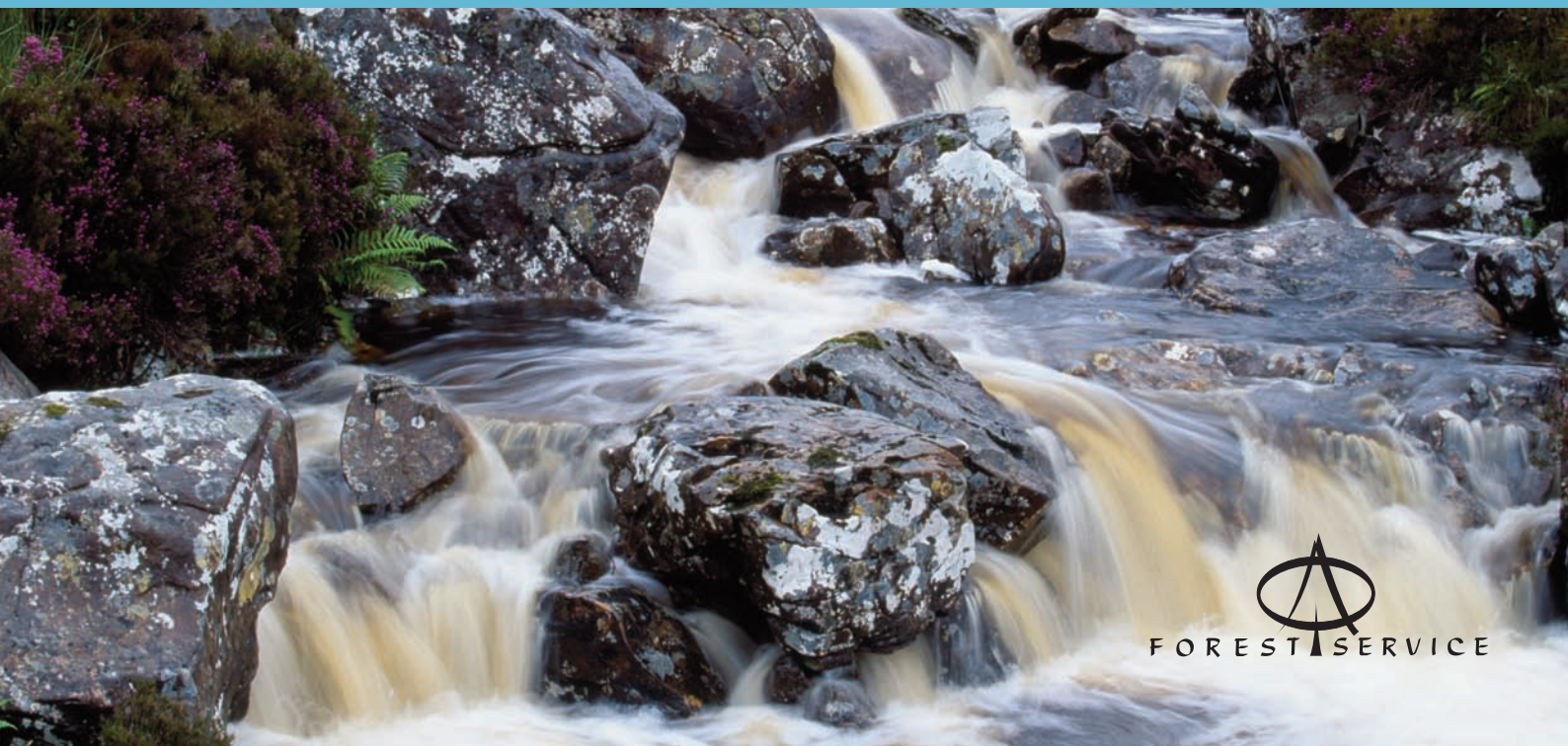


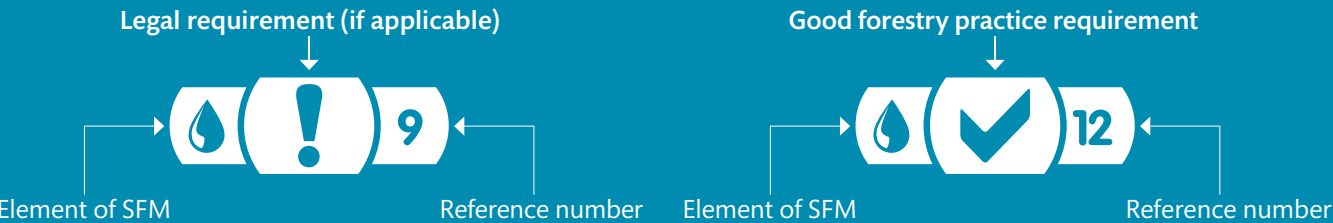
Forests and water

UK Forestry Standard Guidelines



Key to symbols

UKFS Requirements for sustainable forest management



UKFS Guidelines



Forests and water

UK Forestry Standard Guidelines

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Contents

1. Introduction	1
2. Overview of Forests and Water	3
UKFS Requirements	3
Purpose of the UKFS Guidelines	4
Scope and application	4
Definitions and terms	4
3. Introduction to forests and water	7
Forests and freshwater ecology	8
Integrated catchment management	11
Freshwater catchments in the UK	12
Drainage pathways	12
Riparian zones	13
Aquatic zones	14
Groundwater	14
Protected areas	14
Water Protection Zones	14
4. Policy and context	15
Water protection	15
Flood management	16
Conservation and wildlife protection in Europe	16
Conservation and wildlife protection in the UK	17
Forests and water in Europe	17
Forests and water in UK forestry policies and strategies	17
5. UKFS Requirements: Water	19
Water Framework Directive	20
Pollution control	20
Control of pesticides	21
Groundwater regulations and Nitrate Vulnerable Zones	21
Oil and fuel storage	22
Water supply	22
Flood risk management	23
Waste management	23
Aquatic habitats and species	23
Water quality and buffer areas	24
Acidification	25
Water quantity	26
6. UKFS Guidelines: Water	27
Acidification	29
Sediment delivery	31
Nutrient enrichment	35
Pesticides	37
Fuel oils, lubricants and fire-fighting chemicals	38
Water yield and low flows	39

