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ROYAL FORESTRY SOCIETY



INSPIRING PASSION AND EXCELLENCE IN WOODLAND MANAGEMENT



THE COST OF GREY SQUIRREL DAMAGE TO WOODLAND IN ENGLAND AND WALES

REPORT OVERVIEW

In partnership





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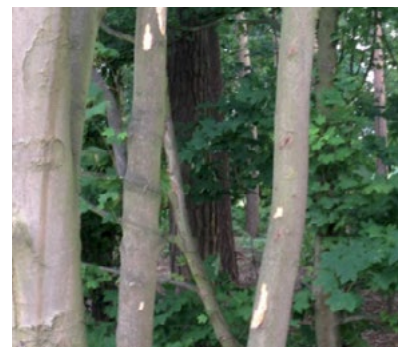
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The full report *An Analysis of the Cost of Grey Squirrel damage to Woodland*, by RDI Associates in association with Newcastle University, Martin Glynn FICFor and Peter Watson Wildlife Management can be read [here](#).



1. KEY POINTS

- Grey squirrel damage to trees in England and Wales is estimated to cost £37m a year in lost timber value, reduced carbon capture, damage mitigation and trees to replace those have died as a result of grey squirrel bark stripping. This is the probable scenario in a wide range of values modelled to estimate the cost of grey squirrel damage to trees by RDI Associates. It assumes that 15% of the broadleaf area and 5% of the conifer area are damaged or killed by grey squirrels.
- According to the report *An Analysis of Grey Squirrel Damage to Woodlands* commissioned by the Royal Forestry Society in partnership with Forestry Commission, National Forest Company, Natural Resources Wales and Woodland Trust, more than 90% of the damage is to broadleaved trees. 81% of the recorded broadleaf damage is accounted for by four species: sycamore (40%), beech (26%), birch (9%) and oak (6%).
- The reduction in carbon sequestration resulting from squirrel damage is estimated to be £9m a year based on the probable scenario. Carbon not sequestered because trees have not grown to their full potential due to damage is not included. No other environmental costs, such as loss of biodiversity, have been included in the study due to lack of research evidence.
- The estimated cost to woodland owners in loss of timber value and the cost of grey squirrel control over the first 40 years when broadleaf trees are most vulnerable is £1.1bn under the probable scenario. This underpins reports by land managers with timber production objectives who were interviewed as part of the study, that they avoid planting broadleaved tree species that are most vulnerable to grey squirrel damage, including oak, beech and sycamore. This change in planting patterns will also have a long-term adverse impact on woodland ecology and biodiversity.
- The report uses data provided by the *National Forest Inventory (NFI)* and recommends additions to NFI squirrel damage survey methods to improve the quality of data in future studies on this topic.
- This report presents a repeatable methodology for modelling the cost of grey squirrel damage and offers the most accurate estimate to date. The report is a reminder to policy makers of the urgency of this issue for the future of broadleaf forestry and climate mitigation.

Cost of grey squirrel damage (£million per yer)		
Scenario	Probable	Possible
Assumption	15% broadleaves/ 5% conifers	25% broadleaves/ 10% conifers
Timber	£13.5	£22.9
Carbon	£9.2	£15.5
Mitigation	£14.1	£28.2
Restocking	£0.2	£0.3
Total	£37.0	£66.9

2. CONTEXT

The grey squirrel is a non-native invasive species which damages and can kill broadleaf and conifer trees by stripping bark. Damaged trees can also die from secondary infections. The cost of this damage in terms of lost timber value has been previously estimated at £6-10m a year. This figure has been quoted in almost all subsequent reports on this topic and is based on observational rather than statistical data. It does not take into account the impact on carbon sequestration, cost of control measures to mitigate squirrel damage or the cost of replacing dead or severely damaged trees.

Grey squirrel damage has been cited as one of the greatest risks to the health of broadleaved woods, especially productive woods, in successive surveys of land managers. Current policies and methods to control grey squirrels are not working.

In 2018 the Royal Forestry Society (RFS), together with the Forestry Commission, Natural Resources Wales, the National Forest Company and the Woodland Trust commissioned a report by RDI Associates in partnership with Newcastle University to update previous research so all those with an interest in raising awareness of the problem of damage by grey squirrels to woodland can point to recent, well supported and transparent evidence. RDI Associates was tasked with developing a transparent and replicable methodology to estimate the true cost of grey squirrel damage in woodlands in England and Wales and to ground-truth the methodology by reference to selected land manager case studies.





3. COST OF DAMAGE

3.1. Methodology

A model of the impact of grey squirrel damage was developed by RDI Associates. It uses data provided by the National Forest Inventory (NFI) to assess the following parameters:

- **area** (in hectares) of grey squirrel damage by tree species and age class.
- **frequency** or the proportion of the area with damage by age class
- **severity** of damage or whether the trees die or survive, by age class

For the proportion of trees that die due to grey squirrel damage it is assumed that there is loss of timber value over the economic life of the tree including loss of income from intermittent thinning and final harvest at 80 years. For the proportion of damaged trees that survive, their value is downgraded from timber (average £72 per tonne) to firewood prices (average £42 per tonne). The price differential for oak planks compared to firewood can be as much as £225 per tonne. These prices are based on price data published by *Grown in Britain*. This does not take into account the significant numbers of trees where damage is only apparent when the tree is harvested.

