

Climate change and bark beetles

How the changing environment will impact bark-boring insects

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Climate change projections indicate more frequent extreme weather events, such as storms, heatwaves, droughts, and floods. One of the likely consequences of this will be an abundance of stressed trees with weakened defences against pests, creating favourable conditions for some species of bark beetle.

General impacts of climate change on bark beetles

Bark beetles live and breed under the bark of broad-leaved and coniferous trees. Most species utilise dead or dying trees and play an important role in the recycling of dead plant material in our forests. Only a small number of species colonise living trees, where their activities can damage the critical conducting tissue for transporting water, sugars, and nutrients. In a healthy and balanced forest system, only very few trees are normally killed by bark beetle attack. So, under what circumstances do certain species of bark-boring insects become 'forest pests'?

Drought stress is one of the main factors leaving trees vulnerable to bark beetle attacks. Conifers suffering from drought have reduced resin flow which assists colonisation of apparently healthy trees by species referred to as 'primary pests', for example, *Dendroctonus micans*, the great spruce bark beetle. To colonise a new host, the adult beetle must overcome their defence mechanisms, so success is much more likely when the tree already has reduced resistance to attack.

Other beetles that profit from the impact of extreme weather events are species of the genus *Ips*. These

are 'secondary pests', as they normally colonise dead or dying trees, recently felled trees, or logs. However, when present in high numbers, *Ips* beetles will also attack, and potentially kill, healthy trees. Populations can increase rapidly when large amounts of suitable breeding material become available, such as many windblown trees after a storm. A simultaneous drought can further impair a tree's resistance to potential pests and increase the chance of an outbreak.

Rising temperatures might also amplify the risk posed by bark beetles by impacting their reproduction, which is temperature dependent. Some species of bark beetle also have an adjustable life cycle. *Ips* species generally produce offspring once per year in cold climates but have more generations in milder conditions. Warmer summers might lead to a shift from one to multiple generations per year in some regions of Europe. Unlike *Ips*, *D. micans* produces offspring all year round but has a comparatively slow development. Higher temperatures could accelerate this process and promote larger populations.



Dendroctonus micans is the largest bark beetle species known in the UK.

Species of concern for our forests and timber industry

Ips typographus Larger eight-toothed spruce bark beetle

Distribution: not established in the UK.

Main host tree: spruce (*Picea*).

Ips cembrae Large larch bark beetle

Distribution: most of the UK. Absent from Ireland, the Isle of Man, and north-west Scotland.

Main host tree: larch (*Larix*).

Dendroctonus micans Great spruce bark beetle

Distribution: Wales, England, and south and central Scotland. Absent from Ireland, the Isle of Man, and northern Scotland.

Main host tree: spruce (*Picea*).

Non-native bark beetles in the UK

Ips typographus has killed millions of Norway spruce trees in continental Europe during mass outbreaks initiated after severe climatic events. This species is not established in the UK but has a wide geographic range in its native mainland Europe and Asia and is capable of breeding in the British climate. During annual surveying for invasive bark beetles, a small population was detected in south-east England in 2018 and has since been successfully eradicated at this site. Recent research shows that wind-driven dispersal over the Channel is likely to be the origin of this population, with regular cross-Channel dispersal events occurring from huge populations on mainland Europe. Extensive surveillance has revealed further outbreaks in the south-east of England and East Anglia, which are under robust eradication action. Scientists are monitoring the situation vigilantly to enable rapid eradication and prevent further populations from establishing. Undetected beetle incursions, coinciding with a dry summer or extensive tree damage after a storm, could create favourable conditions for future outbreaks.

Ips cembrae is considered a dangerous pest of larch in central Europe, where outbreaks were linked to repeated storms and droughts. In the UK, it was first reported in Moray, Scotland in 1957, but has probably been present since the 1940s. The severe gale of 1953 is believed to have had substantial

impact on the dispersal in Scotland. Today, *I. cembrae* is present throughout the UK, but rarely causes considerable damage to standing trees. A severe storm could increase the potential threat to British larch trees.

Dendroctonus micans, a pest of spruce trees, was first discovered in Shropshire in 1982, by which time it was already established throughout most of Wales and parts of the West Midlands. Today, the species is widely distributed across England and Wales and has spread into southern and central Scotland. If infestation is noticed early and control measures implemented, tree mortality rates are generally low, but *D. micans* can be difficult to detect, especially in the early stages of infestation. This can allow large populations to build up unnoticed. Outbreaks of this species are known to coincide with drought seasons.

Bark beetle damage is likely to increase

Our forests have not yet faced the mass outbreaks and widespread tree mortality caused on the Continent, such as by *I. typographus*. The damage caused by bark beetles to timber in mainland Europe has increased over recent decades. With the anticipated rise in severity and frequency of extreme weather events comes an increased risk of bark beetle outbreaks. Woodland design and silvicultural practices therefore need to create more resilient forests. Single-aged monocultures are generally more vulnerable to natural hazards, such as storms and pest outbreaks, than mixed forests. Further diversification of the age and species structure of our forests is essential to be prepared for the future challenges of climate change.

More information:

More detailed information on bark beetles and other insect pests of our woodlands can be found online at Forest Research's pest and disease resources:

www.forestresearch.gov.uk/tools-and-resources/fthr/pest-and-disease-resources/

Report signs of tree pests and diseases using TreeAlert:

treealert.forestresearch.gov.uk

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