DEER DAMAGE TO WOODY PLANTS – THE BENMORE SOLUTION TO DAMAGE LIMITATION

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ABSTRACT

Deer damage to plants within gardens is a common and widespread problem. Gardens adjacent to habitats with natural deer populations are particularly at risk. This paper provides a brief history and description of various types of deer damage frequently encountered at Benmore Botanic Garden on the west coast of Scotland. Thereafter follows a summary of a localised plant protection system, which has been developed through much experimentation over the last few years, to reduce deer damage to woody plants throughout the Garden.

INTRODUCTION

Implacable deer … They will devour (Dutton, 1995).

The climate, topography and early history of Benmore Botanic Garden are well documented in Bown (1992) and the Benmore Guidebook (RBGE, 2002). Benmore Botanic Garden is located in the council area of Argyll & Bute at the southern end of the Cowal peninsula on the west coast of Scotland. In the simplest terms, the rain-soaked 48.5ha site of rugged and ascending terrain lies between the Holy Loch and Loch Eck in the valley of the River Echaig, and tree-planting activity is recorded as far back as the early 19th century. The documented involvement of the Royal Botanic Garden Edinburgh (RGBE) at Benmore commenced in 1925 (Anon., 1925). The Garden now contains a burgeoning and significant scientific living collection of predominantly woody plants and numbers well over 11,500 records. Over 50 per cent of plants in the Garden have wild-origin status with 80 per cent of accessions unique to Benmore (Rae *et al.*, 2012).

WILD AND MANAGED DEER POPULATIONS AT BENMORE

Red deer (*Cerrus elaphus*) and roe deer (*Capreolus capreolus*) have colonised Scotland since at least the end of the last ice age (around 10,000 years ago). Both species are considered to be indigenous. The landscape surrounding Benmore was at one time a favourite deer-hunting ground of the Dukes of Argyll. The office of ‘deer forester’ was habitually given by the head of the Campbell clan, presumably to deter the impact of poaching within the area (Walton, 1967). The maintenance of livestock including

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the establishment of a managed deer park was one of many activities initiated by the energetic and innovative James Duncan (1834–1905), Laird of Benmore throughout the Victorian era (Watson, 2010).

The extensive reforestation of the area from the late 19th century onwards has resulted in the provision of more than adequate shelter and cover for populations of red and roe deer. An apparently expanding deer population, together with the relatively remote location of Benmore Botanic Garden amidst a long established man-made forest, ensures a constant challenge to limit damage and exclude would-be predators.

BOUNDARY DEFENCES

Photographic records from 1929 (Fig. 1) suggest strong evidence of a historic struggle to safeguard the garden and plant collection. The perimeter of the modern-day garden is currently protected by a 1.8–2.0m high-tensile forestry plantation-style netting fence. However the assumption that roe deer in particular can be kept out by a galvanised-iron curtain (Dutton, 1995) has proven to be a flawed strategy at Benmore. This experience is supported by a report stating that no effective fence has yet been designed which successfully excludes lithe and opportunistic roe deer in forestry situations (Collier, 1992).

Public access and long-established servitudes to Benmore House and Benmore Home Farm (including the occasional movement of domestic livestock), together with

Fig. 1 View of Benmore shrubbery 1929 with deer fences along the road edge. Photo: Image RMA-H2177 reproduced courtesy of St Andrews University Library Archive.

the multi-user aspect of the Benmore site in general, has created a situation whereby an indefinite number of roe deer are constantly in the garden. Historically such roe deer with marauder status have been discreetly and humanely dispatched; nonetheless, regular Garden visitors confirm a constant resident roe deer population throughout the last 50 years (Smith, pers. comm., 2016). A review of the annual progress reports and meetings of the Younger (Benmore) Trust from 1945 to 1970 highlight amongst several other recurring problems a deer enemy within the garden (Daniel & McDermott, 2006). The perimeter fence does, however, appear to deter red deer which are almost never found within the Garden boundary.

Types of deer damage to woody plants encountered at Benmore

Casual browsing on foliage and the removal of terminal buds are by far the most common types of deer damage encountered at Benmore. The ragged, frayed appearance of the damage (Fig. 2) betrays the culprits. This characteristic symptom results from the fact that deer lack teeth in the upper jaw (Buczacki & Harris, 1981).

