

Last Leaf Fall

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Helsinki University, the Open University & University of Bristol collaborated with Dr Rick Thomas to trial a cutting-edge photosynthesis sensing spectrometer mounted on a 15kg drone & flown above the tree canopy

When the leaves fall in autumn 2017, large patches of oak woodland at the BIFoR free-air carbon dioxide enrichment (FACE) facility will have experienced a full growing season immersed in an atmosphere with higher concentrations of carbon dioxide (CO₂). Switched on in April this year to coincide with spring flush of leaves, the complex network of pipes, valves, sensors and electronic controls delivered additional CO₂ to elevate the concentration by 150 ppm (parts per million) in the air of the experimental plots, a CO₂ concentration we expect to be the global norm by about 2050. The futuristic [sci-fi forest](#) achieved its performance targets throughout the season. Fitting testament to the expert way this one-off Facility has been tailored to local conditions.

During this first season of extra CO₂, scientific measurements have been intensifying, tracking responses of the whole ecosystem from atmosphere-ecosystem exchanges, tree growth and physiology, understory plants, below ground processes, nutrient cycling, to insect populations. Drones have carried sophisticated sensors above the canopies, complementing fixed installations on the steel towers of the plots, and many physical samples were taken to laboratories

for chemical and molecular analyses. Take a look at the 360° video <https://youtu.be/IZNJcOkjI6g>

Block by block we are building a more complete understanding of how a mature, 'old growth', forest responds to the continuing increase in atmospheric CO₂. Over the past decades mature forests have taken back about 2 to 3 of every 10 CO₂-molecules that human activities had added to the atmosphere, thereby slowing the increase in of CO₂ in the atmosphere and the associated global warming. Unfortunately, there are signs that the capacity of forests to absorb additional CO₂ is about to come to an end as atmospheric CO₂ continues to increase further. Yet, we have very little experimental data for mature forest ecosystems, which makes extrapolations even into the near future rather uncertain. The experiment in BIFoR FACE will fill that vital knowledge gap.

Further improvements to the site infrastructure continue. Each plot is now equipped with walkways, and rope ascenders allow scientists direct and non-destructive access to upper crown foliage. This bespoke access will enable even better coverage of ecosystem processes in the seasons to come.

Funding successes

The European Research Council have awarded Dr Tom Pugh €1.5m to investigate the extent to which forest structure and function are governed by and interact with tree mortality, particularly under environmental change (the TreeMort project).

BIFoR are part of the Natural Environment Research Council ENCOMPASS project, working alongside University of Birmingham colleagues, [Citizen UK](#) and [Earthwatch Institute](#) to build capacity in public engagement with environmental research.

Building on her successful NERC Knowledge Exchange Fellowship in green infrastructure, Dr Emma Ferranti has secured an Engineering and Physical Science Research Council Early Career Fellowship worth £400,000.

BIFoR FACE National Science Community Meeting 2017

Our annual national meeting was well attended once again. More details, including the posters detailing the research currently underway at the BIFoR FACE Facility can be found at

<http://ow.ly/IDPL30gGNk7>





Students and staff from UoB Environmental Health

In a busy six months, we've held tours of the BIFoR FACE Facility for students from the University of Birmingham (UoB) and the University of Birmingham School's A Level cohort. Tours of the Facility can be organised upon [request](#). Over 70 students have registered as Volunteer Research Assistants. We introduced new students to BIFoR during Welcome Week, bringing the forest to the campus using alumni funded virtual reality equipment.



Community Festival, Birmingham

The Royal Geographical Society (RGS) produced a podcast, filmed during our March 2017 workshop for A Level Geography teachers: "What's the role of forests in the carbon cycle." Visit <http://ow.ly/3oqv30fxR90> for more information.



Local woodland open day, Staffordshire

Soil temperature and moisture using active distributed temperature sensing (A-DTS) at BIFoR FACE

In May 2017, [Silixa Ltd](#), in collaboration with University of Birmingham and the British Geological Survey installed a fully automated fibre optics A-DTS system to monitor soil moisture and soil temperature at high resolution. The system measured without supervision along 1,500m of fibre optics cable for 12 weeks. Ultimately, a fully intelligent A-DTS system, will adapt the frequency of the measurements based on natural triggers eg changes in air relative to humidity or in soil temperature. See more on the NERC funded DiPHS project by visiting <https://www.bgs.ac.uk/DiHPS>

Research highlight: Storm events and water quality

Blaen et al (2017), High-frequency monitoring of catchment nutrient exports reveals highly variable storm event responses and dynamic source zone activation, *Journal of Geophysical Research*, [DOI: 10.1002/2017JG003904](#)

We know that storm events can cause rapid increases in river flow, but we do not know their impact on water quality. We used high-frequency sensors to monitor nitrate and dissolved organic carbon during 29 storm events in the Wood Brook stream at Mill Haft. Storm events were important periods of nutrient export, particularly when intense rain fell on wet ground. Our results are important to understand the implications of climate change for river water quality.



Meet the new BIFoR PhD students

Aileen Baird



"I'll be investigating the effects that enriched CO₂ has on fungi and fungal-like pathogens. I feel that environmental microbiology is a very new, exciting area of research to be in at the moment, with lots of opportunities to discover new things."

Ed Eaton



"My PhD will focus on the emission of CO₂ from tree trunks: how much is being emitted – and how this varies within and between trees. My PhD research will give me the opportunity to really examine one of the (often poorly-understood) components of forest carbon balances."

Daniel Haynes



"I will focus on the production of volatile organic compounds (VOCs) and spores, pollen, bacteria etc. I'm excited to have the chance to study a part of what forests may experience in the future, with important implications for future human health, climate and species distribution."

Stay in touch

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