Forestry Commission

The UK Forestry Standard

The governments' approach to sustainable forestry

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Forestry Commission England
Forestry Commission Scotland
Coimisean na Coillteareachd Alba
Cyfoeth Naturiol Cymru
Natural Resources Wales
FOREST SERVICE

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1. Introduction

The United Kingdom Forestry Standard (UKFS) is the reference standard for sustainable forest management in the UK. It outlines the context for forestry, sets out the approach of the UK governments to sustainable forest management, defines standards and requirements, and provides a basis for regulation and monitoring – including national and international reporting.

The UKFS approach is based on applying criteria agreed at international and European levels to forest management in the UK. However, because the history of forestry and the nature of the woodlands in the UK differ in fundamental ways from those of other European countries, a main purpose of the UKFS is to demonstrate that these agreements are applied in an appropriate way to the management of UK forests and woodlands.

The UKFS was first published in 1998 and revised in 2004 and 2011. This fourth edition, which now incorporates the previously separate supporting series of Guidelines, has been produced to:

- update relevant legislation and other regulatory requirements;
- update organisational details and mandates of the forestry authorities;
- reflect key policy changes arising from the increased devolution of forestry;
- incorporate recent developments in international agreements, and the way forestry activity is monitored and reported;
- incorporate recent advances in the scientific understanding of forestry;
- further strengthen the role of forest planning.

The UKFS has been developed by the forestry authorities in England, Scotland, Wales and Northern Ireland, through an open and consensual process in accordance with government guidance. This has involved many interested parties and the general public in a formal consultation.

The UKFS has been endorsed by the UK and country governments and applies to all UK forests and woodlands. Together with the national forestry policies and strategies of England, Scotland, Wales and Northern Ireland, the UKFS provides a framework for the delivery of international agreements on sustainable forest management, alongside policies on implementation.

The standards for the planning, design and sustainable management of forests and woodlands in the UK use an approach based on internationally recognised science and best practice. The UKFS is the basis of forestry practice for the independent UK Woodland Assurance Standard (UKWAS), which is used for voluntary independent certification. It can also be used for assessing compliance as part of an environmental management system such as ISO 14001.

By meeting the Requirements of the UKFS, forest and woodland owners, managers and practitioners can demonstrate that forestry operations and activities are both legal and sustainable. The main bodies responsible for the regulation and monitoring of the UKFS are the Forestry Commission in England and Scotland, Natural Resources Wales, and the Forest Service in Northern Ireland (the 'forestry authorities').

The UKFS is relevant to all those with an interest in UK forests and woodlands, particularly owners, managers and practitioners, and all organisations with responsibilities for forests and woodlands – including government agencies, local authorities, non-governmental organisations, charities and trusts.

2. Overview of the UK Forestry Standard

This section sets out how the UK Forestry Standard (UKFS) Requirements for sustainable forest management are structured, explains the role of the supporting Guidelines, defines the scope of the UKFS and provides explanations of terminology.

Requirements and Guidelines

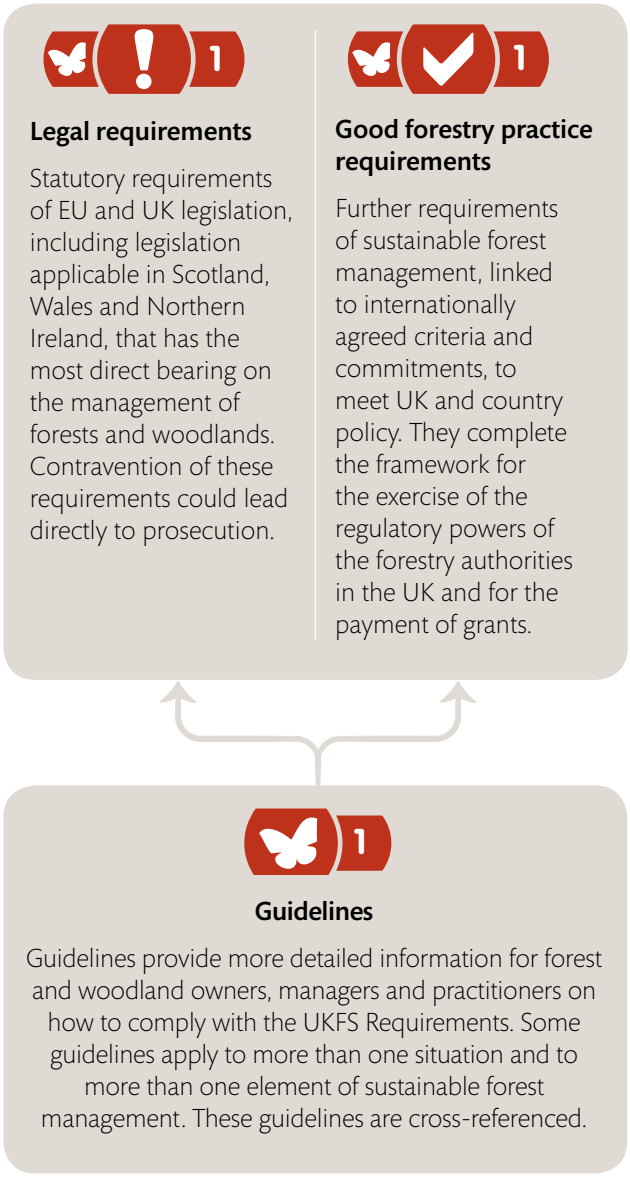
The UKFS Requirements are divided into **legal requirements** and **good forestry practice requirements**. The Requirements are categorised into different elements of sustainable forest management, each supported by Guidelines for managers. The elements are:

- General Forestry Practice
- Biodiversity
- Climate Change
- Historic Environment
- Landscape
- People
- Soil
- Water

The UKFS Guidelines explain the principles of the various elements of sustainable forest management in further detail and set out how the UKFS Requirements can be met. The Guidelines provide guidance and advice for forest and woodland managers and practitioners based on current, relevant research and experience. They form the basis for assessing proposals, management operations and activities to ensure the sustainability of UK forests and woodlands.

General Forestry Practice Requirements and Guidelines are common to the other elements of sustainable forest management. They apply in most forestry situations, for example planning and operations.

UKFS Requirements and Guidelines for General Forestry Practice are set out in Section 5. UKFS Requirements and Guidelines for the different elements of sustainable forest management are set out in Section 6.



Scope and application

The UKFS has been developed specifically for forestry in the UK and applies to all UK forests. The UKFS is applicable to the wide range of activities, scales of operation and situations that characterise forestry in the UK. The relevance of the Requirements and Guidelines will therefore vary according to the circumstances of the site, particularly the size of the forest or woodland, the scale of operation, and the objectives of the forest or woodland owner.

The UKFS encompasses the entire forest environment, which may include open areas, water bodies such as rivers, lakes and ponds, and shrub species in addition to the trees themselves. It applies to the planning and management of forests within the wider landscape and land-use context, and to all UK forest types and management systems, including the collective tree and woodland cover in urban areas. The scope of the UKFS does not extend to the management of individual trees (arboriculture), orchards, ornamental trees and garden trees, tree nurseries, or the management of Christmas trees.

Some aspects of forest management lend themselves to 'yes or no' compliance, but most do not, and so the UKFS has not attempted to condense all the complexities of forest management into an over-simplistic format. The UKFS has therefore been written to be interpreted with a degree of flexibility and applied with an appropriate level of professional expertise.

It is also recognised that forest and woodland management is a long-term business and, while management opportunities should be taken to effect improvements, it may take more than one rotation to achieve some of the Requirements. In assessing whether the Requirements have reasonably been met, the overall balance of benefits or ecosystem services will be taken into account.

Definitions and terms

The UKFS applies to all UK forests. The term **forest** is used to describe land predominately covered in trees (defined as land under stands of trees with a canopy cover of at least 20%), whether in large tracts (generally called forests) or smaller areas known by a variety of terms (including woods, copses, spinneys or shelterbelts). The alternative term **woodland** has local nuances of meaning so it is used in the text where it is more appropriate, but for the purposes of the UKFS the meaning is synonymous with forest. **Forestry** is the science and art of planting, managing and caring for forests.

Forestry authority is a function exercised by government. In the UK, this function is devolved to the respective country administrations in England, Scotland, Wales and Northern Ireland although some areas, such as international forestry policy and plant health, are the responsibility of the UK Government.

The forestry authority function includes the setting and implementation of forestry policy, the provision of grants and incentives, and the regulation and monitoring of forestry activity. While it is the responsibility of the government administration in each of the UK countries to set forestry policy, each has a delivery arm (or forestry body) responsible for implementation, regulation and monitoring.

- In England, Defra (Department for Environment, Food and Rural Affairs) is responsible for setting policy and providing incentives. Forestry Commission England is responsible for delivery.
- In Scotland, the Scottish Government is responsible for setting policy and providing incentives. Forestry Commission Scotland is responsible for delivery.
- In Wales, the Welsh Government is responsible for setting policy and providing incentives. Natural Resources Wales is responsible for delivery.
- In Northern Ireland, the Department of Agriculture, Environment and Rural Affairs is responsible for setting policy and providing incentives. Forest Service is responsible for delivery.

While the organisational arrangements vary between countries and will continue to evolve, the broad regulatory frameworks are very similar and, in implementing these frameworks, each of the countries has adopted the UKFS as its definition of sustainable forest management and good forestry practice.

For the **UKFS Requirements** the term **must** is used to reflect a **legal requirement**, whereas the term **should** is employed for a **good forestry practice requirement**,

which recognises that there may, in exceptional cases, be reasons for divergence.

The **UKFS Guidelines** are concerned with greater detail and therefore use a range of imperative terms appropriate to context. For unacceptable practice or management, the term **avoid** is used, meaning 'keep away', 'refrain from' or 'prevent from happening'. Where specific maximum and minimum values or proportions are defined, they refer to the forest management unit and serve as a starting point for assessing compliance with the Requirements. However, because UK forestry encompasses a variety of activity, the relevance of Guidelines will vary and, as with good forestry practice requirements, there will be exceptional situations where a reasonable case for divergence can be made.

Detailed definitions of terminology specific to the UKFS can be found in the Glossary.

Some UKFS Requirements and Guidelines are expressed as maximum or minimum proportions of the forest. In these cases the area in question is the **forest management unit** (FMU). The FMU is the area subject to a forest management plan or proposal. This area is selected by the owner and/or manager and will be determined by the nature of the forest, the proposed operations and management objectives. Extensive FMUs have the advantage of allowing a strategic approach to be taken in achieving UKFS Requirements, both in terms of the area covered and the timescale.

Short rotation coppice (SRC) and **short rotation forestry** (SRF) are both included within the scope of the UKFS, whether managed as part of a forest or as an agricultural or stand-alone regime. Although requirements for site selection and environmental protection for SRC and SRF will be the same as for other types of forestry, there will be differences in how other requirements can be met, particularly in the case of SRC, but the principles given in the UKFS will be applied.

3. International context for forestry

Concern over environmental degradation and deforestation focused global attention on the management, conservation and sustainable development of forests during the 1980s. A Statement of Forest Principles, designed to ensure that forests are sustainably managed to meet the social, environmental and economic needs of present and future generations, was agreed at the 1992 Earth Summit in Rio de Janeiro.

The 1992 UN Conference on Environment and Development (the Rio 'Earth Summit') resulted in worldwide agreements on sustainability. In addition to the UN Statement of Forest Principles, which promotes the concept of sustainable forest management, the conference also agreed three legally binding conventions: the UN Framework Convention on Climate Change, the UN Convention on Biological Diversity and the UN Convention to Combat Desertification. It also agreed 'Agenda 21', a worldwide and cross-cutting action plan for sustainability.

Since the Rio Earth Summit, the international community has continued to make progress in relation to the three dimensions of sustainable development, namely social, environmental and economic. The UN Sustainable Development Summit in September 2015 agreed 17 Sustainable Development Goals with 169 targets, known as 'Transforming our World: the 2030 Agenda for Sustainable Development'. For forests and forestry, the concept of sustainable forest management of all types of forest is seen by the international community as the definitive framework for increasing the benefits provided to society, and is relevant to several of these Sustainable Development Goals and targets. 'Sustainable Development Goal 15' addresses forests directly. It aims to:

> 'Protect, restore and promote sustainable use of terrestrial ecosystems, sustainably manage forests, combat desertification, and halt and reverse land degradation and halt biodiversity loss.'

International forestry processes

After the 1992 Earth Summit, the consideration of international forest policy continued through the UN Intergovernmental Panel on Forests and Intergovernmental Forum on Forests, which led in 2000 to the UN establishing an International Arrangement on Forests. This consists of the United Nations Forum on Forests (UNFF), an intergovernmental policy forum to promote sustainable forest management, and the Collaborative Partnership on Forests (CPF), a partnership of the major forest-related international organisations and institutions – including the Secretariats of the three Rio conventions. At the sixth session of the UNFF in 2006, the international community agreed the following four global objectives on forests, and agreed to work globally and nationally to make progress towards their achievement by 2015:

- Reverse the loss of forest cover worldwide through sustainable forest management, including protection, restoration, afforestation and reforestation, and increase efforts to prevent forest degradation.
- Enhance forest-based economic, social and environmental benefits, including by improving the livelihoods of forest-dependent people.
- Increase significantly the area of protected forests worldwide and other areas of sustainably managed forests, as well as the proportion of forest products from sustainably managed forests.
- Reverse the decline in official development assistance for sustainable forest management and mobilise significantly increased new and additional financial resources from all sources for the implementation of sustainable forest management.

The seventh session of the UNFF in New York in 2007 saw the adoption of a non-legally binding instrument on all types of forests.

The purpose of this international instrument is to:

- strengthen political commitment and action to implement sustainable forest management and to achieve the global objectives;
- enhance the contribution of forests to the achievement of international development goals;

- provide a framework for national action and international co-operation.

In 2015, the international community agreed to extend the mandate and timescale for the International Arrangement on Forests and develop a strategic plan. Amongst other objectives, the plan will contribute to the 2030 UN Sustainable Development Goals. The non-legally binding instrument was updated to take account of new developments and renamed the 'UN Forest Instrument'.

The current international consensus on forestry continues to be expressed through international and regional treaties and regulations together with substantial non-legally binding instruments (or 'soft law'). The UK plays a full and active part in international forestry processes. This engagement aims to ensure that all forests are managed according to the principles of sustainable forest management and that the influence the UK has on global forests is a positive one. Domestically, the UK approach to sustainable forest management is defined by the UK Forestry Standard (UKFS).

Forestry and the Rio conventions

Of the three legally binding Rio conventions, the UN Framework Convention on Climate Change and the UN Convention on Biological Diversity are most relevant to sustainable forest management in the UK.

UN Framework Convention on Climate Change

The global nature of the climate change problem and the important role of the world's forests in mitigating its effects was recognised at the Rio Earth Summit. The resulting international treaty, the UN Framework Convention on Climate Change (UNFCCC), includes provisions for reporting net changes in greenhouse gases through forest activity. In 1997 a number of nations approved an addition to the treaty – the Kyoto Protocol – which has more specific emissions reduction measures, including binding targets for some developed countries, including the UK. In December 2015, the international community adopted the Paris Agreement, which sets out provisions on mitigation, adaptation and the sustainable management of forests. The UK and EU are both parties to the Convention and its Kyoto Protocol and, in 2014, the EU adopted its Climate and Energy Framework to make a fair and ambitious contribution to reducing greenhouse gas emissions, including through land use, land-use change and forestry (LULUCF).

UN Convention on Biological Diversity

The UN Convention on Biological Diversity (UNCBD) is the primary international agreement covering the conservation and sustainable use of biodiversity. It has three main aims: the conservation of biological diversity, the sustainable use of its components, and the fair and equitable sharing of the benefits from the use of genetic resources. Signatory countries have committed themselves to a significant reduction of the rate of biodiversity loss at the global, regional and national level by 2020.

The UNCBD promotes an ecosystem approach founded on 12 management principles to supply social, environmental and economic benefits within sustainable limits. Forests are recognised as one of the ecosystems fundamental for biodiversity, and the 12 management principles are being applied through the UN principles of sustainable forest management already agreed through a programme of work that sets out key actions. At a European level this has been taken forward through the Ministerial Conference on the Protection of Forests in Europe (MCPFE) process (now known as Forest Europe, see later in this section).

The ecosystem approach

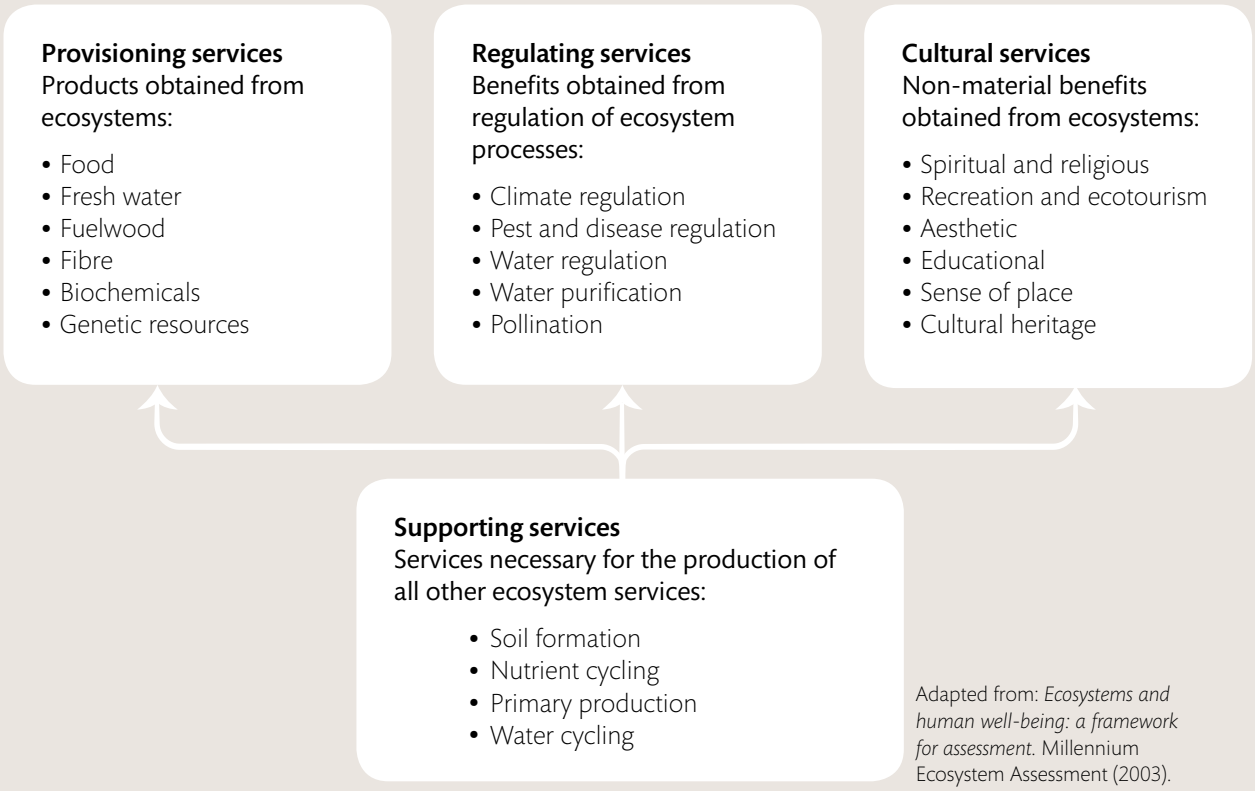
The 'ecosystem approach' is a strategy for the integrated management of land, water and living resources that promotes conservation and sustainable use in an equitable way. The UNCBD adopted the ecosystem approach as the primary framework for action under the Convention. It has a broad scope that goes beyond ecosystems themselves to encompass social, cultural and economic factors and provides a framework for looking at whole ecosystems in decision making, and for valuing the 'ecosystem services' they provide (Box 3.1).

Natural capital and ecosystem services

Ecosystem services describe the wide range of services derived from the world's stocks of natural assets, including

Box 3.1 Ecosystem services

Ecosystem services can be thought of as the link between ecosystems and human well-being. They describe the processes by which natural ecosystems provide resources (used actively or passively) that sustain and benefit people. The Millennium Ecosystem Assessment separated these services into four categories: provisioning services, for example food and water; regulating services, for example pest and disease control; cultural services, for example spiritual and recreational benefits; and supporting services, for example soil formation and primary production that maintain the conditions for life on Earth. The concepts of natural capital and ecosystem services are a major step forward in understanding how nature underpins economic prosperity and human welfare, and in demonstrating the need for investment to maintain natural systems.



Adapted from: *Ecosystems and human well-being: a framework for assessment.* Millennium Ecosystem Assessment (2003).

geology, soil, air, water and all living things, that make human life possible and benefit people. These natural assets are often referred to as 'natural capital', one of five types of capital from which we derive goods and services (the others are human, social, manufactured and financial).

Ecosystem services can also provide a way to describe and evaluate the various benefits that forests and woodlands provide. The diagram in Box 3.1 shows the main characteristics of the four categories of ecosystem services and gives examples of the wide range of benefits forest and woodland ecosystems provide. Conserving and enhancing natural capital and the ecosystem services that flow from it underpins the approach to sustainable forest management set out in the UKFS.

A growing body of evidence and analysis is being used to support the ecosystem approach in the UK. The 2011 UK National Ecosystem Assessment and its 2014 Follow-On report provide seminal analyses of the UK's natural environment in terms of the benefits it provides to society and continuing economic prosperity. Understanding of the role of natural capital in this process has been greatly improved through the work of the UK Natural Capital Committee, including how organisations can account for ecosystem services delivered by natural capital.

The analysis of the natural environment will support global obligations, such as the UNCBD call on countries to conduct natural capital assessments. It will also support regional obligations such as the EU Water Framework Directive, which encourages the management of ecosystem services.

Forestry in Europe

Europe's 1000 million hectares of forests comprise 25% of the world's total forested area and cover 45% of the European landscape. At around 13% the UK's forest cover is among the lowest of any country in Europe (Table 3.1). In 1990, a pan-European governmental process called the Ministerial Conference on the Protection of Forests in Europe (MCPFE) was established. This is now known internationally as 'Forest Europe' and comprises 46 signatory countries including Russia. Through this high-level political process, common principles, criteria and guidelines for sustainable forest management have been developed.

At the conference in Helsinki in 1993, Europe's forestry ministers built on the Statement of Forest Principles and other agreements that were outcomes of the 1992 Earth Summit. The resolutions that were adopted included a definition of sustainable forest management:

> 'the stewardship and use of forests and forest lands in a way, and at a rate, that maintains their biodiversity, productivity, regeneration capacity, vitality and their potential to fulfil, now and in the future, relevant ecological, economic and social functions, at local, national, and global levels, and that does not cause damage to other ecosystems.'

A set of pan-European criteria and indicators, was subsequently agreed at the Third Ministerial Conference in Lisbon in 1998. More detailed guidance on forest management followed in the form of 'Pan-European Level Operational Guidelines'. Forest Europe criteria and indicators were updated in 2015 and continue to define sustainable forestry in the European context (see Table 3.2 and http://foresteurope.org/sfm-criteria-indicators).

Internationally, Forest Europe is regarded as one of the strongest regional political processes addressing forest issues. Through the process, a common understanding on the sustainable management of European forests has been reached and resolutions and commitments to sustainable forest management continue to be agreed. The UK recognises the significant achievements of the ministerial process and is committed to its vision: 'To shape a future where all European forests are vital, productive and multifunctional', and to the various Resolutions, Ministerial Decisions and Declarations. The UKFS, together with the constituent forestry policies and strategies of England, Scotland, Wales and Northern Ireland, implements these commitments in UK forests and woodlands.

Forestry and the European Union

Forestry is not included within the competence to act of the EU, which means that it does not have the power to legislate, to adopt non-legislative acts, or to take any other sort of action on forestry matters. However, many of the other areas in which the EU does have competence (or shared competence), such as environment, energy and agriculture, have the potential to impact significantly on forests and forestry. As a result, the European Commission and Member States co-operate and have developed a common EU vision of forests and forestry that promotes the principles of sustainable management. This vision first became a strategy in 1998.

In May 2014, the European Council adopted a new and revised EU Forest Strategy to enhance co-ordination and to facilitate the coherence of forest-related policies. The Strategy is based on a number of guiding principles with

Table 3.1 Forest cover for selected European countries.

	Forest as % of land area	Forest area (1000 ha)
Finland	73	22218
Sweden	68	28073
Norway	40	12112
Spain	37	18418
Portugal	35	3182
Germany	33	11419
Italy	32	9297
Poland	31	9435
France	31	16989
UK	13	3144
Ireland	11	754

Source: FAO, 2015 Forest Resources Assessment 2015.

Table 3.2 Forest Europe pan-European criteria and indicators for sustainable forest management.

Criterion		Indicator
C1	Maintenance and appropriate enhancement of forest resources and their contribution to global carbon cycles	Policies, institutions and instruments to maintain and appropriately enhance forest resources and their contribution to global carbon cycles 1.1 Forest area 1.2 Growing stock 1.3 Age structure and/or diameter distribution 1.4 Forest carbon
C2	Maintenance of forest ecosystem health and vitality	Policies, institutions and instruments to maintain forest ecosystem health and vitality 2.1 Deposition and concentration of air pollutants 2.2 Soil condition 2.3 Defoliation 2.4 Forest damage 2.5 Forest land degradation
C3	Maintenance and encouragement of productive functions of forests (wood and non-wood)	Policies, institutions and instruments to maintain and encourage the productive functions of forests 3.1 Increment and fellings 3.2 Roundwood 3.3 Non-wood goods 3.4 Services
C4	Maintenance, conservation and appropriate enhancement of biological diversity in forest ecosystems	Policies, institutions and instruments to maintain, conserve and appropriately enhance the biological diversity in forest ecosystems 4.1 Diversity of tree species 4.2 Regeneration 4.3 Naturalness 4.4 Introduced tree species 4.5 Deadwood 4.6 Genetic resources 4.7 Forest fragmentation 4.8 Threatened forest species 4.9 Protected forests 4.10 Common forest bird species
C5	Maintenance and appropriate enhancement of protective functions in forest management (notably soil and water)	Policies, institutions and instruments to maintain and appropriately enhance the protective functions in forest management 5.1 Protective forests – soil, water and other ecosystem functions – infrastructure and managed natural resources
6	Maintenance of other socio-economic functions and conditions	Policies, institutions and instruments to maintain other socio-economic functions and conditions 6.1 Forest holdings 6.2 Contribution of forest sector to GDP 6.3 Net revenue 6.4 Investments in forests and forestry 6.5 Forest sector workforce 6.6 Occupational safety and health 6.7 Wood consumption 6.8 Trade in wood 6.9 Wood energy 6.10 Recreation in forests

the aim to enhance sustainable forest management (as defined by Forest Europe) and the multifunctional (social, environmental and economic) role of forests, to improve resource efficiency and to contribute to global forest responsibility. The Strategy is brought to life through a multi-annual Implementation Plan. The Plan provides a coherent framework for implementing forest-related measures and serves as an instrument of co-ordination between the EU and the forest policies of Member States.

EU directives and conventions

There are a number of important EU directives and conventions that have been implemented through UK laws and that need to be taken into account when planning or practising forestry. The most relevant are highlighted in Box 3.2 and covered more fully in Section 5 and Section 6.

Rural development

The EU Rural Development Regulation 1305/2013 recognises the integral part that forests and their sustainable management have in rural development. The EU's rural development policy, the second pillar of the Common Agricultural Policy, seeks to establish a coherent and sustainable framework for the future of rural areas.

Illegal logging

The UK has a long-standing commitment to address illegal logging globally and is working actively within the EU through the 2003 Forest Law Enforcement, Governance and Trade (FLEGT) Action Plan. The Action Plan sets out a range of measures designed to tackle illegal logging, including two regulations:

- The EU Timber Regulation (EUTR) came into force in the UK in March 2013 and made it an offence to place illegally harvested timber and timber products on the EU market. The legislation also requires that 'due diligence' is applied to all timber and timber products first placed on the EU market to ensure that the risks of it being illegal are minimised. 'Traders' who deal in timber and timber products down the supply chain are also required to keep records and make them available for inspection. In the UK, the UKFS, along with the felling licence legislation, means that most of the requirements of the

Box 3.2 EU directives and conventions

Birds Directive 2009/147/EC Provides a framework for the conservation and management of wild birds in Europe. The Directive recognises that habitat loss and degradation are the most serious threats to the conservation of wild birds. It therefore places great emphasis on the protection of habitats for endangered as well as migratory species.

Environmental Impact Assessment Directive 2014/52/EU Protects the environment through the use of Environmental Impact Assessments on defined public and private projects, the effects of which may be considered to pose a significant threat to the environment.

Environmental Liability Directive 2004/35/EC Seeks to achieve the prevention and remedying of environmental damage to habitats and species protected by EU law. It reinforces the 'polluter pays' principle, making operators financially liable for damage, either threatened or actual.

European Landscape Convention Provides a basis for closer co-operation in the planning, protection and management of landscapes and recognises that landscape has important cultural, ecological, environmental and social dimensions as part of sustainable development.

Forest Reproductive Material Directive 1999/105/EC Establishes marketing procedures and requirements that ensure the plentiful supply of high quality forestry reproductive material within the EU. This in turn helps to increase the stability, disease resistance, adaptation, productivity and diversity of EU forests.

Habitats Directive 92/43/EEC Promotes the maintenance of biodiversity and the restoration of natural habitats and wild species. It protects and monitors threatened habitats, identifies wild flora and fauna as European Protected Species, and controls developments that may affect them.

Water Framework Directive 2000/60/EC Designed to improve and integrate the way the water environment is managed throughout Europe. It establishes a framework for EU action in the field of water policy.

legislation can be accommodated within existing regulatory mechanisms. The body responsible for ensuring compliance with the EUTR is Regulatory Delivery, part of Department for Business, Energy & Industrial Strategy.

- The EU FLEGT Regulation, which works to improve forest governance in timber-producing countries and increase the supply of legal timber to the EU. It establishes Voluntary Partnership Agreements between the EU and timber producing countries. Once such agreements are operational, timber-producing countries will issue exports with 'FLEGT licences' which verify the timber's legality.

Independent forest certification

Independent forest certification arose out of concerns over deforestation and degradation of the world's forests, particularly tropical rainforests, which have a vital role in the Earth's equilibrium and contain 80% of the world's biodiversity. From the mid-1990s a range of schemes were developed to give independent assurances that timber bearing the certification label, and the forests from which it is derived, have been responsibly managed. These voluntary schemes define their own standards of management and are independent of governments.

Box 3.3 International forest certification schemes

The FSC (Forest Stewardship Council) and PEFC (Programme for the Endorsement of Forest Certification) are the two main global certification schemes. Both are owned by international non-governmental organisations and exist to promote sustainable forest management and a system for product assurance. Certification schemes have two key components: a forest management certificate and 'chain of custody' certification, which extends assurances down the forest supply chain. Many different stakeholders, representing the environmental, economic and social aspects of forestry, guide the approaches of both schemes. The schemes allow consumers to identify, purchase and use timber and wood products produced from well-managed forests, through the use of a product labelling system.

FSC was founded in 1993 in response to concerns over global deforestation and the demand for a trustworthy system for labelling wood products. It was the first forest certification scheme and is dedicated to promoting responsible management of the world's forests. FSC defines its own principles and criteria for forest management and has its own system for granting authority to bodies carrying out forest certification and chain of custody audits. Local standards for forest management have to be specially written to conform to the FSC principles and criteria. FSC is based in Bonn, Germany, and there are country-based national offices in more than 50 countries – including the UK. FSC UK is a registered charity. It is supported by non-governmental organisations including WWF, Greenpeace and the Woodland Trust.

PEFC was founded in 1999 by woodland owners in northern Europe, but is now a global organisation with over 35 member countries. It is the largest forest certification scheme, dedicated to ensuring that timber and non-timber forest products are produced with respect for the highest ecological, social and ethical standards. Unlike FSC, PEFC is an umbrella programme that endorses individual national forest certification systems, based on PEFC's requirements and tailored to local priorities and conditions. It also endorses auditing organisations conforming to international accreditation requirements. PEFC's requirements are derived from forestry principles and criteria negotiated by intergovernmental processes. PEFC is based in Geneva, Switzerland, and is represented in the UK by PEFC UK Ltd.

There are presently about 50 certification programmes in different countries around the world. The Forest Stewardship Council (FSC) is a single scheme; many of the others fall under the umbrella organisation of the Programme for the Endorsement of Forest Certification (PEFC). The area of certified forests covered by these two main organisations (Box 3.3) has steadily increased since the 1990s to reach about 450 million hectares in 2016, equivalent to 11% of the world's forests. PEFC certification accounts for approximately two-thirds of the total, with more than 275 million hectares of forests under its scheme.

4. Forestry in the UK

Forests and woodlands in the UK are an integral part of a landscape that has evolved over several thousand years of changing land use. The nature of woodland cover is very different from much of the rest of Europe, in terms of extent, history and ownership. However, the UK has been at the forefront of developing the concept of sustainable forestry and in recognising the benefits that forests and woodlands can deliver for society and the environment.

Woodland history

At the time of the First World War, the forests and woodlands that had once covered almost all of the British Isles had been reduced to around 5% (only 1% in Northern Ireland). This is in contrast to most other European countries where much higher proportions of forest were retained. The War focused attention on how vulnerable the country could be when vital supplies of imported timber were interrupted. The formation of the Forestry Commission in 1919 marked a turning point and the adoption of a new policy to redress woodland loss. This was achieved through both state planting of land and through providing fiscal incentives for private woodland owners to do the same. The Forestry Commission acquired some wooded estates during the 20th century but in the main it created 'new' forests on land of low agricultural value using mostly conifer species. By 2016, UK woodland cover had increased to around 3.16 million hectares, which is 13% of the total land area (Table 4.1).

Table 4.1 Total woodland area for the UK (000s hectares).

	Broadleaves	Conifers	Total	% land area
Forestry Commission/Natural Resources Wales/Forest Service				
England	64	151	215	1.6
Scotland	40	431	471	6.0
Wales	19	98	117	5.6
N. Ireland	7	56	62	4.3
UK	129	735	864	3.6
Private sector				
England	903	189	1 091	8.4
Scotland	337	628	965	12.4
Wales	136	53	189	9.1
N. Ireland	39	11	50	3.5
UK	1 416	880	2 296	9.4
All woodland				
England	966	340	1 306	10.0
Scotland	377	1 059	1 436	18.4
Wales	156	150	306	14.7
N. Ireland	46	66	112	7.8
UK	1 545	1 615	3 160	13.0

The British Isles has a narrower range of indigenous tree species than other European countries, as a result of its separation from mainland Europe since the last Ice Age. Scots pine is the only native conifer of economic significance, and with the initial policy emphasis on timber production, the forest industry had to consider the use of non-native species. New silvicultural techniques were developed to establish a range of imported conifers, particularly those from North America. Sitka spruce proved especially suited to Britain's oceanic climate and grew well on the poorest of soils. It now provides the majority of timber for the wood processing industry.

Semi-natural woodland

The UK has no truly natural forest, but there are around 650 000 hectares of semi-natural woodland. Of this, about 340 000 hectares (~1.2% of UK land area) is identified by the nature conservation agencies as ancient semi-natural woodland (ASNW). This is mainly composed of broadleaved species, but includes the native pine forests of Highland Scotland. ASNWs are derived from the original forest cover of the British Isles, and have had more or less continuously tree-covered use. They are especially significant for biodiversity, landscape and cultural heritage, and reflect centuries of interactions between human activities and the environment. ASNWs have a unique character and they support a high proportion of rare and threatened species. For these reasons they are highly valued and afforded special protection. To be described on the ASNW inventory, there must be indications that the woodland has continuously existed. The indicative dates of 1600 in England and 1750 in Scotland are used to define

ancient woodland, but evidence depends on mapped records and these are sometimes uncertain.

Ownership and management

Approximately two-thirds of the woodland area in the UK is owned by a diverse range of individuals and groups, including farmers, family trusts, charitable trusts, local groups and companies. Typically, woodlands owned by family interests are a part of mixed estates or farms where there are many thousands of small and scattered woodlands. Based on agricultural censuses, it is estimated that there are around 60 000 farm woodland holdings of which about 50 000 are less than 10 hectares. Unlike parts of mainland Europe, the UK has relatively few holdings where both forestry and agriculture are run as an integrated business.

The remaining one-third of woodland area is publicly owned, the majority of it managed by the state forest services in England, Scotland, Wales and Northern Ireland. These forests are managed in the public interest to meet a wide range of objectives that encompass environmental, economic and social benefits. Unlike many parts of Europe, the UK does not have a tradition of forests owned or managed on a community basis – although greater community involvement has emerged as an important theme in recent years and has been developed through a wide range of local woodland initiatives.

Timber production is usually the primary aim in the management of larger forests, but an increasingly wide range of objectives – including biodiversity, amenity and investment – now feature. Providing public benefit can be shown, forest management may be supported with government grants. The provision of sport has been a particular influence in the forest history of the UK, from the time of the Norman Conquest. Cover for game remains an important objective on many wooded estates and farms and has contributed to retention of many small woods that might otherwise have been neglected and eventually lost from the landscape.

Small, scattered woodlands deliver a range of landscape, biodiversity and other benefits but remain vulnerable to neglect, due to the marginal revenues from managing them and pressures from agriculture and development.

More recently, a resurgence of interest in wood for fuel has presented important new markets. Some woodlands are owned and managed by local authorities and an increasing number are managed specifically for amenity, recreational and conservation purposes by charitable trusts, partnerships and some individual owners.

Forestry policy

Forestry is devolved in the UK, which means that England, Scotland, Wales and Northern Ireland each have their own forestry programmes or strategies setting out policies and priorities for woodland creation and management. These are further refined at regional and local levels, often in partnership with other organisations, to deliver objectives for forest and woodland management on the ground. Fundamental to these policies is the concept of sustainable forest management. This is articulated at UK level, as it delivers on international commitments and provides a common basis for the practice of forestry. Some common functions, such as forestry research, international issues and plant health, are also carried out at a UK or GB level.

Sustainable forest management

The concept of sustainable development, first articulated at the 1992 Earth Summit in Rio de Janeiro (see Section 3) provides the agreed basis for forest management worldwide. In the UK, forestry policy had already been broadened from as early as the 1970s to include amenity – particularly recreation and landscape – and the concept of multiple-purpose forestry continued to develop throughout the 1980s. A significant step in Great Britain was the amendment of the Forestry Act 1967 by the Wildlife and Countryside (Amendment) Act 1985, which formalised the concept of balance between the environment and forestry.

This was followed by a series of Forestry Commission Guidelines that addressed the environmental elements of forest management, including water, landscape and nature conservation.

After 1992, international agreements provided a framework for developing concepts of sustainable forest management,

which was refined at a regional level. In Europe it became the Forest Europe Ministerial process, which developed its own definition of sustainable forest management supported by criteria, indicators and guidelines (see Section 3). At the international level, criteria necessarily give weight to some issues (such as protection from landslip, avalanche and fire) that are globally or regionally important, but not necessarily critical in the UK. In contrast, other aspects of forestry, such as the use of non-native species and the importance of forests in the landscape, are of particular relevance to the UK. This fourth edition of the UK Forestry Standard (UKFS) defines a series of forestry requirements that ensure these international commitments are addressed while focusing on the UK context. The updated Guidelines link directly to these UKFS Requirements. The concept of balanced objectives (Box 4.1) is central to the approach to sustainable forest management set out in the UKFS and this is reinforced by the concept of natural capital – the need to invest in maintaining our stock of forest and woodland resources so that they can continue to provide the benefits that society enjoys.

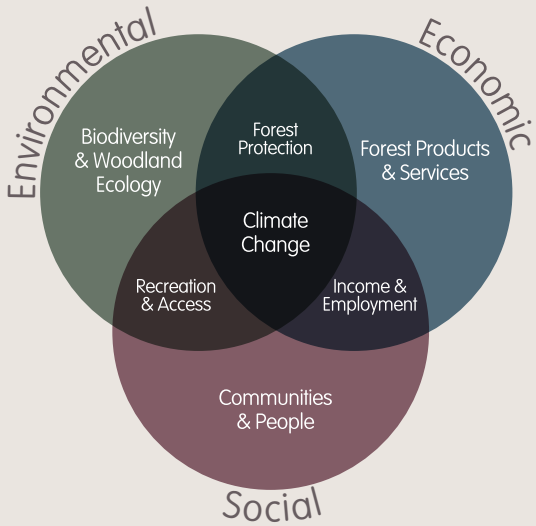
Biodiversity and woodland ecology

The conservation of biodiversity is an essential part of sustainable forest management in the UK. Forests and woodlands provide habitats for a large array of plants and animals, some of which are rare or threatened. The UN Convention on Biological Diversity (UNCBD) provides the context for the UK's approach to forests and biodiversity.

The UK 'Post-2010 Biodiversity Framework' implements the UNCBD and the EU 2020 Biodiversity Strategy. The Framework also sets out how the 'Aichi' biodiversity targets of the Convention for the period 2011–2020 (agreed in Nagoya, Japan, in 2010) will be achieved through the biodiversity strategies of England, Scotland, Wales and Northern Ireland. A key principle of all these strategies is that the conservation of biodiversity should be at the heart of sustainable land management. In the UK a significant proportion of woodland and associated habitats is designated or has other legal protection. The UKFS sets out these statutory requirements together with requirements of good forestry practice to ensure the status of priority habitats and species is protected or enhanced. These considerations will apply both within woodland and to the potential effects of new woodland on existing habitats. However, duties to further the conservation of biodiversity apply more generally and all forests have an important function in this respect.

Forest protection

The UK is committed to maintaining or increasing its forest area, and to enhancing the social, environmental and economic values of forest resources. It is particularly important to retain, extend and enhance ASNW because of its unique qualities, but maintaining all woodland area is central to the Forest Europe criteria; it helps assure the many benefits provided by forests, and is critical in the context of world deforestation and climate change.



Box 4.1 Balanced objectives

Sustainable forest management involves ensuring that the production of all forest and woodland benefits is maintained over the long term. This is achieved when the environmental, economic and social functions of forests and woodlands are interacting in support of each other, as can be illustrated in the diagram on the left. The precise point of balance between environmental, economic and social functions will vary in individual forests and woodlands in response to management objectives and local circumstances. The concept of balanced objectives is central to the approach of the UKFS.

The overarching policy for the sustainable management of forests, woodlands and trees at a UK level is a presumption against the conversion of forest land to other land uses – unless there are compelling reasons in the public interest for doing so (see Restocking in Section 7).

Where deforestation is proposed, an Environmental Impact Assessment is likely to be required, and each case will have to be determined individually. All the various implications, including the practicality of habitat restoration, will need to be considered in the context of policies on woodland removal at country level. This assessment will include the effects on climate, and the potential emissions of greenhouse gases, including methane from peat bogs (see the UKFS Guidelines on Forests and Climate Change and the UKFS Guidelines on Forests and Biodiversity).

Plant health

Forest protection includes effective protection against pests and diseases. The sea has acted as a natural barrier to invasion of the UK by many damaging organisms, but increasing global trade brings with it the threat of incursion by exotic pests and diseases. Imports of plants and timber and the use of wood-based packaging material for imported goods provide many pathways for pests to leave their native habitats and enter new areas. Over the past decade, several new pests and diseases have been found in the UK, notably the discovery of ash dieback disease in 2012, and some of these that have established have had serious economic and environmental consequences. Moreover, climate change may have a major effect on the severity of the impact of some existing pests and diseases and may facilitate the establishment of new problem organisms. The Plant Health Services continue to work to tackle tree health threats and plans to enhance the protection of trees are set out in government biosecurity strategies and tree health management plans.

Forest products and services

The softwood supply from planted conifer forests in the uplands of the UK has encouraged a series of investments by companies involved in the processing of timber and manufacture of wood products. The annual volume of softwood harvested from existing UK forests is forecast to increase from the level of 13.2 million m^3 (standing volume) achieved in 2015 to a peak of around 19.3 million m^3 by 2027–2031. The increase in volume reflects the current age structure of forests, but the actual annual harvest is likely to be less than this. In addition to softwood production, 0.6 million m^3 of hardwood timber is harvested per year, mainly in England. The potential sustainable annual harvest for hardwoods is estimated to be much higher, at around 6 million m^3. These figures include the total volume (softwood and hardwood) used for woodfuel, which has increased in recent years and is estimated at 2.2 million m^3 (2015).

In addition to the timber benefits, the forest estate delivers a wide range of social and environmental or 'non-market' benefits. The non-market benefits of forests and woodlands in Great Britain have been estimated to be worth approximately £1.1 billion per year. The most significant values were found to be for forest recreation (over 250 million visits are made each year to woodlands in Great Britain), woodland biodiversity, landscape and the role of trees in sequestering carbon.

Income and employment

Within the UK forestry and timber industries, the Annual Business Survey reported average employment in 2014 of around 16 000 in forestry and 27 000 in primary wood processing. This excludes small and part-time concerns that are not VAT registered. There are a range of jobs in forest establishment and maintenance and these can be combined with an increasing number in forest recreation, woodfuel supply, game management and conservation. Additional jobs are created indirectly in timber utilisation, tourism and support services, all of which contribute valuable jobs to the rural economy.

Communities and people

Unlike some countries in mainland Europe, the UK does not have a tradition of forests owned or managed on a community basis. However, in recent years the concept of local involvement in woodlands has become more evident, in both urban and rural areas. Community engagement gives people a sense of ownership and responsibility, and can range from consultation on forestry proposals to full community ownership and management. In and around urban areas, the contribution of woodland to urban regeneration and community well-being is increasingly recognised and adopted as an important way

of improving post-industrial areas and developing sustainable communities.

Equality of opportunity

Fundamental to ensuring that the benefits of woodland are available to all of society is the idea of fairness or equality, which means everyone can participate and has the opportunity to fulfil their potential. Equality is supported by legislation designed to eliminate unfair discrimination and ensure the diversity of society is fully recognised and valued. (See Forests and People) For public organisations such as the forestry authorities, there are specific obligations to ensure that people who share certain relevant protected characteristics (see Glossary) are treated equally.

Recreation and access

One of the advantages of forests and woodlands is that they can accommodate large numbers of people without having the appearance of being overcrowded. The UK is densely populated, with around 90% of people living in towns and cities. Trees and woodlands provide a vital resource for recreation and learning, and contribute to social cohesion, health and rehabilitation. There is increasing interest in the role forests can play in improving the nation's health, both through physical activity and by providing respite from the pressures of modern life.

In Scotland, statutory access rights to forests and woodlands are conferred by the Land Reform (Scotland) Act 2003. In England and Wales, virtually all state-owned woodlands are dedicated for public access under the Countryside and Rights of Way Act 2000. This is in addition to public rights of way. Nearly all woodlands in public ownership, and about 30% of others, make special provision for public access and enjoyment in addition to statutory and permissive access.

In Northern Ireland, the Access to the Countryside (Northern Ireland) Order 1983 makes provision for access to the countryside through public path creation agreements (for linear routes) and access agreements (for wider access) between local authorities and private landowners. However, in practice, access to the wider countryside is mostly limited to country parks, forest parks and National Trust lands. Access on foot is normally unrestricted in forests managed by the Forest Service.

Climate change

The Climate Change Act 2008 sets a legally binding target for reducing total greenhouse gas emissions in the UK. Taking 1990 as the benchmark, it commits the UK to a reduction of at least 80% by 2050. To ensure that regular progress is made towards this long-term target, the Act also established a series of five-yearly carbon budgets. The UK is currently in the second carbon budget period (2013–2017), which requires a 29% reduction in emissions on 1990 levels. Meeting the fourth carbon budget (2023–2027) will require that emissions be reduced by 50% on 1990 levels by 2025. Meeting the fifth carbon budget (2028–2032) requires that emissions are reduced by 57% on 1990 levels by 2032. In Scotland, the Climate Change (Scotland) Act 2009 sets a legally binding greenhouse gas emissions reduction target of 80% by 2050 compared with 1990 levels, together with an interim target of 42% by 2020. In Wales, Part 2 of the Environment (Wales) Act 2016 complements the Climate Change Act 2008 and also sets interim emissions targets.

Measures to mitigate climate change and adapt to its impacts (see Box 4.2) are high priorities for the UK Government and the devolved administrations. Sustainable wood products can contribute to climate change mitigation through their use as substitutes for less sustainable materials. For example, in construction, timber can be used in many situations instead of energy-intensive materials such as concrete and steel.

As fuel, wood can provide a valuable substitute for fossil fuels; although wood releases carbon dioxide when it is burned, an equivalent amount has been sequestered from the atmosphere as the trees grew. In this way, woodfuel derived from sustainable forests, or from short rotation crops such as coppice, can be seen as close to carbon neutral. Harvesting forest residues such as leaves and branches also represents a potential source of woodfuel, providing the practice does not compromise site productivity over the long term (see the UKFS Guidelines on Forests and Climate Change for more information).

Land management activities such as forestry and agriculture are likely to be among the first to feel the effects of a changing climate. The challenge for forestry is to adapt to new threats and new opportunities while still maintaining sustainable forests and woodlands. The first

Box 4.2 The role of UK woodlands in combating climate change

Forests, woodlands and trees can help to combat climate change through mitigation and adaptation.

Mitigation

Mitigation means intervention or policies to reduce emissions of greenhouse gases, or otherwise stabilise their concentration in the atmosphere. One of the ways this can be achieved is by enhancing 'sinks' of greenhouse gases such as carbon dioxide so that they are 'locked up' and no longer available. This is often referred to as sequestration. Forests have high levels of stored carbon and as trees grow they continually remove carbon dioxide from the atmosphere. Carbon is locked up in the living trees, in soils and in timber and wood products.

Adaptation

Adaptation can mean any action, either intentional or accidental, taken to minimise the adverse effects of climate change. Adaptation actions will be increasingly necessary to prepare forests and woodlands for the anticipated additional stresses from a changing climate and the resulting extremes in weather. Well-structured and diverse forests will be more resilient to a changing climate. Species and provenance choice will need to take account of predicted changes in climate, while not compromising other sustainable management objectives.

Woodlands and trees can help the wider environment adapt to the impacts of climate change, for example by regulating water flows and alleviating floods, by reducing soil erosion and by providing habitat linkages. They also have an important role in helping society adapt, particularly in urban environments; trees can provide shelter and shade, cool the air and control the run-off of water.

response to the threat of climate change was to concentrate on mitigation – to try to stop it happening. However, with the concentration of greenhouse gases in the atmosphere continuing to increase rapidly and climate models predicting more rapid rates of change, the need for adaptation strategies has become evident. This shift of emphasis means that forest managers have to consider the ways in which forestry will have to cope with change as well as how it can help the drive to reduce emissions.

Standards for carbon sequestration

Planting woodland to remove carbon dioxide from the atmosphere, known as woodland carbon capture, is a cost-effective way of compensating for greenhouse gas emissions while also providing many other social and environmental benefits. Individuals and businesses who want to invest in carbon capture projects need to feel confident that they meet the high woodland management standards set out in the UKFS, and really will capture the carbon dioxide claimed. Certification against the Woodland Carbon Code, a scheme set up by the Forestry Commission in collaboration with other partners, meets this need by providing this evidence. It also creates real and verifiable carbon 'rights' which can be sold to recoup the costs of creating the woodland and generate an income. For more information see www.forestry.gov.uk/carboncode.

Forestry research

The UKFS and its practical delivery are informed by research based on internationally recognised science and best practice. This forms the evidence base for sustainable forest management and the forestry policies of the UK Government and the devolved administrations. The Forestry Commission's Science and Innovation Strategy for Forestry in Great Britain sets out the agreed priorities and programmes for research to address the environmental, economic and social evidence needs of sustainable forestry.

Forest certification in the UK

In the UK, the UK Woodland Assurance Standard (UKWAS) provides a practical basis for independent forest certification. It is essentially an audit protocol recognised by both major international certification schemes active

in the UK (see Section 3): the Forest Stewardship Council (FSC) and the Programme for the Endorsement of Forest Certification (PEFC) schemes. It draws on the UKFS as the basis of practice in the UK, and combines it with the requirements of the certification schemes. The UKWAS was developed and is now managed by a broad consensual partnership of environmental, economic and social organisations (Box 4.3).

Box 4.3 The UK Forestry Standard and the UK Woodland Assurance Standard

Both the UKFS and the UKWAS define a standard of practice to help ensure that forests and woodlands in the UK are well managed. Although there are links between the two standards, they serve different purposes.

UK Forestry Standard

The UKFS defines the approach of the governments in the UK to sustainable forest management. It is based upon the commitments made by the UK to a range of international agreements and conventions, and provides a framework for the delivery of forestry policies in England, Scotland, Wales and Northern Ireland. All forest managers and practitioners in the UK are expected to meet the UKFS Requirements and the authorities will assess applications for forestry proposals against them before giving permission, and before offering grant aid.

UK Woodland Assurance Standard

The UKWAS is owned and managed by a broad partnership and is independent of government. It is based on the requirements of international forest certification schemes (FSC and PEFC) together with those of the UKFS. The principal purpose of UKWAS is to act as an audit protocol for the independent certification schemes, which are paid for by the forest or woodland owner. These feature the use of labels to provide assurances about the integrity of wood products.

Independent forest certification has been encouraged and supported by the Forestry Commission, Natural Resources Wales and the Forest Service. In 2016, certification schemes in the UK covered all of the public forest estate (0.86 million hectares) and about 21% (0.49 million hectares) of other forests. This amounts to around 43% of UK woodland in all. Forest and woodland owners choose to have their forests certified to provide assurances of a high standard of responsible management and because retailers and consumers are increasingly specifying certified timber and wood products (see Timber and wood products below). Although forest certification accounts for only 21% of the non-state woodland area, it amounts to 69% of total timber production from these forests.

The costs of certification have meant that it has generally been confined to the larger forest holdings, and those focusing on marketing timber, rather than the majority of smaller woodlands.

Timber and wood products

The EU Timber Regulation (see Section 3), introduced in 2013, requires all those placing timber and wood products on the EU market for the first time to ensure a system is in place to minimise the risks of timber being illegal. It also puts obligations on businesses who trade in timber and wood products to keep records so that material can be traced. The EU Timber Regulation applies to timber originating in the domestic (EU) market, as well as from non-EU countries. The UKFS, along with felling licence legislation, now plays the primary role in ensuring the Regulation is applied in the UK.

In common with other EU countries, the UK has defined public procurement criteria for timber. Since 2009, UK government policy requires that all timber and wood products supplied to UK and England government departments have evidence of sustainability. Similar policies are in place for departments in Scotland, Wales and Northern Ireland, and the policy has been extended to other public bodies. In addition, an increasing number of private organisations and individuals want to be sure that the timber they buy and use is from sustainable sources.

Timber growers and suppliers of wood products will need to provide suitable evidence that the relevant criteria on

the legality and sustainability of timber have been met. There are a number of ways that this can be achieved. The most straightforward way, and probably the most appropriate for large forests, is through independent forest certification using a recognised scheme (see above).

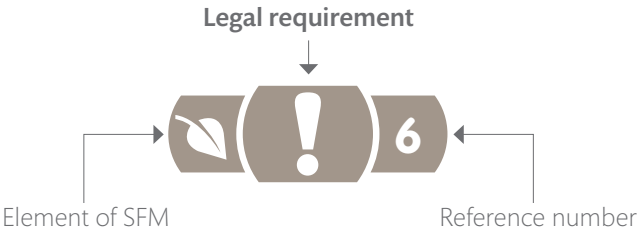
Certification offers assurance in relation to individual woods that the requirements of both the UKFS and of the certification schemes are being met. For woodlands that are not certified, the UKFS may be used to provide a risk-based approach to demonstrating legal and sustainable forest management (see Section 7).

5. General Forestry Practice

This section sets out the UKFS Requirements and Guidelines for General Forestry Practice. See Section 2 for further information and a key to subject symbols. General Forestry Practice describes aspects of management that apply to most forest and woodland situations and that are common to the other elements of sustainable forest management set out in Section 6.

UKFS Requirements

The UKFS Requirements outline the main legislation and are intended as a source of advice. You are advised to consult the relevant statutes for more information and the definitive legal text.



UKFS Guidelines

Cross-references

Cross-references may be made to the other elements of sustainable forest management (SFM), where a Requirement or Guideline is common to more than one subject.

UKFS Requirements for General Forestry Practice

General compliance

All occupiers of land and parties engaged in commercial activities are subject to a range of laws and regulations. Some are of special relevance to land-based activities in general and others are more specific to forestry. Compliance with the law is fundamental to the UKFS, and the main legislation of most general relevance to forestry is outlined in this section. More specific legislation is outlined under the relevant elements of sustainable forest management in Section 6.

Forestry activities and businesses must comply with all relevant laws and regulations.

Operations must be authorised by the legal owner.

Reasonable measures should be taken to ensure no illegal or unauthorised activity takes place within the forest or woodland.

Forestry activities and businesses should comply with relevant codes of practice and industry guidelines.

Forest protection

The Forestry Act 1967 conveys wide powers to control felling and provide assistance to promote the interests of forestry, the development of afforestation, and the production and supply of timber in Great Britain. The Forestry Act was amended by the Wildlife and Countryside (Amendment) Act 1985 and, in Scotland, by the Nature Conservation (Scotland) Act 2004 to take account of wider environmental considerations and to incorporate the concept of 'a reasonable balance' between the interests of forestry and the environment. In Northern Ireland, the Forestry Act (Northern Ireland) 2010 conveys wide powers to promote afforestation and sustainable forestry, to protect the environment and to promote recreational use. There are also powers to regulate felling.

The Town and Country Planning Acts do not apply to forestry activities themselves, as they are not defined as 'development'. The exception is where development, for example housing, is proposed on a woodland site, in which case the planning procedures apply. Local authorities can apply Tree Preservation Orders and designate Conservation Areas to protect trees that are important in the landscape. Owners are notified of these designations. Local authorities may apply planning conditions to protect existing trees or plant new ones as part of the development consent. They may also enter into 'planning gain' agreements for additional woodland creation or protection. Under planning regulations, proposals for new forest roads, and upgrading existing forest roads, are defined as 'permitted development', which requires prior notification to the local planning authority. Depending on local arrangements, this may be combined with the forestry approval process. The exceptions are where access from a forest road onto a public highway is proposed and in areas with landscape designations. For access onto a public highway, planning consent is required and in areas with landscape designations, forest roads and quarries that do not

form part of an approved afforestation scheme may be subject to planning controls. Areas of woodland are material considerations in the planning process and may be protected in local authority Area Plans. These plans pay particular attention to woods listed on the Ancient Woodland Inventory and areas identified as Sites of Local Nature Conservation Importance (SLNCIs).

Where required, proposals for felling or thinning must be submitted to the appropriate forestry authority for approval. Following felling, restocking will normally be required.

Note that:

- Submission for approval can be done as an integral part of a grant application.
- There are a number of exceptions, e.g. trees under a specified size, trees proved to be dangerous, fruit trees and small-scale felling may not require a felling licence.
- Proposals for priority habitat restoration that involve tree felling may not require restocking.
- Forestry authority approval is not required if trees are included in development approval under the Town and Country Planning Acts or other planning legislation.
- Deforestation, for the purposes of conversion to another type of land use, may be subject to the Environmental Impact Assessment (Forestry) Regulations.
- In Northern Ireland, the Forestry Act (Northern Ireland) 2010 regulates the felling of trees growing on land of 0.2 hectare or more, through granting of felling licences which include felling management plans to control necessary replanting.

Before felling and pruning trees, a check must be made to ensure there are no Tree Preservation Orders or Conservation Area designations. Permission must be obtained from the relevant authority to fell or prune trees subject to Tree Preservation Orders or notification made where Conservation Areas have been applied.

Proposals for access onto a public highway by a forest road must obtain planning permission; proposals for all forest roads must be notified to the planning authority and may require planning permission in areas with landscape designations.

The impacts of forestry on the environment must be taken into account in the submission of forestry proposals.

There is a presumption that forest land should not be converted into other land uses; guidance on the exceptional situations where woodland removal may be possible is available from country forestry authorities.

The capability of forests to produce a range of wood and non-wood forest products and services on a sustainable basis should be maintained.

Forests should be protected from the time of planting or restocking to ensure successful establishment and long-term viability.

Environmental impact

Directive 2014/52/EU of the European Parliament and of the Council is transposed into domestic legislation by the various Environmental Impact Assessment (EIA) Regulations, which apply to afforestation – including short rotation coppice and Christmas trees, deforestation, and the construction of forest roads and quarries. The regulations require the forestry authority to determine whether a proposal may have a significant effect on the environment, and where this is the case the proposer is required to prepare an EIA Report.

Environmental Impact Assessment (EIA) Regulations must be complied with; where an EIA is required, all the relevant environmental impacts must be considered by the proposers and the requirements for public consultation must be met.

Plant health and biosecurity

The Plant Health Act 1967 identifies the Forestry Commission as the competent authority in England and Scotland, as regards the protection of forest trees and timber, and empowers the Forestry Commissioners to make orders to prevent the introduction and spread of forestry pests and diseases. The same Act identifies Welsh Ministers as the competent authority in Wales. The Plant Health (Forestry) Order 2005 lays down a number of conditions and prohibitions to support these objectives. In Northern Ireland, under the Plant Health Act (Northern Ireland) 1967, the Department of Agriculture, Environment and Rural Affairs is the competent authority for these purposes, and the Plant Health (Northern Ireland) 2006 and the Plant Health (Wood and Bark) Order (Northern Ireland) 2006 support these objectives.

Statutory orders made under the Plant Health Acts to prevent the introduction and spread of forest pests and diseases must be complied with; suspected pests and diseases must be reported to the forestry authority if they are notifiable, access must be given to Plant Health Inspectors and their instructions must be followed.

Managers should be aware of the risks posed by pests and diseases, be vigilant in checking the condition of their forests and take responsible measures to combat threats to tree health.

Information should be reported to the forestry authority that might assist in preventing the introduction or spread of forest pests and diseases.

Suspected pests and diseases should be investigated, reported to the forestry authority and biosecurity control measures recommended by the forestry authority carried out.

Forest reproductive material

The Forest Reproductive Material (Great Britain) Regulations 2002 implement EU Directive 1999/105/EC in Great Britain and provide a framework for controlling plant materials used in forest establishment. A voluntary scheme is also in place to cover native species and other species commonly planted for forestry purposes. In Northern Ireland, the Forest Reproductive Material Regulations (Northern Ireland) 2002 are applied through the Forest Service, an executive agency within the Department of Agriculture,

Environment and Rural Affairs. The Forest Service maintains a National Register of Basic Material for Northern Ireland.

For species covered by Forest Reproductive Material Regulations, only certified material can be used for forestry purposes.

Forest planning

Forest planning takes place at a number of levels. The highest level is the strategic plan, which defines the broad objectives of the owner and how these can be met across the forest estate or holding, which sometimes comprises several forest areas. Beneath this are the three levels at which the UKFS Requirements should be addressed:

- Forest planning applies to a convenient management unit, called the forest management unit (FMU). The plans will vary with the scale of the forest and the size and nature of the holding – usually called the **forest management plan**.
- Operational planning is concerned with the operational detail of how proposals will be implemented at site level – usually called the **operational plan** or site plan.
- Contingency planning ensures that procedures are in place and can be enacted should unforeseen events occur, for example forests fires, catastrophic wind damage and accidental spillages – usually called the **contingency plan**.

Forest management plans may sometimes include the site operational plan and a contingency plan.

Forest management plan

The forest management plan is the reference document for the monitoring and assessment of forest holdings and forest practice. It is also used for communicating proposals and engaging with interested parties. The plan itself should be proportionate to the scale, sensitivity and complexity of the FMU.

Forest management plans should state the objectives of management, and set out how the appropriate balance between social, environmental and economic objectives will be achieved.

Forest management plans should address the forest context and the forest potential, and demonstrate how the relevant interests and issues have been considered and addressed.

In designated areas, for example national parks, particular account should be taken of landscape and other sensitivities in the design of forests and forest infrastructure.

At the time of felling and restocking, the design of existing forests should be reassessed and any necessary changes made so that they meet UKFS Requirements.