Peak flows and flooding	41
Shade and shelter	42
7. Implementation and monitoring	45
The regulatory framework	45
Felling	45
Restocking	45
Environmental impacts of forestry	46
Consultation on forestry proposals	46
Plant health and forest reproductive material	46
Meeting UKFS Requirements	47
Felling licences	47
Forest management plans	47
Incentives	47
Monitoring	48
Strategic reporting	48
Monitoring of individual forests and woodlands	48
Monitoring and forest certification	49
Evidence of legality and sustainability	49
Further reading and useful sources of information	50
Appendix 1 – Legislation and conventions	53
Appendix 2 – Strategies and delivery mechanisms	56
Appendix 3 – General Forestry Practice	57
Glossary	74

1. Introduction

Forests and Water is one of a series of seven Guidelines that support the United Kingdom Forestry Standard (UKFS). The UKFS and Guidelines outline the context for forestry in the UK, set out the approach of the UK governments to sustainable forest management, define standards and requirements, and provide 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 Guidelines on *Forests and Water* replaces the fourth edition of the *Forests & water guidelines* published in 2003 (and all earlier versions). This new fifth edition, together with the 2011 editions of the UKFS and the rest of the Guidelines, has been produced to:

- provide an explicit statement of UKFS Requirements for sustainable forest management in line with statements for other land uses supported by EU rural development measures;
- ensure that the UKFS and its supporting Guidelines form an integrated whole by linking the UKFS Requirements through to the different elements of sustainable forest management;
- clarify the status of the UKFS, and the assurances provided by meeting the Requirements through the regulatory process;
- strengthen the role of forest planning;
- incorporate recent developments in legislation, international agreements, and the way forestry activity is monitored and reported;
- incorporate recent advances in the scientific understanding of forestry;
- include national and international initiatives on climate change and the role forests can play in mitigation and adaptation.

The new editions of the Guidelines have also replaced the 'Standard Notes', which gave detailed guidance on forestry practice in the first and second editions of the UKFS.

The UKFS and Guidelines have been developed by the Forestry Commission in Great Britain and the Forest Service, an agency within the Department of Agriculture and Rural Development in 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 and Guidelines have been endorsed by the UK and country governments and apply 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 and Guidelines are the Forestry Commission in Great Britain and the Forest Service in Northern Ireland.

The UKFS Guidelines on *Forests and Water* 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 (NGOs), charities and trusts.



An open canopy of native broadleaved woodland can benefit aquatic habitats.

2. Overview of Forests and Water

Forests and Water is structured in the same way as the other Guidelines that support the UK Forestry Standard (UKFS). This section sets out the purpose of the UKFS Requirements, explains the role of the Guidelines and how they relate to the UKFS, defines the scope of the series and provides explanations of terminology.

UKFS Requirements

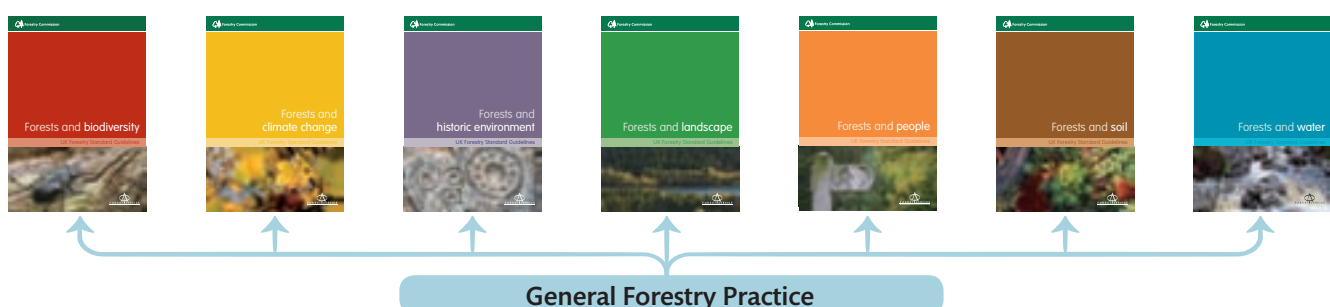
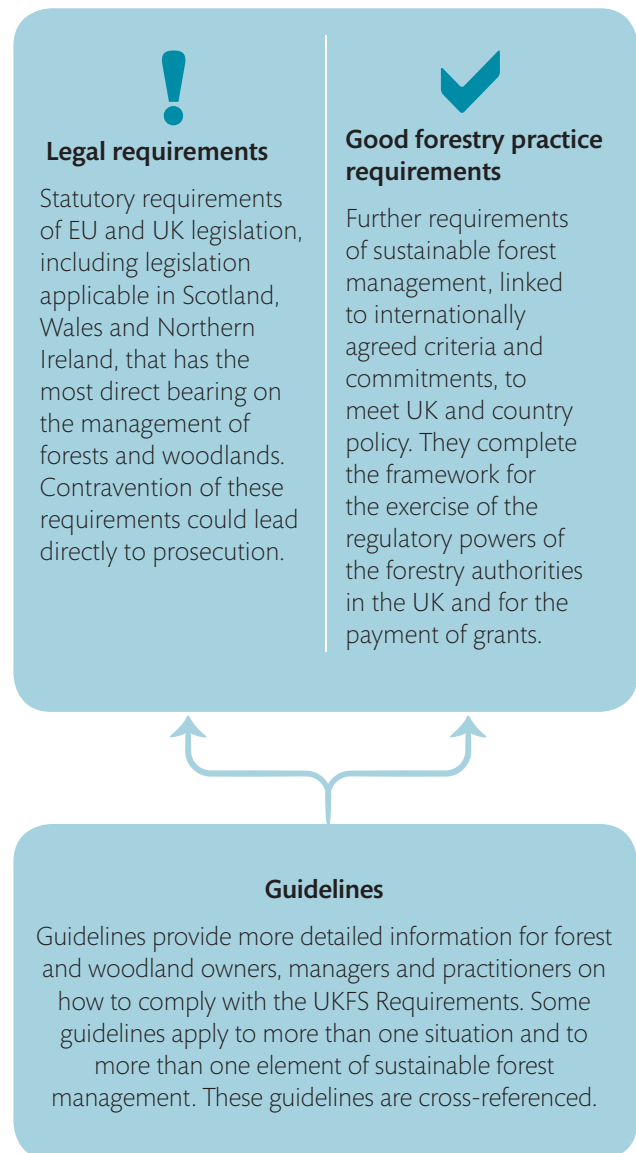
The UKFS Requirements for Water are set out in Section 5. There are two levels of compliance: **Legal** and **Good forestry practice**. Guidelines for managers on complying with the Requirements for Water are set out in Section 6.