Behavioural activities such as scent marking or fraying (removing the velvet from newly grown antlers) result in a small amount of damage to the bark of young trees. The retention of short lateral branches, or 'feathers', on young stems is the best form of defence against fraying damage; otherwise the reactive and timely fitting of plastic spirals is a somewhat ugly but effective alternative.

Other common forms of deer damage, such as bark-stripping and trampling, are relatively unknown at Benmore.

Fig. 2 *Trochodendron aralioides* at Benmore showing ragged or frayed deer-browsing damage. Photo: David Gray.

Deer-proof plants

The unpredictable and eccentric feeding habits of deer are well recognised (Coles, 1997). Inventories of deer-proof plants are notorious for inconsistencies and contradictions. Lists of seemingly unpalatable shrubs and climbers are readily available but usually with depressingly accurate warnings predicting their unreliability (Thomas, 1992).

Within the Benmore Garden almost all woody plants are vulnerable to regular browsing damage. *Magnolia stellata* and *Trochodendron aralioides* are particular roe deer favourites. Relatively uncommon *Rhododendron* species such as *Rh. viscosum*, *Rh. albrechtii* and *Rh. yedoense* var. *poukhanense* are routinely devoured. Fortunately, despite well-intentioned warnings that any *Rhododendron* may be eaten (Cox, 1990), the vast majority of evergreen *Rhododendron* within Benmore are the only woody plants which (to date) roe deer tend to ignore.

There is a myth that conifers are amongst the plants exempt from attack. Close inspection will reveal that *Abies alba*, *A. veitchii*, *Athrotaxis laxifolia*, *Calocedrus decurrens*, *Cephalotaxus harringtonii*, *Cunninghamia lanceolata*, *Chamaecyparis pisifera*, *Fitzroya cupressoides*, *Pseudolarix amabilis*, *Sequoia sempervirens*, *Taxodium distichum* and *Tsuga sieboldii* are all regular targets for attention.

In reality, there are very few woody ornamental plants which can be considered deer-resistant.

A CASE FOR TOLERANCE?

Garden-dwelling roe deer within the Benmore perimeter fence seem to adapt to the presence of humans more or less permanently. This is consistent with observations elsewhere (Coles, 1997). Despite prompting occasional bouts of horticultural exasperation it cannot be denied that chance early morning or evening encounters with these elegant and dark-eyed creatures enhance any Garden visit. The roe deer populations undoubtedly contribute to the placid or mellow atmosphere so readily appreciated by visitors to Benmore.

The challenge

Experience has decreed that in order to increase the chances of successful establishment of new trees and shrubs at Benmore it is necessary to introduce juvenile plants with healthy and suitably fibrous root systems. Traditionally all new plants were protected by a combination of wire netting and 1,250mm × 50mm × 50mm wooden posts. These dimensions were to allow sufficient diameter to accommodate up to two years' lateral growth whilst providing protection against rabbits. This arrangement produced a reasonable success rate; however, the rapid expansion of the woody plant collection over the last ten years has exposed limitations. In many cases, roe deer constantly tour the

planting cages browsing terminal buds and shoots, creating deformed and permanently stunted specimens.

With the awareness that the protection of trees against their enemies and misfortunes is never an easy task (James, 1990), a number of objectives presented themselves. Any new system of plant protection had to be lightweight, portable and relatively inexpensive, as well as time-efficient and moderately simple to erect. The solution would also have to work well on the shallow topsoil prevalent throughout Benmore. Finally, the plant protection must be versatile enough to offer security against roe deer within the garden boundary and red deer in external areas such as the car park. For various reasons the rabbit population at Benmore has disappeared over the last few years, relieving some of the pressure on establishing new woody plants.

On average roe deer measure 75cm to the shoulder, with larger red deer attaining a shoulder height of 120cm. The recorded agility of roe deer in particular is impressive and, as such, browsing height can be difficult to predict as all deer have the ability to stand on their hind legs to reach what they want (Coles, 1997). Experience to date at Benmore suggests that to be free from roe and red deer damage, terminal buds have to attain heights in excess of 1.8m and 2.1m respectively.

THE BENMORE SOLUTION

The Benmore solution (Fig. 3a) to successful protection and establishment of new woody plants utilises a pair of long wooden posts (1,800mm–2,000mm × 50mm × 50mm), a length of standard galvanised (rabbit) wire netting (1,800mm × 1,050mm) and four 1,500mm bamboo canes.

