# Range expansion of bark beetles in the genus Ips (ECLIPSE - Ecological Co-factors Lead IPS Expansion)



Text

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## Description

Bark beetle pests of conifer trees represent the most serious damaging agents and threats to both natural and commercial forestry in Europe. There have been frequent and highly destructive outbreaks of several bark beetle species in the genus *Ips*, the most serious of which, *Ips typographus*, has killed millions of spruce trees particularly from the beginning of the 20$^{th}$ Century. Concurrently with these large outbreaks there have been expansions in the ranges of the main European *Ips* species with both northward and westward infestations being recorded.

The ECLIPSE project has analysed the recent history of *Ips* infestations in Europe, using country narratives as exemplars of the appearance and frequency of attacks by the beetles. These analyses have enabled close examination of potential factors driving geographic distributions of the beetles. Both insect-driven spread by flight and longer-distance spread through human movement of infested wood have been recorded for all the European *Ips* species, exemplified by records of world-wide interceptions. Analysis of infestations across Europe has indicated that presence of suitable host trees is, not surprisingly, an essential factor in whether movements of *Ips* species result in infestations both in known infested areas and in newly invaded areas. Expansion of afforestation, particularly in the west of Europe, using various conifer genera

through the last 120 years has been significant; for example, Belgium, The Netherlands, Ireland and the United Kingdom have gone from virtually no conifers to extensive plantations of these host trees.

We have been able to map the chronology of changes in host tree distribution and abundance and the parallel expansion in ranges of *Ips* species in Europe. From a pest management perspective, provision of extensive conifer plantations has resulted in increases in both severity and distribution of attacks by *Ips* species. In parallel to this primary driver, aspects such as climate suitability, particularly extreme weather events such as high winds and droughts, have provided increased availability of weakened trees which are essential to initiate new infestations. Within this increased total availability of host trees, the proportion of conifers within a mixed woodland is important, with attacks increasing with higher host: non-host ratios.

While long distance dispersal of beetles with trade is a well-established mechanism for potential range expansion, it is also apparent that relatively long-distance flights by adult beetles can be important contributors to spread. This is well demonstrated by the cross-channel dispersal of *Ips typographus* into Kent which correlates with periods of large-scale infestations in the proximal spruce forest areas of Belgium and France. In this respect, the persistent pressure from flying clouds of beetles provides a more sustained presence of the pests among host trees compared with more short-term invasive populations likely to arrive with movements of infested wood.

This study has highlighted the important primary role of host tree availability, correlated with environmental and human-driven factors, in driving historical infestations by *Ips* bark beetles in Europe. It has also raised questions about why some areas and countries, such as Ireland, have had invasions but not establishment of these important pests. While it is not possible to provide a precise numerical value, it appears that a combination of host tree availability and sustained beetle pressure is needed for an invasive population to become established. From a management perspective it is, therefore, important to both monitor for beetle arrivals but also to be aware of the status of beetle source populations to account particularly for long-distance flight to previously uninfested areas.

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## Funding

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## Related resouces

https://drop.euphresco.net/data/4a51015e-5a54-48f5-97b6-e129787df959

## Organisms

- coniferous trees
- Ips
- Ips sexdentatus

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