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Railway Sustainability Guidance Note

Woodland Design and Management Guidance Note

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Issue record

Issue	Date	Comments
0.1	June 2021	First release in advance of online edition

Reference documentation

NR/L2/ENV/122	Managing Biodiversity
NR/L2/ENV/122/01	Biodiversity
NR/L2/ENV/122/02	Habitat Management Plan
NR/L2/OTK/5201/01	Lineside vegetation inspection and risk assessment
NR/L2/OTK/5201/02	Lineside Vegetation Management Requirements
NR/L2/OTK/5201/03	Route Vegetation Management Plans
NR/L3/OTK6202	Protecting railway assets during vegetation work

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Contents

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1 Purpose

The lineside includes a range of woodland habitat types. Effective woodland management will contribute to safe and efficient rail operation and an increase in the natural-capital value of the lineside. This note provides guidance on:

a) Best practice woodland habitat management operations for Regional, Route and Central teams showcasing what good woodland habitat and biodiversity management looks like;

b) Why woodland management decisions are made in certain situations including important considerations and implications;

c) Risks reduced by the application of this guidance note including, delays and unplanned costs from unforeseen/inadequately considered arboricultural and lineside constraints;

d) Benefits of the application of this guidance note including, enhanced biodiversity of the lineside, increased stakeholder confidence and improved relations relating to national biodiversity goals and, the use of green infrastructure solutions to improve resilience of the woodland lineside; and

e) Associated legislation and control documents that this document helps to achieve compliance with.

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2 Scope

This guidance note applies to Network Rail, their supply chain and third parties working on Network Rail owned land. It shows how woodland within the lineside can be managed, supported by templates; habitat specifications; identification; aids; toolbox talks; and case studies.

The guidance note complies with and supports the following documents:

a) Protecting railway assets during vegetation work (NR/L3/OTK/6202);

b) Biodiversity (NR/L2/ENV/122);

c) Lineside Vegetation Management Standards (NR/L2/OTK/5201); and

d) Habitat Design and Management Guidance Note.

NOTE: *Additional guidance notes providing more detailed habitat specific management guidance on other habitat types will succeed this note.*

This guidance note informs:

a) The production of habitat management plans; and

NOTE: *Habitat management plans are described in NR/L2/ENV/122 Module 02*

b) The production of route vegetation management plans and sectional asset plans.

NOTE: *Route vegetation management plans and sectional asset plans are described in NR/L2/OTK/5201 Module 03.*

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3 Definitions

Table 1 – Terms and definitions

Term	Definition
Ancient woodland	A wooded area that has persisted since 1600 in England and Wales, and since 1750 in Scotland.
Ancient Semi-Natural Woodland	Ancient woodland composed of mainly locally native trees and shrubs that derive from natural seed fall or coppice rather than from planting.
Beat(ing) up	The beat-up process involves checking on the establishment of young plants and replacing those that have died or failed to thrive.
Biodiversity	Biodiversity is the variety and variability among all forms of life, including terrestrial, marine, and other aquatic ecosystems and the ecological complexes of which they are part.
Biofuels	A renewable energy source made from organic matter or wastes.
Biosecurity	Procedures or measures designed to protect a population against harmful biological or biochemical substances.
Bog woodland	Coniferous or broadleaved woodland situated on humid to wet peaty substrate with water levels permanently high and even higher than the surrounding water table.
Browsing and grazing	A browser is a type of herbivore which eats leaves, soft shoots, fruits of high-growing plants and shrubs. A grazer feeds on grass or other low vegetation.
Clear-felling	This is the practice of cutting down and removing every tree from an area.
Canopy layer	The upper layer of woodland that is formed by the crowns of mature trees.
Colonisation	Natural regeneration of plants on previously unwooded sites.

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Term	Definition
Continuous cover	An approach to woodland management that seeks to create more diverse woodland, both structurally and in terms of species composition by avoiding clear-felling.
Coppice	An area of woodland in which the trees or shrubs are periodically cut back to above ground level to stimulate re-growth and provide wood products.
Coppicing	Coppicing is the practice of cutting back a tree or shrub to above ground level periodically. This practice stimulates re-growth.
Coppice with standards	A traditional system of woodland management whereby timber trees are allowed to grow to maturity above a coppiced understorey.
Coupe	An area of woodland that has been clear-felled or is planned for clear-felling.
Deciduous	A tree or shrub that sheds its leaves annually.
Edge habitats	Edge habitats are the spaces between two different types of habitat. For example, the boundary between a woodland and grassland habitat is an edge habitat.
Even-aged trees or woodland	A stand of trees made up of trees of approximately the same age.
Field layer	The field layer is the herb and small shrub layer of a woodland.
Flushes	Flushes are areas where water from underground flows out onto the surface to create an area of saturated ground.
Glades	An open space in a woodland.
Green Infrastructure	A network of multi-functional green space, urban and rural, which is capable of delivering a wide range of environmental and quality of life benefits for local communities
Ground layer	The ground layer is the lowest layer of a plant community. This layer can comprise of mosses, lichens, and fungi, together with low-growing herb species.

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Term	Definition
Habitat condition	The ecological condition of a particular habitat parcel. Condition relates to the standard of a habitat parcel relative to other parcels of that particular habitat type. Habitat condition relates to Natural England's Biodiversity Metric 2.0's habitat condition scores which range from 'Poor' to 'Good' (Natural England, 2019a and 2019b). Woodland habitats will vary in their ecological condition. Factors that affect the condition of a habitat include human disturbance, damage by livestock and presence of invasive non-native species (INNS).
Habitat value	A habitat's value is its relative importance in sustaining socially or ecologically significant wildlife populations and biological diversity.
Hibernacula	The winter shelter of a hibernating animal.
INNS	Invasive non-native species (INNS). Species which have been introduced into areas outside their natural range through human actions and are posing a threat to native wildlife.
Lineside	The extensive area of land that falls within the ownership boundary.
Monolith	A tree reduced to its main stem (i.e. without branches), sometimes a partially retained dead or dying tree in appropriate contexts.
Natural capital	The world's stocks of natural assets. These include geology, soil, air, water and all living things. From this natural capital, people derive a wide range of services, (ecosystem services) such as food production.
Natural regeneration	Natural regeneration is the process by which woodlands are restocked by trees that develop from seeds that fall or are dispersed by wind or animals and germinate *in situ*.
Nesting bird season	Generally considered to be 1st February until the end of August.

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Term	Definition
Nursery	A place where plants are grown for transplanting, for use as stock for budding and grafting, or for sale. Commercial nurseries produce and distribute woody and herbaceous plants, including ornamental trees, shrubs, and bulb crops.
Pollarding	The practice of cutting off the top and branches of a tree. This practice helps encourage new growth at the top of the tree.
Resilience	The ability of a social or ecological system to absorb disturbances while retaining the same basic structure and ways of functioning, the capacity for self-organisation, and the capacity to adapt to stress and change.
Restocking	Replacing felled areas by sowing seed, planting, or allowing or facilitating natural regeneration.
Ride(s)	A linear path designed for woodland access. A ride can have several zones including a central track or pathway, grassland areas either side and/or shrubs and bramble thicket grading into the taller woodland trees.
Riparian	Plant community associated with the banks of a watercourse.
Root-jacking	Rock instability caused by tree growth within cracks, joints or defects of a rock mass.
Rotations	The period required to establish and grow trees to a specified size, product, or condition of maturity.
Scalloped edges/Scallops	Scalloped edges (i.e. 'D' shapes) are used to create a varied, zoned woodland edge structure to improve butterfly habitats and increase the overall structural diversity of the woodland.
Self-sown	A plant sown by itself, typically from seeds dispersed from a neighbouring plant.
Semi-natural	Habitats that have been heavily modified by human activities. Most of the UK's naturally occurring habitats are regarded as semi-natural.

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Term	Definition
Silviculture	The practice of growing cultivating trees.
SSSI	Site of Special Scientific Interest.
Stand	A patch of woodland which is uniform in its vegetation structure and tree species.
Thinning	The practice of reducing the density of trees in a stand. This can improve the quality and growth of the remaining trees.
Tree guard	A type of plastic shelter used to nurture trees in the early stages of their growth.
Understory	The vegetative layer of trees and shrubs between the woodland canopy and the ground layer.
Uneven-aged trees or woodland	A group of trees that vary significantly in age.
Urban setting	Belonging to/relating to a town or city.
Veteran tree	A tree which, because of its great age, size or condition, is of exceptional cultural, landscape or nature conservation value.
Wayleaves	A right of way granted by a landowner, generally in exchange for payment and typically for purposes such as the erection of telegraph wires or laying of pipes.
Woodland diversity	A woodland can be diverse both structurally and in terms of species.

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4 Introduction

This document provides guidance on the following:

1. Woodland classification – how to classify woodland into one of three woodland sub-types to help understand the existing woodland and apply relevant best practice woodland establishment and management guidance;
2. Woodland habitat and design – guidance on how to design new woodland within the lineside and key considerations for implementation, this includes species selection, plant procurement and planting density;
3. Woodland establishment – guidance and key considerations on how to successfully establish new woodland in the lineside to maximise its biodiversity and the ecosystem services it supports;
4. Long-term management of woodland habitat – guidance, key considerations and best practice management techniques to enhance established woodland, such as thinning, coppicing and clear felling; and
5. Woodland restoration – guidance on restoring neglected woodland and the associated lineside benefits including best practice techniques for restocking woodland through replanting or natural regeneration.

Figure 1 – Woodland design and management guidance process

Case studies are included in section 7 to illustrate examples of best practice in the delivery of preferred habitat objectives.

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4.1 Document structure

Figure 2 shows the relationship hierarchy of the Woodland Design and Management Guidance Note and other Level 2 and Level 3 Network Rail guidance notes, manuals and modules.

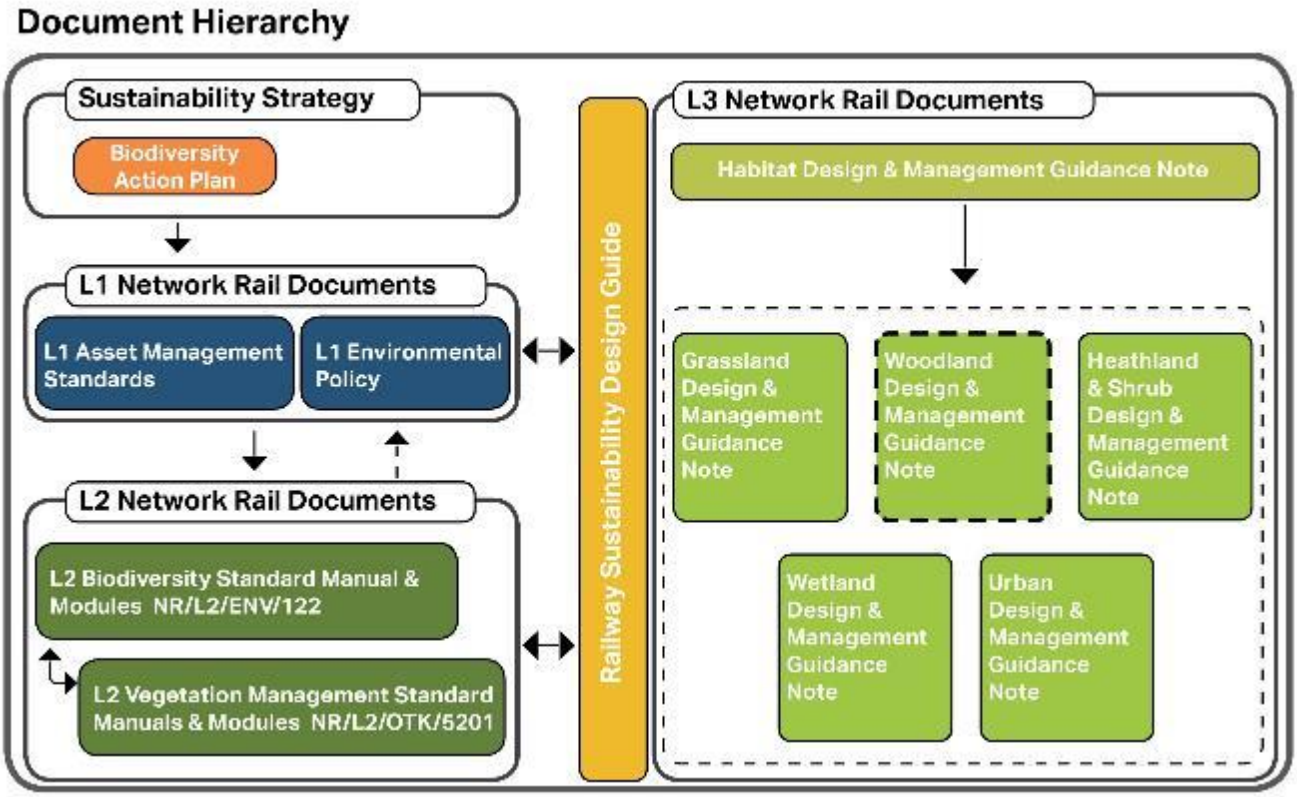

Figure 2 – Document hierarchy

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5 Woodland classification

5.1 Introduction

Network Rail has adopted the UK Habitat Classification to describe the habitats within the lineside. These are set out and described in the Habitat Design and Management Guidance Note, which defines five primary habitat types (UK Habitat Classification Level 2) according to which all land within the lineside should be classified:

- Grassland;
- Woodland;
- Heathland and Shrub;
- Wetland; and
- Urban.

***NOTE**: UK Habitat Classification documents are available at:*
https://ecountability.co.uk/ukhabworkinggroup-ukhab/

5.2 Woodland (UK Habitat classification code - W)

5.2.1 Definition

Woodland is defined as vegetation dominated by trees at least 5m high when mature, forming a distinct canopy covering at least 25% of the total woodland area. Woodland includes recently planted, semi-natural or planted woodland, recently felled woodland, coppice-with-standards, lines of trees, wet woodland and bog woodland.

Figure 3 – Typical woodland found adjacent to the railway

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5.2.2 Attributes

- Tree canopy covers at least 25% of the woodland habitat's total coverage.
- Can be managed in a variety of ways, including coppicing, pollarding and thinning.
- Plantation is woodland which has been obviously planted, whereas semi-natural woodland occurs naturally with some man-made influence.
- Semi-natural coniferous woodland typically only occurs in the highlands, but conifer plantations are frequently planted in the lowlands for commercial forestry.

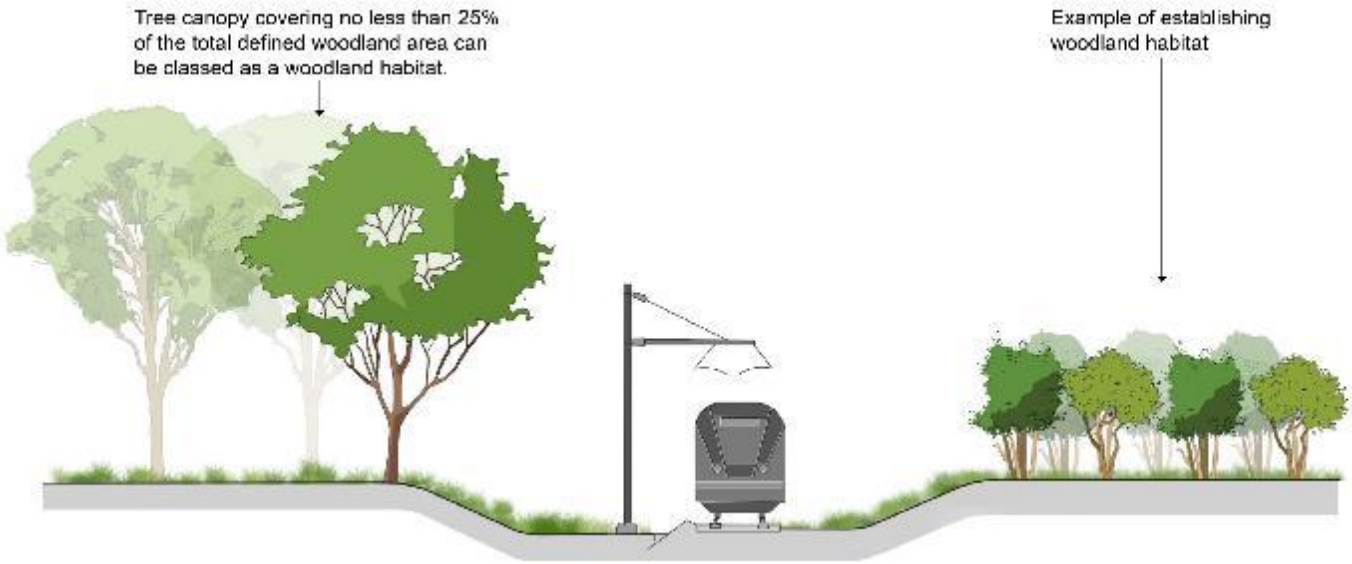

Figure 4 – Examples of typical lineside woodland communities

5.2.3 Classifying woodland habitats

The type of woodland can influence the application of appropriate best practice guidance for woodland design and management.

The following information should be used to further classify the woodland habitat into sub- types. They are defined by the dominant tree species within them (UK Habitat Classification, 2018):

- **W1: Broadleaved, mixed and yew woodland (Level 3)** is characterised by trees of both native and non-native broadleaved tree species which can also contain evergreen yew;

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- **W1h: Other woodland; mixed (Level 4)** is characterised by a mixture of broadleaved and coniferous trees in which neither make up more than 80% of tree cover; and

- **W2: Coniferous woodland (Level 3)** is characterised by trees of either or both native and non-native coniferous trees species (with the exception of yew species).

It is important to check whether existing woodland is designated as Ancient Woodland, as this is likely to have a strong influence on the management objective. This should be recorded as part of the habitat study.

Ancient woodland is irreplaceable habitat which is defined by a range of valuable and unique attributes. Ancient woodland less than 2 hectares is not typically recorded on the designation data set therefore an ecological assessment should be undertaken to determine this within the woodland.