From this information the model calculates a cost of damage per hectare by species and age class.

The model estimates the cost of reduced carbon sequestration from carbon emissions in decomposing wood. The values are based on the *Woodland Carbon Code* look-up tables. The model does not estimate the loss of biodiversity value due to the lack of evidence and subjectivity of the assumptions. This is an area which merits further research.



3.2. Key findings

- **Low** – damage to 23k ha or 1.8% of the broadleaf area and 0.5% of the conifer area of woodland as defined by data supplied by the NFI (January 2020). Sycamore and beech account for 66% of the area of damaged broadleaves. This scenario was developed by RDI but the values lie well outside those previously published and are not supported by evidence on the ground. It is set aside on the grounds of lack of credibility.
- **Probable** – damage to 15% of the broadleaf area and 5% of the conifer area of woodland in each country (which broadly reflects the area of damage identified in the NFI Woodland Ecological Condition Report (February 2020))
- **Possible** – damage to 25% of the broadleaf area and 10% of the conifer area of woodland in each country.

The annual cost of damage in loss of timber value and carbon sequestration ranges from £22.7m (probable case) to £38.4m (possible case). The probable timber value is higher than the previous estimate of £6-£8m. The median carbon value is illustrative of the scale of the environmental or public good impact of squirrel damage.



4. NATIONAL FOREST INVENTORY (NFI) DATA

NFI has used two different approaches to measuring damage:

- **Contagion:** Where grey squirrel damage is observed in a survey plot, even if it was limited to a certain species of tree or part of the plot, it is assumed that squirrels are present in the entire area and thus damage occurs regardless of species. Assuming that all trees are equally affected disregards evidence on the differing susceptibility of various species. This led to high damage levels on some species which were previously considered to be at low risk. This is the basis for the **probable scenario** which is broadly consistent with the NFI Woodland Ecological Condition Report.
- **No contagion:** This approach limits the recorded area of damage for each species to the actual damage observed, with no assumptions of damage to other trees of other species in the same stand. This aligns with the “Area of damaged trees only” data set published by the NFI in December 2020 and was the basis of a **low scenario**.

The NFI published *Squirrel stripping damage and presence of squirrels in woodland in Britain* in December 2020.

The NFI methodologies produce results which may diverge from observational evidence because:

- NFI surveys are conducted throughout the year and thus damage would be difficult to detect in the summer when trees were in full leaf.
- damage was recorded from ground surveys, without any investigation of the upper layers of the canopy by other means e.g. climbing surveys, and thus precluding detection of damage in the upper canopy.
- long standing damage by grey squirrels is difficult to differentiate from damage caused by other factors (wind, frost, other pests and diseases etc.).
- damage recorded below 1.8m is not attributed to grey squirrels, but there is evidence that they strip bark from the ground in young trees.
- mast years have a large influence on the extent of damage because of the increased grey squirrel population. This is not factored into NFI methodology.

The report recommends supplementary NFI data to overcome these limitations in future surveys.



5. COST OF MITIGATION

Many land managers reduce the risk of grey squirrel damage by controlling their numbers. Currently trapping and shooting are the only methods of control available. Warfarin was banned in 2015. There is no reliable data available which measures the area of woodland where control measures are actively pursued. It is assumed that this could range from 5% to 50% of the total area of broadleaves. The cost of mitigation is estimated from published sources which range from £20 to £80 per ha with a median of £50 per ha. Land managers interviewed as part of the study report that the cost of control measures and the need to apply them consistently over at least the first forty years of a tree's life with no guarantee that trees will not be damaged to some extent is a major deterrent to their take up.

On the basis of these assumptions, the cost of controlling grey squirrels is estimated to be between £1.2m and £45m a year, with a mid-point estimate of £14m a year, or £540m over the 40 years of a rotation when this control needs to be exercised.

Where severe and extensive damage has been incurred, land managers may have to replace trees for which there is no government grant. The standard cost of restocking is £7,156 per ha. This has been applied to the area identified in the low scenario where it is assumed trees die due to squirrel damage (2,684 ha). The one-off cost of restocking this area is £19m or £274k per annum assuming a 70-year rotation, excluding the additional costs of establishment.

6. CASE STUDIES

The findings from the modelling were ground-truthed by interviews with six experienced forestry professionals. Their feedback was:

- The probable and possible scenarios align closest with their observational evidence
- A range of £20-£50 per hectare cost of control measures is consistent with their experience with the upper range providing the best outcome in terms of minimizing the risk of damage.
- There is an increasing trend to avoid planting the most vulnerable broadleaf species, including oak, in favour of the least susceptible species including cherry, lime and alder. This will have a long-term impact on the ecological composition of woods and their financial sustainability.



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