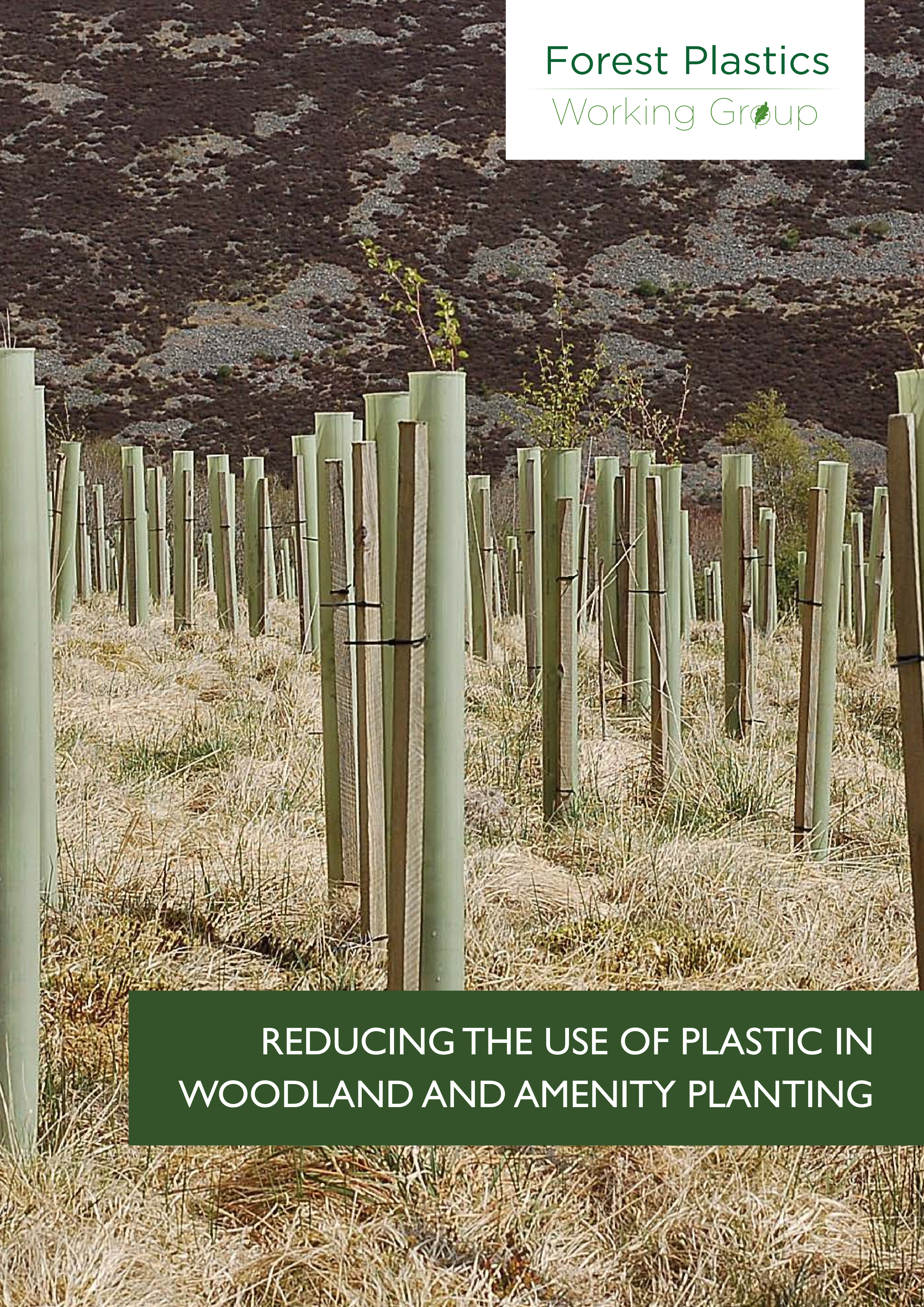
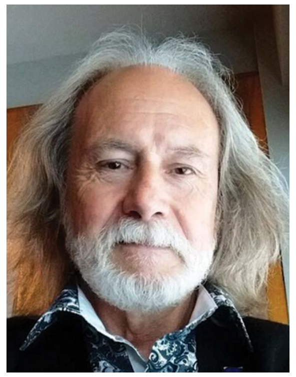


Forest Plastics
Working Group

REDUCING THE USE OF PLASTIC IN WOODLAND AND AMENITY PLANTING

"The number of planted trees in the UK is set to increase dramatically and so inadvertent environmental damage must be minimised. Planting trees with plastic tubes as protective tree guards has been a growing concern in broad environmental terms and for professional practice too. This report is therefore most welcome and will help drive a shift to more environmentally friendly future methods to reduce carbon footprints, costs, and damaging use of plastics. Drawing on a wealth of experience from key professionals this is a thorough and readable review of the issues and future possibilities. The short report is clear, in-depth, informative, and written with authority to cover a neglected but important matter. Read this and it will help change your current practice."

Professor Ian D. Rotherham, September 2022.
Ecologist, researcher, lecturer and environmental campaigner.
Ian's expertise includes ancient woodland and environmental history. His work has been extensively published and includes: Shadow Woods - A Search for Lost Landscapes. Peatlands: Ecology, Conservation and Heritage. Recombinant Ecology – A Hybrid Future? Investigating Tree Archaeology: History and Technology of Woodland Management and Product Use.



"Trees are life. They contain life, they protect life and they improve life - economically, culturally and of course environmentally. It's utterly hypocritical therefore to extol the multitude virtues gained by planting trees in our landscapes, only to encase them in plastic tubes, when we are fully aware of the pollution and problems created by using such tubes. The Forest Plastics Working Group's document 'Reducing the Use of Plastic in Woodland and Amenity Planting' tackles the matter head on and provides invaluable guidance on dealing with this issue."

Dr Alan Simson, Emeritus Professor of Landscape Architecture and Urban Forestry Leeds Beckett University, and Trustee of the Community Forest Trust. Alan is a lead proponent of the IUCN 3-30-300 Urban Forestry Initiative, and led the plastic free establishment of more than 6.5 million trees that form the Telford Urban Forest.

Front Cover Image: Jim Barton, Geograph.

Reducing the Use of Plastic in Woodland and Amenity Planting.
Version one: September 2022.

Any enquiries regarding this publication should be sent to us at FPWG,
c/o Yorkshire Dales Millennium Trust, Main Street,
Clapham, via Lancaster, LA2 8DP.

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The use of plastic shelters in riparian zones should be avoided.

INTRODUCTION

The objective of this guidance is to inform approaches to the prevention, replacement, reduction, reuse, recycling, and recovery of plastics in woodland and amenity planting.

