Forest Research

PROTECTION OF TREES FROM MAMMAL DAMAGE

Roger Trout and Andy Brunt

BPG

NOTE 12

Best Practice Guidance for Land Regeneration

Introduction

Wild mammals and domestic stock can prevent the successful establishment of both planted and naturally regenerated young trees, and reduce field layer diversity. Chewing shoots and stripping bark (Figure 1) can retard the growth of young trees, and may kill them outright if bark is removed in a band around the stem. The relative threat presented by different mammals will often change over time in response to changes in both habitat and land use on adjacent ground. This Best Practice Guidance is aimed mainly at newly planted areas, although some of the information on damage to larger trees may be useful for sites with existing trees or where standard trees are to be planted. Tree protection in urban and peri-urban areas is complicated by the need to achieve a balance between unrestricted public access and the prevention of animal damage. Human disturbance may reduce the risk of potential animal damage, while vandalism can negate protection measures. Sometimes a policy of no animal management may be adopted (at least initially) as a reluctantly accepted compromise.

The protection of newly planted trees from damage by wild and domestic mammals (and from vandalism) is essential for successful woodland establishment. Trees can be protected individually using treeshelters or guards, or by perimeter fencing around sections of the woodland. The cost of individual protection increases proportionately with the number of trees planted, whereas the cost of fencing relates to the size and shape of the area enclosed and is not a direct function of the number of trees planted.

Figure 1 Rabbit damage to ash.

Will there be significant damage to trees by mammals?

Before planting, part of the planning process should establish what mammal species (and stock) likely to cause damage are present or potentially will invade soon after, and take appropriate steps. This will require a survey, and information on the likelihood of future damage should be sought from one or more of the following sources:

- National Biodiversity Network
- Natural England
- Natural Resources Wales
- Scottish Natural Heritage
- Local Wildlife Trust
- Local landowners/farmers, etc.

If mammal damage is found after planting, managers should:

- Determine which species are causing the damage
- Assess the current and likely future levels of damage as the planted habitat changes
- Decide on any protection measures appropriate to the situation

In all cases, cost is only one consideration in the choice of plant protection. Other factors that influence this choice will include:

- Visual intrusion associated with the use of treeshelters and guards
- Restrictions on public access imposed by fences
- Heightened risk of vandalism on new structures
- Desire for enhanced growth rates associated with the use of tree shelters

Recognising types of mammal damage

Wild mammals and domestic stock will usually damage trees in two main ways:

- **Browsing**: selective feeding on the buds, shoots and foliage of trees, shrubs and herbs.
- **Bark stripping**: usually by gnawing or rubbing the bark.

Important things to look for when assessing the causes of such damage are:

- Form of damage (i.e. browsing shoots, gnawing bark/roots or rubbing of antlers)
- Height of damage and size of tree (e.g. voles damage recently planted trees of under 3 cm diameter at 0–10 cm above ground; only squirrels can damage bark above 2 m)
- Presence and size of teeth marks and the detail of any damaged ends of eaten shoots (e.g. deer/sheep produce a ragged edge while rabbits/hares make a clean, angled cut)
- Time of year when damage occurs
- Other signs of animal presence and abundance, e.g. rabbit holes, sheep wool

Table 1 shows the main characteristics of damage by:

- Deer and other wild mammals, including rabbits, hares, mice, voles and badgers
- Domestic livestock

The Table also shows specifications for fences and treeshelters, and guard heights to protect against each species.

Table 1 The main characteristics of mammal damage to trees, and fence and treeshelter/guard specifications for protection from individual mammal species.

