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# Memory and prediction in tree disease control

## A Rural Economy and Land Use Programme research project investigating what lessons we can learn from history about the best ways of responding to tree disease epidemics.

Policy and Practice Notes

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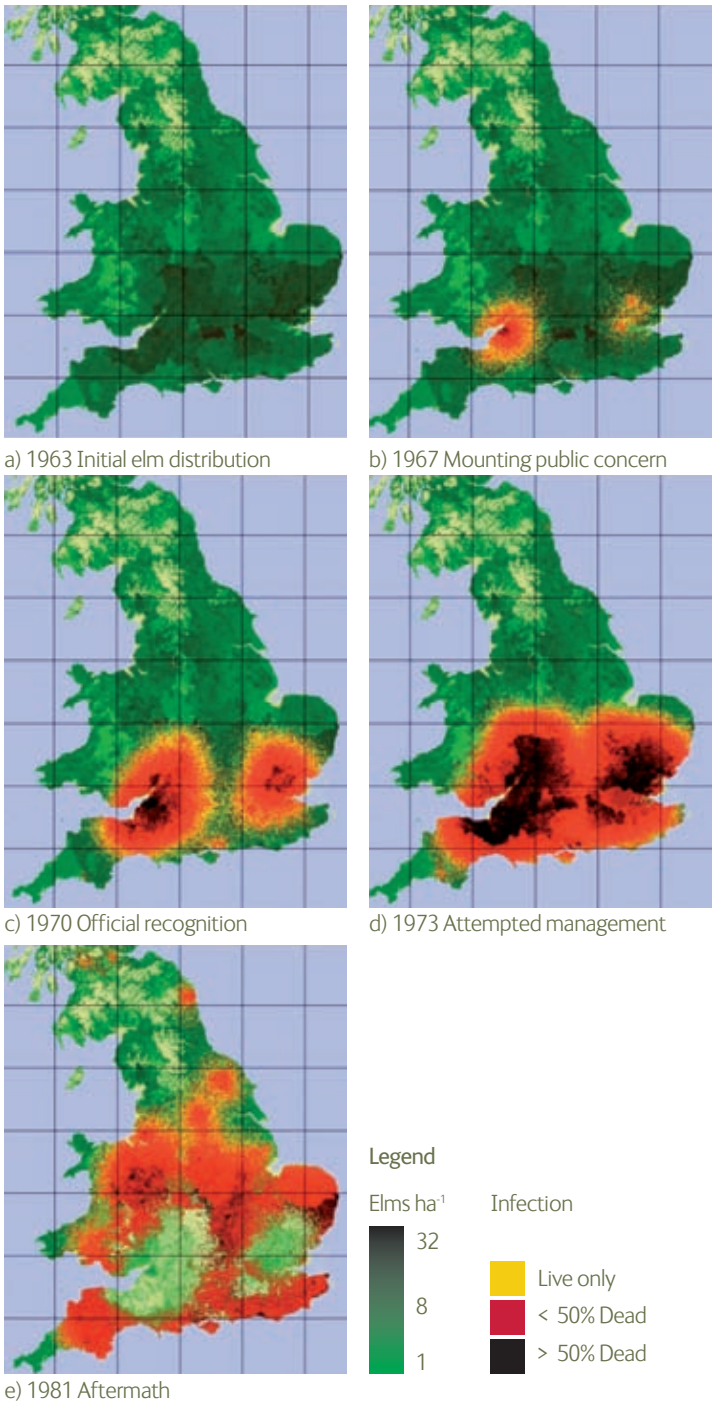
**Invasive diseases now pose a serious threat to trees, woodland and native plants in the UK. Despite early government action to reduce its impact, the current outbreak of 'Sudden Oak Death' continues to spread. Meanwhile, other diseases such as Acute Oak Decline, and the bleeding canker now affecting horse chestnuts, have established themselves and are proving difficult to control. Yet such challenges are not new. Policymakers, scientists, and the growing number of people and organisations with a stake in plant biosecurity, need to learn the lessons of previous tree disease epidemics when putting in place measures to anticipate and prevent future outbreaks.**