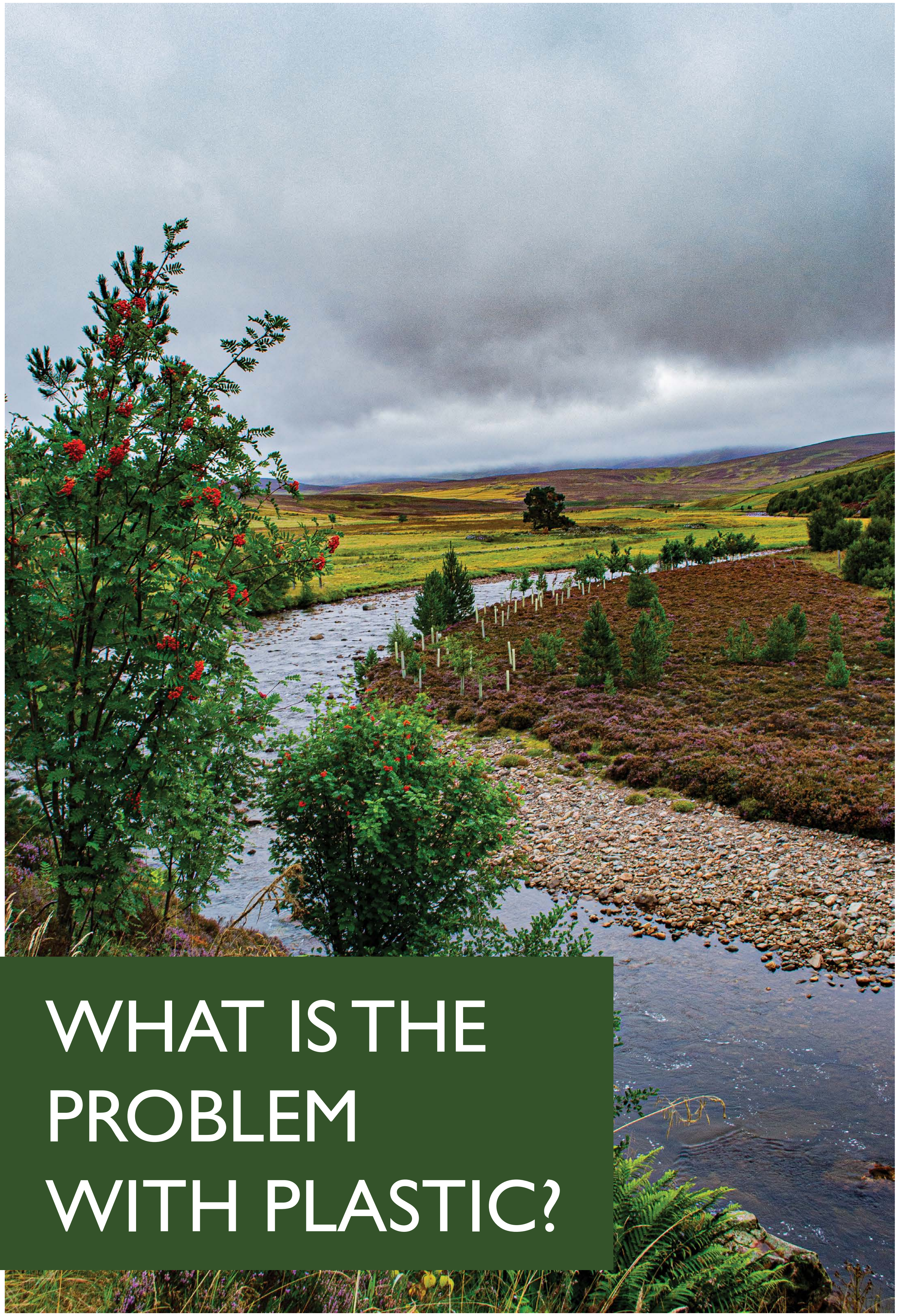
Society is calling for a reduction in plastics in the environment. This requires transformative change[1]. Increasing woodland planting, to sequester carbon and off-set carbon emissions, can be a significant contribution towards addressing the climate crisis. The Forest Plastics Working Group (FPWG) believes increasing woodland creation should not result in a subsequent increase of plastics in the environment. The Group's goal is to achieve the replacement of single use plastics in woodland creation and amenity planting with sustainable silvicultural methods and alternatives. We recognise this is a challenge.

We realise the detrimental effects that single use plastics have; this is particularly the case when their usage is unnecessary, wasteful, or indiscriminate. Cognisant of traditional woodland creation and silvicultural practices where plastic was not used, and the developments in modern alternatives, all those engaged in woodland and amenity planting can play a constructive role in addressing the issue of single use plastics.

When the UK doubled woodland cover between 1919 and the 1950s, fencing provided the primary protection from herbivores. In fact, Oliver Rackham and others evidence how we have used fencing for almost 1,000 years to establish woodlands and the more palatable tree species, with large populations of herbivores present in the landscape, including deer.

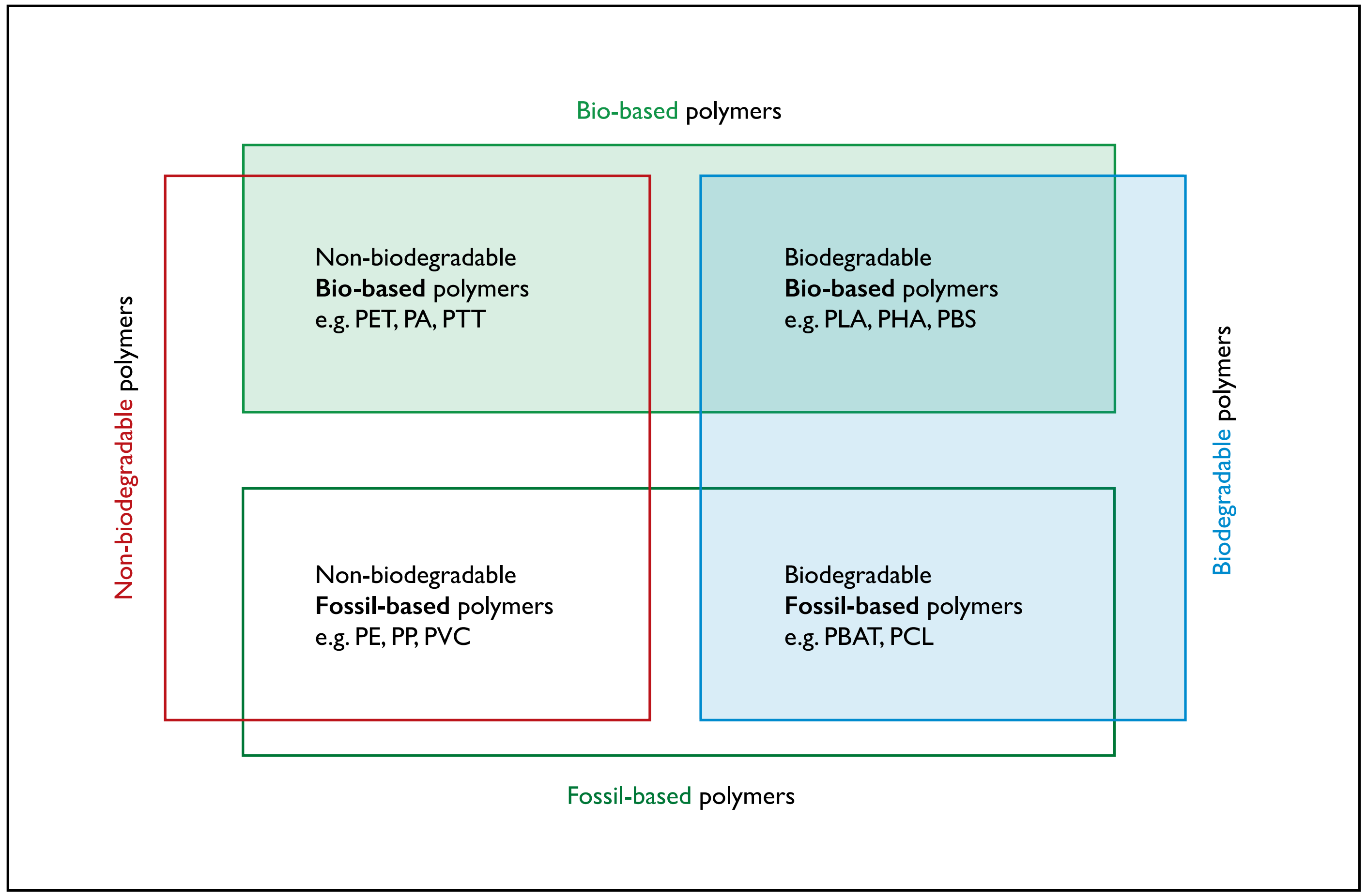
The UK Government's 25 Year Environment Plan[2] sets out the long-term approach to managing our environment and addressing the biodiversity crisis. The Plan states that ours should be the first generation to leave the environment in a better state than we found it and it also highlights the necessity to tackle waste plastic. Legislation and taxation are progressing, and a range of single use plastic products have been banned.

PVC spiral guards are often forgotten, difficult to remove and have limited recycling options.



WHAT IS THE PROBLEM WITH PLASTIC?

THE DEFINITION OF PLASTICS



Plastic is a versatile and durable material. When in the environment, plastic waste may fragment into smaller pieces (microplastics) but, in most cases, does not disappear. Plastics have been documented throughout the environment including in soils, rivers, and the oceans, and can cause detrimental impacts to wildlife, the functioning of ecosystems, and to human health[3].

In the UK it is estimated that five million tonnes of plastic are used every year[4], nearly half of which is packaging. The UK Government publishes regular statistics on the amount of plastic packaging produced and on its final treatment and destination[5].

In 2021, the not-for-profit resources organisation, WRAP, stated that an estimated 1.2 million tonnes of the UK's plastic packaging were recycled in 2020[6], a fourfold increase from levels achieved in the early 2000s.

Around four per cent of oil production worldwide is used in the production of plastics[7].