Species	Typical signs of damage to trees	Fencing	Individual tree protection
Voles (bank and field)	• Eating seeds, seedlings, cutting roots of young planted stock in first 3 years • Ringbarking up to 10 cm high • Teethmarks only 2 mm wide • Bank vole will climb saplings and eat bark around base of branch • Typical runways in grass with dropping and cut grass piles evident • Nests in treeshelters or under mulch mats • Thick grass encourages voles and their runways		**Treeguards:** • 200 mm tall split plastic tubes, buried at least 5 mm into the soil • Easily collected as trees grow • Plastic guards with aeration holes are ineffective • Treeshelters will not protect against voles unless staked firmly and buried 5 mm into soil **Chemical repellents:** • Paint or spray Aaprotect on stem of dormant trees to 300 mm
Rabbit	• Cut and eat accessible shoots • Ringbarking bottom 50 cm • Sharp-angled knife-like cuts across small stems/branches • Removed portion often eaten • Damages trees up to 100 cm diameter but mainly 0–10 years • Most vegetation in area around burrow often grazed very low with round droppings	• 1.05 m netting; 18 gauge x 31 mm hexagonal mesh, with bottom of netting dug in or turned out 150 mm towards the rabbits and turfed	**Treeguards:** • 0.6 m treeshelters, split plastic tubes or plastic mesh or spiral guards (lateral growth may still be browsed with spiral guards and meshes) **Chemical repellents:** • Aaprotect applied to dormant trees from mid-November
Hare	• Cut as rabbits, but shoots often left on the ground • May eat along a row of young trees • Damage up to 70 cm	• 1.2 m netting. Use rabbit netting with a line wire 100 mm above netting	**Treeguards:** • 0.75 m treeshelters or plastic mesh guards **Chemical repellents:** • As rabbits
Badger	• Setts under roots • Limited bark damage • Create holes under fences	• Use heavy wood badger gates in rabbit netting where traditional runways occur	
Roe and muntjac deer	• Roe browse to 1.1 m, fray bark up to 1.2 m up to approximately 8–10 years old • Muntjac browse and fray to 1 m • Muntjac may partly bite through or walk over taller thin stems and pull down to browse	• 1.5 m minimum height for small areas, 1.8 m for larger • Max mesh size muntjac 80 mm x 80 mm • Max mesh size roe 150 mm x 200 mm (150 mm x 150 mm preferred)	**Treeguards:** • 1.2 m treeshelters or plastic mesh guards **Chemical repellents:** • As hares
Sheep and goats	• Removal of ground vegetation • Browsing and bark stripping • Newly planted trees may be pulled out	• 1.5 m (goats) or 1.0 m (sheep) agricultural stock fence. • Max mesh size 150 mm x 150 mm	**Treeguards:** • 1.8 m (with regular access, two tall stout stakes needed for most breeds). Not reliable for goats
Pigs and boar	• Removal of ground vegetation and natural regeneration • Browsing and root damage by grubbing • Digging rabbit burrows, holes under fences • Rubbing on trunks	• Heavy gauge fencing required • Max mesh size 200 mm x 200 mm	
Red, sika and fallow deer	• Browse to 1.8 m • Fraying and rubbing on bark up to 1.8 m • Strip bark leaving vertical incisor marks up to approximately 5–20 years old • Sika score trunks with antlers • Fallow may pull up recently planted trees • Severe damage to herb layer	• 1.8 m red, sika, fallow • Max mesh size red, sika 300 mm x 220 mm • Max mesh size fallow 200 mm x 220 mm	**Treeguards:** • 1.8 m for red, sika and fallow with heavy stake **Chemical repellents:** • As hares
Cattle	• Removal of newly planted trees or natural vegetation • Coarse browsing of foliage to 2 m • Treading impacts and dung patches obvious	• Strong stock fencing but take care with barbed wire if area heavily used by public • A buffer zone is needed between fence and trees • Max mesh size 300 mm x 300 mm	• Individual tree protection 1.8 m high steel netting with 2–3 stout stakes or large dimension exclusion area. Not viable other than for specimen trees
Horses	• Newly planted trees may be pulled out • Browsing to 2.5 m • Bark stripping with characteristic diagonal teeth marks from both jaws • Grazing shrubs and ground flora	• Agricultural stock fence (barbed wire fixed to top edge) • A 1.5 m buffer zone is needed between fence and trees	• Individual tree protection not viable other than for specimen trees – as for cattle

Risk and damage assessment

Prior to planting, the risk of damage can only be assessed using the amount of animal signs in the local area and past local experience as indicators. In existing plantings it is often most practical to estimate levels of damage of trees by surveying the whole block (up to 2 ha). This is often not cost-effective for larger blocks or even affected parts of them: a simple map of areas damaged or a representative sample can be taken using the Nearest Neighbour Method described by Pepper (1998).