In addition to water, there are UKFS Requirements for six other elements of sustainable forest management, each set out in an individual Guidelines publication, categorised as follows:

- Biodiversity
- Climate Change
- Historic Environment
- Landscape
- People
- Soil

General Forestry Practice is a further element of sustainable forest management that is covered by the UKFS itself, as it is common to water and the other elements of sustainable forest management. Requirements for General Forestry Practice apply in most forestry situations, for example planning and operations.

For completeness, and so that these publications stand alone, the UKFS Requirements and Guidelines for General Forestry Practice are set out in Appendix 3 of each of the Guidelines publications.



Purpose of the UKFS Guidelines

The series of UKFS Guidelines explains the principles of the various elements of sustainable forest management in further detail, sets out how the UKFS Requirements can be met, and points to sources of practical guidance. Each of the UKFS Guidelines covers a different element of sustainable forest management and is based on current, relevant research and experience.

The purpose of the UKFS Guidelines is to provide:

- a statement of the UKFS Requirements relevant to that particular element of sustainable forest management;
- guidance and advice for those managing forests and woodlands on how to meet these Requirements;
- the basis for assessing proposals, management operations and activities to ensure the sustainability of UK forests and woodlands.

Scope and application

The UKFS and supporting series of Guidelines have been developed specifically for forestry in the UK and apply to all UK forests. The UKFS and Guidelines are 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 and Guidelines encompass 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. They apply 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 and Guidelines does not extend to the management of individual trees (arboriculture), orchards, ornamental trees and garden trees, tree nurseries, and the management of Christmas trees.

Some aspects of forest management lend themselves to 'yes or no' compliance, but most do not, and the UKFS

and Guidelines have not attempted to condense all the complexities of forest management into an over-simplistic format. The UKFS and Guidelines have 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.

A number of the water guidelines set limits on the extent of forest cover or the scale of certain forestry activities within the water catchment. The degree of sensitivity will depend on the quality of freshwater habitats, the status of the water body that the catchment drains to (as defined by the EU Water Framework Directive, see Section 5), physiographic factors such as altitude, slope and soil type, and the requirements of water users.

Definitions and terms

The UKFS and Guidelines apply 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 and Guidelines the meaning is synonymous with forest. **Forestry** is the science and art of planting, managing and caring for forests.

Short rotation coppice (SRC) and **short rotation forestry (SRF)** are both included within the scope of the UKFS and Guidelines, 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.

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.

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.

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 forest practice requirements, there will be exceptional situations where a reasonable case for divergence can be made.

Unlike the rest of the UKFS Guidelines, a number of the water guidelines have a legal status in Scotland. These **General Binding Rules** are integral to the Water Environment (Controlled Activities) (Scotland) Regulations 2005 (as amended) and the Water Environment (Diffuse Pollution) (Scotland) Regulations 2008, 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 General Binding Rules (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. GBRs are identified in Section 6.

In this publication, **water regulatory authority** should be taken to refer to the Environment Agency in England and Wales, the Scottish Environment Protection Agency in Scotland, and the Northern Ireland Environment Agency in Northern Ireland. **Undertaker** refers to the water utility companies in England and Wales, Scottish Water in Scotland, and Northern Ireland Water in Northern Ireland.

Definitions of terminology specific to the UKFS Guidelines on *Forests and Water* can be found in the Glossary.

Box 2.1 Guidance on good practice and reports of research to support the UK Forestry Standard can be found in the Forestry Commission technical publications series.



Forest bogs and lochans
are important habitats
for the northern
emerald dragonfly.



3. Introduction to forests and 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, provide protection from natural hazards such as flooding or soil erosion and to protect the needs of aquatic species.

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 (e.g. recreation – Figure 3.1). 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.

The EU Water Framework Directive (WFD) provides the common framework for addressing all pressures on the water environment and has set an objective that water bodies should be restored to 'good status' by 2015 (see Section 4). 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 stipulation of the WFD is that

there must be no deterioration in current water status; this includes the need to maintain the quality of waters currently classified as 'high status'. High status waters are those with no or very low human pressure and equate to the 'reference condition' or best status achievable.

Many countries rely on 'protection forests' to preserve the quality of drinking water supplies, alleviate flooding and to 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 – for example biodiversity, carbon sequestration, landscape and recreation.

Figure 3.1 Water in and flowing from forested catchments provides a range of environmental, economic and social benefits.



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 (Figure 3.2). 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 is little scope for finding replacement sources in the event of pollution. High costs are likely for the provision of an alternative water supply.

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 (Figure 3.3). 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 the UKFS Guidelines on *Forests and Climate Change*).

Forests and freshwater ecology

Streams, rivers, lakes, ponds and wetlands all provide habitats for a large range of plant and animal species (Figure 3.4) and forests play a major role in the ecological functioning of the freshwater environment. To meet UKFS Requirements, forest design and management must

Figure 3.2 Mayflies are sensitive to pollution and most species require water of the highest quality.



Figure 3.3 High water temperatures can kill fish eggs by reducing oxygen levels and increasing susceptibility to disease.



Figure 3.4 Dippers are sensitive to disturbance and will move on if water becomes polluted. Acidification is a particular problem as it can severely reduce their food supply of aquatic insects.



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 suitable for a range of purposes.

The Water Framework Directive (WFD) provides overarching legislation that aims to maintain and improve the quality of all aquatic ecosystems. Implementation of the WFD is underpinned by environmental quality standards and criteria for aquatic plants and animals, 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 the UKFS Guidelines on *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.

The needs of protected and priority species such as the otter, water vole, Atlantic salmon and freshwater pearl mussel require particular attention (Figure 3.5). 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 signal crayfish, Japanese knotweed and Himalayan balsam (see also UKFS Guidelines on *Forests and Biodiversity*).

Figure 3.5 The otter is a key indicator of the health of the freshwater environment.



3. INTRODUCTION TO FORESTS AND WATER

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 3.1.

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.

Table 3.1 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 large 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, species diversity and 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.

Integrated catchment management

Integrated catchment management provides a framework to safeguard the natural functioning of freshwater ecosystems and thereby to enhance their value to society. 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 (Figure 3.6). The implementation of River Basin Management Plans (known as RBMPs) allows integrated catchment management to take place and is a key mechanism for implementing the WFD. 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. The management of land has a substantial impact upon the water environment and therefore it is essential that forest planning is integrated with RBMPs to safeguard the water environment in the most effective and beneficial way.