In 2016, it was estimated that 19 to 23 million metric tonnes, or 11 per cent, of plastic waste generated globally entered aquatic ecosystems. The flux of plastics to the oceans could increase by an order of magnitude within the next decade. For the necessary reduction to take place, extraordinary efforts to transform the global plastics economy are needed[8]. The estimated annual quantity of plastics used in forestry globally is 0.2 million tonnes. Plastics that are not collected for separate recycling or formal disposal may enter terrestrial and aquatic ecosystems through any one of three main mechanisms: Damaged, Degraded or Discarded.

Plastic recycling rates for plastic in the UK and Ireland, are low[9] as shown below. The UK Government's target is to eliminate avoidable plastic waste by 2042.

ENGLAND	44.7%
N IRELAND	47.7%
SCOTLAND	42.8%
WALES	54.1%
IRELAND	31%

These are referred to as 'leaked plastics' or 'mis-managed plastics'. It is thought that about 3.2 million tonnes of microplastics are released into the environment annually, of which 1.5 million tonnes (48 per cent) enters the world's oceans[10].

Plastics are now widespread in the natural environment. Due to their size, microplastics (MPs; defined as particles <5 mm), have the potential to cause harm to organisms and may lead to a potential loss of ecosystem services. Research has demonstrated the significant impact of MPs on aquatic systems, whilst little is known about their effects on the terrestrial environment: soil biology is highly responsive to environmental perturbation and change.

One study looking at short term effects of low-density polyethylene (LDPE) micro plastics (MP) in a field environment showed no significant effect on soil bacterial community diversity, the size and structure of the PLFA-derived soil microbial community, or the abundance and biomass of earthworms.

In this instance, it was illustrated that MPs themselves may not pose a significant problem in the short term (days to months), however most MPs in the environment are not pure or uncontaminated. They often contain additives (e.g. plasticisers, pigments and stabilisers) that are generally not chemically bound to the plastic polymer and may be prone to leaching into the soil matrix[11].

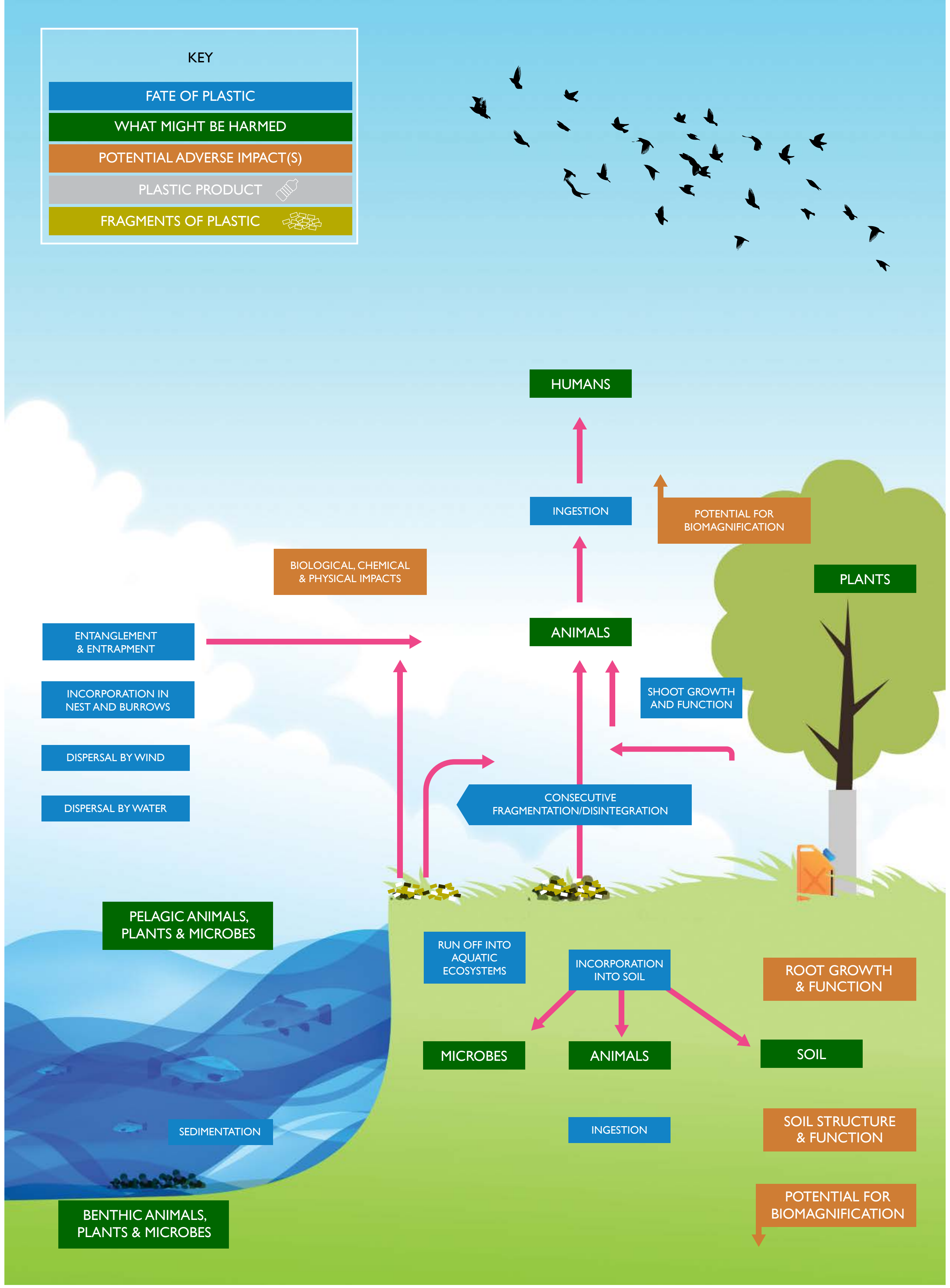
However, a global meta-analysis based on 6,223 observations of plastic residues and microplastics on soil ecosystems showed that plastic residues and MPs can decrease soil-wetting horizontal and vertical movement, dissolved organic carbon, and total nitrogen content of soil by 14%, 10%, 9%, and 7%, respectively. Plant height and root biomass were also decreased by 13% and 14% in the presence of plastic residues and MPs. The body mass and reproduction rate of soil animals decreased by 5% and 11%, respectively[12].

Other studies have also concluded that microplastics increase soil pH and decrease microbial activities as a function of microplastic shape, polymer type and exposure time[13].

Biodegradable plastics have been proposed as a potential solution to plastic pollution, as they can be biodegraded into their elemental components by microbial action. However, the degradation rate of biodegradable plastics is highly variable across environments, leading to the potential for accumulation of plastic particles, chemical co-contaminants and/or degradation products[14].

Removing shelters is often a long process.