Protection methods available

Once it has been decided that damage levels are, or will probably be, above acceptable levels, the most suitable options for protection can be considered. In urban areas, direct population control measures such as shooting and trapping will generally be unsuitable. The most appropriate physical protection will be from barrier methods such as:

- Fencing
- Treeshelters and treeguards
- Chemical repellents

Habitat management to reduce the attractiveness of areas of good habitat to damaging species may also be possible, e.g. mowing areas of long grass between trees makes the area less desirable for voles – and also makes rabbits more wary of venturing far from cover. However, there may be unacceptable tractor access or time costs.

The use of treeshelters in areas where vandalism is likely to occur is ill advised. Fences can be equally unsatisfactory, creating antagonism if they block 'traditional' access lines or sites where open access may have previously been enjoyed. Community consultation at the planning stage and practical involvement in the implementation of schemes can foster a sense of ownership amongst local people and may dramatically reduce the incidence of vandalism.

Fencing

Fencing can be an expensive option and may only become cost effective above a certain block size, as the cost per hectare decreases considerably if larger areas are to be fenced. The line a fence takes will usually be a compromise between cost, visual amenity and accessibility. Long straight lengths are cheaper and easier to construct but, in urban areas, visual impact or the need for accessibility may be much more important than overall cost. Before any fencing is carried out, the route and objectives for the fence must be defined. Fencing a part, or parts, of a site is often most appropriate where the fence is designed to closely control public access within the site. The length of time the fence needs to remain in place will influence the choice of materials and the final cost. A wide variety of specifications and materials are available, although most of these materials are erected using standard working methods. A full account of fencing techniques and specifications for materials can be found in Forestry Commission Technical Guide 2: *Forest fencing* (Trout and Pepper, 2006).

The physical capabilities of animals against which the fence is intended to protect must also be known, e.g. badgers are able to push under and through many lighter meshes. It is generally better to avoid fencing across regularly used animal (or human) paths if possible. However, if this is unavoidable, heavier meshes should be used or, in the case of badgers, a special heavy wooden gate should be installed.

Can the scheme cope with vandals?

At its extreme, neither fencing nor tree shelters can survive sustained attack and still fulfil their prime function. Damaging fences and gates may create a Health and Safety hazard – either to the vandal or the general public. Heavier specifications of steel materials may be more appropriate in some urban areas, where both vandalism and corrosion (e.g. from air pollution, sea winds or deliberate fires) can seriously reduce the effective life of a fence.

Heavy woodwork is less easy to break or steal; plastic or electrified netting is inappropriate. Driven straining posts must be at least 1 m longer than dug-in styles; but the traditional strainers with bottom 'T-pieces' are generally nearly impossible to pull out (Trout and Pepper, 2006).

The use of high tensile line wires (of a minimum 3.15 mm diameter) and 'High Tensile stock type' netting makes casual damage by pliers more difficult. The use of barbed staples reduces the ease of dismantling. Use of high tensile 'locking joint' deer net can result in no highly tensioned line wires being needed.

Steel gates, posts and stiles are more vandal-proof than timber, and vandal-proof gate hinge bolts (the nut deliberately breaks off after tightening) may be essential.

Rabbit net should have at least three high tensile line wires and be of 18 gauge specification. Dug-in rabbit wire is less easy to remove than lapped styles but contractors should consider a tractor-mounted plough to make the trench.

Natural barriers such as thickets and hedgerows of thorny species can sometimes provide a more robust and durable guiding barrier to direct public access than only a fence. In some circumstances it may be necessary to use both individual tree protection in combination with fencing to provide comprehensive protection. Belts of standard trees or individually protected groups of trees/shrubs can separate fenced areas from the main public routes. Planting species close to main access routes that can recover and easily reshoot if broken off by vandals can reduce replacement costs.

The effectiveness of fencing a whole site will depend on the size of the site and the amount of pressure from users and wildlife and the level of vandalism and maintenance. The main advantages and disadvantages for whole-site and subdivided fenced areas are listed in Table 2.