Forests and woodlands in the UK cover 13% of the land area. This compares with a European average of around 45%. Governments in the UK acknowledge the need for more forests for the multiple benefits provided, which is helping to focus attention on forestry as a land use. Country forestry policies and strategies reflect the potential of forests to deliver WFD objectives. These include

highlighting opportunities for woodland to reduce the impact of diffuse pollution from agriculture and urban activities, and assist in flood risk management (Figure 3.7). Climate change brings a number of new reasons in favour of 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.

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.

Figure 3.7 The greater 'hydraulic roughness' of floodplain woodland can help to hold back flood waters.



Figure 3.6 Integrated catchment management is helping to reduce a number of water issues at Llyn Brianne Reservoir in the Towy Valley in Wales.



Freshwater catchments in the UK

Water enters a river basin as precipitation and the vegetation it passes through can exert a strong influence on the quantity and quality of water reaching the outlet. 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. The quality of water can also be affected by the evaporative loss concentrating chemicals present, by the canopy capture of mist, aerosols and pollutant gases, and by chemical interactions within the vegetation layer.

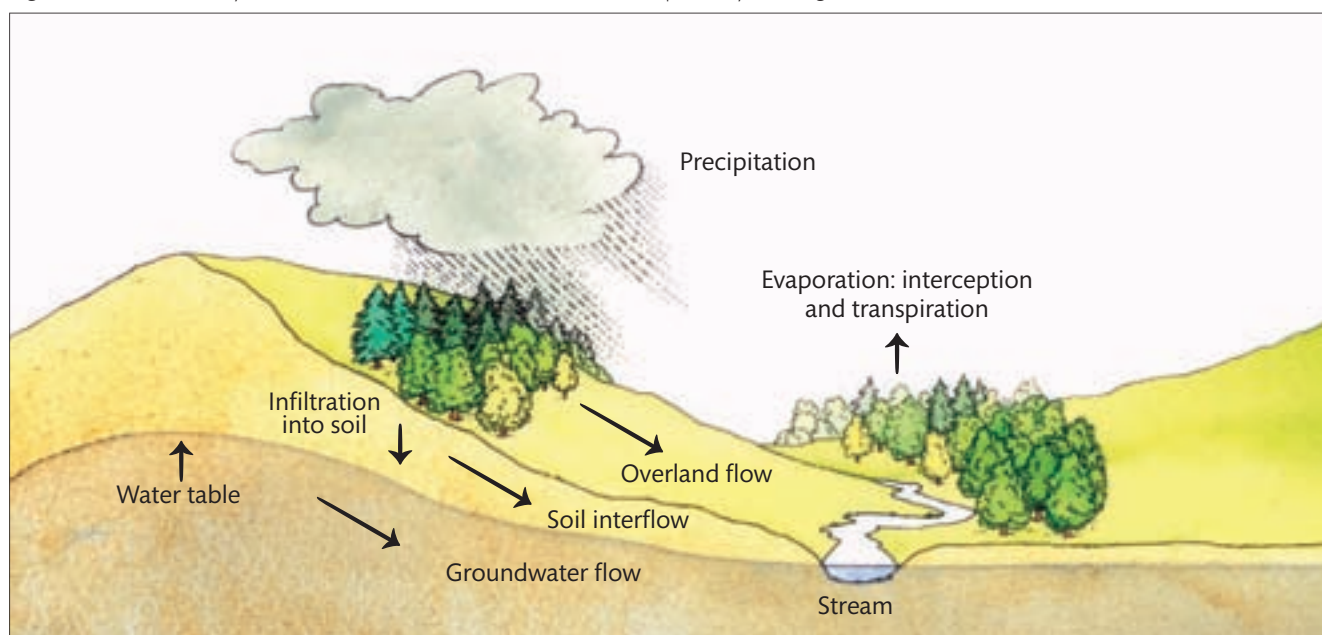
Having passed through the vegetation layer and into the soil, some water is taken up by vegetation and returned to the atmosphere through the process of transpiration. The rest is either retained by the soil, or drains away. The amount of water following each of these routes is influenced by the nature 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 pathways

Drainage water can take a number of pathways over and through the soil and bedrock to the river basin outlet (Figure 3.8). The pathways taken will depend on topography, soil, drift deposit and underlying geology, as well as human interventions through sustainable drainage schemes and flow diversions. These pathways will have a marked influence on the timing, volume and quality of water reaching the aquatic zone:

- 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.

Figure 3.8 The water cycle. Water can follow a number of different pathways through a river basin.



Riparian zones

The riparian zone is defined as the area of land adjoining a river channel, including the river bank but not the wider floodplain (Figure 3.9). Riparian vegetation can directly influence the condition of the aquatic ecosystem, for example by providing shade, leaf litter input and stabilising river banks (Figure 3.10). Some of the soils in riparian zones are frequently at or near to saturation, and it is here that water flowing through the soil and bedrock of the adjacent land may re-emerge to contribute to stream flow.

Riparian zones are frequently ecologically rich because of the variety of habitat types present and the length of 'edge' features. They offer linear migration corridors for invertebrates, birds and mammals and can reduce the fragmentation of habitats by providing key linkages. These areas can form a major part of the network of linked permanent habitats and, through the establishment of native trees, shrubs and ground flora, present a major opportunity to enhance the biodiversity of woodland.

Riparian vegetation can provide a very effective filter and buffer, helping to trap sediment and absorb nutrients, thereby reducing the delivery of pollutants to watercourses. 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