SCHEMATIC REPRESENTATION OF THE FLOW OF PLASTICS IN TERRESTRIAL AND AQUATIC ENVIRONMENTS



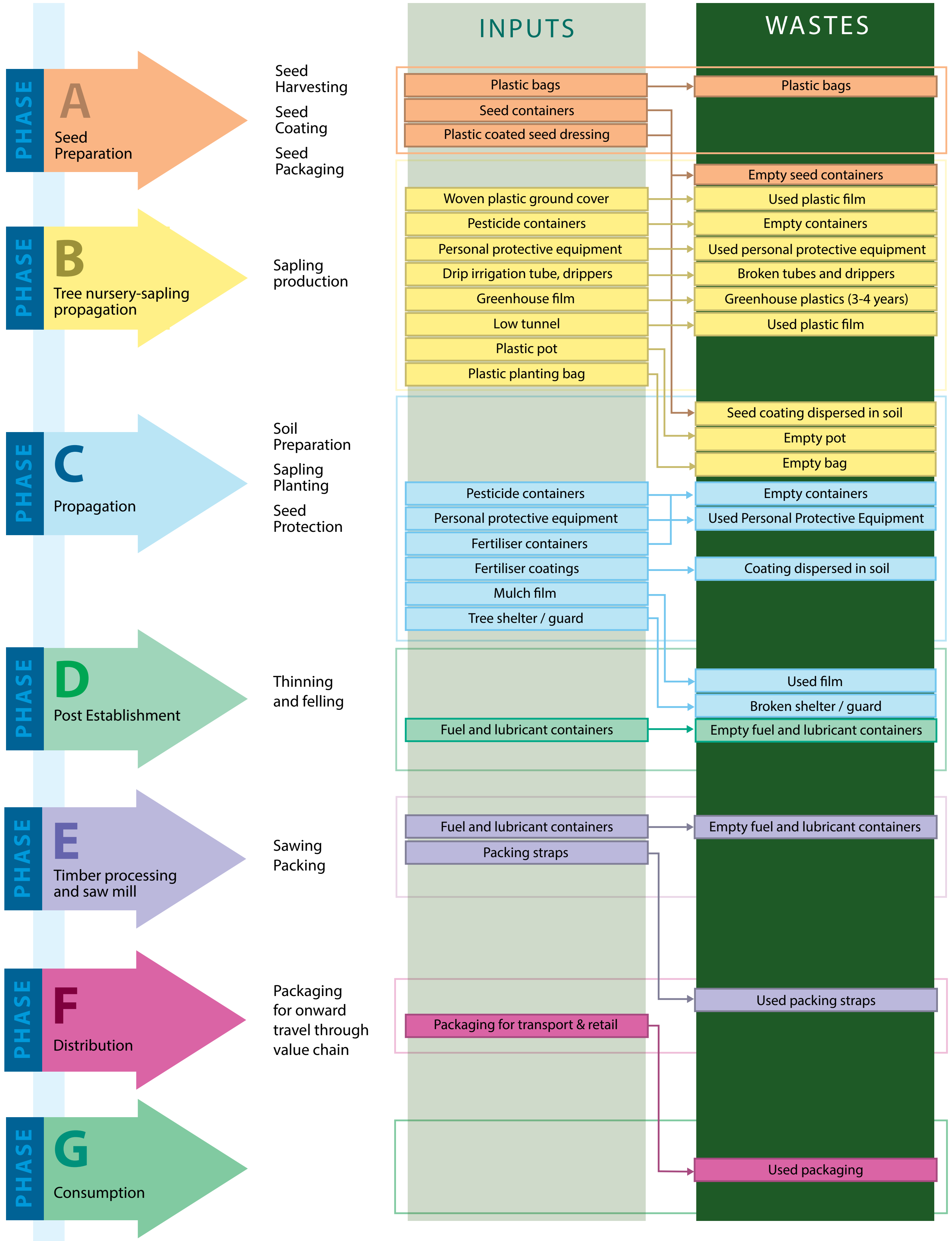
THE WASTE HIERARCHY

Throughout this document we aim to inform how well-managed tree planting activities can reduce the impact of plastic on the environment. These areas are summarised below:

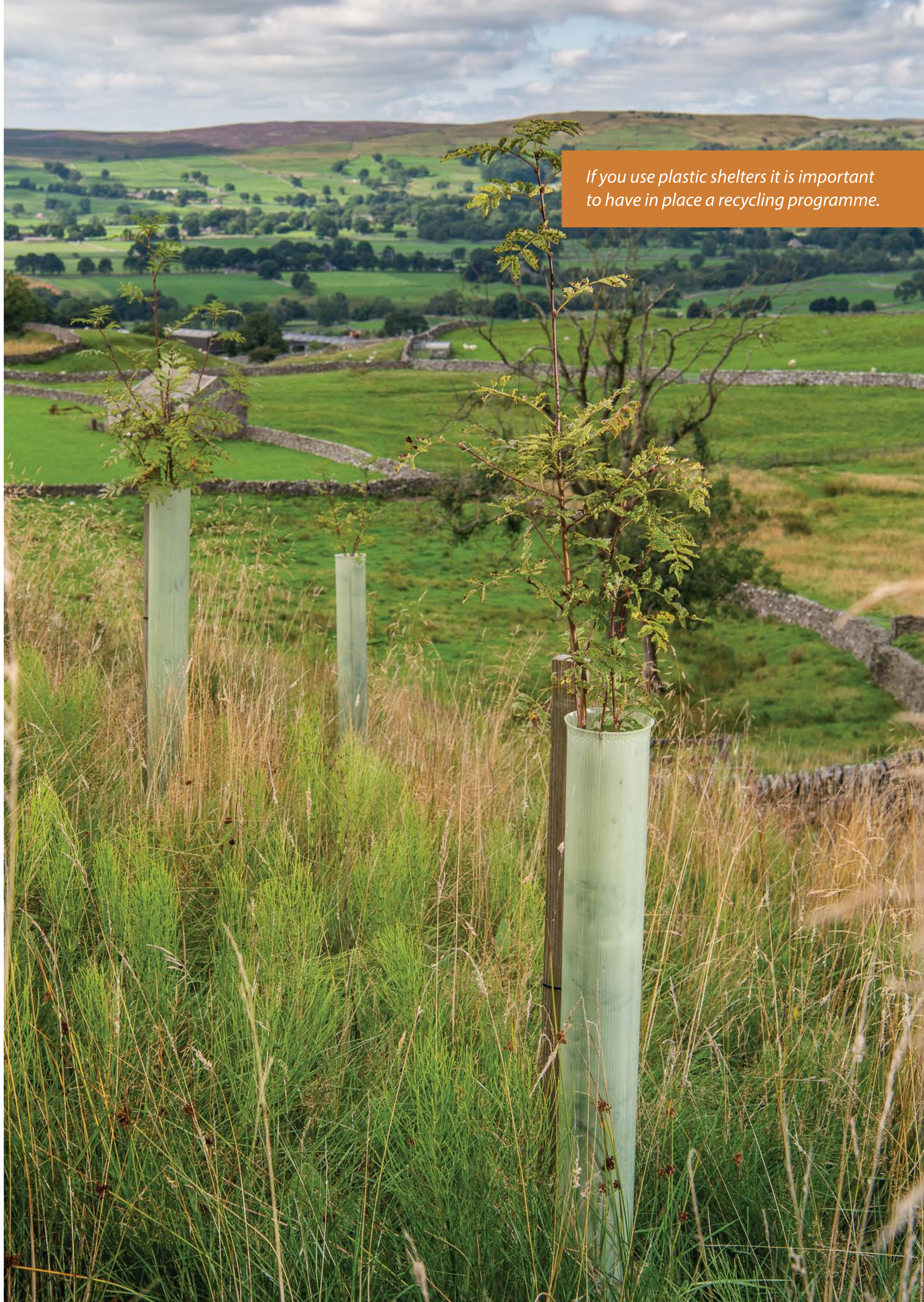
PREVENT	Where can we prevent the use of plastics?
REDUCE	How can we reduce plastic use if we cannot prevent its use?
REUSE	What are the options for reuse?
RECYCLE	What are the opportunities to recycle plastics?
RECOVER	What are the energy recovery options for plastic?
DISPOSE	Can plastic be disposed of sustainably?

WOODLANDS AND TREE PLANTING

This value chain includes analysis of the plastic products produced and used in woodlands and forestry. It includes the preparation of seed, sapling production, propagation, subsequent processing, distribution and transport.



Adapted from Assessment of Agricultural Plastics and their Sustainability – A Call for Action



SOURCES & USE OF PLASTIC IN WOODLAND AND AMENITY PLANTING

A range of single use plastics are used in woodlands and amenity planting.

- Tree shelters and guards are probably the largest source of forest plastics by volume. Given the increase in woodland planting targets throughout the UK, tree shelter and guard use could increase[15].
- Packaging (of shelters, guards, young transplants, and saplings) - young trees and saplings are delivered for planting contained in a variety of ways. These may be tree bags, or trees may arrive as cell grown plants wrapped in plastic, for containment and protection.
- Signage and/or information boards are generally made from a polypropylene plastic.
- Other plastic items include containers; plastic ties; temporary fencing; mulch mats and pegs.

The following sections provide information on preventing, reducing, or recycling these sources of plastic.

The use of tree shelters and guards

Tree shelters and guards are used extensively to protect planted broadleaf trees and hedges in their first few years of growth. Their use is widespread in conservation, amenity, roadside, and woodland situations. They are a recent development in tree planting practice and are often unnecessarily used today.

Using hydrocarbon derived products to aid the establishment of trees, often planted to sequester carbon emitted due to burning of hydrocarbons, is a contradictory practice. The carbon footprint associated with the production of tree guards and shelters emphasises this contradiction.

The use of these products is rarely a closed-loop lifecycle process, with significant volumes of tree shelters and guards lost in gales or floods, or simply neglected and left on site.

There are, however, benefits from both shelters and guards.