Table 2 The main advantages and disadvantages of fencing.

	Advantages	Disadvantages
Fencing major part of site	• Within site access is unrestricted, visitors able to enter into planting compartment unhindered if adequate well-maintained gating • Landscape impact from within site is minimal	• Gates or stiles, which may significantly affect cost and increase maintenance, will be needed where new fence intersects existing footpaths or desire lines • Animals can damage whole site if they gain access at even only one point; removal is expensive and difficult
Fencing part or parts of site	• Corridors can be created following, but set back from, public rights of way and traditional walking routes • If damaging animals gain access to one of several fenced areas the others are unaffected • Materials from one block may be re-usable once trees are established	• Visitors prevented from any 'free roam' and may feel excluded by repeatedly seeing fencing (especially if kept tight to path edges) • Landscape impact is negative • Maintenance and access time to get into all fenced areas is increased

Treeshelters and treeguards

Treeshelters are tubes of plastic used to provide protection for individual trees and promote the rapid growth of young trees because of the favourable microclimate they provide. Treeguards are usually made from plastic mesh of many different designs. Most larger treeshelters/guards are supported by wooden stakes, but some smaller guards can be supported by the tree they are protecting (such as spiral guards) or by themselves (such as some small shelters, e.g. quills or vole guards) which are simply pushed into the ground.

Advantages of treeshelters/guards:

- Cost effective for small areas
- Can make the application of herbicide easier
- Can make trees easier to locate for maintenance when undergrowth becomes tall
- Not a barrier to public access and only one tree at a time is vulnerable to vandals
- Do not prevent positive herbivore impacts on ground vegetation

Disadvantages of treeshelters/guards:

- Do not protect other flora/fauna as does fencing
- Costly for large areas
- Need regular inspection and maintenance
- Usually need to be removed and are generally not re-usable
- Can be an obvious target for vandals at a localised, chronic or widespread scale, even if heavier timber stakes are used. Thin or 'quick release' tree ties are particularly liable to removal

Chemical repellents or weed spraying

Repellents can be a useful emergency measure for immediate and over-winter protection of small areas but are expensive and generally impractical for large areas and where repeat applications are necessary. Spot or strip weed control (see Best Practice Guidance Note 11) can reduce or remove damage by voles living in grassy areas.

Maintenance

Any tree protection mechanism is only as good as the materials and the maintenance employed. Fence inspection and maintenance visits should be at least weekly immediately after completion and then monthly for the first year. In the presence/absence of vandalism these times may need adjusting. Gates and stiles will need extra attention for Health and Safety reasons and keeping some spares is a wise precaution. Holes made in fences should be patched with more netting (with the sharp ends inwards) and clipped firmly using a 'ring-gun'. After several years, it may be appropriate to remove treeguards. Fences may need to be in place for only a few years, or permanently if the larger deer are nearby. Boundary fences with stock fields may need to remain permanently.

Summary and recommendations

- Plan the tree protection measures according to information about both the local wildlife and vandalism circumstances.
- Engage the (younger) public and guide, rather than fence out, if possible. Signage indicating why protection is needed may help.
- Use quality materials of appropriate specification for the job – which may be heavier gauge and thus more costly than normal specifications.
- Budget for adequate maintenance.
- Remove guards and fencing when the damage window has passed.

References and further reading

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Wildlife rangers' handbook (1994). Forestry Commission Management Handbook, Forestry Commission, Edinburgh.

Useful links

www.naturalresourceswales.gov.uk

http://efia.fences.org **The European fencing industry association**

www.fencingcontractors.org **The UK fencing contractors association**

www.hse.gov.uk **Health and Safety leaflets**

www.naturalengland.org.uk **Natural England**

www.nbn.org.uk **National Biodiversity Network**

www.snh.org.uk **Scottish Natural Heritage**

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The Land Regeneration and Urban Greenspace Research Group
Forest Research, Alice Holt Lodge, Farnham, Surrey GU10 4LH
Phone: +44 (0) 1420 22255 Fax: +44 (0) 1420 520180
www.forestry.gov.uk/forestresearch