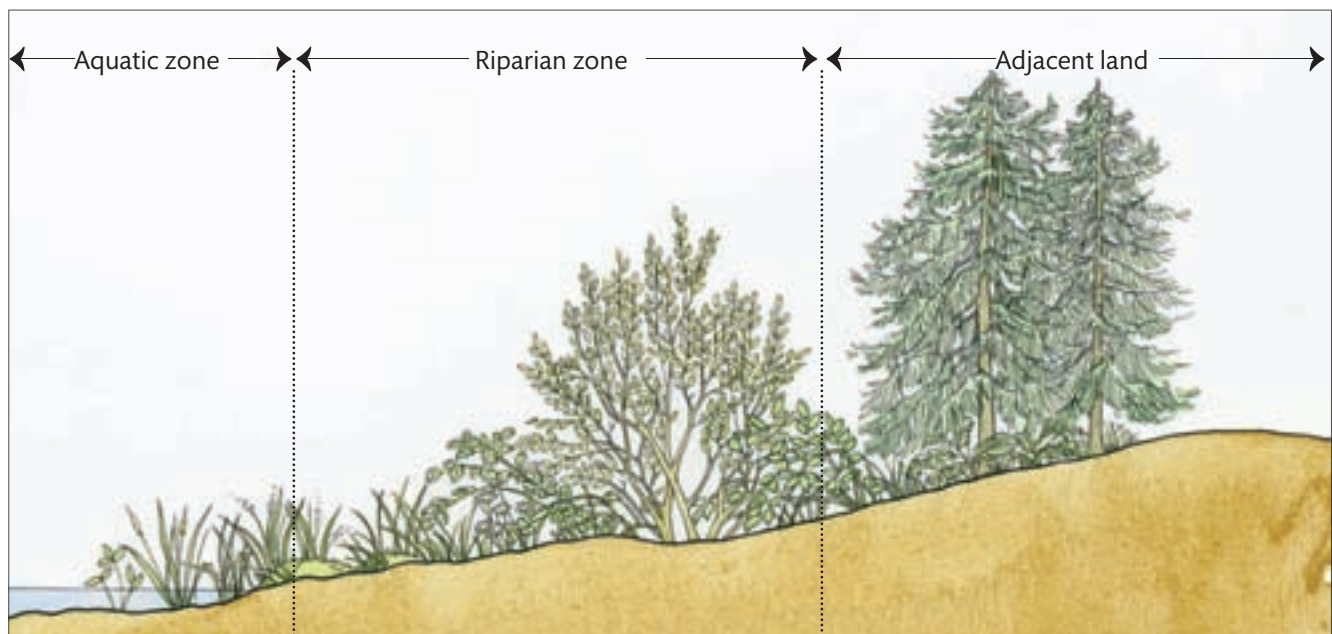
Figure 3.10 Tree roots have a role in stabilising river banks.



rare throughout the UK, and the extension and restoration of wet woodland is a target of the UK Biodiversity Action Plan (see UKFS Guidelines on *Forests and Biodiversity*).

The identification and establishment of an effective buffer area is fundamental to the protection of the riparian zone

Figure 3.9 Diagram to show the transition from the aquatic zone through the riparian zone to the adjacent land.



3. INTRODUCTION TO FORESTS AND WATER

and aquatic habitats. The wetness of the soils and the characteristic instability of stream banks mean that the zone is particularly sensitive to disturbance. Riparian areas can also facilitate the rapid spread of unwelcome invasive species such as Japanese knotweed for which control measures may be required.

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. Under the WFD these are 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 (the WFD sets a general limit of 10 km² for the minimum size of river water body catchments) and sensitivity to pressures; smaller rivers and lakes tend to be more vulnerable to the effects of acid deposition.

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 sustaining wetlands. The WFD identifies individual groundwater bodies as areas of rock forming a distinct volume of water within an aquifer or aquifers, and appropriate objectives are set to protect them from pollution and over-abstraction. 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.

Protected areas

Some water bodies require special protection and are designated 'protected areas' under the WFD (Figure 3.11). These designations seek to preserve water bodies or parts of water bodies that are especially sensitive to pollution or because they are of particular economic, social or environmental importance. For those sites designated for

Figure 3.11 The River Roe and its tributaries in Northern Ireland are Special Areas of Conservation.



their habitats or species, such as Natura 2000, compliance with the standards necessary to meet 'favourable condition' is essential. Some of these standards are higher than those necessary for WFD 'good status' to be met.

Water Protection Zones

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 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.

4. Policy and 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 EC Water Framework Directive, adopted in 2000, and the Ministerial Conference on the Protection of Forests in Europe, which includes a specific resolution on forests and water.

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, UK and country-level strategies and delivery mechanisms are summarised in Appendix 2.

Water protection

The EC Water Framework Directive (WFD) establishes the principal framework for protecting and improving the water environment through a requirement to achieve 'good status' – a term that refers both to chemical and ecological quality. Another key requirement of the Directive is to ensure no deterioration in current water status, including the protection of high status waters. Implementation of the Directive therefore makes a significant contribution to the achievement of sustainable forest management in relation to water.

The protection and improvement of river hydro-morphology contributes to good ecological status and is therefore covered by the Directive and supporting legislation. 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 physio-chemical elements, such as hydrology, habitat structure, fish, invertebrates, phytoplankton, and other aquatic plants.

One of the principal challenges of the WFD was to set up a system of river basin management planning within which the protection, improvement and restoration of water bodies could be monitored and reported. The river

basin approach recognises that activities in one area can have consequences elsewhere. 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 the period to 2015 and in subsequent six-year planning cycles.

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.

Scotland

- Water Environment and Water Services (Scotland) Act 2003 (WEWS).
- Water Environment (Controlled Activities) (Scotland) Regulations 2005 (CAR) (as amended).
- Water Environment (Diffuse Pollution) (Scotland) Regulations 2008.

Northern Ireland

- Water Environment (Water Framework Directive) Regulations (Northern Ireland) 2003.
- Water (Northern Ireland) Order 1999 (including amendments up to 2004).

The WFD states that if more stringent objectives are

specified by other legislation, such as under the Habitats Directive, then they apply. For protected sites, including water-dependent Natura 2000 sites designated under the Birds and Habitats Directives, compliance with these objectives must be achieved by December 2015, unless a specific exemption is made for a particular water body.

Flood management

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. The Floods Directive is transposed into UK law by the:

- Flood Risk Management (Scotland) Act 2009
- Flood and Water Management Act 2010
- Flood Risk Regulations 2009
- Water Environment (Floods Directive) Regulations (Northern Ireland) 2009.

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 will introduce a risk-based approach to reservoir safety for 'large raised reservoirs'. These are redefined as reservoirs holding a minimum of 10 000 m³ (present limit is 25 000 m³), 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.

Conservation and wildlife protection in Europe

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 (SPA) or Special Areas of Conservation (SAC), or by giving certain species protection wherever they occur. SPAs and SACs are referred to collectively as the Natura 2000 network. The EU Habitats Directive is transposed into UK law by the Conservation (Natural Habitats, &c.) Regulations 1994 (as amended). These are usually referred to as the 'Habitats Regulations'.