The wooden posts are driven into the ground 500mm apart on either side of the newly planted tree or shrub, and the length of galvanised wire netting is then used to create a 600mm-diameter protective cylinder or tube around the plant. The setting of the height of the wire is critical to success: the top edge of the wire cylinder must be 400mm–500mm above the height of the terminal buds. At first, it is prudent to set the bottom edge of the wire cylinder 50mm–100mm above ground level to facilitate manual or chemical weed control. The four 1,500mm bamboo canes are inserted through the wire to provide extra strength and stability. This is essential in areas with shallow topsoil. Lower lateral shoots which protrude through the wire netting may be sacrificed to casual browsing in the short term. (The majority of trees and larger shrubs, excluding those tolerant of dense shade, rarely retain lower branches into maturity.)

In balance with plant growth rates, a solitary refixing/upward movement of the protective galvanised wire (rabbit) netting cylinder to ensure that the top edge is repositioned 400–500mm above the terminal buds is necessary as the tree grows (Fig. 4). This adjustment can often result in disturbed feeding habits; top growth consequently escapes rapidly beyond reach. Otherwise this refixing/upward movement process has to be repeated until the terminal buds are comfortably above the casual browsing height of adult roe deer (1.8m) or red deer (2.1m).

The critically important height of the protective wire cylinder (400–500mm) above the terminal buds, deliberate narrowness of the protective wire cylinder, timely refixing/upward movements of the protective wire cylinder, dense/barrier horizontal growth of (perhaps shortened) lower lateral branches and the presence of the bamboo canes ensure that the terminal buds are always secure.

Modifications for larger plants

The basic plant protection system outlined above can be modified to retrospectively secure slightly larger woody plants (Figs 3b & 5), particularly shrubby or decurrent growth habits such as *Hydrangea sargentiana* and *Magnolia stellata*. It is necessary to replace the 1,800mm × 1,050mm length of standard galvanised (rabbit) wire netting with a new length 2,400mm × 1,050mm. The pair of long wooden posts are positioned slightly further apart at 700mm to accommodate the larger protective wire netting cylinder (with a diameter of 800mm). It is necessary to use six 1,500mm bamboo canes to provide additional strength and stability. There is little need to adapt beyond the 800mm diameter system (which relies heavily on the presence of lower lateral growth) to protect terminal buds.

Modifications for red deer

The 600mm and 800mm diameter plant protection systems can be further modified to protect terminal buds from red deer (Fig. 6). To ensure success longer bamboo canes (2,400mm) are necessary together with a pair of 50mm × 50mm longer wooden posts increased in length to 2,000mm–2,250mm. It will be necessary to protect the terminal buds to a height in excess of 2.1m.

CONCLUSION

The use of a localised plant protection system against deer browsing is not a new concept. The decision to prioritise the protection of terminal buds (whilst accepting the possible partial sacrifice of lower lateral growth), the permanent positioning of initially oversized 50mm × 50mm wooden posts at the outset and the incremental repositioning of a solitary piece of standard 1,050mm galvanised wire (rabbit) netting all satisfy the portable, inexpensive, flexible, lightweight and time-efficient demands of the deer protection system desired at the outset.

The methods outlined above are starting to make a significant contribution to vastly improved establishment rates of new woody planting at Benmore. Further, as yet unknown modifications of the Benmore localised plant protection system are anticipated. Constant vigilance and timely responses will always be necessary to limit the opportunistic and at times insatiable natural force of browsing deer populations.