NOTE: *An initial review of ancient woodland datasets, such as those hosted on magic.gov.uk can be used to confirm the presence of (or connectivity of lineside woodland to) these areas prior to compiling the specification for woodland design and management.*

NOTE: *The Woodland Trust Planners' Manual for Ancient Woodland and Veteran Trees (2019) provides further guidance on management considerations in an ancient woodland setting. (https://www.woodlandtrust.org.uk/media/3731/planners-manual-for-ancient-woodland.pdf).*

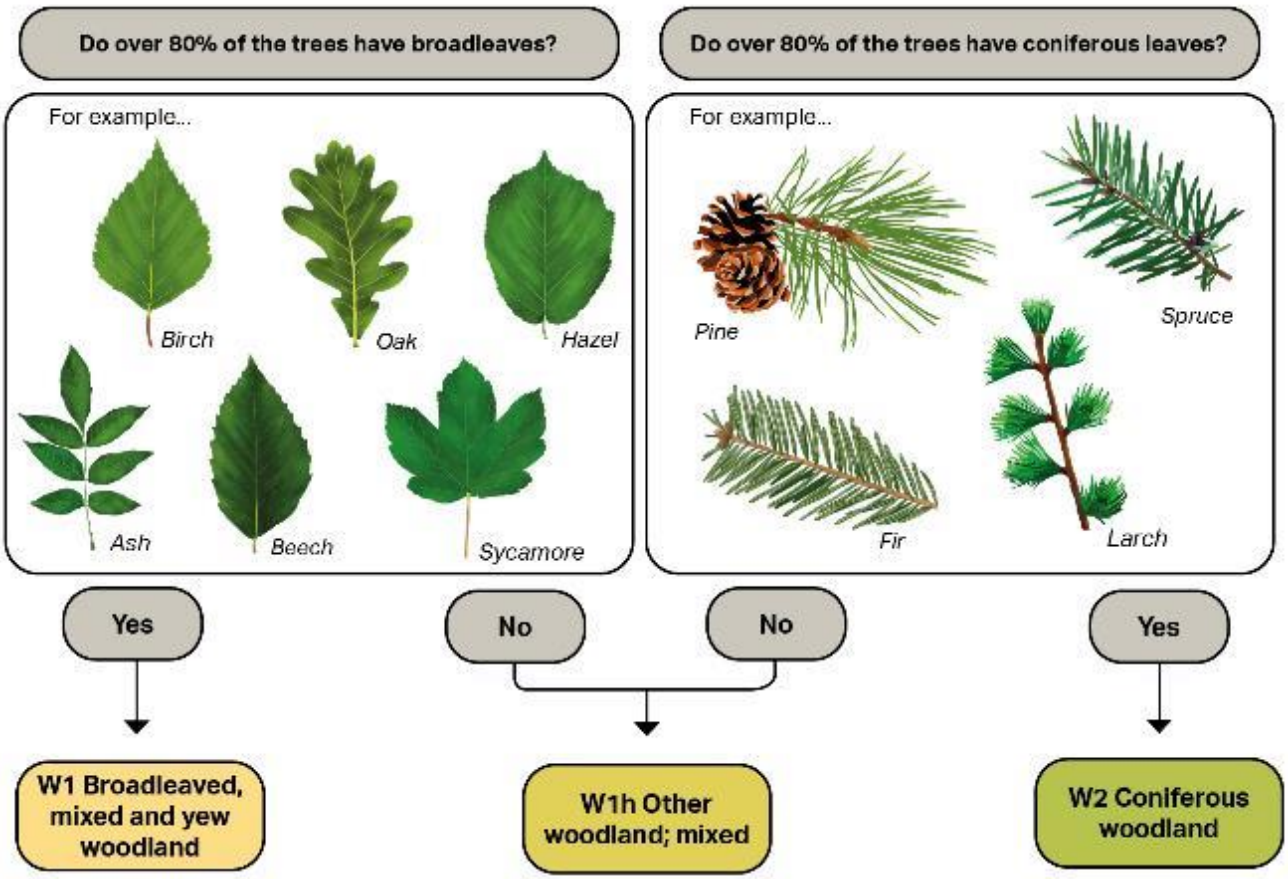

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Figure 5 – Visual aid to determine the woodland habitat sub-type

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5.3 W1 Broadleaved, mixed and yew woodland

Broadleaved trees are characterised by:

- Leaves which vary in shape between species; and
- Being mostly deciduous.

Broadleaved, mixed and yew woodland:

- Comprises all woodland containing more than 80% of broadleaf trees (and/or yew);
- Has less than 20% coniferous species of trees whether natural or planted, including native and non-native species;
- Is dominated by trees over 5m in height when mature; and
- Has a range of ground, field and understorey layers that may range from being well-developed to completely absent (UK Habitat Classification, 2018).

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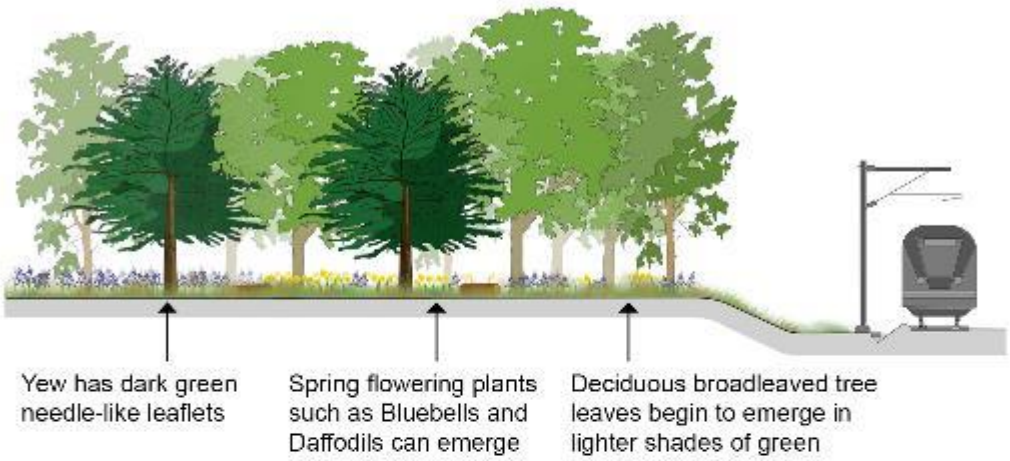
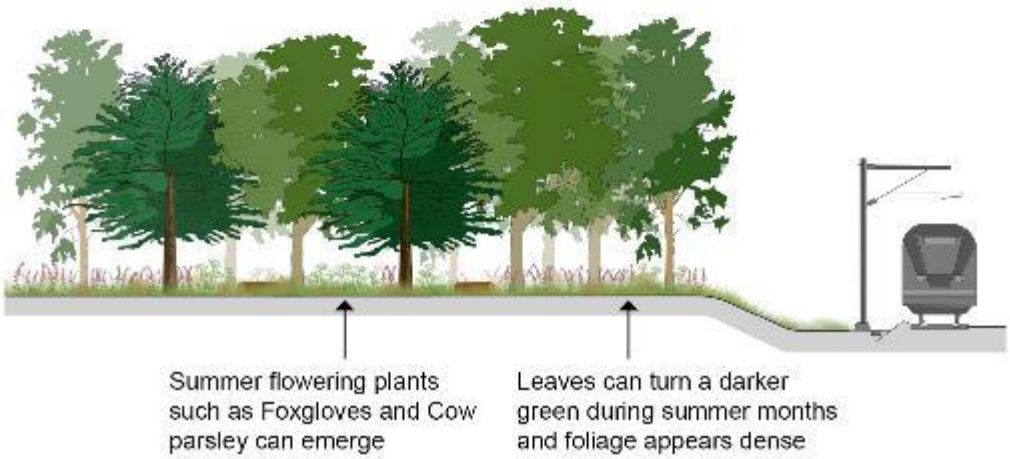
W1 Spring



W1 Summer



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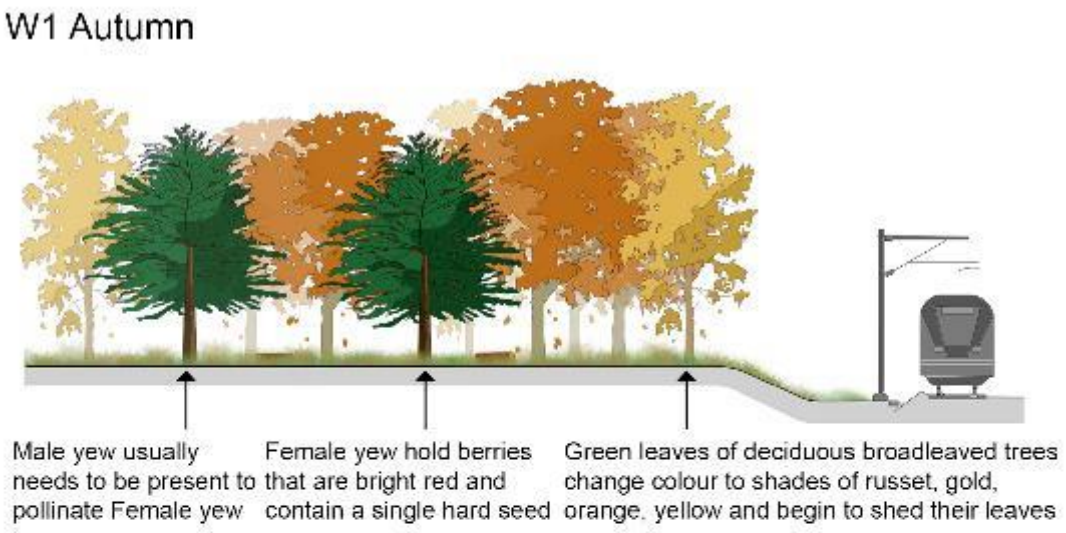

Figure 6 – Broadleaved, mixed and yew woodland throughout seasonal periods

5.4 W1h Other woodland; mixed

Other woodland; mixed is characterised by:

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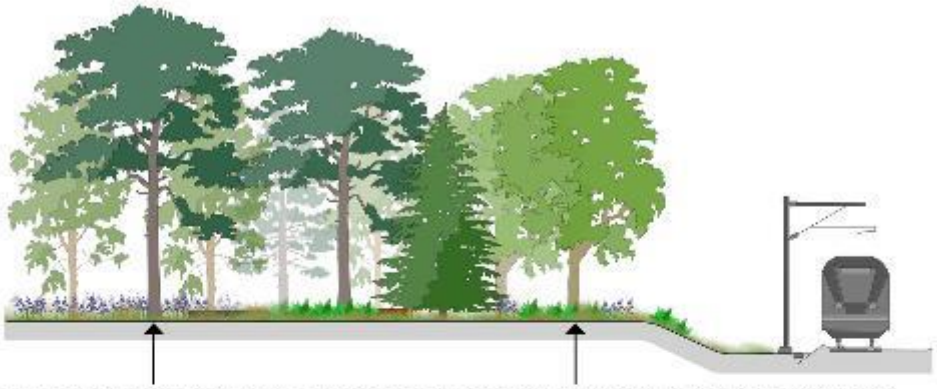
- A mixture of broadleaved and coniferous trees;
- Woodland in which neither broadleaved or coniferous trees make up 80% of the total woodland coverage; and
- Is likely to include woodland that is self-sown and/or recently established in either urban or rural situations.

W1h Spring



Mixed woodland will have a balanced population of broadleaved and coniferous tree species. Coniferous trees will have needles whilst broadleaved trees will generally have wide flat leaves.

W1h Summer

Mixed woodland with a sufficient volume of light at the field layers should typically encourage a rich and diverse range of plant species.

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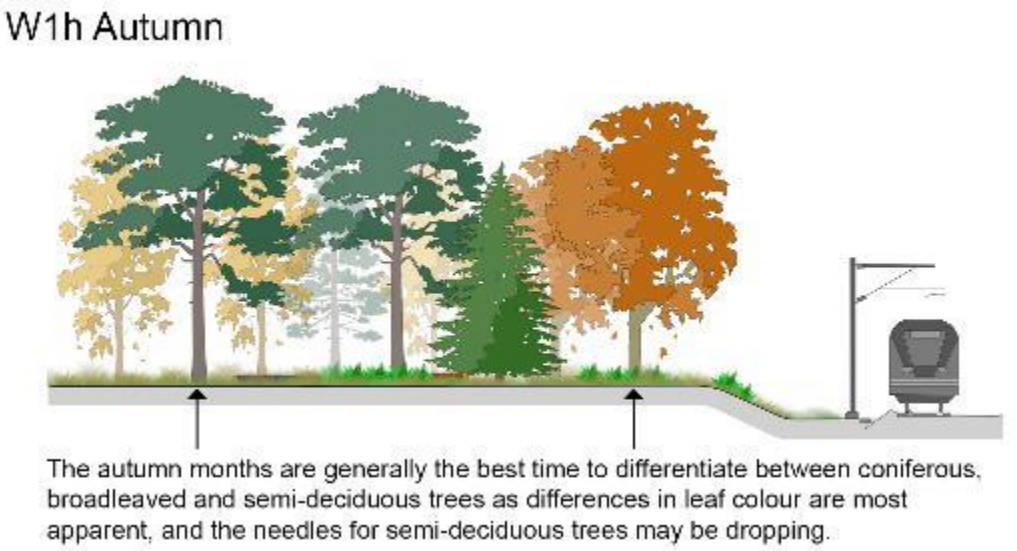

Figure 7 – Mixed woodland habitat sub-type throughout seasonal periods

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5.5 W2 Coniferous woodland

Coniferous woodland typically colonises acid soil types (Scottish National Heritage, 2018) and is characterised by:

- Mostly evergreen trees (except for deciduous species such as larch) with needles instead of leaves; and
- Fruiting bodies which are cones and which range in shape and size.

Coniferous woodland:

- Comprises all woodland containing more than 80% native and/or non-native coniferous trees (except for yew);
- Has less than 20% broadleaf species of trees whether natural or planted, including native and non-native species;
- Is dominated by trees over 5m in height when mature; and
- Has a range of ground, field and understorey layers that may range from being well-developed to completely absent (UK Habitat Classification, 2018).

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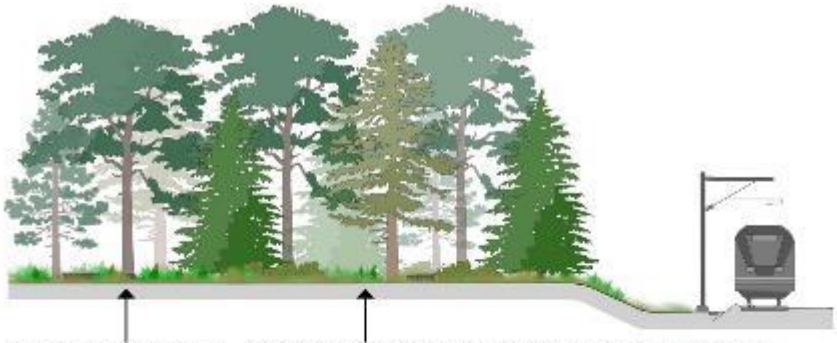
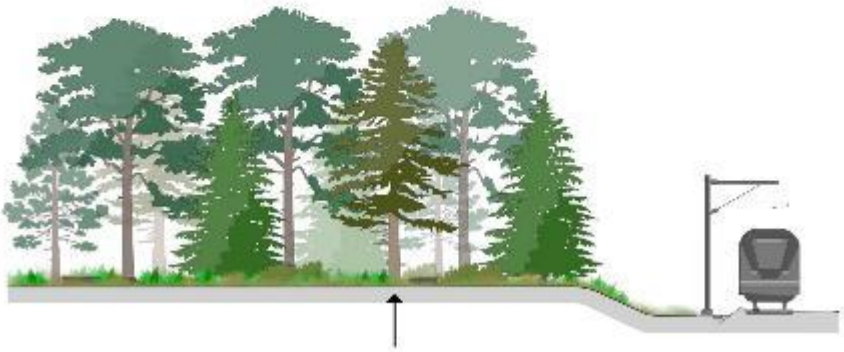
W2 Spring



Coniferous woodland trees appear similar throughout the seasons.

Plant species which require a high amount of light to produce flowers will be excluded from darker coniferous woodlands. The lower field and ground layers may therefore be less diverse than broadleaved or mixed woodland.

W2 Summer



The underlying structure in a coniferous woodland depends on the type of conifer making up the woodland. For example, more light reaches the ground underneath semi-deciduous larch; which has a sparser canopy with more light availability as it seasonally sheds its needles.

