Damage to beech woodlands in the Chilterns by the grey squirrel

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Summary

This study aimed to quantify the extent of grey squirrel damage, by bark stripping, to broadleaved trees in the 15 000-ha Chilterns Area of Outstanding Natural Beauty, and to estimate its impact on the potential to grow high quality broadleaved timber. The results largely confirmed work elsewhere in Britain. Beech and sycamore were more seriously damaged than other species present. Among mature trees, there was significant variation between sites according to the care that had been taken to control squirrels. In the best cases, >90 per cent of trees were undamaged, while in the worst examples only 10 per cent of trees had escaped damage. Among younger trees (<50 years old) levels of damage were much higher: 75 per cent of young trees were damaged, compared with 44 per cent in mature woods. The significance of this latter finding is that the traditional Chilterns’ landscape of beech woods can probably not be maintained beyond the life of the existing trees.

Introduction

The grey squirrel

The American grey squirrel (Sciurus carolinensis) poses one of the greatest threats and constraints to the successful practice of broadleaved forestry in Britain. It is now widespread over southern England and Wales (Gurnell, 1996) as well as Ireland and northern Italy (Huxley, 2003). It became common in the Chilterns in the 1940s. In the 1950s, the grey squirrel was regarded as a pest of secondary importance to the rabbit (Oryctolagus cuniculus), but the significance of the problem it poses has grown throughout the last 50 years, as attempts to control its spread have failed. Grey squirrels are common in mixed deciduous woodland and can cause damage to a wide range of broadleaved tree species by bark stripping. They are now regarded as one of the biggest problems facing broadleaved forestry in Britain.

Previous studies of grey squirrel bark stripping damage to broadleaved woodland in southern Britain (Shorten, 1957; Rowe, 1984) have shown that beech (Fagus sylvatica L.) and sycamore (Acer pseudoplatanus L.) are attacked far more than other species. Beech is reported to be particularly susceptible as a young tree (e.g. Mountford, 1997; Mountford and Peterken, 1999). By contrast, ash (Fraxinus excelsior L.), birch (Betula pendula Roth.) and cherry (Prunus avium L.) are damaged very infrequently.

Rowe (1984) analysed her results using damage categories (the percentage of stems per sample area showing grey squirrel damage). Only 13 per cent of assessed beech stands and 15 per
cent of sycamore stands showed no damage. However, even for beech and sycamore the majority of stands fell into the lowest damage category, with between 1 and 20 per cent of stems showing some sign of grey squirrel damage.

Grey squirrels can reach densities of 0.3–10 ha⁻¹ (Fitzgibbon, 1993), and begin to do economic damage at densities of 0.5 ha⁻¹ (Kenward et al., 1996). Control is difficult and expensive. Several methods are used, including poisoning with warfarin-treated grain placed inside special hoppers, shooting and trapping. Though many private owners prefer shooting to the use of poisoned bait, the latter still remains the most cost effective way of reducing grey squirrel numbers, and should provide the basis of a squirrel control strategy (Mayle et al., 2003).

**Aims of the study**

The aim of this study was to quantify the extent of grey squirrel damage to broadleaved trees in the Chilterns Area of Outstanding Natural Beauty, and to estimate its impact on the potential to grow high quality broadleaved timber in the Chilterns. In England, the Chilterns, with 15 000 ha of forest, including 2700 ha of Ancient Semi-Natural Woodland (ASNW), are particularly known and loved for their attractive beech woods, which receive large numbers of visitors because of their proximity to London.

**Methods: assessing bark stripping damage by grey squirrels**

**Site selection**

Woodland ‘sites’ within the statutory Chilterns Area of Outstanding Natural Beauty (AONB) were sampled. Each ‘site’ was about 75 ha and contained an average of 38 ha of broadleaved trees. It corresponded roughly with one, though occasionally more, contiguous woodland ownerships. The sites that were sampled were selected, without replacement, from English Nature’s ASNW database. A stratified random sampling system was used, the three strata being based on the Ordnance Survey’s 10-km grid squares, soil type (Avery, 1964; Soil Survey of England and Wales, 1983) and topography (e.g. slopes, plateaux, etc). The number of sites in each stratum was based on the total area of woodland within it. Seventy sites were selected in all, of which 49 were listed on the Forestry Commission’s database of Woodland Grant Schemes (WGS), and were assumed to be the actively managed woods.

**Sampling**

In mature woodlands, assessments of grey squirrel damage were made on individual trees at each of 64 sites using a method adapted from Pepper (1998) and Mountford (1997). From a random starting point within any woodland site, individual trees were selected along three to five transects crossing the wood in random directions, using random distances between stops 1–50 m apart. The closest tree to each stopping point was assessed, and 10 trees were inspected along each transect. Thus, 30–50 trees were sampled on each site; it was found that increasing the sample size above 50 trees did not improve estimates of damage. In total 2535 trees were examined. The same method was also used at six sites to assess grey squirrel damage in young beech plantations (aged from 21 to 49 years).

**Measuring grey squirrel damage**

Bark damage was recorded on a five-point scale according to how much had been removed from the base of the stem (Mountford, 1997). This scale is shown in Table 1. Bark is not generally removed higher up the stem, and though there might have been bark stripping from the branches, it was not possible to see or assess it. To the unpractised eye, squirrel damage can occasionally be confused with rabbit damage. Ways to distinguish between the two types are given by Hodge and Pepper (1998).