Consultation on significant or sensitive proposals should be carried out with interested parties as forest management plans are developed.

14 Forests and woodlands should be designed to achieve a diverse structure of habitat, species and ages of trees that is appropriate to the scale, context and ecological potential of the site.

15 Forests characterised by a lack of diversity due to extensive areas of even-aged trees should be progressively restructured to achieve a range of age classes.

16 Forests should be planned and managed to enhance their resilience and mitigate the risks posed to their sustainability by the effects of climate change or attack by pests or diseases.

17 Management of the forest should conform to the plan, and the plan should be updated to ensure it is current and relevant.

18 New forests and woodlands should be located and designed to maintain or enhance the visual, cultural and ecological value and character of the landscape.

Operational and contingency plans

Operational plans can make forest practice more efficient and ensure that important site features are known about and protected in advance. Contingency plans address potential threats to the forest environment and accidental events, such as spillages, and help prevent or remedy environmental damage. These plans may, in practice, be combined with the forest management plan.

19 Operational plans should be in place before major operations such as harvesting and engineering works take place.

20 Where appropriate, contingency plans should be in place for dealing with actual and potential threats to the forest and environment.

UKFS Guidelines on General Forestry Practice

The table below introduces factors important for General Forestry Practice. The Guidelines that follow provide more information on how to comply with the UKFS Requirements, grouped by the factor headings.

Factor	Importance for General Forestry Practice
Forest planning process	
Forest management plans	Forest management plans allow a manager to demonstrate that all relevant aspects of sustainable forest management have been considered. They provide a basis for monitoring and assessment.
Operational plans	Operational plans help to ensure safe and efficient working practices on a site and the protection of the forest environment.
Contingency plans	Contingency plans set out what happens in the event of accidents, unexpected or unplanned events so damage to the forest environment can be minimised.
Forest planning considerations	
Forest productivity	The UK is committed to maintaining or increasing its forest area, and to enhancing the environmental, economic and social values of forest resources.
Forest structure	Diverse forests provide a range of benefits and are more resilient to changing environmental conditions.
Silviculture	A range of silvicultural systems are available to meet management objectives and add to structural diversity.
Felling and restocking	Opportunities are presented at felling and restocking to restructure age classes and to redesign forests to meet UKFS Requirements.
Mammal damage	Wild mammals and domestic livestock can cause damage to forests and woodlands, particularly at the establishment stage. Some such as deer require co-operative action for effective control.
Pests and diseases	Forests and woodlands in the UK are experiencing unprecedented levels of threats from a range of pests and diseases; climate change is likely to exacerbate levels of damage.
Use of chemicals	Chemical pesticides and fertilisers can be an important management tool in some situations but they can cause damage to the environment if used inappropriately.
Fencing	Fencing can have major impacts on wildlife, landscape, archaeology and access.
Forest roads and quarries	Forest roads, quarries and associated works can be highly visible in the landscape and are subject to Environmental Impact Assessment.
Harvesting operations	Harvesting operations are resource intensive and can also have a significant environmental impact both on the forest and surroundings.

Forest planning process

Forest management plans

The details required for a forest or woodland grant or felling application can provide the basis for the forest management plan. This basic plan will be appropriate for the majority of low-key and small-scale proposals, and provides an approach that is proportionate to the risks of the operations involved.

For extensive or sensitive areas, a more comprehensive approach is required. Additional information will need to be collected to ensure that all the relevant issues have been addressed. The most significant proposals may come under the Environmental Impact Assessment (EIA) Regulations, and will require comprehensive analysis.

A thorough forest planning overview is helpful to both the regulatory authorities and landowners and managers; it has the advantage of allowing UKFS Requirements and Guidelines to be considered over a larger area and a longer, more appropriate, timescale. The forest management plan provides assurances of intent and therefore individual operations within it can be approved with a lighter touch.

Some UKFS Requirements and Guidelines are expressed as maximum or minimum proportions of the forest. In these cases the area in question is the forest management unit (FMU). The FMU is the area subject to a forest management plan or proposal. This area is selected by the owner and/or manager and will be determined by the nature of the forest, the proposed operations and management objectives. Extensive FMUs have the advantage of allowing a strategic approach to be taken in achieving UKFS Requirements, both in terms of the area covered and over time.

The process of producing a forest management plan can be organised into seven distinct stages (Table 5.1).

Table 5.1 The process of producing a forest management plan.

Stage	Objective	Activities and/or sources of information
Scoping	Development of management objectives	Owner's objectives, the potential of the site, UKFS Requirements and Guidelines, forestry strategies, policies and plans at country, regional and local level, forestry frameworks.
	Analysis of interests or 'stakeholder analysis'	Consideration of all potential interests, including those of specialist interest groups and the local community.
Survey	Collection of information	A comprehensive exercise to collect and map all the information about the site and its location, including any statutory constraints. Meetings held at this early stage with stakeholders and those with specialist knowledge will help identify all the factors involved and alert interested parties to the proposal.
Analysis	Assessment of survey information	The survey information is evaluated in the light of project objectives, allowing the potential of the site to be assessed.
Synthesis	Development of a design concept	The broad concept for the forest design is formulated from the information that has been collected and analysed, including the visual aspects.
	Development of a draft management plan	The design concept is refined and developed into a draft management plan. The draft forms the basis of consultation with interested parties. Several drafts may be required in an iterative process.
	Finalisation of the plan and submission for approval	The draft is amended, refined and firmed up into a final forest management plan.
Implementation	Development and implementation of work programmes	Operational plans are developed from the forest management plan and work programmes are implemented.
Monitoring	Evaluation of progress	Indicators of progress are checked at regular intervals. Data are collected and recorded to evaluate management.
Review	Periodic updates of the forest management plan	Work done on the plan is recorded, and at regular intervals the plan is updated to keep it current. Periodically (usually at five-year intervals) the plan is thoroughly reviewed and updated.

1 Produce a clear forest management plan to demonstrate that all relevant aspects of sustainable forest management have been considered and to provide a basis for implementation and monitoring. The plan should:

- state the objectives of management, and how sustainable forest management is to be achieved;
- provide a means to communicate forest proposals and engage interested parties;
- serve as an agreed statement of intent against which implementation can be checked and monitored.

Operational plans

Operational or site planning helps ensure safe and efficient working practice on site and the protection of the forest environment. The starting point is a thorough assessment that identifies important features to be protected and options as to how the work could be undertaken. From this a detailed operational plan can be developed which sets out the working arrangements for the site, protected areas and other site constraints. It is particularly important that the operational plan is communicated and understood by all those involved.

2 Produce a clear operational plan that is understood by all those working on the site. For major operations, the plan should include:

- A description of the site, including any relevant designations, consents, licences or agreements.
- A statement of the purpose of the operations and an outline description of activities, which explain how:
  - operations will be modified in case of bad weather;
  - potential hazards to workers will be mitigated;
  - potential hazards to forest users will be mitigated;
  - machine access, refuelling and timber stacking will be handled;
  - sensitive or easily damaged parts of the site will be safeguarded;
  - to ensure only the intended trees and shrubs are felled;
  - biosecurity will be addressed;
  - the site will be left on completion of operations.
- A site map showing constraints, hazards and other key information.

Contingency plans

Contingency plans cover what happens in the event of an unexpected or unplanned event. For site operations this may include accidents and dealing with spillages or other problems that could pose a serious risk to water supplies and aquatic ecosystems. The Environmental Liability Directive (2004/35/EC) seeks to achieve the prevention and remedying of environmental damage and reinforces the 'polluter pays' principle, making operators financially liable for damage. Contingency plans can also be used to address other threats to the forest, for example fire, extreme weather events such as gales, or outbreaks of pests and diseases.

3 Have appropriate contingency plans in place to deal with risks to the forest, including spillages, pest and disease outbreaks, extreme weather events and fire. 20

Forest planning considerations

This section sets out the key forest management issues that should be considered when producing a forest management plan.

Forest productivity

The maintenance of the productive potential of forests includes both timber production, which serves the development of forest industries and economic well-being, and wider non-market benefits and values such as recreation and other ecosystem services. The essential consideration for the landowner or manager is to ensure that the forest thrives and is not degraded. This includes protecting young trees to make sure they become successfully established, and protecting the health of forests and woodlands, for example by ensuring they have the necessary resilience to cope with emerging threats and changing conditions – in particular climate change. It also involves maintaining levels of fertility and site potential for future rotations.

4 Retain or expand the forest area and consider compensatory planting where forest area is lost through land-use change. 11

5 Ensure new woodland and replanting becomes established, and young trees are not overcome by competing vegetation.

6 Plan for forest resilience using a variety of ages, species and stand structure; consider the risks to the forest from wind, fire, and pest and disease outbreaks. 18

7 When selecting trees and shrubs for new woodlands and restocking, consider the risks and opportunities of climate change and vulnerability to pests and diseases for particular species to decide if alternative species or increased species diversity are merited. 12 27

8 Ensure the removal of forest products from the site, including non-timber products, does not deplete site fertility or soil carbon over the long term and maintains the site potential. 7 20

Forest structure

Ensuring a forest has a varied structure in terms of age, species, origin or provenance and open space will provide a range of benefits. It will help endow forests with the resilience necessary to cope with emerging threats and changing climatic conditions, and will provide for flexibility in management options, for example by allowing for modifications to forest practice (see Forests and Climate Change and also Forests and Biodiversity for more information).

Structural diversity can be increased by incorporating open areas and through phased felling and restocking to ensure that, over time, a varied woodland develops. As part of this, some trees can be left as long-term forest cover to produce standing and fallen deadwood. For woods of less than 10 hectares, internal diversity is less important – in these situations diversity can be considered in the context of the landscape setting. There are also some woodlands that derive their particular landscape character or biodiversity value from a principal species and in these situations a case for divergence from the Guidelines can be made.

Open space is a key element of diversity within woodland. It can be used to develop permanent internal edges, structural diversity and flexibility for operational management. Wildlife habitat can be enhanced by developing non-woodland elements, such as streams, ponds, roads, utility wayleaves and rides. Open space is also important for the provision and development of access and recreation.

9 Maintain or establish a diverse composition within the forest management unit; where only one species is suited to a site and management objectives, a maximum of 75% may be allocated to a single species (see notes below). In all cases, incorporate a minimum of:

- 10% open ground or ground managed for the conservation and enhancement of biodiversity as the primary objective;
- 10% of other species;
- 5% native broadleaved trees or shrubs.

Note: (i) Where more than one species is suited to a site and matches the management objectives, opportunities must be taken to further diversify the above species composition. (ii) In woodlands of less than 10 hectares and in native woods the above proportions may be relaxed as long as the adjacent land uses provide landscape and habitat diversity. 10 25

10 Develop a long-term forest structure of linked permanent habitats, such as riparian woodland, open space and broadleaves. 18

11 Leave a proportion of standing and fallen deadwood in each forest management unit, concentrated in areas of high ecological value, where there is existing deadwood and where linkages can be provided between deadwood habitats – avoid uniform distribution across the forest management unit. 21 12

12 Retain and manage existing veteran trees and select and manage suitable individuals to eventually take their place. 22 16

13 Manage a minimum of 15% of the forest management unit with conservation and the enhancement of biodiversity as a major objective. 19

Silviculture

A range of silvicultural systems are available to provide flexibility in meeting management objectives and to add to the structural diversity of the forest. Silvicultural systems with a lower environmental impact than clearfelling are recommended in semi-natural woodland. In the context of climate change, varied silviculture will increase the resilience of forests and may limit the damage caused by extreme events such as gales or pest outbreaks.

14 Consider alternatives to clearfell systems, such as continuous cover forestry, where suitable sites and species combinations allow and management objectives are compatible. 17 19

15 Maintain a range of stand structures and silvicultural approaches across the forest as a whole, including veteran trees, open-crowned trees, occasional windthrow, understorey layers, open space and areas of natural regeneration. 16

Felling and restocking

Many forests, particularly those established in the 20th century, were planted or felled and replanted over a short timescale and have little diversity. Other older woods may have been neglected, leading to the development of a uniform structure. In both cases, felling and restocking presents the opportunity to restructure age classes and improve diversity. In even-aged woodlands, this may involve delaying felling, bringing forward felling or, where windthrow is very likely to occur, delaying restocking. Following initial restructuring, further age class diversity can be introduced in subsequent rotations, especially where the nature of the forest site limited the initial scope.

Rotational felling also presents a major opportunity to reassess the forest through the forest planning process. Future felling coupes can be identified within a long-term forest structure defined by open ground, watercourses and semi-natural habitats. The various elements of sustainable forest management, detailed in the UKFS, can be addressed and changes made where necessary to bring the forest up to current standards. These may include aspects such as the redesign of buffer areas and drainage systems, extending habitats for biodiversity and addressing forest landscape design.

16 In forests characterised by a lack of diversity due to extensive areas of even-aged trees, retain stands adjoining felled areas until the restocking of the first coupe has reached a minimum height of 2 m; for planning purposes this is likely to be between 5 and 15 years depending on establishment success and growth rates.

17 In upland forests, identify future felling boundaries as part of the long-term forest structure, manage compartment edges to increase stability and make use of permanent features such as watercourses and open space.

18 Take the opportunity provided by felling and restocking to redesign forests to meet UKFS Requirements within the forest management plan period and address issues such as buffer areas, drainage systems, biodiversity habitats and forest landscape design.

19 In semi-natural woodland, limit felling to 10% of the area in any five-year period unless there are overriding biodiversity or social advantages.

Mammal damage

Forests and woodlands may be subject to damage or degradation due to grazing or browsing mammals, particularly when trees are at the establishment stage. The manager's role is to monitor damage and decide whether intervention is necessary.

In areas where deer pose a threat to the forest and wider environment, deer control is essential. A deer management plan – often incorporating culling – allows a strategic approach to be taken. Keeping records of both deer culled and levels of damage will help

inform plans so that they can be refined to give more effective levels of control. Participation and consultation with local deer management groups (where they exist) will help to achieve effective deer management on the appropriate landscape scale. In Scotland, Scottish Natural Heritage advises on the sustainable management of wild deer (formerly performed by the Deer Commission), while the Deer Initiative performs similar functions in England and Wales. Responsibility for wild deer in Northern Ireland lies with the Northern Ireland Environment Agency of the Department of Agriculture, Environment and Rural Affairs.

20 Monitor forest damage, and intervene to protect vulnerable trees from browsing and grazing mammals, including voles, deer, rabbits, hares, grey squirrels and livestock.

21 In areas where deer are a threat, develop and monitor deer management plans – ideally in co-operation with neighbours and local deer management groups. 42

Pests and diseases

There has been a significant increase in the incidence of pest and disease outbreaks in forests and woodlands in recent years. Climate change is likely to exacerbate these threats in the future. It is vital that all those involved in forest management take a proactive role in monitoring tree health, keeping abreast of emerging threats and deciding when intervention is necessary.

22 Consider the susceptibility of forests and woodlands to pests and diseases; take specialist advice and develop strategies for resilience.

23 Be vigilant for pests and diseases in forests and woodlands, including those in urban areas where the risks of new introductions can be high. 35

Use of chemicals

The use of artificial pesticides and fertilisers is generally a last resort in practising sustainable forest management, although they can have more of a role in energy crops, such as short rotation coppice. Pesticides and fertilisers are expensive, and should only be deployed in a reactive way to protect trees when a problem has been identified or is highly likely. Their use on special sites such as ancient woodland is particularly discouraged.

24 Minimise the use of pesticides and fertilisers in accordance with Forestry Commission and Forest Service guidance. 15 5 57

Fencing

The alignment and design of forest fences can have major impacts on wildlife, access, landscape and archaeology. Fencelines themselves are not usually prominent but they can generate striking textural changes in the landscape through differences in grazing or land use.

A particular problem of fences in upland areas is that they can be invisible to birds such as black grouse. Techniques to mark fences to improve their visibility and to align them so that they avoid obvious flight paths will help minimise collisions. Fencing also needs to be considered in relation to public access: it is illegal to obstruct rights of way and in other areas access can be an important consideration in fence alignment. When fences are replaced or become redundant, removal is a better option than leaving them as they can be a nuisance to livestock, wildlife and people.

25 Consider the impacts of fencing on biodiversity, landscape, archaeology and access, and minimise adverse effects. 44

26 Identify old and redundant fencing and plan for a phased removal based on site priorities.

Forest roads and quarries

Forest roads, quarries and associated infrastructure works can have a significant impact on the environment and landscape. They may therefore come within the scope of the Environmental Impact Assessment (EIA) Regulations, and be subject to planning controls rather than prior notification arrangements (see UKFS Requirements for Good Forestry Practice). Considering important viewpoints, and allowing road alignments to respond to the landform – rather than taking the most direct route – can both ameliorate visual impacts and sometimes reduce the amount of cut-and-fill during construction. The construction of forest roads and the extraction of material accounts for a high proportion of the total energy expended in the forest life cycle, and so has a bearing on the sustainability of the timber grown (see Forests and Climate Change).

Forest roads and access onto them can disrupt forest drainage systems and cause water and soil problems. It is important that road drainage is designed and functions independently from the main forest drainage network. Where minor public roads and bridges are weak, consideration can be given to how the forest road network can be designed or upgraded, to avoid using public roads for timber transport. In many areas, there are timber transport groups that involve local authorities and advise the forestry industry on preferred routes and the options for using rail or sea alternatives to road transport. Where there are particular sensitivities with timber transport, it should be addressed as part of the forest management planning process.

27 Minimise the adverse visual impacts of forest roads and quarries; blend road alignments with landform, and locate quarries, roads and bridges to respect landscape character, especially in designated landscapes.

28 Design road surfaces, drainage and harvesting machine access points to avoid erosion and other adverse impacts on soils, watercourses and water quality.

29 Plan forest operations, civil engineering and timber transport to minimise energy use; consider using sustainable biofuels. 14

30 Consider how forest road networks can be exploited to minimise damage to public roads, and take advice from timber transport groups.

Harvesting operations

Harvesting and extraction operations are resource intensive and can have a significant environmental impact on both the forest and its surroundings. With careful operational planning it is possible to combine good silviculture and cost-efficiency with care for people and the environment. Soil compaction, leading to rutting and erosion, can be minimised by the planning and good management of forest operations, such as protecting extraction routes by using layers of fresh brash to spread the machine load. Machine choice and working method affect the ground pressure and the risk of damage. The potential of damage to soils and the water environment is usually greatest in wet weather and consideration needs to be given to how changes in weather will affect operations.

Burning of forest residues such as brash is generally discouraged and is not acceptable on ancient woodland sites. Other management options are less environmentally damaging, but if burning is the only practical alternative, a written application to the environment agencies will be required under the Waste Management Regulations (as amended). The maximum weight of forest material that can be burnt in any 24-hour period is 10 tonnes. The environmental risks, safety and potential nuisance of burning should all be taken into account as part of the application. Where felling might have an impact on road users, either from trees coming down or from vehicles emerging onto the highway, safety will need to be considered and liaison with the highway authority is advisable.

31 Minimise compaction, rutting and erosion during forest operations by selecting the most appropriate working method for site conditions; monitor operations and modify, postpone or stop procedures if degradation starts to occur. 9 36

32 Maintain adequate brash mats throughout extraction operations. 11

33 On sites vulnerable to compaction and erosion, consider the weather and aim to carry out operations during dry periods; plan ahead for changes in the weather that could affect site conditions. 10 37

34 Keep streams and buffer areas clear of brash as far as practicable; avoid felling trees into watercourses and remove them or any other accidental blockages that may occur. 39

35 Install culverts or log bridges to avoid crossing and blocking drains; restore the site and drains as extraction progresses.

36 Avoid burning brash and harvesting residues unless it can be demonstrated that it is a management necessity, all the impacts have been considered, and the necessary approvals obtained. 13 26

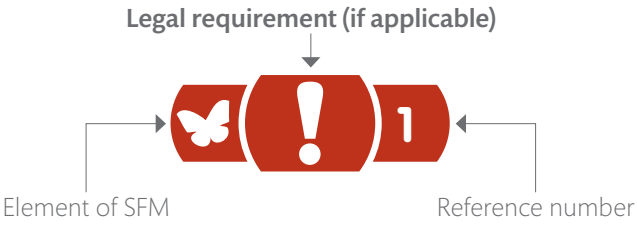
37 Liaise with the highway authority when felling near public highways or when lorries emerging onto the highway might pose a threat to road users.

6. Elements of sustainable forest management

This section provides an introduction to each of the various elements of sustainable forest management and sets out the UKFS Requirements and Guidelines for each element. See Section 2 for further information and a key to subject symbols.

UKFS Requirements

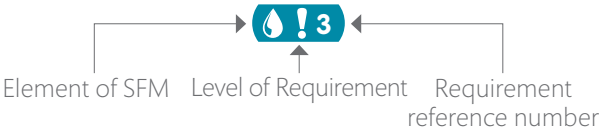
The UKFS Requirements outline the main legislation and are intended as a source of advice. You are advised to consult the relevant statutes for more information and the definitive legal text.



UKFS Guidelines

Cross-references

Cross-references may be made to the other elements of sustainable forest management (SFM), where a Requirement or Guideline is common to more than one subject.



6.1 Biodiversity

The conservation of biodiversity is an essential part of sustainable forest management. Forests cover nearly one-third of the world's total land area and are vital in ensuring environmental functions such as climate regulation and soil conservation in addition to biodiversity. They provide habitats for a large array of plants and animals, many of which are rare or threatened. By providing these important ecosystem services, biologically diverse forests and woodlands also contribute to the sustainability of the wider landscape.

Introduction

The progressive loss and fragmentation of the natural forest that once covered most of the British Isles has left the UK with a much smaller proportion of woodland than many European countries. This has had a dramatic effect on native biodiversity. Some species of large mammals have completely disappeared, while other groups such as fungi, lichens and invertebrates associated with old growth, wood pasture and parkland have become less diverse as the quality and extent of their habitat has declined.

After the formation of the Forestry Commission in 1919, forest and woodland cover increased after centuries of decline and many species benefited from the expansion of wooded habitats. However, as much of this increase was initially achieved through the planting of non-native trees with the focus on timber production, the benefits for forest biodiversity have sometimes been limited. In some circumstances, these large-scale introductions have been detrimental to biodiversity by diminishing or disrupting secondary open semi-natural habitats.

Agricultural intensification in the latter half of the 20th century accelerated the loss of woodland biodiversity as woods and hedgerows were lost and woodland habitat became more fragmented. Grazing pressure also increased, especially in the uplands, which meant that some of the remaining woodland fragments were lost from the landscape. Over the same period, the decline in traditional woodland management, particularly coppicing, reduced the amount of open woodland, together with its associated populations of sun-loving insects such as butterflies.

Since the 1970s forest policies have given increasing emphasis to environmental benefits. Forest landscapes have become more diverse in structure and more native tree species have been planted or allowed to regenerate. There has also been a focus on managing and restoring ancient woodland, creating new areas of native woodland and improving habitat conditions for priority woodland species. However, species and habitats are still at risk from inappropriate management, the long-term effects of habitat fragmentation and degradation, as well as possible adverse effects due to climate change and pests and diseases.

The conservation, enhancement and restoration of semi-natural habitats and priority species is a clear aim in the UK Forestry Standard (UKFS) and in the forestry policies and strategies in England, Scotland, Wales and Northern Ireland. The UN Convention on Biological Diversity (UNCBD) advocates the ecosystems approach, which means managing natural resources to supply environmental, economic and social benefits within sustainable limits. As part of the UK's implementation of the Convention, the UKFS Guidelines on Biodiversity help further this aim by integrating the conservation and management of biodiversity into sustainable forest management practices.

There is no standard biodiversity prescription that can be applied to all forests and woodlands, since they are highly variable in size, situation, structure and composition. They are dynamic habitats that require flexible management strategies. Careful assessment and prioritisation, linked to the monitoring of outcomes, is needed to ensure that management will be effective in securing biodiversity and ecosystem objectives.

Policy and context

This section provides further background, gives an overview of the developments relevant to forests and biodiversity, and summarises the main statutes. Further details of legislation and conventions are provided in Appendix 1.

International context

The UNCBD agreed at the Conference on Environment and Development (the 'Earth Summit') in 1992 was the first treaty to provide a legal framework for biodiversity conservation. Its call for the creation and enforcement of national strategies and action plans to conserve, protect and enhance biological diversity provides the context for the UK approach to forests and biodiversity. The most relevant objectives of the UNCBD programme for forest management in the UK are:

- Applying the 'ecosystem approach' to the management of all types of forest, with an emphasis on working flexibly within the bounds of natural ecological processes.
- Reducing the threats and mitigating the impact of threatening processes on forest biological diversity. This includes mitigating the effects of climate change, non-native invasive species and pollution.
- Protecting and restoring forest biological diversity. The emphasis is on conserving natural habitats and priority species, creating habitat networks and restoring and enhancing biodiversity in managed forests.

Conservation of biodiversity in Europe

There are three principal EU statutes that promote biodiversity, and each has implications for forest management. The 1979 EU 'Birds Directive' and the 1992 EU Habitats Directive are often referred to as the EU's nature legislation, and their implications for forest management can be considered together. The EU Birds Directive protects all wild birds, their nests, eggs and habitats within the European Union. The EU Habitats Directive requires that species and habitats that are rare or endangered at EU level are maintained at, or restored to, favourable conservation status. The requirements of the directives are met through implementing conservation measures within the wider countryside and designating specific portions of land as Special Protection Areas (SPAs) or Special Areas of Conservation (SACs), or by giving certain species protection wherever they occur. SPAs and SACs are referred to collectively as the Natura 2000 network.

The third main statute is the EU Invasive Alien Species Regulations (2015), which provide for the control of invasive, non-native species. The Regulations recognise the importance of controlling damaging non-native species by making it an offence to grow, cultivate or release a non-native species of concern into the environment without specific authorisation. Lists of species of EU and UK concern are published and will be regularly reviewed. In Great Britain there is an Invasive Non-native Species Strategy, and this was updated in 2015 to meet the aims and objectives of these EU Regulations.

The principles behind these three statutes are captured in the EU 2020 Biodiversity Strategy (2011) and the EU Forest Strategy (2013). Both of these EU strategies underline the social, environmental and economic value of ecosystems and the urgent need to maintain them and their underlying biodiversity.

Conservation of biodiversity in the UK

The UK has two principal laws, together with a range of supporting statutes and orders, that are used to protect biodiversity and transpose EU Directives. The Wildlife and Countryside Act offers protection to many specified plants and animals and amends the Forestry Act 1967 to require Forestry Commissioners to find a reasonable balance between afforestation, timber production, nature conservation and enhancing natural beauty.

The Wildlife and Countryside Act 1981 (as amended) contains provision for designating Sites of Special Scientific Interest (SSSIs); with similar provisions under the Environment (Northern Ireland) Order 2002 for Areas of Special Scientific Interest (ASSIs). These designations protect sites of special interest by reason of their flora, fauna, geological, physiographical or other features. Some SSSIs or ASSIs are also National Nature Reserves (NNRs), Natura 2000 sites or Ramsar sites (wetland areas of international importance that are also part of the Natura network of sites). Subsequent legislation (see Appendix 1) strengthens protection for SSSIs and certain species, and places a duty of care on public authorities to have regard to the conservation of biodiversity and nationally important species in exercising their functions. This duty extends to considering the effects of forest management activities on biodiversity.

The second piece of amended legislation is the Conservation (Natural Habitats, &c.) Regulations 1994

(as amended), known as the 'Habitats Regulations'. (The Habitats Regulations have also been transposed differently in Scotland than in England and Wales.) The Habitats Regulations require that any activity within or likely to affect a Natura 2000 site must be undertaken in way that does not damage the value for which it was designated. Moreover, activities within or likely to affect a Natura 2000 site can only proceed after consultation with the statutory conservation authority, and in certain circumstances the authority must undertake an appropriate assessment of potential damage. This whole process is known as a Habitats Regulations Appraisal.

Schedules 2 and 4 of the Habitats Regulations give protection to certain plant and animal species that are known as 'European Protected Species'. Under the Habitats Regulations it is an offence to cause the following to a European Protected Species:

- to deliberately kill or cause significant disturbance;
- to deliberately destroy its eggs;
- to damage or destroy a breeding site or resting place used by them; or
- to disturb those that hibernate or migrate.

European Protected Species living in UK woodland environments include the common dormouse, smooth snake, wildcat, otter and all of the bat species. The presence of any European Protected Species in or around a forest or woodland means that management practices may need to be modified to avoid committing an offence. If a degree of damage or disturbance is unavoidable, a licence must be obtained before operations take place. However, work undertaken in accordance with the UKFS Guidelines on Forests and Biodiversity (and managed through the established forest management planning process) may not need a licence.

In addition to UK legislation outlined above, the importance of biodiversity is embedded in complementary legislation specific to each of Scotland, Wales and Northern Ireland.

- In Scotland, this is the Nature Conservation (Scotland) Act 2004 and the Wildlife and Natural Environment (Scotland) Act 2011.
- In Wales, this is the Environment (Wales) Act 2016.
- In Northern Ireland, this is the Wildlife (Northern Ireland) Order 1985 and the Nature Conservation and Amenity Lands (Northern Ireland) Order 1985, as updated by the Wildlife and Natural Environment Act (Northern Ireland) 2011.

Further details are provided in Appendix 1.

Forestry strategies and delivery mechanisms

In 2012 the UK Biodiversity Action Plan was replaced by the UK 'Post-2010 Biodiversity Framework', and this is the current mechanism for delivering the UNCBD across the UK. The Framework reflects the Convention's 'Strategic Plan for Biodiversity 2011–2020' and its 20 Aichi Biodiversity Targets, and also the EU Biodiversity Strategy to 2020. It looks to achieve the Aichi Targets primarily through the biodiversity strategies of England, Scotland, Wales and Northern Ireland. A key principle of the country strategies is that biodiversity conservation should be at the heart of sustainable land management. The UK Biodiversity Indicators 2015 – official UK statistics that report on progress towards meeting international goals and targets – show there is still much to be done to achieve improvement over time. For more information on strategies and delivery mechanisms for forests and biodiversity at a UK and country level, see www.forestry.gov.uk/ukfs/biodiversity.

UKFS Requirements for Forests and Biodiversity

Protected habitats and species

European Union Directives on habitats and species provide a range of protection and conservation measures including the Natura 2000 network of protected sites and European Protected Species. In addition, a range of UK and country wildlife, countryside and conservation legislation provides protection for special sites and listed species, and places duties of care on public authorities to have regard to the conservation of biodiversity in exercising their functions.

A number of protected and priority species are of particular relevance to the woodland environment. Forestry has the potential to affect both the immediate woodland site and the ecology of the wider environment, so minimising the risk and impact of forestry activities is vital.

Appropriate protection and conservation must be afforded where sites, habitats and species are subject to the legal provisions of EU Directives and UK and country legislation. Advice can be obtained from the relevant authorities on minimising potentially adverse effects for management activity likely to affect them. An appropriate assessment for a Natura 2000 site should be undertaken as part of a Habitats Regulations Appraisal required under the Conservation (Natural Habitats, &c.) Regulations 1994 (as amended). 

Invasive non-native species

Non-native species are not always invasive, but under the EU Invasive Alien Species Regulations (1143/2014) there are general duties to protect the environment, society and economic interests from adverse risks posed by invasive alien species. There are also specific provisions, including the requirement for the appropriate authority to produce a plan, in relation to a published and regularly reviewed 'List of invasive alien species of Union concern'. These provisions extend to the prevention, early detection and rapid eradication of new invasions, and the management of invasions that are already widely spread.

Species subject to the legal provisions of the EU Invasive Alien Species Regulations (and domestic legislation where applicable) must not be grown, cultivated or otherwise released into the environment unless under Order or Permit.

Woodland management and biodiversity

Policies and strategies for forests and biodiversity in the UK emphasise the potential importance of all forests and woodlands for biodiversity. While ancient semi-natural woodlands have highest value for biodiversity, all woods and forests, including those originally established as plantations, can be valuable for biodiversity with appropriate management.

1 Forests and woodlands should be managed in a way that conserves or enhances biodiversity; opportunities for enhancing biodiversity should be considered in forest management plans.

2 Where existing forests fall short of the UKFS Requirements for Forests and Biodiversity, improvements should be made when suitable management opportunities arise.

Biodiversity in the wider landscape

Woodland owners and managers need to consider the impacts of forestry beyond the forest boundary and engage with others if the conservation and enhancement of biodiversity is to be achieved. This has implications for the location, composition and size of new woodlands.

3 The implications of woodland creation and management for biodiversity in the wider environment should be considered, including the roles of forest habitats and open habitats in ecological connectivity.

Biodiversity action plans

Forests and woodlands provide habitats for a large array of plants and animals, some of which are rare or threatened. The biodiversity lists of England, Scotland, Wales and Northern Ireland name priority habitats and species associated with woodland, including wood pasture and parkland.

4 Particular consideration should be given to conserving, enhancing or restoring priority habitats and species identified in the statutory lists of priority species and habitats for England, Scotland, Wales and Northern Ireland, through the delivery of country biodiversity strategies and local level plans.

UKFS Guidelines on Forests and Biodiversity

The table below introduces factors important for forests and biodiversity. The Guidelines that follow provide more information on how to comply with the UKFS Requirements, grouped by the factor headings.

Factor	Importance for biodiversity
Priority habitats and priority species	Priority habitats have the potential to provide for the richest and most varied components of biological diversity. Priority species are those that are rare and at risk of extinction, threatened, or have special requirements.
Native woodlands	Native woodlands, and especially ancient woodlands, are the priority habitats of greatest relevance to forestry. They have a very high biodiversity value or potential, and support a large proportion of priority species.
Ecological connectivity	Ecological connectivity facilitates the movement of species by providing linkages between habitats.
Ecological processes	Natural ecological processes can deliver diversity of structure and other habitat features that benefit many species.
Tree and shrub species selection	Diversity of tree and shrub species is generally beneficial for biodiversity; genetic diversity within species is an important component of biodiversity and underpins sustainable forest management.
Forest and stand structure	Structural diversity in forests creates a wide range of habitats.
Veteran trees and deadwood	Old trees and deadwood are particularly significant for woodland biodiversity.
Open, scrub and edge habitats	Open-ground and edge habitats associated with woodland provide important resources and habitats for biodiversity.
Riparian zones	Riparian ecosystems are rich in wildlife habitats and provide linear habitat linkages.
Habitat creation and restoration	Significant gains for biodiversity arise from restoring degraded habitats and the targeted creation of new habitats.
Invasive species	Species that are invasive, and particularly non-native and invasive, can diminish biodiversity and need effective control.
Grazing and browsing	Managing domestic stock and other herbivores effectively is necessary to protect and enhance biodiversity.

Priority habitats and priority species

Many habitats that are important for biodiversity in the UK have been reduced and fragmented and are in need of protection, restoration and expansion. Priority habitats have the potential to provide the richest and most varied components of biological diversity within the UK. All types of native woodlands, as well as wood pasture and parkland, are woodland priority habitats. Priority species are those that are declining, rare, at risk of extinction, or have special requirements. A high proportion of priority species are associated with woodland.

Advice is available for specific habitat requirements of priority species associated with woodland to help inform management options. For example, while nightjars are more successful in nesting on fairly extensive coupes, woodland flora benefits from intimate coupes. For priority habitats themselves, detailed advice is also available from the forestry authorities and nature conservation agencies on specific management systems and operations aimed at habitat enhancement. For both priority species and habitats certain forest operations can be damaging and may have to be planned for another time of year or otherwise amended.

When land-use change is proposed, the relative merits of existing habitats, and in particular the potential impacts of the change on priority habitats and species, have to be taken into account. Where effects due to afforestation or deforestation are likely to be significant, an Environmental Impact Assessment will be required. Existing semi-natural habitats are likely to have a high value for biodiversity and this will need to be compared with the value of new woodland. Moreover, there is a specific presumption against the conversion of some priority habitats, such as deep peat or active raised bogs. This is for reasons of climate change in addition to biodiversity.

1 Seek advice from the relevant forestry authority and nature conservation agency on the requirements of priority habitats and species and on suitable management options.

2 Consider options to extend and improve priority habitats and to increase and extend populations and ranges of priority species; plan forest operations to minimise any adverse impacts on biodiversity.

3 Consider the impacts of the silvicultural system employed; for example, where a clearfell system is used, ensure coupe sizes are compatible with the habitat requirements of priority species.

4 For new forest and woodland proposals, include an assessment of the potential impacts on priority habitats and species as part of the forest planning process.

5 Avoid establishing new forests on soils with peat exceeding 50 cm in depth and on sites that would compromise the hydrology of adjacent bog or wetland habitats.

Note: Woodland creation on certain sites where deep peat soils have historically been highly modified may be considered, provided that it complies with the relevant country policy. 5 24

Native woodlands

Native woodlands are among the richest habitats for biodiversity and they support a high concentration of UK priority species. Native woods are broadly defined as woodlands mainly composed of native species and can include both semi-natural and planted trees. All types of native woodland are priority habitat types in the country biodiversity lists. Some are also EU priority habitats under the EU Habitats Directive.

Semi-natural native woods are characterised by predominantly natural features. These include a range of native, naturally regenerated tree and shrub species, old trees and deadwood, woodland flora, and rich and undisturbed woodland soils. Sites with the longest continuous history of woodland use are listed as ancient woodland. Woods that are both ancient and semi-natural in character have the greatest value for biodiversity. Known as ancient semi-natural woodland (ASNW) these are still widespread although fragmented. They serve as valuable refuges of woodland biodiversity, particularly for sedentary species that, once lost, do not readily recolonise. ASNWs also frequently retain characteristics of previous management such as coppice and other traces of cultural history.

Sites that were once ancient woodland but have been converted to planted forests are known as plantations on ancient woodland sites (PAWS). Many PAWS retain at least some characteristics or remnants of native woodland, which give them the potential to be restored to native woods. Doing so will contribute to policy objectives for native woodland restoration.

New native woodlands can be created by extending existing woods through natural regeneration, new planting or by converting 20th century plantations of non-native species. Published guidance on improving the ecological quality of new native woodlands, including their role in habitat connectivity and in protecting and augmenting ancient woodland fragments, is available from the relevant forestry authorities and conservation agencies. Improving the condition of existing native woodlands is best done by addressing threats to it, primarily illegal felling, fragmentation, neglect, unmanaged grazing or browsing, invasive non-native species, pests and diseases and pollution.

Manage native woodlands to ensure their biodiversity is maintained or enhanced; base management proposals on protecting or extending semi-natural features characteristic of that woodland type and pay particular attention to ancient semi-natural woodlands.

In ancient semi-natural woodlands, avoid introducing non-native species unless they would maintain or enhance the ecological function of the woodland.

Ecological connectivity

The loss of ecological connectivity through the fragmentation of woodland habitat poses a significant threat to woodland biodiversity. This is particularly the case where woodlands are isolated by development or intensively managed agricultural landscapes. Smaller habitat areas and greater isolation between them increases the likelihood that priority species will become locally extinct. Climate change poses further threats to isolated

populations as the limited genetic base of small populations in isolated fragments gives them less capacity to adapt to new conditions.

The effect of fragmentation on different species depends upon their modes of dispersal, their habitat requirements and their ability to migrate through the surrounding landscape. Many woodland species, especially those associated with ancient woodland, disperse slowly and movement between areas of suitable habitat may be difficult. The only instance in which fragmentation rather than linkage can be beneficial is where isolation can offer a vulnerable population some protection against invasive competitors.

To promote connectivity, habitats have to be considered in the context of the wider landscape. For woodland habitats, a range of options can be used to restore ecological connections. These include expanding existing woodlands and creating new woods adjacent to them. Wood pastures and parkland can also be created or managed to act as a link between woodland habitats. Because of their linear nature, riparian zones offer good opportunities to increase connectivity. Hedgerows and diverse uncultivated field margins can also serve in creating cover and developing connections (see Habitat creation and restoration below).

However, when expanding existing woodlands or siting new woodland, consideration also needs to be given to wider aspects of biodiversity as other important habitats, for example semi-natural open ground, can be fragmented when new woodlands are established.

8 Improve the ecological connectivity of the landscape for woodland and other species by extending and linking habitat features; consider the juxtaposition of wooded and non-wooded habitats and aim for the best overall result for biodiversity. 31

Ecological processes

The ecological processes that shape natural forest ecosystems include vegetation succession, natural regeneration, windthrow, flooding, drought, the activities of herbivores, insect attack, disease and fire. All these agents add a degree of unpredictability, work to develop structural diversity, and can assist with the establishment of new species assemblages. Allowing ecological processes to operate, and mimicking them within silvicultural systems, can therefore benefit biodiversity – providing this is done within the framework of a forest management plan with clear management objectives.

Within a managed forest, the areas with the most potential for this approach will have had limited recent intervention, and will be linked to areas of high biodiversity value, for example continuous cover forestry systems and semi-natural habitat. However, designated sites such as SSSIs and ASSIs and other areas can also be set aside as 'minimum intervention' reserve areas, where no active silvicultural management takes place – providing the biodiversity value is understood and the ecological processes maintain and enhance the site.

In practice, some intervention may still be necessary, for example to manage deer, remove invasive species such as rhododendron, or ensure particular characteristics are favoured.

Risk assessments may reveal that some management of access may be advisable as retained dead trees and branches can constitute safety hazards.

Identify areas for minimum silvicultural intervention and consider encouraging or replicating ecological processes as a way of delivering biodiversity objectives within a forest management plan.

Tree and shrub species selection

A diverse range of tree and shrub species is generally beneficial for biodiversity. Achieving species diversity in forests is a requirement of the UKFS, and forest management plans will need to address the tree species composition of the forest management unit as a whole. Native trees and shrubs support higher species diversity, and especially more rare species, than non-native species. However, non-native forests can also provide significant biodiversity benefits, particularly as they mature, develop herb and shrub layers and are colonised by invertebrates, fungi and lichens. Non-native conifers can also provide vital seed crops for small mammals such as red squirrels, and birds.

For native woodlands, augmenting the existing range of tree and shrub species with others that are characteristic of the woodland habitat type will often help meet biodiversity objectives and could increase the resilience of woods to the threats posed by climate change. There is also new evidence that the ecological implications of localised tree species loss could be mitigated by encouraging the establishment of alternative tree and shrub species which are ecologically similar. The choice of tree and shrub species should also be informed by the needs of priority species, the potential to develop and extend priority habitats, and the potential to develop riparian zones and edge habitats. It should not, however, increase the potential for pests and diseases to spread.

In addition to species diversity, genetic diversity – both within and between populations – is an important component of biodiversity. Genetic diversity varies at local and regional scales and may include distinctive genetic patterns or subspecies. The genetic diversity present in a population reflects its evolutionary history and determines its ability to respond to a changing environment, for example by developing resistance to pests and diseases, and adapting to climatic change. The comparatively long generation time for trees makes it particularly important that populations contain sufficient genetic diversity to be able to adapt to change.

Evidence suggests that most populations of trees in semi-natural woodlands contain high levels of genetic diversity, even in smaller and more isolated woods. However, linking and expanding native woods, using natural regeneration or by planting with well-adapted stock, will increase gene flow and increase the capacity of tree populations to adapt.

For all new woodlands it is vital that material is drawn from a broad genetic base. When planting native species and native woodlands, it is generally best to use well-adapted local or regional origins from similar elevations. Consideration can also be given to planting a proportion of native species from non-local provenances with conditions that are well matched to the predicted future climate at the planting site. Advice on suitable species and origins for both native and non-native planting is available from the forestry authorities.

The Forest Reproductive Material (Great Britain) Regulations 2002, and equivalent legislation in Northern Ireland, provide a system of mandatory identification and control of the seeds, cuttings and planting stock of 12 major species used for forestry. They ensure that planting stock is of traceable origin (and provenance). A voluntary scheme also exists to help users identify and source suitable stock for all native species, including 41 native trees and shrubs that are not controlled by the Regulations. The voluntary scheme uses 24 native seed zones and two altitude bands (see www.forestry.gov.uk/ukfs/biodiversity).

10 Maintain or establish a diverse composition within the forest management unit; where only one species is suited to a site and management objectives, a maximum of 75% may be allocated to a single species (see notes below). In all cases, incorporate a minimum of:

- 10% open ground or ground managed for the conservation and enhancement of biodiversity as the primary objective;
- 10% of other species;
- 5% native broadleaved trees or shrubs.

Note: (i) Where more than one species is suited to a site and matches the management objectives, opportunities must be taken to further diversify the above species composition. (ii) In woodlands of less than 10 hectares and in native woods the above proportions may be relaxed as long as the adjacent land uses provide landscape and habitat diversity. 9 25

11 When managing or creating native woodland, encourage a representative range of the native species associated with the woodland type. 26

12 When selecting trees and shrubs for new woodlands and restocking, consider the risks and opportunities of climate change and vulnerability to pests and diseases for particular species to decide if alternative species or increased species diversity are merited. 7 27

13 Choose trees or shrubs which are well adapted to the site and are drawn from a sufficiently wide genetic base of parent trees to promote future adaptation. 29

14 Encourage natural regeneration of native tree and shrub species to promote natural selection and climate change adaptation, and conserve distinctive genetic patterns – especially in and around semi-natural woodlands. 30

15 Use the information provided under the Forest Reproductive Material Regulations to establish the origin or provenance of available planting material.

Forest and stand structure

Forest structure is determined by the ages and species of trees and shrubs and the pattern of open space and other woodland features. The structure affects the character of the canopy, vegetation layers and the intensity of light reaching the forest floor. Much woodland biodiversity is directly related to forest and stand structure, internal and external edges, and other woodland features.

Different types of forest structure benefit different species (Table 6.1.1). In managed forests and woodlands, the silvicultural system employed will affect the overall structure and supporting floral and faunal communities. Continuity of the management regime is vital to maintain the conditions to which wildlife communities have become adapted. Permanently wooded areas can form part of a long-term forest structure, managed using low-impact silviculture to maintain woodland conditions. This is beneficial to species such as woodland bryophytes. In contrast, open areas are used by a range of species that benefit from a mixture of cover and open space, for example nightjar and fritillary butterflies.

Many broadleaved woodlands have been simplified in their composition and structure through past management and, in some cases, through neglect. Increasing age class diversity and allowing old trees (also known as veteran trees) and deadwood to develop will enhance the structure for biodiversity. Leaving some windblown trees provides nesting sites, decaying wood and structural micro-sites. Regular coppicing of broadleaved woodland is a traditional management regime with a characteristic range of species where continuity of the conditions created is vital to their habitat.

Table 6.1.1 Examples of woodland species associated with different forest and stand structures.

Forest stand structure	Stand age (years)	Example species
Open, new planting and regeneration, restocked areas, recently cut coppice.	0–5	Nightjar, black grouse, Kentish glory moth, hen harrier.
Young woods, coppice regrowth, rides with bog myrtle.	5–15	Whinchat, dormouse, argent and sable moth.
Dense, pole-stage or mid-rotation stands with little or no shrub layer and sparse ground vegetation.	15–50	Mycorrhizal fungi (e.g. *Russula* spp.), red squirrel.
Mature stands, areas that have been well thinned and stands managed under continuous cover forestry systems, development of diverse shrub and understorey layers and deadwood habitats, wood pasture and parkland.	50–120	Herb Paris, bats (e.g. noctule), hole-nesting birds (e.g. redstart).
Natural reserves, stands managed for long-term forest cover, minimum intervention areas. Multi-layered, multi-aged stands with high levels of deadwood.	120+	Lichens (e.g. lungwort *Lobarion* spp.), wood-decaying fungi, invertebrates (e.g. stag and longhorn beetles).

16 Maintain a range of stand structures and silvicultural approaches across the forest as a whole, including veteran trees, open-crowned trees, occasional windthrow, understorey layers, open space and areas of natural regeneration. 15

17 Consider alternatives to clearfell systems, such as continuous cover forestry, where suitable sites and species combinations allow and management objectives are compatible. 14 19

18 Develop a long-term forest structure of linked permanent habitats, such as riparian woodland, open space and broadleaves. 10

19 Manage a minimum of 15% of the forest management unit with conservation and the enhancement of biodiversity as a major objective. 13

20 Identify sites for long-term forest cover and ensure they are appropriately thinned.

Veteran trees and deadwood

Up to a fifth of woodland species depend on dead or dying wood for all or part of their life cycle. The amount of deadwood is used in Forest Europe monitoring (see Section 3) as a key international indicator of the biodiversity of forest ecosystems. Generally, the greater the volume of deadwood, the higher the biodiversity value. Deadwood occurs as whole standing trees, fallen branches and stumps, while veteran or ancient trees – although alive – have rot holes, dying limbs and heart rot. All of these different deadwood types have their own characteristic fungi, flora and fauna.

The most valuable areas for deadwood are where linkages can be made with existing deadwood habitats to develop ecological connectivity, which is why it is important to leave deadwood concentrated in high value areas and not dispersed evenly across a felling coupe. High value areas might be found in long-term forest cover areas and wood pasture, parklands and ancient semi-natural woodland with veteran trees. Deadwood in riparian or wet woodland provides special humid habitats, and a limited amount of coarse woody debris plays an important role in the ecological functioning of streams and rivers by providing structural habitat for fish and invertebrates. Deadwood retained close to sunny glades and edges will provide a useful habitat for insects in particular.

There are numerous opportunities to develop decaying wood habitats and increase the quantity of deadwood in all woodlands, particularly in older stands (more than 120 years old). The long-term provision of deadwood can be assured by protecting veteran trees from loss or harm and ensuring continuity through the identification and management of future veteran trees. In some situations, pollarding can help keep old, previously pollarded trees alive and maintain a range of habitats.

As a guide, forest management units should have around 20 m^3 per hectare (equivalent to a lorry load per hectare) deadwood (excluding tree stumps). Native species provide the most valuable deadwood for biodiversity, especially in sections of 200 mm diameter or more. However, deadwood from all species has value and sections above 100 mm make a useful contribution to the habitat. It is recognised that it may take some time to build up to this level, especially in first rotation, even-aged forests. It will not therefore be necessary to measure site deadwood volumes to comply with UKFS Requirements for Forests and Biodiversity.

In all woodlands there is a need to minimise hazards to visitors by routing paths and siting recreational facilities away from sources of falling deadwood. In some cases it may be necessary to make deadwood and veteran trees safe if they are close to existing recreational facilities or areas well used by the public.

21 Leave a proportion of standing and fallen deadwood in each forest management unit, concentrated in areas of high ecological value, where there is existing deadwood and where linkages can be provided between deadwood habitats – avoid uniform distribution across the forest management unit. 11 12

22 Retain and manage existing veteran trees and select and manage suitable individuals to eventually take their place. 12 16

Open, scrub and edge habitats

The open, scrub and edge habitats within or adjacent to woodland are especially important for biodiversity. These unplanted areas may contain valuable habitats, such as shrubs, open and stunted forest at the natural treeline, grasslands, crags, heaths, limestone pavements, bogs and a range of aquatic habitats. Open areas such as utility wayleaves, roads and rides add to these open habitats.

Their value as habitats is greatly increased if they can be linked together and if the forest edges next to them are managed as part of this network. In some situations, management will be required to maintain open areas and prevent them reverting to woodland; shrubby woodland can be flailed, grassland mown or lightly grazed, and heathland periodically burned. Where woods have been recently planted, open areas within them may contain botanical interest that can be maintained with periodic mowing.

Forest edges that grade into open ground and, where possible, contain mixtures of native trees and shrubs are far more beneficial to biodiversity than abrupt edges. They provide, for example, bird nesting and feeding areas and sources of nectar for pollinators and other insects. Many birds nest in edge habitats, and some, such as black grouse, depend on the maintenance of a diverse edge structure. Butterflies require nectar sources and food plants associated with edges and open areas.

Distinctive open forest habitats and species associations have also developed in woodlands with a long history of grazing, parkland, wood pasture or understorey grazing, and these have specific management requirements.

23 Plan open space in new and existing woodland to create and enhance networks of open-ground habitats.

24 Consider practical opportunities to restore open habitats where their value could be reinstated and sustained.

25 Develop graded edge habitats; thin woodland edges to create a diverse and convoluted structure and a transitional zone between habitats.

26 Ensure wetland features such as springs, flushes and bogs are protected, and take opportunities to restore degraded features.

27 Consider how open areas and areas with partial tree or shrub cover can be managed to maintain or enhance their value for biodiversity.

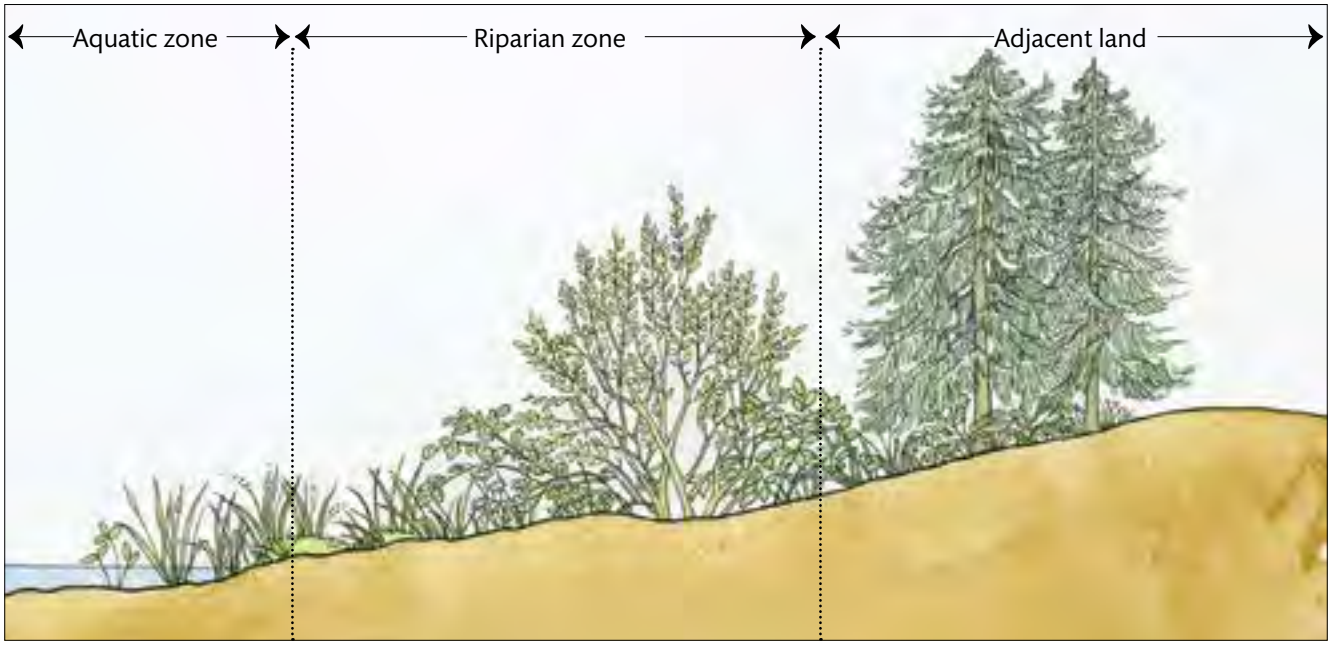
Riparian zones

The riparian zone is defined as the area of land adjoining a river channel, which includes the river bank but not the wider floodplain (Figure 6.1.1). Riparian zones can be ecologically rich, with long and convoluted edges that host a wide variety of habitats. They can also link ecologically rich habitats and offer migration corridors for invertebrates, birds and mammals. In places where natural flooding occurs, large tracts of wet woodland habitat may extend from the riparian zone across the floodplain. These woods are now rare throughout the UK and they are identified as priority habitat types in country biodiversity strategies.

Ideally the riparian zone will be managed to develop a rich herb and shrub layer, with a light and broken tree canopy. Light and broken shade, such as that provided by broadleaves, helps keep summer water temperatures down, which can be important for aquatic life, particularly salmonid fish. The occurrence of lethal temperatures is likely to become more commonplace as climate change progresses (see Forests and Climate Change). The best combination of shade and shelter is usually predominantly native woodland managed to achieve 50% canopy cover. Too much canopy, especially of conifers, can shade out the lower layers of vegetation and result in bank erosion. For this reason, natural regeneration that is likely to lead to a conifer canopy cover should be considered for removal if the riparian zone is not to be compromised.

Riparian zones present a major opportunity to enhance the biodiversity of woodland by linking permanent habitats and establishing native trees, shrubs and ground flora. However, they can also facilitate the rapid spread of invasive species such as Japanese knotweed and giant hogweed, so control measures and careful management are required in areas where invasive species may be a problem.

Figure 6.1.1 Diagram to show the transition from the aquatic zone through the riparian zone to the adjacent land.



In addition to providing shade, riparian vegetation can influence the condition of watercourses by providing an effective filter and buffer, which helps to trap sediment and absorb nutrients thereby reducing the delivery of pollutants to watercourses. Riparian woodland will also provide a source of woody debris to watercourses, which is important for aquatic life (see the UKFS Guidelines on Forests and Water).

Identifying and establishing an effective buffer area is fundamental to the protection of the riparian zone and aquatic habitats; the wetness of the soils and the characteristic instability of stream banks mean that the zone is particularly sensitive to disturbance. Buffer zones will also help to protect watercourses from any potentially adverse effects of adjacent land use. The minimum buffer widths from forest edge to watercourse are given in the UKFS Guidelines on Forests and Water.

28 Aim for a mix of shaded and lightly shaded habitat within the riparian zone – around 50% canopy cover on average but guided by local circumstances and the requirements of priority species. 17 84

29 Remove dense stands of conifers from riparian areas and from the edges of ponds and lakes, and control excessive conifer regeneration. 85

30 Favour locally native tree and shrub species in the riparian zone and control the spread of invasive and non-native species. 86

31 Design and manage riparian woodland along small watercourses (less than 5 m wide) to provide a source of leaf litter and woody debris; retain this within watercourses unless it poses a significant risk of damaging or blocking downstream structures. 87

32 Provide and maintain defined buffer areas along watercourses and water bodies. 88

Habitat creation and restoration

Significant gains for biodiversity can arise from creating new habitats and restoring degraded ones, to help reverse the effects of habitat fragmentation. Woodland edges offer good habitats in their own right, but some species need continuity of woodland without the effect of an edge habitat. Restoration of former habitats is most beneficial where the original features survive and the re-establishment and management of a functional ecosystem over the longer term is a practical possibility. It normally involves enhancing remnant native ecological features by natural regeneration and colonisation, and in some cases removing non-native and invasive species.

The creation of new native woodlands and the extension and restoration of existing ancient semi-natural woodlands is particularly valuable and can help reverse the effects of habitat fragmentation. The clearance of ancient semi-natural woodland for agriculture and development has usually removed all evidence of a wooded past. However, there are sites, such as permanent pastures in the uplands, where a scatter of remnant trees live on and are sometimes accompanied by traces of woodland ground cover. There are also likely to be areas within managed woodlands with indicators of a long history of woodland cover.

If native species are still present, natural regeneration and colonisation are the most appropriate way of creating and restoring woodland habitats. Although this approach has the advantage of conserving local genetic material that is suited to the site, the diversity of the species and origins may need to be considered in light of climate change and threats from pests or diseases (see Tree and shrub species selection above). Restoration will normally involve the progressive enhancement of the remnant native ecological features and the removal of non-native and invasive species. However, in some instances, non-native species may be of high ecological or cultural value, for example veteran trees, and can be retained.

Plantations on ancient woodland sites may have retained some features of ecological and cultural interest and provide valuable opportunities for restoration. The minimum required by the UKFS is to ensure these remnant features are retained and the highest priority for restoration is on sites where irreplaceable features and vulnerable species survive.

Habitat restoration and creation within a forest is not confined to the woody elements, as a range of other habitats and micro-sites contribute to the wider forest environment. Much can be made of sites that are inaccessible or wet and therefore unsuitable for timber production, and they can greatly extend the potential for biodiversity. The management of drainage offers many opportunities through the creation of ponds and wetlands in buffer areas for the seepage of water, which complement the UKFS Requirements for Forests and Water.

Some forests have been established on what are now recognised as priority open-ground habitats, such as bogs and heaths. Although there is a general presumption against deforestation, some of these sites may have potential for restoration where this offers significant and demonstrable benefits for biodiversity. Where deforestation is proposed, an Environmental Impact Assessment is likely to be required, and each case will have to be determined individually. All the various implications, including the practicality of habitat restoration, will need to be considered in the context of policies at country level on woodland removal. This assessment will include the effects on climate change, and the potential emissions of greenhouse gases, including methane from peat bogs (see Forests and Climate Change).

33 Consider expanding native woodlands by creating new woods, restoring native woodland sites and converting non-native woodlands; concentrate on areas that will enhance existing ancient semi-natural woodlands and, where possible, include sites large enough to overcome edge effects.

34 On plantations on ancient woodland sites, ensure that features of ancient woodland remnants are protected and consider progressive restoration to native woodland.

35 Consider creating or restoring semi-natural habitats: prioritise special and designated sites, extensions to them, and areas beneficial for priority species or habitats.

Invasive species

An invasive species is any animal or plant that has the ability to spread and be detrimental to the environment, the economy, or our health and well-being. Some invasive species are native (e.g. bracken) but most are non-native (e.g. grey squirrel and rhododendron). In recent years the UK has experienced a significant increase in the number of new pests and diseases arriving from overseas, some of which have been, or may become, highly damaging to our forests and woodlands. The effects of invasive species on the biodiversity of woodlands and associated habitats are wide ranging. Some highly invasive plants such as rhododendron can modify soils and cause extensive loss of ground flora and associated fauna.

Those invasive species which pose the most significant risk are subject to control provisions under the EU Invasive Alien Species Regulations (and secondary country legislation within the UK). As invasive species can quickly colonise and dominate areas, and are costly to eradicate, early action to prevent populations establishing will be more cost-effective than later attempts at control. A collaborative eradication strategy across a defined geographic area is also likely to be more effective for more mobile species. Advice on practical control measures is available from the forestry authorities or nature conservation agencies.

36 Where non-native species are invasive and pose problems, control or remove them where this is feasible; take action early while populations are still small.

37 Participate in collaborative actions to control invasive species.

38 Plan for the control of invasive species where feasible by developing barriers to their dispersal; ensure newly created elements in habitat networks do not facilitate dispersal.

39 Consider how forest operations, such as felling and thinning, might promote the spread of invasive species and take action to control them beforehand.

Grazing and browsing

Natural woodland ecosystems have evolved together with a range of grazing animals. The effective management of grazing and browsing is important in achieving objectives for woodland and open-ground habitats. While low grazing pressure can be advantageous, in the absence of control, herbivore populations (in particular, deer) can increase to a level where biodiversity is impoverished. This is particularly significant for biodiversity in semi-natural woodlands reliant on natural regeneration. The first step in managing grazing is to assess the intensity in relation to management objectives and biodiversity benefits. The effect of grazing can be monitored, and control measures adjusted accordingly. In exercising control, owners can collaborate with others by joining local deer management groups to implement effective control across multiple landholdings through a deer management plan.

Livestock can sometimes play a role in maintaining the structural diversity of open habitats: they can scarify the ground, which encourages seedling establishment, but this needs to be tightly controlled. Uncontrolled grazing by livestock or horses is invariably detrimental and

will eventually lead to loss of woodland habitat. In wood pastures and parkland, light grazing is an essential element of maintaining the characteristics of the habitat. Where there is no grazing or browsing at all, the development of coarse vegetation and scrub eliminates less competitive plants. By contrast, heavy grazing can prevent woodland regeneration and dramatically reduce the quantity or diversity of woodland ground flora and dependent fauna.

Trees can be protected from grazing by fencing; tree guards or tubes offer protection to individual trees but not the habitat as a whole. Other management techniques, such as piling brushwood on a small scale or the establishment of thorny species, can be used to allow tree species to establish. Landowners and managers should be aware of adverse effects of using fences, such as the long-term decline in vegetation diversity, increased shading and the problem of woodland birds striking fences during flight.

40 Assess grazing and browsing levels and the impact on the biodiversity value of the woodland.

41 Take action to control grazing and browsing levels that will have negative impacts on the woodland or its biodiversity.