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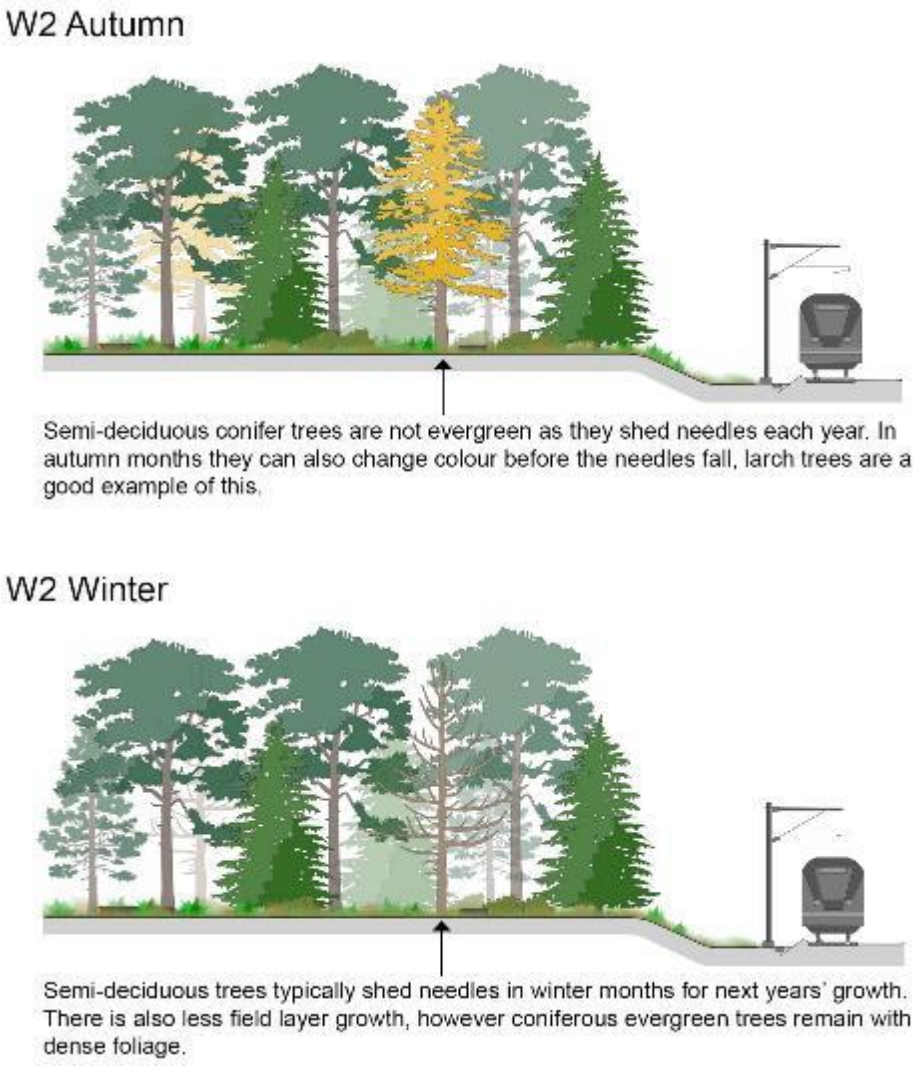

Figure 8 – Coniferous woodland habitat sub-type throughout seasonal periods

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6 Woodland Habitat Design and Management

6.1 Introduction

This section provides guidance on:

- General considerations related to the design and management of woodland;
- The design of new woodland habitat;
- Maintenance required to establish new woodland habitat; and
- Management of established woodland habitat.

Each section includes practical guidance and makes reference to tables in Appendix A to understand the budget costs of carrying out work.

Specialist advice can be sought as necessary to inform decision making and implementation. Typically, this may involve the following:

- Ecological advice where protected habitats or species are identified;
- Arboricultural or forestry advice where tree or woodland management advice is required; and
- Landscape advice where planting design, implementation and management advice is needed.

6.2 General

Good woodland management conserves biodiversity features that are already present, or, alters the woodland over time to enhance its biodiversity value.

Continuous cover is considered the best approach to woodland management within the lineside. This approach seeks to:

- Maintain woodland cover;
- Increase structural and species diversity; and
- Avoid clear-felling wherever possible.

It is important to proactively liaise with owners of adjacent woodland outside of the lineside to ensure objectives are aligned.

6.3 Ecosystem services and design considerations – Woodland

As outlined in the Habitat Design and Management Guidance Note, an initial site appraisal can help identify ecosystem services present and the potential to expand the range provided by the lineside. This will help inform decisions as to how the woodland is designed or managed.

Woodland within the lineside can provide a range of ecosystem services. These include:

- **Biodiversity**: woodland habitat supports a wide range of biodiversity which provides further ecosystem services such as pollination and habitat connectivity;

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- **Water regulation**: vegetation can reduce the rate at which water meets waterbodies and watercourses; reducing the occurrence of flash flooding downstream;
- **Air pollution:** removal and carbon sequestration of trees provide benefits including improved health and protection against climate change;
- **Local temperature regulation**: trees have shown to reduce the urban heat island (UHI) effect and lower local temperatures; providing further protection against climate change;
- **Landscape integration**: woodland can improve lineside aesthetics and integrate the landscape with the wider setting;
- **Noise mitigation**: linear woodland screening can be planted and managed as a noise barrier between the track and the neighbouring community, limiting noise disturbance; and
- **Timber production**: the production of timber can provide benefits such as building materials and paper. Felled timber can also be a suitable habitat for various species of invertebrates, reptiles, *amphibians* and small mammals. Management methods such as thinning and selective felling can contribute to these ecosystem services.

NOTE: *Ecosystem services of the land should be identified when fieldwork is undertaken. This should be determined by an environmental specialist, using professional judgement. Refer to the Habitat Design and Management Guidance Note for more information on ecosystem services.*

In addition to ecosystem services, there are other lineside specific design considerations and benefits which will help to inform whether woodland is an appropriate habitat within a specific location.

Table 2 – Key considerations for woodland in a railway setting

Design consideration	Key woodland design considerations factors	Associated woodland management approaches
Seasonal flooding	• Riparian woodland in upstream water catchments can help to reduce flooding (Defra, 2008). • Riparian woodland can include species tolerant of seasonal flooding, such as willow, birch and alder species. • Deadwood can slow flood flow by reducing downstream siltation (UKFS, 2017).	• Phase felling operations to minimise the risk of flood flow. • Keep streams clear of arisings and avoid felling into watercourses. • Encourage riparian woodland along small watercourses to provide leaf litter and woody debris.

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Design consideration	Key woodland design considerations factors	Associated woodland management approaches
Embankment and cutting stability	• Woodland can reduce the risk of landslips and soil erosion. • Soil protection can be enhanced by shrubs and trees with a diverse range of root systems. Roots can help to bind loose material on slopes but can lead to 'root jacking' and rockfall hazards on exposed cuttings. • Following tree removal, roots can continue to have a positive influence on soil structure. Succession can be planned through natural regeneration or staged planting (Humphreys et al, 2015).	• Careful management can reduce windthrow risk and promote soil stability. • Establishing trees and shrubs on embankments before felling tall trees at a medium-term stage (Humphreys et al., 2015). • Not removing trees from the bottom third of slope settings unless Network Rail standards state necessary.
Shading, visual screening and high leaf fall areas	• Shading from tall trees can reduce line buckling in high temperatures. However, broadleaf trees can result in excessive leaf fall, which can impact braking. • The value of trees to neighbouring residents (e.g. screening views and reducing the perception of noise), or a statutory designation (such as a TPO), should be considered. • Good woodland management approaches can achieve a balance of needs through phasing felling and replanting.	• Applying phased removal of taller/dominant trees through thinning regimes over the 20-year management period. • Liaising with local authority Tree Officers to explore solutions to tree related issues. • Phasing planting of resilient species to provide continuous screening and amenity value to neighbouring residents. • Introducing tree and shrub species at railway edges such as small bramble thickets, holly or trees with needle-like foliage to capture leaf fall.

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Design consideration	Key woodland design considerations factors	Associated woodland management approaches
Fire risk reduction measures	• Lineside vegetation in the urban lineside can be a 'high risk habitat' due to increased occurrences of arson (Forestry Commission, 2014).	• Consider species selection and location and their associated fire risk in the design phase. Refer to the Forestry Commission Practice Guide on '*Building wildfire resilience into forest management planning'*.
Access routes for establishment and maintenance	• Woodland habitat may need to be accessed via routes on third party land for planting and maintenance. • Open rides can improve access.	• Refer to the Forestry Commission Practice guide (2010) "Managing ancient and native woodland in England" for advice on improving and restricting woodland access. • Local stakeholder engagement is key to gaining access to third party land. Landowner permissions should be sought prior to woodland creation. Refer to the Stakeholder Engagement Guidance Note. • Refer to the Habitat Design and Management Guidance Note, section 6.3.4.

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6.4 Habitat management plans

Network Rail's requirements for Habitat Management Plans are set out in NR/L2/ENV/122 Module 02.

The process of setting objectives for the habitat management plan is described in the Habitat Design and Management Guidance Note.

It is recommended that the Habitat Management Plan sets out short, medium and long-term objectives for woodland as follows (UKWAS, 2020):

- *Short-term* (year 0 to 5);
- *Medium-term* (year 5 to 20); and
- *Long-term* (year 20+).

The habitat management plan objectives (e.g. planned felling and regeneration over the following 20-year period) should be set out, agreed and signed off before any works commence.

The habitat management plan will typically:

- Define the woodland (or woodland coupe) to be created or managed by size, boundary, type and name or reference;
- Recognise connections with neighbouring woodland within the lineside or under separate ownership; and
- Appraise the structural composition and species present or desired to achieve an appropriate and diverse mosaic of habitats.

6.5 License requirements

6.5.1 Designated sites

Works to trees situated within Sites of Special Scientific Interest (SSSI) are protected under the Wildlife and Countryside Act (1981), and as such assent may be required to proceed with works that would harm the SSSI.

Works to trees situated within *Special Protection Areas (*SPA*), Special Areas of Conservation (*SAC*) and designed* Ramsar *sites* may also need assessment under the UK habitat regulations before proceeding with works

6.5.2 Protected species

Many species of plant and animal are protected under UK and European law. Those most associated with woodland include native bluebells, wild birds (and their nests and eggs), bats, badger, hazel dormouse, great crested newt, pine marten and red squirrel.

6.5.3 Protected species licenses

Where protected species may be at risk protected species licences may be required. A professional ecologist can advise on license requirements and appropriate

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mitigation. This will include consulting the following relevant government bodies prior to the implementation of woodland creation or management activities:

- Natural England: https://www.gov.uk/guidance/wildlife-licences
- Scottish Natural Heritage: https://www.nature.scot/professional-advice/safeguarding-protected-areas-and-species/licensing
- Natural Resources Wales: https://naturalresources.wales/permits-and-permissions/species-licensing/?lang=en

6.5.4 Other consents

Network Rail has certain exceptions to requirements to apply for consent for tree works on operational land.

However, it is important be aware of any statutory designations applicable to the woodland and liaise with relevant authorities as appropriate. These can include:

- The presence of any individual or group of trees subject to Tree Preservation Orders (TPOs); or
- Trees within Conservation Areas.

A felling license may be required from the Forestry Commission to remove trees where legal and/or statutory undertakings do not qualify. Specialist advice should be sought where relevant.

NOTE: *Budget costs of works to TPO protected trees are addressed in Table 1 of Appendix A.*

6.6 Biosecurity

Biosecurity refers to a set of precautions that aim to prevent the introduction and spread of harmful organisms. With respect to woodland, this can include invasive non-native species (INNS), pests and disease-causing bacteria and fungi.

By implementing proactive biosecurity measures, the risk of introducing or spreading tree pests and diseases can be reduced.

This can be achieved by:

- Referring to government guidance on the requirements for plant passports, quarantining affected planting stock, removing diseased vegetation and reporting on suspected pest and disease attacks (Defra, 2020);
- Proactively planning, monitoring and reporting concerns to identify issues through the UK Plant Health Information Portal and Forest Research; and
- Establishing biosecurity protocols on site, for example regular cleaning of equipment with disinfectant.

NOTE: *Anticipated costs of INNS management are addressed in Table 11 of Appendix A.*

NOTE: *Anticipated costs of disease management are addressed in Table 12 of Appendix A.*

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Figure 9 – An example of a woodland INNS problem is *Phytophthora*-infected *Rhododendron ponticum*

Figure 10 - *Rhododendron ponticum* in flower

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6.7 Woodland Habitat and Design

This section provides advice on the design of new woodland within the lineside and key considerations for implementation.

Good woodland design should seek to achieve the following:

- A 50% established tree cover within a 20-year period of its creation;
- Planned areas of open ground (e.g. glades or rides);
- Graded, informal edge habitats; and
- Having species, age and wildlife diversity.

NOTE: *Open, scrub and woodland edge habitats provide a range of habitats such as grassland, shrubs, open and stunted woodland.*

NOTE: *The value of woodland habitats is greatly increased if they are linked together and managed as part of a network.*

NOTE: *Establishing new woodland on soils with peat exceeding 50 cm in depth (and on sites that would compromise the hydrology of adjacent bog or wetland habitats) should be avoided (Forestry Commission, 2017).*

NOTE: *Anticipated costs of woodland creation are addressed in Table 2 of Appendix A.*

6.7.1 Site selection for woodland creation

The suitability of a site for woodland habitat creation should be assessed through habitat studies and site appraisals as part of the baseline studies. This includes consideration of safety aspects of railway operations, habitat opportunities and constraints. Guidance on the process of recording and analysing this data is found in the Habitat Design and Management Guidance Note.

NOTE: *Refer to NR_L2_OTK_5201 MOD1 Lineside Vegetation Inspection and Risk before undertaking any fieldwork.*

NOTE: *Refer to NR/LN/ENV/122 MOD 01 Biodiversity section 3.3 regarding field surveys.*

NOTE: *Refer to NR/L2/ENV/122 MOD 01 and MOD 02 regarding data gathering, the identification of existing habitats and species (e.g. SSSI) or protected species recorded on site*

The following may indicate a site is suitable for woodland creation:

- Opportunities to connect with existing woodland habitats;
- Contribution of woodland habitat to the biodiversity;
- Low canopy coverage areas on the lineside where future operational requirements which would restrict planting are not anticipated to improve lineside biodiversity;
- Woodland creation after the clearance of pre-existing undesirable species, such as INNS;
- Low wind risk areas;

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- Absence of impractical settings such as narrow lineside areas and steep cutting that do not support tree establishment; and
- Good and safe access for implementation, future management intervention and regimes.

The success of woodland creation is influenced by the type of terrain and soil that is present. Good planting design can make use of areas of flat ground which can support larger tree species.

Steeper terrain can support smaller trees and shrubs and reduce leaf fall risks to the railway line.

NOTE: *For guidance on best practice establishment of small trees and shrubs refer to the Heathland and Shrub Design and Management Guidance Note*

NOTE: *Protected species licences may be required from Natural England, refer to Natural England guidance and the Habitat Design and Management Guidance Note.*

NOTE: *For design considerations for woodland creation in a railway setting refer to section 6.3, Table 2.*

NOTE: *For design options for woodland in high wind risk areas refer to Forestry Commission Practice Guide 'Design techniques for forest management planning'.*

NOTE: *The wider the area of land available for woodland planting, the greater the biodiversity potential through future management. Narrow belts of woodland limit the capacity to incorporate open areas for biodiversity, for example.*

6.7.2 Species selection

Native species will typically make up the larger proportion of a planting mix for woodland within the lineside. This is because the longer a tree species has been present in the British Isles; the wider the range of other species it can support to maximise biodiversity.

NOTE: *Native trees are not always appropriate, specifically in urban environments. Trees should not be felled in urban areas just because they are not native. Refer to the Urban Design and Management guidance note.*

The Ecological Site Classification Decision Support System (ESC-DSS) is a helpful starting point (Forest Research, 2020) in selecting species which are well-suited to the environment of the planting site. ESC-DSS helps woodland managers to:

- Select ecologically suited species to sites;
- Match key site factors with the ecological requirements of different tree species and woodland communities; and
- Work out options for tree species and native woodland communities on individual sites using a grid reference and detailing the soil type.

Current Forest Research guidance stresses the need to create species resilience and adaptability for an unpredictable future climate (Forestry Commission, 2019). A mix of provenances is therefore recommended:

- 1/3 of seed from same local seed source as the site;
- 1/3 of seed from source up to 2º south of the site; and

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- 1/3 of seed from slightly warmer climate sources from 2 to 5° of latitude south of the site.

NOTE: *Refer to Appendix D for the Forestry Commission provenance zones map.*

Tree species with susceptibility to branch failure or high seasonal leaf fall should be avoided in the Action Zone to reduce collision risks and leaf fall risks associated with low railhead adhesion.

NOTE**:** *The Action Zone is defined NR/L2/OTK/5201/02 Lineside Vegetation Management Requirements.*

Species diversity is important as a diverse range of trees can help cope with warmer climates and limit the damage caused by pest and disease outbreaks.

Further advice on selecting appropriate species is contained within the following documents:

- Forest Research: https://www.forestresearch.gov.uk/tools-and-resources/tree-species-and-provenance/;
- Tree Species Selection for Green Infrastructure: A Guide for Specifiers (TDAG, 2019);
- The Right Trees for Changing Climate Database (Forest Research, 2019); and
- The Urban Tree Manual (Forest Research, 2018).

6.7.3 Seed provenance and plant procurement

The success of woodland establishment is influenced by the quality of plants and robust processes for plant procurement.

Seed should be collected in accordance with the Forest Reproductive Material Regulations (Forestry Commission, 2019) and provenance certificates should be provided to demonstrate this.

NOTE**:** *A pro forma provenance certificate is provided in Appendix C.*

Recommendations for the procurement of trees are set out in British Standard 8545: *From the nursery to independence in a landscape setting* (BSI, 2014). It is important that plant stock is checked by a suitably qualified professional at the nursery before lifting, and on arrival at site to ensure it meets the requirements for condition and quality.

Contract growing may be an option for larger contracts where plant requirements are known, and where budgets are established at least a year in advance of planting. JCLI Practice Note 11 provides guidance on this (JCLI, 2014).

6.7.4 Plant specification

The National Plant Specification (NPS) defines criteria for the most commonly specified plant groups. It can provide a useful reference for determining plant sizes, which can inform stocking densities (CSD Hub, 2020).

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For rural areas it is generally recommended to specify one or two-year saplings (1+0) or transplants (1+1) as smaller trees and shrubs tend to establish more quickly.

NOTE: *The height range of saplings/transplants available will depend on the species and growth habit but is likely to be in the range 40-60cm or 60-80cm.*

Plants should typically be specified as bare root stock. It is recommended to also specify the root collar diameter for each species in accordance with the NPS (CSD Hub, 2020).

Larger trees are likely to cost disproportionately more, grow more slowly when first planted, require more aftercare and have a lower survival rate in rural areas. They are not therefore generally recommended as part of a woodland mix. They may be more appropriate in urban settings, where a visual screening function is required and irrigation is provided during establishment.

6.7.5 Planting density and layout

Plants spaced at 2–2.5 metre centres are the most common approach for woodland creation. This typically achieves a planting density of 1,600 to 2,500 plants per hectare.

