

# EPIDEMIOLOGY OF ACUTE OAK DECLINE IN ENGLAND

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Oak has long been affected by a chronic decline in which tree vigour is being reduced by many interacting causes. The decline has typically been observed as a gradual process occurring over decades. In recent years a rapid form of decline has been observed in southern and central England, affecting both native species *Quercus petraea* and *Q. robur*. This syndrome has been termed Acute Oak Decline (AOD) and in all investigations thus far has involved a key bacterial component. Typical symptoms include sticky dark exudates (“bleeding cankers”) from lesions on the tree trunk often (>90%) associated with larval galleries in the inner bark and distinctive exit holes of the beetle *Agrilus biguttatus*. Whether a causal relationship is implied by this association is currently under investigation. A four-year study on the spatial and temporal dynamics of AOD and occurrence of *A. biguttatus* at eight geographically separated sites in England was completed in 2013. The main aims of the study included (1) to examine the correlation of stem symptoms with tree health and mortality, (2) to examine the within-site spread of AOD, and (3) to assess possible links between stem bleeds and beetle exit holes. At each site a complete mapping was made in which the status of all oak trees (115-260 trees per site) was assessed in terms of: (i) presence and absence of AOD symptoms (stem bleed); (ii) presence and absence of *A. biguttatus* exit holes; (iii) co-occurrence (bleeds and exit holes); and (iv) overall tree condition, including mortality. A modified version of the Ripley’s k-function was used to characterise the dynamic within-year and between-year spatial patterns of trees with AOD symptoms at each site. In addition, the spatial association of AOD symptoms with *A. biguttatus* exit holes was analysed. The spatial and temporal dynamics of AOD varied across the sites, with a range of epidemic stages from establishment, through to exponential growth, and to the late plateau stage occurring at different sites. Where exponential growth of the epidemic was in progress the spread of the disorder from tree to tree was documented adding support to the idea of a causal role for biotic agents.

**Keywords:** Acute Oak Decline; *Agrilus biguttatus*, epidemiology, spatial modeling