Using leaf litter to investigate the effects of elevated CO_2 on insect herbivory

Tien. T. T. Nguyen, Aradhana. J. Roberts, Daniel. B. Metcalfe and Scott A. L. Hayward
University of Birmingham, Edgbaston, B15 2TT

1. Background: Forests are a key economic and ecological resource worldwide, as well as a major carbon sink[1]. Understanding the response of these habitats to climate change is therefore of great importance. A key impact of elevated atmospheric CO_2 (eCO_2) will be to reduce the nutritional value of plants because of increased carbon, relative to nitrogen, content. Leaf litter can be used as a non destructive sampling resource to determine impacts on insect herbivory and broader implications on ecosystem processes such as nutrient cycling.

2. Objectives: The Birmingham Institute of Forest Research (BIFoR) Free Air CO_2 Enrichment (FACE) experiment aims to investigate the effects of climate change in a mature, unmanaged, temperate woodland located in Staffordshire, UK.

This project aims to:

- Use leaf litter samples to compare the levels of insect herbivory in Ghost vs Ambient vs eCO_2 conditions (Figure 1) between the four main tree species.

3. Methods:

1) Site Selection – BIFoR FACE eCO2 arrays (Figure 2)
2) Litter trap instalment 1m x 1m area (Figure 3): ghost (N=4), ambient (N=6), eCO_2 (N=7) = 17 total.
3) Weekly-Monthly collections (according to leaf fall prominence)
4) Leaf litter sorted into the four main species: Oak, Hazel, Hawthorne, and Sycamore
5) Leaf litter masses are weighed by species
6) A subset of 10 representative leaves per species is scanned
7) Visual quantification of herbivory through 6 damage classes[2] (Figure 3)

4. Future plans:

- Image analysis of leaves to quantify herbivory and compare across treatments
- Determine C:N content of leaves
- Isotopic analysis
- Leaf decomposition experiments

Figure 2:Leaf Litter trap

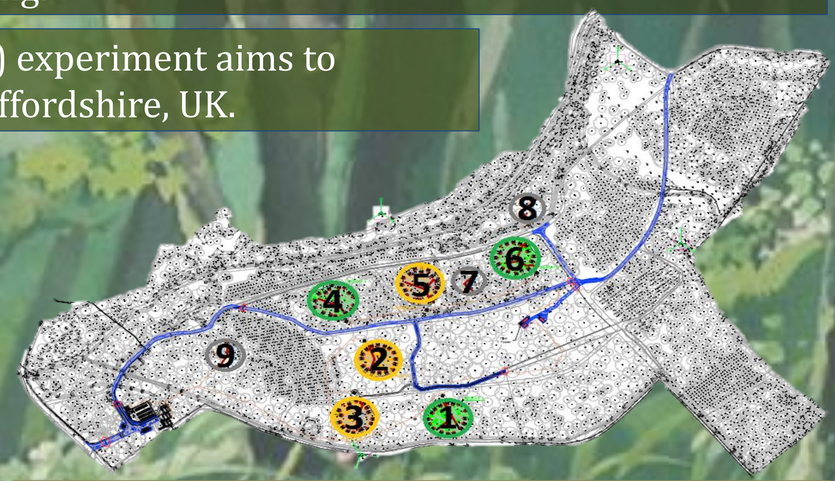

Figure 1: Map of the BIFOR FACE site the circles representing each array: 7/8/9 (Grey) = ghost arrays (no infrastructure);2/3/5 (yellow) = ambient; and 1/4/6 = elevated CO2 .

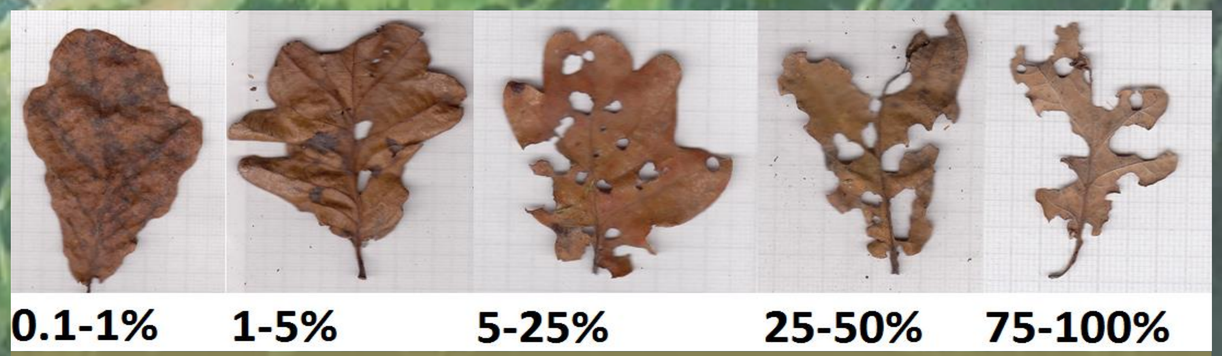

Figure 3: Six damage classes caused by herbivory of oak leaves[2]

References:
[1] Melillo et al. (1993) **Nature**, 363: 234-240.
[2] Kozlov, M.V. et al (2014) **PeerJ**, 2, p.e709.
[3] Karberg, N.J., et al (2008) **Springer, Dordrecht,** 2008. 103-111.

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