



UNIVERSITY OF
BIRMINGHAM

PhD position: Investigating the Impact of Volatile Organic Compounds Released by Plants in Response to Biotic and Abiotic Stressors under ambient and elevated CO₂ conditions (VOC-Plant-Stress-CO₂).

University of Birmingham | The Forest Edge Doctoral Scholarship programme | Birmingham | United Kingdom

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Application deadline: Wednesday, February 06, 2019

Start Date: September 2019

Apply here: <https://sits.bham.ac.uk/lpages/LES067.htm>

Competition Funded PhD Project (European/UK Students Only)

Project Description

There are currently about 32 million trees alongside Britain's trunk roads and motorways; this January plans were announced to plant 50 million trees to create a "Northern Forest" over the next 25 years along a 120-mile stretch of the M62 backed by £6 million from the Government; the attached image depicts the M27 that has been running for the last 40 years along the edge of the New Forest. Such Forest Edges are a dynamic outdoor atmospheric chemistry laboratory where plant-emitted Volatile Organic Compounds (VOCs) meet a cocktail of man-made pollutants, in particular diesel exhaust, nitrogen oxides and ozone.

It is known that anthropogenic abiotic stress factors, such as pollutants (ozone, NO₂ & diesel exhaust) as well as elevated CO₂, and biotic stress factors, such as herbivory by insects, can alter the VOC emissions from plants. Less is known about how abiotic stresses affect the plants' ability to function and signal during biotic stress events (e.g. herbivore attack) and how the herbivorous insects and their natural enemies will respond to these potentially altered VOCs. We propose to study the time evolution of the plants' VOC profiles when growing in environments affected by (i) abiotic stress (elevated ozone, NO₂ & diesel exhaust); (ii) biotic stress (herbivore attack) and (iii) combined biotic & abiotic stress. These plants will be grown both at current & elevated CO₂. VOC profiles will be analysed using kinetic models (and tailored kinetic measurements where literature data are lacking) to distinguish between initially emitted VOCs, reaction products and secondary effects (e.g. emissions from soils or other external factors). The confirmed stress-induced VOCs will then be used in gas-

chromatography-electroantennography (GC-EAG) experiments as well as behavioural experiments on the herbivores to establish the ability of the herbivores and their natural enemies to detect and respond to stress-induced VOCs. The two contrasting CO₂ treatments (normal & elevated) in the laboratory-based studies will be compared to the VOCs measured at the BiFoR FACE facility; similarities and differences will be analysed. Differences between the VOC-profile time evolutions under varying stress scenarios will be contrasted and their impact on forest systems will be estimated.

We will harvest new greenhouse facilities that are being built at Birmingham for growing plants in carefully controlled stress environments and directly link these studies to the unique BiFoR FACE facility for elevated CO₂; our current experiments in the NERC-funded “DOMINO” project (PI: Dr Girling; lead of Chemistry workpackage: Dr Pfrang) will complement BiFoR’s FACE by harvesting findings from the Free-Air-Diesel-Ozone-Enrichment (FADOE) field experiment; VOC measurements will employ CP’s expertise and equipment available within GEES; GC-EAG experiments build on ongoing “DOMINO” work; growing plants in a controlled environment and exposure to pollutants builds on lessons-learned from a current RHS/EPSRC-funded studentship.

Funding Notes

Full payment of tuition fees at Research Councils UK fee level for year of entry (£4,270 in 2018/19), to be paid by the University;

An annual maintenance grant at current UK Research Councils rates (national minimum doctoral stipend for 2018/19 is £14,764), to be paid in monthly instalments to the Leverhulme Trust Doctoral Scholar by the University.

All studentships will come with a minimum of £3,000 Research Training Support Grant.

References

Pinto, D.M., Blande, J.D., Souza, S.R. et al. *J Chem Ecol* (2010) 36: 22.

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Gubb, C., Blanus, T., Griffiths, A. & Pfrang, C. *Air Qual Atmos Health* (2018) 11: 1191.

<https://doi.org/10.1007/s11869-018-0618-9>

Girling, R.D., Lusebrink, I. Farthing, E. et al. *Sci Rep* (2013) 3: 2779.

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