

INTRODUCTION

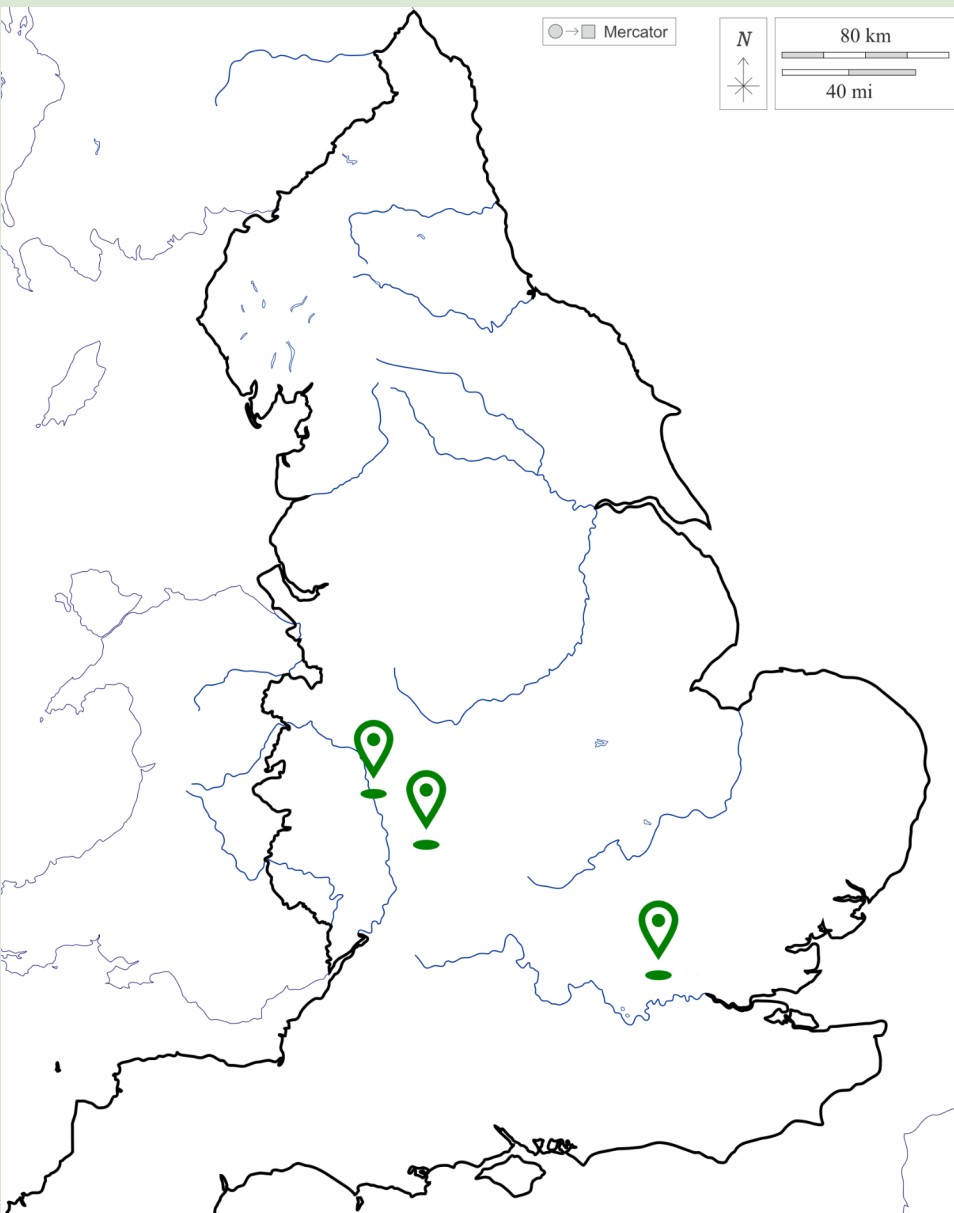
Acute Oak Decline is a complex decline disease caused by multiple biotic and abiotic factors [1]. The main symptoms are weeping cankers, black exudate from cracks between bark plates, larval galleries, and exit holes of the buprestid beetle, *Agrilus biguttatus*, as well as decline in crown condition [2].

Horse chestnut trees across Europe have experienced the emergence of *Pseudomonas syringae* pv *aesculi*, a pathogen that causes the bleeding canker disease [3]. The symptoms include bleeding cankers with orange-red, yellow-brown, or black gum exudate, smaller paler leaves, thinning of the canopy, twig, and branch dieback [4]



1. Denman, S., et al., Microbiome and infectivity studies reveal complex polyspecies tree disease in Acute Oak Decline. *ISME J*, 2018. 12(2): p. 386-399.
2. Denman, S., et al., A description of the symptoms of Acute Oak Decline in Britain and a comparative review on causes of similar disorders on oak in Europe. *Forestry*, 2014. 87(4): p. 535-551.
3. O'Brien, H.E., S. Thakur, and D.S. Guttman, Evolution of Plant Pathogenesis in *Pseudomonas syringae*: A Genomics Perspective. *Annual Review of Phytopathology*, 2011. 49(1): p. 269-289.
4. Percival, G.C. and J.M. Banks, Evaluation of plant defense activators for the potential control of *Pseudomonas syringae* pv *aesculi*. *Arboricultural Journal*, 2014. 36(2): p. 76-88.

STUDY DESIGN AND METHODS



Wyre Forest, West Midlands (Oak)
Heart of England Forest, West Midlands (Oak)
London Borough of Barnet (Horse Chestnut)

24 Oak trees and 20 Horse Chestnut trees
Symptomatic and non-symptomatic

Soil treatment:
Organic mulch and phosphate drench

Soil sample collection:
Microbiome: 16s and ITS sequencing
Soil moisture
Bulk density
pH
C and N
P, K, Fe

Leaf sample collection:
Microbiome: 16s and ITS sequencing
Metabolome

Methane flux measurements

Initial impact (defoliation)
Negative feedback on tree nutrient and water uptake
Threshold (stem damage)
Bacterial pathogens induce AOD symptoms

Number and size of AOD lesions
Photosynthetic activity
Leaf microbiome: 16s and ITS sequencing
Leaf metabolome
Soil microbiome
Root metabolome
Xylem anatomy- end of experiment



AIMS AND OBJECTIVES

Identify the role of soil, both its biotic and abiotic components, in tree health and disease development

Analyse the effects of soil treatment (mulching and phosphates) on diseased and healthy trees

Monitor a wide range of tree and soil parameters to understand the nature of the interactions of these factors and the complexity of the two studied diseases

Monitor how tree health status affects soil functions, focusing on tree-mediated methane emissions

Define better management strategies to improve host tree resistance and health