They:

- provide protection from herbivore damage, for example deer damage, through browsing of young trees, or vole damage, through gnawing of bark. This damage can adversely impact the survival of young trees and shrubs;
- provide a microclimate that increases survival and growth, and
- help to indicate the position of young trees and shrubs. This reduces risk of damage to them, when other work activities are being carried out, for example brush-cutting, strimming, or herbicide application.

Tree shelters can be categorised into two types: 60 to 75cm and over 1.2m. 60cm and 75cm shelters can be made of any material because light transmission is not an issue and shelter life-span can be much shorter. Rabbits and hares usually stop browsing after the soft plant material hardens, after three or four years.

If 1.2m or taller shelters are required for deer, the shelter should have higher levels of light transmission and be strong enough to last up to ten years because, even when the tree is established, deer will rub the stem. After this point, however, there should be a sufficient number of established trees to eliminate the issue, from a wider planting perspective. Very small numbers of tree losses after this point may be considered acceptable[16].

Materials used in manufacture

Currently, most tree shelters are made from polypropylene (PP) and high-density polyethylene (HDPE), both of which can be recycled at the end of their useful life.

Tree shelters are often secured to stakes with ties; these ties are made of nylon, which can also be recycled.

Spiral tree guards are usually made of polyvinyl chloride (PVC) and currently there are no, or very limited, options to recycle these. Therefore, there is an urgent environmental need to find sustainable alternatives to these guards and limit the use of unrecyclable PVC, single and temporary use plastics.

Joe Middleton from the Woodland Trust and his alternative guard trial.

New types of tree shelters and guards are being developed, and are coming to market, which do not use PP, HDPE, or PVC. These alternatives are being manufactured using a variety of materials including card-based materials with waterproof coatings, sheep's wool, cotton, naturally occurring resins, bio-based polymers / bioplastics, and polylactic acid (PLA).

The lifecycle impacts of bio-based polymers can be greater than the plastics that they are replacing.

This includes upstream impacts such as increased carbon footprint from material use and manufacture, and downstream impacts, due to lack of recyclability and the impact of their materials on the environment. More evidence of the risks and impacts of bioplastics are required[17]. There are also gaps in our understanding of how bioplastics actually degrade in natural systems and evidence suggests that many break-down in a similar way to fossil-based plastics, with similar issues associated with microplastic pollution. We also lack understanding of the impacts of the chemical additives that come out of plastics as they are degrading, and the persistence of them, and the plastic itself, in the environment, and and also the impact on organism and ecosystem functioning. In many cases the ecotoxicology impacts on different biota are unknown.

There are significant challenges in recycling and recovering biodegradable and compostable plastics[18]. 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.

A current list of alternatives to PP, HDPE and PVC tree shelters and guards, as known to the Forest Plastics Working Group, can be found on our website[18].

There is growing understanding of the suitability, longevity, and sustainability of the emerging tree shelter technologies. Some replacements for plastic packaging or products made with alternative materials may not be as sustainable as they appear and could have a higher carbon footprint and poorer lifecycle outcome overall. Non-plastic tree shelter and guard alternatives are generally more expensive to purchase and install initially or may require replacement if the material does not last long enough for the trees to establish. When considering use of alternative non-plastic tree shelters for new woodland or amenity planting, additional costs may need to be factored in.

Whilst simple in theory, it is not considered best practice to re-use shelters on different sites.

Removal of tree shelters and guards

There should always be a firm commitment to remove redundant plastic tree shelters and guards once they have served their useful life and particularly before they start to breakdown in the environment. The dual effects of the breakdown of these products are to both pollute our environment and to litter the countryside. If poorly managed, they can cause environmental and ecological harm to wildlife and ourselves.

Anyone commissioning or undertaking new planting using tree shelters and guards, should always ensure that a plan is in place to remove the tree shelters or guards from site once they have served their purpose.

At the time of publication, the average cost of collecting redundant tree shelters and bringing them to roadside is considered to be an additional 30% of the establishment cost. Tree spirals and small guards, such as vole guards, are cheaper to recover due to the lower labour time required.
Planning must include consideration of the waste hierarchy and the reuse, recycling, or recovery of the redundant shelters and/or guards. It is imperative that this cost is included in the pricing of any new planting scheme.

Reuse of tree shelters

The waste hierarchy advises considering the reuse of redundant materials before recycling. Currently there are limited options for the reuse of redundant tree shelters or guards. Any reuse of these products should consider their age and condition. Many of these plastic products breakdown in the environment, and if the product starts to break during or before removal, this will result in localised, and, potentially far reaching, pollution and additional difficulties of removing plastic from the site completely.

Due to the range of existing products, contributing factors, such as amount of light and wind exposure, and pro-degradant ingredients added to polymers, it is not possible to provide accurate guidance on the reuse of plastic shelters. There is a potential bio-security risk when reusing tree shelters and guards of introducing pests or diseases to a new site.

SOURCES & USE OF PLASTIC IN WOODLAND AND AMENITY PLANTING

Recycling options for tree shelters and guards

Recycling capacity is widely available across the UK for processing tree shelters. A list of recycling companies known to the Forest Plastics Working Group is found on our website[20].

Closed-loop recycling should be a guiding principle. It is the process of waste being turned into a new product or converted back to raw material for a product indefinitely, without losing its properties during the recycling process. It is the primary option where plastic tree shelters and guards may still be considered a necessity.

Packaging (of guards, shelters, young transplants, and saplings)

Tree shelters, guards, young transplants, and saplings arrive to a woodland or planting site, often directly from the supplier, with straps and wrapping or in tree bags.
Tree shelters are usually delivered to site in bagged bundles on a pallet, secured with a significant volume of plastic packaging and pack straps. The associated tree stakes are often delivered bound by pack straps.
Plant bags are large plastic sacks that contain between 100 to 250 transplant trees. Many plant bags are constructed from 90% recycled low-density polyethylene. The bags are an innovative design which protects plants from extremes of frost, sun and heat and ensure greater longevity between leaving the nursery and planting.

Plant bags quickly become waste during any woodland or amenity planting activity. Hundreds of thousands of these large plastic sacks are used every year in the United Kingdom. Waste plant bags come in two categories; 'clean' and those contaminated with pesticide. Some conifers are pre-treated with pesticide before planting to protect against a weevil which causes extensive damage to young transplants. Treating the transplants before planting reduces the risks relating to spraying with pesticide after planting.

Recycling options for packaging and tree bags

There are several companies that offer a recycling service for packaging and plant bags. However, the nature of these materials, including some potential for pesticide contamination, and the condition that they are collected in, means that recycling options in many locations are minimal or non-existent. Specialist recycling companies that serve the agricultural sector are often best placed to process these forms of packaging. However, transporting these waste materials to a provider of this service many miles away may not be a sustainable solution. Although if materials can be stored and delivered in bulk, then this still might be a sensible option. In some cases, recovering energy from them might be more sustainable. Your local waste collection organisation can confirm the destination of your waste, so you can be assured it goes for energy recovery rather than landfill.

Alternative options to tree bags

Members of the Forest Plastics Working Group are currently reviewing and trialling a range of options as an alternative to plastic plant bags.

These include:

- reusable crates;
- hessian sacks;
- coated cardboard boxes; and
- wax coated paper bags.

The traditional 'heeling in' of transplants and saplings, used before plastic bags were introduced, is also a good option to consider, provided the plants are sent without plastic packaging. Additionally, another good option is the use of chiller trailers for storing plants, using a racking system with reusable boxes. However, alternatives to the current plastic plant bag may have significant carbon footprints associated with them.

The challenges of trialling alternative signs.

Signage

Most of the more recent signage used by the sector is made from a polypropylene plastic. This is convenient for printing messages and information on and easy to erect, as well as being durable. Other options for signage in woodlands and on amenity planting sites, include wooden or metal display boards.

Alternatives to the plastic signs should be suitable for their purpose.