42 In areas where deer are a threat, develop and monitor deer management plans – ideally in co-operation with neighbours and local deer management groups. 21

43 Consider using controlled grazing by livestock as part of the planned management for biodiversity.

44 Consider the impacts of fencing on biodiversity, landscape, archaeology and access, and minimise adverse effects. 25

6.2 Climate Change

Climate change presents one of the greatest long-term challenges facing the world today. Over the past 150 years, the atmospheric concentration of carbon dioxide has increased significantly. This is as a direct result of human activities, mainly through the use of fossil fuels and changing land use. There is mounting evidence that climate change could create impacts on our environment that may be substantial, abrupt and irreversible.

Introduction

The agricultural and forestry systems on which humans depend have developed in a climate that has undergone fluctuations but remained relatively stable since the end of the last Ice Age (around 10 000 years ago). However, the average global temperature is now rising. According to the Summary of the Fifth Assessment Report of the Intergovernmental Panel on Climate Change (IPCC), the period from 1983 to 2012 was probably the warmest 30-year period of the last 1400 years in the Northern Hemisphere. Globally, the 10 warmest years since instrumental records began (1850) have all occurred since 1998; 2015 and 2016 were signifcantly warmer than all other years. There is evidence that rainfall patterns are changing and there is likely to be an increase in the incidence of extreme weather.

An increased frequency and severity of summer drought is likely to represent the greatest threat to woodlands from climate change in the UK. Annual average temperatures in central England have risen by about 1°C since 1970 and there has been a change in seasonal rainfall patterns, with winter rainfall increasing and summer rainfall declining. Warming has been greater in winter than in summer, particularly in the south and east of the UK. The most visible effects of these changes have been to the timing of natural events: for example, bud break of oak in southeast England has advanced by three weeks since the 1950s.

Guidance on adapting to climate change is inevitably provisional because of the uncertainty associated with climate change projections. However, there are actions that can be taken now to mitigate the impacts of climate change and to adapt to its effects. The UKFS Guidelines on Forests and Climate Change are focused on the actions that forest managers can take to protect forests and woodlands in the UK, and to ensure that we can adapt to the new threats and opportunities that climate change will bring while still maintaining and expanding a sustainable forest and woodland resource.

Forests and carbon

Forests play an important role in the global carbon cycle. They account for almost three-quarters of the annual exchange of carbon between the land and the atmosphere. Land-use change, primarily the clearing of forests for agricultural expansion, particularly in the tropics, has contributed approximately a quarter of the increase in carbon dioxide in the atmosphere since the industrial revolution. Forestry (including deforestation) continues to account for 17.4% of the global annual greenhouse gas emissions attributed to human activity.

However, providing forests are managed in a sustainable way, they perform a vital role as carbon stocks and sinks, representing an important means of removing carbon dioxide from the atmosphere (Box 6.2.1). Globally, forests store 289 GtC (1060 $GtCO_2e$) in biomass alone; forest biomass and forest soils and litter combined contain more carbon than the atmosphere (Box 6.2.2).

If these natural and managed sinks were lost as a result of forest degradation or climate change, the rate of accumulation of carbon dioxide in the atmosphere would rise dramatically. Carbon in forest soils is particularly important, as a greater proportion is often stored in the soil than the tree biomass, especially on peat-based soils.

In addition to carbon sequestration, forests contribute to climate change mitigation as a source of renewable energy and sustainable wood products. It has been estimated that, in 2030, the total mitigation potential of global forests will amount to nearly 13 800 $MtCO_2$ per year (3800 MtC per year), according to the Fifth Assessment Report of the IPCC.

Box 6.2.1 Carbon in forests

The accumulation of carbon in forests is often referred to as 'carbon sequestration'. In a legal context, sequester means to seize temporary possession of something. This gives a good analogy with the pattern of carbon dynamics, highlighting four important features:

- Individual atoms of carbon are continually being exchanged between the atmosphere and forests and woodlands; in other words, an individual atom is only captured from the atmosphere temporarily.
- Over the lifetime of a forest more carbon atoms are captured than are released so there is net accumulation of carbon in the forest.
- Carbon is only accumulated by a stand of trees up until the point when equilibrium is reached, so that the quantity of carbon accumulated is finite.
- The accumulation of carbon by a forest is reversible, as carbon being sequestered can be returned to the atmosphere through dieback, decay, the burning of wood or disturbance of the soil.

The carbon balance of a forest needs to take into account the exchanges or fluxes of carbon between the atmosphere and the different components of a forest ecosystem, including the forest soil. The sum of all the carbon in the forest ecosystem is known as the 'carbon stock' of the forest. A particular carbon balance may be described as representing a 'sink' (resulting in carbon sequestration) if there is a net transfer of carbon from the atmospheric carbon dioxide to the forest.

Forestry and climate change

Over the coming decades UK forestry needs to respond to climate change in two principal ways: through mitigation and adaptation.

Climate change mitigation

Climate change mitigation was defined by the IPCC in its Fifth Assessment Report as 'a human intervention to reduce the sources or enhance the sinks of greenhouse gases'. In the context of forestry, it means establishing new woodlands and managing existing woodlands and wood products sustainably to enhance their potential as a sink of greenhouse gases (see Figure 6.2.1).

Forests and carbon capture

Forests capture carbon and store it as a component of wood itself. Over time, forests can enrich the soil carbon content through the addition of organic matter from leaf litter, branch fall and root death. It follows that the rate of carbon capture is closely related to the growth rate of the trees, and UK forests are among the most productive in northern Europe.

The annual uptake of carbon by UK woodlands is currently declining. This decline can be explained by the age structure of UK forests; many of the 40-year-old (and older) conifer plantations established during the 1950s to 1980s, which have a high uptake, have been felled and replanted since 2004.

Much of the woodland in the UK is not managed for timber harvesting and gradually accumulates carbon in woody biomass and in the soil. Long-established woods with old trees can represent a large carbon store but, in the long term (many hundreds of years), the ecosystem approaches equilibrium when carbon gained through growth may be balanced by carbon lost to the atmosphere through decomposition. Sustainable forest management, including the transfer of carbon stored in the forest to wood products, will maintain woodlands as a net carbon sink.

In general, woodland soils have low and infrequent levels of disturbance, particularly under continuous cover management systems, and, for a given soil type, the total carbon content per unit area of woodland is higher than that for agricultural soils.

Box 6.2.2 Facts and figures

- The six greenhouse gases as defined by the IPCC for reporting purposes are carbon dioxide (CO_2), methane (CH_4), nitrous oxide (N_2O), hydrofluorocarbons (HFCs), perfluorocarbons (PFCs) and sulphur hexafluoride (SF_6). Apart from carbon dioxide, those relevant to forestry are methane and nitrous oxide.

- The 'global warming potential' (GWP) of methane and nitrous oxide, over a 100-year time horizon is, respectively, 28 times and 265 times that of carbon dioxide (excluding climate–carbon feedbacks)[a]. Therefore, total greenhouse gas amounts are sometimes expressed as CO_2e (carbon dioxide equivalents) by using these conversions where more than one greenhouse gas is being considered.

- In 2014 annual UK greenhouse gas emissions were 514 million tonnes (Mt) of CO_2e per year (of which about 442 million tonnes were CO_2)[b].

- To convert carbon (C) to carbon dioxide (CO_2), multiply by 44/12 (approximately 3.7).

- The annual average rate of carbon dioxide removal from the atmosphere, over a typical 40-year rotation of Sitka spruce, is around 13.5 tCO_2 (3.7 tC) per hectare per year – taking into account initial losses from soil respiration stimulated by site preparation. Established mixed oak–ash forest in southern England removes carbon dioxide from the atmosphere at around 15 tCO_2 (4.1 tC) per hectare per year[c].

- In 2014 woodlands in the UK removed 17.3 $MtCO_2e$ per year[b]. The sequestration rate is predicted to peak at 21.3 $MtCO_2e$ in 2019, slowing to 15.3 $MtCO_2e$ in 2030[d].

- One tonne of (oven-dried) wood contains approximately half a tonne of carbon (1.8 t of carbon dioxide)[e].

- Woodlands in the UK can accumulate up to 218 tC (800 tCO_2) per hectare in biomass[c].

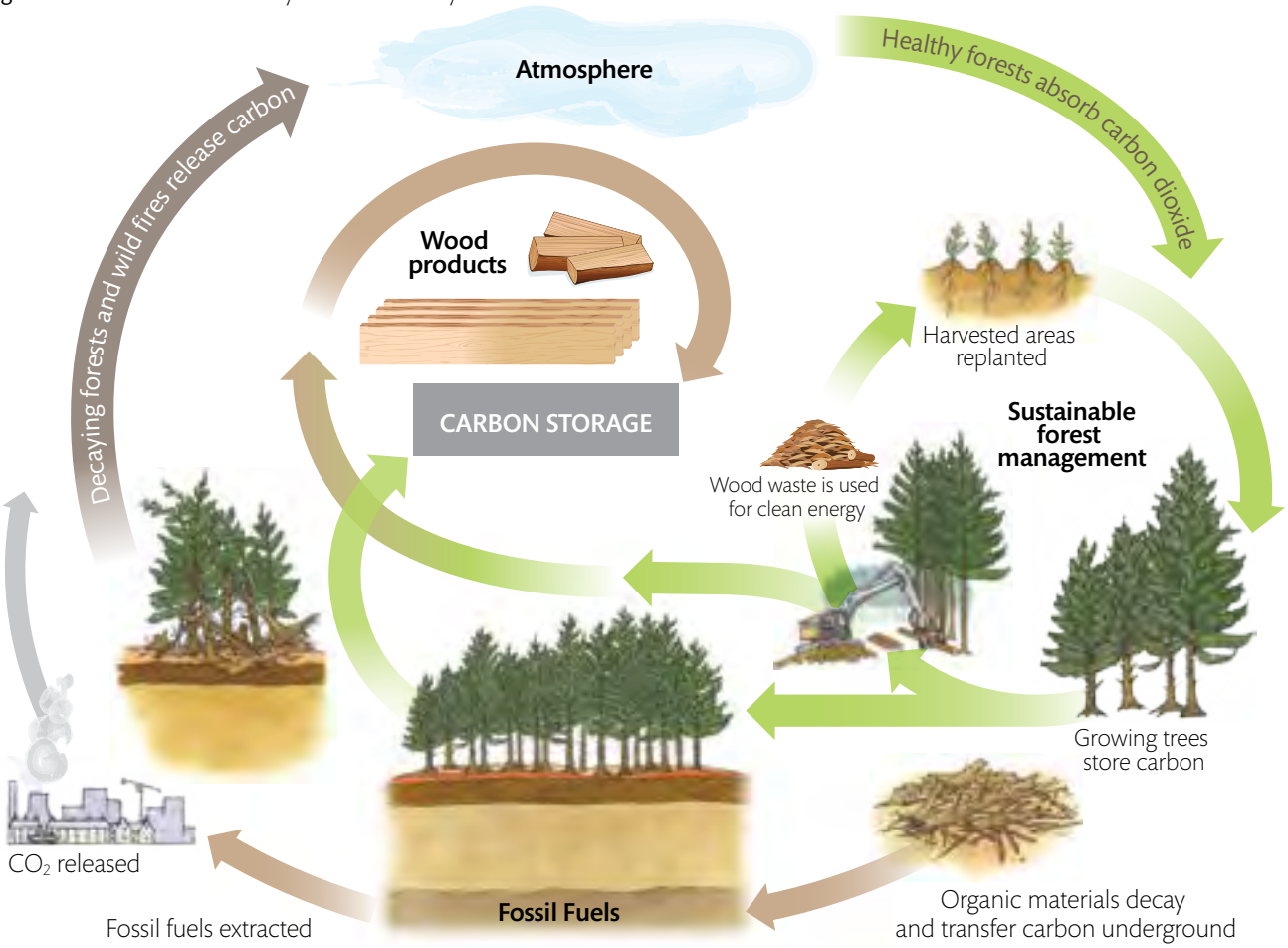
- The estimated carbon stock of UK woodlands (including their soils) is approximately 3781 $MtCO_2e$. Of this, 1066 $MtCO_2e$ is contained in biomass and 2715 $MtCO_2e$ in soil[f].

- The estimated carbon stock in harvested timber and wood products is around 80 MtC (290 $MtCO_2e$)[c].

- One tonne (or 4 m^3) of woodchip has a calorific value of 3500 kWh, equivalent to about 0.3 tonnes (or 350 litres) of heating oil[g].

[a] Contribution of Working Group I to the Fifth Assessment Report of the IPCC.
[b] DECC (2016). 2014 UK Greenhouse Gas Emissions – Final Figures.
[c] Read, D.J. *et al*. (2009). Combating climate change – A role for UK forests. TSO, Edinburgh.
[d] CEH (2017). Projections of emissions and removals from the LULUCF sector to 2050.
[e] Forestry Commission (2003). Forests, carbon and climate change: the UK contribution. Forestry Commission Information Note.
[f] Forestry Statistics 2016 (www.forestry.gov.uk/statistics).
[g] The Biomass Energy Centre Reference Library (www.forestry.gov.uk/fr/bec).

Figure 6.2.1 The role of forestry in the carbon cycle.



Carbon released
Decaying vegetation and trees and forest fires release stored carbon into the atmosphere. In addition, human activities that use energy in the form of fossil fuels – for example transport and manufacturing – generate carbon dioxide which is released into the atmosphere.

Carbon absorbed
Sustainable forest management is an effective way to store carbon. Young, healthy forests absorb carbon more rapidly than older, dense forests. Older forests release carbon at the same rate that they absorb it, which has a neutral effect on the carbon cycle.

Carbon stored
Carbon is stored in the trunks, branches and roots of trees as they grow. Sustainably managed forests continuously store carbon over long time periods. Carbon continues to be stored in wood products after trees are harvested. Harvested forests are replanted and the cycle begins again.

Some forest operations, such as ground preparation to establish trees, may result in a short-term loss of carbon from the soil until this is replaced as forests grow. The aim of the UKFS Requirements and Guidelines on Forests and Climate Change is to minimise short-term losses, while recognising that some level of disturbance is necessary for successful woodland establishment and management. This will deliver the benefits of carbon capture over the longer term (see also Forests and Soil).

Carbon in timber and wood products

Carbon comprises about 50% of the dry weight of wood. Timber and wood products can be used for a variety of purposes, and the longer they remain in use, the longer the carbon is stored. Subsequent recycling can extend carbon storage in wood even further and, at the end of its life, it may be burned to generate heat or energy and substitute for fossil fuels. Even if wood is sent to landfill, it continues to store carbon until it eventually decomposes.

Wood can be used as a sustainable building material in many situations as a substitute for energy-intensive materials such as concrete and steel. In addition to its inherent renewability, timber requires less processing energy than many other materials.

Woodfuel

Substitution benefits also arise when wood is used as fuel to replace fossil fuels such as coal, gas or oil. Although burning wood generates carbon dioxide, an equivalent amount of carbon dioxide was relatively recently sequestered from the atmosphere as the trees grew. In this way, woodfuel can be seen as being close to carbon neutral, and a valuable sustainable substitute for fossil fuel. It is not completely carbon neutral, as carbon dioxide is emitted during harvesting, transport and processing. It is estimated that the total greenhouse gas emission in the UK associated with forest machine operations is 0.26 $MtCO_2e$ per year – or around 2% of the carbon sequestered by UK woodlands in 2009.

Trees planted specifically for use as woodfuel and managed on short rotations can provide a substitute for fossil fuel over a shorter timescale than conventional woodland, but may not provide as wide a range of other benefits, such as for biodiversity and recreation. Harvesting forest residues such as brash and stumps also represents a potential source of woodfuel. However, the harvest of these materials is only suitable under certain conditions. The UKFS Guidelines on Forests and Climate Change provide more detail.

All types of forest and woodland can sequester and store carbon and this is likely to become an increasingly important consideration when setting management objectives. In addition, sustainable forest management and woodland expansion could have an important part in the transition to a society less reliant on fossil fuel, while simultaneously generating a range of social, environmental and economic benefits.

Climate change adaptation

Adaptation was defined by the IPCC in its Fifth Assessment Report as the process of adjustment to actual or expected climate and its effects. In the context of forestry, it means reducing the vulnerability of forests – as well as using forests to reduce the vulnerability of society to climate change.

Climate change projections

UK climate projections show the likely future climate and can be used in the development of risk-based approaches to climate change adaptation. The climate projections for the UK indicate increases in mean summer temperature of 2–6°C by the 2080s under the medium emissions scenario. Increases are greater to the south and east. The projections also suggest that, although there will be little change to total annual rainfall, summer rainfall will decrease while winter rainfall will increase. As a result, summer droughts may become more frequent and severe. A larger proportion of rainfall is likely to occur during extreme events, in summer and winter, extending the duration of winter waterlogging and increasing the severity of summer flooding – as well as increasing soil erosion and the frequency of landslips. Projections also indicate that cloud cover, particularly in summer, will decline.

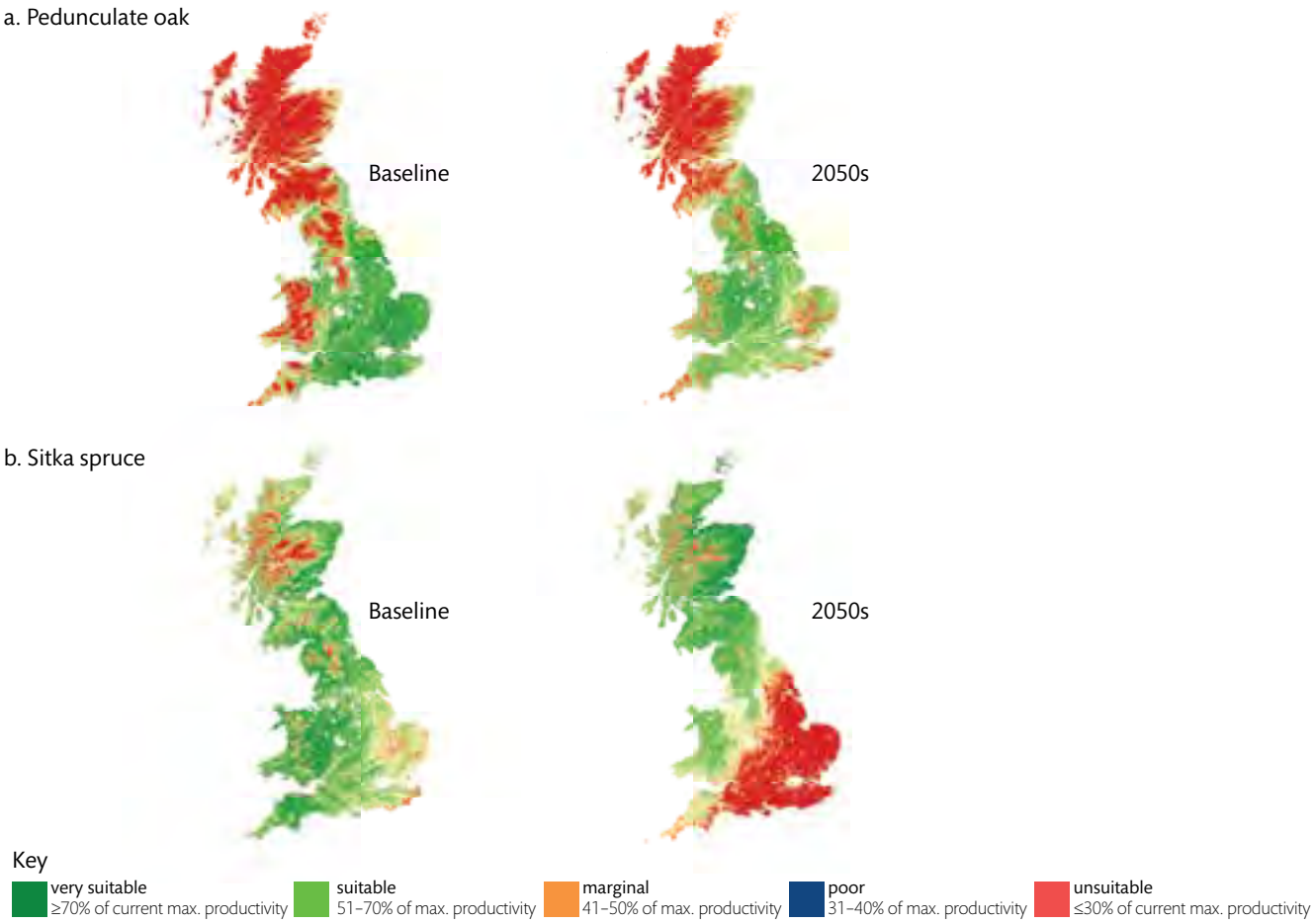
Impacts on tree growth and forest productivity

Carbon dioxide has a direct impact on tree function and forest productivity, as well as being the most significant greenhouse gas. An increased concentration of carbon dioxide in the atmosphere stimulates photosynthesis and is likely to result in an increase in growth rates and leaf area. Other changes in the atmospheric environment may also have impacts, including changes in nitrogen and sulphur deposition and increased levels of ozone pollution. There are also likely to be a number of new and indirect effects on woodlands through changes to the frequency and severity of pest and disease outbreaks, increasing populations of mammals that may do damage and the impact of existing and new invasive species.

It is still uncertain exactly how trees will respond to the likely changes in climatic variables or how woodland ecosystems as a whole will be affected. Irrespective of future success in reducing emissions, the global climate is already locked into a level of change that will require adaptation responses. Planning for uncertainty is therefore the key consideration when developing approaches to adaptation, especially in the case of the long timescales associated with forest management.

An increased frequency and severity of summer drought is likely to represent the greatest threat to forests and woodlands from climate change. There is a very high likelihood that there will be serious impacts on drought-sensitive tree species on shallow, freely draining soils, particularly in the southern and eastern areas of Britain. These impacts will be widespread in established stands and they will mean that the suitability of species for use in commercial forestry in all regions will need to be reassessed (Figure 6.2.2).

Figure 6.2.2 The 'suitability' (productivity relative to maximum productivity achievable by that species under current climatic conditions) for (a) pedunculate oak and (b) Sitka spruce under Baseline (1961–90) and the mean outcome for the 2050s based upon the 11-member Regional Climate Model ensemble (11-RCM) at the medium emissions scenario (A1B).



Approaches to adaptation

The IPCC describes adaptation measures under three categories:

- Autonomous adaptation: occurs automatically as a response to climate change, rather than as a conscious response to anticipated change. It is triggered by ecological changes in natural systems, and by market or welfare changes in human systems.
- Planned adaptation: is the result of a deliberate policy, based on an awareness that conditions are in the process of change and that action is required to maintain, or regain, the desired state.
- Anticipatory (or proactive) adaptation: takes place before impacts of climate change are observed.

For the long timescales of forestry, anticipatory adaptation involves risks because climatic change projections are uncertain. However, it offers the highest potential gains for ensuring forests, and the benefits they provide, are maintained in the future.

Climate change uncertainties, coupled with the long timescales of forestry, suggest that resilience to climate change will be a key attribute for most types of forests and woodlands. However, in developing resilience, a balance is required to ensure that, as far as possible, the integrity of existing ecosystems is maintained. Appropriate choice of species and origin, diversity in species and structure, and effective stand management may all help to build resilience. These measures will also develop the management flexibility required for forests to thrive in a changing environment.

Forests and woodlands can help people and society adapt to climate change by providing a range of benefits such as:

- provision of habitats that provide ecological connectivity;
- natural flood management;
- diffuse pollution control;
- slope stability and control of soil erosion;
- a source of renewable energy;
- temperature control;
- shade and shelter.

Woodlands will contribute these benefits in varying amounts dependent on their location, woodland type and the soil type. In particular:

- Urban and peri-urban woodlands: provide shade and reduce temperature, so ameliorating the 'heat island' effect in towns, and reduce wind speed.
- Trees on farms: provide shade and shelter for animals, habitats that contribute to ecological connectivity, and a source of renewable energy.
- Riparian woodlands: provide shade for watercourses, reducing the occurrence of lethal high water temperatures for fish.
- Protection forests: contribute to natural flood management, slope stability and the control of soil erosion.

The various benefits, or ecosystem services, provided by forests contribute to wider sustainable development objectives, such as the UN's Sustainable Development Goals (see Section 3).

Policy and context

This section provides further background, gives an overview of the developments relevant to forests and climate change, and summarises the main statutes. Further details of legislation and conventions are provided in Appendix 1.

International context

The UN Framework Convention on Climate Change (UNFCCC) is an international environmental treaty established at the UN Conference on Environment and Development (the 'Earth Summit'), in 1992. The treaty is aimed at reducing emissions of greenhouse gases in order to combat global warming.

The UNFCCC came into force in March 1994 and has been ratified by the UK and over 180 other countries. The stated objective of the convention is: 'to achieve stabilization of greenhouse gas concentrations in the atmosphere at a low enough level to prevent dangerous anthropogenic interference with the climate system'.

Kyoto Protocol and Paris Agreement

The Kyoto Protocol is an international agreement linked to the UNFCCC, which has more powerful, and legally binding, measures.. Industrialised (Annex 1) countries that ratified this protocol, including the UK, committed to reduce their emissions of carbon dioxide and five other greenhouse gases, or engage in emissions trading if they maintained or increased emissions. The Protocol sets binding targets for 37 industrialised countries and the European Community for reducing greenhouse gas emissions between 2008 and 2020.

The Paris Agreement came into force in November 2016 and deals with greenhouse gas emissions mitigation and adaptation from 2020 onwards. The Agreement is signed by 192 countries who each proposed the action they would take to help limit the global average temperature increase to less than 2° C above pre-industrial levels.

Forestry and climate change in the EU

A number of commitments have been made by the EU Member States and the European Commission in the Forest Europe ministerial process, which reflect the need for action on European forests, including addressing climate change. These commitments were developed in successive Resolutions on Forests and Climate Change at the conferences in Helsinki (1993) and Vienna (2003) and the 2007 Warsaw Declaration. The Resolutions commit signatory countries to play an active role in addressing climate change through the role that forestry can play in both mitigation and adaptation.

The updated 2013 EU Forest Strategy is delivered through a multi-annual plan aiming for coherence across the EU on forest-related policies. It has eight linked priority areas, one of which is forests in a changing climate.

In 2014 the EU adopted a 2030 Climate and Energy Framework including a binding target to cut emissions by at least 40% below 1990 levels by 2030. All sectors, including land use and forestry have to contribute to this target which will help the EU meet its commitments under the Paris Agreement. Land use and forestry are important contributors to the target as EU forests absorb the equivalent of nearly 10% of EU greenhouse gas emissions each year.

UK climate change programmes

The UK's contribution to the reduction of greenhouse gas emissions is led by the Department for Business, Energy and Industrial Strategy. The Climate Change Act 2008 includes significant powers in relation to mitigation, reporting and adaptation. These are outlined below. The Committee on Climate Change was established under the Act as an independent, expert committee to advise the UK Government and the Devolved Administrations on carbon budgets and to scrutinise progress on an annual basis.

The Act contains provisions that set a legally binding target for reducing total greenhouse gas emissions in the UK and introduced a framework of consecutive five-year carbon budgets, which set the trajectory towards the 2050 target. The Act commits the UK to a reduction of at least 80% by 2050 against the 1990 baseline. The first five carbon budgets covering the period 2008–2032 are set and require greeenhouse gas emissions to be reduced by at least 57% by 2032.

The Adapting to climate change programme drives and co-ordinates work on domestic adaptation across government. The programme aims to deliver the adaptation-related requirements of the Climate Change Act. This includes undertaking five-yearly climate change risk assessments. The first was published in 2012 and includes forestry as one of 11 sectors. The UK's national adaptation programme responds to the risks identified by the risk assessment.

In Scotland, the Climate Change (Scotland) Act 2009 sets a legally binding greenhouse gas emissions reduction target of 80% by 2050 compared with 1990 levels, together with an interim target of 42% by 2020 and a requirement to set annual targets. As required by the Act, the Scottish Government has set out its proposals and policies for meeting these targets in the *Climate Change Plan: the draft third report on policies and proposals 2017–2032*.

In Wales, Part 2 of the Environment (Wales) Act 2016 complements the Climate Change Act 2008 and also sets interim emissions targets.

Renewable energy

The *UK renewable energy roadmap* update 2013 sets out progress towards a UK target of 15% of energy consumption from renewable sources by 2020. In 2015 8.5% of UK energy consumption was from renewable sources. Woody biomass plays a role in meeting this target and three UK Government initiatives provide incentives for this:

- The UK Renewables Obligation (RO) is designed to promote the generation of electricity from renewable sources and includes the use of wood biomass for power generation as well as combined heat and power installations. The RO closes to new generators during 2017 and 2018.

- The Renewable Heat Incentive (RHI) provides finance for the installation of renewable heating, including biomass boilers. The RHI closes to new generators from 2019.

- The Contract for Difference (CFD) scheme also provides support for low carbon electricity generation, including biomass technologies. Generators must bid in auctions ('allocation rounds') to secure a contract, which provides the generator with a guaranteed price.

To receive support under the RO, RHI or CFD, all heat and power generators must comply with sustainability criteria. For more information see www.gov.uk.

The *2020 routemap for renewable energy in Scotland – Update 2015* sets out progress towards Scotland's target for an equivalent of 100% demand for electricity from renewable energy as well as 11% of non-electrical heat to come from renewable sources by 2020. Biomass also helps meet these targets.

Forests and climate change in the UK

Managing forests and woodlands in the UK sustainably means balancing their contribution to a widening range of

objectives, including social, environmental and economic benefits. Felling trees is part of a sustainable cycle, provided that young trees are re-established or allowed to regenerate to ensure woodland continuity. Forests have been managed for timber and other products for hundreds of years while maintaining their biodiversity and value to society. The capacity of woodlands to mitigate and adapt to climate change has added a further critical objective to forest policy and a new dimension in sustainable forest management.

The creation of new woodlands to sequester carbon, protect carbon in the soil and further integrate land uses are key policy themes across the UK. The UK Government has signalled its support for woodland creation in the UK Low Carbon Transition Plan and announced that it would support a new drive to encourage private funding of woodland creation. The governments in England, Scotland, Wales and Northern Ireland have expressed aspirational targets for creating new woodlands (Table 6.2.1).

Standards for carbon sequestration

The Woodland Carbon Code sets voluntary standards for woodland projects in the UK that make claims about the carbon they sequester. It sets robust standards for good carbon accounting and management in addition to the sustainable forest management practices set out in this UKFS. The scheme provides a mechanism to facilitate payments for provision of the ecosystem service of carbon sequestration (www.forestry.gov.uk/carboncode). Projects meeting the Woodland Carbon Code directly help the UK meet targets for both woodland creation and greenhouse gas emissions reduction.

UK Government guidance sets out how an organisation should report their greenhouse gas emissions and also how they can use carbon units generated by a Woodland Carbon Code project to compensate for their unavoidable emissions. For more information see the Defra Environmental Reporting Guidelines. Further guidance issued by the British Standards Institution PAS2060: Carbon Neutrality demonstrates how carbon units can be used in claims of carbon neutrality.

The International Union for Conservation of Nature (IUCN) is also developing a UK Peatland Code following similar standards to the Woodland Carbon Code. It will provide a mechanism for private investment in reducing emissions from peatlands through restoration.

Forestry strategies and delivery mechanisms

In England, the Natural Environment White Paper *The natural choice: securing the value of nature* identifies the need to protect and improve England's forests and woodlands and increase woodland area to mitigate and adapt to climate change. The UK *Carbon plan* (2011) also outlines incentives aimed at woodland expansion and increasing the area of woodland that is managed. The Forestry Commission published a *Woodfuel implementation plan* in 2011.

In Scotland, the *Scottish forestry strategy* highlights climate

Table 6.2.1 Aspirations for woodland creation across the UK.

Country	Aspiration	Expressed in
England	Increase woodland cover from 10% to 12% by 2060 (an average of 5000 hectares per year)	Government Forestry and Woodlands Policy Statement (2013)
Scotland	Increase forest area from 18% in 2016 to 21% by 2032, increasing the planting rate over time to 15 000 hectares per year from 2024/25	Climate Change Plan: The draft third report on policies and proposals 2017–2032
Wales	Create 100 000 hectares of new woodland between 2010 and 2030 (or 5000 hectares per year)	Ministerial announcement (2010)*
Northern Ireland	Double the area of forest from 6% to 12% from 2006 to 2056 (approximately 1700 hectares per year)	Northern Ireland forestry: a strategy for sustainability and growth (2006)

*In 2017 Wales will publish its new Natural Resources Policy which will reflect Welsh Government's policies regarding the sustainable management of natural resources.

change as a major theme, with a key role for forestry in adaptation, mitigation, carbon capture and storage, and raising public awareness. The delivery of these functions is set out in subsequent implementation plans. Forestry Commission Scotland also published a climate change programme in 2013 that develops our commitments, made in the *Scottish forestry strategy*, to increase the contribution and response of Scottish forestry to the challenges of climate change, and focuses on what needs to be done in the coming years.

In Wales, the Welsh Government strategy *Woodlands for Wales* identifies 'responding to climate change' as one of five strategic themes. Adapting Welsh woodlands to ensure their resilience to a changing climate is identified as an overarching priority. A prominent role is given to woodlands and trees in helping society deal with the effects of climate change, as well as other environmental pressures. The Strategy also identifies the role of woodlands and timber in helping to mitigate climate change through carbon storage and both direct and indirect fossil fuel substitution. In this context, a particular emphasis is placed on sustainable forest management as the main delivery method for these ambitions. The Natural Resources Policy, being published under the Environment (Wales) Act 2016, sets out the Welsh Government's policies and priorities for the sustainable management of natural resources in Wales.

In Northern Ireland, reference to the role of forestry and climate change appears in *Northern Ireland forestry: a strategy for sustainability and growth* as part of a joint approach by Northern Ireland government departments. The Strategy states that:

> 'Forestry practices can make a significant contribution to reducing greenhouse gas emissions through increasing the amount of carbon removed from the atmosphere by the national forest estate, by burning wood for fuel, and by using wood as a substitute for energy-intensive materials such as concrete and steel'.

The Department of Agriculture, Environment and Rural Affairs has a long-standing programme to increase the level of forest cover in Northern Ireland by expanding the publicly owned estate and supporting private landowners.

UKFS Requirements for Forests and Climate Change

Climate change mitigation

The climate change programmes of the UK and of England, Scotland, Wales and Northern Ireland seek to encourage activities that will reduce greenhouse gas emissions while allowing sustainable economic development to proceed. This approach is reflected in these UKFS Requirements, which aim to protect and extend the carbon resource in the forest environment over the long term, as well as the carbon stored in wood products.

A long-term view – for example beyond the first rotation where trees are being grown for timber – of the forest carbon stock is important, and recognises that short-term losses of carbon stocks associated with forestry operations such as thinning, felling, site preparation and civil engineering may be countered by gains over the rotation.

Forest management should contribute to climate change mitigation over the long term through the net capture and storage of carbon in the forest ecosystem and in wood products.

Climate change adaptation and protection

Climate change will have an impact on forest ecosystems in the UK and this will present both risks and opportunities for forestry and the achievement of management objectives. These must therefore be taken into account in forest management plans. Risks include tree mortality, fire, extreme weather events, and pest and disease outbreaks. Opportunities include potential increases in productivity and the range of species that can be grown. The understanding of climate change impacts and the risks to forests is likely to change over time. It is therefore recognised that forest owners and managers will need to base decisions on the current available evidence and advice on good practice.

Forests should be planned and managed to enhance their resilience and mitigate the risks posed to their sustainability by the effects of climate change or attack by pests and diseases.

Forest management should enhance the potential of forests to protect society and the environment from the various effects of climate change.

UKFS Guidelines on Forests and Climate Change

The table below introduces factors important for forests and climate change. The Guidelines that follow provide more information on how to comply with the UKFS Requirements, grouped by the factor headings.

Factor	Importance for climate change
Mitigation	
Carbon in forest products	In addition to storing carbon, forest products can substitute for more energy-intensive materials and can be used as a source of renewable heat and electricity.
Carbon in soils	Soils often contain the major proportion of carbon in the forest ecosystem. It takes decades or centuries to accumulate but can be rapidly lost through disturbance.
Carbon in forest ecosystems	Forestry can contribute to climate change mitigation by protecting and increasing forest carbon stocks.
Operational carbon footprint	Reducing fossil fuel usage in management activities can enhance the role of forestry in climate change mitigation.
Adaptation	
Forest planning	Forest design, structure and composition need to be resilient to the effects of a changing climate and extreme weather events.
Adaptive management	Approaches to management that are flexible, reactive and anticipatory will help forests and woodlands adapt to the changing climate.
Tree and shrub species selection	Introducing diversity in tree species and origins will ensure some thrive should others decline.
Ecological connectivity	Woodland and trees can be used to develop ecological connectivity between habitats to enhance the ability of woodland ecological communities to adapt to climate change.
Environmental protection	Woodland and trees that are appropriately located can help to alleviate the impacts of climate change on society and the environment.

Mitigation

Forest and woodland expansion enhances the capacity for mitigation and is a principal consideration in addressing climate change through forestry. Furthermore, forest management can contribute to climate change mitigation through:

- managing for products used in place of energy-intensive construction materials;
- managing for woodfuel to substitute for fossil fuels;
- maintaining and enhancing carbon stocks in woodlands and their soils;
- managing risks such as wind, fire and damage from pests and diseases.

Given a sufficient forest area, it is generally possible to increase forest carbon stocks over the long term, that is at least one forest rotation. However, woodland delivers a range of public benefits and there may be times when the balance favours other management priorities. An example is ancient woodlands, where limited intervention to meet biodiversity objectives may be appropriate and maximising carbon capture would be a secondary objective.

Carbon in forest products

In general, the faster a forest grows, the more carbon dioxide it sequesters from the atmosphere. Management intervention (such as thinning and felling) maintains high rates of growth and carbon capture. Although wood will be removed from the forest, the accumulated carbon is retained in the timber products, particularly in those that last a long time. Using timber as a substitute for energy-intensive materials such as concrete and steel also contributes to climate change mitigation.

Woodfuel is a valuable substitute for fossil fuels such as coal, oil or gas, as a source of heat or electricity. It may be grown specifically as coppice crops and short rotation forestry, or it can be an additional product from forest management or arboricultural work. Markets for woodfuel are continuing to expand and can provide a source of revenue to help support woodland management that would not otherwise be undertaken.

Both forest residues (brash) and tree stumps can be considered as a source of woodfuel. However, their harvesting and removal can have a number of negative and unsustainable effects. The removal of such material can deplete the site of its fertility – particularly in the case of brash, where many of the recyclable nutrients are found. Moreover, when stumps are removed the overall carbon benefit of the operation is likely to be limited due to the energy expended in their extraction and transport, and also from the release of carbon from soil disturbance (see Carbon in soils below). These practices can therefore only be considered sustainable on a limited number of sites where it can be demonstrated that the nutrient status will be maintained, there will be a net carbon gain as a result of the activity over the forest cycle, and where soils are not classified as at high risk of acidification (see Forests and Soil and Forests and Water).

Where woodlands are managed for timber production, maximise carbon sequestration through efficient management, consistent with the output of durable products.

2 Consider the potential for woodfuel and energy crops within the sustainable limits of the site.

3 Avoid removing stumps unless for tree health reasons or where a risk-based assessment has shown that adverse impacts can be reduced to acceptable levels. 15

Carbon in soils

In general, forest soils contain high levels of carbon and maintaining forest cover will help ensure these stocks of carbon are protected. Soil organic matter can decompose to release carbon dioxide if soils become aerated as a result of disturbance or drainage. This effect is most marked in deeper organic or peat soils, although it is important to consider fluxes of all the greenhouse gases – especially methane. On most soils, long-term carbon gains through new woodland establishment are likely to outweigh initial carbon losses due to soil disturbance. Forest management that minimises intervention and results in reduced soil exposure or cultivation (e.g. continuous cover silviculture systems) will help preserve soil carbon stocks. The continual input of organic materials from leaf litter and decomposing roots will gradually increase the soil carbon content (see Forests and Soil).

The carbon benefits associated with woodland creation are generally greatest on soils with low levels of organic matter, such as mineral soils. On some peat soils the magnitude of soil carbon losses due to disturbance and oxidation can be greater than carbon uptake by tree growth over the long term. Oxidation and degradation can also result from changes to the local hydrology by planting adjacent to these sites. For this reason, and for reasons of habitat and biodiversity value, there is a general presumption against forest establishment on deep peat soils. This is particularly the case for raised bogs and blanket bogs. More detailed policies in relation to peat soils are determined at a country level.

The decision to restock forests on deep peat should be carefully considered, taking into account the balance of benefits for carbon and other ecosystem services. In some situations, for example on sites with certain conditions of soil type, peat depth, area, slope or tree growth, restocking on deep peat can lead to positive ecosystem gains – including for carbon. Decisions will be taken on a site-by-site basis in line with the detailed policies for restocking on peat soils that are determined at a country level.

4 Minimise the soil disturbance necessary to secure management objectives, particularly on organic soils. 13 17

5 Avoid establishing new forests on soils with peat exceeding 50 cm in depth and on sites that would compromise the hydrology of adjacent bog or wetland habitats.

Note: Woodland creation on certain sites where deep peat soils have historically been highly modified may be considered, provided that it complies with the relevant country policy. 5 24

6 Consider the potential impacts of soil disturbance when planning operations involving cultivation, harvesting, drainage and road construction. 14 18

7 Ensure the removal of forest products from the site, including non-timber products, does not deplete site fertility or soil carbon over the long term and maintains the site potential. 8 20

8 Consider the balance of benefits for carbon and other ecosystem services before making the decision to restock on soils with peat exceeding 50 cm in depth. 25

Carbon in forest ecosystems

Deforestation is a major source of carbon dioxide emissions and the protection and expansion of forest cover is a global priority in mitigating climate change. The whole ecosystem is a store of carbon, and it is important to consider management implications for all forest carbon, including the underlying soils, which often contain more carbon than the trees.

The highest sustained levels of woodland ecosystem carbon are found in ancient woodlands, mature woods managed for conservation, and continuous cover silviculture systems. Standing and fallen deadwood provides a vital element of ecosystem carbon, and actions to remove forest residues for woodfuel have to be carefully balanced against the benefits of retaining them for ecosystem carbon storage. It follows that any controlled burning of forest residues for forest management reasons diminishes forest ecosystem carbon and returns carbon dioxide to the atmosphere without the compensatory gains from their use as substitutes for fossil fuel. Formal woodland carbon projects, such as those set up under the Woodland Carbon Code, are managed in line with an approved forest management plan. Adherence to this plan ensures that the agreed level of carbon benefit is delivered.

Since the formation of the Forestry Commission in 1919, there has been an increase in forest cover in the UK and a general presumption against the removal of forests and woodlands. Net deforestation would reduce the capacity to sequester carbon and is counter to a number of international commitments on retaining forest cover. In recent years, rates of woodland creation have declined and there have been increasing pressures for woodland removal – both for development and for the restoration of priority open habitats. Where deforestation is proposed, an Environmental Impact Assessment is likely to be required, and each case will have to be determined individually. All the various implications, including the practicality of habitat restoration, will need to be considered in the context of country-level policies on woodland removal. This assessment will include the effects on climate change including the potential emissions of greenhouse gases (see Forests and Biodiversity).

9 Conserve and enhance forest carbon stocks in the medium and long term.

10 Avoid the removal of biomass from an approved woodland carbon project if this is not part of the agreed forest management plan.

11 Retain or expand the forest area and consider compensatory planting where forest area is lost through land-use change. 4

12 Leave a proportion of standing and fallen deadwood in each forest management unit, concentrated in areas of high ecological value, where there is existing deadwood and where linkages can be provided between deadwood habitats – avoid uniform distribution across the forest management unit. 11 21

13 Avoid burning brash and harvesting residues unless it can be demonstrated that it is a management necessity, all the impacts have been considered, and the necessary approvals obtained. 36 26

Operational carbon footprint

Forest operations are mostly mechanised and (through fossil fuel use) emit greenhouse gases. However, the overall emissions associated with forestry operations are small (equivalent to 2% of the carbon sequestered by UK woodlands). Emissions of greenhouse gases in forestry operations are also far lower than for other productive land uses. Although they are small, reducing these emissions will reduce the operational carbon footprint and help mitigate climate change. For example, sustainable biofuels could be used instead of fossil fuels for machines and vehicles. Another source of greenhouse gas emissions is timber haulage, so shorter haulage distances to local markets and use of rail and sea transport as an alternative to road will reduce emissions.

Energy-efficient forest buildings constructed from wood instead of less-sustainable materials, and the use of woodfuel instead of fossil fuels, will all contribute towards minimising the operational carbon footprint of the forestry sector. Within the forest itself, minimising high energy inputs, including fertilisers and pesticides, will also minimise the operational carbon footprint. Forests can also provide sites for other sources of renewable energy generation such as wind and hydro power.

14 Plan forest operations, civil engineering and timber transport to minimise energy use; consider using sustainable biofuels. 29

15 Minimise the use of pesticides and fertilisers in accordance with Forestry Commission and Forest Service guidance. 24 5 57

16 Consider the use of timber for the construction of forest buildings and recreation infrastructure and the use of woodfuel for heating.

17 Consider the energy efficiency of forest buildings, the efficient management of waste and how renewable energy might be used or generated by the forestry business.

Adaptation

Forest planning

Climate change is an element of sustainable forest management that is best addressed within the broad scope and long time frame of a forest management plan (see General Forestry Practice). Ensuring a forest is diverse in terms of age, structure, species and origin, genetic diversity and choice of silvicultural system is likely to endow forests with greater

resilience to the changing climate. This should also keep a wide range of forest management options open.

Continuous cover forest management encourages structural and species diversity and evolutionary adaptation through the promotion of natural regeneration. Such management systems can also make woodlands more resilient to wind damage as, for example, there are always areas of established young trees should windthrow affect the canopy. Regular monitoring of woodlands will provide an early warning of potential problems in relation to climate change.

The future climate may include more extreme weather events, and contingency plans will be valuable in the event of fire, wind or the outbreak of pests and diseases. A range of decision support tools is available to assist with forest planning (see www.forestry.gov.uk/fr/decisionsupport). Changing rainfall patterns, indicated by the UK Climate Projections, will be relevant to operational planning, including the design and specifications for forest roads, culverts and bridges. Forest drainage which follows the advice given in Forests and Water will help ensure water is released slowly following heavy rainfall.

The potential for fire is a particularly important consideration in the context of climate change as fire can result in the uncontrolled release of carbon from the entire forest ecosystem, including peat soils, and may result in forest loss. The risk of fire needs to be assessed in the forest management plan; it can be reduced in the forest design by introducing diversity in age classes. The risk of fire is currently highest in the spring and in areas where there is high recreational pressure, in young trees, in open woodland with accumulations of dead vegetation, and in areas adjacent to heathland or where moor (muir) burning is practised. Contingency plans in the event of fire will help ensure that damage is contained should it occur.

18 Plan for forest resilience using a variety of ages, species and stand structure; consider the risks to the forest from wind, fire, and pest and disease outbreaks. 6

19 Consider alternatives to clearfell systems, such as continuous cover forestry, where suitable sites and species combinations allow and management objectives are compatible. 14 17

20 Have appropriate contingency plans in place to deal with risks to the forest, including spillages, pest and disease outbreaks, extreme weather events and fire. 3

21 Consider projections of changes to rainfall patterns when specifying designs for culverts, drainage systems and roads. 31

Adaptive management

Climate change adaptation will require a flexible, reactive and anticipatory approach to management. Detecting change through vigilance and effective monitoring is necessary to inform such an approach. For small, individual woodlands, published trends and associated guidance may suffice, but for larger forests some form of monitoring could help inform management decisions.

New threats may demand a change in silvicultural practice (e.g. to manage pests and diseases that may prosper in the future climate). This may necessitate changes to species selection or management practice: an example is Dothistroma needle blight, which has meant that the planting of Corsican pine and lodgepole pine has been severely curtailed in the UK, thus removing important timber-producing species used in British forestry.

Some of the management decisions that may need to be reviewed in response to changing climatic conditions are:

- rotation length – to reflect changing wind risk and growth rates;
- planting season – in response to changes in dormancy and water availability;
- mammal control – of deer, grey squirrels and other invasive species that threaten regeneration and growth;
- species choice – in relation to the changing climate and impacts of pest and disease outbreaks;
- the timing of operations – to avoid interfering with vulnerable life-cycle stages of protected species.

Review forest rotation lengths in response to changing productivity and wind risks, and review planting seasons in response to changing conditions and establishment success.

Review species suitability and diversity over time as forest management plans are renewed.

Consider the susceptibility of forests to pests and diseases and develop appropriate strategies for protection; review practice as further evidence becomes available.

Tree and shrub species selection

The plant and animal communities that colonised the British Isles following the last Ice Age around 10 000 years ago have developed in response to the prevailing climatic conditions. Species have adapted by moving to occupy suitable environments within the natural range of climatic fluctuation. However, the recent changes to the climate occurring as a result of human activities will potentially lead to more rapid change, shifting climatic regimes and more frequent extreme weather events. This will present risks and opportunities for most natural and semi-natural populations – both for the trees themselves and to the pests and diseases that attack them.

The challenges of climate change now require thought to be given to ensuring that forests have the resilience to deal with future changes, and reflect the uncertainty associated with climate projections. The resilience of forests and woodlands can be improved by increasing diversity, which includes both species diversity and genetic diversity. Achieving species diversity in forests is a requirement of the UKFS, and forest management plans will need to address tree species composition of the forest management unit as a whole. In addition, there are more specific policies in relation to species diversity, which are detailed at a country level.

The impacts of climate change will vary across the UK and so a range of adaptation strategies will be required. Planting a variety of species, either in mixtures or in pure stands,

can enhance the resilience of forests and woodlands to projected climate change. For productive forests, a broader range of timber species than have typically been planted in the past may therefore warrant consideration. For native woodlands, augmenting the current range of species with others associated with the woodland type will often help meet biodiversity objectives in addition to increasing the resilience of woods.

Climate change projections suggest that, on some sites, growing conditions will become more challenging in the future for some species, especially where summer drought coincides with freely draining soils. Where new woodlands are established in these situations, careful thought needs to be given to the choice of species and to the origin or provenance of the planting material. This may mean planting a more drought-tolerant species, better matched to a drier site, or planting material of a more southerly origin that may be better adapted to the future climate. For example, in southern England, a proportion of species from warmer areas of continental Europe may offer advantages as climate change progresses, depending on the objective of the site.

Genetic diversity, in addition to species diversity, is important in the context of climate change. Genetic diversity – both within and between populations – varies at local and regional scales and may include distinctive genetic patterns or subspecies. The genetic diversity present in a population reflects its evolutionary history and determines its ability to respond to a changing environment: for example by developing resistance to pests and diseases, and adapting to climate change. This applies to the trees and shrubs themselves and to the many other woodland species dependent upon them that may have co-adapted with tree populations over thousands of years. The comparatively long generation time for trees makes it particularly important that populations contain sufficient genetic diversity to be able to adapt to change.

Evidence suggests that most populations of trees in semi-natural woodlands contain high levels of genetic diversity, even in smaller and more isolated woods. Linking and expanding native woods using natural regeneration as part of a habitat network, or planting with well-adapted stock, will increase gene flows and strengthen the capacity of tree populations to adapt. Changes in the nature and composition of the woodland through natural selection and evolutionary adaptation will take place over time. The maintenance of the genetic diversity of tree species can be promoted through the establishment of gene conservation units: these are specific areas managed to allow the full cycle of natural processes to occur.

For all new woodlands it is vital that material is drawn from a broad genetic base. When planting native species and native woodlands it is generally best to use well-adapted local or regional origins from similar elevations. Consideration can also be given to planting a proportion of other origins from areas with conditions that are well matched to the predicted future climate at the planting site, in situations where climate change projections indicate that it may be necessary to do so. Advice on suitable origins for planting of native species can be obtained from country-specific policies and guidance.

The Forest Reproductive Material (Great Britain) Regulations 2002, and equivalent legislation in Northern Ireland, provide a system of mandatory identification and control of the seeds, cuttings and planting stock of 12 major species used for forestry. They ensure

that planting stock is of traceable origin (and provenance). A Voluntary Scheme for the Certification of Native Trees and Shrubs, developed by the Forestry Commission, is also available to help users identify and source suitable stock for all native species, including 41 native trees and shrubs that are not controlled by the Regulations. The Voluntary Scheme uses 24 native seed zones and two altitude bands.

25 Maintain or establish a diverse composition within the forest management unit; where only one species is suited to a site and management objectives, a maximum of 75% may be allocated to a single species (see notes below). In all cases, incorporate a minimum of:

- 10% open ground or ground managed for the conservation and enhancement of biodiversity as the primary objective;
- 10% of other species;
- 5% native broadleaved trees or shrubs.

Note: (i) Where more than one species is suited to a site and matches the management objectives, opportunities must be taken to further diversify the above species composition. (ii) In woodlands of less than 10 hectares and in native woods the above proportions may be relaxed as long as the adjacent land uses provide landscape and habitat diversity. 9 10

26 When managing or creating native woodland, encourage a representative range of the native species associated with the woodland type. 11

27 When selecting trees and shrubs for new woodlands and restocking, consider the risks and opportunities of climate change and vulnerability to pests and diseases for particular species to decide if alternative species or increased species diversity are merited. 7 12

28 Where timber production is an important objective, consider a wider range of tree species than has been typical of past planting, and consider the use of planting material from more southerly origins.

29 Choose trees or shrubs which are well adapted to the site and are drawn from a sufficiently wide genetic base of parent trees to promote future adaptation. 13

30 Encourage natural regeneration of native tree and shrub species to promote natural selection and climate change adaptation, and conserve distinctive genetic patterns – especially in and around semi-natural woodlands. 14

Ecological connectivity

Woodlands that link with each other and with other habitats, particularly semi-natural habitats, facilitate the movement of species through the landscape. This is particularly important in the context of climate change, as it can increase the ability of species and ecosystems to adapt to new conditions. However, these links can also increase the risks associated with the spread of problem species (see Forests and Biodiversity for more information).

The location and composition of woodlands and appropriate design of woodland margins can facilitate the migration of species. Extensive woodlands comprising a diverse range of habitats and sites will help enhance the ability of individual species to endure as climate change progresses. Larger woodland areas contain more varied gene pools, facilitating evolutionary adaptation processes.

Improve the ecological connectivity of the landscape for woodland and other species by extending and linking habitat features; consider the juxtaposition of wooded and non-wooded habitats and aim for the best overall result for biodiversity. 

Environmental protection

Woodland can help society and the environment adapt to the impacts of climate change through the alleviation of flooding, the control of soil erosion and by moderating temperatures in towns and cities as well as within rivers and streams. It is important that these aspects of adaptation are considered in the design and location of new woodlands and individual trees (see Forests and Soil and Forests and Water).

Trees generally use and intercept more water than other types of land use, increasing infiltration rates and reducing water run-off. Variations exist between conifer and broadleaved species, and upland and lowland areas, as well as between woodlands and energy crops such as short rotation coppice. Climate change could increase the effect of forestry on water yields and low flows. Forest interception losses are likely to increase, emphasising the difference in water use between forest and non-forest land cover. However, the impact on water supplies could be offset in some areas by higher winter rainfall, while increasing carbon dioxide concentrations could increase the efficiency of water use by trees and reduce water losses.

Forestry can have a range of effects on flood flows, which can differ from those on water yield, depending on the type and scale of forest operation. Forest establishment and growth have the potential to decrease peak flows, while clearfelling can have the opposite effect until crops are replanted and regrow. There may be opportunities to enhance floodwater storage through restoring forest wetlands and creating ponds and other storage features, for example coarse woody debris 'dams'. The restoration of floodplain forests and riparian woodland could have an important role in reducing flood peaks, as well as providing many other environmental benefits.

Woodland has an important role in helping to reduce landslips and in minimising soil erosion that may become more prevalent with climate change. This is because:

- tree canopies reduce rainfall intensity on the soil;
- windbreaks reduce erosion of agricultural soils;
- riparian woodland stabilises river banks and reduces soil erosion;
- buffer areas alongside watercourses reduce diffuse pollution arising from agricultural activity.

Conversely, care is required to ensure that the type of woodland and choice of management regime do not increase the potential for landslips on vulnerable sites.

Urban woodland and street trees can help society adapt to a changing climate by:

- providing recreational opportunities close to where people live and work;
- providing cooling through evaporation from leaf surfaces and reflecting solar radiation;
- providing shade for comfort and reducing the incidence of UV-related health problems;
- reducing solar gain of buildings in summer;
- reducing wind speeds, and consequently heating requirements, in winter;
- absorbing pollutants and improving air quality;
- contributing towards urban 'wildlife corridors' to aid species movement;
- contributing to sustainable urban drainage systems.

In urban areas, the risk of new pests or diseases becoming established is high because a wide range of planting material is used – much of it is imported – and a range of exotic tree and shrub species is present in parks and gardens. Urban trees are frequently found in a more stressed environment (e.g. with air pollution, soil compaction and water availability issues), and warmer city climates may favour the establishment of some imported pathogens.

32 When siting and designing new woodland, consider the potential benefits in relation to flood alleviation, improvement of water quality and other ecosystem services. 83

33 On steep slopes where there is a risk of slope failure or serious erosion, consider alternatives to clearfelling. 18 35

34 In urban situations, consider the potential benefits of woodland and trees in reducing the impacts of climate change.

35 Be vigilant for pests and diseases in forests and woodlands, including those in urban areas where the risks of new introductions can be high. 23

6.3 Historic Environment

Several thousand years of human activity have contributed to the variety of landscapes found across the UK today. Surviving elements of the historic environment take many forms, and include ancient woodlands, veteran trees, earthworks, ruined structures and buried archaeological features. Together these elements provide a rich source of information about past societies and how they used and managed the land – including forests and woodlands.

Introduction

Following the end of the last Ice Age (around 10 000 years ago), forests and woodlands gradually re-established themselves over most of the land area of the British Isles. The exact nature and distribution of this woodland, sometimes referred to as the 'wildwood' or 'climax forest', is uncertain and a matter of much debate. Its extent may have been as much as 80% of land area, but the proportion of canopy cover may have varied considerably. The distribution of woodland across the landscape would not have remained static. Indeed, many of the areas referred to as 'forest' in the medieval period (~AD 1000–1500) were not wholly or even extensively tree covered. Today, some centuries-old woodland is the result of recolonisation and establishment on previously open ground. This is shown by the nature of remnant features: burial mounds, farmsteads and stone monuments in woodland indicate recolonisation, whereas traces of wood banks, saw-pits and charcoal hearths found in open landscapes indicate woodland removal.

Archaeological evidence suggests that by 2000 years ago woodland cover had been drastically reduced to about 30% through a combination of climate change and human activities. In some areas it is thought to have been as low as 10%. Woodlands were cleared to make way for settlements and agriculture, although some wooded areas would have been retained to provide a source of timber for construction, fencing, fuel, grazing for livestock, and food from herbs and game. By the beginning of the 20th century, woodland cover had been reduced to around 5% in Great Britain, and only 1% in Northern Ireland. The formation of the Forestry Commission in 1919 marked a turning point and the adoption of a new policy to redress woodland loss. This was achieved through both state planting of land and through providing incentives for private woodland owners to do the same. By 2015, woodland cover in the UK had increased to 13% (~3 million hectares). However, the UK still has a low forest cover on a global scale and compares with a European average of 45%.

Because a far greater proportion of the natural forest and woodland cover was lost in the British Isles, compared with most countries in Europe, the remaining wooded remnants have become especially valuable. Woodlands, particularly those on ancient woodland sites, can be of historic value in themselves. Such woods may contain important evidence of past management, for example their use by local people as wood pasture. Historic features might include veteran trees, remnant coppice stools and pollarded trees, boundary features such as internal and external banks and ditches, charcoal hearths and saw-pits. All these features are especially vulnerable to damage or loss by forestry operations or changes in woodland management.

Historic landscape features and artefacts

Historic landscape features and artefacts do not have to be hundreds of years old to make an important contribution to the historic environment. Features from the recent past may be as important as ancient monuments – for example, the remains of former industrial sites, military training areas and Second World War defences have a significant presence in some landscapes. Farmland, settlements, designed landscapes, parks and gardens, and long-established forest plantations also play a part in demonstrating previous human activity and land use. It is important to remember that some elements of the historic environment may not be obvious; many archaeological features and artefacts remain buried below ground. Woodland or vegetation cover may hide other features.

The extent of human activity in the UK has left very few areas untouched, although in some areas, and in the uplands especially, land use has remained largely unaltered for centuries. Where ground has not been cultivated, historic features such as earthworks and stone-built structures are obvious and can be extensive. In other areas, archaeological features may be less visible, and only

evident from oblique aerial photographs (for features such as earthworks and soil or crop marks) and geophysical surveys (for buried features). They may also be inferred from finds at the soil surface. Most woodlands will contain some surviving visible or buried archaeological evidence relating to the historical use of the site.

It is important that all significant heritage features, and not just designated ones, are protected and that consideration is given to the preservation and enhancement of cultural and historic landscapes. The nature and extent of many elements of the historic environment are not fully known, but information is continually being added from survey and research findings and from incidental discoveries. Compared with development or agriculture, woodland can offer a relatively stable context in which many historical features survive. However, good management, as outlined in the UKFS Guidelines in this section, is needed to ensure that these features are preserved for the future and not damaged by forest operations.

Examples of historic environment features found in woodland in the UK are given in Box 6.3.1 – further information and photographs can be found at www.forestry.gov.uk/ukfs/historicenvironment.

Box 6.3.1 Definitions of terms

Built structures These include buildings, walls, towers, brochs, stock pens, shelters and bunkers. They can vary in date from prehistoric settlements to anti-aircraft gun emplacements.

Charcoal hearth An area of flattened or compacted ground used for charcoal burning. They are typically level, circular areas around 4–10 m diameter and can be identified by black, charcoal-rich soil. They may have an accumulation of waste material to one side.

Ditches, trenches, and ponds These are features cut into the soil. By their very nature, they are prone to gradual infilling and can become very subtle depressions.

Earth banks These can vary in size from subtle, difficult to detect features, to substantial ramparts. They may indicate settlement areas or boundaries. The latter may have other boundary markers such as old trees, hedges or stones.

Earthwork A bank or mound of earth used as a rampart or fortification.

Hillfort A hilltop enclosure bounded by one or more substantial banks, ramparts or ditches.

Historic landscapes Indicators of past land use and character beyond traditional archaeological evidence. They vary from individual historic trees, ancient woods and parks, to entire landscapes characteristic of a local region.

Industrial site Many woodlands have been managed as a source of fuel to support local industries. Rather than transport the fuel, these industries were established within close proximity to the woodland and many contain kiln and metal-working sites.

Mines and quarries A range of features that can vary in size from entire landscapes to small individual shafts. They also range in date from prehistoric flint mining to the early 20th century. Quarries typically have a gently sloping side in one area that was used for access.

Raised mounds Burial mounds are the most common and vary in form and height. Most are circular and vary from small cairns to bell barrows (5–25 m in diameter). Some have surrounding ditches, but centuries of erosion may have reduced the height of the mound and filled the ditch.

Saw-pit A pit that was dug to enable tree trunks to be sawn into planks by hand. They are typically oval or rectangular in shape, 2–4 m in width, 4–8 m in length and up to 2 m deep (although most are partly infilled). Most are aligned along the contour with a raised area of spoil outside the downslope edge.

Stone features These include standing stones, stone circles, stone rows, milestones, carved stones (rock art), and site or boundary markers.

Trackways Many types of trackways survive in woodland. These include Roman roads, hollow ways (the product of erosion through continued use) and old rail and tram tracks. Some of these features may be obscured by vegetation or have been partially eroded, leaving only the associated banks visible. Other features may appear on current or historic maps.

Veteran trees Trees that are of interest biologically, culturally or aesthetically because of their age, size or condition, including the presence of deadwood micro-habitats. Trees are the oldest living things and provide a historical link with events and places.

Woodbanks An earthen bank indicating the limit of a wood or coppice.

Policy and context

This section provides further background, gives an overview of the developments relevant to forests and the historic environment, and summarises the main statutes. Further details of legislation and conventions are provided in Appendix 1.