Consideration should be given to the following:

- Higher planting densities can be used to form a visual screen or to speed up canopy closure. However, long-term management costs may be higher as earlier and more regular thinning is likely to be required;
- Woodland edges that grade into open ground and, where possible, contain mixtures of native trees and shrubs are more beneficial to biodiversity than abrupt edges; and
- Informal, scalloped edges increase biodiversity by, for example, providing opportunities for bird nesting and feeding areas for bats, pollinators and other insects.

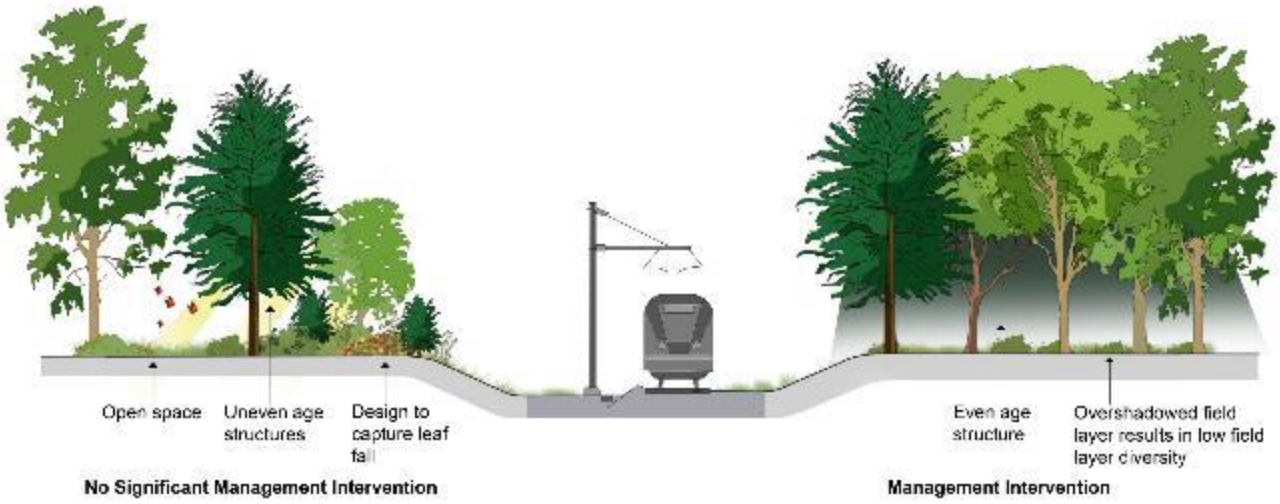

Figure 11 – Factors informing woodland age structure design

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6.7.6 Plant protection

New planting can be liable to significant damage due to grazing or browsing mammals such as deer, rabbits and squirrels, particularly during the establishment stage (Forest Research, 2020).

Visible symptoms of mammal damage to trees typically present as:

- An excessive level of browsing, such as feeding on new buds, shoots and foliage; or
- Bark stripping from main stems or branches (gnawing or rubbing), particularly evident during winter.

Figure 12 – Animal browsing damage

Plants can be protected from damage by:

- Carrying out an assessment of the risk of browsing as part of habitat studies;
- Installing individual biodegradable plant guards;
- Pest control in accordance with best practice;
- Installing exclusion fencing for priority woodland species; or
- Encouraging plants that restrict ground-level grazing animals' access to priority areas where fencing cannot be installed.

The use of mulch mats or loose mulch materials such as bark to supress weeds is not recommended as it is likely to introduce significant ongoing maintenance requirements.

Low-lying plants can be used to discourage excessive grazing of emerging trees. However, large uncontrolled areas of single species such as bracken should be avoided to reduce fire risks, and large uncontrolled areas of bramble can restrict future access for operational requirements.

NOTE: *The installation of exclusion fencing for priority woodland species can be expensive. Anticipated costings of fence installation are identified in Appendix B.*

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NOTE: *Further guidance on plant species less susceptible to deer and rabbit browsing can be found at the Royal Horticultural Society (RHS) official website.*

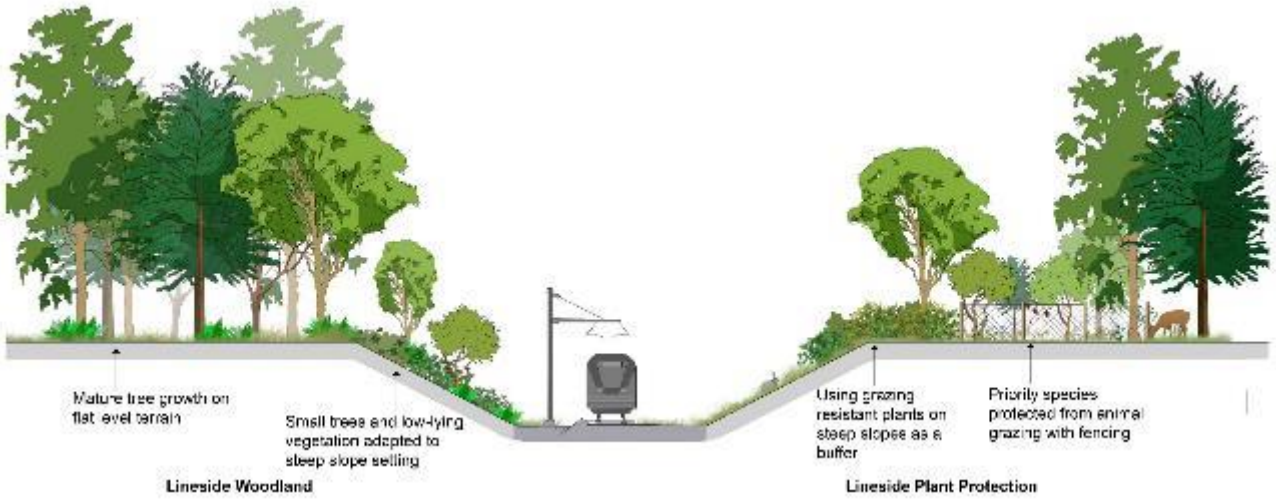

Figure 13 – Examples of plant protection to achieve successful woodland establishment

6.7.7 Planting

The following general principles are key considerations prior to planting new woodland:

- Brambles, weeds or other competing vegetation should be removed from the area prior to planting. This can be achieved through mechanical means and herbicide treatment to kill the roots;
- Compacted ground should be broken up;
- Soil structure should be protected if any machinery is to be used;
- Plants should only be called-off for delivery to site when they are needed to minimise requirements for temporary on-site storage; and
- Bare root saplings and transplants should be delivered in co-extruded polythene bags, clearly marked with the name of the purchaser, the species, quantity, provenance and planting plot to provide full traceability.

The planting of trees and shrubs is best undertaken during winter when plants are dormant (typically November to March, avoiding excessively wet or waterlogged ground, cold frosty weather and cold drying winds).

Planting during the period April to October is not recommended. If it cannot be avoided, it may be possible to mitigate higher losses by using container grown stock and making provision for regular watering.

Natural regeneration can also be used to create new woodland and enhance existing woodland. This should be planned and based on an assessment of desirable species which appear to naturally succeed locally which can reduce the cost of planting. This will typically be pioneer species such as alder, birch, elder, poplar, *sorbus* sp., sycamore and willow. However, this can increase the cost of maintenance as scrub clearance and selective thinning operations may be required.

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NOTE: *'BS 8545:2014 Trees: from nursery to independence in the landscape' (BSI, 2014) provides recommendations of the planting of trees and shrubs.*

6.8 Woodland Establishment

This section provides guidance on how to successfully establish new woodland in the lineside to maximise its biodiversity and the ecosystem services it supports. Best practice suggests the following general principles should be applied:

- Implementing a minimum five-year aftercare programme, which coincides with the recommended defects period for nursery stock;
- Organising toolbox talks for site staff on maintenance protocols, including recording and reporting on suspected cases of pests and diseases.
- Replacing plants that are dead or fail to thrive at the end of each growing season up to the end of the five-year aftercare period (known as the 'beat-up');
- Removing dead or diseased plant material from site to a licensed green waste recycling facility; and
- Consider fire risks of woodland habitats according to woodland sub-type.

NOTE: *The fire risk of woodland varies according to factors including type and location. For example, W1 woodland is a 'low-risk habitat' and young W2 pine woodland is 'high risk'. Lineside vegetation (dependent on time of year and species) in an urban setting is a 'high risk habitat' (see Table 2).*

NOTE: *The routine maintenance schedule for woodland, including when to undertake inspections is set out in Appendix B.*

6.8.1 Maintenance and management

Post-planting maintenance and management is crucial to successful woodland establishment in the first five-year period. Good maintenance practice typically involves:

- Maintaining a 1m diameter circle from the base of each plant that is clear of weeds and grass up to the end of the five-year aftercare period;
- Removing weeds and grass within tree guards;
- Checking and adjusting plant protection, particularly after strong winds;
- Using herbicide control in accordance with best practice guidance.

At the end of the establishment period, plants should exhibit good vigour and not require support for stability.

NOTE: *The Forest Research 'Herbicide Advisor' provides a suitability index for each herbicide as well as further details on crop sensitivity to overall sprays and secondary weed susceptibility.*

NOTE: *Watering and/or irrigating newly planted trees particularly in peak summer periods may require consideration.*

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6.8.2 Inspections

Planting should be inspected at least quarterly by a suitably qualified professional to monitor the success of establishment against the specification. These inspections are important to:

- Ensure the management plan objectives are being met;
- Report on plant vitality and failures and inform and instruct the 'beat-up' process;
- Remove tree stakes, commonly after a two-year period;
- Remove tree guards before they split or disintegrate (usually after 5-10 years);
- Assess the health of woodland and identify actions to address biosecurity issues; and
- Report on the condition and effectiveness of plant protection and any remedial action required.

NOTE: *Suitably qualified professionals for undertaking inspections of planting during establishment include Chartered Members of the Landscape Institute.*

The best time to assess woodland health is in the summer. Visible signs of ill health in broadleaf trees are commonly:

- Leaf discoloration (e.g. excessive yellowing or brownness when the leaves should be green);
- Leaf wilting (drooping);
- Canopy sparseness;
- Premature leaf shedding (a typical response to drought); and;
- Signs of dying back at the outer edges of the canopy.

Visible signs of ill health in coniferous trees are commonly:

- Loss of vitality (excessive needle yellowing or brownness);
- Premature or sudden needle drop in peak season; and
- Resin bleeding from stems and general canopy sparseness.

Pests may also attack the foliage of plants. This may result in the stripping and browning of leaves. Guidance from Forest Research (Gov.uk, 2018) can be helpful in identifying pests and appropriate control methods, as well as reporting suspected sightings using the Tree Alert System (Forest Research, 2020).

If symptoms of ill health or pest attack cannot be resolved within a year; consideration should be given to phased removal and replacement with an alternative suitable species.

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Figure 14 – Images detailing typical ill health symptoms in trees (from left to right: leaf wilting and blight, stem bleeding, canopy dieback, the presence of fungi)

NOTE: *'Tree Pests and Diseases – An Arborist's Field Guide' (Watson, 2013) is a useful guide on common tree pests and diseases.*

6.8.3 Operational considerations in woodland habitats

Creating or enhancing woodland in proximity to the railway requires consideration of the key site-specific constraints to operational rail use.

Typical operational considerations for woodland appraisal may include:

- Flooding or lack of water for irrigation;
- Steepness or stability of embankments and cuttings;
- Lineside width and the proximity to the line;
- Protected species or protected habitats/sites;
- Shading, urban screening and high leaf fall areas; and
- Security, e.g. discouraging public access.

NOTE: *Document NR/L3/OTK/6202 provides guidance on protecting railway assets.*

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6.9 Long-term Management of Woodland Habitat

This section outlines the key considerations for the management of established woodland. It should be read alongside NR/L3/OTK/6202 Protecting railway assets during vegetation work.

Long-term woodland management generally does not differ between W1 and W2 woodland types unless trees are grown for commercial timber purposes. Typically, maintenance involves checking progress towards achieving the objectives that are set out in the Habitat Management Plan.

In the 20-year management period this is generally achieved by carrying out separate visits, which are usually performed every four years.

6.9.1 Tree life cycle

Larger trees typically provide the greatest range of ecosystem services and benefits due to their greater mass and leaf area.

The life expectancy of a tree depends on many factors, which can be largely determined by its species. They can range from decades to many hundreds of years.

The typical life cycle of a tree is shown in Figure 16.

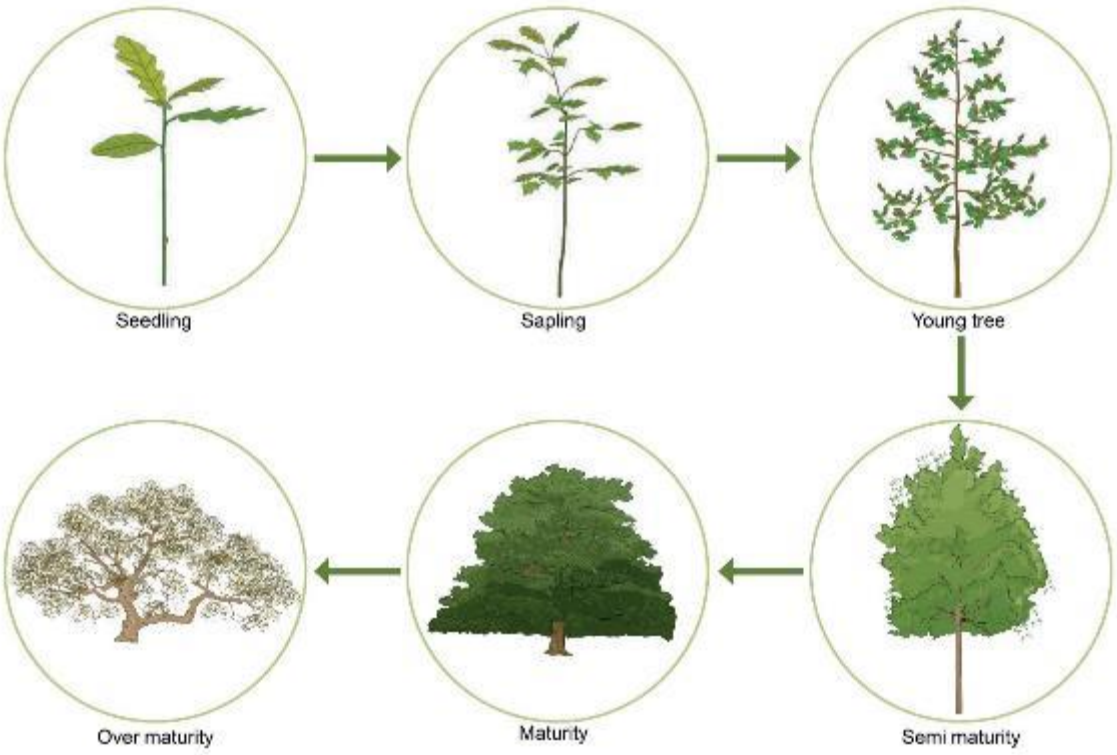

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Figure 15 – Tree life cycle

After maturity, some broadleaf trees withdraw their form, developing smaller crowns and increasing in biodiversity value. These trees could have potential 'veteran' or 'ancient' tree status which are irreplaceable habitat features. Figure 17 displays some of the typical features of a 'veteran' or 'ancient' tree. Guidance published by the Ancient Tree Forum may be helpful in determining whether trees meet these criteria (Ancient Tree Forum, 2020) and appropriate management regimes.

NOTE: *Anticipated costs of veteran tree management are addressed in Table 10 of Appendix A.*

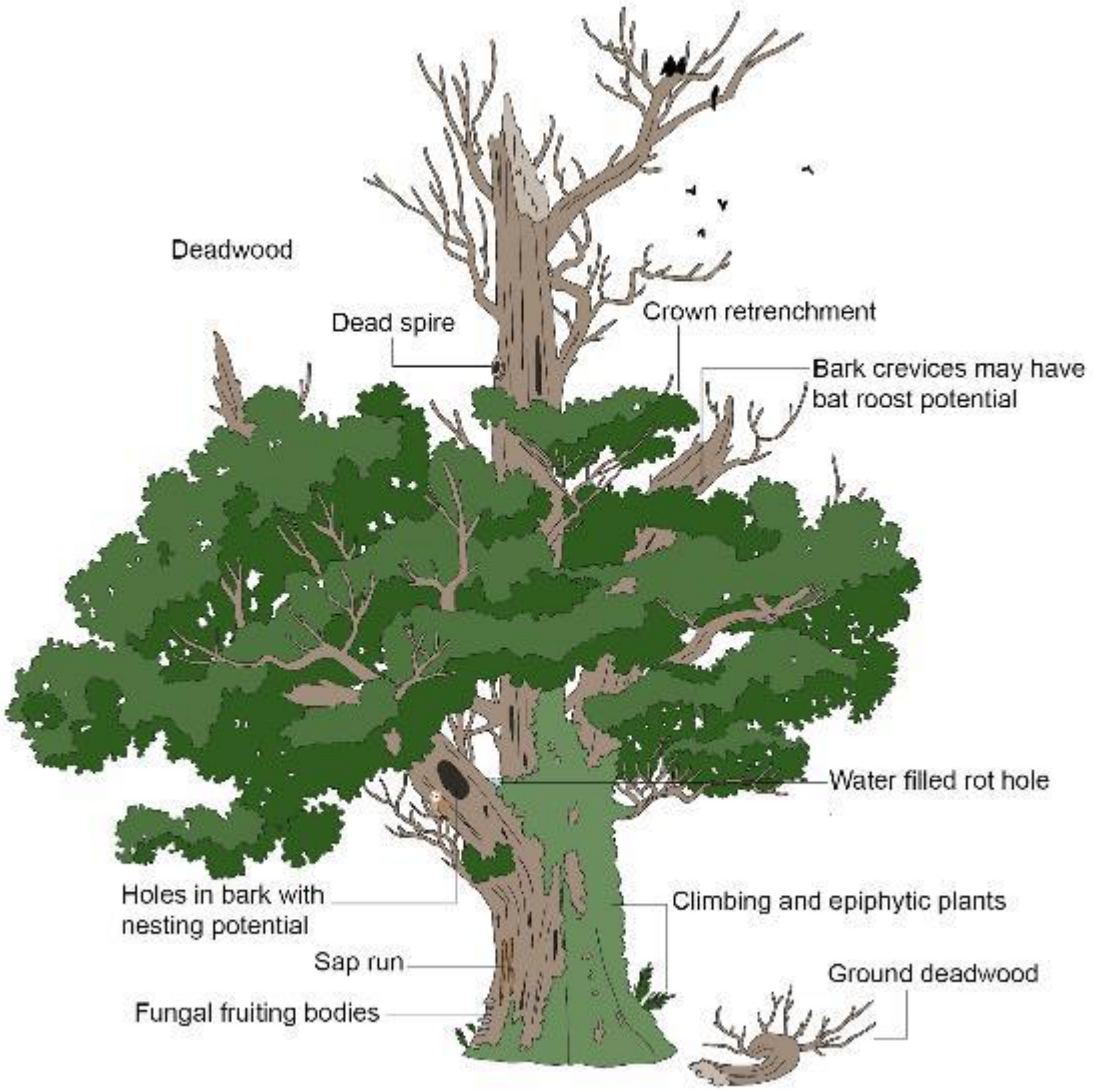

Figure 16 – Typical features of an 'ancient' or 'veteran' tree

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6.9.2 Woodland structure

Poor woodland structure is the main reason that many woodland species in the UK are in decline. This is often due to inappropriate management. This can lead to a closed canopy, simplified field and understorey layers suppressed by even-aged trees and insufficient open areas or glades.

