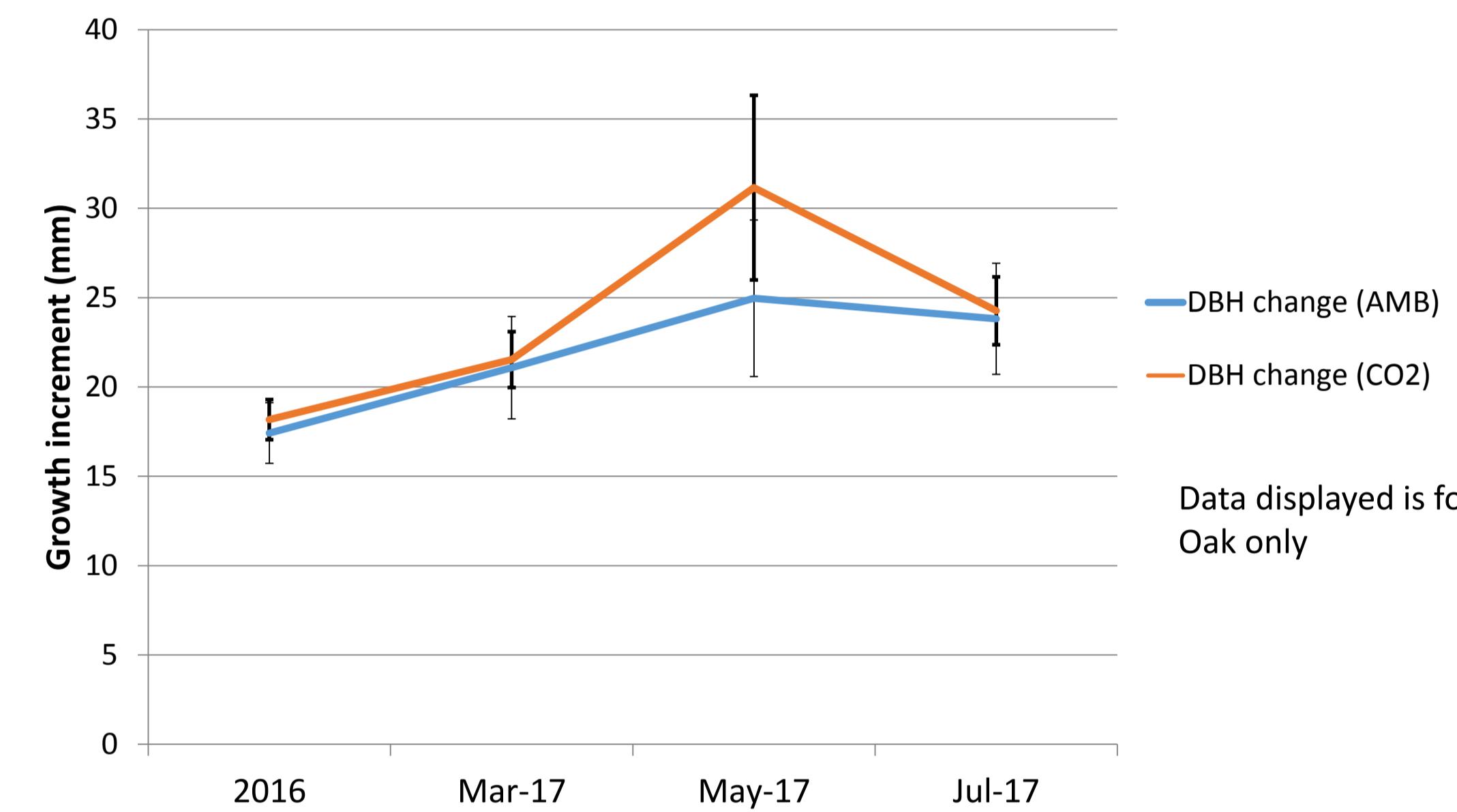
We will investigate how CO₂ enrichment influences the rate of leaf litter decomposition. The majority of tree net primary production is allocated to leaves, and it is anticipated that CO₂ enrichment will alter leaf litter chemistry, with knock-on effects on decomposition rate and thus CO₂ release from the forest. The question will be addressed by measuring decomposition rates of leaf litter, which will be collected from all experimental and control plots, followed by reciprocal exchange of bags of leaf litter.

- Leaf litter will be collected from litter traps within all arrays and control plots in autumn 2016, 2017, 2018;
- Leaf litter will be dried, sorted and weighed;
- Leaf litter will be placed inside over 200 mesh bags (1 mm and 5 mm), and deployed within the FACE arrays to be sacrificially sampled and analysed over the course of each year to determine mass loss over time.

Our work so far

1. How does CO₂ enrichment influence within season tree growth?

Initial data show small differences in the growth rates of oak trees in the +CO₂ and Ambient FACE rings since the start of CO₂ switch on in April.



2. How does CO₂ enrichment influence leaf litter decomposition rates?

- 216 leaf litter bags were created, each with ~5g of leaf litter inside;
- Leaf litter bags were deployed in May 2016 in 4 x 3 grid arrangements, with two grids per array;
- Bags are undergoing sacrificial sampling every 3 months.



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