Protection of archaeological heritage in Europe

The European Convention on the Protection of the Archaeological Heritage, usually referred to as the Valetta Convention, is an initiative from the Council of Europe. The 1992 treaty was ratified by the UK Government in 2000 and aims to protect European archaeological heritage as a source of European collective memory and as an instrument for historical and scientific study. All remains and objects and any other traces of humankind from past times are considered elements of the archaeological heritage. The Convention is one of a series of conventions for the protection of cultural heritage produced by the Council of Europe over the past 50 years. All derive their authority from the 1954 European Cultural Convention, which established the competency of the Council of Europe in this area. Others include the original Convention on the Protection of the Archaeological Heritage (London, 1969) and the Convention for the Protection of the Architectural Heritage of Europe (Granada, 1985).

The Valetta Convention recognises the holistic nature of the historic environment and seeks to protect all aspects of it while promoting an increased understanding of the past. By ratifying the Convention, the UK Government has undertaken to maintain a legal system to protect archaeological heritage and to devise appropriate supervision and protection measures.

Some of these themes are also captured in the European Landscape Convention, which was signed by the UK Government in 2006. This Convention aims to encourage public authorities to adopt policies and measures at local, regional, national and international level for protecting, managing and planning landscapes throughout Europe. It covers all landscapes, both outstanding and ordinary, that determine the quality of people's living environment – recognising that the landscape is our living natural and cultural heritage and a reflection of European identity and diversity.

Protection of the historic environment in the UK

Archaeological heritage and other aspects of the historic environment are protected in a variety of ways in the UK – mostly by legislation and by planning controls. Many of the most significant heritage assets are given specific protection through national systems of listing, scheduling, designation and registration. However, the fact that many heritage assets are not currently designated should not necessarily be taken as an indication of their lack of significance.

The main statutory provisions relating to planning controls on listed buildings are contained in the Planning (Listed Buildings and Conservation Areas) Act 1990 and the Planning (Listed Buildings and Conservation Areas) Regulations 1990, as amended. The 1990 Act, and the Regulations made under it, relate to England and Wales, though analogous legislation was made in Scotland and Northern Ireland. Planning is a devolved matter, and Wales generally now adopts separate but analogous regulations to those that apply in England.

Each country sets out its approach to the historic environment in a range of policy statements and is advised by a statutory authority. These authorities develop policies and are responsible for protecting the historic environment. They also recommend the designation of features of national importance where special protection measures, such as Scheduled Monument or listed building status, should be applied and develop mechanisms to foster the care of historical features.

Forestry strategies and delivery mechanisms

Forestry policy is set out in the forestry programmes and strategies for England, Scotland, Wales and Northern Ireland. These set out the priorities for each country and how historic environment and the other elements of sustainable forest management will be addressed. Some local authorities have developed specific plans for forestry, which identify opportunities and sensitivities in forestry strategies, local forestry frameworks and community forest plans.

Local authorities have responsibility for some historic environment issues within their area and may register sites of local historical importance. Local authority policies are reflected in structure plans, development plans, local plans and community strategies. Local historic environment services are delivered across the UK through various arrangements overseen by the local authority historic environment (or archaeological) services in England and Scotland, the four regional Welsh Archaeological Trusts and the Northern Ireland Environment Agency. To ensure that the impacts on the historic environment can be fully considered, the forestry authorities seek comments on forestry proposals from the relevant historic environment service to assist in the determination of applications.

Many local historic environment services maintain a register of all the known archaeological sites in their area, generally known as a historic environment record (HER). Only a small proportion of these sites are protected as Scheduled Monuments or listed as being of national importance, but many other recorded sites merit protection for their regional or local importance. HERs represent the major information source for understanding the local historic environment. The inclusion of a site on an HER gives it formal recognition in the planning process and local planning authorities take account of this in drawing up development plans and reaching planning decisions.

In urban and peri-urban areas in particular there are many projects that combine the development of woodland-based public facilities with the improvement and interpretation of the historic environment. Community forests situated in and around many of the main urban areas have produced strategies involving cultural heritage and historic environment considerations, and there are many smaller community-based projects across the UK.

UKFS Requirements for Forests and Historic Environment

Scheduled Monuments

The Ancient Monuments and Archaeological Areas Act 1979 in Great Britain, Historic Environment Scotland Act 2014, Historic Environment (Wales) Act 2016, and Historic Monuments and Archaeological Objects (Northern Ireland) Order 1995 provide the legal basis for protecting historic environment heritage in the UK. Developing and improving on legislation of 1882, these provide for nationally important archaeological sites to be statutorily protected as Scheduled Monuments. The statutory authorities responsible for archaeology and the historic environment are Historic England, Historic Environment Scotland, Cadw (Wales) and the Northern Ireland Environment Agency. Consent is required from the relevant historic environment authority for any work on a Scheduled Monument site that has the potential to damage the monument. Causing unauthorised damage can lead to criminal prosecution.

1 Scheduled Monuments must not be damaged and consent must be obtained from the relevant historic environment authority for any works that have the potential to damage the monument.

Archaeological finds

In England, Wales and Northern Ireland there is a legal requirement to report treasure finds, which are carefully defined under the Treasure Act 1996. In Scotland there is a legal requirement to report all archaeological finds under the Treasure Trove system and only disclaimed finds can be legally acquired. In each country there are regulations affecting the use of metal detectors. Throughout the UK, it is illegal to use a metal detector on, or to remove any archaeological finds from, a Scheduled Monument site without the permission of the historic environment authorities.

2 The historic environment authority must be informed if objects are found that come within the scope of the law covering archaeological finds. Metal detectors must not be used where legally restricted or on a Scheduled Monument site.

Listed buildings and structures

The word 'listing' is used to describe one of a number of legal procedures that help the cultural heritage or historic environment authorities protect significant buildings and structures. When a building or structure is listed, it is placed on a statutory list of buildings and structures of 'special architectural or historic interest'. These lists are compiled by the relevant authority in each country. From an owner's or manager's perspective, the listed building or structure cannot be altered, damaged or demolished without obtaining the necessary consent from the relevant national or local authority. Repairs that match exactly the existing may not need consent, but the local authority or relevant historic environment authority will advise, as the impact and effect of any repairs is not always straightforward.

3 Listed building consent must be obtained from the local authority or relevant historic environment authority to demolish a listed building or structure or any part of it, or to alter it in any way which would affect its character, inside or out.

Historic landscape character

The long history of human settlement and land use in the British Isles has meant that there are very few landscapes in the UK that are entirely natural. The historic environment shapes landscape character and, through its physical remains, tells us about the organisation of society and about how humans interacted with their environment over time. It also reveals how people adapted to ongoing climate, economic and technological change. There are also many historical and literary associations with particular land uses, historical features and areas of landscape that bring a cultural dimension to the historical value. Policies have been developed to reflect the importance of historic character and protect important landscapes. Many areas have special designations and some may have locally specific policies that apply in addition to those accompanying the designation.

In some situations, new forests and woodlands can enhance or develop the historic character of the landscape, but in others they may be inappropriate and detract from it. Where existing forests were planted with little attention to the historic landscape, felling and restocking presents an opportunity to reassess their design; this is especially the case where previously unrecorded features have since been identified. In many parts of the UK there are projects identifying the historic character of landscapes that can help inform decisions about a proposed change.

Forests should be designed and managed to take account of the historical character and cultural values of the landscape.

Forests should be designed and managed to take account of policies associated with historic landscapes, battlefield sites, historic parks and gardens, and designed landscapes of historic interest.

Historic features

The primary responsibility for land managers in relation to historic features is to ensure they are conserved and not accidentally or unknowingly damaged. This will involve an appropriate evaluation of the site, and an assessment of features of importance – whether scheduled or not – as part of the forest management plan. A range of measures can then be set out in the operational plan to ensure the features are protected, and these will extend to a reasonable area of their settings. Historic features are not confined to archaeological remains and include a range of features of local significance, for example earth banks and veteran trees. Each feature will need to be evaluated on an individual site basis. Advice is available from the local historic environment services (see the UKFS Guidelines on Forests and Historic Environment).

Steps should be taken to ensure that historic features, which may be adversely affected by forestry, are known and evaluated on an individual site basis, taking advice from the local historic environment services.

Forest management plans and operational plans should set out how important historic environment features, including veteran trees, are to be protected and managed.

Where existing forests do not meet the UKFS Requirements for Forests and Historic Environment, improvements should be made when management opportunities arise.

UKFS Guidelines on Historic Environment

The table below introduces factors important for forests and historic environment. The Guidelines that follow provide more information on how to comply with the UKFS Requirements, grouped by the factor headings.

Factor	Importance for historic environment
Historic context	All landscapes have intrinsic historical value and many have special cultural significance, as can the individual elements within them. The historic context provides the starting point in forest planning for the historic environment.
Evidence of the historic environment	Assessing the evidence is vital in establishing the historic environment value of a site.
Forest planning	Consideration of the historic environment forms part of the forest planning process in both new woodlands and the redesign of existing woodlands.
Woodland heritage	Woodlands in their own right are often of significant historical interest, and historic environment features may have been preserved within them.
Open space	Open space is often the most appropriate setting for historic environment features; open areas may have to be managed to minimise erosion or inappropriate woodland regeneration.
Forest operations	Forest operations, ground disturbance and heavy machinery involved in earthworks all have the potential to seriously damage historic environmental features.
Site hydrology	Many buried archaeological features have survived well in waterlogged soils and altering the hydrology can affect their preservation.
Access and interpretation	The historic environment provides considerable public benefit and enjoyment. Interpretation can provide a site focus and enhance the visitor experience.

Historic context

The long history of human settlement and land use in the British Isles has left a legacy of varied landscapes rich in historical and cultural values. The vast majority of natural tree cover was cleared to provide land for other uses and, at a broad scale, the geomorphology of an area dictated where activities such as quarrying, mining, agriculture or forestry would have been the predominant land use. Features such as burial mounds, hillforts and farmsteads indicate a history of open land, whereas features such as saw-pits or charcoal hearths indicate a woodland history.

Ancient woodland, parkland and wood pasture will all have a long history of woodland culture associated with them – although the historical use of the term 'forest' was misleading as it was often used to describe wild land, irrespective of tree cover, in ancient hunting forests. Cultural values are often linked to historical uses and may include designed landscapes, literary associations, or areas imbued with social history such as the crofting landscapes of Scotland.

Projects to understand the historic development of landscapes, rather than individual special sites, have been undertaken across the UK. Examples include Historic Landscape Characterisation (HLC) in England, and Historic Landscape Assessment (HLA) in Scotland. These projects examine the origins of land-use patterns and map them in areas of similar character to provide a basis for guiding land-use policies. They can also contribute the historical element to wider landscape character assessments.

The most important historic and designed landscapes are entered onto registers of landscapes of historic and design interest and some of the most sensitive historical areas have been identified in indicative forestry strategies, regional forestry frameworks and local forest management plans.

There is popular interest in landscape history, and this can present opportunities: for example in generating support for proposals to restore woodland cover on sites that were wooded in the recent past. First-series Ordnance Survey, other early maps and old aerial photographs (e.g. the RAF stereoscopic cover produced from the late 1940s) provide useful sources of information and can help show how the landscape has developed over time and how the woodland and tree elements have changed.

In some cases, tree planting may have disguised or detracted from the historical value of landscapes and there may be a case to consider removing trees to restore special sites.

See also Forests and Landscape.

1 Contact the local historic environment services for information on the historical context; check to see if a historic assessment/categorisation has been undertaken or the landscape is listed or registered as being of historic or design interest. 8

2 Use the historic assessment/categorisation or any description given in a historic register or list, together with the Landscape Character Assessment, to inform the development of proposals. 9

3 Consider the impacts of forestry on the historical context and landscape character in forest management plans; consider opportunities to complement, enhance or re-create landscapes of historic interest. 10

Evidence of the historic environment

In cultivated agricultural landscapes, many buried archaeological features are first identified as crop marks in aerial photographs. In grazed areas, aerial photographs and other surveys have also been used to identify buried features. These images, taken from flights over several decades, have allowed an extensive monument mapping programme to be undertaken with the results incorporated into various record systems. The results of fieldwalking and geophysical surveys have also added to our knowledge.

Traditional aerial survey techniques cannot be used in areas where there is tree cover. As a result, many existing records do not extend to forests and woodlands, which, in comparison to open areas, have received relatively scant field study. The lack of widespread detailed surveys means that many historic features in woodland are unknown or not recorded, and are therefore at greater risk of accidental damage. However, recent progress in using new remote sensing techniques such as LiDAR (Light Detection and Ranging) has been encouraging and is contributing new data to the records.

Where the historic environment is identified in an environmental assessment determination, or where important historic environment features are known but information is lacking, a more detailed historic environment survey may have to be commissioned. However, for many sites, some information may have already been collected, and useful starting points in identifying what might be there are the historic environment records (HERs). The local historic environment services will be able to advise and interest groups may hold additional relevant information. Some HERs are accessible via the internet and are being continually updated.

There are many other sources of historical information; features may be evident on old maps, in documents or on old aerial photographs. However, a great deal of information is awaiting field validation or verification and so it will not appear in the record. Moreover, as records are generally poor for wooded areas it is inadvisable to base forestry proposals solely on current mapping, especially where the landscape is believed to have a high archaeological potential. It is important to bear in mind that virtually all locations and landscapes in the UK are the product of human cultural activity to at least some extent.

It will not be necessary to conduct a full historic environment survey for every woodland or potential woodland site. A visual survey, together with reference to existing records, will help reveal any obvious evidence and determine whether further investigation is warranted. A visual survey will also identify extant features of historical interest, for example long-established cultural boundaries such as ancient rides, walls, banks, hedgerows, veteran trees and features associated directly with woodland management. Forestry practitioners are encouraged to make themselves aware of the common types of historical evidence and to record the location of features of interest they come across (see Box 6.3.1 for examples of historic environment features found in woodland).

4 Take advice on the historical interest of the site from the historic environment services and by checking the historic environment records.

5 Look for indications of the historic environment on the ground and conduct further investigation where evidence is found; commission specialist surveys where evidence is significant.

6 Ensure those working in woodlands are aware of the importance of the historic environment; encourage them to recognise evidence and assist in gathering information.

7 Include long-established boundaries, banks and veteran trees as historic environment features to be protected.

8 Record the nature and position of any historical features or objects such as pottery, flint or bone, and report them to the relevant historic environment services.

9 Where historic environment surveys are requested, offer access and assistance to help extend historic environment records.

Forest planning

UKFS Requirements and Guidelines for the forest planning process are set out in Section 5 General Forestry Practice. The process for integrating the historic environment into the forest management plan involves collecting and analysing all relevant information, including the historical context and evidence of the historic environment resource. Where there are designations for other specific reasons such as landscape or biodiversity, for example Areas of Outstanding Natural Beauty (AONBs), or Sites of Special Scientific Interest (SSSIs), this does not negate consideration of the historic environment, which may also be important.

In some situations, evidence of the historic environment will be compelling and forestry may be inappropriate. However, where features or areas of interest have been identified within a forest area, it will sometimes be possible to safeguard them as an area of open space within a forest management plan. As a guide, a margin of at least 20 m should be identified and maintained around Scheduled Monuments or other identified features of importance, but this will depend on the site itself. Linear features such as ancient rides, walls, banks and hedgerows, and woodland features such as veteran trees, may not justify as much as 20 m; they can be identified for protection in the forest management plan and operational plans. Sites where evidence suggests that significant historical remains may be present, but specific features have not yet been identified, also need to be identified in forest management plans.

The settings of features, in addition to the features themselves, may be relevant and will need to be considered in the forest management plan. Where groups of features occur (Figure 6.3.1) adjacent to each other, a larger area of open space is preferable to a series of smaller spaces. Where features are prominent in the landscape (Figure 6.3.2), or have sight lines associated with their function, then the area to be excluded from planting will need to be larger to accommodate these visual qualities.

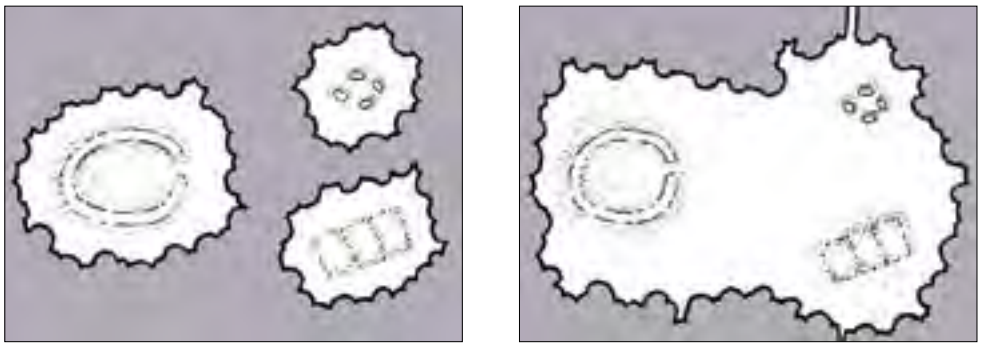


Figure 6.3.1 Where groups of historic features are close together they should be incorporated into a larger area of open space.

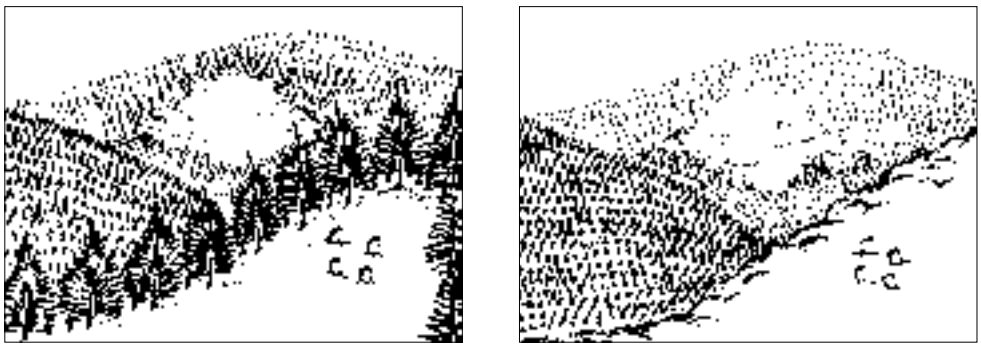


Figure 6.3.2 In some circumstances it is important to protect the visibility of historic features in a wider landscape.

In some parts of the UK, the historic character of the landscape can be enhanced by establishing new woods on sites with a documented loss of woodland cover. This approach can also help to inform forest management plans for the reinstatement of historic and designed landscapes, where that is an objective.

Growing short rotation forestry or coppice crops on agricultural land to provide a source of woodfuel is of increasing interest, but the practice can pose threats to the historic environment. Species such as willow have a high water demand that can affect waterlogged archaeology. In addition, these crops may eventually be removed by a deep cultivation process, which can disrupt or destroy buried historic environment evidence.

10 Ensure the historic environment considerations are fully integrated into the forest planning process.

11 Plan an appropriate area of open space around features of historical significance; for Scheduled Monuments this will normally be a minimum of 20 m. Consider the setting as well as the individual features.

12 Where evidence suggests that significant historical remains may be present, but specific features have not been identified, identify these areas in forest management plans, restrict any planting to smaller trees or shrubs and minimise ground disturbance.

13 For new woods in areas where the landscape history is important, consider restoring tree cover on previously wooded sites.

14 Take particular care to avoid sites of historic interest where short rotation forestry or coppice crops are proposed.

Woodland heritage

Existing woodlands are also part of the historic environment; some may contain veteran trees or coppice, reflecting centuries-old management traditions, while others reflect more recent social and economic policies from the 20th century.

Woodland cover has often protected historical features of woodland management, such as saw-pits, boundary banks and charcoal hearths, and earlier pre-woodland uses such as farms, settlements and burial mounds. Compared with open land, and in particular arable farming, woodland can protect historical evidence from disturbance and from physical pressures such as exposure, frost and erosion. Some evidence of earlier non-woodland use can even be found in long-established ancient semi-natural woodland. Woodland cover can be vital for enhancing the historical value of features by providing them with an appropriate setting and so contributing to their 'spirit of place' (see the UKFS Guidelines on Forests and Landscape).

While woodland cover may have afforded some protection to the historic environment, the management of trees and shrubs on or adjacent to individual features needs to be considered. Historical earthworks may initially be protected from erosion by the binding action of roots, but in some circumstances roots can become disruptive and pose a threat. Damage by windblown trees can also be considerable, for example where root plates lift and disrupt archaeological material. When this occurs, it is advisable to cut the trunk and return the root plate to its original position. Smaller trees and shrubs are likely to cause less damage, and pollarding and coppicing can help restrict growth. The remains of buildings and walls are best kept free of woody vegetation, but grass or moss may have protective qualities. Occasionally trees will have grown and become firmly established in the walls of standing structures. The tree may be holding the structure together, so removal needs to be undertaken with care and appropriate specialist advice taken.

Woodland features such as veteran trees, old coppice and pollards also need to be protected and it is important to select and manage suitable replacement trees that will eventually take their place. A low level of woodland browsing can be advantageous as it will discourage the encroachment of woody vegetation, particularly in wood pasture systems, but care has to be taken to ensure overgrazing does not result in erosion. This is particularly important when livestock is introduced to woodland. For example, pigs or wild boar turn over a lot of soil and additional measures such as fencing may be required to protect the ground around individual sites.

Regular visits to important sites, especially Scheduled Monuments, to monitor their condition will identify any new threats or damage (e.g. a new badger sett in relation to an earth mound, or a canopy gap that could lead to windblow on a historical site). A useful method of monitoring is to keep a photographic record that includes the date of inspection.

15 Manage trees and shrubs that may damage important historical sites and features: limit the establishment of woody vegetation and consider removing large trees vulnerable to windthrow.

16 Retain and manage existing veteran trees and select and manage suitable individuals to eventually take their place. 12 22

17 Monitor important historic environment sites and features, including woodland features, to check they are not being damaged or degraded.

Open space

Open space within woodland can provide an appropriate setting for specific historic environment features, or be of historical interest in its own right. Keeping these areas free from woody vegetation can help to preserve the features, provide physical access and capture something of the visual context and spirit of place. Open space can also provide biodiversity benefits by maintaining open-ground plant and animal communities. However, thought needs to be given to monitoring these areas and, if necessary, undertaking active management.

Once grazing by livestock ceases, most open areas will start to revert to woodland through vegetation succession. Succession can take decades in areas where there is a dense grassy sward from a previous grazing regime, but may be quite rapid where the ground is disturbed in some way – for example by rabbits or where trees have been removed. Where present, deer and rabbits will provide some grazing; occasionally admitting livestock will increase grazing levels but careful management will be required. An alternative to grazing is mowing, cutting or flailing. Even one cut per year can help control coarse vegetation, favour low-growing ground cover species and grasses, and encourage incidental grazing. Bracken obscures features and rhizomes can disturb archaeological deposits. Once established, it will prevent grazing and lead to vegetation succession. Repeated cutting, just when the fronds have unfurled, will help keep it in check.

Historical sites that may be hidden within woodland can have the advantage of being protected from excessive recreational activities and vandalism. In some cases, volunteers from interest groups within local communities may be able to offer help by monitoring and maintaining historical sites.

18 Aim to maintain the open settings for features of historical interest; where appropriate monitor changes in vegetation and consider using grazing or mowing as part of the management plan.

19 Manage public access so that open settings for historical features are not subject to erosion or damage caused by visitor pressure.

Forest operations

Forest operations and civil engineering activities involve heavy machines and occasionally earth-moving equipment. These activities can destroy or damage archaeological remains, veteran trees and other features of the historic environment; even the close proximity of machines presents risks of physical damage, soil vibration, compaction and erosion.

The construction of roads, trails, paths and car parks all involve earth moving, and quarries are frequently opened to provide materials. Other engineering works can involve modifying watercourses and the construction of drains and other structures such as bridges. The felling and extraction of timber usually involves large harvesting machines and sometimes a winch to drag heavy loads of timber.

Ground disturbance may be required for tree establishment, and operations involving deep cultivation, scarification and drainage can all destroy archaeology buried in the ground. In addition, the Post-2010 Biodiversity Framework seeks to restore a number of habitats important for nature conservation. Some restoration projects involve considerable ground disturbance such as pulling out tree stumps and inverting soil layers to reduce the surface nutrient content. As with any soil disturbance, this can have potentially damaging consequences and the possible effect on buried archaeological features needs to be considered before proposals are finalised.

The first stage in protecting a site is to identify all elements of the historic environment, including woodland features such as veteran trees, in the forest management plan. This information, together with any more detail provided by site examination, can be transferred to a site-level operational plan when operations are proposed (see General Forestry Practice). The operational plan sets out how site works are to be organised, together with measures to avoid damaging vulnerable features. Where there are Scheduled Monuments, or where other evidence of historic environment importance is known, detailed liaison with the local historic environment service is essential before work commences. Obtaining consent is a legal requirement where operations may affect a Scheduled Monument. This liaison process can take time and will need to be planned in advance.

The historic environment is particularly vulnerable to unintentional damage during site operations. It is important to ensure that all those working on site understand why measures are in place and how best to avoid damage. Therefore, the final stage in the planning process is to mark out important features on the site itself – ensuring that site workers are fully aware of the operational constraints. In addition to the operations themselves, areas of historical interest will also need to be protected from incidental activities such as the stacking of timber or storage of other materials on site. Where operations are a necessity in the vicinity of historical features, a number of measures can be taken to ensure the impacts are minimised. These include limiting work to periods of dry weather and protecting the ground with brash mats. Low-impact harvesting and extraction methods, such as felling by hand, extraction by winch, or by using horses, may also help minimise site impacts in some circumstances.

Steps can also be taken to lessen future impacts and improve management options, for example by thinking carefully about the position of fencelines (Figure 6.3.3) and the provision of access routes to features (Figure 6.3.4).

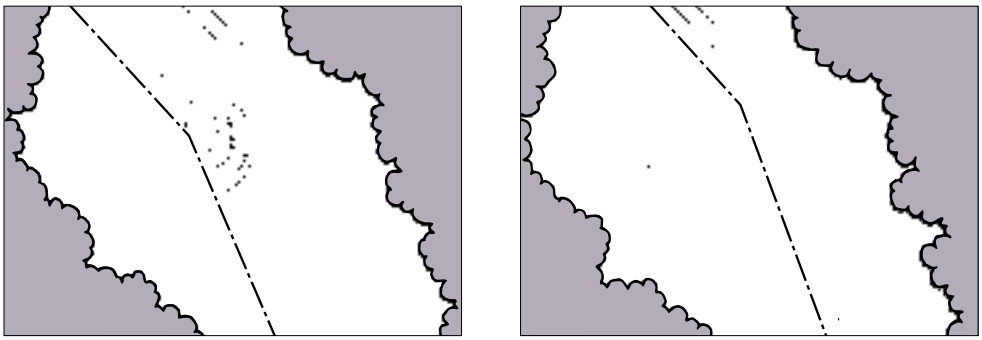


Figure 6.3.3 Fencelines should not cross historic environment features, as they focus erosion caused by people and grazing animals.

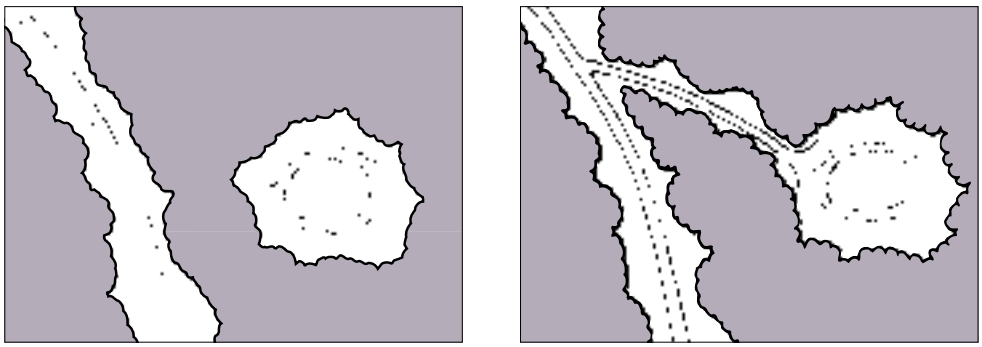


Figure 6.3.4 The layout of roads, rides and tracks should be planned to avoid crossing the site, but should secure access to the archaeological feature for management purposes.

20 If operations are planned near a Scheduled Monument, consult the relevant historic environment authority before site operations commence. If operations are likely to affect other known or suspected features of historic environment interest, seek advice on operations from the local historic environment service.

21 Avoid disturbing the ground on or near sites of historical significance.

22 Identify relevant historic environment features in the operational plan and identify them on the ground; ensure they are excluded from the operational area and that the plan is communicated to all those working on the site.

23 Avoid using areas of historical importance for storing material, stacking timber or as a parking area for machinery.

24 Where operations are a necessity near vulnerable historical features, take precautions to avoid damage and take particular care with felling and extraction.

Site hydrology

The flow of water through soils and the degree of saturation can affect historical remains. In permanently waterlogged soils, vulnerable organic remnants such as leather, cloth and wood can be preserved. Many finds have been made in peat bogs: for example wooden tablets recovered from waterlogged deposits in the vicinity of Hadrian's Wall show inscriptions recording aspects of daily life during the Roman occupation. The main danger to these types of artefacts is desiccation and exposure to air. When organic remnants are exposed to air they are readily broken down by microorganisms. In other soils, water flows

can affect durable remains through erosion and washout, especially if natural drainage patterns are disrupted and more rapid flows and discharges result.

In many cases visible, above-ground historic environment features are part of larger sites with subsurface archaeology which is more vulnerable to changes in hydrology. Where historic environment remains are known to exist or thought likely, keeping drains well away from the features should prevent waterlogged soils drying out and avoid erosion problems. The appropriate distance will depend on the soils and drain depths, but 20 m provides a guide as a working distance for forest planning. Where wetland archaeological evidence is known to occur, there may be a case for blocking or re-routing drains and removing trees.

New woods can also alter site hydrology by increasing water uptake and so drying out soils. This is particularly the case with energy crops, such as short rotation willow coppice, which have a high water uptake. There is also the potential problem of windblow occurring on very wet sites, which can lead to drying out of soils and to erosion.

25 Keep drains well away from known archaeological deposits; as a guide a minimum of 20 m, depending on the nature of site hydrology.

26 Where there is preserved archaeology, and drains may be having a detrimental effect, consider blocking or re-routing them.

27 Avoid the establishment of new woodlands or short rotation coppice on areas where changes in hydrology may affect preserved remains.

Access and interpretation

Forests and woodlands often have an interesting history which enhances the contribution that they make to society. There is considerable public interest in cultural heritage and the historic environment and interpretation of these aspects of woodlands can provide a focus for visitors. This may be as part of a wider access or recreation strategy or an informal opportunity to appreciate a specific feature in a wood.

The history of an individual woodland is often wide ranging, and can include features associated with previous land uses as well the management of the woodland itself. Evidence of past land use may include the remains of agricultural fields and farms, prehistoric burial mounds, settlements and fortifications. The history of woodland management might be linked to the establishment of a strategic timber reserve, the iron industry, ship building, hunting or some other impetus for the use of woods. The ancient woodland, veteran trees, historic parklands, wood pasture and coppice woodlands that we see in the landscape today all have a story to tell. Some woods contain features that span several thousand years of history.

Historic environment features can sometimes be linked by heritage trails and explained through the use of interpretative panels, leaflets and maps. However, such facilities need to be managed to avoid negative impacts on the historic features or the surrounding area. For example, increased visitor numbers may lead to an increased risk of erosion. Monitoring and, where necessary, mitigating action will be required to ensure that historic features and

visitor facilities remain of a good standard. For example, paths may need to be re-routed and interpretation boards relocated to remove risks to sensitive locations.

28 Consider providing access to features of historical interest.

29 Consider how the historic environment could be interpreted for visitors as part of an integrated access strategy if that is a management objective.

30 Ensure historical features and any visitor facilities associated with them are well maintained.

6.4 Landscape

The European Landscape Convention describes landscape as 'an area, as perceived by people, whose character is the result of the action and interaction of natural and/or human factors'. This is a wide-ranging and inclusive definition, and it covers all landscapes – including towns, villages and open countryside, whether natural or managed, and whether special or ordinary.

Introduction

The British Isles have a great diversity of landscapes that have arisen from the interaction between geology, landform and climate since the last Ice Age, and the long history of human land use. This diversity is reflected in the rich variety of forest and woodland landscapes across the UK.

Landscape can be thought of as a combination of:

- Natural components: geology, landform, soils, watercourses, climate.
- Human influences: land use, land management, settlement.
- Aesthetic qualities: visual and sensory impressions.
- Cultural values: historical, social and personal associations.

Visual perception is fundamental to the term landscape. It is more than just an area of land with its individual arrangement of features; it has an intrinsic visual quality imbued with the knowledge, emotions, associations and understanding of individuals and communities.

Time is a vital consideration in landscape planning, design and management, particularly when dealing with the long life cycle of trees and woodlands. Landscapes are constantly changing under the influence of natural or human forces. Sometimes these changes are subtle and imperceptible, reflecting gradual shifts in land management or climate; at other times they can be more dramatic or intense, such as when mineral sites are worked and restored or new development takes place.

Implicit in the European Landscape Convention is that all landscapes are important, whether officially recognised through formal designations or not. In addition, the Convention highlights the importance of involving the public and other interested parties in the creation and implementation of landscape policies – including the design and management of forests, woodlands and trees.

Forests and woodlands in the landscape

Forests and woodlands are important visual elements in the landscape that change over time. They have great potential to enhance and enrich the environment and make a significant contribution to landscape quality. Very often they are the dominant element in the landscape, shaping and enclosing space, framing views and providing colour, texture and scale. Forests and woodlands provide a place for recreational activities and can bring people closer to nature in both town and country. Management activities provide a context for engaging local people, which can help promote community cohesion and environmental awareness.

The UK has lost a greater proportion of its natural forest cover than most countries in Europe, due to agriculture and other land uses. This has helped make the remnants particularly valuable and, as early as the Norman Conquest, areas such as the New Forest have been preserved (see Forests and Historic Environment). Moreover, climate change has focused attention on the special roles of trees and woodlands in both mitigation – to reduce the effects of greenhouse gases, and adaptation – to reduce the vulnerability of both natural and human systems to the effects of climate change (see Forests and Climate Change).

In terms of visual design, forests, woodlands and trees have long been appreciated in the layout of grounds of great houses, parks and sporting estates. In the UK, naturalistic approaches pioneered by great English designers such as Capability Brown and Humphry Repton in the late 18th century replaced the formal geometric styles of the 17th and early 18th century. The idea of a romantic 'wild' landscape, which has its origins in Classical mythology, later informed the development of the 'picturesque', which influenced the early landscape architects and landscape appreciation today.

The history of forest design

In the early years of the Forestry Commission – from the 1920s to the 1950s – the creation of a strategic timber

reserve was the priority for the organisation that took precedence over landscape, biodiversity and other environmental considerations. New forests (or more correctly the re-establishment of forest cover) were often characterised by large-scale plantations of non-native conifers laid out in geometric shapes that followed ownership boundaries and which had limited species and age diversity. While these proved to be the best choice for timber production and to meet the objectives of the time, they resulted in rapid and dramatic landscape change and were criticised by some as unnatural or 'alien'.

From the early 1960s, more attention was given to landscape issues, with two guiding principles being adopted as a foundation for the visual design of forests:

- Forest landscape design should emulate 'natural' patterns and forms, and contrast with that which is controlled, regular and urban.
- Principles of visual design, used by designers in other fields, should be applied to forests in the landscape.

Much early work on forest landscape design was applied to large-scale afforestation and focused upon the aesthetics of these as features, especially in the uplands, where the scenery was highly valued. The same design principles have subsequently been extended and adapted to lowland and urban woodland to meet social and recreational needs. There has also been more recognition of the importance of woodland type, relative to its landscape setting, informed by studies such as Landscape Character Assessments (LCAs) and Landscape Capacity Studies.

The development of forest design has been supported by research into public preferences for woodlands and trees in the landscape. Studies have highlighted the features people consider important in visually attractive forests and woodlands. Diversity of structure and composition emerge as the most important characteristics, while other preferences include:

- organic rather than geometric shapes;
- open areas within the forest;
- variety of tree size and species;
- views under the woodland canopy;
- ephemeral effects of colour, light and seasonal change;
- still or flowing water enhancing the attractiveness of a wooded landscape.

Benefits for people

In urban areas, there has been increasing interest in the contribution that woodland and trees can make to urban character, quality of life, the restoration of derelict land and the rehabilitation of urban communities. They can be used in the landscape restoration process to help visually integrate otherwise disparate elements, as well as reducing any unwelcome visual prominence in the wider landscape of hard built structures such as roads and buildings. Woodlands and trees can be thought of as part of the green infrastructure – bringing a natural element into urban lives that can provide places for recreation and relaxation. This can enhance urban areas, and provide a setting for both new housing and economic developments.

Access to forests and woodlands for recreation is an important public benefit, and providing such opportunities is now a management consideration for all forests and woodlands in the UK. If internal landscape and recreation facilities are well designed, forests can accommodate large numbers of people participating in a variety of activities – many of these enhanced by the experience of being in a forest environment. Optimising a visitor's experience is a main objective in forests and woodlands designed for recreation, although careful planning is required where activities such as equestrian bridleways and cycle tracks might conflict and require geographic separation (see Forests and People).

The recognition that action is needed to combat climate change will mean that in some areas there will be land-use changes in favour of forestry to help offset carbon emissions. This expansion can be undertaken in a way that will enrich the landscape and bring a range of public benefits, providing care is taken with siting and design, as outlined in the following Guidelines. Climate change policies have also meant that coppice management, practised for centuries with species such as hazel and chestnut, have taken on a new significance; fast-growing crops of both native and non-native tree species offer an alternative and sustainable energy source. These crops have the potential to become woodland, and, as such, are included within the scope of these Guidelines – particularly in relation to siting and design.

The forest design process

The long-term nature of forestry has led to the development of forest management plans that aim to define and communicate forest management proposals and describe the consequences of activities over time. The forest planning process, involving all aspects of forestry, starts with the owner's objectives and the opportunities and constraints offered by a site. This involves assembling and integrating a wide range of information about the site and its potential. The landscape and visual aspects of the forest design represent just one of many site and woodland management issues to consider, but in its broadest sense landscape provides the setting for the planning process. For a large forest, such planning will usually involve the services of a range of professionals dealing with different aspects of the forest environment (see General Forestry Practice).

The landscape and visual aspects of forest design start by taking account of the broad-scale landscape character and other factors affecting the context. This will guide the nature of forestry and, for new planting, the capacity of the landscape to accommodate change. For most areas, Landscape Character Assessment (LCAs) studies have been completed and these will help inform decisions about the nature, location and design of new forests or woodlands (see Landscape Character Assessment). Having taken the landscape context into account, the forest design principles can then be applied to the spatial design of the forest and their landscape and visual impacts assessed. The social dimension of forest planning is also an important consideration from the outset. For woodland that will be regularly used for recreation or is prominent in the landscape, community involvement in the planning process will be a vital part of developing proposals (see Forests and People).

Forest landscape design is important both for the creation of new forests or woodlands, and for redesigning existing forests at the rotation age; felling and restocking provides the management opportunity to reassess their design and enhance the visual contribution they make. There are also landscape considerations to address when forests or woodlands are lost from the landscape; where deforestation is proposed, an Environment Impact Assessment will normally be required and the visual impact is likely to be cited in the determination. The UKFS Guidelines on Forests and Landscape cover both the landscape context and the forest design principles, and provide a rationale to underpin the design process. By following the guidelines, landscape change can be developed in an informed way and communicated to a wide range of audiences. The analysis of the landscape and visual impacts using photographs and three-dimensional visual representations of the forest has been undertaken for many years, and these are a vital aid to understanding and communicating the potential landscape change. An illustration of the application of the Guidelines in some typical examples of UK forest and woodland landscapes can be found at www.forestry.gov.uk/ukfs/landscape. Definitions of terms commonly used in forest design are given in Box 6.4.1.

Box 6.4.1 Definitions of terms

Balance (visual) A state when the dynamic influences of the parts of a design or composition appear to be in visual harmony and equilibrium.

Characteristic An element or feature that is repeated or distributed in a design or landscape which is distinctive in itself or contributes to the landscape character.

Coalescence When several elements overlap and combine to visually reinforce each other. A technique used to create the appearance of greater scale in landscape design by using a number of small elements.

Element (landscape) A fundamental component or basic building block of the landscape such as trees, woods, hedges, buildings and roads.

Interlock A relationship between two elements, where one extends into the other and creates a visual connection; this can increase the unity of a design, or the unity between elements in a landscape.

Margins The borders or edges of a forest; divided into the external margins between forest and other land uses and the internal margins or boundaries between, for example, species, felled areas and open ground.

Nearness (visual) The proximity of elements to each other so that they appear to be part of a group in a composition; this can increase the perception of scale.

Proportion (visual) The relative size or extent, the visual relationship of parts of a design or composition to the whole; rules and theories of satisfactory visual proportion have been established from ancient times.

Rule of thirds A way of proportioning parts of a design by dividing it into sections of one-third to two-thirds of the whole. Loosely based on the ratio of 1:62 (the Golden Section), it helps achieve a satisfactory proportion in which one part dominates.

Scale The relative size (of visual elements) as perceived by the observer. Scale varies with the position and distance of the observer.

Texture (visual) The appearance of a surface due to the size, nature and density of surface elements, coarser textures having larger elements at wider spacing and finer textures having smaller elements at closer spacing. In forestry, different ages and species of tree appear as different textures in the landscape.

Unity (visual) The appearance of wholeness and continuity between an element and its background or landscape, or when all the elements of a design or landscape appear part of the whole. Unity is achieved when forests or woods are well integrated and have the appearance of belonging.

Visual force The illusion of movement, or potential movement, found in a static image or object. The landscape is full of visual forces, especially influencing the way we look at landform.

Policy and context

This section provides further background, gives an overview of the developments relevant to forests and landscape, and summarises the main statutes. Further details of legislation and conventions are provided in Appendix 1.

European Landscape Convention

The European Landscape Convention, an initiative of the Council of Europe, is the first international convention to focus specifically on landscape. It promotes the protection, management and planning of all European landscapes, including natural, managed, urban and peri-urban areas, and landscapes that are special, everyday and even degraded. The Convention is one of a number of international and national policies and agreements that affect the landscape of the UK. The UK ratified the Convention in 2006, which means that the following common core principles and actions have been agreed:

- To put people from all cultures and communities, and their surroundings, at the heart of spatial planning and sustainable development.
- To recognise that all landscapes are important, whether beautiful or degraded, and that they are an inheritance shared by everyone.
- To increase awareness and understanding of landscape and its value, as a unifying framework for all stakeholders whose activities affect it.

- To promote a more accessible, integrated and forward-looking approach to managing the landscapes we have inherited, and in shaping new ones.

The provisions of the Convention are already integrated into UK policy and the broad context is provided by *Securing the future: delivering UK sustainable development strategy* (2005) and corresponding plans for the constituent countries of the UK.

Forests and landscape in the UK

The Forestry Commission established the first national forest parks, starting with Argyll in 1936. Subsequently, post-war movements to protect the countryside and provide access led (in England and Wales) to the National Parks and Access to the Countryside Act 1949 and a range of subsequent legislation and designations. Each country within the UK has a statutory body that advises its respective government on landscape matters. These bodies develop policies and are responsible for landscape protection, conservation and enhancement in key areas. They also recommend areas of national landscape importance, such as National Parks, National Scenic Areas and Areas of Outstanding Natural Beauty for special protection measures and mechanisms to foster their care as well as consider their management (see www.forestry.gov.uk/ukfs/landscape). Forests and woodlands are frequently significant components of these protected areas and the landscape impacts of afforestation, clearfelling and forest roads are considered in the context of the designation(s) and policies that apply.

Landscape planning

Forestry activities themselves are not defined as 'development' and so do not come within the scope of the Town and Country Planning Acts. The exceptions are where development, for example a wind farm or housing scheme, is proposed on a woodland site, or structures associated with a forest proposal – such as an access track – are predicted to have significant adverse environmental effects. In these cases the planning regulations apply and an Environmental Impact Assessment may be required. Local authorities can apply Tree Preservation Orders and designate Conservation Areas to protect trees that are important in the landscape. The owner will be notified of these designations. Local authorities may apply planning conditions to protect existing trees or plant new ones as part of the development consent. They may also enter into 'planning gain' agreements for additional woodland creation or protection. In areas with landscape designations, forest roads and quarries that do not form part of an approved afforestation scheme may be subject to planning controls.

At a local level, planning authorities have responsibility for landscape issues. They have powers to designate local landscapes of importance, and their policies are incorporated into a range of plans and policy statements, all of which are likely to have a bearing on forestry. These include structure plans, development plans, local plans, local development documents and frameworks, and community strategies. Local planning authorities are consulted on forestry proposals and landscape and visual impacts are frequently important issues to be considered.

Some local authorities, in partnership with the forestry authorities, have developed specific plans for forestry which identify opportunities and sensitivities in forestry and woodland strategies, forestry frameworks and community forest plans. There are also local woodland initiatives and projects that have special policies, and sometimes incentives, for woodland development.

Many local authorities take a proactive role in co-ordinating registers or inventories of landscapes of design interest, and some also work with the historic environment agencies on historic landscapes. These sources of information help develop as comprehensive a picture as possible of the landscape context for forest and woodland design.

Several tools have been developed by local authorities, landscape professionals and statutory landscape advisors to analyse landscapes and help in decision making. Foremost are Landscape Character Assessment and Landscape and Visual Impact Assessment.

Landscape Character Assessment

Landscape Character Assessment (LCA) is a recognised method used to analyse the key characteristics that make landscapes distinct, and to categorise and map landscape character types. LCAs have become strategic landscape planning frameworks across the UK. Frequently they have developed through partnerships between local authorities

and the statutory landscape agencies. LCAs can operate at a range of scales, from broad regional studies to local areas of land (see www.forestry.gov.uk/ukfs/landscape).

Landscape and Visual Impact Assessment

Landscape and Visual Impact Assessment (LVIA) provides a consistent and recognised method for assessing the effects of landscape change. An LVIA can be tailored to the complexity of a forestry proposal and the sensitivity of the landscape. Forestry proposals considered sufficiently sensitive to require an Environmental Impact Assessment (EIA) may also require an LVIA (see www.forestry.gov.uk/ukfs/landscape).

Forestry strategies and delivery mechanisms

Forestry policy is set out in the forestry programmes and strategies for England, Scotland, Wales and Northern Ireland. These set out the priorities for each country and how landscape and other elements of sustainable forest management will be addressed. In urban areas, in particular, initiatives have been established to improve the landscape and promote regeneration through new woodlands. For example, the National Forest, Community Forests and Central Scotland Forest have produced local strategies involving landscape considerations, and there are many smaller community-based projects.

UKFS Requirements for Forests and Landscape

Landscape context

The landscapes of the British Isles are renowned for their beauty and diversity. The variety of landscapes found across the UK is a result of the interactions between geology, landform and climate since the last Ice Age, together with the long history of human settlement and land use. Cultural values play a large part in the perception and appreciation of landscapes, and this is particularly the case in the UK, where many landscapes have a strong and locally distinctive 'character', often with historical and literary associations. Policies have been developed that recognise the importance of landscape character and protect landscape qualities. Many areas have special designations and some may also have locally specific policies that apply in addition to those accompanying the designation.

All these influences contribute to the setting or 'context' in which forestry is practised today. Through the appreciation and analysis of landscape context, forests and woodlands can be designed so that they make a positive contribution to the character of a local area, and in some areas create attractive new landscapes. However, it is also the case that, in a limited number of situations, the landscape context will be such that forests, woodlands and associated infrastructure will be inappropriate or restricted, in terms of type, extent or both.

1 Forests should be designed and managed to take account of the landscape context.

2 Forests should be designed and managed to take account of landscape designations, designed landscapes, historic landscapes and the various policies that apply.

Forest design principles

The factors that determine landscape context provide the framework for assessing the forest site and local area, determining the sensitivities and refining the forest design objectives. Informed by this assessment, forest design principles, based on the principles of visual design, can be applied. These have stood the test of time and provide a proven rationale for improving the visual quality of forests and woodlands.

3 The principles of forest design, informed by the landscape context, should be applied to ensure landscape and visual aspects are appropriately addressed.

4 Where existing forests do not meet the UKFS Requirements for Forests and Landscape, improvements should be made when management opportunities arise.

UKFS Guidelines on Forests and Landscape

The table below introduces factors important for forests and landscape. The Guidelines that follow provide more information on how to comply with the UKFS Requirements, grouped by the factor headings.

Factor	Importance for landscape
Landscape context	
Landscape character	An appreciation of landscape character helps determine the capacity of a landscape to accommodate new forests and their design with respect to the key landscape characteristics of a particular area.
Landscape and visual sensitivities	Within a valued landscape, new forests, woodlands and trees can have a significant impact on its recognised qualities and on how people experience it.
Historic context	Forests, woodlands and individual trees are key landscape components that can be integral to historic character, but new ones can also detract from historic character if sited or managed inappropriately.
Designed landscapes	Designed landscapes and their woodlands and trees are a valued art form and an important part of the cultural heritage of the British Isles.
Forest design principles	
Shape	The shapes of forests and woodlands within the landscape can be the most striking visual features: both the overall shape, and the patterns of species and felling coupes within.
Landform	In hilly or mountainous areas, landform is usually the dominant and most obvious landscape influence for forest and woodland design.
Pattern of enclosure	In lowland areas, where landform is subdued, field patterns are usually the dominant and most obvious landscape influence for forest and woodland design.
Scale	Scale describes the relative size of visual elements as seen by the viewer. Generally, the scale of forest and woodland shapes should reflect the scale of the landscape.
Diversity	Diversity refers to the number of different elements in a design. Diverse forests are usually more visually appealing, but the level of diversity should be appropriate to the situation.
Unity	Unity is achieved when forests or woodlands integrate well with other features and look as though they belong in the landscape. Unity also applies to the integration of the various elements within a forest design.
Spirit of place	Spirit of place is a term used to describe the intangible qualities, such as wildness, tranquillity and cultural associations, that make a location special or unique.

Landscape context

This section begins with consideration of the landscape context; this is the first part of the forest design process and starts with an assessment of landscape character.

Landscape character

The UK has a rich variety of landscapes, and understanding their character is fundamental to planning for landscape change and informing forest design. A systematic process of identifying distinct, recognisable and consistent patterns of elements that give tracts of landscape their character and coherence is provided by Landscape Character Assessments (LCAs). LCA studies have been carried out throughout the UK, at national, regional (Figure 6.4.1) and local (Figure 6.4.2) levels. These have identified landscape character types based primarily on distinct combinations of geology, landform, watercourses, land use and settlement patterns (see www.forestry.gov.uk/ukfs/landscape for more details).

LCA studies also provide guidance on a variety of issues that may result in landscape change, which may include the design and location of a forest or woodland. Where available, formal LCA studies and associated guidance provide an essential starting point for forest design, and will inform how the extent, form and structure of forests and woodlands can be planned so that they make a positive contribution to the landscape. This is particularly important for significant areas of new woodland or large-scale felling and restocking, and also for proposals that may impact on sensitive landscapes.

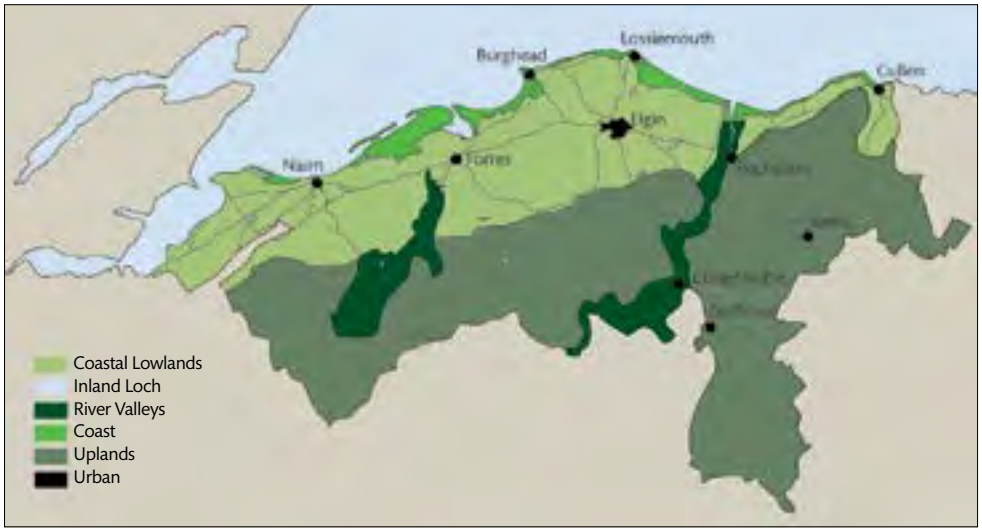


Figure 6.4.1
An example of a regional landscape character map from the series produced by Scottish Natural Heritage. The map divides the area into different zones based on geology, landform, land-use types and other factors.

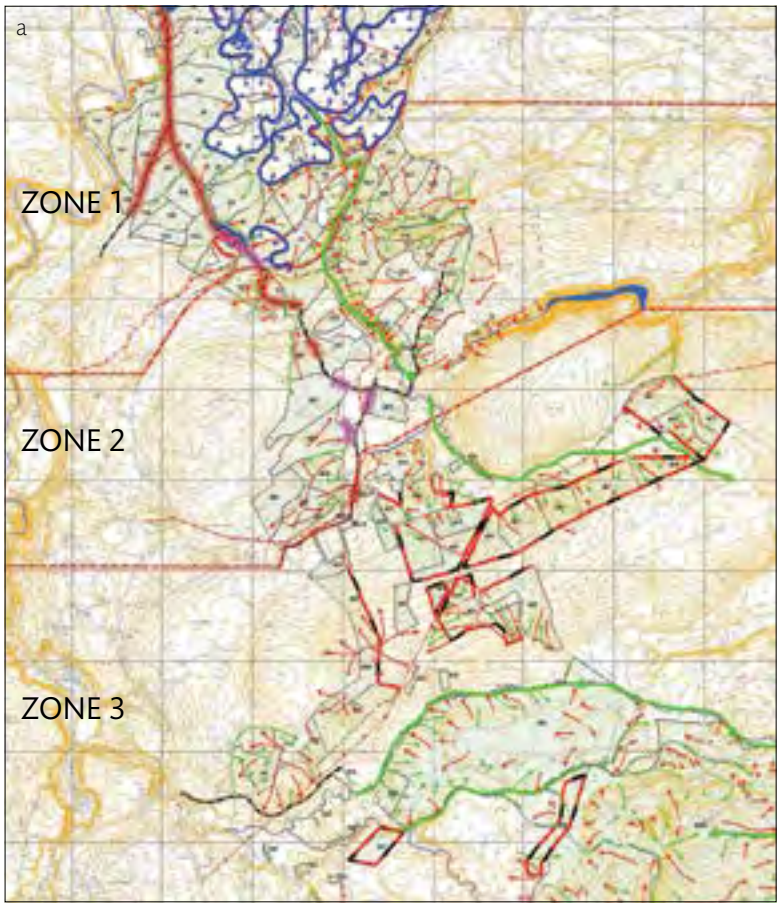
1 Refer to relevant Landscape Character Assessments and associated design guidance as part of the forest planning process.

2 Study the landscape character at a local level, identifying the key characteristics of the landscape; use the analysis to inform the forest design.

3 Where new forests or woodlands are proposed, consider the capacity of the landscape to accommodate change, and design them to have a positive impact on landscape character.

Figure 6.4.2
An example showing the analysis of local landscape character produced at the scale of a forest management plan, with associated photographs.

a. A map showing the area divided into three different zones on the basis of landform, land use, scale, and the nature of the viewing experience (see below).



b. Zone 1 is a flat area of estate grounds with views across open areas through trees.

c. Zone 2 is a rolling, medium-scale landscape with farms.

d. Zone 3 is a large-scale open landscape with distant views dominated by semi-natural vegetation.

Landscape and visual sensitivities

The creation of new forests and woodlands and the felling and restocking of existing woodlands have the potential to dramatically alter landscapes. Changes occurring to familiar scenes can be unwelcome – especially when the change is sudden and unexpected. An essential part of the forest design process is therefore a consideration of the visual sensitivity of the landscape within which changes are proposed. This can be considered and assessed in terms of:

- Landscape visibility – determined by the prominence and topography of the landscape (Figure 6.4.3), the number of viewpoints, and the presence of elements that block or screen views.
- Number of viewers – will depend on the size of the local population, settlement pattern and how the landscape is used by local people and visitors.
- Nature of viewing experience – is influenced by factors such as whether the view is seen from a moving vehicle or a neighbouring dwelling, or provides the backdrop to a visitor attraction, or is a view glimpsed through a forest opening.
- Landscape value – cultural or historical associations all contribute to landscape value, and may be reflected by a designation such as a National Park, an Area of Outstanding Natural Beauty (in England, Wales and Northern Ireland) or a National Scenic Area (in Scotland).

The particular quality of a locality that gives it its identity and makes it unique and special to the people who live there or visit is known as local distinctiveness (Figure 6.4.4). This quality may be cultural or historical, or linked to local and individual perceptions of what is important. Local distinctiveness helps people enjoy, remember and value particular places.

Proposals for change need to be considered throughout the area from which they will be visible and the impacts on the nature of views assessed. This is typically done from a range of representative viewpoints. The changes can then be illustrated to provide the basis for an assessment of people's responses to proposed changes, and to the overall effects on visual amenity.

The potential landscape and visual effects of forestry proposals from each selected viewpoint can be considered against six criteria:

- Description of effect is an assessment of the potential impact of the proposals on the viewer by virtue of their extent, proximity and transience and whether they have a positive or negative effect on the landscape.
- Importance of view is a judgement on the relative significance of the viewpoint to the viewer, including an assessment of the local distinctiveness of the scene to local people, including those in neighbouring dwellings.
- Landscape sensitivity is an evaluation of the sensitivity of the landscape and whether proposals can be accommodated without detrimental effect on landscape character.
- Magnitude and duration of landscape effect is an assessment of the relative scale and nature of the potential changes to the landscape and their duration.
- Mitigation of landscape and visual effects considers any measures that could be considered to mitigate the landscape and visual impacts of the proposals from the selected viewpoints.
- Significance of landscape and visual effects is a summary statement of the potential significance of the effects of the proposals on the landscape after all mitigation measures have been considered.

Figure 6.4.3
This landscape is sensitive to change as it is in a National Park, visible from major roads and settlements and seen by many people – including tourists. Brecon Beacon, Wales.

Figure 6.4.4
This dominant hill, Slemish, in Northern Ireland, adds local distinctiveness to the landscape. Any proposals for afforestation or tree planting which could affect well-known local views should be discussed with the local community.

For all forestry proposals, assessing the landscape context will involve an appreciation of landscape and visual sensitivities as part of the forest design process. For the more extensive and environmentally significant proposals, for example where an Environmental Impact Assessment is required, a methodology described as a Landscape and Visual Impact Assessment (LVIA) may be required to guide the forest design and communicate the landscape change (see www.forestry.gov.uk/ukfs/landscape for more information). This involves an assessment of landscape and visual sensitivities, evaluation of design options, and the impacts of the design proposal that represents the best overall solution. Where visual sensitivity and local distinctiveness are important, taking account of local opinion will help inform the development of proposals and provide assurances about the nature, scale and rate of change.

4 Analyse the visual sensitivity and local distinctiveness of the landscape; consider visibility, how people view the area, the nature of the viewing experience and the importance of views.

5 Where visual sensitivity and local distinctiveness are important, communicate the predicted visual effects of proposals to interested parties and consider local opinions in developing the best overall solution.

6 Consider making use of a Landscape and Visual Impact Assessment, proportionate to the complexity of the proposal and the sensitivity of the landscape.

7 Ensure that forest designs adequately reflect the visual sensitivity and local distinctiveness.

Historic context

The long history of settlement and land use in the British Isles has left a legacy of varied landscapes rich in historical and cultural values (Figure 6.4.5). The vast majority of natural tree cover was cleared to provide land for other uses and, at a broad scale, the geomorphology of an area influenced where activities such as quarrying, mining, agriculture or forestry would have been the predominant land use. Features such as burial mounds, hillforts and farmsteads indicate a history of open land, whereas features such as saw-pits or charcoal hearths indicate a woodland history.

Ancient woodland, parkland and wood pasture will all have a long history of woodland culture associated with them – although the historical use of the term 'forest' was misleading as it was often used to describe wild land, irrespective of tree cover, in ancient hunting forests. Cultural values are often linked to historical uses and may include designed landscapes, literary associations, or areas imbued with social history such as the crofting landscapes of Scotland.

Projects to understand the historic development of landscapes, rather than individual special sites, have been undertaken across the UK. Examples include Historic Landscape Characterisation (HLC) in England, and Historic Land-use Assessment (HLA) in Scotland. These projects examine the origins of land-use patterns and map them in areas of similar character to provide a basis for guiding land-use policies. They can also contribute the historical element to wider landscape character assessments. The most important historic and designed landscapes are entered onto registers of landscapes of historic and design interest and some of the most sensitive historical areas have been identified in forestry and woodland strategies, forestry frameworks and forest management plans (see Forests and Historic Environment).

There is popular interest in landscape history, and this can present opportunities: for example, in generating support for proposals to restore woodland cover on sites that were wooded in the recent past. First-series Ordnance Survey, other early maps and old aerial photographs (e.g. the RAF stereoscopic cover produced from the late 1940s) provide useful sources of information and can help show how the landscape has developed over time and how the woodland and tree elements have changed.

In some cases, tree planting may have disguised or detracted from the historical value of landscapes and there may be a case to consider removing trees to restore special sites.

Figure 6.4.5 A view in Dartmoor National Park where the landscape is full of many different historical features. The hedgerow pattern and the hedgerows themselves are an important part of this, dating back centuries or even millennia.

8 Contact the local historic environment services for information on the historical context; check to see if a historic assessment/categorisation has been undertaken or the landscape is listed or registered as being of historic or design interest. 1

9 Use the historic assessment/categorisation or any description given in a historic register or list, together with the Landscape Character Assessment, to inform the development of proposals. 2

10 Consider the impacts of forestry on the historical context and landscape character in forest management plans; consider opportunities to complement, enhance or re-create landscapes of historic interest. 3

Designed landscapes

Designed landscapes are an important part of the cultural heritage of the British Isles and trees and woodlands are often their defining components. Most of the more prominent examples of designed and historic landscapes are listed in the registers or inventories maintained by government agencies and local authorities, where special policies and restrictions (such as Conservation Areas) may apply (Figure 6.4.6). However, these lists are not always complete and in many landscapes it may be possible to identify a fading design history for conservation and restoration. Further relevant information may be obtained from Historic Land-use Assessments and The Gardens Trust.

11 Check if the landscape is listed in the relevant register or inventory of designed or historic landscapes. If so, seek specialist advice to inform the development of proposals.

12 If the landscape is not listed, but there is evidence that it is part of a park or designed layout, investigate the original design intentions and use these to inform design proposals.

Figure 6.4.6
Stourhead Park in Wiltshire is a listed landscape park.

Forest design principles

The assessment of landscape context, as described above, will inform how the following forest design principles should be applied to ensure that forests and woodlands make a positive environmental contribution. Many existing forests were originally planted with little attention to landscape, but felling and restocking provides the management opportunity to reassess their design and enhance the visual contribution they make.

Shape

Shape is a powerful factor that has a major influence on how we perceive our surroundings. The perception of a particular shape is influenced by its overall proportions, how edges are defined and the viewer's position. Compatible shapes achieve harmony in a composition, whereas shapes that are incongruous have a visually jarring effect. Landscapes contain many shapes but there is always an underlying influence which can be used to help integrate new forest shapes.

Studies of public preferences for forest landscapes have confirmed 'shape' as one of the most important visual factors. The distinction between naturalistic (usually meaning organic) and geometric (implying human-influenced) shapes is particularly significant and plays a major part in forest and woodland design (Figure 6.4.7). This applies to both the overall shapes of forests or woodlands in the landscape and to the patterns within them made by species compartments, felling coupes, access tracks and fencelines (Figure 6.4.8).