Woodland with a well-developed structure commonly has the following characteristics, without any one being particularly dominant:

- **A ground layer** - supporting grasses, ferns, flowering plants and lichens that cover the ground;
- **A field layer** - supporting low-growing plants and shrubs that reach up to about 5m in height;
- **An understorey layer** - consisting of low-growing shrubs and coppice stools, smaller tree species and emerging larger tree species;
- **A canopy layer** - with trees that are a range of different heights;
- **Retained deadwood** - in all woodland layers, particularly edges which provide a useful habitat for insects and fungi; and
- **Open areas** – designating open ground as glades (at least 10%) that have no mature trees, letting light reach the ground and field layers.

The figure below illustrates even and uneven age Broadleaved woodland (W1) and the Coniferous woodland (W2) sub-types within a lineside context.

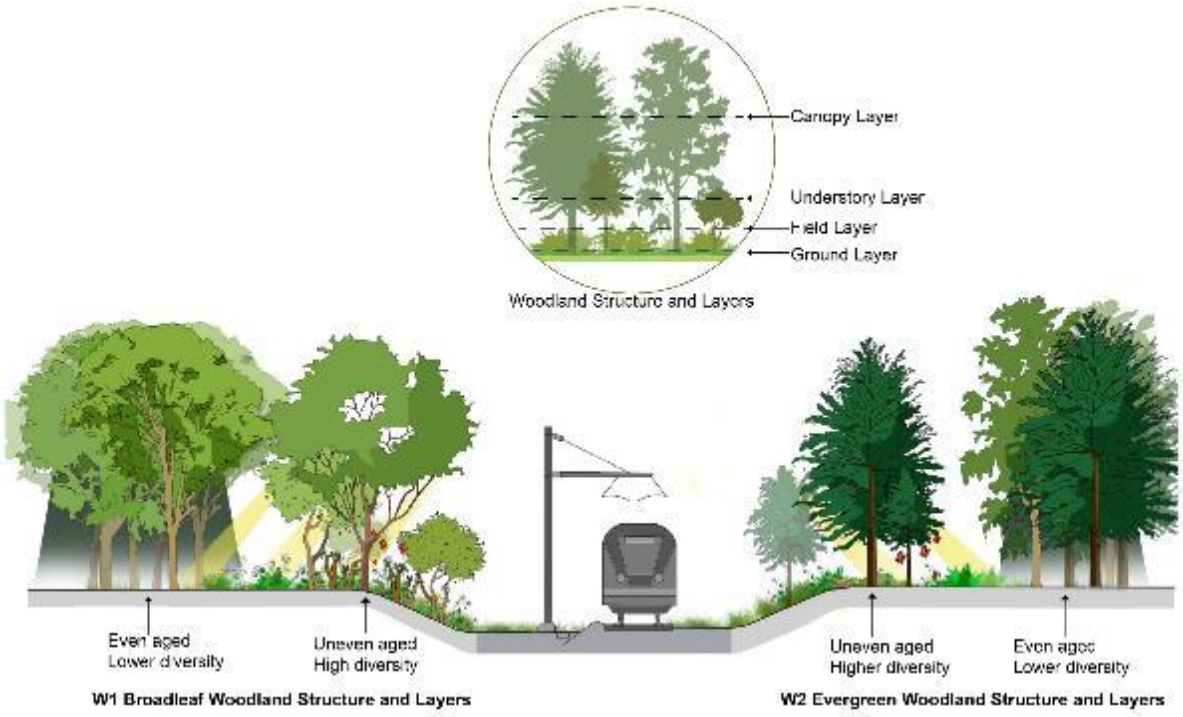

Figure 17 – Age structures of W1 (left) and W2 woodland (right)

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NOTE: *Anticipated costs of glade creation and maintenance are addressed in Table 3 of Appendix A.*

NOTE: *Anticipated costs of ride creation and maintenance are addressed in Table 4 of Appendix A.*

6.9.3 Tree works

Remedial works to individual established trees within existing woodland may be necessary for lineside and public safety.

Pruning is best undertaken when trees are dormant to reduce the overall impact on the trees' health.

The optimum period for tree works outside of the bird nesting season is generally between November to late January (subject to the absence of protected species) when the tree is less active and better placed to respond to wounding and a reduction in leaf area.

NOTE: *'BS 3998:2010 Tree work.' (BSI, 2010) provides on best practice management options for established trees.*

NOTE: *Refer to Lineside Vegetation Management Manual (NR/L2/OTK/5201).*

6.9.4 Thinning

Woodland thinning can create an improved woodland age structure and diverse field layers. Thinning typically starts when trees reach 10m in height. This is usually between 15 to 25 years of age, depending on species and growth rate.

The degree to which the ground flora is suppressed by shading and the canopies of all trees touching (i.e. seeing very little sky when looking upwards) are useful visual indicators of when to start thinning within a woodland area.

In well stocked woodland, thinning operations typically:

- Commence early to maintain light penetration to the woodland floor for biodiversity development at the lower layers (e.g. crown reduction);
- Thin the trees that are suppressed (i.e. negative selection) by more dominant (i.e. positive selection) established trees;
- Remove less than 15-20% of trees;
- Select trees for thinning that are based on the management objectives, such as overrepresented species or those of poor form and condition. This requires a systematic, on-site assessment of the woodland; and
- Provide a continuity of different tree ages over time to support the woodland habitat.

Woodlands where trees have been planted at wider spacings with poor survival rates may not need to be thinned during the 20-year woodland management plan period.

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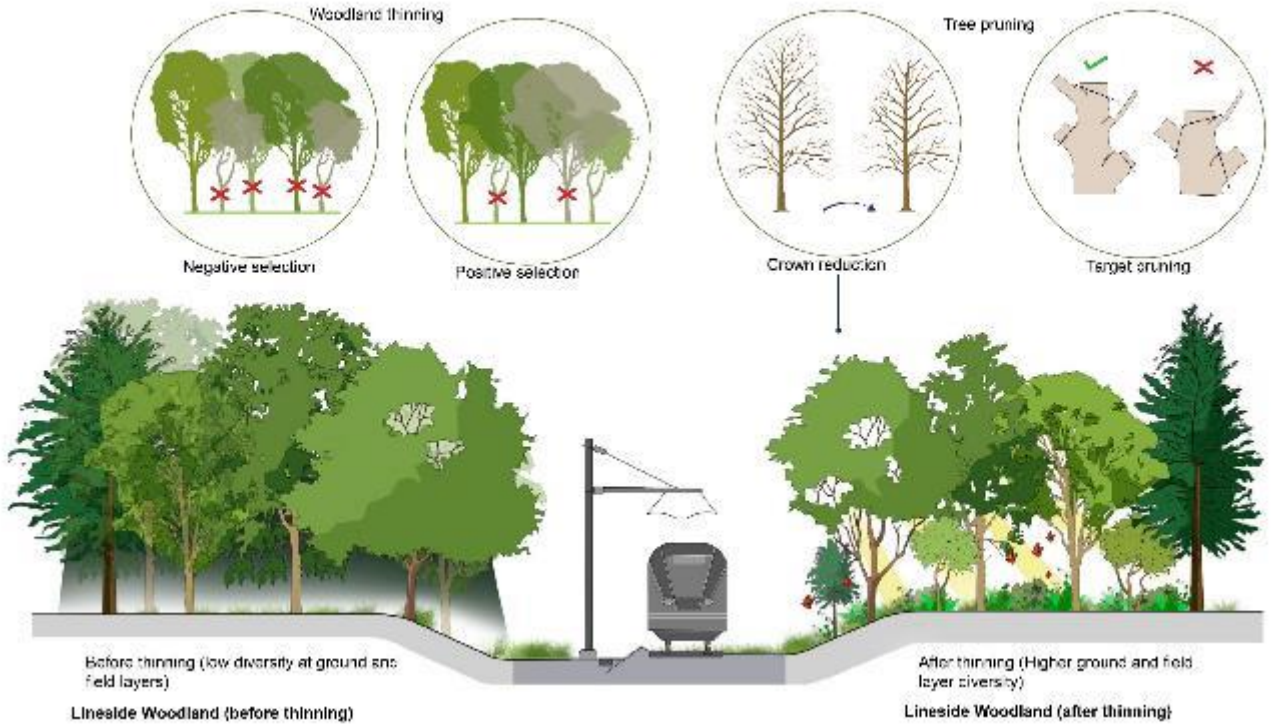

Figure 18 –Positive and negative selection for woodland thinning management

NOTE: *Excessive loss of windfirm woodland edges through woodland thinning should be avoided. This can result in increased windthrow risks and loss of screening in urban areas where trees are valued by lineside neighbours.*

6.9.5 Coppicing and pollarding

Coppicing and pollarding are well-established woodland management practices that can provide important habitat which enhances biodiversity.

Pollarding:

- Removes the upper branches of a tree to promote foliage and branches at a much lower height than the normal full height of a tree;
- Can allow the retention of large trees to promote biodiversity whilst also considering lineside safety;
- Is typically initiated when trees are younger to maintain a reduced canopy size;
- Generally leaves the trunk with three to five main branches which are then cut back to a desirable length in winter months;
- Requires ongoing cyclical management to prevent possible future branch failure; and
- Is best suited to species that regenerate strongly (such as London plane, willow and oak).

Coppicing:

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- Promotes woodland biodiversity;
- Is typically carried out every 7 to 18 years (dependant on species) (Crowther and Patch, 2010);
- Is best undertaken during winter in phases, encouraging different structures and leaving some mature plants during a management period;
- Is best suited to species which regenerate strongly from a cut stump (such as oak, hazel, willow, field maple and sweet chestnut);
- Typically involves cutting stems down to a 5-7.5cm (2-2½in) from the ground in winter;
- Should have not more than 30% volume of canopy shade surrounding the plant for a coppice stool to establish (Forestry Commission, 1995); and
- Should relate to plants at a minimum distance of 2m from other trees or coppice stools species (Forestry Commission, 1995).

NOTE: *Short rotation coppice is an energy crop which usually consists of densely planted, high-yielding varieties of poplar or willow. The woody solid biomass can be used in applications such as district heating, electric power generating stations, alone or in combination with other fuels.*

NOTE: *Coppicing a mature and suitable species tree may be a better option in urban areas than stump treating and killing it, as this can reduce the presence of undesirable species and maintain screening for lineside neighbours.*

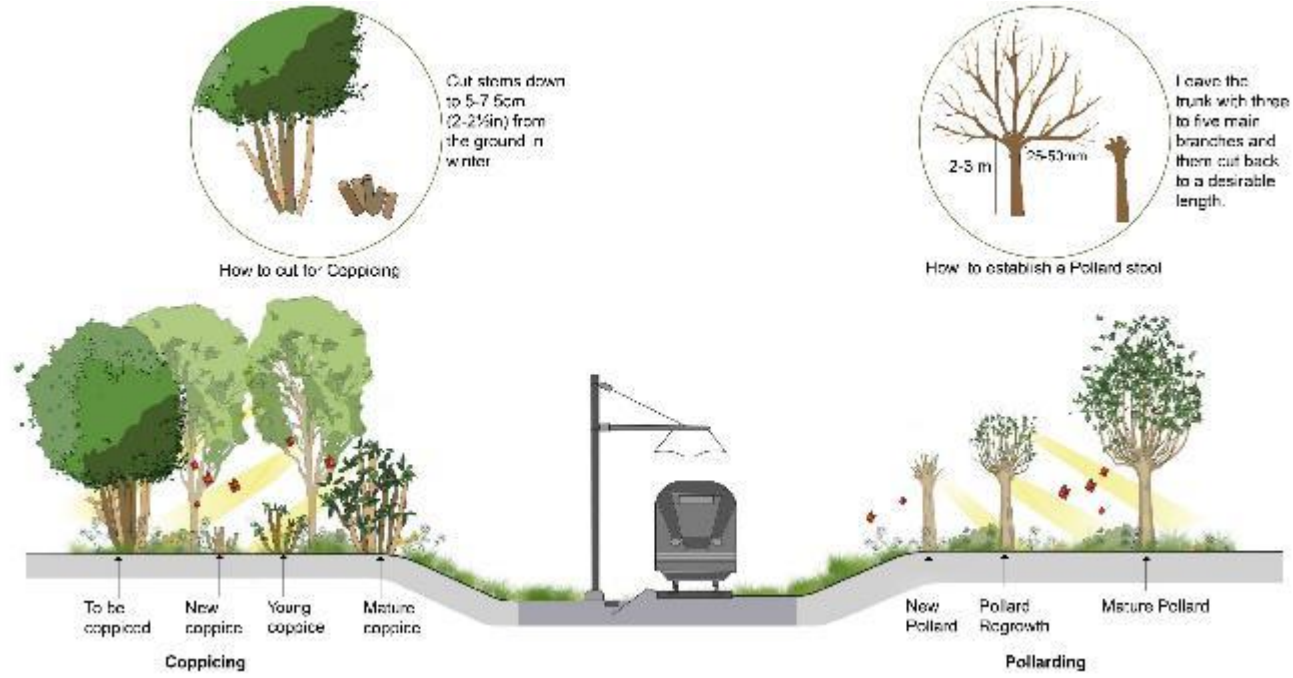

Figure 19 – Coppicing and pollarding at different establishment stages

NOTE: *Anticipated costs of pollarding are addressed in Table 8 of Appendix A.*

NOTE: *Anticipated costs of coppicing are addressed in Table 9 of Appendix A.*

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6.9.6 Clear felling

Clear felling should be avoided.

If it can be demonstrated through a full and detailed assessment of alternatives that clear felling of woodland cannot be avoided; further assessment should be carried out. This should set out the options for replanting which maximise biodiversity and ecosystem services, in consideration of:

- Habitat condition and value;
- Avoiding bird nesting seasons;
- Plant health and vitality; and
- Environmental function (e.g. visual screening).

There may be exceptions, for example:

- Imminent risks to operational rail safety;
- Woodland restocking; or
- Where a Statutory Plant Health Notice is served by the Forestry Commission or other plant health authorities (Forestry Commission, 2017).

Impacts to adjacent retained trees due to a loss of shelter and windthrow risk also need to be considered. Retaining woodland edges (particularly those facing the prevailing wind) are important for reducing windthrow risk.

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6.10 Woodland Restoration

Restoration is the careful process of managing existing woodland threats, such as excessive even-aged composition, poor biodiversity and disease outbreak. Natural regeneration of native trees and plants can help biodiversity and suitable tree species to be resilient in the future. Good management can restore neglected woodland, as well as providing other benefits, such as income from timber and support from neighbouring landowners.

6.10.1 Restocking existing woodland

The restocking of existing woodland provides an opportunity to restructure age classes and enhance the biodiversity value following phased tree felling and/or the creation of open areas (glades).

Restocking can:

- Be achieved either through replanting or natural regeneration;
- Promote a diverse range of tree species; and
- Ensure successful establishment and long-term viability of desired species.

Where even-aged stands within woodland are to be felled for glade creation, any neighbouring stands should be retained until the restocking of the area has reached a minimum height of 2m. This is likely to be between 5-15 years, depending on establishment success and growth rates.

Following felling, the stumps of many broadleaf species may regenerate (such as ash, oak, sycamore etc). Where this is not desirable, the stumps may need to be treated with an approved herbicide or removed to prevent regeneration.

Too much of one tree species in a woodland can result in unforeseen felling works that could detrimentally impact the woodland habitat in the future. Encouraging woodland resilience through species diversity in the early stages of woodland creation and/or management can prevent this threat.