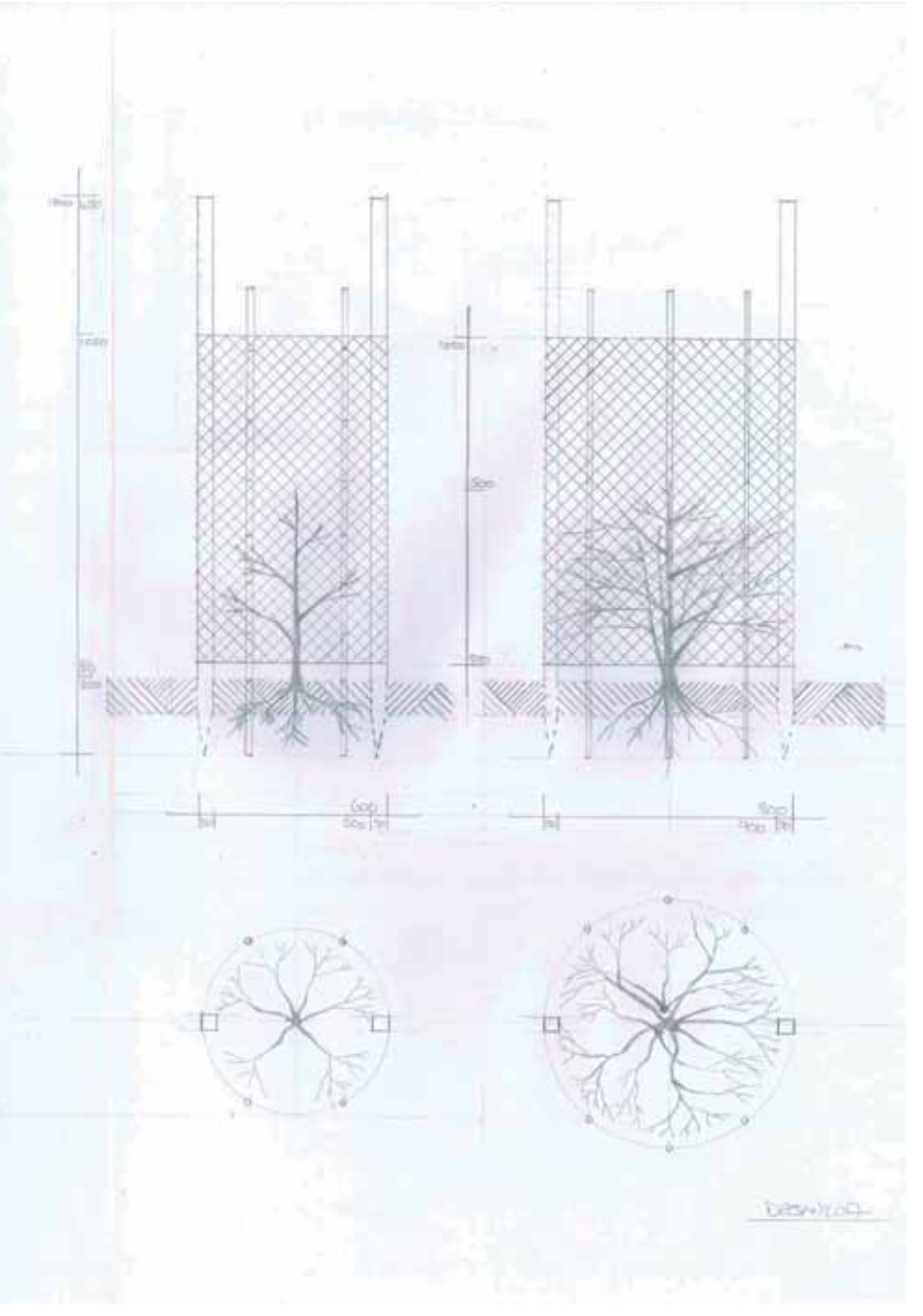

Fig. 3 (a) Line drawing (plan & elevation): 600mm diameter Benmore solution. (b) Line drawing (plan & elevation): 800mm diameter Benmore solution. Drawings by David Gray.