Shapes in a forest design that are influenced by the landscape appear better integrated with their surroundings. The dominant landscape influence differs according to whether the landscape is upland, lowland or flat:

- In the uplands, the landform is the dominant influence on shapes and on the patterns of vegetation and rocky areas. The hills and terrain may be rugged and angular, or smooth and rolling. The use of irregular shapes that reflect these landforms will help integrate the woodland with its surroundings.

- In the lowlands or on undulating farmland, the field or enclosure pattern may be more dominant than the landform. In these landscapes woodland shapes can be based more on these influences.

- In flat landscapes, where there are no vantage points for people to see the overall shapes of a woodland, the woodland edge and internal spaces (e.g. felling coupes) are the main influences and considerations in deciding shapes.

For new woodlands, existing semi-natural vegetation patterns can also help guide planting shapes and species choices (Figure 6.4.9). Vegetation responds to soil type, drainage, aspect and exposure, and these patterns are often related to the underlying landform. However, it should be borne in mind that the existing vegetation may have been modified to a greater or lesser extent by enclosure and management such as fencing, re-seeding, fertilising and draining. Much of the coherence of various patterns in the landscape is due to the interlocking of shapes, rather like pieces of a jigsaw puzzle (see Unity below).

Figure 6.4.7
Examples of different shapes.

a. Geometric, symmetrical shapes.

b. Organic, asymmetrical shapes.

Figure 6.4.8
Examples of different forest shapes.

a. This forest has a very geometric layout, which looks out of place on this hillside. Gospel Pass, Black Mountains, Wales.

b. This semi-natural woodland has an organic shape, which reflects the underlying landform. Sutherland, Scotland.

c. A felling coupe, which also has an organic, curvilinear shape, near Lairg, Scotland.

Figure 6.4.9
a. A landscape near Loch Arklet, Scotland, where the vegetation pattern is very well defined, related in part to the local landform. Vegetation often indicates soil condition.

b. A design for new woodland based on the vegetation pattern. Conifers (possibly Scots pine) on the heathery, drier sites and broadleaves (possibly birch) on the grassy, moister slopes. Rocky, shallow soils are left open.

13 Analyse the main landscape influences and base forest shapes on either the landform or the enclosure pattern.

14 If the enclosure pattern is dominant, use the field pattern and links to existing hedges and woodlands to guide the design of forest shapes.

15 In landscapes where the landform dominates, design forest shapes that reflect the landform: avoid geometric shapes, symmetry and parallel lines.

16 On hillsides, where the landform predominates, use curving diagonals to run across slopes rather than straight, horizontal or vertical lines.

17 Use the natural or near-natural vegetation pattern to help guide new planting shapes and species patterns.

18 Consider how management practice will achieve the most appropriate forest shapes over time, including the effects of fences, felling coupes and access tracks.

Landform

When viewing a landscape the eye tends to look around a scene, for example along a river or a winding road. This applies in particular where landform is the dominant landscape influence, and it has been widely recognised that there are directional forces that affect how a landform is observed. These directional forces 'flow' down the main spurs, ridges and convex landforms, and up into hollows, valleys and concave landforms. This perception of movement in landform holds true for all but the flattest landscapes where the eye is led across the horizon. Known as 'visual forces', these directions can be identified and analysed. The most prominent landform features have the strongest visual forces, and lesser forces relate to the more minor features (Figure 6.4.10).

Natural forests and other vegetation patterns tend to reflect the underlying landform. Upper treelines are lower on exposed ridges and higher in sheltered valleys. Forests look artificial when shapes and lines are imposed that cut across landform patterns, and fail to respond to visual forces. An example is where an upper forest margin follows a horizontal line (often a fenceline or ownership boundary) rather than an irregular margin that inflects by rising up into valleys and falling back on exposed ridges (Figure 6.4.11).

Identifying visual forces and using them to help shape a forest design ensures it will reflect the landform influence and fit in to the scene rather than contrast with it and create a disruptive visual effect (Figure 6.4.12).

Figure 6.4.10 **(a)** A landscape with dramatic landform in the Highlands of Scotland. **(b)** An analysis of visual forces demonstrates how the landform tends to draw our attention and how there appear to be directional movements associated with the ridgelines and valleys; our gaze is subconsciously attracted to the junction of the visual forces.

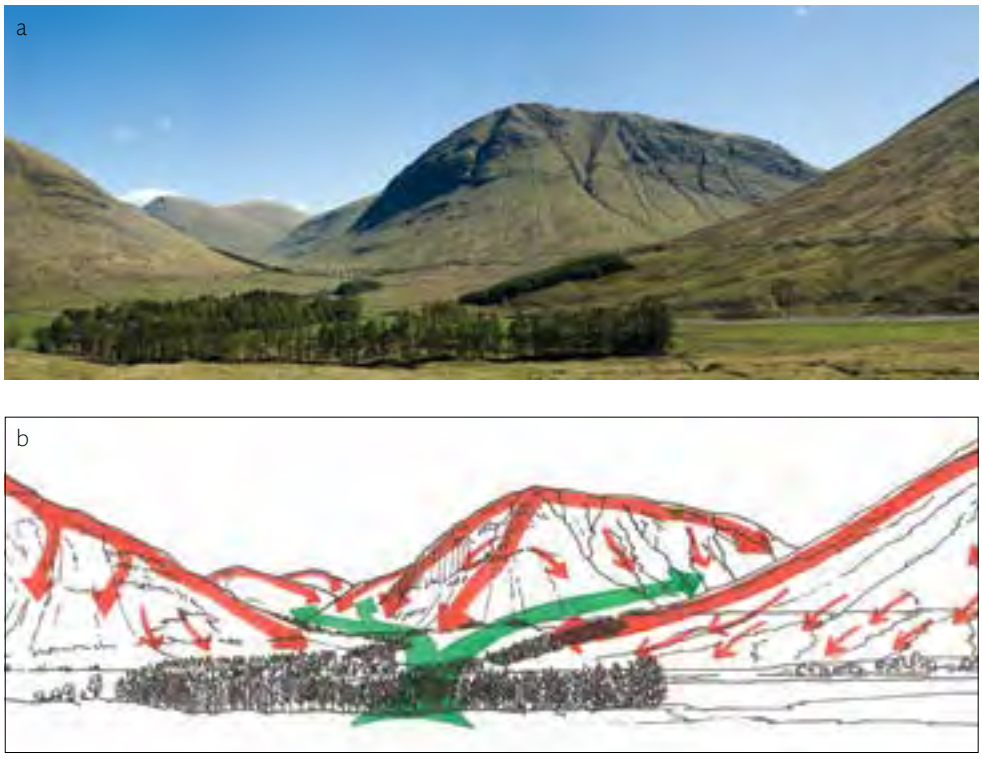


Figure 6.4.11
Landform and forest design.

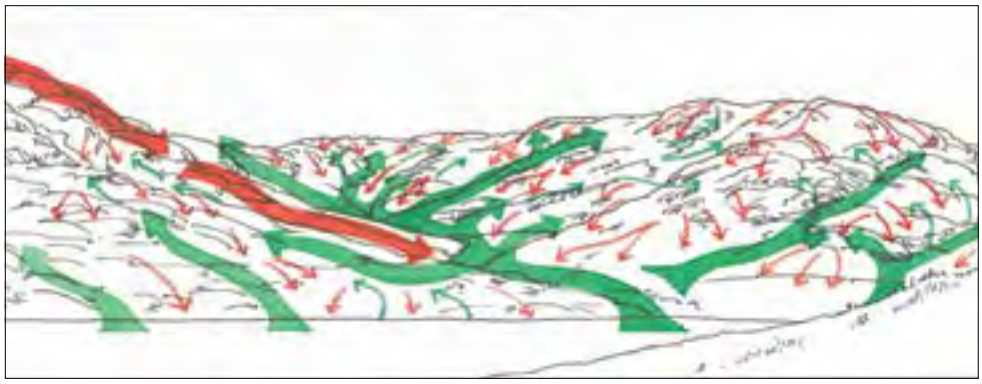
a. Two contrasting patches of woodland at Loch Fyne, Scotland. The natural colonisation on the left flows up the gullies; the geometric block on the right does not respond to landform.

b. This felling coupe has been designed to follow the landform, which is the major influence in this landscape. Loch Lomond and The Trossachs National Park, Scotland.

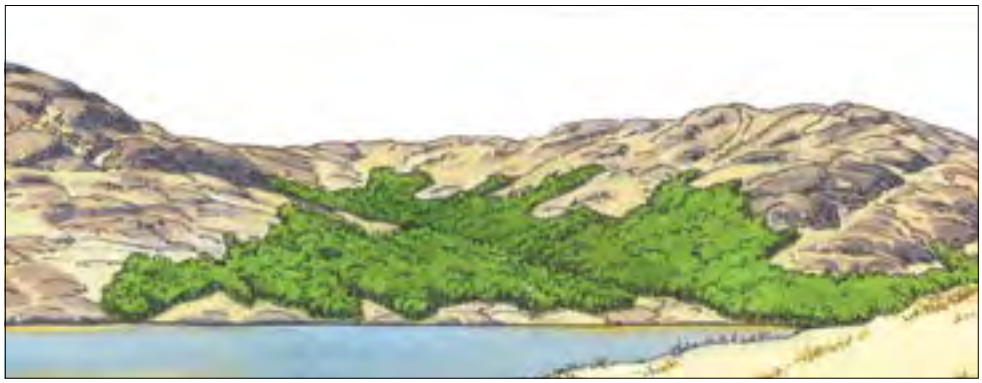
Figure 6.4.12
An example to show how landform and an analysis of visual forces can be applied to the design of the forest.

a. The original landscape.

b. The visual force analysis of landform using red and green arrows to follow the ridges and hollows, respectively. The strongest arrows illustrate the largest and most pronounced forms, the smaller arrows the more subtle shapes.



c. A woodland design based on this analysis, where the trees run up into the hollows and the open ground runs down the ridges.



19 Analyse the landform by identifying lines of visual force; use a combination of contour maps, aerial and perspective photographs or a digital terrain model of the landscape.

20 Design the edges of forest shapes, such as planting areas or felling coupes, so that they respond to landform by rising up into hollows following the upward forces, and flow down on ridges with the downward forces.

21 Vary the degree to which the shapes respond to the landform. The main woodland shapes should reflect the major landforms, and the more detailed design – such as edges and internal features – should reflect the minor landforms.

22 Avoid putting straight lines of forests across distinctive landforms or over skylines; where this is unavoidable, take forest margins across skylines at low points.

Pattern of enclosure

An enclosure pattern refers to the network of hedges, walls, ditches, fences and trees that define field boundaries in most of the lowlands and upland fringes of the British Isles. Enclosure has a historical and cultural value and is a cherished and distinctive visual feature of the UK countryside. Broadly, there are two main categories of enclosure, known as 'ancient' countryside and 'planned' countryside:

- Ancient countryside can be traced back to prehistoric times and is characterised by irregular field boundary shapes, winding lanes, hedges of many species, and patches of ancient woodland linked into the hedgerow pattern (Figures 6.4.13a; 6.4.14a).

- Planned countryside dates from when open common fields and other land were enclosed by the Parliamentary Enclosure Acts in the 18th and 19th centuries. It is characterised by a more geometric and regular patchwork of fields, simple hedges and plantation woodlands (Figures 6.4.13b; 6.4.14b).

In some landscapes the enclosure pattern is the dominant feature (Figure 6.4.15a); in others landform exerts a stronger influence (Figure 6.4.15b).

a. Ancient countryside

b. Planned countryside

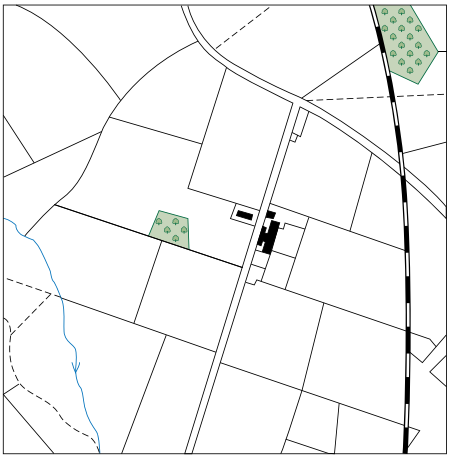


Figure 6.4.13 These diagrams illustrate the visual differences between 'ancient' and 'planned' countryside. **(a)** Shows the irregular fields and winding roads while **(b)** shows straight field boundaries and roads.

Figure 6.4.14 **a.** An example of ancient countryside in Dorset. Note the irregular field shapes and loose, dense hedgerows.

b. An example of planned countryside in East Lothian. Note the regular pattern of enclosure.

Figure 6.4.15 **a.** A scene in Herefordshire where the enclosure pattern is very strong and intact, providing a major influence in the landscape compared with the underlying landform.

b. Another Herefordshire scene where the hedgerow pattern has become weak through removals – as a result the landform is starting to exert a greater effect.

The first step in the forest design process is to assess whether the landform (see previous section) or enclosure pattern is dominant and should be the main influence on the design. Where the enclosure pattern is dominant, tree planting and woodland management can help reinforce the pattern, especially where hedges have been removed and trees have been lost. The layout and proportion of woods can be designed to reflect and add to the established pattern (Figure 6.4.16). New woodlands or areas of short rotation coppice can be linked into the pattern where hedgerows intersect by planting similar species and providing a degree of interlock.

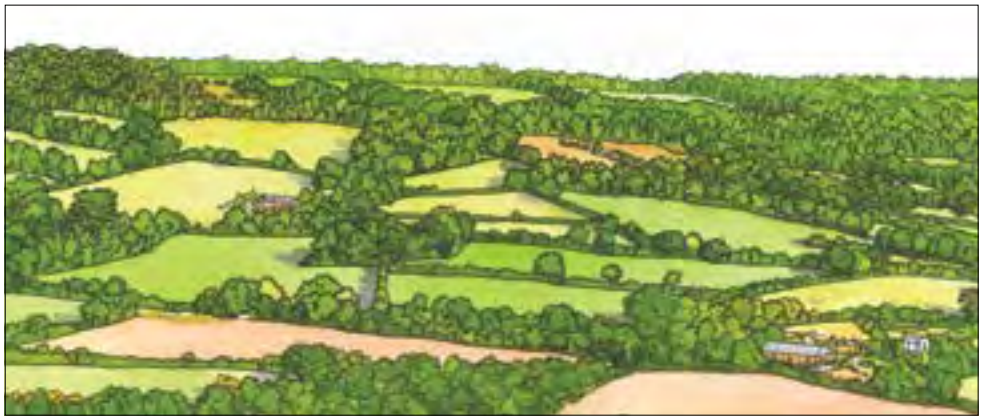


Figure 6.4.16 Designing woodland in landscapes with strong enclosure patterns.

a. A hillside in Devon where the enclosure pattern is strong and intact.

b. An illustration to show how extra woodland could be fitted in among the field pattern, enhancing it yet not creating a geometric woodland structure.

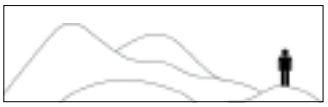
23 Analyse the enclosure pattern, and where it is the dominant influence in the landscape use it to guide woodland planning.

24 Use new woodlands to reinforce and extend the enclosure pattern; avoid the imposition of extensive forests in important landscapes that detract from the enclosure pattern.

Scale

Scale has a major effect on perception. In landscape, it is defined as the relative size of one visual element to another, and the relative size of the whole landscape to the observer. The scale increases with the elevation of the observer and the expanse of the view (Figure 6.4.17). Hilltops and higher slopes with open views present a much larger scale of landscape than the intimacy of restricted views on lower slopes and in valleys.

Figure 6.4.17
Scale is related to the size of the human figure. In this sketch the hills appear to be small **(a)** or large **(b)** in scale when compared with a human figure.



Scale is an important visual factor in fitting forests and woodlands into the landscape. This applies both to the forest or woodland overall and to its constituent elements, such as felling coupes, species compartments or open space. In assessing scale, the position of the viewpoint is all-important. In general, this results in small elements being appropriate in valley bottoms, on lower slopes and along lower woodland edges, whereas much larger elements fit in at higher elevations and on hilltops where the scale is greater (Figure 6.4.18).

Problems of scale in forest and woodland design may be caused by:

- a single felling coupe that is too extensive or a number of coupes that are perceived as a single element because previous restocking of felled adjacent coupes has not yet established (see General Forestry Practice);
- large-scale swathes of forest in intimate landscapes;
- small-scale unrelated elements at higher elevation;
- thin strips of woodland on skylines.

It is important to assess the scale of the landscape and to ensure that, as far as possible and within limits imposed by ownership boundaries and site fertility, the proposed woodland relates to landscape scale (Figure 6.4.19).

Figure 6.4.18 Examples of different scale landscapes.

a. A large-scale landscape in Wester Ross. The size of the cottages at the foot of the mountain gives a measure of the scale.

b. A medium–scale landscape in Argyll. The size of the trees becomes quite important relative to the size of the hills.

c. A small-scale, intimate and enclosed landscape at Faskally, Perthshire.

Figure 6.4.19 Scale and forest and woodland design.

a. A large-scale landscape in the border hills near Moffat in Scotland. The small patches of woodland seem to float and are too small for the scale.

b. Replacing the isolated woods with a single, larger area of woodland creates a better balance of scale.

There are four aspects to scale that can help with issues of visual design:

The rule of thirds can help to resolve the visual balance between elements such as woodland and open ground. When a landscape, or part of it, is seen as divided into two major elements, a ratio between them of one-third to two-thirds is usually the most satisfying visual proportion (Figure 6.4.20). This ratio also applies to proportions of visual elements within a wood, or the size of felling coupes – providing the resultant scale is commensurate with the landscape. The visual balance will change with the viewpoint – when applying the rule of thirds, priority should be given to the most important views.

Enclosure can be used to define space and break down the scale of the landscape (Figures 6.4.21, 6.4.22 and 6.4.23). This applies in flatter areas where the height of trees confines the view and creates a visual separation.

Nearness is a way to increase the apparent scale of small woodlands or clumps of trees and ensure they do not appear isolated and incongruous in a large-scale landscape. When woodland elements are positioned far apart they appear completely separate, but when relatively close together they tend to be seen as a group and the apparent scale is increased (see Figures 6.4.24 and 6.4.25).

Coalescence can also be used to give the appearance of a more heavily wooded landscape than is actually the case (Figure 6.4.23). Small woods and trees can be positioned so that they overlap each other when seen from important viewpoints (see Figures 6.4.26 and 6.4.27).

Figure 6.4.20 The rule of thirds.

a. The forest occupies more than two-thirds of the scene and leaves a small, poorly scaled open area at the top of the hill.

b. The forest and open ground are split 50:50 so that neither is dominant and a horizontal split occurs, despite the shape of the margin.

c. The forest occupies two-thirds of the visible area and the open ground one-third, which is more visually pleasing.

Figure 6.4.21
This diagram illustrates the concept of enclosure, where the space in the centre is separate from that beyond the green shapes.

Figure 6.4.22
A sketch showing how woodlands elements can enclose space, creating a smaller scale to the landscape. Enclosure is not complete – a space is still visible – but is sufficient for the viewer to sense that the trees enclose the space.

Figure 6.4.23
The trees coalesce and create a sense of enclosure in this view. They appear as a larger-scale element in the landscape than the area they actually occupy in plan.

Figure 6.4.24 These sketches illustrate the concept of nearness. **(a)** shows several woodlands separated by wide spaces so they appear to be isolated and not visually connected. **(b)** shows how they appear to be part of a group or unit when placed closer together.

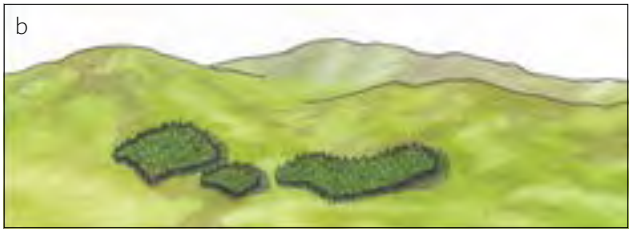


Figure 6.4.25
These woods are too far apart to appear as part of a group. They appear to 'float' in the landscape because they are too small in scale.

Figure 6.4.26 These sketches illustrate the concept of coalescence. **(a)** shows several woodlands separated by space in plan view. However, in **(b)** the perspective view shows that they appear to be part of one larger and better-scaled woodland.

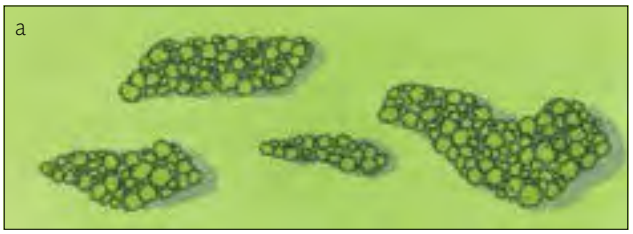


Figure 6.4.27
In this Gloucestershire landscape the separate woodland elements and clumps of trees seem to coalesce into a single wooded appearance.

25 Consider the relative size of woodland elements and aim to fit with the scale of the landscape.

26 Use smaller-scale woodland elements in valleys and progressively larger elements at higher elevation.

27 On hilltops and ridges, avoid narrow slivers or patches of both trees and open ground.

28 Consider a visual proportion of one-third to two-thirds where there are two main visual elements in important woodland views.

29 Make use of enclosure, nearness and coalescence to increase apparent scale and resolve design issues.

Diversity

Visual diversity refers to the number of different elements in a landscape or design. Landscapes in the British Isles have a high degree of diversity and this is described and classified in Landscape Character Assessments.

Diversity is a complex factor; it applies both to the wider landscape and to the constituent elements, such as woodlands. Diversity has many benefits for forest and woodland habitats and provides resilience in the face of climate change. In general, diversity creates visual interest and is welcomed (Figure 6.4.28a and b), whereas a lack of diversity can result in visual monotony (Figure 6.4.28c). However, it is not always the case that more diversity equates to a higher quality landscape (Figure 6.4.29); too much diversity can be visually confusing and appear cluttered, chaotic and incoherent – for example where many signs or advertisements compete for attention. It should also be appreciated that some landscapes have an intrinsic quality based on their very simplicity.

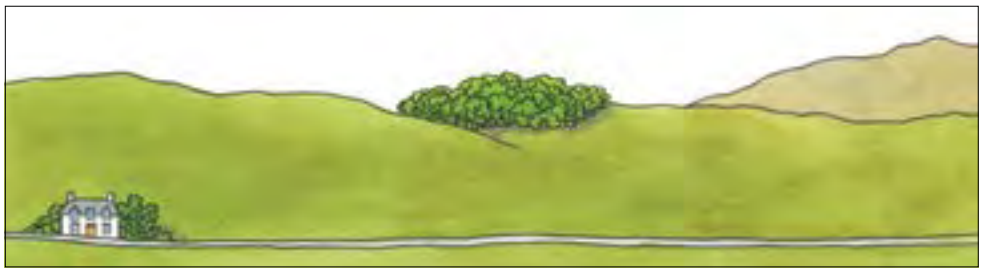
Figure 6.4.28 Examples of diversity in forest landscapes.
a. A forest landscape which has a lot of diversity, but not too much for the character of the landscape. The spring colours show this to good effect. Achray, Scotland.

b. A forest landscape with a good balance of diversity which reflects the background colours in the landscape, such as bracken on the upper slopes and the larch below. Dysynni Valley, Wales.

c. A forest landscape lacking in diversity – a large proportion of the scene is covered in evergreen conifer of the same age, colour and texture. Glen Orchy, Scotland.

Figure 6.4.29
Examples of increasing landscape diversity.

a. A simple landscape with little diversity.



b. An increase in diversity through additional woodland, field boundaries and a house.

c. Adding more and more elements of diversity can lead to a scene that looks visually cluttered or chaotic.

In the wider landscape, forests and woodlands introduce diversity into treeless scenery, but extensive uniform forests can hide landscape features and reduce visual diversity and habitat diversity. An assessment of landscape character will help identify the degree of diversity and the key characteristics within a given landscape type.

Within forests, public preference research shows a strong affinity for diversity (Figure 6.4.30). Internal diversity can be achieved by cultivating different ages, densities and species of trees – providing these are suited to site conditions. From a distance these will appear as a visual composition of contrasting textures and colours, with subtle changes marking the passage of the seasons. Diverse and graded forest edges, together with species mixtures, can help in creating visual diversity. Other landscape elements, such as water, wetland, rocky outcrops and open spaces, also contribute to woodland diversity and should be revealed and emphasised, rather than hidden within the trees.

Figure 6.4.30 A view of a very diverse forest where the pattern of different species reflected in the autumn colours makes the scene attractive without being chaotic or fussy. This kind of appearance reflects public preferences. Crafnant Valley, Wales.

30 Consider the appropriate level of visual diversity: this will depend on the location, scale and character of the landscape.

31 Match elements of diversity to the scale of the landscape. Use a greater number of small elements where the landscape is contained, such as in valleys, and progressively fewer and larger elements within simpler landscapes at higher elevations.

32 Emphasise natural features and non-woodland elements as part of the visual diversity of a forest.

33 Pay particular attention to the diversity of external and internal forest edges: vary the tree density and consider adding additional tree and shrub species.

Unity

Unity is achieved when the component parts of a design contribute harmoniously to the whole and all the visual design factors work well together. In landscape, this is achieved when the elements fit together well and relate to the landscape characteristics, and nothing looks out of place or unbalanced (Figure 6.4.31).

In forest design, unity means that the wooded elements should appear to be an integral part of the landscape, fitting in with or defining local character, and not standing out from it (Figure 6.4.32). Similarly, within a woodland itself, the various component parts should appear to fit together (Figure 6.4.33).

Figure 6.4.31 These sketches illustrate the concept of unity. The various elements in **(a)** are not compatible with the landscape or each other in shape, scale, colour and position. **(b)** shows how the woodland and the building could be better unified within the landscape.

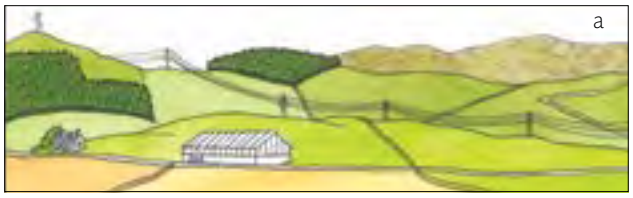


Figure 6.4.32
a. In this scene the various elements of forest sit uncomfortably on the hillside. The shape, scale and position of the woodlands detract from the unity of the landscape. Near Moffat, Scotland.

b. These felling coupes detract from the unity of the forest due to their geometric shapes, positions and overall proportion. They also make the forest itself stand out in the landscape. Ballachulish, Scotland.

Figure 6.4.33 This forest shows a strong sense of unity in the pattern of species shapes, their proportions, interlock and degree of diversity. County Down, Northern Ireland.

The interlock of shapes provides coherence to various patterns in the landscape by giving shapes a stronger visual connection to one another (Figure 6.4.34; see also Shape above). Interlock can be at a large scale, as in the broad pattern of open space and woodland, or at a very small scale, for example between two woodland tree species. A high degree of interlock gives more unity to a design (Figure 6.4.35).

Figure 6.4.34
The shapes on the left abut one another and do not interlock. The two shapes on the right interlock and appear as a single unit.

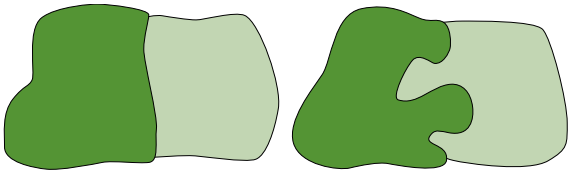


Figure 6.4.35 **a.** The forest on this hillside has an organic shape to its upper edge which interlocks quite strongly with the open hill above.

b. The patterns of different tree species in this view are organic in shape and strongly interlock with one another.

34 Apply the forest design principles, particularly shape, scale and diversity, to achieve unity in design proposals.

35 Design interlocking shapes with forest margins and edges to make the internal forest elements fit together and to tie the forest into the wider landscape.

Spirit of place

Spirit of place is linked with the factors affecting landscape context, but is included here as one of the well-established principles of forest design. It is a term for the intangible factor that gives a specific location special character and makes it unique to people. Often it is a combination of things, and it is important to identify what makes a place special so that this quality is not lost or damaged when changes occur. Dramatic landform or rocks, the presence of water (Figure 6.4.36), ancient trees (Figure 6.4.37), striking views (Figure 6.4.38), or a sense of wildness and tranquility, may all define a 'spirit of place'. Human elements, such as historical or artistic associations and archaeological elements, are also likely to contribute.

Trees themselves can be fundamental to the spirit of place, or the woodland environment may enhance the setting of other features, or the access to them. Forest design and management needs to be undertaken with sensitivity to ensure that changes enhance the special quality of a place rather than detract from it.

Figure 6.4.36
Waterfalls like this frequently have a strong sense of place. Dunkeld, Scotland.

Figure 6.4.37
These 'Ancient and Ornamental Woods' in the New Forest have a strong spirit of place.

Figure 6.4.38
An impressive view of Urquhart Castle and Loch Ness – a place redolent of history with a strong spirit of place. The forest in the background is integral to the setting and will appear in the many photographs taken by tourists.

36 Identify what makes a place special or unique and consider how forest design can conserve and emphasise these qualities, rather than detract from them.

6.5 People

Forests and woodlands provide wide-ranging and diverse benefits to people in the UK. In addition to supporting livelihoods and employment, either directly or indirectly, sustainably managed forests deliver a range of environmental and social goods and services. They can enhance biodiversity by providing wildlife habitats, mitigate the effects of climate change, and provide opportunities for access and recreation. Forests also have a role in our historical and contemporary culture and contribute to attractive landscapes.

Introduction

The history of forestry in the British Isles is different from many other European countries. The UK has a low proportion of forest cover – only 13% of land area compared with a European average of 45% – and much of that has been created over the last century to establish a timber resource. However, it has been increasingly recognised that forests and woodlands provide a range of other benefits in addition to the production of timber, and forest policies have widened to embrace the concept of multi-purpose forestry. Although timber production continues to be an important management objective in most forests, consideration of the full range of social and environmental benefits is now expected as part of good forestry practice.

The social benefits of forests and woodlands are particularly valuable in the UK, because of its high population density and demand for outdoor recreation. The main social themes have centred on:

- maintaining and increasing access and provision for recreation;
- maintaining livelihoods based on the production of forest products and services;
- encouraging public participation in forest decision-making processes.

More recently there has been considerable interest and progress on understanding the wider social benefits that well-managed forests and woodlands can deliver. These include:

- Opportunities for rural development.
- Improved health and well-being – time spent in forests has demonstrable benefits.
- Enhanced social integration and community development.
- Opportunities for the development of education and skills.
- Improved quality of life – especially in urban areas.

There has also been increasing recognition that the benefits of forests and woodlands can be delivered through community involvement in management and, in some cases, community ownership.

Access and recreation

Since the mid-20th century, government policy has been to promote access to forests and woodlands. Public access to forests led the way in terms of opening up the countryside to people – the first forest parks in 1935 predated the designation of the national parks. Today, general public access is available over the majority of the public forest estate and encouraged on other forest land. Recent years have seen new access legislation that builds on public rights of way in England and the tradition of access in Scotland. The Countryside and Rights of Way Act 2000 in England and Wales and the Land Reform Act 2003 in Scotland have greatly extended access to the countryside.

Woodland in urban areas is particularly valued for the access to greenspace that it can provide. The creation of new woodlands and provision of access to existing woodlands as part of urban access networks are key elements in contemporary urban planning. Woodland has also helped secure the restoration and regeneration of post-industrial areas.

Woodland in areas close to where people live and work has also provided opportunities for groups in society who may not have traditionally made use of them. In some areas, maintaining and extending public access to woodland has supported health campaigns involving walking or cycling routes to schools and workplaces.

Equality and diversity

Society in the UK is becoming more diverse and this is likely to continue. The Equality Act 2010 is designed to

promote equality of access to public goods and services for everyone and, for forestry, the essence of the legislation is to ensure that all members of society have the opportunity to share in the benefits that forests and woodlands can provide. Public bodies in Great Britain have a duty to actively provide opportunities for, and actively encourage participation by, all sectors of the community.

Rural development

Compared with 50 years ago, rural land-based occupations have dwindled. To address this, UK and EU policy lays emphasis on rural diversification; for forestry this means finding new services, products and markets that can support rural economies. This includes expanding the service economy, and in particular those enterprises related to recreation and tourism. Increasingly, partnerships with woodland owners, or in some cases community ownership, are providing scope for new forest-based businesses and community development. This includes vocational training such as traditional woodcrafts, and other life skills such as team building and management development.

Public involvement

The public is increasingly being encouraged to get involved in the decision-making processes of forest management and planning. However, the UK does not yet have as strong a tradition of communal ownership or management of forests as many other parts of Europe – although some areas, including the New Forest and Forest of Dean, do have long traditions whereby local people have involvement with the forest in some way. Many designated areas that encompass forests, and many publicly owned forests, now also have formal procedures providing for a public say in their management. Local people often have expertise and knowledge that can be of great value to forest managers; there are many examples where naturalists, historians and others with local knowledge are key contributors to forest planning and management.

New forms of forest ownership and tenure have started to emerge where community groups have taken on ownership or management responsibility for particular woodlands. Forest and woodland owners and the voluntary sector have developed processes of consultation and collaboration, which are designed to incorporate the views of interested parties into the forest planning process.

Community identity

Forests contribute to the local sense of place, and they can form part of the wider physical and cultural landscape. Local forest management practices, together with vernacular designs and materials, place forests within a historical and geographical context. Frequently, forests are a focus for cultural activities, traditional and new; these help to maintain and extend the role of a forest in contemporary culture and build a sense of community. Collaboration between forest owners can be advantageous in forest management, for example in controlling wildlife, and can also contribute to community cohesion.

Policy and context

This section provides further background, gives an overview of the developments relevant to forests and people, and summarises the main statutes. Further details of legislation and conventions are provided in Appendix 1.

Forest principles

The Statement of Forest Principles agreed at the Earth Summit in 1992 was the first global agreement concerning sustainability of forest management. One of the key principles was that forest resources and forest lands should be sustainably managed to meet the social, economic, ecological, cultural and spiritual needs of present and future generations. The UK made a commitment to apply the Forest Principles at the Second Ministerial Conference on the Protection of Forests in Europe in Helsinki in 1993.

Sustainable development

When the Brundtland Commission promoted the idea of sustainable development in its 1987 report during the World Commission on Environment and Development, one of the most significant changes it championed was the idea that people should be placed at the centre of things. Rather than seeing environmental protection and development as technical issues, there was a change in

emphasis which recognised that people's attitudes, opinions and behaviours impact on our aspiration to ensure a healthy environment for future generations. The definition of development also changed to include cultural and social dimensions that, alongside the economic aspects, were seen to contribute to people's quality of life or 'well-being'.

The meeting of the UN Conference on Environment and Development in Rio de Janeiro in 1992, and the work of the Helsinki and Lisbon conferences in 1993 and 1998, built on these perspectives. There was international acceptance that forestry had to be understood within its social context, and that people (individuals, communities and society) and their expectations and demands had to be considered as part of forest management.

Forests and people in the UK

This evolution in the international understanding of people's involvement with forestry has had implications for forestry policy and practice in the UK. Since the early 1990s, the UK Government has contributed to the international forestry policy processes and is a signatory to new forestry policy agreements at a European and international level.

In England, the Natural Environment White Paper *The natural choice: securing the value of nature* sets out the government's ambition to reconnect people and nature:

> 'We want to help more people enjoy the benefits of nature by giving them more freedom to connect with it. Everyone should have fair access to a good-quality natural environment. We want to see every child in England given the opportunity to experience and learn about the natural environment. We want to help people take more responsibility for the environment, putting people and local communities in control and making it easier for people to take positive action.'

The Land Reform (Scotland) Act 2003, the Land Reform (Scotland) Act 2016 and the Community Empowerment Act 2015 have strengthened the ability of communities to acquire land, including publically owned land.

In Wales, the Well-being of Future Generations (Wales) Act 2015 strengthens governance arrangements to improve the well-being of people in Wales. The Act puts in place a set of principles that public bodies must adhere to, which include collaboration and community involvement in decision making. The Environment (Wales) Act 2016 is intended to support improved resilience of natural resources and their use by society for a range of benefits for the long term. In this way it supports the Well-being of Future Generations (Wales) Act to ensure that present needs are met without compromising the ability of future generations to meet their own needs.

The Forestry Act (Northern Ireland) 2010 promotes and encourages the enjoyment and recreational use of departmental forest land by the public, including a right of pedestrian access, and promotes the social benefits of other woodland. Partnership arrangements between Forest Service and local government districts have resulted in significant new recreational and access facilities in Forest Service woodlands. Support for afforestation through the Northern Ireland Rural Development Programme 2014–2020 favours funding bids providing public access.

Forestry strategies and delivery mechanisms

UK forestry policy has sought to serve the national public interest since the establishment of the Forestry Commission in 1919. However, the nature of this public interest has changed with time and today's forest managers are expected to recognise the multiple benefits that forests and woodlands can provide, and to understand the different cultural, social and economic values placed on forest resources by the public.

The core principles of the *Scottish forestry strategy* are based on sustainable development and social inclusion to be achieved through a culture of 'forestry for and with people'. The Strategy aims to deliver three main outcomes including the 'improved health and well-being of people and their communities'. This commitment to support and develop the social benefits of forestry gives emphasis to community engagement and development, increased community ownership and involvement in forestry, and broader access to and use of forests. These priorities are supported by delivery programmes and incentives that encourage owners and managers to work more closely with local people and to provide opportunities for them to enjoy and benefit from woodland.

In Wales, the *Woodlands for Wales* strategy notes that woodland has long been recognised as a valuable setting for a wide range of community activities and public involvement for all sectors of society. Woodlands and forests can help to improve people's health and wellbeing, support community development and provide learning opportunities. In many cases the same activities also support economic objectives such as job creation and enterprise development. These jobs and businesses may involve the direct use of trees and timber products, or the use of woodlands as a setting for leisure and tourism enterprises - which are a significant part of the Welsh economy, particularly in rural areas.

The Strategy identifies four key outcomes where woodlands could improve the quality of life:

- more communities benefit from woodlands and trees;
- more people enjoy the life-long learning benefits of woodlands and their products;
- more people live healthier lives as a result of their use and enjoyment of woodlands;
- more people benefit from woodland related enterprises.

Delivery against the strategy is outlined in a shorter-term action plan, which lists the priority actions against these strategic themes. The latest action plan aligns with the frameworks set out in the Environment and Well-being of Future Generations Acts, and recognises the important role of woodlands, forestry and trees across rural and urban areas to delivering a range of well-being benefits for the people of Wales.

UKFS Requirements for Forests and People

Public rights of way

All four countries of the UK have legislation covering public rights of way. A right of way is a route along which the public have a right of passage. To be newly designated as a right of way, a route must meet certain conditions. These include that the route must have been used peaceably by the public for at least 20 years, it must connect two public places, and it must follow a more or less defined route. Some rights of way can cover long distances, for example historical drove or kirk roads; others may be shortcuts across fields or urban areas.

In England and Wales, highway authorities have a duty to maintain legally recognised maps of rights of way, usually shown on Ordnance Survey maps. The situation is similar in Northern Ireland, where district councils hold maps showing 'asserted' and 'alleged' rights of way. The landowner or land manager and the highway authority have responsibilities for rights of way that cross private land.

In Scotland, rights of way are recorded at a national level in the National Catalogue of Rights of Way. This was compiled by the Scottish Rights of Way & Access Society (Scotways), in partnership with Scottish Natural Heritage and with the co-operation of local authorities. The National Catalogue is maintained by Scotways and local authorities hold a copy of records for their area.

Rights of way must be respected and not obstructed.

In England, Wales and Northern Ireland, permission must be obtained from the local authority before gates or stiles are installed across public footpaths or bridleways; the landowner must maintain these in a safe condition.

Access to forests and woodlands

In England and Wales, there is no general statutory right of public access to woodland. However, the Countryside and Rights of Way Act 2000 provides for public access on foot to land mapped as 'access land' by Natural England or Natural Resources Wales. The Act also allows for owners, or long leaseholders, to dedicate their woodlands voluntarily as access land in perpetuity. Access land includes 'open country' (generally mountain, moor, heath and down), registered common land or land that has been voluntarily dedicated by its owners for public access. In addition, the Act updates and amends the law relating to public rights of way. The Act also enables an owner to restrict access in some circumstances by a Direction granted by a relevant authority.

In Scotland, the Land Reform (Scotland) Act 2003 establishes a statutory right of responsible non-motorised access, for recreational and other purposes, to land and inland water throughout Scotland with few exceptions. This right allows people to pursue recreational, relevant educational, and certain commercial uses of the countryside; it covers a wide range of activities such as walking, cycling, canoeing, horse riding and ski touring. Access rights are not exercisable over some land, including land used wholly for cultivation of tree

seedlings in beds or on which building, civil engineering or demolition works are being carried out. Detailed guidance for the public and landowners can be found in the Scottish Outdoor Access Code.

In Northern Ireland, the Access to the Countryside (Northern Ireland) Order 1983 gives district councils the power to enter into public path creation agreements with landowners to create public rights along linear routes, and access agreements permitting persons to have access to 'open country' (land consisting wholly or predominantly of mountain, moor, heath, hill, woodland, cliff, foreshore, marsh, bog or waterway) for responsible recreation. The Forestry Act (Northern Ireland) 2010 provides a right of pedestrian access to land managed by the Forest Service, subject to byelaws. There is also considerable informal access to the countryside that takes place outside the above.

In England and Wales, responsible access must be allowed on mapped access land, including woodland dedicated under the Countryside and Rights of Way Act 2000, unless a Direction is in place to restrict or exclude access.

In Scotland, the provisions of the Land Reform (Scotland) Act 2003 must be complied with, including access rights to woodland; people must not be obstructed from using their access rights responsibly.

In Northern Ireland, the provisions of the Access to the Countryside (Northern Ireland) Order 1983 must be respected; this provides for access agreements between landowners and district councils, where there is a duty to permit the public to have access to open country for responsible recreation.

In addition to statutory rights of access, many owners permit or encourage additional public use of their forests and woodlands. This may be for recreation or other uses, sometimes traditionally exercised over many years. The provision of visitor facilities and site interpretation can help manage access and increase the public benefit.

The Active Travel (Wales) Act 2013 seeks to make it easier for people to walk and cycle in Wales as an alternative means to motorised transport for everyday journeys. Any forestry paths that connect settlements and provide links to destinations such as schools and workplaces should be considered for development as potential active travel routes.

Forests and woodlands are sometimes subject to irresponsible use, including trespass, damage, arson, tipping and vandalism. Such anti-social behaviour can damage the woodland environment and is a nuisance to other members of the public.

Landowners and managers should consider providing access to their woodland, in addition to that required by statute.

Where uses of woodland are established by long tradition they should be respected and allowed to continue, providing the use is sustainable and not detrimental to management objectives.

Where public access for recreation and other responsible uses is well established and recognised as a public benefit, or a potential benefit, consideration should be given to the design and provision of appropriate facilities.

Reasonable steps should be taken to discourage anti-social behaviour; where anti-social behaviour continues, the local authority or police should be informed and advice sought.

Equality in service provision

Equality is about creating a fairer society, where everyone can participate and has the opportunity to fulfil his or her potential. Equality is supported by legislation designed to eliminate unfair discrimination against different groups in society. In Great Britain, the Equality Act 2010 protects people with disabilities and other defined 'protected characteristics' (see Glossary) from being discriminated against in the provision of all facilities, goods and services. The Act describes a wide range of illegal discrimination and makes a requirement for reasonable adjustments for disabled people to allow them access to facilities, goods and services. For public sector organisations such as the Forestry Commission and Natural Resources Wales, the Act has an impact on forestry policies and on the management of the public forest estate, for example in the provision of forest access and recreation. Activities that affect people which are carried out by public bodies, or supported by public funds, may be subject to an Equality Analysis. This is required to demonstrate that the interests of groups with protected characteristics have been accommodated. In implementing forestry policies and setting standards, the forestry authorities will address equality and diversity to ensure that all requirements are fulfilled.

In Great Britain, the Equality Act 2010 must be complied with in the provision of facilities, goods and services.

Employment and health and safety

Landowners and managers need to be fully aware of their obligations under both employment and health and safety legislation. This is extensive and includes equality of treatment for recruitment processes and contracts, and a duty of care for staff while at work. There is also a duty of care towards people visiting business premises or land, whether they are there with permission or not. In some circumstances volunteers may legally be considered as employees, whether engaged directly by the landowner or undertaking activities for a third party.

In Great Britain, the Equality Act 2010 is the major piece of legislation that brings together a wide range of previous legislation in the area of employment. The Act provides a legal framework to protect the rights of individuals with protected characteristics, to advance equality of opportunity and to tackle inequality and discrimination. The Act simplifies, strengthens and harmonises previous legislation and provides Britain with a discrimination law that protects individuals from unfair treatment and promotes a fair and more equal society. In Northern Ireland, changes along the lines of the above may follow.

In addition to the Equality Act, the main employment-related legislation includes:

- Occupiers' Liability Acts 1957 and 1984
- Occupiers' Liability Act (Northern Ireland) 1957
- Occupiers' Liability (Northern Ireland) Order 1987
- Employer's Liability (Compulsory Insurance) Act 1969
- Health and Safety at Work etc Act 1974
- Health and Safety at Work (Northern Ireland) Order 1978
- Management of Health and Safety at Work Regulations 1999
- Management of Health and Safety at Work Regulations (Northern Ireland) 2000
- Reporting of Injuries, Diseases and Dangerous Occurrences Regulations 1995
- Reporting of Injuries, Diseases and Dangerous Occurrences Regulations (Northern Ireland) 1997
- National Minimum Wage Regulations 2015
- Modern Slavery Act 2015

The rate of accidents within the forestry sector has always been a cause for concern. Addressing this concern requires attention to safety protocols and training, and a commitment to the health and well-being of the workforce. Guidance on managing health and safety in forestry is produced by the Forest Industry Safety Accord (FISA).

7 Those responsible for forestry businesses and activities must be aware of the range of legislation relating to employment and ensure compliance.

8 Responsibilities under health and safety legislation must be complied with in relation to employees, contractors, volunteers and other people who may be affected by their work.

9 Safe working practices must be implemented, and the safety of plant and machinery must be ensured, as set out in legislation and the guidance produced by the Forest Industry Safety Accord (FISA).

10 Insurance must be in place where it is a legal or contractual condition in relation to employment, third parties and public liabilities.

Visitor health and safety

The Occupiers' Liability Acts 1957 and 1984 in Great Britain and the 1957 Act and 1987 Order in Northern Ireland direct landowners and managers to ensure that visitors to forests and woodlands are not put at risk. This includes visitors exercising rights of access or using permissive ways and dedicated land, and also covers responsibilities to people who are not invited or permitted to be on the land in question. In this case, a duty of care still exists if:

- the landowner or manager is aware of a danger or risk, and it is known that people may be in, or come into, the vicinity of the danger;
- the risk is one against which the landowner or manager may reasonably be expected to offer some protection.

The landowner or manager must discharge their statutory duty of care in relation to people visiting land, whether or not they are there with permission.

In England and Wales, reasonable care must be taken to ensure the safety of visitors using permissive ways and land dedicated under the Countryside and Rights of Way Act 2000.

Forest environments can present a range of natural and man-made hazards that could put visitors at risk. Natural hazards include old trees and unstable rock faces. Man-made hazards include quarries, mineshafts and abandoned structures, as well as potentially hazardous activities such as forest operations, pest control measures and some sports.

The Forestry Commission has produced detailed guidance, endorsed by FISA, on managing public safety in relation to forest operations, such as that required for harvesting sites. This includes the definition of roles and responsibilities and the selection and management of control measures – for example, diverting routes and providing information and signs.

Hazards that pose significant and foreseeable risks to visitors should be managed to ensure the risks are minimised, whether or not the area is open to the public.

All those involved in forestry should be familiar with and follow industry standard health and safety guidance on managing public safety.

Public involvement and local livelihoods

Before approval by the forestry authority, proposals for felling or planting are made available for public comment. Arrangements for this vary across England, Scotland, Wales and Northern Ireland. Where an Environmental Impact Assessment is required, the consultation processes are extensive. Although these arrangements are appropriate for the majority of proposals, taking further steps to involve people who have a recognisable interest in a proposal can help improve the social benefits of an activity. In Scotland, the Land Reform (Scotland) Act 2016 makes provision for the development of guidance by the Scottish Government for engaging communities where land-use decisions will affect them.

The Equality Act 2010 encourages public engagement and consultation in all planning and decision making that can have an effect on people. The engagement is intended to be inclusive and involve people from the protected characteristic groups in all relevant communities of interest, both existing and potential. Such engagement will help ensure that the facilities, goods and services provided are suitable for the widest range of people.

Forest and woodland-based enterprises of all types make an important economic contribution to the local economy. This can be particularly important in supporting rural livelihoods and providing new economic activity in regenerating urban areas.

Consideration should be given to involving people in the development of forestry proposals who have a recognisable interest in the proposal or its outcomes.

Consideration should be given to promoting and facilitating local forest and woodland-based enterprises and economic activities.

UKFS Guidelines on Forests People

The table below introduces factors important for forests and people. The Guidelines that follow provide more information on how to comply with the UKFS Requirements, grouped by the factor headings.

Factor	Importance for people
Public involvement	Involving the public in forest management or ownership can enhance the role of forests and woodlands in community identity, contribute to cultural values and help to build supportive relationships.
Accessibility	Access to woodlands is a public benefit that can improve people's health and well-being. It can generate public understanding and support for forest management.
Visitor information	Information can be provided to encourage access, manage risk, influence behaviour and improve the visitor experience.
Recreation	Forests and woodlands offer opportunities for a variety of formal and informal recreational activities that can support tourism and provide a useful community asset.
Traditional and cultural uses	Important cultural traditions are linked to woodland resources, such as the collection of firewood, berries and mushrooms.
Education and learning	Experience of the outdoors can lead to an increased interest in the natural environment, respect for flora and fauna, and an increased understanding of sustainable forest management and the benefits of growing and using trees.
Volunteering	Volunteering, community work and initiatives with an environmental and conservation focus can benefit woodland management as well as the individuals and communities involved. Voluntary work can lead to individuals participating more widely in society.
Vandalism and anti-social behaviour	Vandalism can damage woodland ecology, make woodlands seem unattractive or threatening, create risks for woodland managers and members of the public, and encourage further anti-social behaviour.
Enterprise development	Forest and woodland enterprises can help sustain communities and livelihoods.

Public involvement

Local people and interested parties can offer valuable knowledge and insights that can be of great assistance when formulating forest management proposals. Moreover, developing a proactive dialogue can help improve decisions, implement forestry proposals more effectively, and lead to a culture of co-operation and support. A range of models has been developed by the Forestry Commission to describe the increasing levels of public involvement from providing information through to community management or ownership; in some parts of the UK there are successful examples where forest land has been made available for community leasing or outright ownership.

Before approval, most forestry proposals are subject to a consultation procedure and available for public comment. Where the proposals are significant, an Environmental Statement is likely to be required and consultation processes are more extensive. For the public to be involved in forest planning, clear information is required in a form that suits their likely levels of knowledge and expertise. The objectives for consultation need to be shared to ensure all those involved are clear about their role and how their input will be used. Public participation does not mean that the public has a veto on forest management decisions.

For forests and woodlands where access is provided and recreation encouraged, public support and understanding can be fostered by good communication with interested parties and users of the forest. This can help with issues such as temporary closures due to forest operations, and dealing with anti-social behaviour.

Forests and woodlands can have a profound effect on the local landscape and in many situations contribute to the character and the 'sense of place' felt by local communities (see Forests and Landscape). When planning public engagement, it is important to consider all groups in society, including those with protected characteristics. Where public bodies introduce changes that affect people, an Equality Analysis will be required.

1 Consider engaging with the local community by seeking their views, developing proposals that are responsive to them and building co-operative partnerships.

2 As part of the forest planning process, consider which individuals and organisations from all groups in society may have an interest in the formulation of forest management proposals, or something to contribute.

3 Aim to communicate forestry proposals and their operational impacts clearly; consider presenting several options and try to accommodate local needs where they are compatible with management objectives.

4 Consider the cultural significance of woodland features, taking account of local opinion, and develop measures to protect important features in forest management plans.

Accessibility

Access is a major public benefit provided by forests and woodlands. There are legal obligations relating to the provision of access in all parts of the UK, as set out in the UKFS Requirements for Forests and People. In all four countries, greater public access is an objective of forestry policies and strategies. Woodland visits help build an understanding and appreciation of the forest environment. Access to woodlands can be particularly beneficial for people from urban areas, people from disadvantaged social backgrounds, and people with disabilities or any other protected characteristic.

Where public access is provided, incorporating an overview of arrangements into the forest management plan allows a strategic view to be taken and access to be zoned. For more significant access, a risk assessment will be necessary to show that the duty of care towards visitors has been considered. As part of this, regular inspections together with records of work done will help minimise risks to the public and demonstrate that appropriate actions have been taken. This will include inspections of potentially dangerous trees in areas that are more intensively used by the public or adjacent to facilities such as car parks.

5 Consider increasing public access to forests and options for how this could be achieved.

6 Ensure all members of society, including hard-to-reach groups, those with protected characteristics and those who may not have been traditional users, are considered when planning the provision of access.

7 Where public access is significant, consider producing an access management plan that involves regular inspections of the main routes used for public access and any facilities provided; a risk assessment to identify potential woodland hazards and to ensure action is taken to minimise risks; and a system for recording data on inspections, work undertaken, and any accidents and incidents.

Visitor information

The provision of information for visitors can range from simple waymarks and signs to visitor centres with a range of educational and other resources. Signs and notices are important for managing visitor access as part of an access management plan, including the zoning, where appropriate, of conflicting activities. The public also needs to be made aware of temporary closures of access routes due to forest operations and alternative routes to take.

Information is also useful to help people plan their visit and find out which routes and facilities are most suitable for them. For example, details of route lengths, path surfaces, walk gradients and the availability of facilities such as handrails, benches and toilets will help many people. In providing such information, the needs and interests of different groups in society are an important consideration and may have a bearing on the format or language used. Considering alternative formats such as pictograms, Braille, large print and audio can help those with learning difficulties or visual or hearing impairments.

Public enjoyment and educational value can be enhanced by providing information about the forest environment and location. A simple leaflet can make visitors feel welcome and

on-site interpretation can be supplemented by off-site information such as websites. The provision of accessible information can also influence visitor behaviour (e.g. biosecurity awareness), as can codes such as the Scottish Outdoor Access Code or the Countryside Code in England and Wales.

8 Provide signs and information in order to manage visitors' use of forests; guide visitors away from hazards and help avoid conflicting uses in the same area of forest.

9 Where access is restricted due to forestry operations or other potential hazards, provide and maintain clear signs to inform people of the restrictions.

10 Provide information that will help people to plan their visit, in consideration of disabilities and other special requirements.

11 Consider how signage and interpretation can be used to enhance visitor experience for all groups in society.

12 Consider the guidance on signage provided by the Forestry Commission, local authorities and other specialist organisations dealing with access and accessibility issues.

13 Promote codes of responsible access.

Recreation

Recreation, sports and tourism can contribute to people's health, well-being and sense of identity – in addition to enhancing their enjoyment of the outdoors. The provision of recreational goods and services associated with woodland activity contributes to local tourism, sustainable community development and quality of life. It also provides opportunities for people to develop new knowledge and skills.

Forests have the capacity to absorb large numbers of people, while maintaining an experience of nature without a perception of overcrowding. This is particularly important in or near urban areas, where woods can provide valuable greenspace. Forests provide an ideal environment for many types of activities such as horse riding, mountain biking, orienteering, walking and running; rural woodlands are also important in providing for the pursuit of traditional country sports such as shooting. Some woods are suited to organised events such as mountain bike races, car rallies or paint-balling. Zoning the various activities, and leaving some quiet areas, as part of the forest management plan will ensure that incompatibility between various pursuits and damage to the environment is minimised.

There is an increasing understanding that sustainable health requires not only effective medical approaches but also healthy environments and lifestyles. Medical referrals for programmes of activity are becoming more widespread in the UK. These referrals can be to a leisure centre or gym, or for greenspace activity. In this respect, woodland is well placed to provide spaces for people to improve their health through physical activity or by contributing to a sense of mental and social well-being.

Policies and incentives are in place to encourage recreation in all woodlands, and a range of guidance is available on the detailed design of recreation facilities. Designing facilities together with local communities will help ensure the facilities are appreciated and respected by all groups and interests. Safety is an important consideration, especially in urban areas where the design of the woodland itself can be used to improve safety and, in particular, a user's perception of safety.

14 Consider providing facilities for public recreation within forests and woodlands and how these can be managed.

15 Where recreation use is extensive, consider how activities can be zoned or timed to minimise potential conflicts between different interest groups.

16 Consider developing partnerships with health interests to establish and promote forest recreation activities in relation to health and well-being.

17 Take account of environmental objectives and the impact of recreation on susceptible wildlife, especially at critical life stages such as breeding, nesting and flowering.

Traditional and cultural uses

Some traditional uses of woodland include rights of pannage (feeding pigs on acorns and similar), estovers (taking wood), turbary (taking peat or 'turf') and agistment (grazing). There are also many low-key informal uses that are not defined as rights, for example the collection of fruits, berries, fungi and other seasonal products – although in Scotland the Land Reform Act 2003 and Outdoor Access Code established and extended these benefits as a statutory right. Woodland also provides cover for game, and traditional country sports take place in many woods across the UK. Another traditional use of woodlands may be to visit well-known natural or built landmarks. Other than in Scotland, access to these may be at the discretion of the landowner. Some religious and immigrant cultures have strong links to nature and trees and value access to forests and woodlands to celebrate traditional festivals.

All these woodland uses are important in encouraging healthy recreational activity, maintaining traditions and developing connections between different cultures and the local environment. The benefits of such uses also extend to increasing understanding and appreciation of local woodlands and the plants and animals they contain.

18 Consider permitting the use of forests for sustainable low-key community uses, especially where such uses are linked to cultural activities or are established by tradition.

Education and learning

Natural play for children is an important aspect of the learning process. Building dens and climbing trees can help with children's personal and social development as they learn to take considered risks and interact with others. In addition, natural play can help people with learning difficulties or mental health issues and can assist in the rehabilitation of vulnerable at-risk adults and offenders. Forests and woodlands provide a dynamic and stimulating resource for education and learning for all groups in society.

Guided walks and interpreted trails can provide learning opportunities in woodlands. Contact with the outdoors often leads to an increased interest in the natural environment, respect for plants and animals, a greater understanding and knowledge about forestry and the benefits of forests, woodlands and trees, and the effects of climate change on tree health and resilience. In addition to the natural environment, forests provide learning resources for subjects such as mathematics, geography and orienteering, and natural play can help develop social skills, confidence and a sense of worth.

19 Consider permitting or promoting the use of forests for education and learning activities of all kinds.

20 Consider providing, or encouraging others to provide, educational interpretation for visitors – especially if a particular wood has distinctive ecological, historical or cultural features.

Volunteering

Voluntary work in woodlands can extend to a wide variety of tasks, from manual work, such as coppicing or building paths, to leading guided walks and talks. Volunteering in the form of tree planting is a popular activity, particularly for schools and communities. The roles and tasks that volunteers undertake have increased as the ownership or management of woodlands by community groups and voluntary organisations has increased. Volunteering can generate benefits for all members of society, as well as contributing to woodland management and providing assistance to the landowner or manager.

Volunteers can learn a variety of skills through their activities. It can be a means for people to develop new skills that will help them find employment; young people about to enter the job market increasingly rely on volunteering to demonstrate their willingness and interest in a particular field. Older people may also use volunteering to help them find new employment, or simply to maintain their fitness or increase their community involvement. The number of retired people is increasing in the UK; people in retirement often have time, skills and knowledge to offer and value the opportunity to contribute.

However, a duty of care rests with the landowner or manager for all visitors to woodlands, and there are liabilities associated with the employment of volunteers. It is important that the legal status of both managers and volunteers is understood as it encompasses safety and security and can extend to employment rights if volunteers have a contract or any form of payment beyond expenses. The involvement of children and more vulnerable adults needs specific planning; disclosure procedures apply in each country and written policies covering vulnerable groups will be needed.

21 Consider providing, or encouraging others to provide, opportunities for volunteering in woodlands, particularly from groups who would benefit most, such as young, old or disabled people, or those who have not traditionally used woodlands.

22 Manage the health and safety of volunteers and follow appropriate procedures in working with young people and vulnerable people; ensure that landowners' or managers' liabilities in relation to volunteers are understood and insurance policies cover their activities.

Vandalism and anti-social behaviour

Vandalism can be a problem in forests and woodlands; trees can screen anti-social behaviour and make illegal activities such as fly-tipping less visible. The police may be able to help in dealing with some of the issues particularly where the behaviour is of a criminal nature. In Scotland the Land Reform (Scotland) Act 2003 provides landowners with rights to restrict access if visitors to land continue to behave unacceptably.

The design of the forest, particularly the layout, access and design of facilities, can help control unacceptable behaviour. Places that are little used or are out of sight can be more susceptible than those that are regularly used or are on view. Fly-tipping is most prevalent in places that have easy and unseen vehicular access. Evidence suggests that once vandalism, fly-tipping or littering have occurred, recurrence is much more likely. Prompt action to deal with it is therefore considered the best management response.

Fly-tipping and dropping litter are offences although the legal provisions vary across the UK. In the absence of prosecution, it ultimately falls to the landowner to clear up, although it is advisable to inform the local authority and seek their help to deal with the problem. Where forests and woodlands are at risk, good maintenance and regular visits to check for damage will generally result in reduced vandalism and anti-social behaviour. In addition, encouraging access and engaging with local communities can help win their support in keeping woodlands free of problems. There are a range of campaigns and initiatives aimed at tackling anti-social behaviour and advice can be obtained from the local authority. Unpopular behaviour is not necessarily anti-social and care must be taken not to stigmatise people or groups on the strength of complaints from other users.

23 In forest management plans, use design solutions to mitigate the problems of vandalism and anti-social behaviour.

24 Where vandalism or litter occurs, aim to act promptly to remedy the situation and thus remove the likelihood of further problems.

25 Encourage regular users of woodland to act responsibly and report emerging problems so they can be dealt with quickly.

26 Co-operate with public agencies and partnerships to manage the misuse of woodlands; consider working with others to develop community policing or wardens in areas where problems are significant.

Enterprise development

Forest and woodland-based enterprises provide social and economic benefits and can make an important contribution to the sustainability of communities. Forests and woodlands can be seen as a resource for the basis of a wide range of activities, whether these are undertaken directly by the landowner or in partnership with other businesses.

Traditional woodland enterprises, in addition to timber, include country sports such as hunting, shooting and stalking, and the production of venison, charcoal, crafts and

firewood. There are also opportunities in the provision of recreation, adventure play, fitness, team building and other commercial leisure activities, which all add value to the local economy.

Forests can also make a major contribution towards the tourism and recreation resource. This can bring people into an area and benefit a range of local businesses such as shops, restaurants and hotels. The role of forests and woodlands in this respect is increasingly recognised by bodies responsible for planning local and regional development.

Consider the potential for developing sustainable woodland-based businesses and livelihoods and how this might be explored with interested parties and through local co-operation.

6.6 Soil

Soil is a fundamental component of the forest ecosystem. It is a complex and variable medium comprising mineral particles, organic matter, water, air and living organisms. The characteristics of soil largely determine the nature of the flora and fauna that sustains the world's terrestrial biodiversity and its productive potential. It is a vital resource that must be used in a sustainable way to ensure it can continue to perform its many functions.

Introduction

Geology, topography and climate all play a part in creating the many different soil types found across the British Isles, which often vary within short distances. The physical, chemical and biological properties of soils are continually modified by a number of natural processes, which include leaching, waterlogging and the addition and decomposition of organic matter. Soil is a valuable habitat in itself and it forms a living system that includes organisms belonging to many plant, animal and microbial species.