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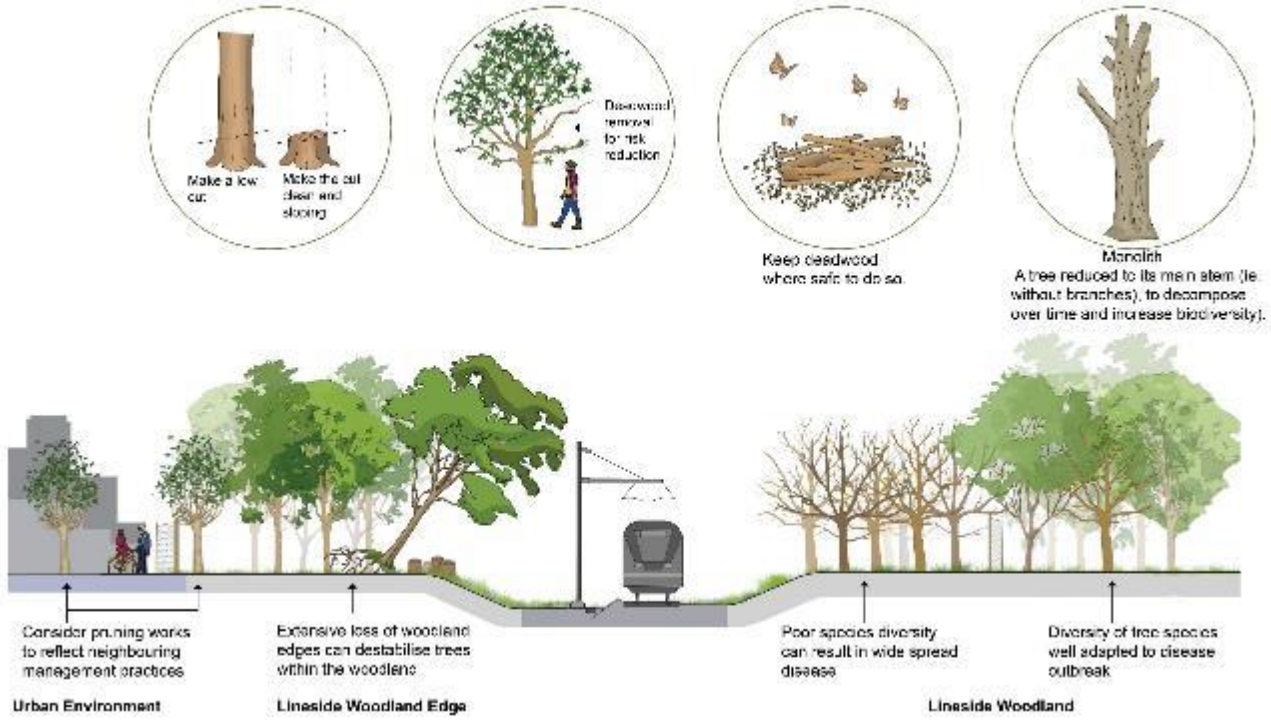

Figure 20 – Typical considerations for woodland on and neighbouring the lineside

6.10.2 Removal of timber and other arisings

As far practicable, all timber and other arisings should be retained on site and either:

- Piled in small heaps away from the bases of trees; and;
- Neatly stacked to create hibernacula.

If timber or other arisings need to be removed on and off the lineside, this should be carried out in accordance with NR/L3/OTK/6202 Protecting railway assets during vegetation work.

6.10.3 Deadwood and hibernacula

Deadwood, which includes snags caught in tree canopies, fallen trees and monoliths), can be retained within woodland to provide important habitats. If safety allows:

- From all species; deadwood above 100mm in diameter can make a useful habitat contribution. Piles ranging from 2.0 to 8.0m long by 1.0 to 1.5m high (RFS, 2015) are optimal;
- Should not be piled higher than 2m as log piles, and tree cuttings more than 1.5m in accordance with NR/L3/OTK/6202 Protecting railway assets during vegetation work);
- Standing dead trees may be retained, if branches are removed to form a monolith;

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- Can be retained in all woodland layers, particularly edges which provide a useful habitat for insects; and
- A good volume equates to around 20m^3 per hectare of woodland (equivalent to a lorry load per hectare).

Deadwood can serve as hibernaculum for wildlife and increase the biodiversity of the woodland. Hibernacula creation can be particularly useful in a railway woodland where operational restrictions limit the retention of standing or stacked deadwood.

In environments where the retention of loose deadwood is unsafe, particularly on steep embankment slopes, hibernacula could be created in small glade areas that are buffered by trees.

NOTE: *Anticipated costs of monolith creation are addressed in Table 5 of Appendix A.*

NOTE: *Anticipated costs of deadwood creation are addressed in Table 6 of Appendix A.*

NOTE: *Anticipated costs of hibernacula creation are addressed in Table 7 of Appendix A.*

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7 Case Studies

7.1 Introduction

The following five case studies have been selected as they represent typical operational scenarios where management practices applicable to a woodland have been applied with good and bad outcomes. Key management considerations are identified for each setting.

The following examples are identified and discussed:

- Management of rare and protected plant species within a Site of Special Scientific Interest (SSSI) and Special Area of Conservation (SAC);
- Established woodland management practices in a parkland setting, and the negative implications of not adhering to the woodland management plan objectives;
- Managing the presence of a tree disease in a high-risk transport setting for woodland under multiple land ownership;
- Woodland creation and best practice after a 25-year implementation period; and;
- The effects of managing the spread of INNS in a woodland over a four-year period.

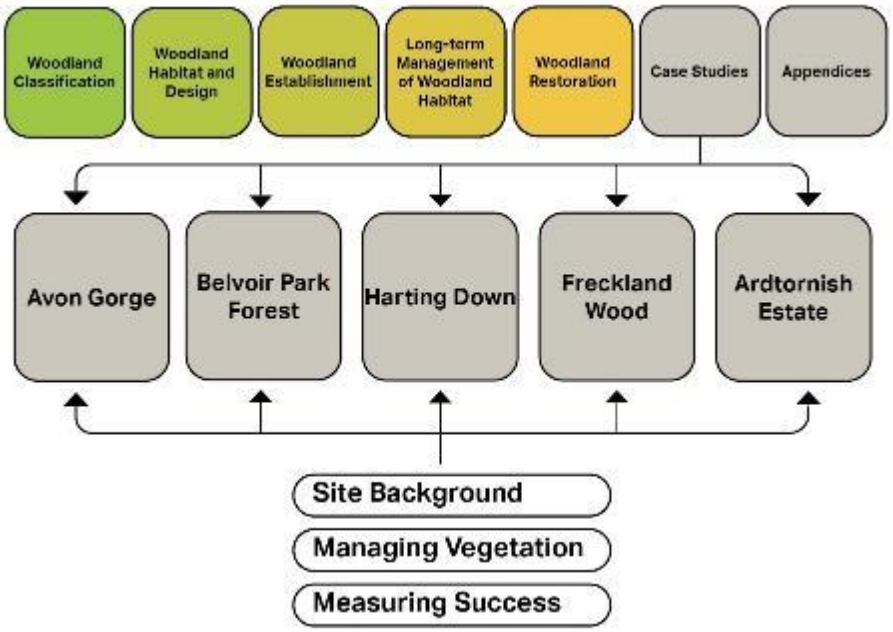

Figure 21 – Case study structure presented in a flowchart diagram

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7.2 Avon Gorge, Bristol

Managed by: Network Rail
Approximate area of land managed: 11.5 hectares running through SSSI and SAC protected areas
Management implementation: July 2018 – June 2023

7.2.1 Site Background

The Avon Gorge lies on the edge of Bristol and has been selected as a case study to demonstrate the approach to lineside vegetation management in an area protected by statutory designations. The Portishead (POD) line runs through a SSSI which overlaps with the Avon Gorge Woodlands SAC.

Figure 22 – Avon Gorge site location

- The site supports several protected and rare plant species, including the Bristol whitebeam (*Sorbus bristoliensis*) which is classed as a qualifying feature of the Avon Gorge SSSI.
- The competition for light due to the density of competing vegetation has affected the way protected species have grown. Several plant species have grown above or beside the railway track causing overhanging vegetation that poses a safety risk.
- The growth and spread of native plants and invasive non-native species (INNS) were also identified as a concern. Their emergence threatens small vascular plants which survive only in open conditions (Network Rail, 2018).
- The aim of Network Rail's maintenance operations is to permit the safe and easy passage of trains through the site. Due to the presence of protected and rare species, a bespoke and sympathetic vegetation management programme was required.

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7.2.2 Managing Vegetation

Managing vegetation within the Avon Gorge was programmed to take place over a 5-year period with routine maintenance of perceived risks to railway operations taking place annually. Scenarios for managing vegetation that each require a different response included:

- **Qualifying feature species but safety critical:** avoidance of felling where possible, controlling limb growth or applying coppice management to promote regeneration. Removal of any rare species requires prior notification and consent from Natural England;
- **Qualifying/non-qualifying feature species and non-safety critical:** vegetation should be left to improve overall biodiversity;
- **Non-qualifying feature species and safety critical:** removal and plugging of stumps using herbicide application. Limb reduction or pollarding applied to ensure safety to infrastructure or immediate surrounding species; and
- **INNS:** safety critical species will be felled, and non-safety critical species will be added to an itinerary for removal where possible.

7.2.3 Measuring Success

The aim of the vegetation management is to enhance the qualifying features of Avon Gorge SSSI and SAC. This is planned to be achieved by:

- Reducing undesirable and competing species and seed source;
- Opening of the canopy to allow more light in and removal of canopy around track edges to provide more favourable conditions for the succession of the endemic Bristol whitebeam; and
- Setting a target of biodiversity net gain across the SSSI and SAC designated area through proactive management.

Figure 23a – Before vegetation management. Vegetation is creeping onto the track and over-hanging branches are a safety risk

Figure 23b – After vegetation management. There is evidence of tree felling and the cess strip is clear of any vegetation

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7.3 Belvoir Park Forest, Belfast

Managed by: Forest Service of the Department for Agriculture for Northern Ireland
Approximate area of land managed: Belvoir Forest is a 75-hectare woodland
Management implementation: 1995

7.3.1 Site Background

The following case study has been selected as it highlights the implications of failing to adhere to woodland management plan objectives. For Belvoir Park Forest, this resulted in a significant disease spread, habitat loss and most likely, income loss. This is not from a lineside context.

Figure 24 – Belvoir Park Forest site location

- The site is on the southern outskirts of Belfast and is a mixed woodland containing some of the oldest trees in Ireland. Coniferous woodland (including Larch) was planted between 1961 and 1981 for commercial purposes (The Forestry Authority, 1995).
- A woodland management plan was detailed in a publication by The Forestry Authority in 1995. The management plan aimed to balance the recreational, wildlife, landscape and commercial forestry needs of the site through sustainable management at five-year rotations.
- Woodland visitors and the Friends of Belvoir Park Forest (formed in 1992), were kept informed of management operations by the Forest Service. This promotes positive working relationships between woodland managers and local people.

7.3.2 Managing Vegetation

Belvoir Park Forest's vegetation management objectives were focused on the following aims:

- Clearing INNS and sycamore in the northern region of the site over a 5-year period and targeting the cleared areas for the creation of glades;

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- Spreading age-class distribution by increasing thinning of 200m3 of timber from 1995, to 0.5ha per-annum in 2005 to yield income from harvesting;
- Clearance of much of the larch at the south-west of the site dominated by straight powerline wayleave edges, and re-populating cleared areas with a mixed species range to break up the regular geometry of the area;
- Maintaining screening and amenity value for housing estates and playing fields at southern areas; and
- Removing dense undergrowth adjacent to paths.

7.3.3 Measuring Success

A 2020 desk-based assessment draws out positive and negative signs of woodland management.

Positives include:

- An uneven aged structure has been introduced through management in key central areas of the parkland setting; and
- The dense undergrowth adjacent to paths has been removed and a suitable distance appears to have been maintained.

Negatives include:

- In 2014, 6,500 Larch trees were affected by *Phytophthora ramorum* and were felled to reduce the risk of wider disease spread (BBC, 2014). If the management plan had been adhered to, a more diverse range of species would be present, and the presence of the disease may not have had such a significant impact.
- The resulting area of cleared larch remains largely exposed to residents and park users, with powerline wayleaves present and unscreened by vegetation; and
- Northern areas of the site appear to be dominated by INNS (rhododendron) and mature even-aged sycamore species, in addition to a proportionately low amount of open glade areas and field layer diversity.

Figure 25a – Belvoir Park Forest sketch design (The Forestry Authority, 1995), showing conifer plantations south of the site

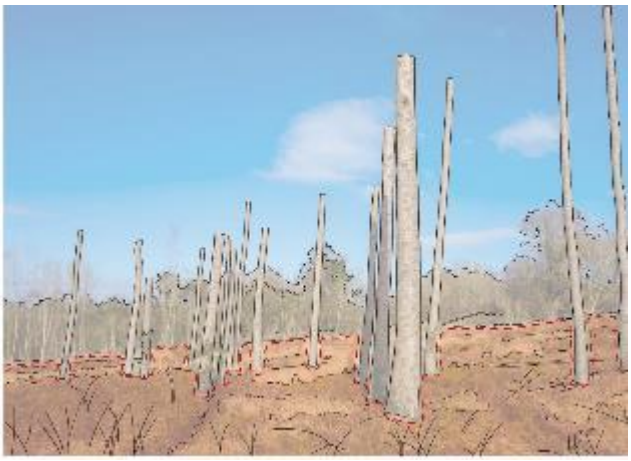

Figure 25b – Excessive larch felling required to control disease outbreak

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7.4 Harting Down, West Sussex

Managed by: Multiple owners including the National Trust and Uppark Estate
Approximate area of land managed: 1.4 miles of road along the B2141
Management implementation: 2-week operation undertaken in October 2018

7.4.1 Site Background

This case study has been selected as it demonstrates the approach to managing the presence of a tree disease. The B2141 road runs through an area of woodland between South Harting and Lavant in the South Downs National Park. This is not from a lineside context.

Figure 26 – Harting Down site location

- High-speed travel is frequently reported along the road and is therefore a high-risk transport setting that is comparable to a railway context.
- The broadleaved and coniferous woodland that borders the highway is under multiple ownership with large parts belonging to the National Trust and the Uppark Estate (RFS, 2019).
- Ash trees, of varying age, constituted approximately 50% of the broadleaf tree cover which dominated the roadside setting. These trees form a closed canopy cover over the highway.
- Much of the woodland was historically undermanaged, until 2013 when large sections of the woodland underwent a thinning programme which aimed to selectively remove mature ash specimens to promote a then emerging sycamore understorey layer.

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7.4.2 Managing Vegetation

- Ash dieback (*Hymenoscyphus fraxineus*) symptoms were observed in 2015, which can ultimately result in the death and collapse of affected trees. The issue of road user safety was raised by landowners and this concern was heightened when failure of presumed infected trees across the road occurred (RFS, 2019).
- The landowners, in close consultation with the Forestry Commission, appointed a forestry contractor and shared the cost of the management works.
- The 1.5km stretch of road was closed for a two-week period; during which time all ash trees within one mature tree length of the road were felled to reduce the risk of potential tree failure to road users.

7.4.3 Measuring Success

- The removal of ash trees was undertaken successfully. The only wider concern raised by the public was the perceived untidiness of the felling operations.
- Each respective landowner took proactive measures to prioritise the risk to road user safety and collaborated in seeking specialist consultation on advice from the Forestry Commission.
- The commercial value of the harvested timber was incentivised to the appointed forestry contractor. This helped to fund the overall management works required.

Figure 27a – Diseased Ash tree over-hanging the B2141 road

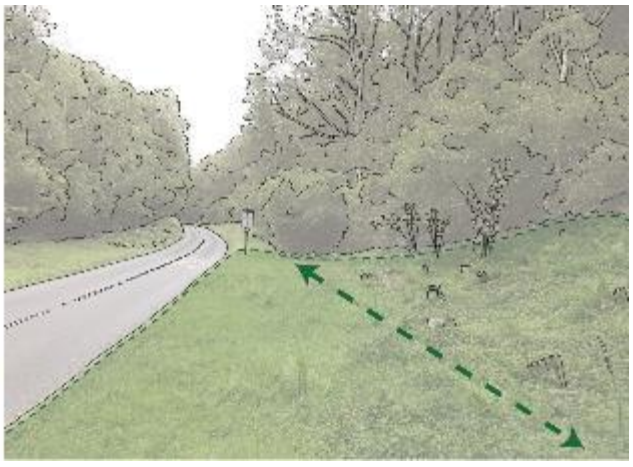

Figure 27b – Example of Ash die-back clearance within one mature tree length from the roadside

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7.5 Freckland Wood, Nottinghamshire

Managed by: Nottinghamshire County Council
Approximate area of land managed: 20 hectares
Management implementation: 1995 at ongoing five-year rotations

7.5.1 Site Background

This case study has been selected as it demonstrates best practice for woodland creation. The Site is located in Newstead, Nottinghamshire approximately 200m east of the Robin Hood Railway line, which in 1995 was a former colliery (The Forestry Authority, 1995).

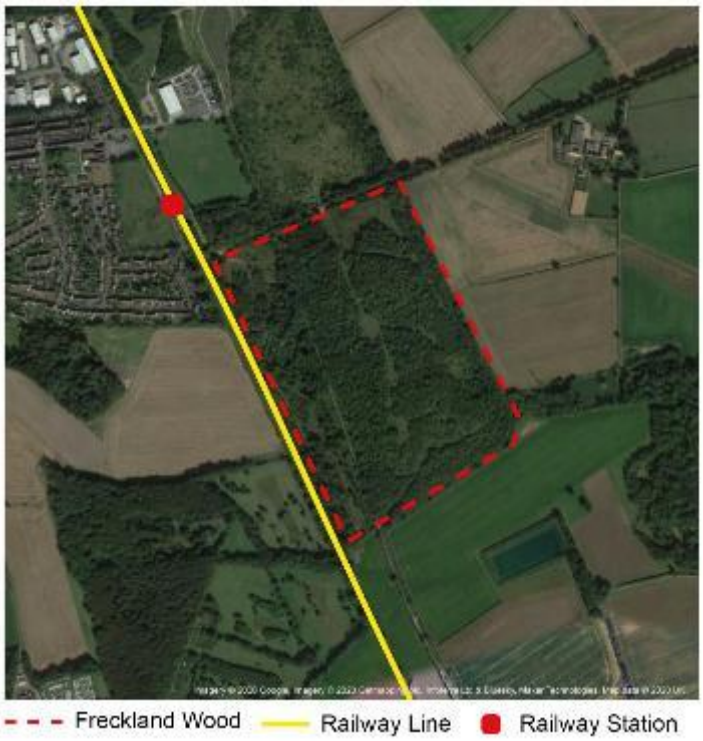

Figure 28 – Freckland Wood site location

- In 1995, a plan to create a 20ha woodland on the Site was established between Nottinghamshire County Council and the Forestry Authority.
- The objective was to create a woodland with open grassland and paths.
- The finalised design specifications proposed that the Site was to be divided up into various woodland types as follows:
    - *3.5 ha hazel coppice creation;*
    - *English oak/ash/hazel species typeover a 1.5 ha area;*
    - *Hybrid larch covering a 5.0 ha area;*
    - *Red oak coppice covering a 3.0 ha area;*
    - *Red oak stands covering 1.0 ha;*
    - *Demonstrations (of practical silviculture techniques including 'establishment', 'silvicultural systems' and 'objective led community woodlands') 1.0 ha; and*
    - *Open space/glade creation covering a 3.8 ha area.*

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7.5.2 Managing Vegetation

The prescriptions for establishment included:

- Planting 3,000 trees/ha using the best quality plants;
- Weed control on 1m^2 points at each tree base for 5 years using approved herbicides;
- Using a slow release fertiliser in the April of the second season (and following seasons if necessary);
- At the end of the first and second year, bulking up plant density. In the following years, bulking up plant density if it falls below 2,222 trees/ha; and
- Mowing rides and fire breaks when required.