Plant and animal species receiving protection under the Habitats Regulations are known as 'European Protected Species' (EPS) and they are listed in Schedules 2 and 4 of the Regulations. The Regulations also require that any activity – including forestry – within, or likely to affect, Natura 2000 sites must be undertaken in ways which do not damage the value of the sites for the habitat or species for which the sites were designated. Moreover, activities can only proceed after consultation with the statutory conservation authority. The Habitats Regulations require competent authorities to undertake appropriate assessments in certain circumstances where a plan or project affects a Natura site. Habitats Regulation Appraisal (HRA) refers to the whole process, including the appropriate assessment step (see Appendix 2).

Since 1994 it has been an offence, under the Habitats Regulations, to deliberately kill or cause significant disturbance to a European Protected Species, or to deliberately destroy its eggs. Changes made to the Regulations in 2007 and 2009 to increase the legal protection afforded to these species mean that it is now also an offence to damage or destroy a breeding site or resting place used by them, or cause disturbance to those that hibernate or migrate. In addition, the clause that stated that if damage was an incidental result of a lawful operation, and reasonable precautions had been taken to avoid it, has been removed.

Among the water-dependent species to receive European protection are the otter, great crested newt and the freshwater pearl mussel. However, 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. Further details of the Regulations are given in the UKFS Guidelines on *Forests and Biodiversity*.

Conservation and wildlife protection in the UK

Across the UK there are designations that offer protection to species and habitats, including some habitats that are designated for their geological or geomorphic interest. In Great Britain, in addition to amending the Forestry Act (1967), the Wildlife and Countryside Act 1981 (as amended) contains provision for designating Sites of Special Scientific Interest (SSSIs).

The Environment (Northern Ireland) Order 2002 provides similar provisions to designate 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, or Ramsar sites (wetland areas of international importance that are also part of the Natura network of sites).

The Wildlife and Countryside Act 1981 (as amended) was supplemented by the Countryside and Rights of Way Act 2000, the Natural Environment and Rural Communities Act 2006 (England and Wales), and the Nature Conservation (Scotland) Act 2004. These Acts strengthen protection for SSSIs and certain species, which are listed in Schedules 1–5 of the Acts. They also place 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.

Country legislation also includes lists of semi-natural habitats and priority species that are given statutory protection. Many of these habitats and species are subject to non-statutory action plans as part of the UK Biodiversity Action Plan. In Northern Ireland, the Wildlife and Natural Environment Act (Northern Ireland) 2011 gives protection to wild animals, birds, plants, and their habitats. The Act largely supersedes the Wildlife (Northern Ireland) Order 1985 (as amended). See the UKFS Guidelines on *Forests and Biodiversity* for more information.

Forests and water in Europe

The Ministerial Conference on the Protection of Forests in Europe (MCPFE or 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.

Forests and water in UK forestry policies and strategies

In England, the Natural Environment White Paper *The natural choice: securing the value of nature* (2011) 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* (2006) 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, the Welsh Assembly Government strategy *Woodlands for Wales* (2009) highlights water protection

and management in terms of quality and resources as one of the main outcomes under its strategic theme on environmental quality.

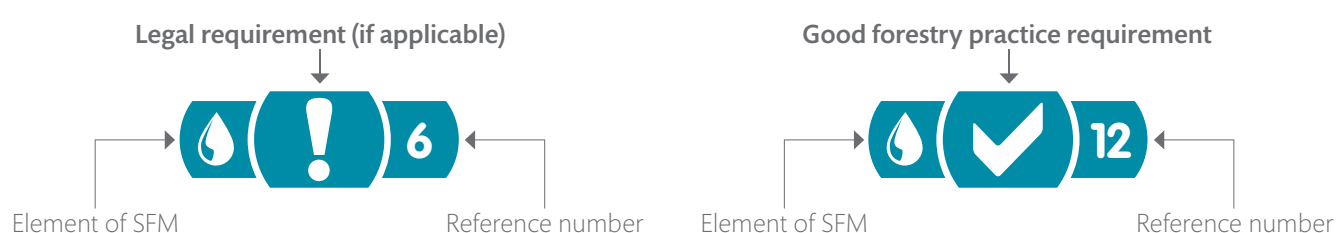
In Northern Ireland, the sustainable development strategy *Northern Ireland forestry – a strategy for sustainability and growth* (2006) highlights the protection and enhancement of the freshwater environment as one of its strategic objectives under natural resource protection and environmental enhancement.

5. UKFS Requirements: Water

The UKFS Requirements for Water are set out in this section (see Section 2 for further information). The UKFS Requirements for General Forestry Practice are given in the UKFS itself and in Appendix 3 of this publication.

Key to symbols









Requirements



Cross-references

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



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

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.

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 (see Appendix 2). 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 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, the Water Environment (Water Framework Directive) (Northumbria River Basin District) Regulations 2003, the Water Environment (Water Framework Directive) (Solway Tweed River Basin District) Regulations 2004, the Water Environment (Water Framework Directive) Regulations (Northern Ireland) 2003, the Water (Northern Ireland) Order 1999 (including amendments up to 2004), 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 2005, the Water Environment (Diffuse Pollution) (Scotland) Regulations 2008, and other relevant legislation. Authorisation is given under the Water Environment (Controlled Activities) (Scotland) Regulations 2005 (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 fertiliser, 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.

-   **2** 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).
-   **3** 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).
-   **4** 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) 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.

-   **5** 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.  **2**
-   **6** 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.  **3**

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 2005 as amended by the Water Environment (Groundwater and Priority Substances) (Scotland) Regulations 2009, 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, resulting in Nitrates Action Programme measures applying across the whole of the country. 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.



7 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 2005, the Water Environment (Oil Storage) (Scotland) Regulations 2006 and the Control of Pollution (Oil Storage) Regulations (Northern Ireland) 2010 impose requirements aimed at preventing leakage and pollution. Although these regulations do not yet apply in Wales, meeting these requirements will help prevent water pollution.



8 Oil and fuel must be stored in a way that minimises the risks of leakage and pollution.

Water supply

The EC 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.



9 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 for the planting of trees within 7 m of the watercourse. Restrictions may also apply on designated watercourses in Scotland and Northern Ireland.




10 Appropriate regulators must be consulted for new woods next to 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, Wales or Scotland), 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.



11 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.



12 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 forest edge to water's edge to protect the aquatic zone are set out in Table 5.1.

Table 5.1 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.

-  **1** 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.
-  **2** Forest management should contribute towards achieving the objectives of River Basin Management Plans and ensure that forestry pressures on the aquatic environment are addressed.