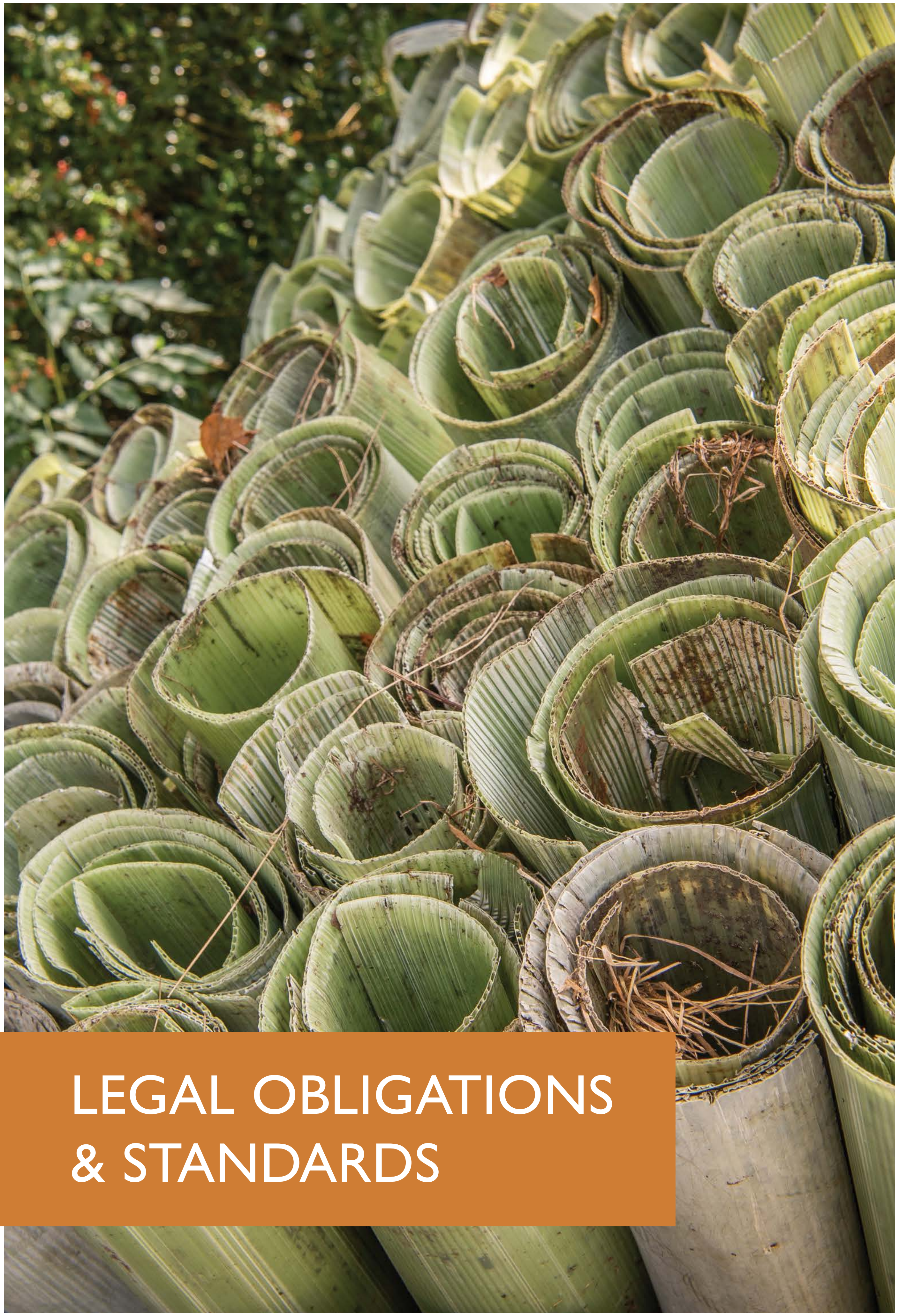
For example:

- signage for temporary work areas such as timber stacks and exclusion zones; and
- signage for more permanent information, such as a managing organisations' contact details.

Redundant plastic signage used in the forestry sector is either recycled or goes to landfill or incineration. Increasingly newly established companies are providing more sustainable signage options, using durable wood panel or card.

Other plastics in woodland and amenity planting

Other plastics in woodlands and amenity planting may come from a variety of sources and include, for example, containers, cable ties and temporary fencing. Good woodland and site management, along with applied waste management protocols, are key to ensuring that plastic waste is removed from the environment and recycled or sustainably disposed of.



LEGAL OBLIGATIONS & STANDARDS

Let's Recycle is a resource that provides current information and helps you to make good waste management and recycling decisions: www.letsrecycle.com

Waste Duty of Care

Redundant plastics, or indeed any redundant material used for forestry and amenity planting activities, are subject to waste legislation and regulation. Those responsible for producing, carrying, or disposing of the waste all have a waste duty of care.

Waste is any substance or object that the holder discards, intends to discard or is required to discard. The meaning of "discard" applies to "disposal" and "recovery" operations and processes and can be intentional or unintentional on the part of the holder.

Any packaging should be gathered and stored in a contained manner on site to avoid escape into the environment and removed from the site by a registered waste carrier and taken to a waste transfer station, waste treatment or disposal point authorised to receive the waste. This is known as the Duty of Care.[21]

In England, under the England Woodland Creation Offer (EWCO), if tree shelters are used they must be disposed of in line with waste disposal regulations by the end of the EWCO Agreement's period[22].

In Scotland, Section 34 of the Environment Protection Act 1990 places a duty of care on all landowners to store and dispose of waste appropriately[23]. Once redundant, all tree shelters and vole guards must be removed and reused, recycled or disposed of appropriately.

In Wales, the use of plastic tree shelters and guards is the last resort. Natural Resources Wales promotes the Waste Hierarchy with the focus on site visits and maintenance. Where larger scale threats are identified, such as deer in South East Wales, in conjunction with wildlife management, tree guards have a targeted role, alternative methods such as fencing are used, and Trico and sheep's wool are being trialled. NRW are delivering a Plastic Footprint Reduction Project.

Waste should be handled, stored, transported, and disposed of according to waste regulations and guidance from the Environment Agency, Scottish Environmental Protection Agency, Natural Resources Wales, DAERA, or the EPA in Ireland, depending on country and location.

There may also be a requirement to register for waste exemptions, such as an S2: storing waste in a secure place exemption, in England, if storing waste on another site pending collection. A waste transfer note is also a requirement when moving waste.

UK Forest Standard (UKFS)

The UKFS is the reference standard for sustainable forest management in the UK. It applies criteria agreed at international levels to forestry management and demonstrates how these agreements are applied in the appropriate way to the management of UK forests and woodlands.
By meeting the requirements of the UKFS, forest and woodland owners, managers and practitioners, can demonstrate that forestry operations and activities are both legal and sustainable.

The UKFS is the basis of forestry practice for the independent UK Woodland Assurance Standard (UKWAS), which is used for voluntary independent certification.

UK Woodland Assurance Standard (UKWAS)

The UKWAS is a voluntary independent certification standard for verifying sustainable woodland management in the UK that is used for both Forest Stewardship Council® (FSC®) and the Programme for the Endorsement of Forest Certification (PEFC)[24].

Certification to UKWAS requires that an owner and/or manager of a woodland "shall prepare and implement a prioritised plan to manage and progressively remove redundant materials." This includes planning for removal of redundant woodland plastic, including tree shelters and guards.

The UKWAS also asks that alternatives have been assessed and considered. This falls firmly under legal and other compliance obligations.

Extended Producer Responsibility

Extended Producer Responsibility (EPR) is an established policy approach adopted by many countries around the world, across a broad range of products and materials. It gives producers an incentive to make better, more sustainable decisions at the product design stage, including decisions that make it easier for products to be reused or recycled at their end of life. It also places the financial cost of managing products, once they reach end of life, on producers of products and materials.

The Organisation for Economic Co-operation and Development (OECD) puts it thus: "Extended Producer Responsibility (EPR) is a policy approach under which producers are given a significant responsibility – financial and/or physical – for the treatment or disposal of post-consumer products. Assigning such responsibility could in principle provide incentives to prevent waste at the source, promote product design for the environment and support the achievement of public recycling and materials management goals".

Suppliers of these products and materials need to plan for EPR and the increasing coverage of EPR from packaging to other products. In the UK, a growing number of businesses are in scope of Plastic Packaging Taxation.

The Plastic Packaging Tax came into force in April 2022. This sets a tax of £200 per tonne of plastic packaging which does not have at least 30% recycled content.

MAKING THE CHANGE

Are tree shelters and guards necessary?

For nearly three decades the default position when planting broadleaves has often been to use plastic shelters or guards. Consideration should be given to a range of management and establishment options. Alternatives to the use of plastic shelters or guards must be considered, including fencing and herbivore control.

Below are some considerations to help you during the design phase of woodland or amenity planting.