7.5.3 Measuring Success

Following a desk-based assessment in 2020, Freckland Wood creation has been successfully achieved. The following features demonstrate the successful establishment of Freckland Wood:

- Freckland Wood is now an established deciduous woodland interspersed with open space habitats;
- Plant species in these areas include knapweed, St John's wort, birdsfoot trefoil, wild carrot and orchid;
- The habitat also supports birds and butterfly activity;
- The woodland exceeds a 50% canopy cover;
- Open spaces and rides have been created and maintained;
- A diverse range of tree species and age classes is present (species include field maple, larch, silver birch, oak and beech); and
- Graded (i.e. informal) woodland edges and rides have been maintained.

In 2020, future management approaches at the 25-year stage may now consider commencing the selective thinning of dense even-aged canopy areas for greater field layer diversity.

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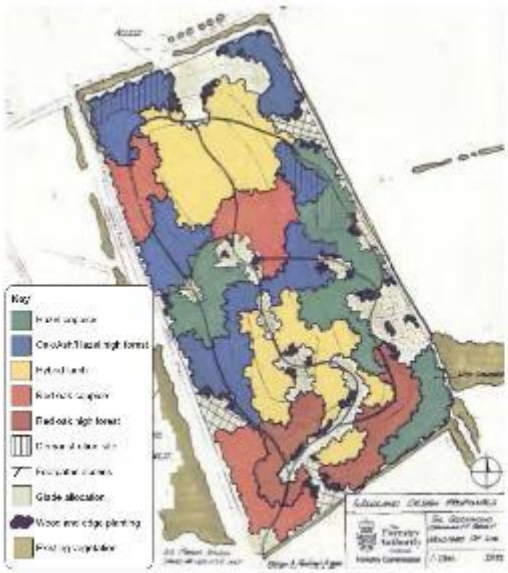

Figure 29a – Freckland Wood woodland creation and management plan (The Forestry Authority, 1995)

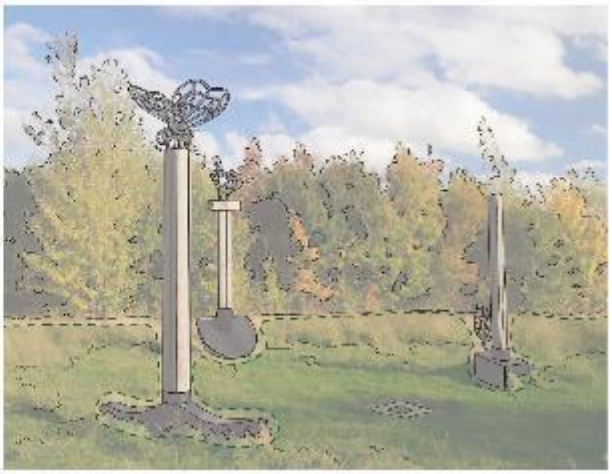

Figure 29b – Present day Freckland Wood showing woodland glade with monuments to commemorate the area's mining heritage

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7.6 Ardtornish Estate, Lochaber

Managed by: Ardtornish Estate
Approximate area of land managed: 2,000 hectares of affected land
Management implementation: 1995-1998

7.6.1 Site Background

This case study has been selected as it demonstrates the effects of managing the spread of INNS in a woodland over a four-year period, alongside the issues that were encountered. This is not from a lineside context.

- The Site is located within the Ardtornish Estate, Scotland and covers 14,000 ha. The estate includes a mixture of habitat types including native and planted woodland.
- Following a Site Condition Monitoring assessment, it was found that the condition of some of the woodland habitat had declined, which was due to grazing and the re-generation of rhododendron.

Figure 30 – Ardtornish Estate site location

- Once established, rhododendron suppresses the growth of native trees, understory plants and moorland and grassland vegetation.
- The site included vast numbers of invasive rhododendron that were shown to:
    - Reduce the numbers of earthworms, birds and plants;
    - Reduce the regenerative capacity of a site; and
    - Lead to a reduction in the biodiversity of the woodland.
- The rhododendron removal scheme aimed to eradicate the invasive plant from 2,000 ha of affected land.
- The invasive species was recognised as being detrimental to site woodland health, biodiversity value, and other habitat management objectives.

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7.6.2 Managing Vegetation

The removal scheme was undertaken between 1995 and 1999. During this period:

- All confirmed rhododendron plants were treated (as well as any re-growth sprayed) with between one and three applications;
- Most of the treatment involved cutting (by chainsaw or teams using hand tools), with other areas being treated using a mechanical flail on a tracked excavator (which was only efficient on gentle terrain);
- Plants under 1m tall, along with re-growth, were sprayed with herbicide;
- An additional method (cut-stump treatment) was used in less accessible areas; and
- Arisings were burnt on site, cut for firewood or mechanically flailed (dependant on accessibility).

7.6.3 Measuring Success

The recovery of the site following the rhododendron control measures was variable:

- In 2013, seedlings of rhododendron were still being removed from 25% of the estate annually;
- The 'cut-stump' treatment was found to be impractical and not financially viable; and
- The herbicide used for this project was glyphosate. It is important to check the current rules and best practice herbicide to use before starting rhododendron removal works (Parrott and MacKenzie, 2013).

Ongoing management of the estate is likely to continue to control seedling emergence of INNS. However, the most effective controls for invasive rhododendron are:

- Killing the plant by complete excavation (plant/stump removal and controlled disposal) (Barron, 2009); and

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- Stem injecting herbicide (Forest Research, 2020).

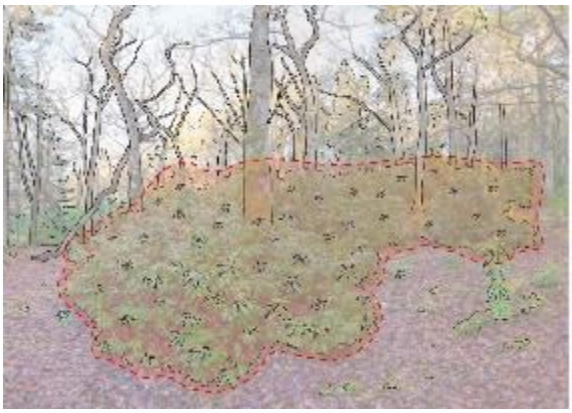

Figure 31a – Invasive rhododendron species within a broadleaved woodland

Figure 31b – After invasive rhododendron management

Appendix A: Illustrative costings and routine maintenance schedule

The purpose of this section is to provide information on indicative costs and a schedule of routine operations. This will help inform management decisions, for the creation and maintenance of woodland features as well as protected trees.

The following tables provide a summary of costs and a schedule of site visits in relation to the creation, routine maintenance and inspection of the different woodland types.

These costs are indicative and are based on Spon's External Works and Landscape Price Book 2020 and 'A guide to creating small native woods in England' by the Woodland Trust.

Assumptions

The following assumptions have been made in preparing these indicative costs:

- All figures are based on current (2020) costs and do not allow for inflation;
- Costs have been rounded up or down to the nearest £500;
- All figures require additional uplift for works in London;
- The figures are based on the anticipated cost per year of new woodland and existing woodland over 20-year life cycles;
- The frequency of visits for routine maintenance could be reduced by carrying out multiple tasks in a single visit. This would depend on the programme of works. Therefore, for simplicity in the figures below it is assumed each task will require a separate visit.
- Weather conditions will be checked before visiting site;
- Felling cost is per day so it is assumed that 10 trees would be felled a day. This does not account for location, access or size of trees;
- 1/8 mile figures are based on 200m x 20m = 40,00m2;

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- For the calculations of the volume of timber created from felling or thinning operations, four mature trees per 0.5ha in established woodland is assumed as 10 cubic meters of timber. This assumes an individual mature tree as having a 15m height tree, with a 40-50cm girth producing 2.5 cubic meters of timber). (Forestry Commission).

Exclusions

The following costs for implementation and routine maintenance of woodland have been excluded from the indicative costs' tables:

- Preliminary costs, such as providing site welfare;
- Securing the site (diverting trains etc);
- Clearing the track of debris (e.g. leaf litter);
- Bringing equipment and materials to the rail side;
- Obtaining and maintaining access to the site;
- Ensuring biosecurity measures;
- Working near water;
- Removing vegetation and debris from waterbodies;
- Earthworks or reinforcements;
- Effects of embankment or land instability;
- Structural works;
- Maintaining drainage features;
- Health and safety requirements (unless specified);
- Soil testing/analysis; and
- Ecological assessment or watching briefs in relation to protected species and habitats.

Table 1 – Anticipated costs of works to TPO protected trees per 1/8 mile

Works to TPO/ Protected Trees (Primary Level 3 UK Woodland Classification)	
Costs	
Creation	0
Routine Maintenance	£500
Inspection	£1,500
Schedule (number of site visits)	**Total number of visits over 20-year life cycle**
Creation (year 1)	0
Management	2
Inspection	6

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Table 2 – Anticipated costs of woodland creation per 1/8 mile

Woodland (Primary Level 3 UK Woodland Classification)	
Costs	
Creation	£26,000
Routine Maintenance	£19,000
Inspection	£500
Schedule (number of site visits)	**Total number of visits over 20-year life cycle**
Creation (year 1)	16
Management	14`
Inspection	2

Table 3 – Anticipated costs of glade creation and maintenance per 1/8 mile

Glades – Woodland feature (Primary Level 3 UK Woodland Classification)	
Costs	
Creation	£7,000
Routine Maintenance	£4,500
Inspection	£500
Schedule (number of site visits)	**Total number of visits over 20-year life cycle**
Creation (year 1)	3
Management	6
Inspection	2

Table 4 – Anticipated costs of ride creation and maintenance per 1/8 mile

Rides – Woodland feature (Primary Level 3 UK Woodland Classification)	
Costs	
Creation	£1,000
Routine Maintenance	£2,500
Inspection	£500
Schedule (number of site visits)	**Total number of visits over 20-year life cycle**
Creation (year 1)	5
Management	10
Inspection	2

Table 5 – Anticipated costs of monolith creation per 1/8 mile

Monolith - Woodland feature (Primary Level 3 UK Woodland Classification)
Costs

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Creation	£500
Routine Maintenance	£0
Inspection	£500
Schedule (number of site visits)	**Total number of visits over 20-year life cycle**
Creation (year 1)	2
Management	0
Inspection	2

Table 6 – Anticipated costs of deadwood creation per 1/8 mile

Dead wood – Woodland feature (Primary Level 3 UK Woodland Classification)	
Costs	
Creation	£1,000
Routine Maintenance	£0
Inspection	£500
Schedule (number of site visits)	**Total number of visits over 20-year life cycle**
Creation (year 1)	2
Management	0
Inspection	2

Table 7 – Anticipated costs of hibernacula creation per 1/8 mile

Hibernacula – Woodland feature (Primary Level 3 UK Woodland Classification)	
Costs	
Creation	£7,500
Routine Maintenance	0
Inspection	£500
Schedule (number of site visits)	**Total number of visits over 20-year life cycle**
Creation (year 1)	5
Management	0
Inspection	2

Table 8 – Anticipated costs of pollarding per 1/8 mile

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Pollard – Woodland feature (Primary Level 3 UK Woodland Classification)	
Costs	
Creation	£3,000
Routine Maintenance	£8,000
Inspection	£500
Schedule (number of site visits)	**Total number of visits over 20-year life cycle**
Creation (year 1)	2
Management	4
Inspection	2

Table 9 – Anticipated costs of coppicing per 1/8 mile

Coppicing – Woodland (Primary Level 3 UK Woodland Classification)	
Costs	
Creation	£7,000
Routine Maintenance	£7,000
Inspection	£1,500
Schedule (number of site visits)	**Total number of visits over 20-year life cycle**
Creation (year 1)	2
Management	2
Inspection	6

Table 10 – Anticipated costs of veteran tree management per 1/8 mile

Veteran Trees (Primary Level 3 UK Woodland Classification)	
Costs	
Creation	0
Routine Maintenance	£500
Inspection	£500
Schedule (number of site visits)	**Total number of visits over 20-year life cycle**
Creation (year 1)	0
Management	2
Inspection	2

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Table 11 – Anticipated costs of INNS management per 1/8 mile

Invasive species – Woodland (Primary Level 3 UK Woodland Classification)	
Costs	
Creation	0
Routine Maintenance	£500
Inspection	£5,000
Schedule (number of site visits)	**Total number of visits over 20-year life cycle**
Creation (year 1)	0
Management	2
Inspection	20

Table 12 – Anticipated costs of disease management per 1/8 mile

Treatment of disease (eg Ash die back) – Woodland (Primary Level 3 UK Woodland Classification)	
Costs	
Creation	0
Routine Maintenance	£500
Inspection	£500
Schedule (number of site visits)	**Total number of visits over 20-year life cycle**
Creation (year 1)	0
Management	2
Inspection	2

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Appendix B: Schedule for routine management and inspections for woodland

Activity	Element Type	Task	January	February	March	April	May	June	July	August	September	October	November	December	Total number of visits in year 1	Year 5	Year 10	Year 20	Summary of frequency over a 20 year life cycle
Woodland creation																			
Installation	New planted / replacement planting	Ground preparation													1				1
Installation	New planted / replacement planting	Weed removal													1				1
Installation	New planted / replacement planting	Litter picking													1				1
Installation	New planted / replacement planting	Mulching													1				1
Installation	New planted / replacement planting	Re-firming													1				1
Installation	New planted / replacement planting	Watering													6				6
Installation	New planted / replacement planting	Fertiliser													2				2
Installation	New planted / replacement planting	Remove Arising's													2				2
Installation	New planted / replacement planting	Tree guards (per tree)													1				1
																			16
Woodland management																			
Routine Maintenance	Woodland management	Litter picking													1	1			2
Routine Maintenance	Woodland management	Clearance of existing vegetation													1	1			2
Routine Maintenance	Woodland management	Thinning (10% of woodland)													1		1		2
Routine Maintenance	Woodland management	Removing arising eg chippings													1		1		2
Routine Maintenance	Woodland management	Pruning													1		1		2
Routine Maintenance	Woodland management	Weed removal													1			1	2
Routine Maintenance	Woodland management	Felling 25% trees - within woodland providing a function eg Stabilising, screening (per hectare)													1		1		2
																			14
Woodland features																			
Installation & Routine Maintenance	Woodland - Monolith	Felling													1		1		2
Installation & Routine Maintenance		Removing arisings													1		1		2
																			4
Installation & Routine Maintenance	Woodland - Dead wood retained in situ	Felling													1		1		2
		Stacking dead wood													1		1		2
																			4
Installation & Routine Maintenance	Woodland - Pollard	Pruning													1		1		2
Installation & Routine Maintenance		Removing arisings													1		1		2
																			4
Installation & Routine Maintenance	Woodland - Glades	Pruning													1		1		2
Installation & Routine Maintenance		Felling													1			1	2
Installation & Routine Maintenance		Removing arisings													1		1		2
																			6
Installation & Routine Maintenance	Woodland - Rides	Pruning													1		1		2
Installation & Routine Maintenance		Felling													1			1	2
Installation & Routine Maintenance		Mowing grass													1		1		2
Installation & Routine Maintenance		Pruning shrubs													1		1		2
Installation & Routine Maintenance		Removing arisings													1		1		2
																			10
Installation & Routine Maintenance	Woodland - Hibernacula	Removing arisings													1		1		2
Installation & Routine Maintenance		Felling and leaving on site (per day / 10 trees)													1		1		2
Installation & Routine Maintenance		Mowing grass													1		1		2