The actions and complex interactions of soil biota help to maintain the nutrient, energy and water flows that support the forest ecosystem. Soils provide an important filtering and buffering action that protects other parts of the ecosystem from pollution and damage and they can be a major source or sink of carbon dioxide and other greenhouse gases. Some of the least disturbed soils in the UK are found in ancient woodlands, since they have been untouched by agriculture for hundreds of years.

Forest soils

For the purpose of the UK Forestry Standard (UKFS), 'forest soils' are defined as those soils supporting forests and woodlands, including post-industrial, or brownfield, soils that are being restored. Historically, British forests tend to have survived on, or have been planted on, ground of generally poorer quality than agricultural land, for example steep slopes, seasonally waterlogged peats and gleys, infertile podzols and ironpan soils (see Definitions of terms in Box 6.6.1). A small proportion of forests are located on better, well-drained brown earth soils, particularly in England and Wales. Woodlands created in recent decades for social and environmental reasons have often been established on a wider range of soil types, including restored or brownfield soils.

Box 6.6.1 Definitions of terms

Brown earth A type of soil having a brown humus-rich surface layer.

Gley A soil that is permanently or periodically waterlogged, lacking oxygen and characterised by its blue-grey colours, often mottled with orange-red.

Ironpan A soil with a hardened impervious layer, in which iron oxides are the chief cementing agents, that impairs drainage and plant growth.

Peat A largely organic substrate consisting of partly decomposed plant material forming a deposit on acidic, boggy ground.

Podzol An infertile acidic soil having an ash-like subsurface layer (from which minerals have been leached) and a lower dark stratum, where organic carbon has accumulated, occurring typically under heathland and some temperate coniferous woodland

Forest soils are slightly acidic, unless underlain by calcareous rock. Inputs of atmospheric pollutants, particularly sulphur and nitrogen, can have significant impacts on acidity and also on nutrient status. Forest soils naturally have a high organic or carbon content, on average about 75% of total organic carbon contained in the forest. Climate change has the potential to affect forest soil function both directly and indirectly. Rising temperatures can accelerate mineralisation rates and soil nutrient availability, while nutrient leaching may be enhanced by higher winter rainfall. Increasing soil moisture deficits in summer could decrease both nutrient uptake by trees and leaching losses. The risk of physical soil disturbance may increase as a result of greater winter waterlogging and windthrow, especially if the frequency of storm events increases. All of these effects will have implications for the nutrient and carbon balance of forest soils.

In general, woodland soils have low and infrequent levels of disturbance, particularly under continuous cover management systems. However, some forest management activities, for example planting, harvesting, and moving

and stacking timber, can have impacts on forest soils. Engineering works, such as the building of roads and bridges involve soil movement and disturbance. More subtle changes to forest soils can be induced by species choice, stocking density and brash management. Some forestry practices, for example cultivation and drainage, may also result in a short-term loss of soil carbon until this is replaced over the rotation as forests grow (see Forests and Climate Change). Deep peat soils are particularly vulnerable to disturbance and woodland establishment can result in a net loss of stored carbon.

Brownfield soils

Brownfield soils are those that have been used for industry or development in the past. They are likely to have been substantially modified physically, chemically and biologically by their previous use. Forests provide a way of reclaiming post-industrial areas and establishing a productive and environmentally beneficial resource. However, the restoration of brownfield sites can present a range of problems: the soils can be very acidic or very alkaline, contain toxic compounds or low levels of organic matter, and be either too compact or too loose. Successful restoration often requires intensive management and the importation of soil or soil-forming materials from elsewhere.

Forest soils and ecosystem services

The term 'ecosystem services' is derived from the UN Convention on Biological Diversity (UNCBD). It describes how ecosystems and the biodiversity contained within them produce a range of resources useful to people. Forest soils provide a number of ecosystem services including:

- A store of carbon: organic matter is accumulated in the soil itself and in the wider forest ecosystem that soil supports.
- A growing medium for trees: forest soils provide physically and chemically for tree growth and forest products.
- Water management: the high infiltration capacity of most forest soils helps to reduce rapid run-off, with potential benefits for managing local flooding and controlling or abating diffuse pollution.
- A historical archive: forest soils may contain archaeological and palaeo-environmental evidence of the past.
- Revitalisation of derelict or neglected land: the establishment of woodland and development of forest soil on derelict or neglected land can play a vital role in economic regeneration, particularly in and around towns.
- Habitat creation and restoration: forest soils support the creation and restoration of habitats for woodland flora and fauna and soil biodiversity.

Maintaining these ecosystem services remains a challenge, and work is underway to develop methods for assessing the specific role of soils in their delivery.

Policy and context

This section provides further background, and gives an overview of the main developments relevant to forests and soil. Further details of legislation and conventions are provided in Appendix 1.

International agreements

The UK is a signatory to several long-standing international agreements and processes specifically aimed at the protection and sustainable use of soil. These include the FAO World Soil Charter, which was updated in 2014, the 1992 UN Conference on Environment and Development, the UNCBD, and the Forest Europe process. General guidance on forest soils is included in the 1993 Helsinki agreement, and soil protection is included under Criterion 5 of the 1998 Pan-European Level Operational Guidelines. The importance of soils in the global carbon cycle is reflected in the UN Framework Convention on Climate Change (UNFCCC) and in the EU agreement on accounting rules on greenhouse gas emissions and removals resulting from activities relating to land use, land-use change and forestry (LULUCF).

Soil protection in the European Union

The European Soil Charter was signed by the Committee of Ministers for the Council of Europe in May 1972. This was a significant step in that it recognised that soil was a precious asset of limited supply and it committed signatories to develop soil protection and conservation policies. In particular, the Charter promotes the protection of soils against erosion and pollution, and specifically mentions the need for farmers and foresters to apply

methods and practices to preserve soil quality. The Charter also emphasises the value of soil mapping or inventories, and highlights the importance of raising public awareness of soil as a valuable resource. In 2003 the EU Committee of Ministers agreed a new charter for the Protection and Sustainable Management of Soil that built on the 1972 Charter and other policy developments.

The European Commission subsequently adopted a Thematic Strategy for Soil Protection, and the sustainable use of soil is at the heart of the EU's 7th Environment Action Programme, 2014. This commits Member States to increasing efforts to reduce soil erosion, increase soil organic matter, and other soil conservation measures linked to land-use planning targets.

Soil protection in the UK

In England, the Natural Environment White Paper: *The natural choice: securing the value of nature* includes the objective that, by 2030, all of England's soils are managed sustainably and degradation threats are tackled successfully, in order to improve the quality of soils and to safeguard their ability to provide essential ecosystem services and functions for future generations. Soil management in forests has a clear role in delivering this.

In Scotland, the *Scottish soil framework* sets out the vision for soil protection and formally recognises the important services soils provide to society. Key outcome targets are the protection of biodiversity and soil organic matter, the reduction of erosion, soil contamination and greenhouse gas emissions, and better water quality through improved soil management. Protecting the environmental quality of water and soil resources are two of the seven key themes in the *Scottish forestry strategy*.

In Wales, the Environment (Wales) Act 2016 provides the framework for the sustainable management of natural resources. In relation to forest soils, emerging management issues include climate regulation (soil carbon), productive capacity, water quality, flood mitigation, human health and habitat quality and connectivity.

UKFS Requirements for Forests and Soil

Waste management

Waste management regulations apply to sewage sludge and other waste materials (such as waste soil, bark, wood or other plant material) that may be applied to forest or other soils (as set out by the Waste Management Licensing Regulations 1994 (as amended for England, Scotland or Wales), and the Waste Management Licensing Regulations (Northern Ireland) 2003 (as amended)). Any operations involving the above must be registered with the regulatory authority. Sewage sludge may be applied to forest land, providing this results in ecological improvement and does not cause levels of potentially toxic elements in soils to exceed those permitted under the Sludge (Use in Agriculture) Regulations 1989 (as amended). There are exceptions from the Waste Management Regulations for the application of materials not considered to be 'waste', such as brash, and exemptions for wood ash up to defined amounts, providing these ameliorate the soil.

The regulatory authority must be consulted prior to the application of wastes to forest soils, including sewage sludge, waste soil or compost, waste wood, bark or other 'listed substances'. Conditions applied to permissions or licences, including 'relevant objectives', must be complied with. 

Control of pesticides

The Control of Pesticides Regulations 1986 (as amended) in Great Britain and 1987 (as amended) in Northern Ireland provide details of pesticides subject to control and prescribe approvals required for supply, storage and use, including aerial application. Users of pesticides are required to take all reasonable precautions to protect the health of humans, animals and plants, safeguard the environment and, in particular, avoid the pollution of water.

Where a designated site or priority habitat or species might be affected, appropriate regulators and conservation agencies must be consulted prior to the aerial application of pesticides and the use of pesticides in or near water, and, where appropriate, authorisation obtained. 

All those employed to use pesticides must be trained to the required standard or their work supervised by a certified person. Operators must fully comply with instructions on pesticide product labels. 

Soil protection

The physical structure of a soil affects the movement of gases, water and nutrients. A good structure is vital for soil fauna and the growth and reproduction of trees and other flora. Ancient woodlands, in particular, are a valuable resource of relatively undisturbed soils, which are likely to be of high biodiversity value. The nature and structure of soil is strongly influenced by the amount and quality of organic matter present and by the inorganic

constituents of the soil matrix. These also determine the chemical properties of soils, including soil fertility.

Soil microorganisms play a vital role in the retention, breakdown and incorporation of organic matter and influence soil structure and porosity. Soil microbial activity is also directly linked to carbon and nutrient cycles and breakdown of pollutants. A decline in levels of soil organic matter can lead to an increase in the susceptibility of soil to compaction, lower infiltration rates, and possibly increased run-off or erosion. Climate change projections of rising temperatures could accelerate mineralisation rates and soil carbon loss.

Forest management, as well as changes in environmental conditions, can have impacts on soil structure and fertility, including influencing the availability of nutrients and the capacity of soils to buffer adverse effects. Soil disturbance can cause the loss of soil carbon – increasing greenhouse gas emissions and reducing soil carbon stocks. Activities such as cultivation and drainage can affect neighbouring land and water users through run-off and erosion.

The quality of forest soil should be protected or enhanced in terms of its physical, chemical and biological properties.

Forest soil fertility levels should be maintained to safeguard the soil's character and productive potential.

Forest operations should be planned and managed to avoid damage to soil structure and function; should damage occur, reinstatement measures should be undertaken and adverse effects mitigated.

The environment adjacent to forests should not be subject to adverse effects due to water run-off, contamination or erosion arising from forest management practices.

UKFS Guidelines on Forests and Soil

The table below introduces factors important for forests and soil. The Guidelines that follow provide more information on how to comply with the UKFS Requirements, grouped by the factor headings.

Factor	Importance for soil
Acidification	Acid deposition and other acidifying inputs can adversely affect soil biodiversity, soil fertility, tree growth and water quality.
Contamination	Contamination can prevent tree growth, reduce soil biodiversity and affect water quality and fisheries.
Compaction	Compaction can adversely affect nearly all of the physical, chemical and biological properties and functions of soil. It reduces the permeability of soil and can inhibit tree growth, increase run-off and erosion and reduce soil biodiversity.
Disturbance	Disturbance affects soil characteristics and can result in erosion and leaching together with the oxidation of organic matter, which leads to carbon loss.
Erosion	Erosion reduces the soil resource, and can irreversibly damage soil productivity and result in the loss of carbon. It can affect water quality and damage aquatic habitats.
Fertility	Fertility has a major influence on the productivity of forest ecosystems and the composition of the vegetation and soil organisms.
Organic matter	Organic matter has a large influence on the physical, chemical and biological properties of the soil, as well as forming a major carbon store.

Acidification

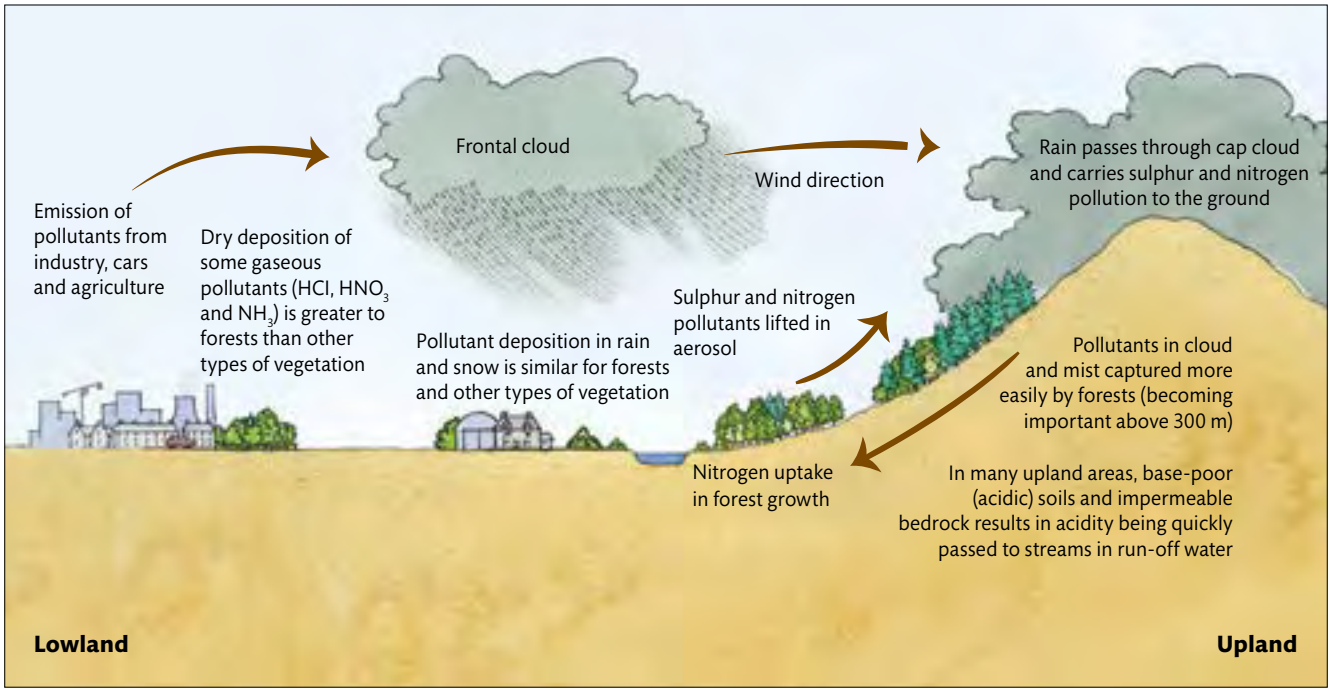
Forests and woodlands in the UK tend to occur on poorer soils that, particularly in the uplands, are often characterised by their natural acidity. Long-established woodlands on neutral soils usually develop a marginal acidity of surface layers due to the enrichment of the soil with organic matter. This natural acidity reflects normal forest processes and rarely leads to any adverse effects.

However, the addition of acidity to the environment, largely from atmospheric pollution, can result in soil acidification (Figure 6.6.1). This leads to a gradual depletion of calcium and other soil base cations from the surface layers and a reduction in the natural ability of soil to neutralise or buffer acidic inputs. Enhanced soil acidification generally has adverse effects, leading to:

- decreased pH of water draining from the soil, which can harm aquatic organisms;
- increased aluminium and heavy metal mobilisation, which can be harmful to tree roots and aquatic organisms;
- a reduction in tree growth and changes to the ground flora;
- a change in the predominant groups of soil organisms.

The highest deposition of acidifying compounds that will not cause chemical changes leading to long-term harmful effects on the ecosystem structure and function is called the critical load. Where acid inputs exceed the critical load, ecosystem changes can pose significant risks to both soil and water quality. Critical load exceedance of acidity for forest soils is currently defined in terms of risk of damage to tree roots from aluminium toxicity.

Figure 6.6.1 Interactions between forests and acid deposition.



The most acidified areas in the UK are in the uplands, where base-poor, slow-weathering rocks and soils have coincided with high pollutant inputs in the form of large volumes of moderately polluted rainfall. Emission control has resulted in major reductions in pollutant inputs, although modelling and monitoring data predict that soil recovery may take decades and could be further delayed by nitrate leaching and climate change (see Forests and Water).

Whole-tree harvesting and the removal of harvesting residues represents an additional drain on the ability of soil to buffer acid deposition. Acid-sensitive soils are most at risk. Artificial and non-permanent measures can be taken to combat soil acidity, including the application of alkaline materials such as limestone or wood ash. However, these can also have detrimental effects and advice from the relevant regulatory authority is advisable before they are used. Repeated cropping for short rotation forestry or coppice could also lead to the acidification of sensitive soils if base cations are not replaced by soil treatments.

On brownfield land that has been restored but may have residual contamination, the oxidation of minerals containing sulphur (e.g. pyrites) can cause acidification on some sites. Potentially toxic elements, including aluminium, become more mobile as acidity increases, thereby increasing the risk of damage to tree roots and the contamination of drainage waters. These effects can be countered by adding alkaline materials.

1 Avoid filling trenches, created for mounding on restock sites, with fresh brash. 7
Note: The above only applies to catchments of water bodies identified by the water regulatory authority within the River Basin Management Plans as failing or at risk of failing good status due to acidification.

2 On soils classified as at high risk of increased soil and water acidification (regardless of water body status) avoid short rotation forestry or short rotation coppice, and the harvesting of whole trees, forest residues and tree stumps. 4

3 On brownfield sites, consider ameliorating excess soil acidity by incorporating alkaline materials.

Contamination

Contamination arises when soils become contaminated from the introduction of waste or polluting substances that cause instability and harm. Potential contaminants of forest soils include fuel oils, lubricants, pesticides and other chemicals, sewage sludge and inorganic nutrients. Pathogens such as faecal coliforms (from sewage sludge) can be a source of microbial contamination. Contaminants can have a range of adverse impacts on soil function and tree growth, water quality and public health.

It is a requirement of the UKFS that a contingency plan is in place in case of spillages to help limit incidents and ensure clean-up procedures are effective. It is also a legal requirement to have permission before some potential contaminants (e.g. sewage sludge) are applied or the aerial application of pesticides (see Waste management and Control of pesticides).

On brownfield sites, woodland offers a beneficial land-use option for site restoration. Some industrial sites have high levels of contaminants and dealing with them is a complex area where specialist advice will be required. This will involve checking that any restoration obligations have been implemented or are enforceable prior to acquiring land for woodland establishment.

Erosion on contaminated brownfield sites can be a problem that can affect the surrounding environment. Contamination is often variable across the site and can be difficult to manage. The establishment of trees can protect soil from disturbance and, through rooting and the build up of organic matter, can improve soil structure and reduce the risk of erosion. Some tree species have a high tolerance to contaminants and selected clones can remove potentially toxic elements from the soil and accumulate them within the woody biomass.

4 Avoid the contamination of forest soils and have contingency plans in place to deal with accidental spillage and pollution.

5 Minimise the use of pesticides and fertilisers in accordance with Forestry Commission and Forest Service guidance. 24 15 57

6 Place any waste or recovered oil in an impermeable container and remove from the site for disposal at a suitable licensed site. 73

7 Where it is necessary to store fuel oils on site temporarily, use double-skinned or bunded, securely lockable tanks. 71

8 When restoring brownfield sites, take particular care with existing contaminants and seek specialist advice in dealing with them.

Compaction

Soil compaction is an increase in soil bulk density and a reduction in pore space due to compression. This affects the movement of water and air through the soil, reducing water infiltration and storage, and increasing the risk of water run-off and erosion. Compaction may also affect the growth and functioning of roots and soil organisms, which in turn can adversely affect tree stability and growth.

Natural processes such as freeze–thaw cycles, wetting–drying cycles and root penetration can mitigate compaction, and in some situations these processes can restore soils to their original condition over time. However, on some soil types, compaction is virtually irreversible.

The ground pressure of heavy machines used for harvesting or forwarding timber can compact the soil and cause rutting and puddling (peaty and clayey soils being the most vulnerable), particularly with frequent passes over a sustained period and when logs are skidded along the ground. Compaction to topsoil can usually be ameliorated, but damage to the subsoil (greater than 20 cm depth) is more difficult to rectify. Brownfield sites are often subject to repeated vehicle traffic during restoration, leading to severe compaction. Soils with a previous history of intensive grazing can be compacted and agricultural ploughing sometimes leads to a compacted layer just below the reach of the plough. Soil

stacked temporarily, for example for road construction and mineral extraction, can become compacted if it is stacked too high and for too long.

Compaction, leading to rutting and erosion, can be minimised by good planning and management of forest operations, such as using extraction routes made from layers of fresh brash to spread the load. A well-designed road infrastructure, with stacking and turning areas, will help minimise skidder haul tracks and other incidental causes of compaction on forest soils. Machine choice and working method affects the ground pressure and the risk of damage. Wheeled vehicles pose the greatest risk, but the use of lower tyre pressures and controls on the frequency and speed of vehicle movements can reduce this. Tracked vehicles exert less ground pressure, while cable extraction poses virtually no risk of compaction and is the least environmentally disruptive for particularly sensitive sites. Dry soils have a greater bearing capacity than wet soils and so harvesting in dry periods reduces the risk of compaction. Compacted soils may require remedial treatment, such as subsoiling, carefully matched to the depth of compaction, to minimise the extent of disturbance.

9 Minimise compaction, rutting and erosion during forest operations by selecting the most appropriate working method for site conditions; monitor operations and modify, postpone or stop procedures if degradation starts to occur. 31 36

10 On sites vulnerable to compaction and erosion, consider the weather and aim to carry out operations during dry periods; plan ahead for changes in the weather that could affect site conditions. 33 37

11 Maintain adequate brash mats throughout extraction operations. 32

12 Where compaction has occurred and will affect tree growth or lead to other detrimental effects, apply remedial treatment, but minimise the soil disturbance involved.

Disturbance

Soil disturbance is defined as any activity that mixes or moves soil material. Disturbance affects a wide range of soil characteristics and processes by altering the continuity of soil pores and the relative position of soil material. A number of forest operations and engineering works disturb the soil.

Cultivation disturbs the soil to improve tree growth by preparing a favourable planting site and lowering the water table. This increases nutrient availability and improves drainage and permeability. It also reduces the competition from weeds and can increase soil temperature to favour rooting. Drainage operations also result in soil disturbance and are carried out to collect and remove excess water, particularly water arising from cultivation channels.

Although soil disturbance can assist with forest management, it can also have a range of undesirable and potentially detrimental effects. These include:

- releasing greenhouse gases through the oxidation of soil organic matter;
- damaging soil structure and increasing the risk of erosion;

- leaching of nutrients and contaminants;
- destroying palaeo-environmental and archaeological remains.

Removing tree stumps disturbs and can damage forest soils but on some sites this may be necessary for tree health reasons (e.g. controlling the fungal pathogen *Heterobasidion annosum*). Stump removal may also be considered to provide a source of biomass for fuel; in this case, a risk-based assessment is required to take account of soil type, the potential for soil damage and carbon loss through oxidation. Stump removal can only be considered sustainable where it can be demonstrated that the nutrient status will be maintained and that greenhouse gas releases do not exceed the carbon dioxide benefits from using stumps as fuel.

On brownfield sites, topsoil is often moved, stored and then re-applied to restored areas. In undertaking all these operations, minimising handling and general soil disturbance will help limit detrimental effects.

13 Minimise the soil disturbance necessary to secure management objectives, particularly on organic soils. 4 17

14 Consider the potential impacts of soil disturbance when planning operations involving cultivation, harvesting, drainage and road construction. 6 18

15 Avoid removing stumps unless for tree health reasons or where a risk-based assessment has shown that adverse impacts can be reduced to acceptable levels. 3

Erosion

Soil erosion results in a loss of rooting medium, including nutrients and organic matter. This has a number of potentially detrimental effects to the forest environment, downstream water bodies and surrounding areas. These include the formation of erosion scars, water pollution through sedimentation and nutrient enrichment, and loss of habitat. Most soil erosion is caused by water flows, but wind can also erode soil. Trees can be useful as windbreaks in exposed areas with light soils and to stabilise windblown sands on the coast. Erosion is a natural process, but it can be increased by poor forestry practice and is likely to be worsened by the wet winters and dry summers that are the anticipated result of a changing climate. In contrast, well-managed forests can stabilise soil and protect it from erosion.

Erosion is likely where ground vegetation is lost, and ruts and water channels develop. These concentrate and accelerate water flows. The aim of forest drainage is to encourage percolation through the soil and to channel excess water slowly away. Drains designed to intercept water and lead it at a shallow gradient to seepage zones and buffer areas will minimise erosion. Ground vegetation is particularly important near watercourses to help prevent soil erosion; excessive tree shade can lead to bare, eroding river banks (see Forests and Water).

On steeper slopes, trees and shrubs can have an important role in reducing the risk of landslip. The binding action of roots increases soil strength and the canopy helps intercept

rainfall and reduces soil wetness. Continuous cover silviculture or other low-impact silvicultural systems, which maintain a protective cover of vegetation, can help to reduce the risk of slope failure and erosion. Clearfelling has the opposite effect by removing the protective canopy and causing the death of tree roots.

The risks of soil erosion, together with those of compaction and disturbance, can be minimised through forest planning, at both a forest and site level. The choice of silvicultural system, design of riparian areas and timing and arrangement of felling coupes, all affect the risks. At a site level, planning detailed arrangements and contingencies for operations such as forest cultivation and drainage, harvesting and engineering will help ensure erosion does not become a problem (see General Forestry Practice).

16 Address the risks of soil erosion as part of the forest and operational planning processes.

17 Aim for a mix of shaded and lightly shaded habitat within the riparian zone – around 50% canopy cover on average but guided by local circumstances and the requirements of priority species. 28 84

18 On steep slopes where there is a risk of slope failure or serious erosion, consider alternatives to clearfelling. 33 35

19 Consider planting woodland to protect erosion-prone soils and intercept sediment-laden run-off. 9

Fertility

Soil fertility is defined as the availability and balance of nutrients required for plant growth. The availability reflects the soil conditions as modified by nutrient inputs and outputs. Nutrient inputs include the breakdown of organic matter, the weathering of mineral particles, water inflows, atmospheric deposition and the application of fertilisers. The principal losses are from the removal of timber and harvest residues from the site, soil leaching and erosion, and gaseous emissions.

Fertility has a major influence on the productivity and health of woodland ecosystems. Communities of woodland flora and fauna also largely reflect soil fertility. In accordance with principles of sustainability, the UKFS seeks to minimise the use of chemicals in forestry. In some UK forests, particularly plantations established on nutrient-poor soils, fertiliser applications were sometimes initially required for young trees to become established. The poorest sites may require some fertiliser for restocking but generally fertiliser usage in established forests has declined in recent years because nutrient deficiencies are less common in subsequent rotations. There is also less new planting on marginal, infertile sites. A small number of forest sites receive applications of sewage sludge or other recycled organic materials such as compost.

The loss of nutrients can undermine the long-term productivity of forest sites. The majority of nutrients, which are contained within the crown and foliage, are normally left on the site at harvesting. However, whole-tree harvesting, and the removal of forest residues such as brash and tree stumps, can contribute to a net loss of fertility and impoverish the soil. The

removal of forest residues by burning or harvesting of woody biomass under short rotation coppice and short rotation forestry systems can similarly deplete fertility. Depletion is most likely to occur where naturally infertile and shallow soils coincide with high rainfall. A risk-based assessment will be needed when these operations are proposed to ensure fertility is not compromised.

In general, forests and woodlands are effective at retaining nutrient inputs. Problems occasionally arise where fertiliser has been applied and the run-off or leaching of nutrients leads to eutrophication or enrichment of watercourses. This is most likely when heavy rain follows fertiliser application, especially on steep topography. Atmospheric nitrogen deposition can sometimes exceed the absorption capacity of woodland, leading to soil nitrogen saturation and nitrate-enriched run-off.

20 Ensure the removal of forest products from the site, including non-timber products, does not deplete site fertility or soil carbon over the long term and maintains the site potential. 8 7

21 Choose tree species and silvicultural systems that are well suited to the site and, with the exception of short rotation forestry or short rotation coppice, do not require continuing inputs of fertilisers. 44

22 Minimise the use of inorganic fertilisers and confine these to areas where analysis clearly shows management benefits. 45

23 Plan any fertiliser applications to minimise the risks of nutrient loss. 46

Organic matter

Soil organic matter is made up of compounds that originated from living organisms, and is distinct from inorganic or mineral material. It includes plant and animal residues at various stages of decomposition, substances produced by plant roots, roots themselves and living soil organisms. The organic matter content of soil affects:

- physical properties – including structure and water-holding capacity;
- chemical properties – including carbon content and the retention of nutrients and contaminants;
- biological properties – including the nutrients and energy available for plants and animals.

Forests can increase soil organic matter and ecosystem carbon through large inputs of decomposable material such as foliage, woody material and fine roots. However, soil organic matter can be impoverished through disturbance, erosion, forest fires and the harvesting or burning of brash and stumps. Cultivation and drainage pose a particular risk of depleting the organic content of peaty soils through soil drying and oxidation. Following the Guidelines set out in this section will help ensure soil organic matter is retained.

24 Avoid establishing new forests on soils with peat exceeding 50 cm in depth and on sites that would compromise the hydrology of adjacent bog or wetland habitats.

Note: Woodland creation on certain sites where deep peat soils have historically been highly modified may be considered, provided that it complies with the relevant country policy. 5 5

25 Consider the balance of benefits for carbon and other ecosystem services before making the decision to restock on soils with peat exceeding 50 cm in depth. 8

26 Avoid burning brash and harvesting residues unless it can be demonstrated that it is a management necessity, all the impacts have been considered, and the necessary approvals obtained. 36 13

6.7 Water

Water is the most vital element of all natural resources and is essential to life. Forests and woodlands have a close relationship with our water resources, and forest management and water quality are closely linked. Sustainable forest management is essential to ensure the supply of good-quality fresh water, to provide protection from natural hazards such as flooding or soil erosion and to protect the needs of aquatic species.

Introduction

Land management activities can affect water flows and degrade the quality and ecology of waters. This has implications for the economic, environmental and social benefits that water provides. Some activities directly affect the water body itself, while others are a result of catchment land use such as urban development. There are also effects that arise from well beyond the boundaries of an individual catchment, such as the deposition of acid pollutants from the atmosphere and the effects of greenhouse gases and climate change.

Many countries rely on 'protection forests' to preserve the quality of drinking water supplies, alleviate flooding and guard against erosion, landslides and the loss of soil. The benefits of protection forests and sustainable forest management for water quality are increasingly recognised, and woodland is being created to safeguard the water environment. While there may be water trade-offs in terms of the potential for forests to reduce water yield, these are usually more than compensated by the water quality and the other ecosystem services provided by forests (see Section 3).

However, forestry land use itself can also have a range of detrimental effects on water, both within the forest and downstream. Forests that are poorly designed or managed or forests planted in unsuitable locations can exacerbate the effects of acid deposition, cause eutrophication, increase sediment delivery, affect water colour and contribute to local flooding. These in turn can degrade aquatic habitats and result in the loss of aquatic wildlife, reducing ecological quality and damaging fish populations and dependent fisheries. Where drinking water is abstracted, poor forest management can add to water treatment costs and have an impact on public health, requiring the suspension or, in extreme cases, cessation of public supply. Private water supplies are particularly vulnerable to disturbance since they often undergo limited or sensitive forms of water treatment and there may be little scope for finding replacement sources in the event of pollution.

Climate change is expected to have a marked impact on the freshwater environment. It is likely to affect both the timing and volume of river flows and extent of groundwater recharge, with knock-on impacts for water quality and ecology. Of particular concern is the increased risk of flooding and soil erosion due to wetter winters and more frequent extreme rainfall events throughout the year. Another concern is the vulnerability of water resources to reductions in summer rainfall, with potentially serious implications for water supplies and ecosystem flows. 'Water footprinting' is likely to become increasingly common in the future as water users are tasked with demonstrating responsible water stewardship. Forestry-related water footprints will show how much water is consumed in producing and selling forest products, including the water used in growing timber. This will allow a comparison to be made with alternative products.

Greater soil drying due to climate change could increase water colour as a result of enhanced decomposition of soil organic matter and the release of dissolved organic carbon. This could affect freshwater ecology and greatly interfere with water treatment, causing taste problems and increasing treatment costs. Higher water temperatures could threaten the survival of salmonid fish and other sensitive freshwater life. Forests and forestry management practices can help to moderate or exacerbate climate change impacts and so there is a need to develop appropriate strategies for managing and redesigning forests for water protection (see Forests and Climate Change).

Water catchments

The catchment forms the principal water gathering ground for precipitation falling on the land. The vegetation cover through which the precipitation first passes can exert a strong influence on both the quantity and quality of

the water entering the soil. Water quantity is affected when the trees and other vegetation intercept some of the precipitation, which then evaporates back to the atmosphere without reaching the ground; this is known as interception loss. Water quality can be affected by evaporative loss, which concentrates chemicals present, by the canopy capture of mist, aerosols and pollutant gases, and by chemical interactions within the vegetation layer.

Having passed through the vegetation layer and into the soil, some water is taken up by vegetation and returned to the atmosphere through the process of transpiration. The rest is either retained by the soil, or drains away. The amount of water following each of these routes is influenced by the nature of the vegetation and soil, and therefore by land-use practices. Interception and transpiration losses vary between different types of forest and non-forest vegetation, as well as being strongly affected by rainfall amount and pattern. Forest harvesting will temporarily reduce evaporation due to the removal of the vegetation, and in the short term will result in more water leaving the soil as drainage.

Drainage water can take a number of pathways over and through the soil and bedrock to the river basin outlet (Figure 6.7.1). The pathways taken will depend on geology, topography and soil, as well as human interventions. These pathways will have a marked influence on the timing, volume and quality of water reaching watercourses and water bodies:

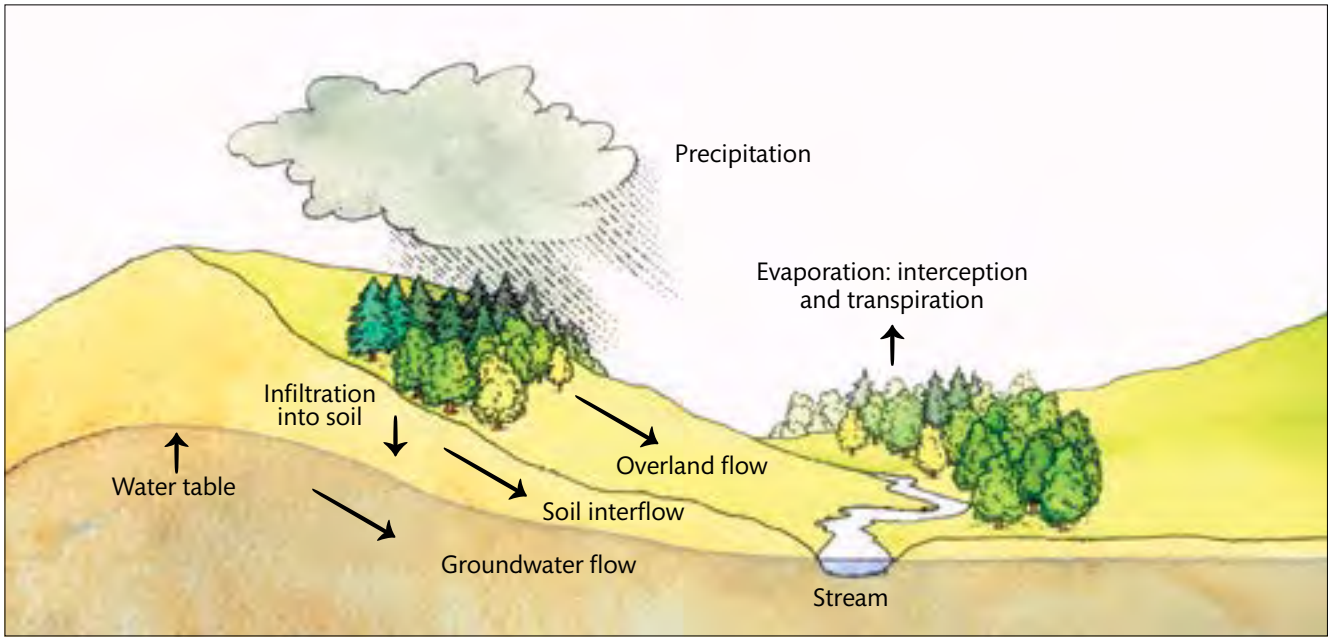
- Rapid run-off in response to precipitation is characterised by superficial pathways and occurs on steep slopes, poorly draining or compacted soils, and shallow, impermeable bedrock. Superficial waters tend to be low in base cations, brown (due to high dissolved organic carbon) and acidic, reflecting their short passage through the upper organic soil horizons.

- Slow run-off in response to precipitation is characterised by deeper pathways leading to a delayed and moderated response, reducing flood flows and increasing groundwater recharge. This occurs on gentle slopes, freely draining soils, deep drifts and porous bedrock. Waters following deeper pathways tend to have higher base cation levels and be clearer and more alkaline, due to the longer period in which rainfall is in contact with soil and rock minerals and is able to react with them.

Groundwater

Where the geology is porous, water drains to the underlying water table, forming groundwater. Groundwater is important for public and private water supply, maintaining river flows in drier months and

Figure 6.7.1 The water cycle. Water can follow a number of different pathways through a river basin.



sustaining wetlands. Groundwater bodies can be defined as areas of rock forming a distinct volume of water within an aquifer or aquifers. Groundwater bodies are very sensitive to contamination such as the careless use of pesticides. Such chemicals may not reach a river or borehole abstraction point for several decades, but once groundwater is contaminated it may be difficult or impossible to restore good water quality.

Riparian zones

When drainage waters eventually emerge from the soil and bedrock they pass through the riparian zone and then form the aquatic zone. The riparian zone is the area of land adjoining the aquatic zone and influenced by it, which includes the river bank but not the wider floodplain. Riparian zones can be ecologically rich, with long and convoluted edges that host a wide variety of habitats. They can also link ecologically rich habitats and offer migration corridors for invertebrates, birds and mammals. In places where natural flooding occurs, large tracts of wet woodland habitat may extend from the riparian zone across the floodplain. These woods are now rare throughout the UK and they are identified as priority habitat types in country biodiversity strategies (see also Forests and Biodiversity).

Aquatic zones

The aquatic zone is frequently or permanently under water, forming streams, rivers, ponds, lakes, wetlands, estuaries and coastal waters, as well as human-made canals and reservoirs. Aquatic zones can be divided into discrete water bodies, each with a defined water catchment area. Water bodies form the management units for controlling pressures exerted by human activities, with environmental objectives and standards set to protect and improve their quality and that of the river basin as a whole. They can vary greatly in size and sensitivity to pressures, e.g. smaller rivers and lakes tend to be more vulnerable to the effects of acid deposition.

Forests and freshwater ecology

Streams, rivers, lakes, ponds and wetlands all provide habitats for a large range of plant and animal species and forests play a major role in the ecological functioning of the freshwater environment. To meet UKFS Requirements, forest design and management must maintain or restore the natural features, processes and habitats that determine the freshwater ecology and characterise the site. In doing so, the water element of the forest environment will be protected and the water resource will be suitable for a range of purposes.

The ecological requirements of freshwater plants and animals differ from species to species, encompassing a natural range in water chemistry, temperature, oxygenation, flow velocity, depth and substrate type. Some of the broad ecological requirements of organisms and how forests and forest management can help sustain these are shown in Table 6.7.1. The needs of protected and priority species such as the otter, water vole, Atlantic salmon and freshwater pearl mussel require particular attention.

The spread of invasive non-native species is an increasing problem, which, if unchecked, has the potential to degrade riparian and freshwater habitats and lead to a loss of native species. Co-ordinated action between landowners and authorities will be required to control the spread of invasive animal and plant species such as the American signal crayfish, Japanese knotweed and Himalayan balsam (see also Forests and Biodiversity).

Small streams, including those less than 1 m wide, can form very important spawning habitat for salmonid fish. Their protection is therefore fundamental to the sustainability of fish populations and downstream fisheries, as well as for maintaining other freshwater life.

Estuarine and coastal waters are less influenced by forestry due to dilution and other factors, but some water bodies are very sensitive to disturbance, such as designated shellfish waters in shallow marine lochs. Shellfish could be adversely affected by increased sediment and nutrient inputs associated with larger-scale forestry operations.

Integrated catchment management

Integrated catchment management approaches sustainable forest management from a catchment perspective, in contrast to a piecemeal approach that artificially separates land management from water

Table 6.7.1 Broad requirements of aquatic wildlife and how forests can sustain these.

Ecological requirement	Forest contribution
Well-oxygenated water free of contaminants, or water containing contaminants at less than harmful concentrations.	Well-designed and managed forests protect the soil and can act as a trap or sink for contaminants. Riparian woodland buffer areas have an important role in intercepting sediments, nutrients and pesticides draining from the adjacent land.
Adequate light reaching the water to support aquatic plants and algae and the maintenance of temperatures suitable for animal metabolism.	A variable density of tree cover is a key component of riparian habitat, although open areas are also important for more light-demanding species. In many places, a woodland canopy can provide the right balance of light and shade, and help control temperature extremes – this is likely to become increasingly important for fish survival as climate change progresses, since spawning and growth of some species are very sensitive to water temperature.
A range of natural features and habitats, such as pools, riffles, gravel bars, fringing wetlands, ponds and backwater channels, dry river terraces, alluvial floodplains connected to the river; banks that are steep, shallow, or undercut.	The binding action of tree roots helps to strengthen and stabilise river banks, reducing erosion and bank collapse. Tree stumps and underwater tree roots also provide important refuges for fish and other aquatic wildlife, including white-clawed crayfish; they can also provide nests or holts for otter. Natural accumulations of woody debris increase habitat diversity in rivers and streams.
Vegetation appropriate to the site, such as algae and mosses on stony streambeds; rooted plants in the silt or sand of less turbulent waters; also bankside trees, shrubs and ground vegetation.	Native riparian woodland generally provides an ideal cover for protecting river morphology. Floodplain and riparian woodland can link disconnected habitats to form an extended forest habitat network, benefiting the movement and dispersal of wildlife.
Natural range in acidity and alkalinity.	As the pH falls below 6.0, physiology and growth of fish, invertebrates and other freshwater life are increasingly affected. Forest canopies, especially conifer, can increase the capture of acid pollutants in the atmosphere and thereby reduce stream pH where acid geology renders waters susceptible to increased acidity. Forest restructuring can help to reduce pollutant capture by increasing open space and species diversity, and by reducing the area of closed canopy.
Appropriate inputs of organic matter and nutrients.	The variety and seasonality of leaf litter inputs and microbial processes in the root zone are critical to maintaining energy and nutrient flows and the effective ecological functioning of aquatic ecosystems. Twigs, leaves and terrestrial invertebrates that fall from woodland canopies into the water provide an important source of food for aquatic organisms.
Natural range in water flow and depth.	Reduced water flows can impede fish access and decrease available habitat for freshwater life. Forests, particularly conifer, can reduce water flows, but this effect can be ameliorated by good forest design and management.

management. It provides a framework to safeguard the natural functioning of freshwater ecosystems. The various demands on the catchment, such as water supply, power generation, flood storage, navigation and fisheries, can be integrated and reconciled with each other without jeopardising the natural characteristics of the water environment. The management of land has a substantial impact upon the water environment and therefore it is essential that forest planning is considered in the context of the wider catchment to safeguard the water environment in the most effective and beneficial way.

Understanding the value of forests in terms of the various products and ecosystem services they provide to people and society can help clarify their role in integrated catchment management. This will enable better decisions to be made about forest planting and design and how the impacts of climate change will be managed.

Policy and context

This section provides further background, gives an overview of the developments relevant to forests and water, and summarises the main statutes. Further details of legislation and conventions are provided in Appendix 1.

International context

All aspects of forestry and water, including the protection of water quality, the management of water resources and mitigation of flood risk are covered by international agreements. The principal frameworks for action to protect and improve the water environment are the EU Water Framework Directive, adopted in 2000, and Forest Europe, which includes a specific resolution on forests and water. The principal framework for action to manage flood risk is the European Directive on the Assessment and Management of Flood Risks (Floods Directive).

Water Framework Directive

The EU Water Framework Directive (WFD) provides the principal framework for protecting and improving the water environment in the UK. It has set an objective that water bodies should be restored to 'good status' (a term that refers both to chemical and ecological quality) by 2027 at the latest. The majority of water bodies in the UK and in other EU countries currently fail to meet this target status due to diffuse pollution and related pressures, including water abstraction. Another key requirement of the WFD is that current water status must not deteriorate. This includes the need to maintain the quality of waters currently classified as 'high status' (i.e. waters with no or very low human pressure, which equate to the 'reference condition' or best status achievable).

The Directive also aims to protect the quality and quantity of groundwater, ensure that the water needs of adjacent wetlands are adequately met and mitigate the effects of flooding and drought. The Directive provides a structured basis for monitoring the quality of surface waters and groundwaters. It extends the way in which ecological status is assessed to include a range of plant and animal life and supporting physico-chemical elements, such as hydrology, habitat structure, fish, invertebrates, phytoplankton and other aquatic plants.

Implementation of the WFD is underpinned by environmental quality standards and criteria for aquatic plants and animals, and water flow and water chemistry, as well as for the physical structure and condition or 'morphology' of aquatic habitats. The standards developed for the water-dependent elements of sites designated under the EU Habitats and Birds Directives (addressed in Forests and Biodiversity) do not always accord with those of the WFD. Where this occurs, it is the higher standards of the Habitats or Birds Directives that apply in order to ensure that the 'favourable condition' stipulated by these directives is met. For protected sites, including water-dependent Natura 2000 sites designated under the Habitats and Birds Directives, compliance with these objectives should have been achieved, unless a specific exemption was made for a particular water body.

Forest Europe

Forest Europe includes a specific Resolution on Forests and Water. The 2007 Resolution commits signatory states, including the UK, to:

- Maintaining and enhancing the protective functions of forests for water and soil, as well as for mitigating local water-related natural disasters through sustainable forest management, including through public and private partnerships.

- Assessing afforestation and reforestation programmes in terms of their effects on the quality and quantity of water resources, flood alleviation and soil.

- Promoting the restoration of degraded forests, particularly in floodplains and upper watershed areas for the benefit of the water environment, flood reduction, conservation of biodiversity and soil protection.

There is also a commitment to better co-ordinate policies on forests and water, to address the impacts of climate change, and to undertake an economic valuation of water-related forest services.

Floods Directive

The European Directive on the Assessment and Management of Flood Risks (2007/60/EC), known as the

Floods Directive, is designed to help Member States prevent and limit floods and their damaging effects on human health, the environment, infrastructure and property. Consideration is also given to long-term developments, including climate change and sustainable land-use practices.

Forests and water in the UK

The requirement of the WFD for River Basin Management Plans (known as RBMPs) allows integrated catchment management to take place and is a key mechanism for achieving the protection, improvement and sustainable use of the water environment. The water regulatory authorities in the UK have published plans for the UK's river basins. These cover all types of water, including rivers, lakes, reservoirs, estuaries, coastal waters and groundwater, and sectors with links to the water environment, such as forestry. The plans describe the current condition of the water environment and provide a programme of measures to deliver environmental improvements over consecutive six-year planning cycles.

The water regulatory authority is the lead agency for RBMPs but is reliant on a wide range of organisations and individuals for delivering actions to improve the water environment. Public bodies have a general duty to have regard to RBMPs and compliance will be achieved through a mix of voluntary, economic and regulatory measures.

Some water bodies require special protection and are designated 'protected areas' under the WFD. These designations seek to preserve water bodies or parts of water bodies that are especially sensitive to pollution or because they are of particular social, environmental or economic importance. For those sites designated for their habitats or species, such as Natura 2000, compliance with the standards necessary to meet 'favourable condition' is essential.

A number of primary and secondary pieces of legislation make provision for the protection of the water environment and transposition of the WFD into law in the UK. These include:

England and Wales

- Water Environment (Water Framework Directive) (England and Wales) Regulations 2003.
- Water Environment (Water Framework Directive) (Northumbria River Basin District) Regulations 2003.
- Water Environment (Water Framework Directive) (Solway Tweed River Basin District) Regulations 2004.

Water Protection Zones (WPZs) are a regulatory mechanism in England and Wales. They deal with diffuse water pollution and damage to the physical structure and flow conditions of water bodies that cause them to fail WFD objectives. WPZs represent a defined geographical area in which the Environment Agency or Natural Resources Wales has additional powers to manage or prohibit activities which cause or could cause habitat damage or pollution of water, for example by issuing Works Notices. Woodland creation may have an important part to play in helping to protect and restore the water environment within these zones.

Scotland

- Water Environment and Water Services (Scotland) Act 2003 (WEWS).
- Water Environment (Controlled Activities) (Scotland) Regulations 2011 (as amended).

Northern Ireland

- Water Environment (Water Framework Directive) Regulations (Northern Ireland) 2003.
- Water (Northern Ireland) Order 1999 (including amendments up to 2004).

The Floods Directive is transposed into UK law by the:

- Flood Risk Regulations 2009.
- Flood Risk Management (Scotland) Act 2009.
- Water Environment (Floods Directive) Regulations (Northern Ireland) 2009.
- Flood and Water Management Act 2010.

The legislation also covers potential flooding from reservoirs, which is addressed nationally by the Reservoirs Act 1975. The Flood and Water Management Act 2010 and the Flood Risk Management (Scotland) Act 2009 introduced a risk-based approach to reservoir safety for 'large raised reservoirs'. These are redefined as reservoirs holding a minimum of 10 000 m^3 (the present limit of 25 000 m^3 applies until the relevant sections of the Acts commence for all purposes), extending the scope of the legislation to potentially include large artificial ponds or

similar water features. The new regulations will require a system of regular inspections, monitoring and supervision for reservoirs designated as being at high risk of uncontrolled releases endangering human life.

Forestry strategies and delivery mechanisms

Country forestry policies and strategies reflect the potential of forests to deliver WFD objectives. These include highlighting opportunities for woodland creation to reduce the impact of diffuse pollution from agriculture and urban activities, and assist in flood risk management. Climate change brings a number of new reasons for forest expansion, including biomass energy, increased forest productivity, soil protection and the sequestration of carbon. However, realising these benefits could present risks to the water environment and the species present, and a balance is required between these objectives.

In England, the Natural Environment White Paper *The natural choice: securing the value of nature* identifies the need to protect and improve England's forests and woodlands and increase woodland area. It also highlights the role of woodlands in water supply, flood management and water quality.

In Scotland, the *Scottish forestry strategy* and its implementation plan provide the framework for taking forestry forward through the first half of this century and beyond. One of the main objectives is to contribute positively to water quality, and the key theme on environmental quality includes aims to protect water resources.

In Wales, *Woodlands for Wales* highlights water protection and management in terms of quality and resources as one of the main outcomes under its strategic theme on environmental quality.

In Northern Ireland, *The long-term water strategy for Northern Ireland (2015–2040)* sets out a range of initiatives to deliver the long-term goal of sustainable water management, which includes afforestation to mitigate flood risk and reduce riparian bank erosion.

UKFS Requirements for Forests and Water

Water Framework Directive

The EU Water Framework Directive 2000/60/EC and supporting legislation across the UK established a comprehensive system for the protection, improvement and sustainable use of the water environment, including the introduction of River Basin Management Plans. The Directive places controls over water abstractions, impoundments and engineering activities in or adjacent to watercourses that may have impacts on river and lake hydromorphology. Note: the definition of 'in or adjacent to watercourses' is dependent on regional byelaws but often refers to within 7 m of a watercourse.

Prior authorisation must be obtained from the water regulatory authority or lead local flood authority for building, engineering and other activities in or adjacent to watercourses that affect river hydromorphology; this includes water abstraction, impoundments, constructing culverts and extracting river gravel. Authorisation for gravel extraction may also be required from the conservation agency if the river is designated as, or flows through, a Special Area of Conservation, Special Protection Area or Site of Special Scientific Interest (Area of Special Scientific Interest in Northern Ireland).

Pollution control

In England, Wales and Northern Ireland it is an offence to cause or knowingly permit the entry of poisonous, noxious or polluting material into any controlled waters. Forest managers must meet their legal obligations under the Water Environment (Water Framework Directive) (England and Wales) Regulations 2003 (as amended), the Water Environment (Water Framework Directive) (Northumbria River Basin District) Regulations 2003 (as amended), the Water Environment (Water Framework Directive) (Solway Tweed River Basin District) Regulations 2004 (as amended), the Water Environment (Water Framework Directive) Regulations (Northern Ireland) 2003, the Water (Northern Ireland) Order 1999 (as amended), and other relevant legislation, when carrying out all forestry operations. In England and Wales, it is an offence to fail to meet the requirements of a Water Protection Zone, as specified under the Water Resources Act 1991 (Amendment) (England and Wales) Regulations 2009. There is also a requirement to abide by any Work Notices issued to polluters to restore water quality and prevent damage to, or restore, the physical condition of water if the riverbed or banks are damaged.

In Scotland, it is an offence to carry out, or to cause or permit others to carry out, any controlled activity unless that controlled activity is authorised and carried out in accordance with that authorisation. When carrying out forestry operations, legal obligations are defined under the Water Environment and Water Services (Scotland) Act 2003, the Water Environment (Controlled Activities) (Scotland) Regulations 2011 (as amended), and other relevant legislation. Authorisation is given under the Water Environment (Controlled Activities) (Scotland) Regulations 2011 (as amended) subject to General Binding Rules for specific activities, such as operating any vehicle, plant or equipment for certain purposes, the storage and application of fertilisers, the construction and maintenance of water-bound roads and tracks, and the discharge of water run-off via a surface water drainage system to the water environment.

The entry of poisonous, noxious or polluting material into the water environment must not be caused or knowingly permitted (unless authorised by the water regulatory authority).

Any water containing fish, or any tributary of that water, must not be rendered poisonous or injurious to fish, their spawning grounds, fish spawn or the food of fish (unless authorised by the water regulatory authority).

In Scotland, all forestry operations must meet relevant General Binding Rules and any divergence must be licensed or registered with SEPA (Scottish Environment Protection Agency).

Control of pesticides

The Control of Pesticides Regulations 1986 (as amended) in Great Britain and 1987 (as amended) in Northern Ireland provide details of pesticides subject to control and prescribe approvals required for supply, storage and use, including aerial application. Users are required to take all reasonable precautions to protect the health of humans, animals and plants, safeguard the environment and, in particular, avoid the pollution of water.

Where a designated site or priority habitat or species might be affected, appropriate regulators and conservation agencies must be consulted prior to the aerial application of pesticides and the use of pesticides in or near water, and, where appropriate, authorisation obtained. 

All those employed to use pesticides must be trained to the required standard or their work supervised by a certified person. Operators must fully comply with instructions on pesticide product labels. 

Groundwater regulations and Nitrate Vulnerable Zones

These regulations protect groundwater from pollution caused by careless disposal of potentially harmful and polluting substances. Under the Groundwater (England and Wales) Regulations 2009, and the Groundwater Regulations (Northern Ireland) 2009, as amended, permission is needed from the water regulatory authorities (England, Wales and Northern Ireland) to dispose of 'listed substances' to ground, including sprayer washings.

In Scotland, under the Water Environment (Controlled Activities) (Scotland) Regulations 2011 (as amended), prior authorisation is needed from SEPA to dispose of any hazardous substance or any other pollutant.

Authorisation is not required for normal use of pesticides covered by relevant codes of practice, except in Scotland, where authorisation is given subject to General Binding Rules.

Some areas of the UK are designated as having groundwater vulnerable to the addition of nitrogen from fertilisers or organic amendments under the EU Nitrates Directive (91/676/EEC). Protection of Water Against Agricultural Nitrate Pollution Regulations came into force in 1996 in England, Scotland, Wales and Northern Ireland. These Regulations were replaced by the Action Programme for Nitrate Vulnerable Zones (Scotland) Regulations 2008, Nitrate Pollution Prevention (Wales) Regulations 2008 and Nitrate Pollution Prevention Regulations

2008, which identify Nitrate Vulnerable Zones (NVZs) as areas where nitrate pollution from agriculture is a problem. In Northern Ireland, a total territory approach to implementation of the Nitrates Directive was adopted in 2004, followed by the Nitrates Action Programme Regulations (Northern Ireland) 2014. The legislation applies directly to agriculture, but it is recommended that any nitrogen fertilisation or application of organic amendments to forests within NVZs adhere to the restrictions contained within these Regulations.

Groundwater must be protected from harmful and polluting substances, including sprayer washings; the water regulatory authority must be consulted regarding the disposal of such substances to land.

Oil and fuel storage

Forestry operations frequently involve the permanent or temporary storage of oils and fuel, including containers, mobile bowsers and drums. The Control of Pollution (Oil Storage) (England) Regulations 2001, the Water Environment (Controlled Activities) (Scotland) Regulations 2011, the Water Environment (Oil Storage) (Scotland) Regulations 2006, the Water Resources (Control of Pollution) (Oil Storage) (Wales) Regulations 2016 and the Control of Pollution (Oil Storage) Regulations (Northern Ireland) 2010 impose requirements aimed at preventing leakage and pollution.

Oil and fuel must be stored in a way that minimises the risks of leakage and pollution.

Water supply

Directive 98/83/EC on the quality of water intended for human consumption (the Drinking Water Directive) sets bacteriological, chemical and aesthetic standards for the quality of all public and private water supplies. The requirements of the Directive are transposed into national legislation, in respect of public water supplies, through Water Supply (Water Quality) Regulations. In respect of private water supplies, the requirements are transposed into national legislation through private water supply regulations. The objective of the Directive and Regulations is to protect human health by ensuring that water intended for human consumption is wholesome and clean. Article 7 of the Water Framework Directive covers the protection of Drinking Water Protected Areas with respect to the need to reduce levels of water purification treatment required for public supply.

The Drinking Water Inspectorate in England, Wales and Northern Ireland and the Drinking Water Quality Regulator for Scotland are responsible for regulating both public and private water supplies. Local authorities have a duty to complete a risk assessment for all private water supplies, monitor their compliance with drinking water standards, investigate any failures and advise on improvements to water treatment.

Forestry operations must not lead to harmful or polluting substances contaminating public or private water supplies.

Flood risk management

On some watercourses in England and Wales, particularly those designated as 'Main River' for flood protection purposes, periodic access for maintenance is required. In such access areas, consent may be required from the Environment Agency or Natural Resources Wales for the planting of trees within 7 m of the watercourse. Restrictions may also apply on selected watercourses in Scotland and Northern Ireland.

Appropriate regulators must be consulted for new woods next to main rivers and flood defences, and the necessary consents obtained.

Waste management

Waste management regulations apply to sewage sludge and other waste materials (such as waste soil, bark, wood or other plant material) that may be applied to forest or other soils (as set out by the Waste Management Licensing Regulations 1994 (as amended for England, Scotland or Wales), and the Waste Management Licensing Regulations (Northern Ireland) 2003 (as amended)). Any operations involving the above must be registered with the regulatory authority. Sewage sludge may be applied to forest land, providing this results in ecological improvement and does not cause levels of potentially toxic elements in soils to exceed those permitted under the Sludge (Use in Agriculture) Regulations 1989 (as amended). There are exceptions from the Waste Management Regulations for the application of materials not considered to be 'waste', such as brash, and exemptions for wood ash up to defined amounts, providing these ameliorate the soil.

The regulatory authority must be consulted prior to the application of wastes to forest soils, including sewage sludge, waste soil or compost, waste wood, bark or other 'listed substances'. Conditions applied to permissions or licences, including 'relevant objectives', must be complied with. 

Aquatic habitats and species

European Union Directives on habitats and species provide a range of protection and conservation measures including the Natura 2000 network of protected sites and European Protected Species. In addition, a range of UK and country wildlife, countryside and conservation legislation provides protection for special sites and listed species, and places duties of care on public authorities to have regard to the conservation of biodiversity in exercising their functions.

A number of protected and priority species are of particular relevance to the aquatic environment. Forestry operations have the potential to affect the immediate aquatic environment and for the effects to be exported well beyond the confines of a site.

Appropriate protection and conservation must be afforded where sites, habitats and species are subject to the legal provisions of EU Directives and UK and country legislation. Advice can be obtained from the relevant authorities on minimising potentially adverse effects for management activity likely to affect them. For Natura 2000 sites likely to be affected, an appropriate assessment is required. 

Water quality and buffer areas

Water flowing from and within forests supports habitats for a large range of plants and animals, and is used for both public and private drinking water supplies, agriculture, industry and recreation. Well-oxygenated water that is low in sediment content and free from contaminants is required. Water quality can be maintained or enhanced through good forest planning and management, and in particular through the identification and management of buffer areas. These areas, which will include the riparian zones next to watercourses, are set aside to help buffer any potentially adverse effects of adjacent land management. A range of special measures applies to buffer areas in terms of forest and operational planning and any applications of pesticide or fertiliser. These measures ensure that soil disturbance, siltation and the risk of pollution are minimised.

A buffer area is fundamental to both existing and new forests. Key aspects of the design of the buffer area are width, structure, choice of species and management regime. Extending the buffer margin to include wet and boggy source areas can be particularly important in relation to pesticide applications. In general, the aim in buffer areas is to establish and maintain a partial cover of riparian woodland comprising species native to the location and soils. It is important for landscape and water environment reasons to avoid parallel-sided corridors and design the margin in response to the landform. In addition, where there are particular sensitivities in the aquatic zone, such as salmonid spawning beds or the presence of the freshwater pearl mussel, wider buffer areas may be required. Factors such as climate, altitude, slope and soil type all have a bearing on the effectiveness of the buffer area and therefore on the desired width. The recommended minimum widths of buffer areas from the forest edge to the watercourse or water body to protect the aquatic zone are set out in Table 6.7.2. In Scotland, buffer widths for land-based activities are measured from the bank top of a watercourse or water body.

Table 6.7.2 Minimum buffer widths from forest edge to the watercourse/body or abstraction point.

Buffer width	Situation
10 m	Along permanent watercourses with a channel less than 2 m wide. (Narrower widths of buffer area may be allowable along minor watercourses with a channel less than 1 m wide, especially on steep ground.)
20 m	Along watercourses with a channel more than 2 m wide and along the edge of lakes, reservoirs, large ponds and wetlands.
50 m	Around abstraction points for public or private water supply, such as springs, wells, boreholes and surface water intakes.

Where existing forests do not meet the UKFS Requirements for Forests and Water, priorities for improvement should be identified and implemented at the earliest practical opportunity.

Forest management should contribute towards achieving the objectives of River Basin Management Plans and ensure that forestry pressures on the aquatic environment are addressed.

Woodland creation and management should aim to help protect or restore the quality of the freshwater environment by reducing the impact of more intensive land management activities and environmental change.

Early consultation with appropriate organisations should be carried out to determine site sensitivity and inform forest management plans and operations:

- Water regulatory authority – for water status, location of Nitrate Vulnerable Zones, River Basin Management Plan objectives, risk factors, use of fords and, in England and Wales, for fisheries.
- Local fishery bodies – for fisheries, including identifying key spawning streams and spawning times, and for advice on replacing culverts.
- Water companies – for location of Drinking Water Protected Areas and public water supplies, and for information on the vulnerability of water treatment works.
- Local authorities – for the location of private water supplies.
- Conservation agencies – for the location of designated sites and presence of protected and priority species and habitats.

Watercourses and water bodies should be identified and appropriate buffer areas established and maintained to protect aquatic and riparian zones from adjacent activities.

Forest drainage should be planned and, where necessary, existing drains should be realigned to ensure that water is discharged slowly into buffer areas and not directly into watercourses.

Forest operations should be conducted to prevent watercourses being polluted with sediment or discoloured; inspections should be carried out during forestry works and any incidents involving contamination of the water environment reported to the water regulatory authority without delay – remedial action should be taken immediately if pollution starts to occur.

Fertiliser and pesticide applications should match the needs of the stand and should be planned with careful attention given to buffer and storage areas, weather and ground conditions, and the risk to water supplies; contingency plans should be in place in case of a spillage.

Where extensive fertiliser applications are being planned within the same catchment, phasing should be considered to ensure nutrient losses do not exceed environmental quality standards.

