

Climate change and diseases of tree foliage

Will foliar diseases become more damaging to our trees?

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Introduction

Foliar pathogens infect the leaves or needles of trees. Their spores have the potential to disperse long distances by wind and rain. Spore release and infection of hosts is linked to temperature and rainfall, suggesting foliar pathogens are likely to benefit from the milder winters and warmer and wetter springs predicted for the UK as the climate changes.

Climate change may cause an increase in the incidence and severity of foliar diseases and some pathogens might expand their host range. This can reduce tree growth and may lead to tree death which will reduce the benefits that trees provide, including their key role in climate-change mitigation. Climate change may also create more favourable conditions for the survival, establishment and spread of new pathogens if they enter the country. Although it can be hard to predict which diseases will become problematic as climate changes, several are already occurring more frequently and impacting a number of tree species.

Many factors improve tree health and disease resilience including careful species selection for the site, well-planned planting operations, and sourcing healthy trees from

nurseries with good biosecurity policies. Invasive plant pathogens can be spread in infested planting material and this risk can be mitigated by ensuring good biosecurity practice throughout plant-supply chains.

The six main foliar pathogens already causing significant damage to conifers and broadleaved tree species in the UK are described below along with the likely impact of climate change on their spread and severity.

Foliar fungal pathogens of conifer species

Swiss needle cast (SNC) – *Nothophaeocryptopus gaeumannii*

- SNC affects Douglas fir. The disease attacks new foliage, causing chlorotic/brown needles, decreased needle retention and sparse crowns.
- SNC first appeared in the North and West of the UK in 1928 but the disease has now spread to the South-west of England. In the US, epidemics of SNC have been linked to increased winter temperatures and spring rainfall caused by climate change.
- SNC can severely affect tree health and growth; in its native range in Oregon, USA, SNC has reduced growth by 20 – 55% in epidemic areas.

Dothistroma needle blight (DNB) – *Dothistroma septosporum* and *Dothistroma pini*

- DNB causes needle death and tree mortality and has already severely impacted pine species

throughout the UK. Premature defoliation can occur year-on-year, gradually weakening trees and significantly reducing growth.

- At the moment, only *D. septosporum* is present in the UK, found in three genetically distinct populations. The three populations grow at different rates in response to temperature, raising concerns that interbreeding could increase DNB severity and range.
- *D. pini* could spread to the UK from Europe and, if so, would exacerbate DNB impacts.

Diplodia sapinea (formerly *Sphaeropsis sapinea*)

- *D. sapinea* exists often without causing symptoms on pine. Severe drought stress weakens the trees and enables the disease to flourish and cause damage that includes shoot blight, top dieback and cankers on the stem and branches.
- Damage is most severe in older or weakened trees.
- In Southern Europe drought incidence and average temperatures have increased in recent years and *D. sapinea* has become more damaging to many pine species. Similar impacts are expected in the UK in areas which experience reduced rainfall under climate change.

Foliar fungal pathogens of broadleaved species

Marssonina – several species

- *Marssonina* species cause leaf spots and shoot blights and are particularly common on poplar, birch and willow.
- *Marssonina betulae* also causes branch and stem cankers on young silver birch resulting in crown dieback.
- An increase in mild, wet seasons will favour spore production, enabling the fungi to infect new hosts and probably cause more secondary infections. This will result in premature defoliation, weakening of the tree and mortality at epidemic disease levels.

Powdery mildew – *Erysiphe* spp.

- Several species cause powdery mildew throughout Europe but in the UK *Erysiphe alphitoides* is of most concern at present.
- The fungus causes leaf and shoot blight on native oak species and *Quercus robur* is particularly susceptible.

- With milder winters predicted for the UK, *Erysiphe* infections will likely begin earlier in the year and outbreaks will be more severe, so it will be able to infect later summer foliage growth.
- Successive years of infection will cause decline, hamper growth and lead to mortality of young saplings.

Venturia – several species

- *Venturia* causes blackening and death of leaves and shoots in poplar and willow, distorting growth.
- The disease can be destructive; an outbreak in Manchester on native black poplar killed trees within five years of infection.
- More reports of this disorder appear after particularly wet springs.

Major future threats

- ‘The most dangerous plant pathogen worldwide’ as described by the European Commission is currently the bacteria *Xylella fastidiosa*. It can infect over 500 plant species resulting in leaf scorch, wilt and increased mortality. It is transmitted between plants by sap-feeding insects.
- This pathogen is not yet present in the UK but is now established in Italy, Spain and France.
- Models predict climate change will exacerbate the spread of *X. fastidiosa* and enable a northward movement of the subspecies *multiplex* by 2070 and cause more severe disease in Italy, Corsica and Sardinia.
- Stronger controls over plant imports have recently been introduced to reduce the risk of movement into the UK.

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