To assess the extent to which bark stripping damage causes decay within the stems of beech trees, 72 felled trees at Rummerhedge Wood (from a single late selective thinning operation) were examined for lasting evidence of damage at earlier stages of their growth. The number of stems showing evidence of damage was determined and incidences where extensive decay in the cut face had necessitated trimming of the stem were recorded.
Results

Grey squirrel damage in mature woods

The results agree with those of previous studies (e.g. Shorten, 1957; Rowe, 1984) that beech and sycamore are most damaged by grey squirrels. Fifty-four per cent of beech trees surveyed had some evidence of grey squirrel damage, and damage was apparent on 44 per cent of sycamore trees. The relative levels of damage on mature trees (over 50 years of age) are shown by species in Figure 1.

The overall average levels of damage are shown in Figure 2. This shows that for a typical Chiltern woodland around 44 per cent of mature trees will be damaged by grey squirrels, although only a relatively small number (17 per cent) will be damaged to a significant extent (i.e. a score of 2 or more).

There was significant variation between sites according to the care that had been taken to control squirrels. In the best cases, >90 per cent of trees were undamaged, while in the worst examples only 10 per cent of trees had escaped grey squirrel damage. A comparison is shown in Figure 3. Kingston Wood was one of the sites with the least evidence of squirrel damage, while Holly Grove was one of the most severely damaged.

It was anticipated that grey squirrel control would be practiced as part of a woodland grant scheme (WGS) management plan, and that control was less likely at sites with no current WGS. However, no significant differences were found in the levels of squirrel damage between sites that are currently under a WGS and those that are not.

Grey squirrel damage to young trees

Levels of damage were much higher in young plantations (aged between 21 and 49 years) than in mature stands (>50 years). An average of 75 per cent of young trees were damaged by squirrels, compared with 44 per cent across all the mature woodlands surveyed. Half of young trees assessed received a damage score of 2 or above. The average damage score was 1.73 in young plantations, while in mature woods it was 0.67.

Effect of grey squirrel damage on timber value

Of the 72 felled beech trees examined at Rummer-hedge Wood for the presence of grey squirrel

Table 1: System of scoring squirrel damage to beech (from Mountford, 1997)

<table>
<thead>
<tr>
<th>Score</th>
<th>Category</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>No damage</td>
<td>No bark removal</td>
</tr>
<tr>
<td>1</td>
<td>Limited damage</td>
<td>&lt;10% bark removed</td>
</tr>
<tr>
<td>2</td>
<td>Moderate damage</td>
<td>10–50% bark removed</td>
</tr>
<tr>
<td>3</td>
<td>Severe damage</td>
<td>&gt;50% bark removed</td>
</tr>
<tr>
<td>4</td>
<td>Very severe damage</td>
<td>Ring-barked</td>
</tr>
</tbody>
</table>

Figure 1. Squirrel damage by species in the Chilterns.

Figure 2. Overall percentages (± 1 SE) of trees in each of the damage categories shown in Table 1.

Figure 3. Comparison of grey squirrel damage at Kingston Wood and Holly Grove.
damage at the base, 41 (57 per cent) had evidence of past squirrel damage on the cut face (i.e. interior of the log). However, only three stems had needed trimming (in each case 30 cm was lost from the base) to remove badly decayed timber. The levels of grey squirrel damage at Rummer-hedge are similar to those throughout the Chilterns. Thus it appears that decay from bark wounds does not necessarily cause widespread decay within the stem, and is not likely to be found far beyond the limits of the original bark damage. It is not thought to reduce the value of a mature stem to a significant degree.

Discussion
Levels of grey squirrel damage to mature beech trees in the Chilterns are high, and to young trees, much higher. Over half the trees surveyed showed some sign of damage, although there was significant variation between sites. Beech and sycamore were much more severely damaged by grey squirrels than birch, ash, cherry and oak. However, the extent to which decay due to bark stripping can reduce the value of mature standing timber appears small. If the base of a stem is badly affected by decay from wounds induced by grey squirrels, a section of up to 50 cm long, or just over 0.1 m³, may have to be removed before the log is presented for sale. In the one parcel of felled beech timber we assessed, this was found to be necessary only in very rare instances.

Mature trees in the Chilterns were mostly already large and mature when the grey squirrel first invaded the area in the 1940s. They did not grow, when young, in squirrel-infested woods. It is clear that the grey squirrel has seriously damaged broadleaved plantings in the Chilterns within the last 60 years. Levels of damage are much higher in plantations of young trees than in mature stands. This result agrees with the finding of Mountford and Peterken (1999) that trees within a diameter range of 10–35 cm at 1.3 m are much the most vulnerable. Grey squirrel damage to young trees is important because bark stripping at an early age can seriously affect subsequent growth and form of the tree. In the Chilterns damage levels are well above those that are tolerable for the production of high quality timber trees and, as a result, there must be doubt about the wisdom of replacing mature beech as they are felled, with young trees of the same species. Even if grey squirrel control is practised with unremitting vigour, damage to young beech trees may continue to be a problem. It is partly for this reason that the establishment or planting of a larger proportion of more squirrel-resistant tree species (e.g. ash or cherry) is often recommended on suitable sites. The significance of this is that the traditional Chilterns’ landscape of

Figure 3. Differences in the level of squirrel damage between sites.
beech woods can probably not be maintained beyond the life time of the existing trees.

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