-   **3** 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.
-   **4** 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.
-   **5** Watercourses and waterbodies should be identified and appropriate buffer areas established and maintained to protect aquatic and riparian zones from adjacent activities.
-   **6** 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.
-   **7** 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.
-   **8** 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.
-   **9** 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.
-   **10** 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 has been agreed to protect waters from adverse effects.

-   **11** 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.

Water quantity

In some parts of the UK there is a growing imbalance between water demand and supply, leading to potential water shortages. Climate change could put additional pressure on water supplies and river flows, which will be exacerbated by demographic change (see the UKFS Guidelines on *Forests and Climate Change*). In general, trees and forests use more water than shorter vegetation types and therefore new planting in these areas could further reduce water yield and low flows, exacerbating water shortages, reducing aquatic habitat and enhancing concentrations of waterborne pollutants. However, the amount of water used varies between forest type and species, and in some situations woodland water use, particularly for broadleaved species, may be less than other land covers. The ability of trees to protect the soil and increase water infiltration may also offset their higher water use. Forest planning and management thus has an important role to play in managing forest water use and the impact on water quantity.

-   **12** 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.

6. UKFS Guidelines: Water

Guidelines on meeting the UKFS Requirements for Water are set out in this section. Guidelines on meeting the UKFS Requirements for General Forestry Practice are given in the UKFS itself and in Appendix 3 of this publication.

Key to symbols









Guidelines



Cross-references

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



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

General Binding Rules – Scotland

Unlike the rest of the UKFS Guidelines, a number of the water guidelines set out in this section have a legal status in Scotland. These General Binding Rules (see Section 2 for more information) are included here, where relevant, for application across the UK as they address many of the key issues and describe good practice.



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.

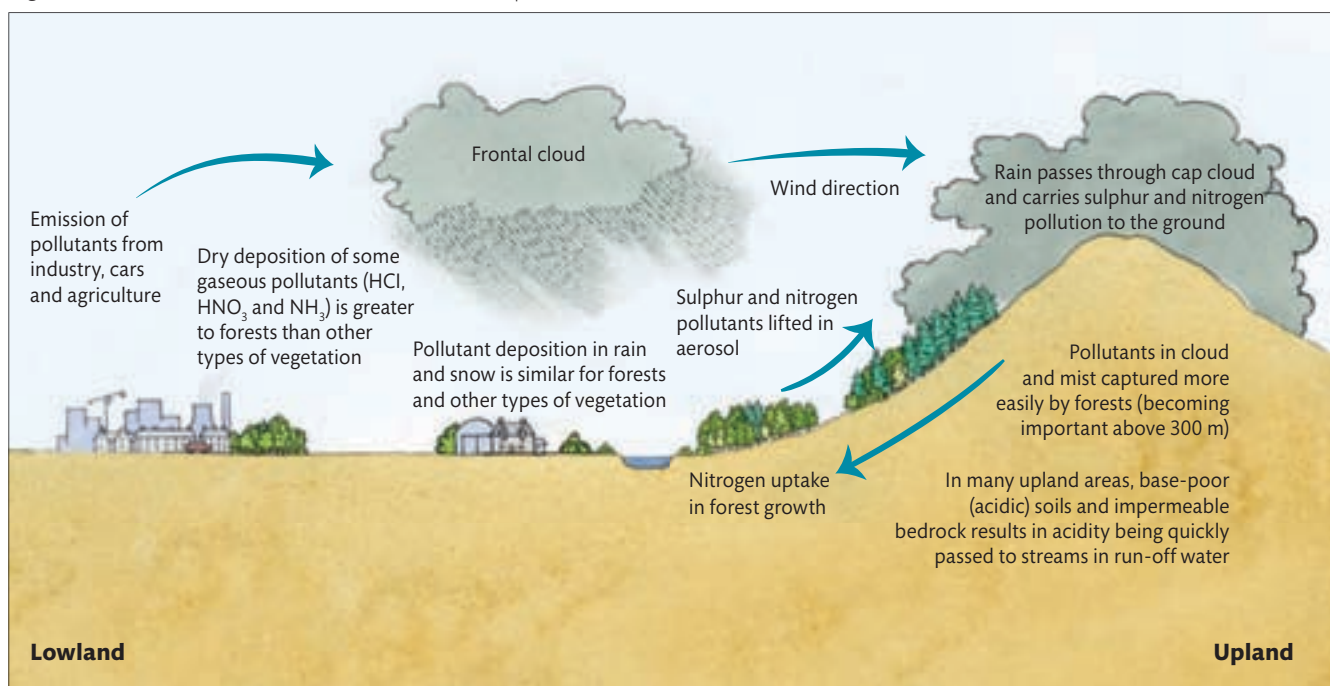
Acidification

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 (Figure 6.1).

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 re-adjust 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

Figure 6.1 Interactions between forests and acid deposition.



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 windfarm 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.  **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 – Appendix 3).













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 historic 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 for 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 $>4.5^\circ$ (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 road-side 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.  **19**
-  **32** Avoid road drains discharging directly into watercourses.
-  **33** Where there is a risk of spreading invasive non-native species (such as 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 **GBR6a-f** and temporary bridges **GBR6g-k**, small-scale bank reinforcement **GBR8a-f**, and the removal of sediment from culverts **GBR13a-d**.

-  **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.  **31**  **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.  **30**  **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.   **10**
-  **38** Plan felling and timber extraction to minimise the number of stream and drain crossings, and protect any crossing points from damage by harvesting machinery.
-  **39** 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.  **33**
-  **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).


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, in accordance with a nutrient and soil management plan.  **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; within 50 m of any spring, well or borehole; waterlogged; or has an average soil depth of less than 30 cm and overlies gravel or fissured rock, except where stored in an impermeable container. **GBR18a**
-  **51** No organic fertiliser shall be applied to land that is: within 2 m of any drainage ditch or 5 m of any surface water or wetland; within 50 m of any spring, well or borehole; sloping with an overall gradient in excess of 15°, or 25° on uncultivated land designated for forestry; or

has an average soil depth of less than 30 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, or 5 m of any spring, well or borehole; has an average soil depth of less than 30 cm and overlies gravel or fissured rock, except where the application is for forestry operations; or is frozen, 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 Regulations, page 21).