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Activity	Element Type	Task	January	February	March	April	May	June	July	August	September	October	November	December	Total number of visits in year 1	Year 5	Year 10	Year 20	Summary of frequency over a 20 year life cycle
Installation & Routine Maintenance		Pruning shrubs					■								1		1		2
Installation & Routine Maintenance		Removing arisings					■						■		2		1		3
Works to veteran trees																			11
Routine Maintenance	Woodland management	Obtainingf permission										■			1				1
Works to veteran trees															0				0
Routine Maintenance	Woodland management	Pruning											■		1			1	2
Routine Maintenance	Woodland management	Removing arisings											■		1			1	2
Woodland coppicing - maximum 25% of woodland cover to coppiced at one time																			4
Routine Maintenance	Woodland management	Broadleaf woodland coppicing											■		1		1		2
Routine Maintenance	Woodland management	Coniferous woodland coppicing											■		1			1	2
Routine Maintenance	Woodland management	Mixed woodland coppicing											■		1			1	2
Treatment of invasive species																			6
Routine Maintenance	Shrubs - existing	Rhododendron removal (per m²)											■		1	1			2
Routine Maintenance	Shrubs - existing	Laurel removal (per m²)											■		1	1			2
Routine Maintenance	Shrubs - existing	Japanese knotweed (per m²)											■		1	1			2
Routine Maintenance	Shrubs - existing	Other invasive species											■		1	1			2
Treatment of disease																			8
Routine Maintenance	Woodland management	e.g. Ash dieback											■		1	1			2
General inspections																			
Inspection	Woodland management	Site wide tree inspection							■						1		1		2
Inspection	Woodland management	Identify if the site is covered by SSSI							■						1				1
Recently planted trees																			3
Inspection	New planted	Health of tree							■						1	1			2
Inspection	New planted	Presence of weeds and litter	■												1	1			2
Inspection	New planted	Check to see if watering or feeding is required	■												1	1			2
Inspection	New planted	Fencing (per m) - fixtures, fittings and identify signs of damage	■												1	1			2
Inspection	New planted	Tree guards (per tree)	■												1	1			2
Inspection	New planted	Stakes and ties (per tree)	■												1	1			2
Existing woodland																1			12
Inspection	Woodland management	Litter picking	■												1	1			2
Inspection	Woodland management	Identify if thinning or pruning required							■						1	1			2
Inspection	Woodland management	Identify if woodland requires feeling (per hectare)							■						1	1			2
Inspection	Woodland management	Inspect the stability function of the woodland is being maintained (per hectare)							■						1	1			2
Inspection	Woodland management	Inspect if the screening function of the woodland is being maintained (per hectare)							■						1	1			2
Existing woodland features																			10
Inspection	Woodland - Monolith	Check feature still fulfils its brief							■						1	1			2
Inspection	Woodland - Dead wood retained in situ	Check feature still fulfils its brief							■						1	1			2
Inspection	Woodland - Pollard	Check feature still fulfils its brief							■						1	1			2
Inspection	Woodland - Glades	Check feature still fulfils its brief							■						1	1			2
Inspection	Woodland - Rides	Check feature still fulfils its brief							■						1	1			2
Inspection	Woodland - Hibernacula	Check feature still fulfils its brief							■						1	1			2
Works to protected trees																			12
Inspection	Woodland management	Check health of TPO tree							■							1	1	1	3
Inspection	Woodland management	Check health of WPO tree							■							1	1	1	3
Works to veteran trees																			6
Inspection	Woodland management	Inspect health of the veteran tree							■						1	1			2
Woodland coppicing																			2
Inspection	Woodland management	Broadleaf woodland coppicing							■						1	1			2

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Activity	Element Type	Task	January	February	March	April	May	June	July	August	September	October	November	December	Total number of visits in year 1	Year 5	Year 10	Year 20	Summary of frequency over a 20 year life cycle
Inspection	Woodland management	Coniferous woodland coppicing							■						1	1			2
Inspection	Woodland management	Mixed woodland coppicing							■						1	1			2
Treatment of invasive species																			6
Inspection	Shrubs - existing	Identify the presence of invasive species rhododendron, laurel, Japanese knotweed(per m²)	■												1			19	20
Treatment of disease																			20
Inspection	Woodland management	e.g. Ash dieback	■												1	1			2
																			2

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Appendix C: Forest Reproductive Material Regulations (Forestry Commission, 2019) Pro forma Certificate

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SUPPLIER'S DOCUMENT FOR MULTIFUNCTIONAL FORESTRY

Forest Reproductive Material (Great Britain) Regulations 2002/Voluntary Scheme for the Certification of Native Trees and Shrubs

(2) Date supplied: 01/07/2014

(4) Supplied by: Amanda Campbell
The Forestry Commission
231 Corstorphine Road
Edinburgh, EH12 7AT

(5) Supplied to: Mr Stuart AÎHara
Forest Research
Northern Research Station
Roslin, Midlothian, EH25 9SY

(1) Supplier certificate: 2014/0001
(THIS MUST BE A UNIQUE NUMBER)

(1a) Internal ref:
(THIS IS AN OPTIONAL NUMBER FOR YOUR OWN INTERNAL USE)

Customer Ref:

(0)*	Species Botanical Name (6)	Qty (15)	Master Certificate No (3)	Type of Basic Material (9)* a	b	c	d	e	f	Category (8)* a	b	c	d	x	Nature of Planting Stock (7)* a	b	c	d	Nat. Reg BM Ident (11)	Origin (12)* a	b	c	Provenance (13)	Age of planting stock (16)	Y/N Veg. Prop (19)*	Purpose (10)* a	b
	Alnus glutinosa																				X		20	N/A	N	X	
		0.05kg	UK20140055	X	X					X					X				psyRPN2-psyTP201SI	X		X	10	N/A	N	X	
		0.06kg	UK20120123							X					X								201	N/A	N	X	
	Picea sitchensis	0.5kg	UK20140123		X						X				X				tplST20-tplSR21QU								
	Pinus pinaster	400	UK20120622			X						X					X				X				N	X	
	Pinus sylvestris	40	UK20140002					X				X				X			popCLNQU00	X			10		Y	X	
		500	UK20130100				X						X				X		popPF65TE		X				Y	X	
	Picea sitchensis																			X				N/A	N	X	
	Populus nigra																										
	Pinus sylvestris	0.3kg	UK20130145		X					X					X				psySTN2-15SI								
	_	_	_	_	_	_	_	_	_	_	_	_	_	_	_	_	_	_	_	_	_	_	_	_	_	_	_

*key:
0 – International Country code of where the stock has been grown **(voluntary information field)**

7a – Seeds
7b - Parts of plants
7c - Planting stock (bare-root)
7d - Planting stock (containers)

8a - Source Identified
8b – Selected
8c – Qualified
8d – Tested
8x - Provisionally approved

9a - Seed source
9b – Stand
9c - Seed orchard
9d - Parents of families
9e – Clone
9f - Clonal mixture

10a – multifunctional forestry
10b - other

12 – Parent trees of the trees from which seed was collected are:
a - indigenous b - non-indigenous c - unknown

19 – material has been vegetatively propagated **Y** or **N**

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Basic Material Identities

The Basic material ident tells you:

- Species
- Category
- Type
- Region of provenance/seed zone
- Origin

Types of Basic Material	Category of FRM	Region of Provenance
RP – Region of provenance	SI – Source Identified	10, 20, 30 or 40 – defined for GB
ST – Stand	SE – Selected	A 3-digit number used for native species
SO – Seed orchard	QU - Qualified	
PF – Parents of family(ies)	TE - Tested	
CL – Clone		
CM – Clonal mixture		

Examples

fsyRP406SI

Species code – fsy – Beech
Type of Source/BM – Region of provenance (Seed source)
Region of provenance/seed zone – 406
Category of material – Source Identified

psySTN2-15SI

Species code – psy – Scots pine
Type of source/BM – Stand
Native status indicator – If applicable, N if the Basic Material is indigenous, otherwise not used.
Category of material – Source Identified

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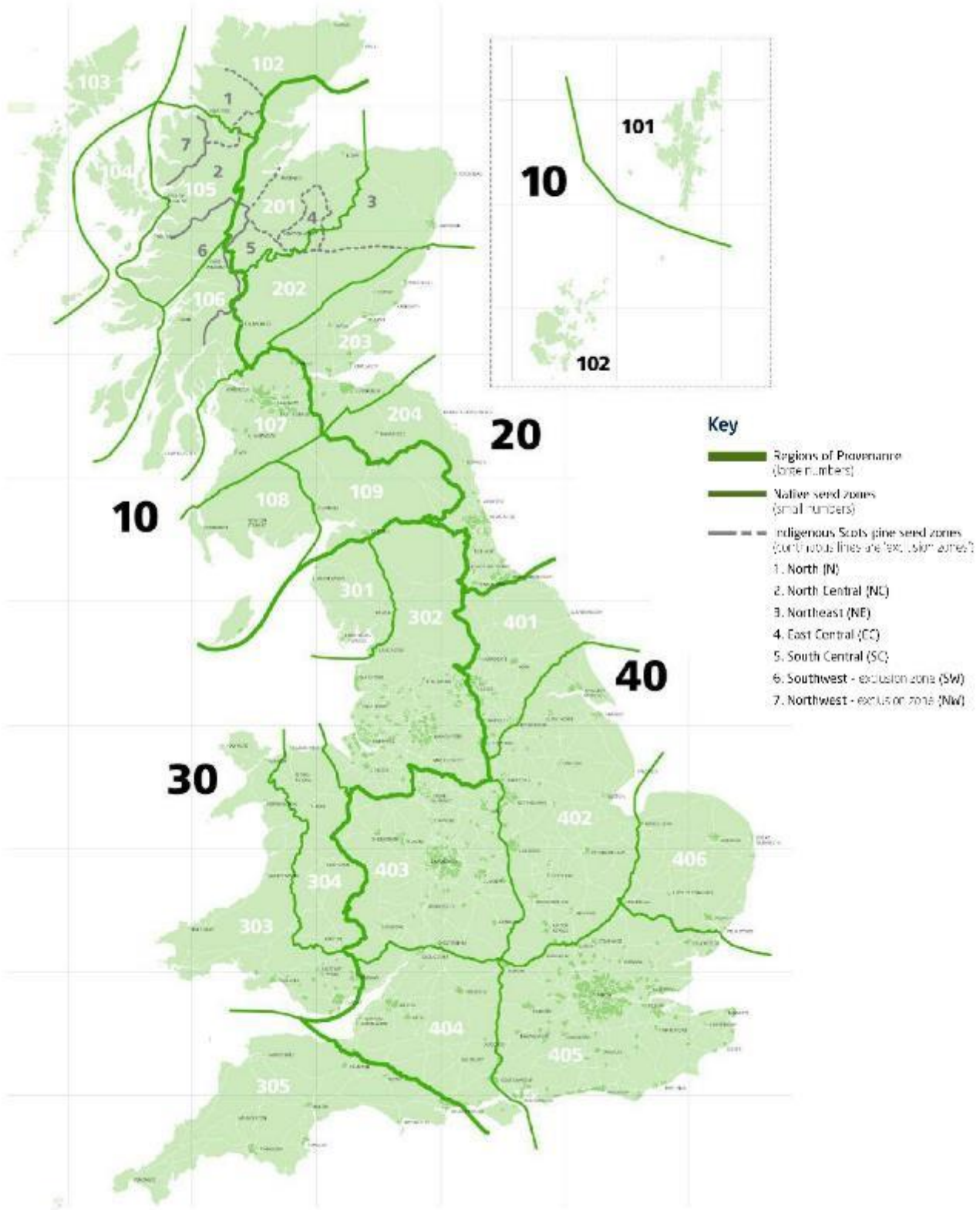
Appendix D: Forestry Commission provenance zones map



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8 Sources of further information

8.1 References

Ancient Tree Forum. (2020) Ancient Tree Forum. Available at: https://www.ancienttreeforum.co.uk/.

Barron, C. (2009) The Forest Service: The control of rhododendron in native woodlands. Available at: https://www.woodlandsofireland.com/sites/default/files/No.%203%20-%20Rhododendron%20Control.pdf.

BBC. (2014) Belvoir Forest trees cut down after outbreak of disease. Available at: https://www.bbc.co.uk/news/uk-northern-ireland-28654490.

BSI. (2014) BS 8545:2014 Trees: from nursery to independence in the landscape – Recommendations. Available at: https://www.thenbs.com/PublicationIndex/documents/details?Pub=BSIandDocID=306058

Crowther, R. E. and Patch, D. (2010) Coppice. Arboriculture Research Note 21, Arboricultural Advisory and Information Service. Available at: https://www.trees.org.uk/Trees.org.uk/files/2d/2d2ce123-8ed3-4866-a573-4f9c25a3393e.pdf

CSD Hub. (2020) CS Design Software: National Plant Specification. Available at: https://www.csdhub.com/national-plant-specification/what-is-the-nps/.

Defra. (2008) Defra FCERM Innovation Fund: Restoring Floodplain Woodland for Flood Alleviation. Available at: https://www.forestresearch.gov.uk/documents/1022/defra_floodplain_report_15june2008.pdf.

Defra. (2020) UK Plant Health Information Portal. Available at: https://planthealthportal.defra.gov.uk/

Forest Research. (2018) UK-grown Timber. Available at: https://www.forestresearch.gov.uk/tools-and-resources/statistics/forestry-statistics/forestry-statistics-2018/uk-grown-timber/.

Forest Research. (2018) Urban Tree Manual. Available at: https://www.forestresearch.gov.uk/tools-and-resources/urban-tree-manual/.

Forest Research. (2019) The Right Trees for Changing Climate Database. Available at: http://www.righttrees4cc.org.uk/default.aspx.

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Forest Research. (2020) Ecological Site Classification Decision Support System (ESC-DSS). Available at: https://www.forestresearch.gov.uk/tools-and-resources/ecological-site-classification-decision-support-system-esc-dss/.

Forest Research. (2020) Recognising types of mammal damage to trees and woodland. Available at: https://www.forestresearch.gov.uk/research/recognising-types-of-mammal-damage-to-trees-and-woodland/.

Forest Research. (2020) Slope stabilisation. Available at: https://www.forestresearch.gov.uk/tools-and-resources/urban-regeneration-and-greenspace-partnership/greenspace-in-practice/benefits-of-greenspace/slope-stabilisation/.

Forest Research. (2020) Tree Alert: Tree Pest and Disease sighting reporter. Available at: https://treealert.forestresearch.gov.uk/.

Forest Research. (2020) Rhododendron Control. Available at: https://www.forestresearch.gov.uk/research/management-of-upland-native-woodlands/rhododendron-control/.

Forestry Commission (1995) Forestry Commission Research Information Note 259: Management of Coppice Stools. Available at: https://www.forestresearch.gov.uk/documents/992/rin259.pdf.

Forestry Commission. (2010) Managing ancient and native woodland in England. Available at: https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/689543/Managing_Ancient_Woodland.pdf.

Forestry Commission. (2014) Building wildlife resilience into forest management planning. Available at: https://www.forestresearch.gov.uk/research/building-wildfire-resilience-into-forest-management-planning/.

Forestry Commission. (2017) The UK Forestry Standard: The government's approach to sustainable forestry. Available at: https://www.forestresearch.gov.uk/research/the-uk-forestry-standard/.

Forestry Commission. (2019) Forest Reproductive Material: Regulations controlling seed, cuttings and planting stock for forestry in Great Britain. Available at: https://www.forestresearch.gov.uk/research/forest-reproductive-material-regulations-controlling-seed-cuttings-and-planting-stock-for-forestry-in-great-britain-2nd-edition/.

OFFICIAL

Forestry Commission. (2019) Genetic consideration for provenance choice of native trees under climate change in England. Available at: https://www.forestresearch.gov.uk/research/genetic-considerations-provenance-choice-native-trees-under-climate-change-england/.

Forestry Commission. (2020) Managing Ash Dieback in England. Available at: https://www.forestresearch.gov.uk/documents/7277/7894_New_FC_Chalara_leaflet_dft9.pdf.

Gov.uk. (2018) Guidance: identify a tree pest or disease. Available at: https://www.gov.uk/guidance/identify-a-tree-pest-or-disease-overview.

The Forestry Authority (1995) *Forestry Commission Handbook 11: Creating and Managing Woodlands Around Towns*. HMSO.

Humphreys, M., Leech, K. and Nettleton, I. (2015) Risk assessment and management of unstable slopes on the national forest estate in Scotland. *IOP Confrence Series Earth and Environmental Science*, 26 (1).

JCL. (2014) JCLI Practice note 11: Contract Growing Guidance. Available at: https://landscapewpstorage01.blob.core.windows.net/www-landscapeinstitute-org/migrated-legacy/JCLIPN11ContractGrowingGuidance2014-10.pdf.

Network Rail. (2018) Appendix 6 – Avon Gorge SSSI and SAC Vegetation Management Plan.

Network Rail. (2018) Avon Gorge SSSI and SAC POD Branch Line. Site Management Statement 2018 – 2023.

Parrott, J and MacKenzie, N. (2013) A critical review of work undertaken to control invasive rhododendron in Scotland. Available at: http://mantaecology.co.uk/rhododendron-control-review-2013.pdf.

Royal Forestry Society. (2015) Chapter 6: Biodiversity. Available at: https://www.rfs.org.uk/media/441735/6-biodiversity.pdf.

Royal Forestry Society. (2019) Managing Dieback Case Studies 2019. Available at: https://rfs.org.uk/media/598372/rfs-managing-ash-dieback-case-studies-2019.pdf.

Scottish National Heritage. (2018) Coniferous Woodland (UK BAP Broad Habitat). Available at: https://www.nature.scot/sites/default/files/2018-02/Broad%20Habitat%20-%20Coniferous%20Woodland.pdf.

TDAG. (2014) Trees in Hard Landscapes: A Guide for Delivery. Available at: http://www.tdag.org.uk/uploads/4/2/8/0/4280686/tdag_trees-in-hard-landscapes_september_2014_colour.pdf.

OFFICIAL

TDAG. (2019) Tree Species Selection for Green Infrastructure: A guide for specifiers. Available at: http://www.tdag.org.uk/uploads/4/2/8/0/4280686/tdag_treespeciesguidev1.3.pdf.

Woodland Trust. (2019) Planning for Ancient Woodland. Planner's Manual for Ancient Woodland and Veteran Trees. Available at: https://www.woodlandtrust.org.uk/media/3731/planners-manual-for-ancient-woodland.pdf

The Woodland Trust. (2020) The Woodland Trust. Available at: https://www.woodlandtrust.org.uk/.

UKWAS. (2020) UK Woodland Assurance Standard. Available at: http://ukwas.org.uk/.

UK Habitat Classification Working Group. (2018). UK Habitat Classification. Available at: https://ecountability.co.uk/ukhabworkinggroup-ukhab/.

Watson, G. (2013) *Tree Pests and Diseases – An Arborists' Field Guide.* The Arboricultural Association.

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8.2 Figure references

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https://upload.wikimedia.org/wikipedia/commons/5/55/Phytophthora_kernoviae_Rhododendron.jpg

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