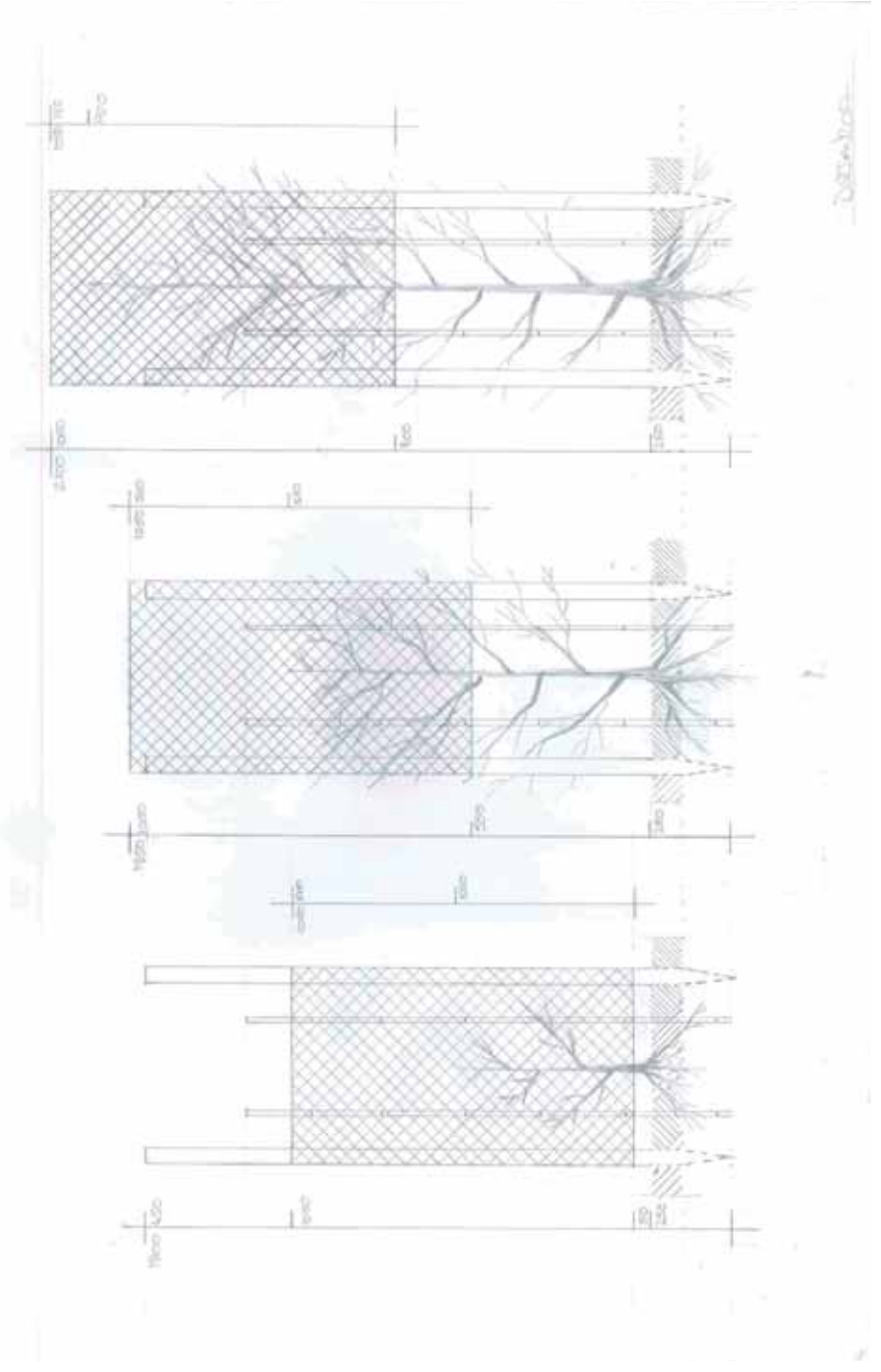

Fig. 4 Line drawing (elevation) demonstrating incremental stages of Benmore solution. Drawings by David Gray.

Fig. 5 *Hydrangea sargentiana* planted at the Golden Gates at Benmore: 800mm diameter Benmore solution. Photo: David Gray.

Fig. 6 *Magnolia stellata* planted in the car park area at Benmore: 800mm diameter Benmore solution, modified for red deer. Photo: David Gray.

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APPENDIX

Estimate of material costs and time

The purchase of materials can be extremely variable depending upon exact specifications and bulk-order discount rates. Mobile bandsaw conversion of felled timber from within Benmore together with the recycling or multiple use of wire netting significantly reduces

costs. An approximate figure of £6.34 for materials to implement a solitary 600mm diameter localised plant protection system is calculated from the following commercial rates:

(£2.16 each) 1,800mm × 50mm × 50mm unspecified square wooden stakes
(£34.40 per roll) 1,050mm × 31mm × 50m galvanised hexagonal rabbit wire netting (1.0 gauge)*
(£0.20 each) 1,520mm × 14–16mm diameter bamboo cane
(£0.34 each) 2,440mm × 14–16mm diameter bamboo cane

*Galvanised hexagonal (rabbit) wire netting is available in a slightly wider roll (1,200mm × 31mm × 50m) at £45.05 per roll. Possible time-efficiency savings would have to be factored against extra material costs.

At Benmore the caging or protection of individual young plants from deer browsing is generally carried out as the final act of planting. An initial set-up time for a solitary 600mm diameter plant protection system is estimated at approximately ten minutes per plant. This figure assumes that all materials and tools are already on site.

Adjustment to re-establish the 400–500mm gap between the terminal buds and the wire top edge is generally accompanied by hand-weeding, formative pruning and repositioning primary/secondary labels. These combined tasks are estimated at approximately ten minutes per plant. This figure again assumes that tools and any replacement materials necessary are already on site.