A minimum of oil and fuel should be stored on site and appropriate precautions should be taken.

Acidification

Acidification is one of the most serious threats to water quality in some parts of upland Britain. The role of forestry in relation to diffuse pollution through acid deposition has been the subject of research and is now better understood. Where forestry could pose a threat, a range of measures and assessment procedures have been agreed to protect waters from adverse effects.

Where new planting or restocking is proposed within the catchments of water bodies at risk of acidification, an assessment of the contribution of forestry to acidification and the recovery process should be carried out; details of the assessment procedure should be agreed with the water regulatory authority.

Flooding and water resources

Flooding is a serious issue in many areas of the UK and flood events may increase with climate change. Forests and woodlands can help to reduce damaging flood flows in a number of ways: trees tend to use more water than other vegetation types, and they protect soil and increase water infiltration and storage. Trees and natural accumulations of deadwood slow flood flows by increasing flow resistance, and they reduce downstream siltation – increasing the capacity of river channels to hold and convey flood waters. The composition and location of woodland, and the way it is managed, all influence the ability of trees to affect flood flows.

In other areas of the UK there is a growing imbalance between water demand and supply that can lead to water shortages. In addition to the imposition of water restrictions, such shortages can diminish aquatic habitats and concentrate waterborne pollutants. Although trees tend to use more water than some other vegetation types, this varies with forest type and tree species; in some situations woodland water use, particularly for broadleaved species, may be less than other land covers.

In areas prone to flooding, woodland creation or the management and redesign of existing forests and woodlands in relevant upstream water catchments should be considered as a way of mitigating flood risk.

Where new woodlands are proposed, the sensitivity of downstream water bodies and wetlands to a reduction in water quantity should be considered; where this is an issue, advice should be sought from the water regulatory authority and conservation agency.

UKFS Guidelines on Forests and Water

The table below introduces factors important for forests and water. The Guidelines that follow provide more information on how to comply with the UKFS Requirements, grouped by the factor headings.

Factor	Importance for water
Acidification	Acidification can have a major impact on water quality and freshwater ecology in acid-sensitive areas.
Sediment delivery	The deposition of fine sediment in watercourses can degrade aquatic habitats, reduce the survival of fish eggs and young fish, and alter river substrates. High water turbidity can impair water quality, including drinking water.
Nutrient enrichment	Nutrient enrichment can damage aquatic habitats by adverse ecological changes such as increased growth of aquatic weeds and algal blooms and reduced species diversity. It can also disrupt water supplies.
Pesticides	Pesticides can seriously contaminate surface and groundwater, threatening water supplies and destroying freshwater life.
Fuel oils, lubricants and fire-fighting chemicals	Spillage can contaminate surface and groundwaters, tainting water supplies and reducing freshwater life.
Water yield and low flows	A reduction in water yield and low flows can increase the risk of water shortages during dry periods, reduce freshwater habitat and increase pollutant concentrations.
Peak flows and flooding	Higher peak flows in the upper reaches of drainage systems can increase river channel erosion, water colour and acid episodes, and lead to flooding downstream.
Shade and shelter	Insufficient shade increases temperature extremes and promotes the excessive growth of aquatic plants, while too much shade can lead to bare, eroding river banks and wider, shallower channels.

General Binding Rules – Scotland

Unlike the rest of the UKFS Guidelines, a number of the Guidelines on Water have a legal status in Scotland. Relevant 'General Binding Rules' (GBRs) are included here, in a summarised form, for application across the UK as they address many of the key issues for forests and water and describe good practice (see www.sepa.org.uk/regulations/water for the full text).

General Binding Rule → **GBR20a** ← Reference number

GBRs are integral to the Water Environment (Controlled Activities) (Scotland) Regulations 2011 (as amended), where they form part of the regulatory framework with respect to water and apply to all types of rural land use. Under the Regulations, activities likely to have a significant adverse effect on the water environment need to be authorised proportionate to the level of risk posed to the environment. There are three tiers of authorisation: the GBRs, Registration, and Licence (Simple or Complex). GBRs represent the lowest level of control and are appropriate for managing low risk activities. Compliance with GBRs is considered as prior authorisation for the activity and application to the water regulatory authority is not required.

Acidification

The primary cause of acidification is the deposition of acidifying sulphur and nitrogen compounds derived in part from the combustion of fossil fuels. Acidification of fresh waters occurs where the inputs of these pollutants exceed the buffering capacity of the soils and the underlying rocks through which water passes before entering streams, rivers and still water (see Figure 6.6.1 in Forests and Soil).

The most acidified areas in the UK are in the uplands, where catchments with naturally occurring base-poor, slow-weathering soils and rocks coincide with high pollutant inputs in the form of large volumes of moderately polluted rainfall. Emission control has resulted in major reductions in pollutant inputs, leading to significant improvements in water chemistry across much of the uplands. However, there is scope for further improvement as emissions continue to decline and soils readjust to lower pollutant deposition. Nitrate leaching from soils to surface water remains a concern and could delay full chemical recovery. Biological recovery lags behind chemical recovery and, although some areas show biological improvement, it generally remains slow or absent. Long-term studies continue to determine the chemical and biological response of waters to emission control and climate and land-use change. Some recovered waters, especially those draining peaty soils overlying acid rocks, will remain naturally acidic and support a range of acid-loving species.

Forest canopies can significantly increase the capture of sulphur and nitrogen pollutants in the atmosphere. This is particularly the case for conifer canopies because of their large, evergreen surface area and aerodynamic roughness. The increased capture is greatest at higher altitudes (>300 m) because of the longer duration of cloud cover and higher wind speeds. By increasing acid deposition, forests could delay the recovery of acidified waters or even lead to further acidification in the most sensitive areas. An expansion of conifer forest over a significant proportion of acidified catchments (>30%), or similarly the restocking of existing forests above 300 m altitude, present the greatest risk. However, restructuring closed canopy conifer stands can help reduce pollutant capture and the risk of acidification by creating a more diverse forest with different-aged stands, more open space, and a wider range of tree species including broadleaves.

A separate acidification effect is associated with clearfelling. Tree removal can increase nitrogen mineralisation and nitrification, which can promote nitrate leaching and enhance acidity and aluminium solubility in waters draining some soils. The effect usually lasts for two to five years after felling, depending upon the rate at which vegetation re-establishes. The filling of cultivation trenches with fresh brash could accentuate the effect by promoting nitrate leaching below the rooting zone.

The starting point for forest managers is to assess where new planting or restocking could contribute to increased acidification or delay recovery. The agreed approach is to undertake a catchment-based critical load assessment for waters failing or at risk of failing good status due to acidification. The critical load is defined as 'the highest deposition of acidifying compounds that will not cause chemical changes leading to long-term harmful effects on the ecosystem structure and function'. Where a catchment-based assessment shows acid deposition exceeds the freshwater critical load, approval of new planting or restocking

above certain thresholds of forest cover is unlikely until there are further reductions in pollutant emissions. In time, emission reductions will reduce forest pollutant capture and protect most water bodies from acidification. Achievement of the critical load will help to protect water supplies from acidification and related effects on the solubility of aluminium and manganese.

Forest managers can control the impact of forest harvesting on acidification by phasing clearfelling or using continuous cover systems. Other management practices can also ameliorate the effects, such as restricting whole-tree harvesting and the removal of forest residues in acid-sensitive areas. Research shows that the effects of harvesting on surface water acidity are difficult to discern when 20% or less of a catchment is felled within any three-year period. Consequently, where the rate of felling exceeds this figure it may be necessary to carry out a site impact assessment to determine if the watercourse is at risk; this includes felling for habitat restoration or wind farm developments.

The opening-out of stream sides can promote biological recovery in streams showing chemical improvement in response to emission reductions. Targeting such streams for earlier clearance of dense conifers, conversion to open, native broadleaved woodland and linking restored zones can aid the migration of fish and recolonisation by invertebrates. Alder is not suitable for larger-scale riparian planting in acidified catchments because of its ability to contribute to acidification through nitrogen fixation and nitrate release.

Forest applications of liming materials, including wood ash, are not generally recommended for alleviating surface water acidification. On some soils, applications can promote nitrate release and water acidification, especially after clearfelling.

Note: Guidelines 1–8 apply to catchments of water bodies identified by the water regulatory authority within River Basin Management Plans as failing or at risk of failing good status due to acidification.

1 Where the area of new planting or restocking could contribute to increased acidification or delay recovery, undertake a catchment-based critical load assessment.

2 Avoid new planting or restocking where catchment assessments based on critical load calculations and relevant supporting information indicate this will lead to deterioration in water body status or prevent recovery to good status.

3 Where an area to be felled will exceed 20% of the acidified catchment in any three-year period, undertake a site impact assessment.

4 On soils classified as at high risk of increased soil and water acidification, regardless of water body status, avoid short rotation forestry or short rotation coppice, and the harvesting of whole trees, forest residues and tree stumps. UKFS 2

5 Co-ordinate the phasing and timing of felling of conifers in riparian zones to promote the ecological recovery of watercourses.

6 Limit the planting of alder to less than 10% of the area within riparian zones.

7 Avoid filling trenches, created for mounding on restock sites, with fresh brash. 1

8 For water-bound roads and tracks, avoid using material resulting in metallic, sulphide-rich or strongly acidic polluted water run-off. GBR22a

Sediment delivery

Well-managed forests and woodlands protect the soil from disturbance and improve soil structure due to high inputs of organic matter and the action of tree roots. These conditions enhance soil infiltration pathways and water storage capacity thereby reducing direct surface water run-off, erosion and downstream siltation. New woodland can therefore help to reduce the higher rates of sediment delivery and resulting turbidity and siltation that are associated with more intensive land uses – such as arable cropping. A reduction in sediment delivery will also reduce soil carbon loss. The bare cultivated soils associated with autumn-sown winter cereals and spring cropping are particularly at risk of soil loss by heavy rainfall and strong winds, respectively. Strategically placed woodlands in the form of shelterbelts or riparian buffer zones can help to intercept sediment-laden run-off from such sites and reduce delivery to watercourses.

Poor forest management can lead to large quantities of sediment entering surface waters. Cultivation, drainage, harvesting, road building and quarrying, and a lack of adequate road maintenance can all cause unacceptable turbidity levels. This can seriously disrupt water treatment works and consequently water supplies. The financial consequences of such incidents can be great and may require the construction of new treatment works.

Sediment can discolour water and have a high content of nutrient, carbon, metal (such as iron and manganese) or pesticide, which can seriously interfere with water treatment. This can lead to dirty water and a failure of microbiological and chemical water standards. It can also represent a significant loss of soil carbon, in both dissolved and particulate forms, and contribute to the enrichment and contamination of downstream waters, particularly reservoirs and lakes where the sediment may remain for a considerable period of time. Angling is another activity that can be seriously affected.

When fine sediment settles in watercourses it can damage spawning areas (gravel redds) by cementing river gravels, trapping fish fry and critically reducing the oxygen supply to fish in their early life stages. High levels of suspended sediment may clog fish gills, reducing respiration efficiency and increasing vulnerability to bacterial infection. Siltation may also blanket plants and modify substrates leading to a decrease in invertebrate diversity, and reduce the capacity of river channels to contain floodwaters. Some protected species are very vulnerable to siltation, such as the freshwater pearl mussel. Large inputs of coarse sediment can have a significant impact on hydromorphology. This can de-stabilise stream beds and channels, reduce the depth of watercourses and reservoirs, and block pipelines and water intakes. Shallow coastal waters can also be vulnerable to siltation, especially where these support shellfish populations.

Forest planning, both at site and wider catchment levels, is the key to ensuring that siltation and erosion are minimised. It is important to undertake a site survey before operations commence to assess the vulnerability of the site to erosion, including the upslope and

downslope routing of water, the condition of watercourses, and any pre-existing deficiencies in the drainage system that are contributing to active erosion. There is a need to prepare an operational plan, including contingencies for possible events such as severe weather. The operational plan will describe how the site will be set out and worked to reduce the risk of adverse effects. This will cover the selection of cultivation techniques to minimise disturbance, such as mounding or scarification, and the appropriate matching of harvesting machinery to ground conditions. The timing of operations to avoid adverse weather and ground conditions, and the strict enforcement of protective riparian buffer areas will all be covered in the plan (see General Forestry Practice).

A drainage plan is also useful as a framework for the management of the forest and water environment over the longer term and should allow for climate change projections. This will define buffer areas and ensure that watercourses are protected. The drainage systems from any road network and the forest itself will need to be separated.

The fording of watercourses by forestry vehicles is of potential concern as disturbance to the bed and banks can degrade aquatic and riparian habitats and adversely affect freshwater life. The wash-off of soil and associated oil from machinery during crossings can lead to localised siltation and contamination, and major pollution could be caused by a larger oil spill. Watercourses most at risk are those used for public or private water supply, or where they support priority species such as the freshwater pearl mussel or salmonid spawning beds. For these reasons, water regulatory authorities are generally opposed to the fording of watercourses and normally expect a minor or temporary bridge to be installed. However, it is recognised that some locations rely on historical fords for access and in some situations it may be acceptable to continue to use an existing, purpose-built ford, providing reasonable precautions are taken to minimise the risks to the water and riparian environment.

9 Consider planting woodland to protect erosion-prone soils and intercept sediment-laden run-off. 19

10 Prior to clearfelling and where access permits, assess the drainage system, identify watercourses, and plan restoration work to reduce the risk of erosion and sediment delivery.

11 Identify sites of protected aquatic and wetland habitats and species, including spawning areas, and ensure protective buffer areas are established.

12 Identify any private or public water supplies and ensure sources are protected from disturbance.

13 Assess whether culverts or other structures are de-stabilising the banks or beds of watercourses, or forming a barrier to fish access – if so plan for their replacement or removal.

Note: Guidelines 14–16 only apply to the operation of machinery in watercourses for dredging, construction of minor or temporary bridges, bank reinforcement, removal of sediment or boulder placement. Contact the water regulatory authority or fishery organisations for information on fish spawning times, which will vary between fish species.

14 Work must not be carried out when fish are spawning in the affected surface water, or in the period between spawning and the subsequent emergence of juvenile fish. If in doubt about these times, contact the local District Salmon Fishery Board for advice. GBR9f

15 Any plant, vehicles or equipment must not be operated in any river, burn or ditch if there is a reasonable likelihood that there are freshwater pearl mussels within 50 m of such an operation. GBR9g

16 The operator shall not operate machinery in watercourses during forestry operations. GBR9h

17 Minimise the soil disturbance necessary to secure management objectives, particularly on organic soils. 4 13

18 Consider the potential impacts of soil disturbance when planning operations involving cultivation, harvesting, drainage and road construction. 6 14

19 Within defined buffer areas, limit cultivation to hinge mounding.

20 Avoid forest drains discharging directly into watercourses.

21 Align forest drains to run at a maximum gradient of 2° (3.5%) and lead them towards the heads of valleys.

22 No land shall be cultivated that is within 2 m of any surface water or wetland, 5 m of any spring, well or borehole, or is waterlogged. GBR20a

23 No land shall be mole-drained on slopes where the overall gradient is >4.5° (8%) GBR20b

24 Land must be cultivated in such a way that minimises the risk of pollution to the water environment. GBR20c

25 Run-off must be discharged in such a way to minimise the risk of pollution of the water environment. GBR21a

26 No discharge from drains shall result in the de-stabilisation of the banks or bed of the receiving watercourse. GBR21b

27 Build roads outside riparian buffer areas wherever possible.

28 When culverts are to be installed, site them at the point where a watercourse is intercepted by a road or track to avoid discharging the watercourse into the roadside drain

29 Ensure the installation of bridges or culverts does not present barriers to fish movement, or promote channel erosion or bank collapse.

30 Where there is a necessity for in-stream work, ensure this is undertaken in a way that minimises the risk of pollution and damage to freshwater life.

31 Consider projections of changes to rainfall patterns when specifying designs for culverts, drainage systems and roads. 21

32 Avoid road drains discharging directly into watercourses.

33 Where there is a risk of spreading invasive non-native species (such as the American signal crayfish) take action to clean footwear and vehicles before moving between sites and avoid moving gravel between rivers and catchments.

In Scotland, a large number of additional GBRs apply to the construction of minor and temporary bridges GBR6a-k, small-scale bank reinforcement GBR8a-k, and the removal of sediment from culverts GBR13a-h.

34 Avoid clearfelling more than 20% of the catchment of a public water supply within any three-year period.

35 On steep slopes where there is a risk of slope failure or serious erosion, consider alternatives to clearfelling. 33 18

36 Minimise compaction, rutting and erosion during forest operations by selecting the most appropriate working method for site conditions; monitor operations and modify, postpone or stop procedures if degradation starts to occur. 31 9

37 On sites vulnerable to compaction and erosion, consider the weather and aim to carry out operations during dry periods; plan ahead for changes in the weather that could affect site conditions. 33 10

38 Plan felling and timber extraction to minimise the number of stream and drain crossings, and protect any crossing points and riparian zones from damage by harvesting machinery.

39 Keep streams and buffer areas clear of brash as far as practicable and avoid felling trees into watercourses. 34

40 Avoid fording streams and rivers, unless there is an existing purpose-built ford and measures are taken to minimise the potential risk to the water environment; seek advice from the water regulatory authority.

Nutrient enrichment

The leaching and run-off of phosphate and nitrate from the land represents a loss of soil fertility and can reduce surface water and groundwater quality. Peat soils are particularly liable to leach phosphate from brash following large-scale felling operations; this can pose a risk to sensitive lake water bodies. Soil erosion can also transport phosphate bound to soil particles, which can be subsequently released in the receiving water body. Fertilisers may be accidentally sprayed or blown into watercourses, or may be transported indirectly via subsequent leaching or run-off. The risk of nutrient losses depends upon the timing, method and scale of fertiliser applications.

Of principal concern are naturally nutrient-poor upland waters in which biological activity is usually limited by phosphorus. Enrichment can lead to unwelcome ecological changes and a reduction in water status. In extreme cases, phosphorus enrichment can produce excessive algal growth, resulting in dissolved oxygen fluctuations and disruption of the ecosystem. Excess phosphate may result in increased water treatment costs and may require improvements to water treatment works.

Heavy rainfall following fertilisation with urea can result in high ammonium concentrations in streams; this may interfere with water treatment processes and cause an unacceptable taste in drinking water. Fish deaths could result from the toxic effects of ammonia where water pH is high. Nitrate release following large-scale clearfelling could potentially have an adverse impact on the ecology of receiving waters, especially in shallow coastal waters supporting shellfish populations. Urea use in stump treatment is considered to pose a very small risk of water pollution.

Woodland can be an effective land use for intercepting and removing excess nutrients from agricultural land, helping to protect water quality and freshwater ecology. This is especially beneficial in catchments of water bodies at risk from diffuse nutrient pollution, particularly within Nitrate Vulnerable Zones (NVZs) and Source Protection Zones (SPZs).

The main exception is conifer forest in polluted and drier areas, where there is evidence that the enhanced capture of nitrogen pollutants from the atmosphere can lead to concentrated nitrate levels in groundwater. High nitrogen inputs can result where forests are downwind of local pollutant sources, such as intensive pig and poultry rearing units. However, this effect can be used to protect more vulnerable habitats from nitrogen deposition, providing local groundwater supplies are not affected.

Organic pollution of watercourses can occur following the spreading of sewage sludge and other organic wastes. This can result in microbial contamination, as well as bacterial growth and oxygen depletion, which in some cases may kill fish.

41 Consider opportunities for woodland planting to reduce nutrient leaching and run-off to watercourses.

42 Where water bodies are sensitive to nutrient enrichment, including shallow coastal lochs designated for shellfish, limit any clearfelling to less than 20% of the catchment in any three-year period.

43 Within Nitrate Vulnerable Zones (NVZs), ensure any fertiliser applications or organic soil amendments adhere to NVZ Regulations.

44 Choose tree species and silvicultural systems that are well suited to the site and, with the exception of short rotation forestry or short rotation coppice, do not require continuing inputs of fertilisers. 21

45 Minimise the use of inorganic fertilisers and confine these to areas where analysis clearly shows management benefits. 22

46 Plan any fertiliser applications to minimise the risks of nutrient loss. 23

47 If heavy rain is forecast, wind conditions are inappropriate, or if the ground is frozen, waterlogged or covered with snow, delay the application of inorganic fertiliser or sewage sludge.

48 Within buffer areas, restrict the application of inorganic fertilisers and only apply by hand; exclude the application of sewage sludge or other organic materials, and avoid the storage of fertilisers or empty fertiliser bags being left overnight.

49 On restock sites in catchments of water bodies sensitive to nutrient enrichment, avoid filling trenches with fresh brash, and avoid applying inorganic fertiliser or sewage sludge until sites have re-vegetated.

50 No fertiliser shall be stored on land that is within 10 m of any surface water or wetland; is within 50 m of any spring, well or borehole; is waterlogged; has an average soil depth of less than 40 cm and overlies gravel or fissured rock (except where the fertiliser is stored in an impermeable container); or is sloping (unless the fertiliser is inorganic or it is ensured that any run-off will be intercepted by a sufficient buffer zone). GBR18a

51 No organic fertiliser shall be applied to land that is within 10 m of any surface water or wetland; is within 50 m of any spring, well or borehole; is sloping (unless it is ensured that any run-off will be intercepted by a sufficient buffer zone); has an average soil depth of less than 40 cm and overlies gravel or fissured rock (except where the application is for forestry operations); or is frozen (except where the fertiliser is farmyard manure), waterlogged or covered with snow. GBR18c

52 No inorganic fertiliser shall be applied to land that is within 2 m of any surface water or wetland; is within 5 m of any spring, well or borehole; is sloping (unless it is ensured that any run-off will be intercepted by a sufficient buffer zone); has an average soil depth of less than 40 cm and overlies gravel or fissured rock (except where the application is for forestry operations); or is frozen (except where the fertiliser is farmyard manure), waterlogged or covered with snow. GBR18d

53 No fertiliser shall be applied to land in excess of the nutrient needs of the crop. GBR18e

54 Maintain all equipment used in fertiliser applications in a good state of repair. GBR18f

55 Fertiliser shall be applied on land in such a way and at such times that the risk of pollution to the water environment is minimised. GBR18g

Pesticides

Pesticides in the form of herbicides, insecticides and fungicides can pollute water supplies and have serious effects on the aquatic environment. The ability of some pesticides to give unpalatable tastes and odours at extremely low concentrations can be particularly problematic, and can markedly increase the cost of water treatment and have implications for public health. Other pesticides can be extremely toxic to fish, aquatic plants and

invertebrates, and can build up to damaging levels in birds and other wildlife. Also of concern are the sub-lethal effects of very low pesticide levels on fish reproduction and physiology.

Pesticide use in forestry in the UK is very low and is declining in response to policies and plans for chemical reduction. The approach of the UKFS is to:

- restrict pesticides to those approved by international agreement;
- seek alternatives to pesticide use;
- confine necessary usage to the absolute minimum.

This involves careful attention to working practices, avoiding adverse effects such as off-site drift, contamination from discarded planting bags and contingency planning for spillages. There are legal requirements in relation to pesticide usage, storage, disposal and aerial applications (see Control of pesticides).

One pesticide attracting particular concern due to its extreme toxicity to freshwater invertebrates is cypermethrin. Its use in sheep dip is banned in England and Wales, and attention has turned to other potential pollution sources, such as forestry. Rigorous attention to good practice and spraying precautions is essential for minimising the risk of water contamination. This involves extending buffer areas to incorporate boggy ground and flushes that form the source areas of streams, even if these appear dry at the time of application; this may require pre-application site surveys during wet periods. Monitoring work in Wales has shown that re-wetting of these areas following treatment can lead to local water contamination.

The low usage of pesticides and general absence of contamination within well-managed forests means that new woodlands can help to offset the greater pollution threat from more intensive land uses. In particular, forestry can have an important role in protecting sensitive areas, such as Source Protection Zones (SPZs), from contamination. Targeted farm woodland planting can be effective at protecting watercourses from pesticide spray drift and leaching or run-off of pesticides following crop applications.

56 Identify opportunities for new woodland to reduce the adverse effects of adjacent pesticide spray drift, leaching and run-off to watercourses and groundwater.

57 Minimise the use of pesticides and fertilisers in accordance with Forestry Commission and Forest Service guidance. 24 15 5

58 Plan the storage, transportation, disposal and handling of pesticides, including containers and planting bags used for treated trees, to prevent spillage and the pollution of watercourses; ensure a contingency plan is in place to mitigate any accidental spillage.

59 If heavy rain is forecast, wind conditions are inappropriate, or if the ground is frozen, waterlogged or covered with snow, delay the application of pesticides.

60 Within buffer areas, exclude field application of pesticides, unless approved for use in or near water, subject to the consent of the water regulatory authority; buffer areas should incorporate boggy source areas and flushes, even if dry at the time of pesticide application.

61 Prior to spraying pesticides, check that the drainage channels in the area to be treated do not discharge directly into watercourses; extend buffer areas to incorporate individual drains where they are not separated from watercourses.

62 The preparation of pesticide for application and the filling, cleaning or maintenance of pesticide sprayers shall be undertaken in conditions such that any spillage, run-off or washings will be prevented from entering any surface water or wetland; these activities shall not be undertaken within 10 m of any surface water or wetland, or any opening into a surface water drainage system. **GBR23a**

63 Pesticide spraying equipment shall be maintained in a good state of repair. **GBR23b**

64 Pesticide sprayers shall not be filled with water taken from the water environment unless a device preventing back siphoning is fitted or the water is first placed in an intermediate container. **GBR23c**

65 Pesticide-treated planting stock shall not be soaked in any surface water or wetland prior to planting. **GBR23d**

66 Pesticide shall be applied in accordance with the terms and instructions of the relevant product approval. **GBR23e**

67 No pesticide shall be applied in, onto or over ground, or allowed to drift onto or over ground that is within 1 m of any surface water or wetland; is within 50 m of any spring, well or borehole; is frozen, waterlogged or covered with snow (except where the application in, onto or over waterlogged ground is necessary to control fungal disease and all precautions are taken to minimise the risk of contamination of any surface water or wetland); is sloping (unless it is ensured that any run-off of pesticide will be intercepted by a sufficient buffer zone); has an impermeable surface which drains directly into a surface water drainage system (unless measures are taken to minimise this risk); or is along roads, railway lines, permeable surfaces or other infrastructure (unless measures are taken to minimise the risk of pollution of any surface water or wetland). **GBR23f**

68 Pesticide shall be applied in such a way, and at such times, that the risk of pollution of any surface water or wetland is minimised and, in particular, shall not be applied during rainfall or wind conditions when there is a risk that spray will drift or be blown outwith the target area. **GBR23g**

69 No pesticide, including any used packaging that has been stored in contact with pesticide, shall be stored on land that is within 10 m of any surface water or wetland, or 50 m of any spring, well or borehole; or on an impermeable surface draining to a surface water drainage system. **GBR23h**

Fuel oils, lubricants and fire-fighting chemicals

There are legal requirements with respect to the storage of oils (see Oil and fuel storage). The primary concern arising from the use of fuels and lubricants in forests is the risk of spillage leading to water pollution. Both the accumulation of small spills during routine

handling and larger accidental spills can lead to serious contamination of soils and waters. All oils, and in particular diesel oil, can quickly move through the soil and small quantities are sufficient to taint drinking water supplies and disrupt water treatment processes. Oils can have a toxic effect on freshwater life and can prevent the transfer of oxygen through the water surface, causing aquatic animals to suffocate. Bio oils are less persistent in the environment, but tend to emulsify more easily making recovery difficult and can still pose a risk of pollution through accidental spillage or misuse.

The use of fire-fighting chemicals can also pose a threat to the freshwater environment, which could increase in the future if climate change increases the incidence of fires (see Forests and Climate Change). Synthetic detergents and protein foams have a high oxygen demand, which can kill fish in receiving watercourses. The spillage or careless disposal of concentrates presents the greatest risk to water quality during operational use.

70 Plan the storage, transportation and handling of fuels, oils and fire-fighting chemicals to prevent spillage and pollution of watercourses; ensure a contingency plan is in place to mitigate any accidental spillage.

71 Where it is necessary to store fuel oils on site temporarily, use double-skinned or bunded, securely lockable tanks. 7

72 Within buffer areas, exclude the storage and handling of fuel oil, lubricants or fire-fighting chemicals.

73 Place any waste or recovered oil in an impermeable container and remove from the site for disposal at a suitable licensed site. 6

74 Any refuelling must take place at least 10 m away from any surface water. GBR9b

75 Any static plant or equipment used within 10 m of surface water shall be positioned on a suitably sized and maintained impervious drip tray with a capacity equal to 110% of the capacity of the fuel tank which is supplying the tank or equipment. GBR9c

76 Any plant or equipment used in or near surface water must not leak oil. GBR9d

77 The washing of any vehicles, plant or other equipment must take place at least 10 m away from any surface water and the washings must not be allowed to enter any surface waters. GBR9e

Water yield and low flows

Water yields from upland catchments containing significant proportions of closed-canopy conifer forest are less than yields from moorland or grassland catchments. This is due to higher interception losses. Losses are greatest in the wetter and windier parts of the UK and increase with forest height and canopy development. Research suggests there may be a 1.5–2% reduction of potential water yield for every 10% of a catchment under mature conifer forest. Water yields from newly planted, young or felled forests are unlikely to differ significantly from moorland catchments until canopy closure is achieved.

In lowland areas, the drier and less windy climate reduces interception loss in absolute terms, but tree transpiration rates may be higher due to roots reaching deeper soil water reserves. The net effect can be a marked reduction in potential water yield, amounting to as much as 7% for every 10% of a catchment under mature conifer forest. This can have important implications for the quality and quantity of lowland groundwater resources and the maintenance of river flows.

Annual evaporation from broadleaved woodland is generally much less than from conifers due to reduced interception losses during the leafless period. Studies have shown that groundwater recharge under beech and ash woodland on chalk can be expected to be similar or slightly higher than that under managed grassland. Therefore planting broadleaved woodland can help to protect and may enhance chalk groundwater resources. However, recharge under broadleaved woodland on drier sandy soils is likely to be reduced compared with grass. This is because the deeper rooting of trees enables transpiration to continue unaffected by water stress for a longer period during the summer than for grass.

Energy forest crops such as short rotation poplar and willow coppice are able to sustain high transpiration rates on moist or wet soils, resulting in a 5% or greater reduction in potential water yield for every 10% of a catchment covered, when compared with grassland. Modelling studies suggest that short rotation forestry crops of *Eucalyptus* or *Nothofagus* could have an even greater impact on water supplies, while those of ash could have the opposite effect and actually increase water yield.

Adequate summer baseflows in rivers are critical for wildlife, water supply and the dilution of effluent. Research suggests that the reduction in water yield due to upland conifer forests has a relatively small effect on these flows. The cultivation and drainage of wet soils prior to planting can significantly increase baseflows, as can clearfelling; these help to compensate for any reduction caused by the higher forest water use during the main growth phase. Baseflows can be greater from broadleaved woodland compared with agricultural land due to higher soil infiltration rates and a similar water use.

The situation can be different in the lowlands, however, where large areas of conifer forest or crops of short rotation forestry could result in a significant decline in summer baseflows. This is because of the greater potential reduction in water yield and the fact that baseflows tend to form a much larger proportion of the annual run-off.

Climate change could exacerbate the effect of forestry on water yields and low flows. Forest interception losses are likely to increase, accentuating the difference in water use between forest and non-forest land covers. However, the impact on water supplies could be offset in some areas by higher winter rainfall, while rising carbon dioxide concentrations could increase the efficiency of water use by trees and reduce water losses. See Forests and Climate Change for further information on climate change projections and guidance on forestry for adaptation and mitigation.

78 Where the maintenance of water flows is an issue, consult the water regulatory authority (or water utility company) and conservation agency before carrying out large-scale woodland establishment – especially involving conifer or short rotation forestry crops with a high water use; consider the projected impacts on future water yield, including the effects of climate change.

Peak flows and flooding

Accentuated peak flows in watercourses can have a range of negative impacts including coloured water, erosion and siltation, damage to bankside habitat and spawning gravels, and increased downstream flood risk. In areas subject to acidification, peak flows are often linked to acid episodes in watercourses. Conversely, reduced peak flows can have an impact on replenishing reservoirs, which could pose a problem for water supplies.

Forestry can have a range of effects on peak flows, which can differ from those on water yield, depending on the type and scale of forest operation. Cultivation and drainage operations have the potential to increase peak flows, although the effect tends to decrease with increasing storm size and is difficult to detect for large flood events. Past forest drainage practice can contribute to localised flooding, but as forests are redesigned and restocked these effects will decrease. There may be opportunities to enhance floodwater storage through restoring forest wetlands and creating ponds and other storage features, such as coarse woody debris 'dams'.

Forest establishment and growth have the potential to decrease peak flows, while clearfelling can have the opposite effect until the trees are replanted and regrow. Overall, research suggests that the contrasting effects of the different stages of the forest cycle (cultivation, drainage, road construction, forest growth and harvesting) may even out at the catchment scale, especially as forest areas become more diverse in age. As a result, well-designed and sited forests in headwater catchments are likely to have a beneficial impact on downstream flood risk and may contribute to flood alleviation.

New woodland on soils vulnerable to structural degradation by agricultural activities can increase soil infiltration rates and reduce rapid run-off and local flood flows. Larger-scale planting could potentially contribute to downstream flood mitigation but there is limited hard evidence from international catchment studies. The inclusion of new woodland as part of sustainable urban drainage systems is expected to improve water retention and slow down flood flows. Sites can be identified where planting is best targeted to assist flood management.

The restoration of floodplain forests and riparian woodland could play an important role in attenuating flood peaks, as well as providing many other environmental benefits. Flood flows are able to spread out over natural floodplains, and the presence of a diverse forest structure, for example in the form of multiple woody dams within water channels and on the forest floor, can aid the retention and delay the release of floodwaters. Strategically placed floodplain forests and riparian woods may therefore offer a means of mitigating downstream flooding, although care is required to avoid sites where the backing-up of floodwaters upstream could affect local properties, or the washout of large woody debris could block downstream structures. There are constraints on new woodland along some rivers due to the need to protect flood banks and preserve access for maintaining flood protection.

79 In flood risk management plans, consider opportunities for woodland creation and management to reduce flood risk; this includes their use as part of sustainable urban and rural drainage systems.

80 Within areas of high flood risk, phase clearfelling to minimise the risk of increasing local flood flows.

81 Where practicable, amend drains on restock sites to slow down surface run-off.

82 Consider opportunities to restore forest wetlands and create ponds to increase flood storage and slow flood flows (e.g. by building porous 'dams' of coarse woody debris).

83 When siting and designing new woodland, consider the potential benefits in relation to flood alleviation, improvement of water quality and other ecosystem services. 32

Shade and shelter

The structure and composition of riparian vegetation can have a dramatic impact on the aquatic environment. A key factor is the degree of shade. Ideally the riparian zone will be managed to develop a rich herb and shrub layer, with a light and broken tree canopy. Light and broken shade, such as that provided by broadleaves, helps keep summer water temperatures down, which can be important for aquatic life, particularly salmonid fish. The occurrence of lethal temperatures is likely to become more commonplace as climate change progresses (see Forests and Climate Change).

The best combination of shade and shelter is usually predominantly native woodland managed to achieve 50% canopy cover. Too much canopy, especially of conifers, can shade out the lower layers of vegetation and result in bank erosion. For this reason, natural regeneration that is likely to lead to a conifer canopy cover should be considered for removal if the riparian zone is not to be compromised.

Prioritising riparian conifer plantations for clearance within forest management plans can help meet the objectives of the Water Framework Directive. The linkage of cleared sections will create a network of wet woodland habitat and promote the recovery of fish and aquatic invertebrate populations. This is particularly important in acid-sensitive catchments. However, such networks can also facilitate the rapid spread of invasive species such as Japanese knotweed and giant hogweed, so control measures and careful management are required in areas where invasive species may be a problem (see Forests and Biodiversity).

In addition to providing shade, riparian vegetation can influence the condition of watercourses by providing an effective filter and buffer, which helps to trap sediment and absorb nutrients thereby reducing the delivery of pollutants to watercourses. Riparian woodland will also provide a source of woody debris to watercourses, which is important for aquatic life.

Identifying and establishing an effective buffer area is fundamental to the protection of the riparian zone and aquatic habitats; the wetness of the soils and the characteristic instability of stream banks mean that the zone is particularly sensitive to disturbance. Buffer zones will also help to protect watercourses from any potentially adverse effects of adjacent land use. The minimum buffer widths from forest edge to watercourse are given in Table 6.7.2.

84 Aim for a mix of shaded and lightly shaded habitat within the riparian zone – around 50% canopy cover on average but guided by local circumstances and the requirements of priority species. 28 17

85 Remove dense stands of conifers from riparian areas and from the edges of ponds and lakes, and control excessive conifer regeneration. 29

86 Favour locally native tree and shrub species in the riparian zone and control the spread of invasive and non-native species. 30

87 Design and manage riparian woodland along small watercourses (less than 5 m wide) to provide a source of leaf litter and woody debris; retain this within watercourses unless it poses a significant risk of damaging or blocking downstream structures. 31

88 Provide and maintain defined buffer areas along watercourses and waterbodies. 32

7. Implementation and monitoring

The revised edition of the UK Forestry Standard (UKFS) has not changed the legal framework for forestry or introduced new regulations. The aim is to provide greater clarity by outlining the scope of relevant existing regulations, and using these, together with the principles of sustainable forestry, to define forest management requirements in a more explicit way.

This section explains the mechanisms for regulating forestry in the UK and ensuring that forests are managed sustainably according to UKFS Requirements.

The regulatory framework

The Forestry Commission in England and Scotland and Natural Resources Wales have a range of powers under the Forestry Act 1967 (as amended) through which the primary regulatory powers over forestry in Great Britain can be exercised. In Northern Ireland, the equivalent role in respect of the Forestry Act (Northern Ireland) 2010 is performed by the Forest Service, an agency within the Department of Agriculture, Environment and Rural Affairs. Some legislation is specific to forestry, but much legislation of relevance to forest and woodland owners and managers has wider application to any land management activity. The implications for forest managers of the main statutes of relevance are set out in the UKFS Requirements in Section 5 and Section 6.

Forestry policy in England, Scotland, Wales and Northern Ireland is the responsibility of the respective governments. Their forestry policies and strategies set out the priorities and programmes agreed in each country. For the public forest estate, policy is applied directly by the Forestry Commission in England and Scotland, Natural Resources Wales and the Forest Service. For other forests, policy is implemented through a range of regulatory instruments and incentives. The forestry authorities also fund research and provide advice and guidance to support policy development. Increasingly, forestry policy is delivered through or in partnership with a range of other departments of government, agencies and organisations.

Felling

Under the Forestry Act, it is illegal to fell trees in Great Britain without prior approval, although there are exceptions for trees below a specified size, dangerous trees, and very small-scale felling operations. Cases of illegal felling are investigated, and prosecution may ensue. Where trees are subject to designations, for example on Sites of Special Scientific Interest or Areas of Special Scientific Interest, the consent of the relevant statutory authorities is required for management activity. In addition, deforestation for the purposes of conversion to another type of land use may be subject to the Environmental Impact Assessment Regulations (see below).

Restocking

There is a presumption against the removal of woodland and the loss of forest cover in the UK, and it is normally the case that felling approval is granted subject to restocking. Restocking is required as a policy priority linked to a number of national and international commitments to prevent forest losses worldwide and to mitigate the effects of climate change. In Great Britain, the Forestry Commission in England and Scotland, and Natural Resources Wales, may serve a Restocking Notice, which requires restocking and establishment to take place.

In Northern Ireland, granting of a felling licence will be subject to conditions set out in a felling management plan, which may refer to the restocking of the land with trees. In addition, a Restocking Notice may be served following unauthorised felling. There are some special cases in the UK where trees can be established elsewhere (usually referred to as compensatory planting) or permanently removed.

The permanent removal of trees may be sanctioned if there are overriding environmental considerations, for example to allow the restoration of important habitats; such projects have to be individually assessed, taking into account the practicality of restoration, together with the implications for future management.

The removal of trees may also take place to enable development, authorised under the planning regulations,

to proceed. Such developments may include alternative sustainable land uses such as wind farms or hydroelectric schemes. In such cases, all the arguments, including impacts on climate change through loss of forest cover, will need to be addressed within the framework of woodland removal policies at country level and the planning legislation. As deforestation is involved, an Environmental Impact Assessment is likely to be required.

Environmental impacts of forestry

Proposals for new planting (including short rotation coppice and Christmas trees), deforestation, and the construction of forest roads and quarries come under the forestry provisions of the EU Environmental Impact Assessment (EIA) Regulations. The Forestry Commission in England and Scotland, Natural Resources Wales and the Department of Agriculture, Environment and Rural Affairs in Northern Ireland are responsible for the implementation of the Regulations, and will advise applicants about their scope and whether there is likely to be a need for an EIA. Forestry proposals that may have significant environmental impacts will require an EIA before approval is granted.

If an EIA is required, the applicant must prepare a comprehensive forest management plan, together with an exploration of the potential environmental impacts – this process will involve appropriate specialists. The applicant must submit an Environmental Statement to the forestry authority, and this and the EIA will be made available to the public and to the various statutory environmental authorities. The Forestry Commission in England and Scotland, Natural Resources Wales or the Department of Agriculture, Environment and Rural Affairs will take account of any comments received before making their decision.

The Environmental Liability Directive (2004/35/EC) establishes a common framework for liability with a view to preventing and remedying damage affecting the land, including damage to animals, plants, natural habitats and water resources. The Directive is the first EU legislation whose main objectives include the application of the 'polluter pays' principle. It requires those responsible for the most significant cases of environmental damage to take immediate action to prevent the damage occurring and to put right damage where it does occur.

Consultation on forestry proposals

The forestry authorities make provision for comments on forestry proposals before a decision is reached. The mechanisms for doing this vary across England, Scotland, Wales and Northern Ireland, and with the significance and extent of the proposal. Consultation is extensive where an Environmental Impact Assessment is involved. Arrangements for commenting on proposals can be found on forestry authority websites.

The minimum consultation requirement in England and Scotland is that felling proposals, other than thinning, and woodland creation proposals are entered on the Public Register of New Planting and Felling.

In Wales, felling proposals, other than thinning, are recorded in a public register, which provides the public with an opportunity to comment or provide additional information before a licence permitting felling is granted.

In Northern Ireland, the location and extent of felling and thinning proposals may be published on the Forest Service Public Register with consent of the owner. For woodland creation, Forest Service will publish a notice on the Forest Service Public Register providing location and extent of the proposed woodland.

Plant health and forest reproductive material

The Forestry Commission, Natural Resources Wales and the Forest Service also exercise legal powers to prevent the entry and spread of non-endemic pests and diseases of trees, under the 1967 Plant Health Acts. Trade in forest reproductive material (seeds, plants or cuttings) is also controlled under the 2002 Forest Reproductive Material Regulations (as amended), which implement the EU Directive 1999/105/EC on the marketing of forest reproductive material.

Meeting UKFS Requirements

The UKFS Requirements in Section 5 and Section 6 provide the basis for assessing whether the UKFS has been implemented. The numbered Guideline points in the same sections will enable an assessment to be made as to

whether the relevant Requirements of the UKFS have been achieved.

There are two current mechanisms for regulating forestry and approving of forest and woodland management proposals:

- Felling licences
- Forest management plans.

The forestry authorities also provide incentives to encourage the creation of new woodlands and the management of existing woodlands. The payment of grants is conditional on meeting UKFS Requirements.

Felling licences

The felling licence is a straightforward statutory instrument that gives permission to fell trees and is separate from the offer of incentives. There are many situations where a felling licence will be the most appropriate way to get approval for forestry proposals. Felling licences offer proportionate and expedient regulation to suit many UK situations, particularly where management activities are of limited scope, modest impact or infrequent occurrence.

In Northern Ireland, a felling management plan is an integral part of a felling licence under the Forestry Act (Northern Ireland) 2010.

A felling licence gives the owner the legal authority to proceed on the basis of the discrete operational area and activity involved. The licence requires the applicant to submit a range of information and to exercise good forestry practice. However, the licence does not extend to the wider context and area covered by a forest management plan – as a result, there will be UKFS Requirements and Guidelines that are not relevant or applicable to the individual licence area.

While the Requirements and Guidelines that are relevant or applicable to the licence area must be complied with, the limited scope of a felling licence necessarily restricts the levels of assurance that can be provided in relation to sustainable forest management. Accordingly, the minimum levels of UKFS assurance provided by a felling licence will be confined to the discrete operational area and defined as:

- Legality
- Environmental suitability to the site
- Conservation of high value habitats and protected sites
- Protection of society values and the provision of opportunities for public comment
- Protection of the forest area through a replanting condition.

Forest management plans

The forest management plan provides a more comprehensive basis for assessment that extends beyond the discrete operational area. This area is defined as the forest management unit (FMU). Forest management plans set proposals in a broader context, both in the area covered and over time. They also provide a clear statement of intention and allow proposals to be communicated to others. Forest management plans will be assessed for approval, monitored and periodically updated and their approval renewed. All publicly owned forests are managed using forest management plans which are available for public comment. The level of assurance provided by a forest management plan will therefore extend to all the UKFS elements of sustainable forest management applicable to the FMU.

Incentives

Each country in the UK has grant programmes aimed at supporting the delivery of its forestry policies and strategies. For forests and woodlands that are not part of the public forest estate, most planting, natural regeneration and some management operations take place with the assistance of grants or incentives and through the approval of a forest management plan. However, the approval required by the forestry authorities to proceed with proposals may be separate from the offer of a grant.

In the UK, the offer of incentives is conditional on meeting the UKFS Requirements. Moreover, under the rules for EU Rural Development Funding, meeting the UKFS has to be demonstrated through the submission and approval of an agreed forest management plan. This is subject to area thresholds set at country level, but a clear statement of objectives, management proposals, or establishment prescriptions will be required for all grant applications.

Monitoring

Monitoring is carried out at a strategic level, which is used for international and national level reporting, and at the level of individual forests and woodlands, to check that agreed proposals are being implemented.

Strategic reporting

The UK is committed to international agreements on sustainable forest management and these require countries to report at intervals of about five years on indicators developed by the Global Forest Resources Assessment (GFRA) and Forest Europe (formerly the Ministerial Conference on the Protection of Forests in Europe). These indicators show the extent and condition of forests and woodlands, together with social, environmental and economic aspects of sustainable forest management.

The range of reportable indicators was greatly increased for the GFRA in 2005 and 2010 and for the Ministerial Conference on the Protection of Forests in Europe in 2007. These, together with indicators at country level, now form the main basis for strategic monitoring that has superseded the earlier UK Indicators of Sustainable Forestry. Forestry also features in other international indicator sets on which the UK reports, such as those for the UN Convention on Biological Diversity (UNCBD) and the UN Framework Convention on Climate Change (UNFCCC).

A range of mechanisms provides data for this monitoring and reporting. For indicators concerned with UK forests, the national forest inventories, where the total forest and woodland resource is comprehensively assessed, have been the main source of data. Additional data are provided by a range of research plots across the UK that are used for environmental monitoring, and which form part of international co-operative programmes. Aspects covered include biodiversity, forest health, air pollution and climate change.

In the UK, each of the country forestry programmes or strategies has developed a set of performance indicators linked to strategic priorities. Where regional strategies exist within countries, indicators can also be linked to their strategic aims. These country indicators also draw upon existing statistics and surveys (e.g. the current National Forest Inventory), and projects such as the Native Woodland Survey of Scotland, which has improved the quality of data and increased the scope for future reporting.

In Great Britain, the Forestry Commission has prepared a digital base map for all woodlands over 0.5 hectare, as part of the National Forest Inventory. This will ensure that monitoring will take place against definitive woodland areas. A sample survey, based on the digital map, will be undertaken for all these woodlands and data collected on species, structure, timber potential and a range of environmental attributes. (A separate survey has been proposed for woodlands less than 0.5 hectare.) New technologies, including remote sensing, will enable the forestry authorities to carry out further checks on forest management and ensure the woodland map and associated survey data are regularly updated. In Northern Ireland, the Forest Service has published a draft Woodland Register which provides a breakdown of woodland area by woodland type and by the proportion of that area managed by the Forest Service for each county in Northern Ireland.

Monitoring of individual forests and woodlands

Within the framework of the UKFS, the Forestry Commission in England and Scotland, Natural Resources Wales and the Forest Service in Northern Ireland have developed their own country-specific approaches to assessing forestry proposals for approval and verifying their implementation. These approaches will be informed by the nature of forests and woodlands in each country and risk factors associated with non-compliance.

The UKFS Requirements and Guidelines provide explicit statements against which proposals can be checked and their implementation monitored. The approval and monitoring regime will extend to individual forests and woodlands, but, as with all aspects of compliance, a risk-based approach appropriate to the context will be taken. This will reflect the relevance and importance of the various elements of sustainable forest management, and individual Guidelines.

The implementation of forest management plans will be checked by the forestry authorities for grant payment purposes and again periodically as plans are amended or revised. At intervals, active forest management plans will

be updated and formally resubmitted for an assessment of implementation to date and approval. Inspections will be based on a proportion of approved plans, selected at random, and the remainder based on the perceived risk profile of non-compliance.

Inspectors will offer advice on meeting the UKFS Requirements and allow the opportunity for remedial work to be carried out. However, where there are serious or persistent departures from UKFS Requirements, and these are not remedied, approved plans may be suspended and grants may be reclaimed. Where there is failure to meet the legal requirements, legal action may ensue.

Operational plans are a requirement of good forestry practice (see General Forestry Practice), and the forestry authorities may ask to see these on site visits and more formally when forest management plans are due for renewal. Other UK regulatory authorities and organisations responsible for environmental standards, water quality, health and safety and employment may carry out checks to provide assurance of operational and legal compliance. As with other aspects of forest monitoring, the authorities will take a risk-based approach.

In addition, at a country level, representative sample surveys of approved forest management plans will be used as a general audit on the implementation of UKFS Requirements and the systems in place. Taken together, these various measures will give assurance that the UKFS is being applied for the forest resource as a whole and, on the basis of a risk-based sample programme, will give assurance for individual woodlands.

Monitoring and forest certification

The processes of government regulation and independent forest and woodland certification will remain distinct. However, the forestry authorities will take account of certification in adopting a risk-based approach to monitoring. The UK Woodland Assurance Standard (UKWAS), which is used as the basis of independent certification in the UK, draws on the UKFS and is compatible with the UKFS Requirements. Certified forest management plans will generally be considered to have a lower risk profile for non-compliance and this will be taken into account by monitoring and inspection regimes. All the forests and woodlands managed by the Forestry Commission, Natural Resources Wales and the Forest Service are independently certified and this will similarly be taken into account in the monitoring regime.

Evidence of legality and sustainability

For the majority of timber production in the UK, certification can be used to provide evidence that timber and wood products are legal and sustainable. For forests and woodlands that are not certified, the UKFS may be used to provide a risk-based approach to demonstrating legal and sustainable forest management. All active forest management plans will be regularly assessed and renewed against the UKFS Requirements, but checks on the detailed implementation of plans will be undertaken on a sample basis. As with certification, evidence will also be needed that links products to the forest covered by the management plan (see Timber and wood products in Section 4). Where a felling licence is issued but a forest management plan is not in place, the levels of assurance will be lower and extend to legality and the aspects of sustainability outlined under Felling licences above.

Further reading and useful sources of information

Further information and resources for the UK Forestry Standard can be found at: www.forestry.gov.uk/ukfs

Forestry Commission publications can be viewed and downloaded from: www.forestry.gov.uk/publications

Natural Resources Wales publications can be viewed and downloaded from: naturalresources.wales/our-evidence-and-reports

Forest Service publications can be viewed and downloaded from: www.daera-ni.gov.uk/forestservice/publications

Other useful websites

Information and guidance

For information on **forestry statistics**, including forestry facts and figures: www.forestry.gov.uk/statistics

For information about the **National Forest Inventory**: www.forestry.gov.uk/inventory

For information on **plant health** and biosecurity: www.forestry.gov.uk/planthealth

For information on **forest reproductive material**: www.forestry.gov.uk/frm

For information and guidance on **Environmental Impact Assessments**:
www.forestry.gov.uk/eia
www.naturalresources.wales/forestry
www.daera-ni.gov.uk/forestservice/environment

For information and guidance on **felling**:
www.forestry.gov.uk/felling
www.naturalresources.wales/forestry
www.daera-ni.gov.uk/forestservice

For information and guidance on **grant schemes**:
www.forestry.gov.uk/grants
www.naturalresources.wales/forestry
www.daera-ni.gov.uk/forestservice

To view the **public registers** on grants, felling applications, and Environmental Impact Assessments:
www.forestry.gov.uk/publicregister
www.naturalresources.wales/forestry
www.daera-ni.gov.uk/forestservice

Research and evidence

www.forestry.gov.uk/forestresearch
Forest Research is the Forestry Commission's Research Agency and is the UK's foremost body for forest and tree-related research.

www.uknea.unep-wcmc.org
The UK National Ecosystem Assessment (UK NEA) was the first analysis of the UK's natural environment in terms of the benefits it provides to society and continuing economic prosperity.

www.gov.uk/government/groups/natural-capital-committee
The Natural Capital Committee provides independent advice to the government on the sustainable use of natural capital, including forests, rivers, land, minerals and oceans.

Forest and timber certification

www.ukwas.org.uk
The UK Woodland Assurance Standard (UKWAS) is used for independent certification in the UK. The UKWAS standard is endorsed by two independent forestry certification schemes:

FSC UK (Forest Stewardship Council) – www.fsc-uk.org

PEFC UK (Programme for the Endorsement of Forestry Certification schemes) – www.pefc.co.uk

Legislation

www.legislation.gov.uk
All enacted legislation and revisions for the United Kingdom, Scotland, Wales and Northern Ireland.

Safety

www.ukfisa.com
The Forest Industry Safety Accord (FISA) produces Safety Guides, Alerts and Bulletins for the forest industry.

International context

www.cpfweb.org/en/
The Collaborative Partnership on Forests (CPF) is a voluntary arrangement among 14 international organisations and secretariats with substantial programmes on forests.

http://ec.europa.eu/agriculture/forest/strategy
The European Commission adopted a new EU Forest Strategy in 2013, which responds to the new challenges facing forests and the forest sector.

www.foresteurope.org
Forest Europe is the pan-European voluntary high-level political process for dialogue and cooperation on forest policies in Europe.

www.unece.org/forests
The United Nations Economic Commission for Europe (UNECE) Timber Committee and the FAO European Forestry Commission work together to promote sustainable forest management in Europe, the Commonwealth of Independent States and North America.

www.fao.org/forestry
The United Nations Food and Agriculture Organization (FAO) Forestry Department helps nations manage their forests in a sustainable way.

www.un.org/esa/forests
The United Nations Forum on Forests is an intergovernmental body to strengthen political commitment and action on forests.

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Appendix 1 – Legislation and conventions

This appendix provides further information on the main legislation and conventions of relevance to forestry and web-links to source documents, which must be consulted for definitive interpretation. This list is not comprehensive. The level of detail varies according to the relevance to forestry.

General Forestry Practice

Forest Europe

http://foresteurope.org

'Forest Europe' is a pan-European governmental process and comprises 46 signatory countries including Russia and other former Soviet Republics. Through this high-level political process, common principles, criteria and guidelines for all aspects of sustainable forest management have been developed.

EU Forest Strategy

https://ec.europa.eu

The EU Forest Strategy exists to enhance co-ordination and facilitate the coherence of forest-related policies. The Implementation Plan provides a framework for implementing forest-related measures and the forest policies of Member States.

EU Environmental Impact Assessment Directive (2014/52/EU)

https://ec.europa.eu

The newly amended Directive 2014/52/EU is transposed into UK legislation by the various Environmental Impact Assessment (EIA) Regulations, which apply to afforestation – including short rotation coppice and Christmas trees, deforestation, and the construction of forest roads and quarries.

Forestry Act 1967

www.legislation.gov.uk

The Forestry Act 1967 (as amended) conveys wide powers to control felling and provide assistance to promote the interests of forestry, the development of afforestation, and the production and supply of timber in Great Britain. The equivalent in Northern Ireland is the Forestry Act (Northern Ireland) 2010.

Town and Country Planning Acts

www.legislation.gov.uk

The Town and Country Planning Acts do not apply to forestry activities themselves, but where development is proposed on a woodland site then planning procedures apply. Where woodland is lost, then compensatory planting is likely to be a planning condition. Local authorities (in Northern Ireland, the Planning Service of the Department of

Agriculture, Environment and Rural Affairs) can apply Tree Preservation Orders and designate Conservation Areas to protect trees that are important in the landscape.

Plant Health Act 1967

www.legislation.gov.uk

The Plant Health Act 1967, together with The Plant Health (Forestry) Order 2005, encompasses the protection of forest trees and timber, and preventing the introduction and spread of forestry pests and diseases. The Plant Health Act (Northern Ireland) 1967 and associated orders perform a similar role in Northern Ireland.

Forest Reproductive Material (Great Britain) Regulations 2002

www.legislation.gov.uk

The Forest Reproductive Material (Great Britain) Regulations 2002 implement EU Directive 1999/105/EC in Great Britain and provide a framework for controlling plant materials used in forest establishment. In Northern Ireland, the Forest Reproductive Material Regulations (Northern Ireland) 2002 apply.

Environmental Liability Directive

http://ec.europa.eu

The objectives of this legislation include the application of the 'polluter pays' principle. Directive 2004/35/EC on environmental liability with regard to the prevention and remedying of environmental damage establishes a common framework for liability with a view to preventing and remedying damage to animals, plants, natural habitats and water resources, and damage affecting or contaminating the land.

EU Environment Action Programme 2014

http://ec.europa.eu

The 7th Environment Action Programme (EAP) provides a framework for a broad range of environmental legislation, much of which concerns forestry. The Programme will be guiding EU environment policy until 2020 together with a vision beyond that until 2050. It is the responsibility of EU institutions and the Member States to ensure it is implemented. It identifies three key objectives:

- to protect, conserve and enhance the European Union's natural capital;
- to turn the Union into a resource-efficient, green, and competitive low carbon economy;
- to safeguard the Union's citizens from environment-related pressures and risks to health and well-being.

Environment (Wales) Act 2016

www.legislation.gov.uk

This Act aims to plan and manage Wales' natural resources sustainably and proactively so that current and future generations benefit from a prosperous economy, a healthy and resilient environment and vibrant, cohesive communities. The Act features:

- the State of Natural Resources Report – Natural Resources Wales (NRW) must produce a report that gives an assessment of natural resources and their sustainable management;
- a National Natural Resources Policy – the Welsh Government must produce a national policy that sets out the priorities, risks and opportunities for managing natural resources sustainably;
- area statements – NRW will produce an evidence base to implement the priorities, to identify the risks and opportunities and to explain how these are to be addressed.

The Act also provides new powers for NRW to enter into land management agreements, to work with landowners with the aim of managing land in a sustainable way, and to undertake trials into new ways of working.

The key parts of the Act in relation to forestry are: Part 1: Sustainable management of natural resources, and Part 2: Climate change, which sets targets for emission reductions and a programme for reducing reliance on fossil fuels.

Environment (Northern Ireland) Order 2002

www.legislation.gov.uk

This Order contains provisions for pollution control, air quality and Areas of Special Scientific Interest (ASSI). ASSIs are designated by the Department of Agriculture, Environment and Rural Affairs and make it an offence to carry out operations likely to damage an ASSI without prior permission from the Northern Ireland Environment Agency. It is also an offence to damage or destroy a protected scientific interest. In addition to a fine, offenders may be liable for the costs of restoring the damaged area to its original condition.

Biodiversity

UN Convention on Biological Diversity

www.cbd.int

At the 1992 Earth Summit, world leaders agreed the UN Convention on Biological Diversity (UNCBD). It has three main goals; the conservation of biological diversity; the sustainable use of its components; and the fair and equitable sharing of the benefits from the use of genetic resources.

Three goals are particularly relevant to forest management in the UK:

- Applying the 'ecosystem approach' to the management of all types of forest, with an emphasis on working flexibly within the bounds of natural ecological processes.
- Reducing the threats and mitigating the impact of threatening processes on forest biological diversity. This includes mitigating the effects of climate change, non-native invasive species and pollution.
- Protecting and restoring forest biological diversity. The emphasis is on conserving natural habitats and priority species, creating habitat networks and restoring and enhancing biodiversity in managed forests.

Forest Europe

http://foresteurope.org
Forest Europe is an intergovernmental process and links to the UNCBD work programme on forests. Resolution H2 provides *General guidelines for the conservation of the biodiversity of European forests*.

In 2003, the forest ministers adopted Vienna Resolution 4, *Conserving and enhancing forest biological diversity in Europe*, as well as the *Assessment guidelines for protected and protective forest and other wooded land in Europe*. The *Pan-European guidelines for afforestation and reforestation* take into account effects of afforestation on biological diversity.

Habitats Directive

http://ec.europa.eu
Council Directive 92/43/EEC on the conservation of natural habitats and of wild flora and fauna, known as the Habitats Directive, was adopted in 1992. The main aim of the Habitats Directive is to promote the maintenance of biodiversity by requiring Member States to take measures to maintain or restore natural habitats and wild species listed on the Annexes to the Directive at a favourable conservation status. The Directive introduced robust protection for those habitats and species of European importance. In applying these measures, Member States are required to take account of economic, social and cultural requirements, as well as regional and local characteristics.

Birds Directive

http://ec.europa.eu
Directive 2009/147/EC on the conservation of wild birds, known as the Birds Directive, is the EU's oldest piece of nature legislation (the original Directive dating back to 1979), and one of the most important, creating a comprehensive scheme of protection for all wild bird species naturally occurring in the EU. It is a response to increasing concern about the declines in Europe's wild bird populations resulting from pollution and loss of habitats, as well as unsustainable use. It was also in recognition that wild birds, many of which are migratory, are a shared heritage of the Member States and that their effective conservation required international co-operation.

The Birds Directive bans activities that directly threaten wild birds, and controls hunting to ensure it is sustainable. It also promotes research to underpin the protection, management and use of all species of birds covered by the Directive (Annex V).

EU Invasive Alien Species Regulations (2015)

http://ec.europa.eu
These Regulations make it an offence to grow, cultivate or release a non-native species of concern into the environment without specific authorisation. Lists of species of EU and UK concern are published and regularly reviewed. In Great Britain, the Invasive Non-native Species Strategy is informed by the Regulations.

EU 2020 Biodiversity Strategy (2011)

http://ec.europa.eu

The EU Forest Strategy (see above) and EU Biodiversity Strategy underline the environmental, economic and social value of ecosystems and the urgent need to maintain them and their underlying biodiversity.

Conservation (Natural Habitats, &c.) Regulations 1994 (as amended)

www.legislation.gov.uk

The Conservation (Natural Habitats, &c.) Regulations 1994 transposed the Habitats Directive into national law (the Regulations, together with the nature conservation legislation below, also transpose the Birds Directive). The Regulations came into force on 30 October 1994, and have subsequently been amended several times. Containing five parts and four schedules, they provide for the designation and protection of 'European sites' – Special Protection Areas (SPAs), Special Areas of Conservation (SACs) and Ramsar wetland sites (named after the convention in Iran, 1971). The Regulations also provide for 'European Protected Species' (EPS). Changes in 2007 to the Habitats Regulations increased the legal protection given to protected species in England, Scotland and Wales. The following nature conservation legislation applies in the UK:

- England and Wales – the Conservation of Habitats and Species Regulations 2010 (as amended) consolidate all the various amendments made to the 1994 Regulations.
- Scotland – the Habitats Directive is transposed through a combination of the Conservation of Habitats and Species Regulations 2010 (as amended) (in relation to reserved matters) and the 1994 Regulations (as amended).
- Northern Ireland – the Directive is transposed by the Conservation (Natural Habitats, etc.) Regulations (Northern Ireland) 1995 (as amended).

Guidance on implementing the Regulations and other aspects of biodiversity can be found on the websites of the statutory bodies for nature conservation (see www.forestry.gov.uk/ukfs/biodiversity).