## What can we learn from Dutch Elm Disease?

**Lessons can be drawn from the biology, policy and economics of the Dutch Elm Disease outbreak of the 1970s. A reconstruction of the epidemic, based on archival research, interviews with key informants and modelling (*see Fig 1*) suggests that:**

- Biology trumped policy at an early point in the outbreak. The disease entered the UK earlier than was previously thought, probably late in 1962, incubating slowly, but then spreading very rapidly. This rapid spread was due to its inherent virulence, but was also aided by human movements of diseased timber that were restricted very late in the day.
- Scientific experts were initially slow to identify the new disease but, even when it was confirmed as a threat, policymakers were reluctant to put containment measures in place. Government was preoccupied with concerns about exposing the Treasury to escalating costs. This resulted in responsibility for disease control being devolved to poorly resourced local authorities.
- Prevention would have been better than any attempted cure. Earlier and more aggressive sanitation felling would not have slowed the disease spread to any significant extent, but port inspections and quarantining of diseased timber might have prevented the establishment of the disease in the first place

*Fig 1*: Five phases of the UK Dutch Elm Disease outbreak



## Why do tree diseases pose a major threat?

**Pathogens such as Sudden Oak Death have the potential to kill large numbers of trees and thus seriously to reduce the biodiversity and visual quality of our rural environments:**

- The Dutch Elm Disease outbreak of the 1970s killed 30 million trees and profoundly changed the UK s lowland landscape.
- Expanding trade, increased movements of people and climate change, all contribute and constitute a growing threat.
- New diseases, once established, may develop slowly, and thus go undetected for significant periods of time.
- The large numbers and diversity of stakeholders affected (commercial woodland managers, the horticultural trade, gardeners, landowners, amenity organisations and nature conservationists) make it very difficult to reconcile public good and private commercial interests, and to agree who is to pay for any preventative or remedial action.

## Is history repeating itself with Sudden Oak Death ?

**The Sudden Oak Death pathogen is thought to have entered the UK through the nursery trade. It affects trees like Japanese larch, Douglas fir, beech, ash, birch, sweet chestnut and evergreen oaks, as well as many shrubs.**

As with Dutch Elm Disease, the authorities seem to be dealing with an epidemic with unpredictable characteristics. New susceptible species are being discovered as the epidemic unfolds, and attempts to contain the outbreak appear to have failed (*see Fig 2*). The main conclusions we can draw from this are:

- The plant health authorities in the UK acted with reasonable speed to attempt to contain this new outbreak, but these measures, and the considerable efforts made to bring garden owners, landowners and other stakeholders on board, had limited success. This is due both to the complexity of the disease and its unpredictable and shifting host range, but also to resistance from some large garden owners and others to the removal of diseased plants and trees.
- Despite important biological differences, there are growing parallels between this outbreak and the Dutch Elm Disease epidemic. Whereas Dutch Elm Disease rapidly became uncontrollable because of its ability to spread very quickly across a given host range, Sudden Oak Death is proving equally uncontainable due to its capacity to infect new types of plant host species.
- The cardinal lesson to be drawn from both outbreaks is the same it is far better to prevent the entry of a disease than to attempt to contain it once it is established.
- However, the recent Sudden Oak Death outbreak illustrates how difficult this principle is to implement in the contemporary setting of a European Single Market; it was a breach of biosecurity within the European horticultural trade which enabled a diseased plant to be brought into the UK.

