

Eradication of the pine wood nematode: Aerial surveillance over ground surveillance, tree selective cutting over clear-cutting

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POLICY BRIEF

BACKGROUND

The pine wood nematode, the most devastating forest pest in Eurasia



Pine wood nematode
(*Bursaphelenchus xylophilus*)

The pine wood nematode (PWN), *Bursaphelenchus xylophilus*, is a priority quarantine pest in the European Union due to the immense economic, environmental and social impacts in countries already infested (Japan, China, Korea, Portugal, Spain). Once infested, a pine tree can wilt and die within 4 weeks when conditions are favourable for the disease's expression (specifically high summer temperatures). The PWN is transmitted from one tree to another by insects of the genus *Monochamus*. In Europe, *Monochamus galloprovincialis* has been identified as the vector responsible for this transmission, making the assessment of its dispersal capabilities of the utmost importance. The first two detections of the PWN in France (in November 2025 and March 2026, respectively) have raised concerns of outbreaks in PWN-free European countries.

STATE OF POLICY

EU regulation to eradicate the pine wood nematode



As soon as the PWN is detected within the EU, the infested tree should be cut and destroyed. This must be followed by clear-cutting of host trees within a 500m radius from this origin point and intensive surveillance in the buffer zone (20km radius) in addition to other measures such as restrictions of wood transportation. Although Portugal implemented this eradication strategy, the PWN spread across much of the country. All of Portugal is now considered to be infested and the buffer zone is located at its border. Spain also failed to eradicate the PWN in the Galicia region despite multiple clearcuts. The effectiveness of the clear-cutting approach has thus been questioned. An initial study concluded that the method was not effective in homogeneous pine forests because *M. galloprovincialis* could fly much further than 500m (Robinet et al. 2020). Examining the topic further, a 2026 scientific article by Sun et al. compared the effectiveness and costs of clear-cutting with those of tree selective cutting, i.e. cutting only symptomatic trees.



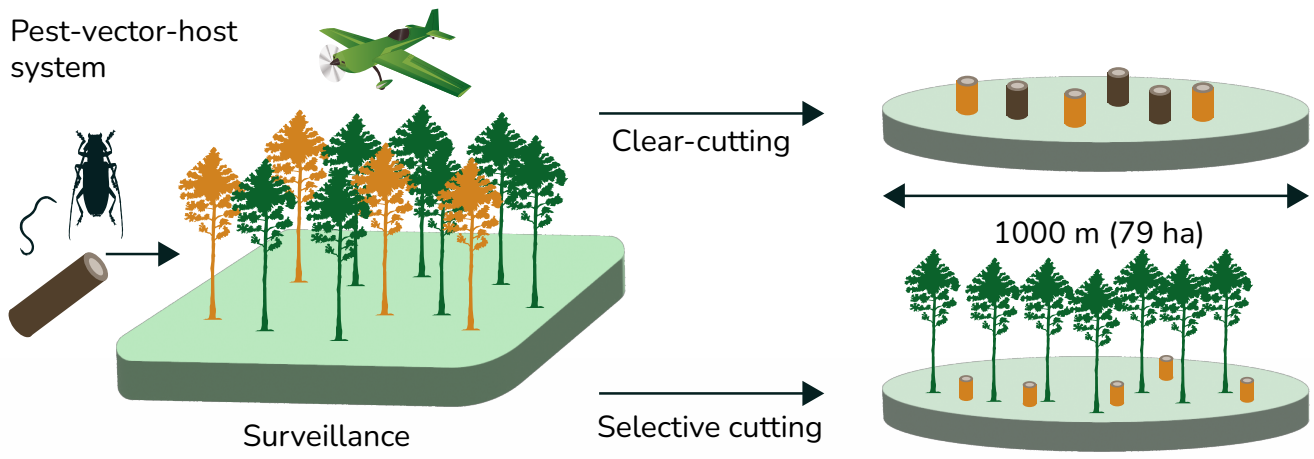
ANALYSIS

Modelling PWN dispersal, surveillance, control and estimating the costs

A dispersal model was developed to describe the trajectory of individual insects (Robinet et al. 2019), the transmission of the PWN to host trees and the development of wilting symptoms. It assumes a homogeneous pure pine forest. Two alternative surveillance options were considered:

-  ground surveillance from roads and forest paths, combined (or not) with insect trapping - the current norm in EU member states
-  aerial surveillance with AI for image analyses - a method developed in the EU-funded project HOMED and currently further improved in the EU-funded project FORSAID.