Wildlife and Countryside Act 1981 (as amended)

www.legislation.gov.uk

This legislation offers protection to many specified plants and animals, as well as broad protection to unspecified plants and animals such as nesting birds. The degree of protection and scope of the various measures are not confined to rare species. They include methods of controlling species and prevention of the establishment or release of non-native species. An important development for forestry in Great Britain was the Wildlife and Countryside (Amendment) Act 1985. This amended the Forestry Act 1967 to require Forestry Commissioners to endeavour to achieve a reasonable balance between afforestation, timber production, the conservation and enhancement of natural beauty, and the conservation of flora, fauna and geological and physiographical features of special interest.

Countryside and Rights of Way Act 2000

www.legislation.gov.uk

The Countryside and Rights of Way (CRoW) Act places duty on government ministers and departments in England and the Welsh Government to have regard to the purpose of the conservation of biodiversity in the exercise of their functions. This relates explicitly to obligations under the UNCBD. The CRoW Act requires the publication of official lists of priority habitats and species in England and Wales and the promotion of action.

Natural Environment and Rural Communities Act 2006 (England and Wales)

www.legislation.gov.uk

Certain wild birds are afforded increased protection under the Natural Environment and Rural Communities (NERC) Act, which created an offence of taking, damaging or destroying nests at any time during the year. Two new provisions relating to Sites of Special Scientific Interest (SSSIs) were also included.

Protection of Badgers Act 1992 (as amended)

www.legislation.gov.uk

This Act applies in Great Britain and its purpose is to protect the animals from deliberate cruelty and from the incidental effects of lawful activities that could cause them harm. Under this legislation it is an offence to:

- wilfully kill, injure, take, possess or cruelly ill-treat a badger, or attempt to do so;
- interfere with a sett by damaging or destroying it;
- obstruct access to, or any entrance of, a badger sett;
- disturb a badger when it is occupying a sett.

Note that if any of the above resulted from a person being reckless, even if they had no intention of committing the offence, their action would still be considered an offence.

The Act provides for licences to be issued for certain activities which would otherwise be prohibited and these can be obtained from Natural England, Scottish Natural Heritage or Natural Resources Wales. (For Northern Ireland, protection is provided by the Wildlife (Northern Ireland) Order 1985.)

Nature Conservation (Scotland) Act 2004

www.legislation.gov.uk

The majority of provisions under this Act came into force in Scotland in November 2004. The Act contains five parts and seven schedules which:

- place general duties on public bodies to further the interests of conservation of biodiversity;
- increase protection for SSSIs;
- amend legislation on Nature Conservation Orders;

- provide for Land Management Orders for SSSIs and associated land, and strengthen wildlife enforcement legislation;
- require the preparation of a Scottish Fossil Code.

The Act also amends the 1967 Forestry Act to remove the requirement to automatically replant on Conditional Felling Licences. It requires Scottish Ministers to designate one or more strategies for the conservation of biodiversity, and to publish lists of species of flora and fauna and habitats of principal importance.

Wildlife and Natural Environment (Scotland) Act 2011

www.legislation.gov.uk

This Act aims to make the law on wildlife and the natural environment in Scotland more efficient, effective and proportionate. The Act will support sustainable economic activity, particularly in the countryside, and will help to preserve the high quality of the natural environment for the benefit of the public and many rural businesses. The main purposes of the Act are to:

- modernise deer management legislation, including recreational deer stalking;
- modernise and deregulate game law (relating to game birds and ground game), including the abolishment of game licences;
- introduce new rules on snaring, including the training of snare operators;
- ensure badger licensing legislation is consistent with that of other species;
- control, contain and eradicate invasive non-native species;
- improve the administration of species licensing;
- abolish the Areas of Special Protection designation;
- increase flexibility in how muirburn (controlled burning of heather, grass and other moorland) is carried out;
- improve Sites of Special Scientific Interest (SSSI) legislation.

Wildlife and Natural Environment Act (Northern Ireland) 2011

www.legislation.gov.uk

This Act largely supersedes the Wildlife (Northern Ireland) Order 1985 (as amended).

The legislation aims to protect wild animals, birds, plants and their habitats. It is an offence:

- to kill, injure, disturb, take or sell specially protected wild animals, such as badger, otter and red squirrel;
- to kill, injure, disturb, take or sell all wild birds, their nests and eggs (with certain exceptions for pest and sporting species);
- to uproot, pick or sell specially protected plants.

Badgers and their setts are protected under Schedules 5, 6 and 7. It is an offence to disturb these animals or obstruct access to their place of refuge, or destroy or damage anything which conceals or protects their place of refuge. Badgers are also protected by the Animal Welfare Act 1972, which prohibits any act of cruelty including activities such as 'badger bating'.

Nature Conservation and Amenity Lands (Northern Ireland) Order 1985 (as amended)

www.legislation.gov.uk

This Order provides the Department of Agriculture, Environment and Rural Affairs in Northern Ireland with the power to acquire land for the purpose of managing it as a nature reserve. The Department may also enter into a management agreement with the owners and occupiers of land for this purpose. The Order also makes provision for the establishment of marine nature reserves. Byelaws can be made to protect both nature reserves and marine nature reserves.

Climate change

United Nations Framework Convention on Climate Change

www.unfccc.int

The UN Framework Convention on Climate Change (UNFCCC) forms the basis of international law in respect of climate change. The Convention does not itself contain legally binding targets for the reduction of greenhouse gases or enforcement mechanisms but it does provide for updates or Protocols which can contain emissions limits. The best known of these so far is the Kyoto Protocol.

The EU is a party to the UNFCCC (and subsequent Protocols) and has passed legislation, based on its Kyoto commitments, that sets climate change obligations for Member States including the UK.

Activities in land use, land-use change and forestry (LULUCF) offset emissions, either by increasing the removals of greenhouse gases from the atmosphere (e.g. by planting trees or managing forests), or by reducing emissions (e.g. by curbing deforestation).

Kyoto Protocol

http://unfccc.int

The Kyoto Protocol is an international agreement linked to the UNFCCC. The major feature of the Kyoto Protocol is that it sets binding targets for 37 industrialised countries and the European Community for reducing greenhouse gas emissions.

Paris Agreement

http://unfccc.int

The Paris Agreement builds upon the UNFCCC and – for the first time – brings all nations into a common cause to undertake ambitious efforts to combat climate change and adapt to its effects, with enhanced support to assist developing countries to do so. As such, it charts a new course in the global climate effort.

The Paris Agreement's central aim is to strengthen the global response to the threat of climate change by keeping a global temperature rise this century well below 2 degrees Celsius above pre-industrial levels and to pursue efforts to limit the temperature increase

even further to 1.5 degrees Celsius. Additionally, the Agreement aims to strengthen the ability of countries to deal with the impacts of climate change. The Agreement also provides for enhanced transparency of action and support through a more robust transparency framework. Forests have been formally recognised for the first time: Article 5 requires Parties to take action to conserve and enhance sinks and reservoirs of greenhouse gases, including forests. It also encourages Parties to implement and support activities to reduce emissions from deforestation and forest degradation, and highlights the role of conservation, sustainable management of forests and enhancement of forest carbon.

EU 2030 Climate and Energy Framework

http://ec.europa.eu

EU countries have agreed to the 2030 Climate and Energy Framework which sets three key targets for the year 2030: at least 40% cuts in greenhouse gas emissions (from 1990 levels), at least 27% share for renewable energy and at least 27% improvement in energy efficiency. The framework was adopted by EU leaders in October 2014. It builds on the 2020 climate and energy package.

Directive 2003/87/EC

http://ec.europa.eu

Directive 2003/87/EC on establishing a scheme for greenhouse gas emission allowance trading within the EU is the principal piece of EU legislation stemming from the Kyoto Protocol that established the EU Emissions Trading System (ETS).

EU Regulation 525/2013

http://ec.europa.eu

This is a mechanism for monitoring and reporting greenhouse gas emissions and for reporting other information at national and EU level relevant to climate change.

EU Renewable Energy Directive 2009/28/EC

http://ec.europa.eu

The Renewable Energy Directive establishes an overall policy for the production and promotion of energy from renewable sources in the EU. It requires the EU to fulfil at least 20% of its total energy needs with renewables by 2020 – to be achieved through the attainment of individual national targets. All EU countries must also ensure that at least 10% of their transport fuels come from renewable sources by 2020.

In relation to forestry, a new sustainability criterion on forest biomass is introduced, in order to ensure that the production of woodfuel continues to be sustainable and that any LULUCF emissions are accounted for (in the country of biomass production).

Climate Change Act 2008

www.legislation.gov.uk

This Act provides a framework to assist the UK's attempts to become a low carbon economy. It includes a legally binding target of at least an 80% cut in greenhouse gas emissions by 2050, to be achieved through action in the UK and abroad, and also a reduction in emissions of at least 34% by 2020. Both these targets are against a 1990 baseline. The principal provisions of the Act are:

- setting ambitious, legally binding targets;
- taking powers to help meet those targets;
- strengthening the institutional framework;
- enhancing the UK's ability to adapt to the impact of climate change;
- establishing clear and regular accountability to the UK Parliament and to the devolved legislatures.

Climate Change (Scotland) Act 2009

www.legislation.gov.uk

The central objective of the Scottish Act, like the UK Act, is to reduce greenhouse gas emissions by 80% by 2050. There is also an interim target, currently set at 42% by 2020. The new legislation enshrines in law for the first time targets, duties and mechanisms to tackle the causes of climate change.

Historic Environment

European Convention on the Protection of the Archaeological Heritage (revised) Valetta 1992

www.coe.int/en/web/conventions

This Convention, ratified by the UK in 2001, requires the promotion of public awareness of archaeological heritage together with supervisory and protection measures. It also requires the maintenance of a legal system to protect important heritage.

European Landscape Convention Florence 2000

www.coe.int/en/web/conventions

Signed by the UK in 2006, this Convention defines landscape as 'an area, as perceived by people, whose character is the result of the action and interaction of natural and/or human factors'. Signatories undertake to integrate landscape into regional and town planning policies and in their cultural, environmental, agricultural, social and economic policies, as well as in any other policies with possible direct or indirect impact on landscape.

Forest Europe

http://foresteurope.org

Forest Europe embraces the concept of sustainable forest management and includes the protection of areas of cultural heritage and the landscape.

Ancient Monuments and Archaeological Areas Act 1979

www.legislation.gov.uk

This Act is the main piece of legislation concerned with the protection of archaeological sites and ancient monuments in the UK. The Act provides for the investigation, preservation and recording of matters of archaeological or historical interest and for statutory protection as Scheduled Monuments. The provisions regulate operations or activities affecting them and also allow grants to be paid. The heritage authorities recommend archaeological monuments and buildings to the Secretary of State for listing (so called because the monuments and buildings are noted on physical lists or schedules).

Planning (Listed Buildings and Conservation Areas) Act 1990

www.legislation.gov.uk

The primary purpose of this legislation in England and Wales is to protect important buildings and their surroundings from changes which will materially alter the special historic or architectural character of the building, setting or local area. Inclusion in the list requires special consents for demolition or alteration. The related secondary legislation for England and Wales is the Planning (Listed Buildings and Conservation Areas) Regulations 1990 (as amended).

Treasure Act 1996

www.legislation.gov.uk

The Treasure Act 1996 came into force on 24 September 1997 in England, Wales and Northern Ireland (but not Scotland), and replaced the common law of Treasure Trove.

Anyone finding treasure has a legal duty to report the finds. Treasure is defined as gold and silver objects, prehistoric base-metal assemblages, and groups of coins from the same finds over 300 years old (see Code of Practice on the Treasure Act: Department for Culture, Media and Sport).

In Scotland, it is the prerogative of the Crown to receive all lost and abandoned property which is not otherwise owned. The system under which archaeological objects are dealt with is known for convenience in Scotland as Treasure Trove (see www.treasuretrovescotland.co.uk) and applies in practice to all ownerless goods regardless of whether objects were lost or intentionally hidden, or what material the objects are made of. The Crown Office relies on the recommendations of an expert group known as the Scottish Archaeological Finds Allocation Panel.

Planning (Listed Buildings and Conservation Areas) (Scotland) Act 1997

www.legislation.gov.uk

The primary purpose of this legislation in Scotland is to protect important buildings and their surroundings from changes which will materially alter the special historic or architectural character of the building, setting or local area. Inclusion in the list requires special consents for demolition or alteration. The related secondary legislation for Scotland

is the Town and Country Planning (Listed Buildings and Buildings in Conservation Areas) (Scotland) Regulations 1987.

Historic Monuments and Archaeological Objects (Northern Ireland) Order 1995

www.legislation.gov.uk

This Order relates to the protection of Scheduled Monuments in Northern Ireland and includes the obligation to report the finding of archaeological objects to a relevant authority.

Planning (Northern Ireland) Order 1991

www.legislation.gov.uk

The primary purpose of this legislation in Northern Ireland is to protect important buildings and their surroundings from changes which will materially alter the special historic or architectural character of the building, setting or local area. Inclusion in the list requires special consents for demolition or alteration.

Article 42 of this legislation concerns the protection of the character and setting of listed buildings.

Historic Environment Scotland Act 2014

www.legislation.gov.uk

This legislation determines how Scotland's historic environment is protected and managed. It introduces revised notification directions in relation to Listed Building/Conservation Area and Scheduled Monument Consents.

Historic Environment (Wales) Act 2016

www.legislation.gov.uk

The Act makes changes to improve current weaknesses and inconsistencies and make it harder for those who unlawfully damage a Scheduled Monument to escape prosecution. The Act also introduces new structures and negotiable arrangements to support the coherent and consistent management of historic assets. The Act will be complemented by an integrated body of policy, advice and guidance.

Landscape

Landscape designations

The relevant statutory bodies in England, Scotland, Wales and Northern Ireland advise on landscape matters, develop policies, review legislation and are responsible for landscape protection. Details of designations and planning policy in relation to landscape can be found on their websites (see www.forestry.gov.uk/ukfs/landscape).

The European Landscape Convention (ELC)

www.coe.int/en/web/conventions

The ELC is the first international convention to focus specifically on landscape, and is dedicated exclusively to the protection, management and planning of all landscapes in Europe. The ELC was signed and ratified by the UK Government in 2006, and became binding from 1 March 2007. The ELC definition of landscape is: 'A zone or area as perceived by local people or visitors, whose visual features and character are the result of the action of natural and/or cultural (that is, human) factors.'

This definition reflects the idea that landscapes evolve through time, as a result of being acted upon by natural forces and human beings. It also underlines that a landscape forms a whole, whose natural and cultural components are taken together, not separately.

The Convention highlights the need to recognise landscape in law, and to develop landscape policies dedicated to the protection, management and creation of landscapes. It also establishes procedures for the participation of the general public and other interested parties in the creation and implementation of landscape policies.

In Article 6, specific measures include the identification and evaluation of landscapes, and setting landscape quality objectives. The relevance of Article 6 to individual forest plans is the need for carrying out and using Landscape Character Assessments and providing context to individual forest plans; these are co-ordinated through the relevant agencies and local authorities.

People

European Landscape Convention

www.coe.int/en/web/conventions

The European Landscape Convention (ELC) is the first international convention to focus specifically on landscape, and is dedicated exclusively to the protection, management and planning of all landscapes in Europe. The ELC was signed and ratified by the UK Government in 2006, and became binding from 1 March 2007.

The Convention highlights the need to recognise landscape in law, and to develop landscape policies dedicated to the protection, management and creation of landscapes. It also establishes procedures for the participation of the general public and other interested parties in the creation and implementation of landscape policies.

Equality Act 2010

www.legislation.gov.uk

The Equality Act 2010 replaces previous anti-discrimination laws with a single act to make the law simpler and to remove inconsistencies. It also strengthens protection in some situations. The Act covers nine protected characteristics, which cannot be used as a reason to treat people unfairly. The protected characteristics are age, disability, gender

reassignment, marriage and civil partnership, pregnancy and maternity, race, religion or belief, sex and sexual orientation.

The Equality Act sets out the different ways in which it is unlawful to treat someone, such as direct and indirect discrimination, harassment, victimisation and failing to make a reasonable adjustment for a disabled person. The Act prohibits unfair treatment in the workplace, when providing goods, facilities and services, when exercising public functions, in the disposal and management of premises, in education and by associations (such as private clubs).

Occupiers' Liability Acts

www.legislation.gov.uk

The liability to visitors is covered by the Occupiers' Liability Act 1957 and the Occupiers' Liability Act 1984. The 1957 Act deals with lawful visitors and the 1984 Act deals with trespassers. The occupier means the person in control of the land, and they have a duty to show care towards people on that land. The level of this duty of care is the level which it is reasonable to foresee will be needed so that people do not suffer injury or damage. In England and Wales the 1957 and 1984 Acts apply. In Scotland the Occupiers' Liability (Scotland) Act 1960 applies, and in Northern Ireland the Occupiers' Liability Act (Northern Ireland) 1957 and the Occupiers' Liability (Northern Ireland) Order 1987 apply.

Employers' Liability (Compulsory Insurance) Act 1969

www.legislation.gov.uk

This Act ensures that an employer has at least a minimum level of insurance cover against any claims from current or former employees for injuries or illness resulting from their time at work.

Modern Slavery Act 2015

www.legislation.gov.uk

The Modern Slavery Act consolidates and simplifies a range of offences into a single Act. It also gives law enforcement bodies a range of powers to combat modern slavery, ensure perpetrators can receive suitably severe punishments and enhance support and protection for victims.

National Minimum Wage Regulations 2015

www.legislation.gov.uk

These Regulations Increase the national minimum wage and update the previous Regulations with regards to the 'accommodation offset', the European Community Erasmus Programme or Comenius Programme, and service charges or tips paid to a worker through the employer's payroll.

Countryside and Rights of Way Act 2000

www.legislation.gov.uk

In England and Wales, the Countryside and Rights of Way (CRoW) Act introduced significant changes to rights of way and their management. Rights of way are also affected by a range of other legislation, and the responsibilities of Highway Authorities due to the status of rights of way as 'highways' in law. The CRoW Act is supported by Natural England's Countryside Code.

Other relevant legislation in England and Wales:

National Parks and Access to the Countryside Act 1949
Natural Environment and Rural Communities Act 2006
The Highways Act 1980
Wildlife and Countryside Act 1981

Land Reform (Scotland) Act 2003

www.legislation.gov.uk

Statutory rights of public (non-motorised) access have been established over most land and inland water in Scotland under this Act together with a modern system for protecting paths and developing new path networks.

The Act, sometimes summarised as a 'right to roam', is supported by the Scottish Outdoor Access Code and places new responsibilities on local authorities and national park authorities to uphold access rights. In addition, Local Access Forums have been set up in all local authority areas and national parks to help promote the new access arrangements and encourage the development of new path networks.

Land Reform (Scotland) Act 2016

www.legislation.gov.uk

This Act by the Scottish Parliament introduced a wide range of provisions in relation to land rights and responsibilities. These include facilitating the purchase of land to further sustainable development, the need to engage communities in decisions relating to land, the introduction of non-domestic rates to be levied on shootings and deer forests, deer management, public access, agricultural tenancies and rights to buy.

Community Empowerment (Scotland) Act 2015

www.legislation.gov.uk

This Act aims to empower community bodies. It has a number of provisions including community ownership of land and buildings (right to buy), and strengthening the statutory base for community planning.

Well-being of Future Generations (Wales) Act 2015

www.legislation.gov.uk

This Act aims to improve the social, economic, environmental and cultural well-being of Wales. The Act will make the public bodies listed work sustainably, take a long-term view, work with people and communities, and work with each other. To facilitate this, the Act also establishes Public Services Boards for each local authority area.

The Active Travel (Wales) Act 2013

www.legislation.gov.uk

This legislation seeks to make it easier for people to walk and cycle in Wales as an alternative means to motorised transport for the purpose of making everyday journeys. Local authorities must map and plan walking and cycling infrastructure networks and make improvements to them every year. While these duties apply to built-up areas, local authorities are encouraged to also consider links to neighbouring areas, which may well include woodlands where active travel journeys are practicable.

Access to the Countryside (Northern Ireland) Order 1983

www.legislation.gov.uk

This Order allows for the creation of public paths and access agreements by local authorities. The Order is supported by the Northern Ireland Country Code produced by the Northern Ireland Tourist Board.

Health and Safety at Work etc. Act 1974

www.legislation.gov.uk

This Act (often referred to as HASAW or HSW) is the primary piece of legislation covering occupational health and safety in the UK. The Health and Safety Executive is responsible for enforcing the Act and a number of other Acts and Statutory Instruments relevant to the working environment. In Northern Ireland the Health and Safety at Work (Northern Ireland) Order 1978 applies.

Management of Health and Safety at Work Regulations 1999

www.legislation.gov.uk

The main requirement of the Management of Health and Safety at Work Regulations is that employers must carry out risk assessments to eliminate or reduce risks. In Northern Ireland the Management of Health and Safety at Work Regulations (Northern Ireland) 2000 applies.

Reporting of Injuries, Diseases and Dangerous Occurrences Regulations 1995

www.legislation.gov.uk

Under these Regulations (often referred to as RIDDOR) certain work-related accidents are reportable by law to the Health and Safety Executive or the local authority.

Control of Substances Hazardous to Health Regulations 2002

www.legislation.gov.uk
These Regulations (often known as the COSHH Regulations) require employers to assess and prevent (or at least adequately control) the risks to health from the use of any hazardous substances used in the workplace.

Provision and Use of Work Equipment Regulations 1998

www.legislation.gov.uk
These Regulations set out minimum standards for the use of equipment at work.

Health and Safety (First-Aid) Regulations 1981

www.legislation.gov.uk
These Regulations require employers to provide adequate and appropriate first-aid equipment and facilities, an adequate number of qualified first aiders and an 'appointed person', if a first aider is absent, to take charge of first-aid arrangements.

Soil

World Soil Charter

www.fao.org
The World Soil Charter calls for a commitment on the part of governments, international organisations and land users in general to manage the land for long-term advantage rather than for short-term expediency. Special attention is called to the need for land-use policies which create the incentives for people to participate in soil conservation work taking into account both the technical and socio-economic elements of effective land use.

Agenda 21

www.un.org
Agenda 21 is the programme of action that came out of the UN Conference on Environment and Development (UNCED), the 'Earth Summit', which was held in Rio de Janeiro in 1992. It is a comprehensive plan of action to be taken globally, nationally and locally by organisations of the UN system, governments and major groups in every area in which humans impact on the environment.

UN Convention on Biological Diversity

www.cbd.int
The UN Convention on Biological Diversity (UNCBD) was opened for signature at the UN Conference on Environment and Development (UNCED) which was held in Rio de Janeiro in 1992, and came into force in 1993. Its overarching aim is to conserve the world's biodiversity. Refer to the UKFS Guidelines on *Forests and Biodiversity* for further information.

Forest Europe

www.foresteurope.org
Forest Europe has passed several resolutions relevant to soil conservation, specifically Criterion 5 of the 1998 Pan-European Level Operational Guidelines (PELOG).

European Soil Charter Res(72)19

www.coe.int
In 1972 the European Commission Committee of Government Ministers, including the UK, recognised the increasing biological deterioration of the soil in many parts of Europe and adopted a charter for soil protection. Among other things the charter recognises that:

- soil is a precious asset;
- soil is a limited resource which is easily destroyed;
- farmers and foresters must preserve the soil's quality;
- soil must be protected from erosion and pollution.

Thematic Strategy for Soil Protection

http://ec.europa.eu
The European Commission adopted the Thematic Strategy for Soil Protection in 2006. The Seventh Environment Action Programme, which entered into force on 17 January 2014, recognises that soil degradation is a serious challenge. It provides that by 2020 land is managed sustainably in the Union, soil is adequately protected and the remediation of contaminated sites is well underway and commits the EU and its Member States to increasing efforts to reduce soil erosion and increase soil organic matter and to remediate contaminated sites.

Integrated Pollution Prevention and Control Directive

http://ec.europa.eu
The aim of EU Directive 2008/1/EC, known as the IPPC Directive, is to prevent or reduce pollution of the atmosphere, water and soil, as well as the quantities of waste arising from industrial and agricultural installations, to ensure a high level of environmental protection.

Kyoto Protocol

www.unfccc.int
The Kyoto Protocol is an international agreement linked to the UNFCCC. It highlights the fact that soil is a major carbon store, worthy of protection wherever possible.

Control of Pesticides Regulations 1986 (as amended)

www.legislation.gov.uk
These Regulations provide details of pesticides subject to control and prescribe approvals required for supply, storage and use, including aerial application. In Northern Ireland the Control of Pesticides Regulations (Northern Ireland) 1987 (as amended) applies.

Waste management legislation

www.legislation.gov.uk

The following Regulations bring into force the waste management licensing system under Part II of the Environmental Protection Act 1990, which is designed to control the disposal of waste materials, including sewage sludge, waste soil, and waste wood, bark and other plant material:

- The Waste Management Licensing Regulations 1994
- The Waste Management Licensing Regulations (Northern Ireland) 2003
- The Sludge (Use in Agriculture) Regulations 1989 (as amended) – this Regulation implements EU Council Directive 86/278/EEC on the protection of the environment, and in particular of the soil, when sewage sludge is used in agriculture.
- Sludge (Use in Agriculture) Regulations (Northern Ireland) 1990 SR 245 – this Regulation bans the use of sewage sludge from treatment plants in agriculture, unless certain requirements are met including specified pH levels, no fruit or vegetable harvesting and no soil and groundwater pollution.

Water

Water Framework Directive

http://ec.europa.eu

EU Directive 2000/60/EC on establishing a framework for European Community action in the field of water policy, establishes the principal framework for protecting and improving the water environment. The Directive is transposed into law by a number of regulations, which are detailed in the section on UK water environment legislation below.

Drinking Water Directive

http://ec.europa.eu

EU Directive 98/83/EC on the quality of water intended for human consumption aims to protect the health of consumers by making sure water is wholesome and clean.

Groundwater Directives

http://ec.europa.eu

The purpose of EU Directive 80/68/EEC on the protection of groundwater against pollution caused by certain dangerous substances and Directive 2006/118/EC on the protection of groundwater against pollution and deterioration is to prevent and control groundwater pollution. The Directives include provisions for assessing the chemical status of groundwater, identifying pollution trends, and measures to prevent or control the discharge of certain toxic, persistent and bio-accumulative substances into groundwater.

Nitrates Directive

http://ec.europa.eu

EU Directive 91/676/EEC concerning the protection of waters against pollution caused by nitrates from agricultural sources aims to encourage the use of good agricultural practices and thereby prevent pollution from agricultural sources. The Directive is transposed into law by national regulations aimed at preventing pollution by designating Nitrate Vulnerable Zones and controlling the addition of nitrogen from fertilisers or organic amendments.

Floods Directive

http://ec.europa.eu

EU Directive 2007/60/EC on the assessment and management of flood risks aims to reduce and manage the risks that floods pose to human health, the environment, cultural heritage and economic activity.

Habitats Directive and Birds Directive

http://ec.europa.eu

These Directives form the cornerstone of Europe's nature conservation policy by providing robust protection for those habitats and species of European importance. Refer to the UKFS Guidelines on *Forests and Biodiversity* for further information.

Forest Europe

www.foresteurope.org

Forest Europe is an intergovernmental process that aims to develop common principles, criteria and guidelines for sustainable forest management. In 2007, the forest ministers adopted Warsaw Resolution 2, Forests and water. The resolution commits signatory states, which include the UK, to the sustainable management of forests in relation to water, better co-ordination of policies on forests and water, addressing the impacts of climate change, and an economic valuation of water-related forest services.

UK water environment legislation

www.legislation.gov.uk

The following legislation transposes the EU Water Framework Directive into law, making provision for the protection of the water environment in the UK. Additional regulatory controls over potential polluting activities, including General Binding Rules, were introduced in Scotland under the Controlled Activities Regulations.

- Water Environment (Water Framework Directive) (England and Wales) Regulations 2003
- Water Environment (Water Framework Directive) (Northumbria River Basin District) Regulations 2003
- Water Environment (Water Framework Directive) (Solway Tweed River Basin District) Regulations 2004
- Water Environment and Water Services (Scotland) Act 2003
- Water Environment (Controlled Activities) (Scotland) Regulations 2011 (as amended)

- Water Environment (Water Framework Directive) Regulations (Northern Ireland) 2003
- Water (Northern Ireland) Order 1999 (including amendments up to 2004)
- Water Resources Act 1991 (Amendment)(England and Wales) Regulations 2009

UK flood management legislation

www.legislation.gov.uk

The following legislation transposes the EU Floods Directive into UK law:

- Flood and Water Management Act 2010
- Flood Risk Regulations 2009
- Flood Risk Management (Scotland) Act 2009
- Water Environment (Floods Directive) Regulations (Northern Ireland) 2009
- Reservoirs Act 1975

UK oil and fuel pollution legislation

www.legislation.gov.uk

These Regulations impose requirements aimed at the safe storage of oils and fuel to prevent leakage and pollution.

- Control of Pollution (Oil Storage) (England) Regulations 2001
- Water Environment (Oil Storage) (Scotland) Regulations 2006
- Control of Pollution (Oil Storage) Regulations (Northern Ireland) 2010
- Water Resources (Control of Pollution) (Oil Storage) (Wales) Regulations 2016

UK nature conservation legislation

www.legislation.gov.uk

The following Acts and Orders form the principal legislation relating to nature conservation in Great Britain and Northern Ireland. Refer to the UKFS Guidelines on *Forests and Biodiversity* for further information.

- Wildlife and Countryside Act 1981
- Countryside and Rights of Way Act 2000
- Natural Environment and Rural Communities Act 2006
- Conservation (Natural Habitats, &c.) Regulations 1994 (as amended)
- Nature Conservation (Scotland) Act 2004
- Wildlife and Natural Environment Act (Northern Ireland) 2011
- Environment (Northern Ireland) Order 2002

Control of Pesticides Regulations 1986 (as amended)

www.netregs.gov.uk

These Regulations provide details of pesticides subject to control and prescribe approvals required for supply, storage and use, including aerial application. In Northern Ireland the following legislation Control of Pesticides Regulations (Northern Ireland) 1987 (as amended) applies.

Waste management legislation

www.legislation.gov.uk

The following Regulations bring into force the waste management licensing system under Part II of the Environmental Protection Act 1990, which is designed to control the disposal of waste materials, including sewage sludge, waste soil, and waste wood, bark and other plant material.

- Waste Management Licensing Regulations 1994 (as amended)
- Waste Management Licensing Regulations (Northern Ireland) 2003 (as amended)
- Sludge (Use in Agriculture) Regulations 1989 (as amended)

Groundwater legislation

- Groundwater (England and Wales) Regulations 2009
- Groundwater Regulations (Northern Ireland) 2009 (as amended)
- Water Environment (Groundwater and Priority Substances) (Scotland) (Regulations) 2009

Nitrate Vulnerable Zones legislation

- Protection of Water Against Agricultural Nitrate Pollution Regulations 1996
- Nitrate Pollution Prevention Regulations 2008
- Action Programme for Nitrate Vulnerable Zones (Scotland) Regulations 2008
- Nitrate Pollution Prevention (Wales) Regulations 2008
- Nitrate Action Programme Regulations (Northern Ireland) 2014

Glossary

Access management plan Part of an operational plan used to channel and zone the recreational use of a forest. It should aim to ensure activities do not conflict with each other, facilities are used to best effect, visitors are not put at risk by forest operations and the forest environment and wildlife is protected.

Acid deposition The process by which acid pollutants, primarily sulphur and nitrogen compounds derived in part from the combustion of fossil fuels, deposit from the atmosphere to the ground. This can be in particulate form as aerosols or gases (dry deposition), or through indirect input in aqueous solution or suspension, as rain and snow (wet deposition) or cloud water (occult deposition).

Acid episode An intensive, short-term surge of acidic stream water characterised by rapidly changing chemical composition. Acid episodes are usually associated with heavy rainfall or rapid snow melt.

Acidification A continuing loss of acid neutralising capacity manifested by increasing hydrogen ion concentrations and/or declining alkalinity; the term may be applied to a catchment, waters or soils.

Adaptation Initiatives and measures to reduce the vulnerability of natural and human systems against actual or expected climate change effects (IPCC Assessment Report 4). In this context initiatives and measures to reduce the vulnerability of forests to climate change as well as using forests to reduce the vulnerability of society.

Adaptive management A systematic process for continually improving management policies and practices by learning from the outcomes of operational programmes.

Afforestation The process of establishing a new forest on land that was not previously forest or land which has not been forest in the recent past.

Algal bloom A sudden growth of algae in an aquatic ecosystem. Algal blooms occur naturally but may also be induced by nutrient enrichment of waters due to pollution. *See* Nutrient enrichment

Ancient hunting forest Usually Crown or Ducal land where the feudal owner held rights over game. The term 'forest' includes areas of open land.

Ancient semi-natural woodland (ASNW) Ancient woodland composed of mainly locally native trees and shrubs that derive from natural seedfall or coppice rather than from planting.

Ancient woodland Woodland which has been in continuous existence since before AD 1600 in England, Wales and Northern Ireland, and before AD 1750 in Scotland. The term ancient woodland site refers to the site of an ancient woodland irrespective of its current tree cover. Where the native tree cover has been felled and replaced by planting of tree species not native to the site it is referred to as a plantation on ancient woodland site (PAWS).

Ancient Woodland Inventory A map-based record of the location and boundaries of ancient woods held and maintained by the statutory conservation agencies in Great Britain. In Northern Ireland, the Woodland Trust produced the inventory. The inventories are provisional, and subject to the evidence available.

Anticipatory (or proactive) adaptation Adaptation that takes place before impacts of climate change are observed.

Approvals (herbicide or pesticide) Chemical products, for which usage and methods of application have been approved by the UK Chemicals Regulation Directorate.

Arboriculture The management of individual trees, but sometimes used to include the management of trees and woodlands in urban situations.

Area of Outstanding Natural Beauty (AONB) A conservation designation used in England, Wales and Northern Ireland for areas of countryside having natural features of exceptional beauty.

Area of Special Scientific Interest (ASSI) An area or site designated in part IV of the Environment (Northern Ireland) Order 2002 as having special scientific interest.

Area Plan A document providing a planning framework for areas of change including intensive growth, or regeneration, and areas of conservation.

Artefact An object made by a human being, typically one of cultural or historical interest.

Autonomous adaptation Adaptation that occurs automatically as a response to climate change, rather than as a conscious response to anticipated change. It is triggered by ecological changes in natural systems, and by market or welfare changes in human systems.

Baseflow Sustained run-off consisting largely of groundwater. At times of peak river flow, baseflow forms only a small proportion of the total flow, but in periods of drought it may represent nearly 100%, often allowing a stream or river to flow even when no rain has fallen for some time.

Biodiversity The variety of plant and animal life (species), including genetic variation within species.

Biofuels Fuels derived from biomass (plant matter) rather than fossil fuels (coal, oil or gas).

Biosecurity A set of measures designed to prevent the spread of harmful organisms or diseases.

Brash The residue of branches, leaves and tops of trees, sometimes called 'lop and top', usually left on site following harvesting.

Brash mats Brash (mainly cut branches) laid along the route where forestry machinery will be driving to spread the load and reduce soil damage.

Broadleaves Trees and shrubs that belong to the angiosperm division of the plant kingdom (as distinct from the gymnosperm division that includes conifers). Most in the UK have laminar leaves and are deciduous. Sometimes referred to as hardwoods but not all produce hardwood timber.

Brownfield (sites) Land or sites that have been used in the past for industrial activity or development; sometimes abandoned, underused or contaminated by past activities. When work is required to restore them to useful purposes they are also known as derelict land.

Buffer (area/zone) An area of land which protects the watercourse from activities on the adjacent land, such as by intercepting polluted run-off. The buffer area will usually include the riparian zone and may extend into the adjacent land.

Buffering capacity A measure of the ability of a soil to resist a change in pH.

Carbon dioxide equivalent (CO_2e) Greenhouse gases can be referred to as an equivalent carbon dioxide emission by multiplying their mass by their global warming potential. This allows comparison of the relative radiative forcing effect of different greenhouse gases.

Carbon sequestration (or capture or uptake) The accumulation of carbon in the forest reservoir. Over the lifetime of a forest stand, there is a net accumulation of carbon in the forest up until the point when equilibrium is reached. Thus the quantity of carbon accumulated is finite. The process is also reversible and carbon can be returned to the atmosphere through dieback, decay, the burning of wood or disturbance to the soil.

Carbon sink and source The carbon balance of a forest is often described as a sink if there is a net transfer of carbon from the atmosphere to one or more of the carbon pools in the forest (resulting in carbon sequestration). When a forest is described as a carbon source then there is a net transfer of carbon to the atmosphere.

Carbon storage The act of storing carbon, for a finite period, in a component of the Earth system, or a carbon pool. Examples of carbon pools include trees, deadwood, litter and soil as well as harvested wood products which retain carbon during their use.

Central Point of Expertise on Timber (CPET) A service of the UK Government. CPET has been set up by the Department for Environment, Food and Rural Affairs (Defra) to provide advice on the responsible purchasing of timber and timber products.

Certification scheme A voluntary scheme that establishes a forest management standard together with an auditing system to verify compliance. Forestry certification schemes are owned by international non-governmental organisations and exist to promote good forestry practice. They offer product labels to demonstrate that wood or wood products emanate from well-managed forests.

Clearfelling Cutting down of an area of woodland (if it is within a larger area of woodland it is typically a felling greater than 0.25 hectare). Sometimes a scatter or small clumps of trees may be left standing within the felled area.

Climax forest A forest, usually a natural and indigenous one, that is the product of ecological succession to the point where a stable vegetation cover is reached.

Colonisation Natural regeneration (of trees) on previously unwooded sites.

Community (of interest) All the people living in one district or a group of people with shared origins or interests.

Community woodland Woodlands for people to access and enjoy, where the needs and wishes of local people are important in planning and management.

Compaction The compression of soil leading to reduced pore space, usually due to the weight of heavy machinery. Compacted soils become less able to absorb and transmit rainfall, thus increasing run-off and erosion.

Compensatory planting Creating new woodland on previously unwooded land should an area of woodland be lost due to change in land use.

Competent authority A person or organisation that has the legally delegated or invested authority, capacity, or power to perform a designated function.

Compliance Acting in accordance with something, particularly in accordance with the law. In the context of this standard, the term 'compliance' refers to meeting the requirements of the UKFS.

Conifers Trees and shrubs that belong to the gymnosperm division of the plant kingdom (as distinct from the angiosperm division that includes broadleaves). Conifers mostly have needles or scale-like leaves and, with the exception of larches, all are evergreen. Sometimes referred to as 'softwoods', they produce softwood timber.

Conservation agencies The statutory nature conservation agencies: Natural England, Scottish Natural Heritage, Natural Resources Wales and the Northern Ireland Environment Agency.

Contingency plan A plan of action to address potential threats to the forest such as spillages, pollution, pest attack or wind damage.

Continuous cover forestry A silvicultural system whereby the forest canopy is maintained at one or more levels without clearfelling.

Controlled activities Activities that affect the water environment as defined in the Water Environment (Controlled Activities) (Scotland) Regulations 2011 (as amended). These include discharges and disposal to land, abstractions from wetlands, surface waters and groundwaters; impoundments such as dams and weirs; and engineering works in inland waters and wetlands.

Controlled water All streams, rivers, lakes, groundwaters, estuaries and coastal waters to three nautical miles from the shore.

Coppice An area of woodland in which the trees or shrubs are periodically cut back to ground level to stimulate growth and provide wood products. *See also* Short rotation coppice (SRC)

Copse A small wooded area historically used for small-wood production, often through coppicing.

Coupe An area of woodland that has been clearfelled or is planned for clearfelling.

Critical load (of acidity) The highest deposition of acidifying compounds that will not cause chemical changes leading to long-term harmful effects on the ecosystem structure and function.

Cultivation Any method of soil disturbance to aid the establishment of trees.

Cultural heritage Man-made things of a nation, people, community or group passed down from previous generations. They can be divided into the tangible (such as paintings, sculpture, monuments and archaeology) and the intangible (such as customs, intellectual achievements, history and institutions).

Cultural landscape An area of countryside whose character is predominantly the result of the patterns of human activity, often built up over long periods of time.

Cultural value The weighting or worth attributed to the arts, customs, intellectual achievements, history and institutions of a nation, people, community or group.

Deadwood All types of wood that are dead including whole or wind-snapped standing trees, fallen branch wood and stumps, decaying wood habitats on living trees such as rot holes, dead limbs, decay columns in trunks and limbs, and wood below the ground as roots or stumps. Deadwood of native species that exceeds 200 mm diameter and is associated with sites of high ecological value contributes the most to biodiversity.

Designed landscape A pleasure ground, park or large garden laid out with the primary purpose of creating an aesthetically pleasing scene or sequence of vistas.

Design plan The part of a forest management plan that predominantly addresses landscape and visual aspects.

Development Change of land use authorised by the planning authorities, usually for building and urbanisation.

Diffuse pollution Pollution arising from land-use activities (urban and rural) that are dispersed across a catchment. These are distinct from 'point' sources of pollution associated with discharges of industrial wastes, municipal sewage, and deep mine or farm effluent.

Drift deposit A deposit of mixed clay, gravel, sand and boulders transported and laid down by a glacier.

Duty of care A legal, contractual or moral obligation, depending on circumstances. The obligation is to ensure that reasonable measures are taken to ensure that individuals will be safe when they participate in an activity, such as visiting a forest.

Ecological status An indication of the structure and functioning of aquatic ecosystems associated with rivers, lakes, and coastal and transitional waters. The Water Framework Directive defines five status classes: high, good, moderate, poor and bad. Waters are classified according to the degree to which they meet relevant biological and environmental quality standards defined by the Directive.

Ecosystem The interaction of communities of plants and animals (including humans) with each other and the non-living environment. Ecosystems are considered to be 'in balance' when they remain stable over the long term (hundreds of years in the case of woodland).

Ecosystem services The benefits people obtain from ecosystems. These include provisioning services such as food and water; regulating services such as regulation of floods, drought, land degradation and disease; supporting services such as soil formation and nutrient cycling; and cultural services such as recreational, spiritual, religious and other non-material benefits.

Emissions scenarios A plausible representation of the future development of emissions of substances that are potentially radiatively active (e.g. greenhouse gases, aerosols), based on assumptions of demographic and socio-economic development as well as technological change.

Enclosure An area of land defined by a boundary such as a fence, wall, hedge or woodland belt. The enclosure pattern is the distribution of such boundaries in a tract of landscape. A sense of enclosure is the degree to which views or spaces are limited by surrounding landscape elements.

Energy crops Crops grown to provide energy for heating or the production of electricity. In forestry these are usually fast-growing species. *See* also Short rotation coppice (SRC) *and* Short rotation forestry (SRF)

Enterprise development A process to encourage the establishment and growth of businesses which will contribute economically and socially to society.

Environmental Impact Assessment (EIA) The process and documentation associated with the statutory requirement under the EU Environmental Impact Assessment Directive 85/337/EEC, as amended. This introduced a Europe-wide procedure to ensure that environmental consequences of projects are evaluated and public opinion is taken into account before authorisation is given.

Environmental Statement A statement of environmental effects that is required where an Environmental Impact Assessment is called for.

Establishment (period) The formative period which ends after young trees are of sufficient size so that, given adequate protection, they are likely to survive as woodland at the required stocking density.

European Protected Species Species of plants and animals (other than birds) which are protected under European and UK law.

Eutrophication *See* Nutrient enrichment

Fertility The availability and balance of nutrients required for plant growth.

Field pattern *see* Enclosure

Fieldwalking A systematic survey of the ground on foot used to produce a record of any evidence of historical interest.

Forest Land predominately covered in trees (defined as land under stands of trees with a canopy cover of at least 20%), whether in large tracts (generally called forests) or smaller areas known by a variety of terms (including woods, copses, spinneys or shelterbelts).

Forest carbon stock The sum of all the carbon in the forest ecosystem at a given point in time, including the whole tree, leaf litter and the forest soil.

Forest certification *see* Certification scheme

Forest Europe The brand name of MCPFE (Ministerial Conference on the Protection of Forests in Europe), Forest Europe is the pan-European policy process for the sustainable management of the continent's forests. Forest Europe develops common strategies for its 46 member countries and the EU on how to protect and sustainably manage forests.

Forest infrastructure Structure and facilities practice of forestry such as roads, tracks, stacking and landing areas, and buildings.

Forest Law Enforcement, Governance and Trade (FLEGT) A commitment to tackle illegal logging globally through an action plan agreed by the EU.

Forest management plan (woodland management plan) A plan which states the objectives of management together with details of forestry proposals over the next five years and outlines intentions over a minimum total period of 10 years. Forest plans allow managers to communicate proposals and demonstrate that relevant elements of sustainable forest management have been addressed, and can be used to authorise thinning, felling and other management operations.

Forest management unit (FMU) The area subject to a forest management plan or proposal. A convenient management area determined by the nature of the woodland, the management objectives and proposed operations. Extensive FMUs allow a strategic approach to be taken to meeting UKFS Requirements and Guidelines.

Forest potential The capability of a forest area to produce goods and services within the limits of sustainability. *See* Sustainable forest management

Forestry The science and art of planting, managing and caring for forests.

Forestry authority *see* Section 2.

Forestry operations Work or procedures carried out within a forest such as felling, extraction, cultivation and planting.

Functional landscapes Landscapes that typically provide more habitat, greater habitat diversity, and larger populations of known and unknown species, and that sustain key ecological processes within their natural ranges of viability over the long term.

Game Animals that are either wild or reared that are managed for hunting, shooting or fishing, usually for food.

Global warming potential (GWP) An index measuring the radiative forcing of greenhouse gases in the atmosphere integrated over a given timescale (normally 100 years) relative to that of carbon dioxide. It represents the combined effect of the different timescales that gases remain in the atmosphere as well as their effectiveness in absorbing outgoing thermal infrared radiation. This allows other greenhouse gases to be referred to as an equivalent carbon dioxide emission (CO_2e).

Greenhouse gases (GHGs) Gases in the atmosphere, both natural and man-made, that absorb and emit thermal infrared radiation emitted by the Earth's surface, the atmosphere itself and clouds. The primary greenhouse gases in the Earth's atmosphere are water vapour (H_2O), carbon dioxide (CO_2), nitrous oxide (N_2O), methane (CH_4) and ozone (O_3).

Green infrastructure The planned network of multifunctional open spaces of parks, trees, shrubs, grass areas and so on, with access routes and interconnecting links designed, developed and managed to meet the social, environmental and economic needs of communities and to contribute to a high quality natural and built environment.

Groundwater All water which is below the surface of the ground in the saturation zone and in direct contact with the ground or subsoil. This zone is commonly referred to as an aquifer, which is a subsurface layer or layers of rock or other geological strata of sufficient porosity and permeability to allow a significant flow of groundwater or the abstraction of significant quantities of groundwater.

Historic environment All tangible evidence of past interactions between humans and their environment, incorporating archaeological sites, historic landscapes and natural heritage.

Historic environment record(s) A central record of known heritage, maintained by local authority historic environment services. Previously referred to as Sites and Monuments Records (SMRs).

Historic Landscape Assessment (HLA) The process of mapping the extent of past and present land-use areas, categorised according to their form, function and period of origin.

Historic Landscape Character The character of a landscape defined by its historical interest such as historic buildings, ornamental landscapes and evidence of past uses, and embracing features such as hedge patterns and managed woodland. It recognises that the landscape itself can be of historical interest, in addition to the individual historic features within it. Historic Landscape Characterisation is a process (undertaken in England and Wales) to map the extent of past and present land-use areas, and categorise them according to their form, function and period of origin. (A similar process in Scotland is known as Historic Landscape Assessment (HLA).)

Hydromorphology The physical characteristics of the shape, the boundaries and the content of a water body.

Infiltration The entry of water into the soil.

Interception The evaporation of rainwater from the wetted surfaces of leaves, branches and tree trunks, resulting in less water reaching the ground.

Invasive species Animal or plant species which spread rapidly to the exclusion of other species. Many invasive species are not native or locally native.

ISO 14001 An international standard for environmental management systems developed by the International Organization for Standardization (ISO). It can be applied to any industry sector. ISO 14001 requires a company to undertake a review of its environmental impact, and, based on this, to develop a policy, objectives and targets and a programme to ensure they are implemented. ISO 14001 does not set specific performance targets, other than legal compliance, and therefore sector-specific performance targets can be linked with the standard.

Landform The three-dimensional shape of the land or terrain.

Landscape An area, as perceived by people, the character of which is the result of the action and interaction of natural and/or human factors (Article 1, European Landscape Convention, Council of Europe).

Landscape and Visual Impact Assessment (LVIA) A technique used to assess the effects of change on the landscape. The assessments help to locate and design the proposed change, so that negative landscape effects are avoided, reduced or offset.

Landscape character The distinct and recognisable pattern of elements that occur consistently in a particular type of landscape and combine to describe its essential nature.

Landscape Character Assessment The process of systematic description, classification and analysis of landscape in order to identify, describe and understand its character. The scale and detail of the assessment will depend upon the purpose for which it is being undertaken (*Landscape character assessment guidance for England and Scotland*. The Countryside Agency and Scottish Natural Heritage, 2002).

Landscape context The relevant circumstances pertaining to the site, situation and local area; in landscape these will include the landscape character, sensitivity, distinctiveness, historic and cultural significance.

Landscape sensitivity The degree to which specific types of land-use changes or development affect the character and qualities of the landscape. Sensitivity depends upon the type, nature and magnitude of the proposed change and the characteristics of the host landscape. High sensitivity indicates landscapes are vulnerable to the change; low sensitivity that they are more able to accommodate the change and that the key characteristics of that landscape will essentially remain unaltered.

Large woody debris Pieces of deadwood larger than 100 mm diameter and 1.0 m length, comprising whole trees, logs, branches and root boles that can accumulate within river systems.

Leaching The removal of soluble elements from one zone in soil to another via water movement in the profile.

LiDAR (Light Detection and Ranging) This remote sensing technique uses airborne lasers to record and map the landscape below.

Listed building A structure recognised as being of special architectural or historic interest, as specified under the relevant legislation, and one that requires listed building consent before any alterations, extensions or demolitions can be made which might affect its character.

Local distinctiveness The qualities of a particular locality that give it identity and make it unique and special to the people who live there or visit.

Locally native *see* Native species

Main River Designated stretches of river in England and Wales where the Environment Agency or Natural Resources Wales have permissive powers for flood defence purposes to construct and maintain defences and to control the actions of others through byelaws and the issuing of consents.

Mineralisation The production of inorganic ions such as nitrate in the soil by the oxidation of organic compounds.

Minimum intervention Management with only the basic inputs required to protect the woodland from external forces or to ensure succession of key habitats and species.

Mitigation (climate change) A human intervention to reduce the sources or enhance the sinks of greenhouse gases (IPCC Assessment Report 4). In this context, establishing and managing forests and their products to enhance their potential as a 'sink' of greenhouse gases.

Mounding The process of forming a small mound on which to plant a tree, thus increasing the aerobic zone of soil and maximising root extension. Hinge mounding is where an excavator scoops out and inverts a mound of soil with one edge of turf remaining intact.

National Scenic Area (NSA) A conservation designation used in Scotland for areas of outstanding scenic value in a national context.

Native species Species which have arrived and inhabited an area naturally, without deliberate assistance by humans. For trees and shrubs in the UK, usually taken to mean those present after post-glacial recolonisation and before historical times. Some species are only native in particular regions. Differences in characteristics and adaptation to conditions occur more locally – hence 'locally native'.

Native wood(lands) Woods mainly or entirely composed of native species.

Natura 2000 A network of sites contributed to by all EU Member States which consists of Special Protection Areas (SPAs) for birds (a requirement of the EU Birds Directive) and Special Areas of Conservation (SACs) for other species and habitats (a requirement of the EU Habitats Directive).

Natural regeneration Plants growing on a site as a result of natural seedfall or suckering. The term is also used to describe the silvicultural practices used to encourage natural seeding and establishment.

New native woodland New woodland, or woodland allowed to regenerate, especially designed and managed to develop a natural character by using communities of native trees and shrubs, ideally of local origin.

Nitrate leaching The removal of nitrate in solution from the soil via water movement, with the potential to contaminate surface water and groundwater.

Nitrate Vulnerable Zones (NVZs) Designated areas of land designed to protect waters against nitrate pollution from agriculture.

Nitrification Biological oxidation of ammonium to nitrite and nitrate.

Notification The process of informing someone (about something). The forestry authorities have various arrangements for notifying interested parties of forestry proposals.

Nutrient enrichment (eutrophication) Excessive richness of nutrients in waters or soils which results in adverse effects on the diversity of the biological system, the quality of the water, and the uses to which the water may be put.

Open space Areas within a forest without trees, such as glades, stream sides, grass or heathland, water bodies, rocky areas, roads and rides.

Operational plan The operational details of how planned work will be implemented at site level within the framework of a forest management plan. Also called a site plan.

Organic matter The organic fraction of the soil exclusive of undecayed plant and animal residues.

Origin The geographic locality within the natural range of a species where the parent seed source or its wild ancestors grew.

Peat A largely organic substrate consisting of partly decomposed plant material forming a deposit on acidic, boggy ground.

Permissive (use) Use by permission, whether written or implied, rather than by legal right.

Pesticide Any substance, preparation or organism prepared or used, among other uses, to protect plants or wood or other plant products from harmful organisms, to regulate the growth of plants, to give protection against harmful creatures or to render such creatures harmless.

pH A logarithmic index for the hydrogen ion concentration in an aqueous solution, used as a measure of acidity. A pH below 7 is considered to be acidic and one above 7 alkaline.

Phenology The study of natural phenomena in biological systems that recur periodically (e.g. development stages, migration) and their relation to climate and seasonal changes.

Planned adaptation Adaptation that is the result of a deliberate policy, based on an awareness that conditions are in the process of change and that action is required to maintain, or regain, the desired state.

Planning gain Provision by a developer to include in a proposal projects beneficial to a community in exchange for permission for a commercially promising but potentially unacceptable development.

Plantations Forests that have been planted or sown and are characterised by intensive silviculture treatment to meet a specific objective or limited range of objectives. Plantations lack most of the characteristics of natural forests.

Plantation on ancient woodland site (PAWS) Planted forests of native or non-native tree species that have replaced the original 'natural' woods on sites with a long history of woodland cover. *See* Ancient woodland

Pollard/pollarded trees A tree cut 2–4 m above ground level, managed to produce a crop of branches which can be harvested in subsequent years.

Priority habitat or species Habitats and species that have been listed as priorities for conservation action in biodiversity strategies.

Productivity (of woodland) The capacity to produce forest goods and ecosystem services.

Programme of measures A set of actions which are required to achieve the environmental objectives defined for a given water body under the River Basin Management Plan.

Protected characteristics The Equality Act 2010 covers nine 'protected characteristics' that cannot be used as a reason to treat people unfairly. The protected characteristics are: age, disability, gender reassignment, marriage and civil partnership, pregnancy and maternity, race, religion or belief, sex, sexual orientation.

Protected habitat or species Habitats or species protected by EU Directives and transposed into UK law by the Habitats Regulations. These provide a range of protection and conservation measures including the Natura 2000 network of protected sites and schedules of European Protected Species. In addition, a range of UK and country wildlife, countryside and conservation legislation provides protection for special sites and listed species.

Protection forest A forest that has a primary function of protecting the environment.

Provenance Location of trees from which seeds or cuttings are collected. Designation of Regions of Provenance under the Forest Reproductive Material Regulations is used to help nurseries and growers select suitable material. The term should not be confused with 'origin', which is the original natural genetic source.

Public Register Public listing by the forestry authorities of grant schemes, felling proposals and Environmental Impact Assessments to allow public comment.

Red Data Book The IUCN (International Union for Conservation of Nature) maintains an international list, published as the Red Data Book. Red Data Book species are classified into different categories of perceived risk. Each Red Data Book usually deals with a specific group of animals or plants (e.g. reptiles, insects or mosses).

Regeneration The regrowth of a forest through sowing, planting or natural regeneration, or regrowth following coppicing.

Registers of landscapes of historic and design interest Lists and descriptions of landscapes such as gardens, grounds, planned open spaces and parks of historic and design interest (rather than botanical interest *per se*) compiled under the aegis of heritage authorities. The inclusion on the register is of material consideration to the planning process.

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.

Restructuring Diversifying the distribution of age classes of a forest, usually by advancing felling in some areas and retarding it in others. Restructuring is usually associated with wider measures to redesign a forest as part of a forest management plan.

Retentions Trees retained, usually for environmental benefit, beyond the age or size generally adopted by the owner for felling.

Ride (or ryde) Open space used to separate forest areas and provide an access route.

Riparian Relating to or situated adjacent to a watercourse or water body.

River basin The area of land from which all precipitation eventually drains to the sea at a single river mouth, estuary

or delta, through a sequence of streams, rivers and lakes.

River Basin Management Plan A detailed document describing the characteristics of the basin, the environmental objectives that need to be achieved and the pollution control measures required to achieve these objectives through a specified programme of work.

River morphology Term used to describe the shapes of river channels and how they change over time due to sedimentation and erosion processes.

Rotation The period required to establish and grow trees to a specified size, product, or condition of maturity. The period varies widely according to species and end use, but for conifers in the UK this is usually about 35 years and for broadleaves at least 60 years.

Rutting (vehicle) Making deep tracks in the ground by the repeated passage of the wheels of vehicles.

Salmonids Fish belonging to the family Salmonidae, including salmon, brown trout, sea trout, grayling, powan and charr.

Scarifying A method of shallow cultivation designed to create suitable positions for tree planting or a seedbed for natural regeneration.

Scheduled Monument A monument or area of archaeological remains of national importance that is entered into a schedule maintained by the Secretary of State under the relevant legislation and is subject to legal protection under that legislation.

Semi-natural woodland Woodland composed of mainly locally native trees and shrubs that derive from natural seedfall or coppice rather than from planting. However, the definition varies according to the local circumstances in England, Scotland, Wales and Northern Ireland.

Sequestration *see* Carbon sequestration

Shelterwood system Felling of a proportion of the trees within an area leaving some trees as a seed source and shelter for natural regeneration. The seed trees are subsequently removed.

Short rotation coppice (SRC) Trees (usually willow or poplar) typically grown as an energy crop and harvested at intervals of about three years.

Short rotation forestry (SRF) The practice of growing single or multi-stemmed trees of fast-growing species on a reduced rotation length primarily for the production of biomass.

Siltation Deposition of waterborne, mainly soil-derived, particles within a watercourse, other body of water, or wetland.

Silviculture The growing and cultivation of trees, including techniques of tending and regenerating woodlands, and harvesting their physical products.

Site plan *see* Operational plan

Site of Local Nature Conservation Importance (SLNCI) A site identified in a local plan and managed as a nature reserve, while not being a designated site of international or national importance.

Site of Special Scientific Interest (SSSI) A site in Great Britain, referred to as an Area of Special Scientific Interest (ASSI) in Northern Ireland, that is protected by law for nature or geological conservation.

Soil carbon Carbon stored within the soil; primarily associated with the organic component of soil, it can be classified into three main fractions: rapidly cycled carbon stored in microbial biomass and easily decomposed plant residues; slowly cycled stable carbon held through chemical and physical processes for around a hundred years; and an inert or passive store which takes more than a thousand years to recycle.

Soil horizons Individual layers of soil differing in colour, texture or composition.

Soil productivity The capacity of a soil to produce a certain yield of crops or other plants with a specified system of management.

Soil structure The combination or arrangement of primary soil particles into secondary units or peds. The secondary units are characterised on the basis of size, shape and grade (degree of distinctness).

Source Protection Zone (SPZ) An area of land supplying groundwater to a well, borehole or spring for public supply, which is designated by the competent authority as being at risk from potential polluting activities.

Special Protection Area (SPA) Area designated under the EU Birds Directive.

Species assemblages Collections of species making up any co-occurring community of organisms in a given habitat.

Species compartment A geographically recognisable unit of forest land forming the basis for planning and management activities. In the UK compartments are usually identified by species composition and planting year.

Spinney A small area of trees and bushes traditionally surrounded by a hedge.

Spirit of place The intangible factor that gives a specific location special character and makes it unique to people. Often it is a combination of character, features, quality, space and associations which creates the sense of identity of a location.

Stand A discrete area of trees; characterised by homogeneity in attributes such as yield class, age, condition, distribution and thinning history.

Statutory body(ies) The authorities and bodies responsible for nature conservation (Natural England, Scottish Natural Heritage, Natural Resources Wales and Northern Ireland Environment Agency); environmental protection (Environment Agency in England, Natural Resources Wales, Scottish Environment Protection Agency and Northern Ireland Environment Agency); and the historic environment (Historic England, Historic Environment Scotland, Cadw and Northern Ireland Environment Agency).

Structural diversity The degree of physical variation in the elements of a forest, particularly the spatial distribution of trees, and vertical distribution of the canopy and other layers of vegetation.

Stump removal Harvesting of the basal part of the tree, including most of its woody roots, that remains after felling of the stem/log.

Substitution The use of wood products in place of other more energy-intensive materials such as concrete, metals and glass,

or the use of wood as a fuel in place of fossil fuels such as coal, oil and gas.

Sustainable forest management The stewardship and use of forests and forest lands in a way, and at a rate, that maintains their biodiversity, productivity, regeneration capacity and vitality and their potential to fulfil, now and in the future, relevant ecological, economic and social functions at local, national and global levels, and that does not cause damage to other ecosystems. (MCPFE 1993)

Thinning The removal of a proportion of trees in a forest after canopy closure, usually to promote growth and greater value in the remaining trees.

Traditional and customary uses Access or uses in relation to specific areas of land which are not established as a right in law but have been exercised through habitual or customary actions with uninterrupted acquiescence on the part of the landowner.

Transpiration The evaporation of water through the stomata on the surface of leaves.

Vegetation succession Changes that occur in vegetation as bare ground is progressively colonised by different species, ending in climax vegetation.

Veteran tree A tree of considerable age that is of interest biologically, culturally or aesthetically because of its age, size or condition, including the presence of deadwood micro-habitats.

Visual sensitivity An attribute determined by the visibility of the landscape, the main views of the forest, by whom and how it is seen, the nature of the viewing experience and the value placed on the landscape. Cultural or historical associations all contribute to this value.

Water body The basic water management unit defined under the Water Framework Directive for which environmental objectives are set. Water bodies can be parts of rivers, lakes and estuaries, stretches of coastal water or distinct volumes of groundwater.

Water catchment The area of land from which precipitation drains to a defined point in a river system, or to a lake or reservoir.

Watercourse Any natural or man-made channel through which water flows continuously or intermittently.

Water regulatory authority The Environment Agency in England, Natural Resources Wales, the Scottish Environment Protection Agency, and the Northern Ireland Environment Agency.

Wetlands Wetlands are transitional areas between wet and dry environments: they range from permanently or intermittently wet land to shallow water and water margins. The term can describe marshes, swamps and bogs, some shallow waters and the intertidal zone. When applied to surface waters, it is generally restricted to areas shallow enough to allow the growth of rooted plants.

Whole-tree harvesting The removal from a felled site of every part of the above-ground tree, except the stump.

Wildness (wildland) A quality of the landscape, usually due to natural character, remoteness or lack of obvious human influence, experienced by people through such values as feeling close to nature and experiencing a sense of solitude.

Windthrow (or windblow) Uprooting of trees by the wind.

Woodfuel Wood used as a fuel. Woodfuel may be available in a number of forms such as logs, charcoal, chips, pellets or sawdust.

Wood pasture Areas of historical, cultural and ecological interest, where grazing is managed in combination with a proportion of open tree canopy cover.

Practising sustainable forestry means managing our forests in a way that meets our needs at present but that does not compromise the ability of future generations to meet their needs. They will rightly expect that their forests and woodlands offer at least the same benefits and opportunities as we enjoy today. To sustain these expectations, the UK governments have set out their requirements for sustainable forest management in the UK Forestry Standard. Guidelines on how to meet the requirements are set out in sub-sections covering Biodiversity, Climate Change, Historic Environment, Landscape, People, Soil and Water. At the heart of this approach is the importance of balancing the environmental, economic and social benefits of forests and the recognition that our forests serve a wide range of objectives.

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