Focus on forest plastics

Reducing single-use plastics in forestry

By Virginia Harden Scott

Introduction

With organisations and landowners increasingly looking to reduce their use of single-use plastics – and with some advances and developments since this journal last looked at the issue – now seems a good time to re-examine the subject of forest plastics, with a focus on single-use tree shelters and vole guards, and what the industry is doing to reduce its environmental impact.

Rackham and others (Anderson-Bickley, 2023) have shown that we have used fences for up to a thousand years to grow trees in landscapes with herbivores present, with plastic tree shelters and vole guards appearing in the 1980s. With increasing grazing pressure, their use has become a mainstream strategy for crop establishment.

Plastic shelters and guards can be effective, though evidence is mixed. Potter (1991) cites the first tree shelter experiment, in which every oak tree planted in a shelter survived, while 25% of those without died within the first two years. Kerr and Evans (1993) reported that, in three experiments with sheltered and unsheltered beech, they found no significant differences in survival rates after three years. Where possible, deer fencing is the preferred method; tree shelters were originally intended for small sites where fencing was uneconomic and where palatable broadleaves were planted.

These products rarely have a closed-loop life cycle; significant numbers are lost in severe weather, or neglected and left on site, the key challenge being collection cost (possibly up to a third of the establishment cost). When left, they break down into microplastics, entering the soil and the marine environment, potentially harming organisms and leading to a loss of ecosystem services.

Since 2015, approximately 2.3 million trees have been protected with shelters funded by Scotland's Forestry Grant Scheme (FGS), and 19.5 million vole guards (Cowe, 2023). Although the proportion of trees planted with FGS-funded shelters is small (2.3% of those planted via the scheme), tree shelters and vole guards were also funded previously under various legacy grant schemes (e.g. SRDP Rural Priorities Scheme). Add to this an unquantified number of single-use tree shelters and vole guards used in amenity, roadside and housing development landscaping, and we have a significant and highly visible legacy plastic problem for the forest industry in Scotland.

Current policy on forest plastics in Scotland

The Scottish Government is fully supportive of efforts to reduce, remove and recycle plastics used in the woodland and forest environment, and to encourage development and use of viable biodegradable alternatives, in line with the Waste Hierarchy (**Figure 1**).

As of July 2022, FGS guidance states: 'Section 34 of the Environment Protection Act 1990 places a duty of care on all landowners in Scotland to store and dispose of waste appropriately. Once redundant, all tree shelters and vole guards must be removed and reused, recycled or disposed of appropriately.' This is, in effect, a contractual obligation under the scheme.

The UK Forestry Standard, 5th edition (Forest Research, 2023), states that 'the use of plastics, whether made from oil-based or bio-based polymers, should be avoided or reduced as much as possible', and redundant products 'should be removed and recycled to avoid the impacts of bio-accumulation in the forest soil'.

The Forest Plastics Working Group

Established in 2020, the Forest Plastics Working Group (FPWG) focuses on reduction in single- and temporary-use plastics in UK tree establishment, bringing together environmental scientists, waste experts and all the large planting organisations from the private, state and charity sectors, including Scottish Forestry. Some members have banned single-use shelters on their sites; others are trialling more sustainable silvicutural alternatives.

THE AUTHOR

Virginia Harden Scott is the Chairperson for RSFS Lothian and Borders Region, being a member of the committee since 2015. Having worked in the forestry industry since 2009, she is currently Land Use Practice Advisor for Scottish Forestry, which she represents on the UK-wide Forest Plastics Working Group.

The FPWG produces a newsletter (sign up at tinyurl.com/ForestPlastics) and its website features case studies – you can add your own by contacting mike.appleton@ydmt.org – and a citizen science project, Plot That Plastic, to map plastic guards in the environment. The group (Forest Plastics Working Group, 2022a) offers ideas and silvicultural alternatives to reduce single-use plastic shelters. Advice includes following the Waste Hierarchy (**Figure 1**), and avoiding plastics use in or near riparian zones, where they may become detached during floods and storms.

Are tree shelters and guards necessary, and what are the alternatives?

The default when planting broadleaves has been to use plastic shelters or guards, but consideration should be given to a range of management and establishment options. Alternatives include fencing and herbivore control, and the FPWG provides a range of potential fencing, silvicultural and wildlife management options (Forest Plastics Working Group, 2022a), including:

- Planting broadleaves at higher stocking densities to reduce establishment failure
- Using thorny and less tasty species, e.g. hawthorn and blackthorn, as nurses and natural protection for more palatable and vulnerable species
- Herbivore impact assessments to support better deer management and tree protection
- Applying sheep's wool to tree leaders to deter deer
- Use of TRICO.