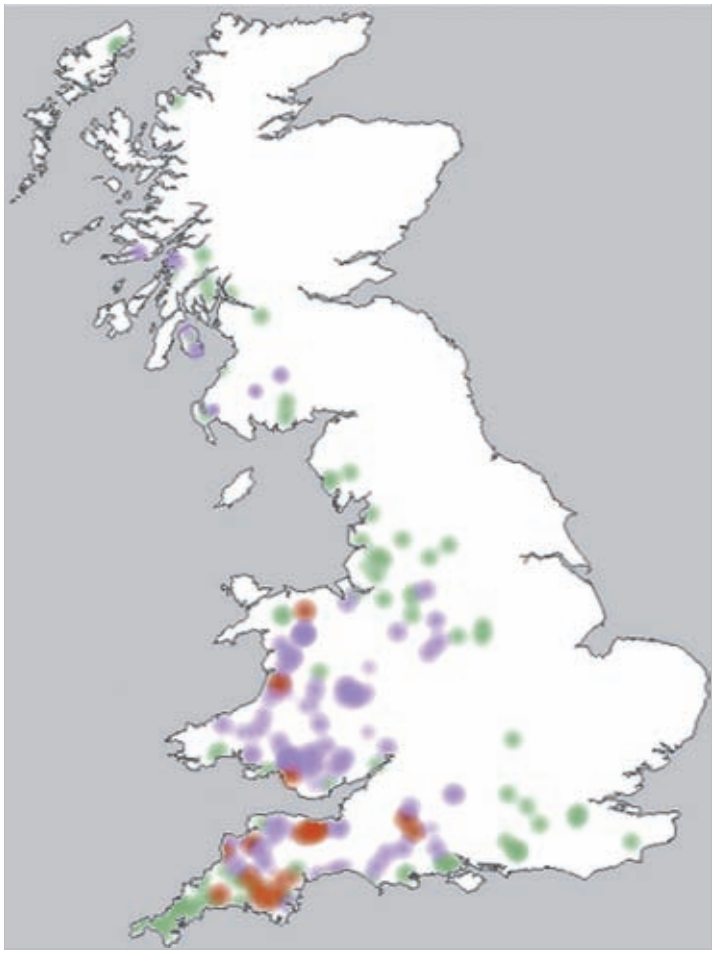


*Fig 2:* The changing face of Sudden Oak Death infection in the UK as it moves into new areas and onto more species. The map shows infections confirmed (red) and suspected (purple) in 2010 on Japanese larch. Green areas show infection previously confirmed in semi natural woodland.

## Why is history important?

**Each new epidemic is to some degree biologically unique, but there is much policymakers and can learn from previous outbreaks.**

**Historical analysis can:**

— reveal past successes and help policymakers to avoid repeating past mistakes in tree disease control.
— demonstrate the value of predictive knowledge, the importance of timing of interventions, and the often greater cost-effectiveness of preventative rather than remedial action.
— remind the public of the potentially devastating consequences of tree disease epidemics and their significance as environmental events. This is important, given the low levels of current public awareness of tree diseases, and the need to reaffirm periodically that government intervention is justified in the public good.

## How can policymakers learn from history?

**Greater awareness of tree disease outbreaks in history would help us to be better prepared:**

— We need more public debate about the threat from tree diseases. There is a surprisingly low level of awareness or understanding of the tree disease threat; valuation surveys from the research suggest this leads to people being unwilling to pay for control measures. Public awareness needs to be raised, both in order to establish a stronger sense of personal responsibility for preventing tree disease spread (as gardeners, landowners and visitors to the countryside), but also to elicit more support and a greater willingness to pay for any more restrictive measures and policies that may be necessary in the future.
— Environmental agencies and environmental groups need to give more attention in their campaigning and advocacy work to how invasive diseases threaten biodiversity, our horticultural heritage, and other public goods.
— Experts need to develop a better and more critical understanding of the interlinked biology, economics and policy of biosecurity measures, and of the difficult trade-offs that will need to be made between freer trade and effective biosecurity. Expert biosecurity discourse is heavily focused on the risk assessment tools and largely technical procedures that have been developed to anticipate and manage outbreaks.
— Beginning at European Union level, there is a need for a more critical and interdisciplinary analysis of the underlying causes of the growing threat to biosecurity, and of conflicts between those advocating further market liberalisation in the context of the Single Market and those arguing for restrictions on trade in the interests of biosecurity.

## Further information

**The research has been carried out at the Centre for Environmental Policy, Imperial College London with additional contributions from Forest Research UK and the Food and Environment Research Agency.**

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**Useful resources:** Harwood, T, Tomlinson, I, Potter, C, Knight, J, (2010) Dutch Elm Disease Revisited: Past, present and future management in Britain, Plant Pathology, (In Press but available online)

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**Project Website:** www.relutreedisease.org.uk