Understanding your site and making better silvicultural choices

All sites are different and will present a range of establishment options. It can be highly effective to combine some of these measures.

Fencing options

- Fencing has been used to protect woodlands for almost one thousand years[25]. It is usually the most cost-effective option to protect trees in the establishment phase; this is particularly the case for sites of more than one hectare in area.
- In some areas, small, stock-fenced exclosures have been used as an effective deterrent to deer. It is understood that, behaviourally, deer feel exposed and are reluctant to enter these areas.
- The use of open wire mesh guards, made on site from weld mesh roll, can be considered as protection for trees from browsing. Affixing the mesh guards to timber stakes can protect them from sheep and cattle rubbing. This system works particularly well for open grown field trees. The mesh can be recovered and reused.
- More substantial wooden or metal tree cages can be used, dependent on the location, but additional protection may be required for the tree within the cage.
- Sustainable UK sourced timber should ideally be specified for fencing operations. Consideration should be given to the use of treated or untreated timber. Timber from species including oak, sweet chestnut and larch have natural durability so reduce the need for treatments. Other timber species need treatment to ensure the longevity of the materials used.
- Metal fencing systems are an option, depending on the situation, as they offer the ability to re-site and reuse.
- Fences should be inspected periodically to ensure that they remain deer proof.

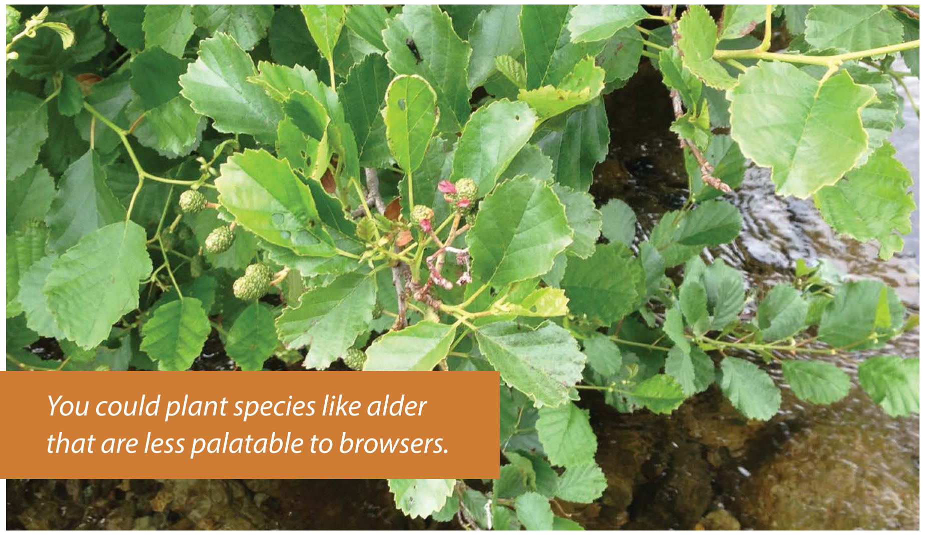
Silviculture

- Planting broadleaves at a low density of stems per hectare has become more usual in recent years for biodiversity objectives. Increasing tree stocking rates can also be considered to reduce establishment failure whilst delivering biodiversity outcomes (for example, broadleaf planting at high densities is common practice in continental Europe). Planting at higher stocking densities helps to create apical dominance, and the loss of a low percentage of trees may therefore be tolerable and negate the requirement for plastic shelters.

Steel mesh cages around single saplings.

An alternative guard could be an option.

- Less palatable and fast-growing pioneer species, like alder, birch, and willow, may not need tree shelters, particularly where herbivore management and expanded levels of deer culling are implemented. Less tasty and thorny species like blackthorn may also be established as protection for more palatable species[26].
- Ensure that weeding and beat-up is carried out to support early establishment, and that there is careful species selection within a single site, rather than one uniform prescription that only relies on shelters.
- Ensure a sufficient budget is allocated for greater beating-up and weeding costs, if combining with reduced plastic, establishment, and accept a potentially longer establishment phase.
- Consider whether less palatable species[27] can be planted as a nurse species. Nurse trees, including conifers, can be used to protect vulnerable broadleaf trees during the establishment phase.
- Ground preparation using mounding, weeding during the establishment phase and the provision of raptor perches, are silvicultural actions that can reduce the incidence of vole damage.
- Ground preparation and mulching (using either mats, woodchip or even sheep's wool) can reduce or avoid the need for weed control.



You could plant species like alder that are less palatable to browsers.

PALATABILIY (High to Low)	TREE SPECIES
1	ASPEN, WILLOW
2	ASH, ROWAN
3	HAZEL, OAK
4	SCOTS PINE, JUNIPER, HOLLY
5	BIRCH, HAWTHORN
6	BEECH
7	ALDER

Wildlife and managing mammals

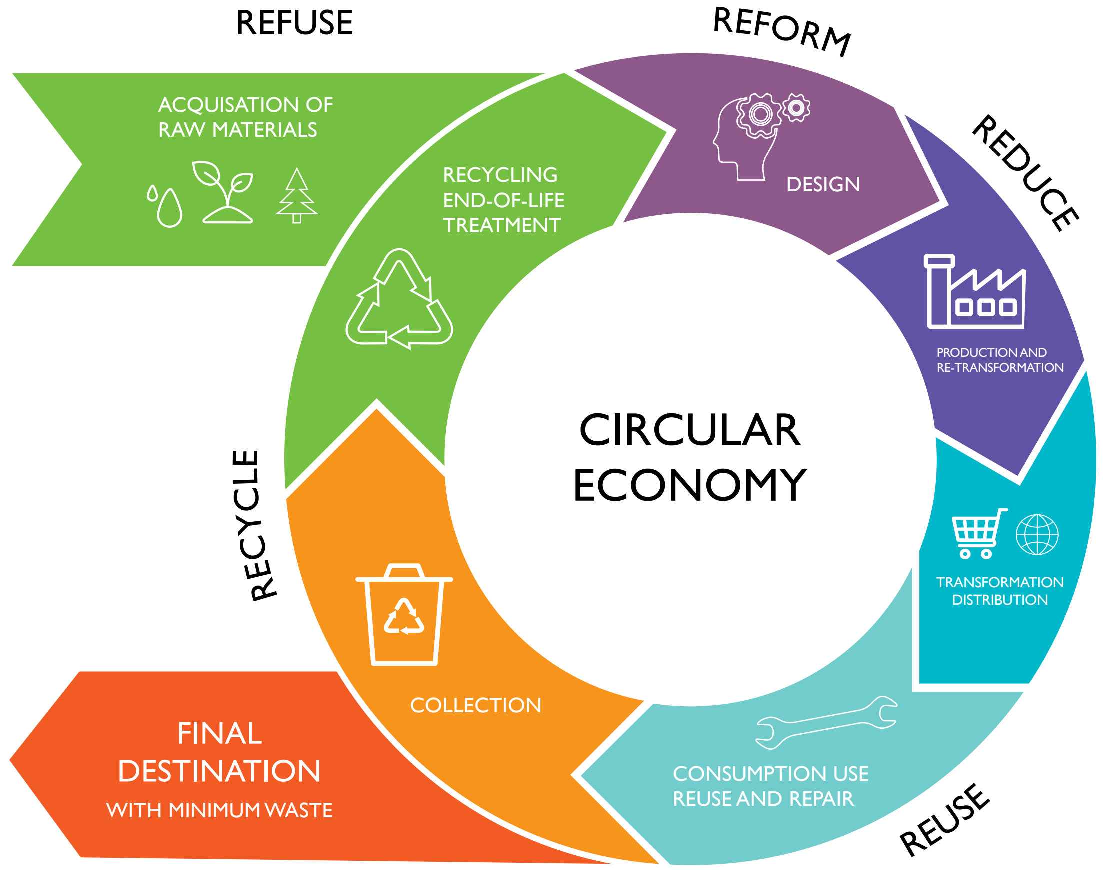
- Undertaking herbivore impact assessments will support better deer management and tree protection.
- It is critical to understand and manage the impacts of deer and herbivores on your site. Expanding deer populations put browsing pressure on woodlands and ground flora. Woodlands where deer are not effectively managed, can act as a source of deer and the tree planting site becomes a sink that attracts them. Deer control beyond the site and ownership is difficult to influence or achieve. Fencing or other methods may be required to ensure successful woodland establishment. It is important to understand that neighbours may have different, and valid, deer management strategies, which may include ethical reservations to culling, maintaining deer populations for hunting interests, or to enhance visitor experience and support wildlife tourism revenue.
- Further information on deer management in relation to woodland creation can be found by reading: Woodland creation and mitigating the impacts of deer[28].
- A vegetation free area of 1m diameter around each tree can reduce the likelihood of attack from voles and greatly increases tree growth.
- Consider the use of minimal protection such as vole guards. Voles are one of the hardest mammals to control at the woodland establishment phase. Protection from voles alone may be adequate for establishment in some situations. However, PVC vole guards are difficult to recycle and should be avoided.
- Consider how to encourage predator populations as part of the establishment plan. You can reduce the damage caused by voles and rabbits, for example, by installing owl and kestrel boxes.
- Trico is a deer repellent that is applied to young trees that are at risk from browsing. It has been used successfully in northern Europe for more than 20 years and is approved for use in the United Kingdom. It is highly regarded in Scandinavia, where it is used to prevent browsing from Cervidae including moose. Trico is a natural solution derived from sheep fat that is diluted and applied during dry weather to young trees. It will typically last for a growing season and up to two applications are required per year. It will limit deer damage.
- Applying sheep wool to the leaders of young trees has been shown to deter deer browsing. Raw wool has a specific smell, which is immediately sensed by deer from a short distance, causing the animals to avoid the protected trees. The wool must be untreated or raw and may be affixed with adhesive[29].