Chau et al. (2021) argued that planting without plastic should be standard practice. The research – which analysed the life cycle of the plastic and trees – concluded that it was better, for the environment, to lose a certain percentage of saplings than to use plastic guards to protect them. Best practice depends on location – and in areas with very high levels of grazing damage, it was better to use tree guards. Co-author Professor Mark Miodownik (Chau et al., 2021) advised: 'Start with the premise you're not going to use plastic tree guards. Use them if it's the only feasible way to protect the trees in that location.'

TRICO repellent

Regularly and effectively used in Scandinavia for more than 20 years, and being trialled in Scotland, TRICO is an oil emulsion in water, consisting of 64.6g of sheep fat per litre, repelling deer due to its odour and taste. Applied by knapsack sprayer to cover the leader and stem, it adheres well to treated plants.

Watson (2022) reports that Bowlts Chartered Surveyors have been trialling TRICO since 2019 (see **Figures 2 and 3**), initially as an overspray (after planting) on cell-grown, soft conifers on modestly-sized restocks where fencing was not an option. Initial results were good,

Figure 1, below: The Waste Hierarchy (Forest Plastics Working Group, 2022a)

Figures 2 (page 24, bottom right) **& 3** (page 26): These photos from near Rothes, Moray, of Norway spruce (NS) planted in spring 2021, are an indication of TRICO application success. The NS is essentially untouched despite reasonable deer pressure (red and roe). Browsing on regenerated Sitka spruce can be seen in Figure 3 and on the bark of windblow in Figure 2, whilst the NS remains untouched in both. It was treated in the bags at time of planting (April 2021) and again in October 2021. The pictures were taken February/March 2022 and the site continued to be unbrowsed. A further application was made in Autumn 2022. © Ben Watson, Bowlts Chartered Surveyors

Figure 4, above: Glenmore Forest, Forest Research trial site. Many biodegradable products still require further development to ensure they are robust enough for the job. © Virginia Harden Scott

with plants protected through winter with very little browsing, although in spring, new shoots were browsed. Bowlts adjusted their methodology and range of use, applying TRICO to trees in bags before planting, so cutting costs and ensuring even cover. Additional applications are then made in autumn and spring as required.

Scottish Woodlands, also trialling TRICO, has had good success with this in south east Scotland, now planting higher-density broadleaves treated with TRICO, and without shelters, to see what happens. It reports that TRICO works best in low deer pressure areas, with effectiveness seeming to decline rapidly as population increases, but considers it worth considering on the right sites. Planting at higher density, plus TRICO, is currently cheaper than use and removal of tree shelters. According to practitioners sharing experiences from the field, one to two sprays per year are required, depending on quality of alternative browse.

Alternative tree shelters

New types of shelters and guards are being developed and marketed which do not use polypropylene (PP), high density polyethylene (HDPE) or polyvinyl chloride (PVC). These use ingredients including card-based materials with waterproof coatings, sheep's wool, cotton, naturally occurring resins and bio-based polymers (bioplastics).

Longer-term environmental effects of many alternatives are not known and, in fact, some alternatives can have a higher carbon footprint than conventional plastic. More research is required to refine alternatives, trial over longer timescales and to research breakdown and long-term environmental impacts. Current evidence suggests that bio-polymers may break down in a similar way to fossil-based plastics, with similar microplastic pollution.

There are significant challenges in recycling and recovering biodegradable and compostable plastics. They often require specific, high-temperature processing, and therefore should not be left in situ to degrade. Additionally, the presence of biodegradable plastics and compostable plastics in fossil-based plastic recycling processes can cause contamination, resulting in process rejects and increased disposal of materials to landfill or incineration. Defra, based on current evidence, recommends that biodegradable plastic and compostable plastic are not used, and treats them the same as fossil polymers (plastics).

The current cost of bioplastic/biodegradable tree shelters is, generally, higher than the use of conventional plastic tree shelters plus collection for recycling/reuse – approximately three times the cost of fossil plastic products. This is a fast-moving area, however, with a growing number of products under development, and some more recent products certified soil biodegradable by TÜV SÜD, according to strict ISO standards. A list of current alternatives to PP, HDPE and PVC is available from the FPWG (Forest Plastics Working Group, 2022b).