The model also simulated the effects of clear-cutting all host trees within 500m as opposed to selective cutting (i.e. cutting only declining trees). Under consideration were the costs of ground and aerial surveillance, those of wood sampling and DNA-based detection of PWN presence as well as those of tree cutting and the loss of revenue from cutting non-declining trees.



Modelling study describing surveillance and management actions against the pine wood nematode to compare their cost-effectiveness (Sun et al. 2026)

RESULTS

Which is the most effective surveillance method?

Aerial surveillance, combined with AI, performs better than ground surveillance. On average, 85% of the infested trees were detected via the former against 19% via the latter. Insect trapping in the PWN's surveillance has no additional effects on ground surveillance.

Is eradication possible? If yes, using which methods and at what cost?

Eradication is possible using both methods, but only in optimal conditions, i.e. incorporating aerial surveillance and making several flights per year when all infested trees show symptoms. In this case, two flights are needed to achieve eradication with clear-cutting (237.8M€) as opposed to four flights with tree selective cutting (1.2 M€). The latter therefore reduces costs by 198 times in homogeneous pine forests as it avoids the loss of income from non-infested trees' timber products.

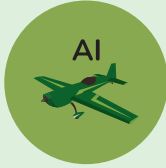
When eradication is not possible, which method provides the best cost-effectiveness ratio?

Under non-optimal conditions, namely when some of the infested trees do not show any wilting symptoms, eradication is unfeasible regardless of the management strategy. The objective then is to reduce the impact of the nematode by containing the disease. Tree selective cutting offers the best cost-effectiveness ratio in this case as well.

CONCLUSIONS

In homogeneous pine forests where the development of the pine wilt disease is expected:

1



Aerial surveillance is a promising method that should be further developed and operationalised using AI for image analysis.

2



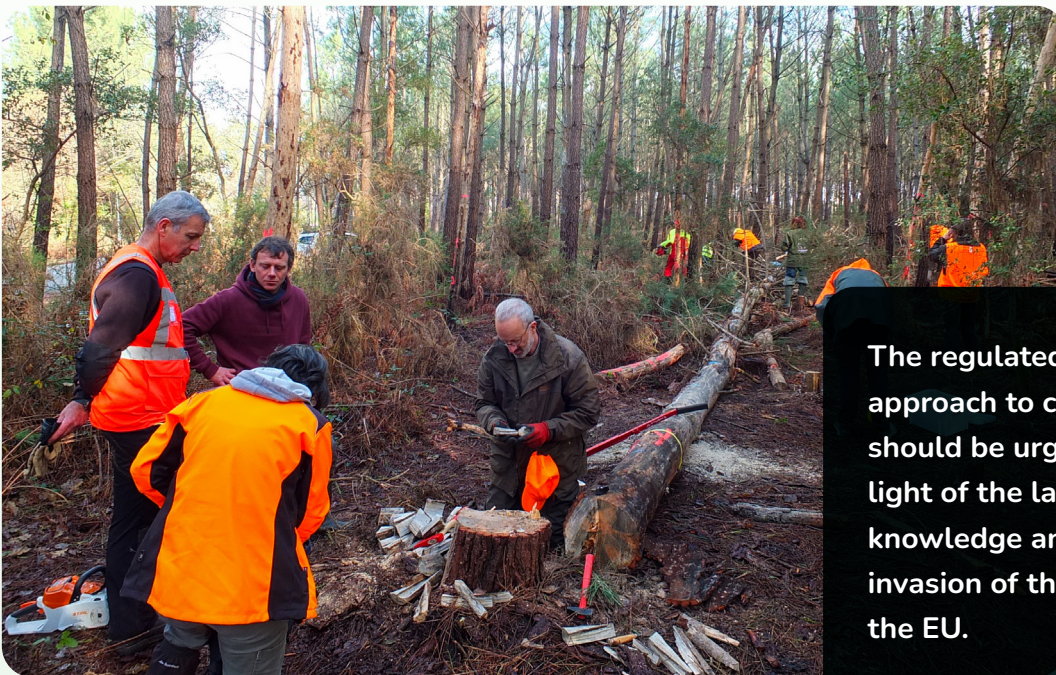
Aerial surveillance should take place several times per season, particularly during periods when trees are supposed to show symptoms.

3



Tree selective cutting has a better cost-effectiveness ratio than clear-cutting.

POLICY RECOMMENDATION



Detection of the pine wood nematode in France in 2025 raises concerns throughout Europe © INRAE BIOGECO

The regulated clear-cutting approach to control the PWN should be urgently revised in light of the latest scientific knowledge and the continuous invasion of the species across the EU.

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