Deer fencing and sustainable vole guards could be considered instead of wholesale shelter use.

Caution

- Plastic tree shelters and guards should not be used in riparian areas where there is a significant risk that they may become detached and lost during flood and storm events.
- Serious consideration should be given to using shelters in exposed upland and mountain locations, where there is a high risk that they may be lost in storm events.
- Tree shelters can create a micro-climate that forces early growth, but can cause issues in later establishment, such as with stability and poor branching habit. Not all species benefit from tree shelters, for example Scots Pine.
- Consider a 'Reduced Plastic Establishment Initiative'. This could provide advice to include suggestions on how to protect woodlands and amenity planting against mammal damage.
- This initiative can take cues from European and American techniques and can share regional and local experiences and expertise. This should help to reduce the over-reliance on the use of plastic tree shelters and guards.

JARGON BUSTER



Some of the terms used for plastics, and the materials used in woodland and amenity planting, can seem complex. Here's what they mean:

Most common plastics are derived from the distillation and polymerisation of non-renewable petroleum reserves. These include polypropylene (PP), polyethylene (PE) and polyvinyl chloride (PVC).

A challenge with plastics, which are not collected and recycled, is that they can degrade to form microplastics in the environment. Microplastics are fragments of any type of plastic less than 5mm (0.20 in) in length, according to the U.S. National Oceanic and Atmospheric Administration and the European Chemicals Agency[30].

They enter natural ecosystems from a variety of sources. Wildlife in or around rivers is exposed to the threats of microplastic pollution. We know that they can be ingested by organisms as small as zooplankton. If ingested, microplastics can block the gastrointestinal tracts of organisms, or trick them into thinking they do not need to eat, leading to starvation. Many toxic chemicals can also adhere to the surface of plastic and, if ingested, contaminated microplastics could expose organisms to high concentrations of toxins.

As concentrations of microplastics increase in our marine environment, they are consumed by the creatures that inhabit our waters and greater concentrations of these plastic particles are entering our food chain[31].

New and emerging plastics
Increasingly, we are seeing more alternative materials on the market. Key questions are can they be managed in a closed-loop and circular system (see above), considering the full impact of their 'lifecycle' or are we shifting the problem?

Bio-based Plastics include PLAs or polylactic acid, are a thermoplastic polymer that is derived from plant-based sources like starch or cellulose. Bio-based plastics are still a type of plastic and therefore behave like one. Depending on the type of polymer that is created they can be recyclable, although not necessarily within established plastics recycling processes. They may also be biodegradable, but not necessarily to the full extent required in order to leave them in the natural environment without causing harm. They are likely to require specialised industrial processing – see Industrially Compostable. The full lifecycle impacts of switching to these materials are not yet known, such as the impact of crop switching, land-use change and water consumption.

Biodegradable Plastics which can be broken down by micro-organisms into simple compounds. Biodegradation depends on environmental conditions: temperature, humidity, and oxygen. Technically, almost any product could be labelled 'biodegradable' because most things will break down at some point in the future, whether they are derived from nature, like a banana skin, or made from chemicals – even some conventional plastics will eventually break down in to smaller, sometimes toxic, components. The term biodegradable can be misleading as it does not refer to how long the material will break down and biodegradable materials are not necessarily compostable.

Bio-sourced - a biological source of some material. This material is intentionally made from substances derived from living (or once-living) organisms. This is differentiated from fossil-based plastic, which is also derived from once-living organisms. These can still be defined as plastic and can still have the same characteristics, including long life spans and lack of degradability.

Compostable Plastics are a subset of biodegradable plastics that should be certified to break down completely into non-toxic components (water, carbon dioxide, and biomass) given the right conditions. Those conditions are unlikely to be met in the UK climate. The time it takes for something to break down depends largely on the product itself and the composting conditions. However, no home composting standard exists for the UK (only industrial composting as below).

Industrially Compostable - terminology often applied to polylactic acid (PLA) type bio-based plastics which are compostable in industrial facilities. This material requires temperatures of between 55 to 70 degrees Celsius to enable microbes to degrade the biopolymer plastic, at which point it breaks down to water, biomass (carbon) and gasses. In order for these materials to break down, they must be processed in Industrial Composters, not Anaerobic Digestion (AD) plants. PLA is often a more expensive material than other plastics. PLA manufacture may result in slightly increased CO_2 emissions compared to plastics derived from the distillation and polymerization of non-renewable petroleum. Although in the case of tree shelters this is generally offset within the first few years of tree growth[32].

The seedling logo, an international certification and symbol, exists and clearly identifies certified industrial compostable degradable "plastics." The seedling logo is a symbol that the product's claims of biodegradability and compostability have been verified[33].

PLA tree shelters still require recovery and collection from site once the trees are established. Responses to Defra's call for evidence highlighted that even when compostable plastics are sent to Industrial Composters, these materials are often stripped out at the start of the process and sent to landfill or incineration, as they are unable to distinguish between conventional and compostable plastics.

Oxo-degradable and Oxo-biodegradable refer to plastics containing pro-degradant agents that aid the biodegradation process. Currently such technologies are unproven and are considered likely to be a source of microplastic pollution. Subject to further evidence and public consultation, Defra is considering introducing a ban on oxo-degradable plastics.

Open and Closed Loop recycling - open-loop recycling is a recycling process that postpones disposal, through converting manufactured goods into both new raw materials (which can be used as production inputs) and products. Closed-loop recycling is a recycling process through which manufactured products or packaging is recycled back into itself, or a similar product, without significant degradation or wastage.

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Forest Plastics
Working Group

Mar Lodge, Cairngorm.
The level of regeneration seen was achieved by a twenty year commitment to intensive deer culling over a wide area.

REDUCING THE USE OF PLASTIC IN WOODLAND AND AMENITY PLANTING has been produced for informational purposes on behalf of the Forest Plastics Working Group; it does not represent the position of any single organisation.

The Forest Plastics Working Group includes a broad range of sector representatives and the group's aims are to:

- advocate and facilitate good practice around use of plastic in woodland and amenity planting and waste compliance;
- research and share information on plastic packaging and tree shelter alternatives to ensure adverse environmental impacts are reduced, and balanced sustainable solutions found; and
- promote the environmental benefits that result from forestry and woodland management.

The group is supported by the FIEG (the Forest Industry Environment Group), Yorkshire Dales Millennium Trust and the Confederation of Forest Industries (Confor).

Membership of the Group at time of publication included: Woodland Trust; National Trust; Yorkshire Dales Millennium Trust; Yorkshire Dales National Park (on behalf of the National Parks); Coillte Ireland; Natural Resources Wales; Forestry and Land Scotland; Scottish Forestry; Defra; Confor; Forest Research; Cheviot Trees Limited; Tilhill Forestry; Scottish Woodlands; Forestry England; Forestry Commission; the Chartered Institution of Wastes Management; Heart of England Forest, and the Community Forest Trust.