Forest Research trials: alternatives to conventional plastic tree shelters

Funded in part by the FPWG, this research (Forest Research, n.d.) has three elements:

1. Field experiments on contrasting forest sites across Britain to determine practicality, durability and efficacy of bio-polymer, biodegradable shelters, and other silvicultural approaches
2. Assessment of likely environmental impacts and degradation end points of alternative products used in the field experiments, based on evidence provided by manufacturers
3. A time and method study focusing on the costs and practicality of products.

Willoughby (2023) advises: 'This research is in its early stages and it is too early to draw any conclusions from it. Therefore for now, until we gather more evidence, if you need to use individual tree protection rather than other methods such as fencing, the most effective, least impact approach is probably still to use conventional plastic tree shelters and then collect and recycle them before they start to degrade.'

Re-using existing tree shelters

Some forest owners and managers reuse plastic shelters, although this is considered difficult at scale. The main brands of corrugated shelters may be considered delayed oxo-degradable (photo-degradable) plastics if not recovered and recycled – in other words, they start to break up after about ten years. Some manufacturers are looking at product composition to extend lifespan, increasing the potential for multiple reuse, increasing product sustainability. Only 30–40% of current tree shelters may be reusable.

Recycling

Most tree shelters are made from PP and HDPE, which can be recycled at the end of their useful life. Spiral tree guards are usually PVC, which quickly degrades and breaks up, making them very difficult to recover; currently there are limited, options to recycle these, although the largest manufacturer is switching to PP to improve recyclability.

Recycling capacity is widely available across the UK for processing tree shelters, with a number of agricultural recycling companies accepting and collecting shelters in Scotland. Tree shelter company Tubex is expanding its free plastic tree shelter collection and recycling points, which include one location in Scotland, in Dumfries and Galloway. Yorkshire Dales Millennium Trust, with members of the FPWG, is looking to establish more collection hubs in Scotland.

Case Studies

A growing number of organisations and individual landowners are examining ways to reduce single-use plastic guards:

Borders Forest Trust

BFT has decided to stop purchasing plastic shelters, instead opting for biodegradable varieties made from wool and cotton. There is currently a major programme of plastic tree protection removal underway across all its sites.

Tilhill

Writing on behalf of the FPWG, Appleton (2022) reports that at Jerah Woodland Creation, managed by Tilhill, deer browsing was identified as a major

constraint during the design process. Care was taken to balance the risk of browsing versus the scale and cost of deer fencing and to limit the use of individual plastic tree shelters to vulnerable species outside the fence. Intensive deer management is carried out across the woodland, and rather than using 1.2m tubes for protection of all vulnerable trees outside the deer fence, these were targeted to more remote, undisturbed areas, whilst spiral guards were used in proximity to access tracks. Tilhill reports that the successful establishment of broadleaf trees within the fence is impressive. Although plastic vole guards, being smaller than standard tree shelters, resulted in reduced cost (a saving of around £2/unit) and a significant reduction in plastic, the guards were not considered a longer-term solution due to their brittleness and difficulties in their recovery.

Tilhill has also been redesigning restocking by grouping and fencing broadleaves for protection, reducing plastic tree shelter use. Increased stocking density was also considered as an alternative to shelters, but deer numbers at Jerah were still too high. In addition, Tilhill is developing a framework to prescribe requirements for biodegradable tree shelters under forest environment conditions.

Writing on their tree tube trials, Mackinnon (2022) reported that: 'There is also a shift in thinking required. We often use guards without question and without considering if it's really the best option. Deer fencing or increased beat-up rates should be considered. Many people are also asking if more natural options are out there, for example using sacrificial species or barrier species to push browsers away from the new stock.'

Woodland Trust

The Woodland Trust has pledged no more new single-use plastic tree guards on their land from the end of 2021, and are funding research into viable alternatives. According to Maltby & Middleton (2022), the Trust's *Internal Guidance on Waste Hierarchy* sets out the following hierarchy of decision making:

- What does the research say?
- Challenge the assumption that every tree requires a tube; where possible, use techniques that avoid individual plant-based protection
- Remove every shelter at end of use until there is evidence that a shelter is biodegradable with no adverse effects on the environment
- Reuse tubes more than once if possible

Figure 5, above: Failure to remove tree shelters can damage trees. © Virginia Harden Scott

- Recycle all legacy plastic tubes at the end of their useful life
- Replace conventional plastic tubes with sustainable alternatives - when there is no other option but to use a tree shelter, use sustainable, non-fossil-based plastic alternatives that are demonstrably operationally effective.

The Woodland Trust will carry out deer impact assessments, controlling where required and where it will be effective. Fencing will be used where required, and is the number one solution for deer.

Readers are invited to submit their experiences of reducing forest plastics: virginia.hardenscott@forestry.gov.scot

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