One pesticide attracting increasing concern due to its extreme toxicity to freshwater invertebrates is cypermethrin. Its use in sheep dip is now banned in England and Wales, and attention is turning 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. (Buffer areas do not apply to products that are approved for use in or near water, subject to the consent of the water regulatory authority.)

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, 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.  **23**  **13**  **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 cleaning or maintenance of pesticide sprayers shall be undertaken in conditions such that any spillage, run-off or washings will be prevented from entering watercourses. **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 watercourse prior to planting. **GBR23d**

Fuel oils, lubricants and fire-fighting chemicals

There are legal requirements with respect to the storage of oils (see Oil and fuel storage, page 22). 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 the UKFS Guidelines on *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.

-  **66** 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.
-  **67** Where it is necessary to store fuel oils on site temporarily, use double-skinned or bunded, securely lockable tanks.  **7**
-  **68** Within buffer areas, exclude the storage and handling of fuel oil, lubricants or fire-fighting chemicals.
-  **69** Place any waste or recovered oil in an impermeable container and remove from the site for disposal at a suitable licensed site.  **6**
-  **70** Any refuelling must take place at least 10 m away from any surface water. **GBR9b**
-  **71** 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**
-  **72** Any plant or equipment used in or near surface water must not leak oil. **GBR9d**
-  **73** The washing of any plant or machinery 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. Base flows 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 the UKFS Guidelines on *Forests and Climate Change* for further information on climate change projections and guidance on forestry for adaptation and mitigation.



74

Where the maintenance of water flows is an issue, consult the water regulatory authority (or water undertaker) 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.

Forest establishment and growth appear to have a small effect (decrease) on peak flows, with the impact of clearfelling (increase) often being difficult to detect. Overall, research suggests that the contrasting effects of the different stages of the forest cycle (cultivation, drainage, road construction, forest growth and harvesting) will even out at the catchment scale, especially as forest areas become more diverse in age. As a result, upland forests are unlikely to adversely affect downstream flood risk.

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 supporting evidence from international 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.



75 In catchment 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.



76 Within areas of high flood risk, phase clearfelling to minimise the risk of increasing local flood flows.


-  **77** Where practicable, amend drains on restock sites to slow down surface run-off.
-  **78** Consider opportunities to restore forest wetlands and create ponds to increase flood storage and slow flood flows, e.g. by building dams of large woody debris.
-  **79** When siting new woodland, consider the potential benefits in relation to flood alleviation, improvement of water quality and other ecosystem services.  **30**








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. Too much shade can lead to bare, eroding banks, wider, shallower channels and reduced productivity of fish and aquatic invertebrates. Too little shade can result in a lack of shelter and more extreme temperature fluctuations, including the risk of lethal high temperatures for fish during summer months. The occurrence of lethal temperatures is likely to become more commonplace as climate change progresses (see the UKFS Guidelines on *Forests and Climate Change*). The desired level of shade and the frequency of intervention in the form of thinning, coppicing or felling to maintain this will vary from place to place, depending on the sensitivity and intrinsic value of a given watercourse. In most locations, predominately native woodland that is managed to reach an average of 50% canopy cover will provide the best combination of shade and shelter for bankside morphology and protecting freshwater habitats and species. This woodland will also help supply large woody debris to watercourses, which is important for aquatic life.

The heavy shading of watercourses by bankside conifer plantations is undesirable. These shade out ground vegetation and can lead to erosion. Heavy shade also diminishes biodiversity, and exerts a morphological 'pressure' on water bodies which can reduce ecological status. Nevertheless, it may be advantageous to retain a few individual, and preferably old, conifer trees or small stands where these are likely to be stable. This can provide some shade and shelter until the riparian zone re-vegetates and native woodland becomes established.

The restoration or establishment of native riparian woodland habitat can provide a buffer area that can help to protect watercourses from future activities on the adjacent land. 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. Management may be required in riparian areas to control conifer regeneration or invasive non-native species such as Japanese knotweed and Himalayan balsam (see the UKFS Guidelines on *Forests and Biodiversity*).

-  **80** 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.  **30**  **17**

-  **81** In the riparian zone, favour locally native tree and shrub species and control the spread of invasive and non-native species.  **31**
-  **82** Provide and maintain defined buffer areas along watercourses and waterbodies.
-  **83** Remove dense stands of conifers from riparian areas and from the edges of ponds and lakes, and control excessive conifer regeneration.  **32**
-  **84** Retain large woody debris within streams unless it is clear that it forms a barrier to fish or poses a flood risk; design and manage riparian woodland to sustain the delivery of large woody debris to small watercourses (<5 m wide).  **33**

7. Implementation and monitoring

The revised edition of the UK Forestry Standard and its supporting series of Guidelines have 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 has 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 and Rural Development. 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 (Section 5).

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 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 rare, but suspected cases are investigated, and prosecution may ensue. Where trees are subject to designations, for example on Sites 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).

In Northern Ireland, the Forestry Act (Northern Ireland) 2010, with its provisions for felling licences and felling management plans, now aligns more closely with Great Britain.

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 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. This provision of the Forestry Act will come into operation when subordinate legislation is made. 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 windfarms 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 and the Department of Agriculture and Rural Development 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 or Department of Agriculture and Rural Development 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 EC 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 anybody to comment 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. The minimum consultation requirement in Great Britain is that clearfelling applications, forest management plans (for the public forest estate and for other woodlands) and grant applications are entered on the Public Register of New Planting and Felling. The arrangements for viewing the Register are on the Forestry Commission website at: www.forestry.gov.uk/publicregister.

In addition to the Public Register, local authorities and other statutory bodies are sent details of proposals under formal consultation and notification procedures. This process ensures a wide range of views is taken into account. The majority of applications, often with amendments, are approved through this process. If objections are lodged and sustained, the Forestry Commission may ask for advice from an advisory committee, and/or refer to the appropriate forestry minister before arriving at a decision. The above procedures do not negate the requirements for forest and woodland owners to consult other statutory agencies with regard to particular woodlands, for example the conservation agencies in the case of Sites of Special Scientific Interest.

Plant health and forest reproductive material

The Forestry Commission 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 materials (seed, 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 provide the basis for assessing whether the UK Forestry Standard has been implemented. Guidelines for forest and woodland managers on meeting the Requirements are given in Section 6 of this publication for Water, and in the rest of the Guidelines series for the other elements of sustainable forest management. The numbered Guideline points will enable an assessment to be made as to whether the relevant Requirements of the UKFS have been achieved.

The current regulatory mechanisms for forestry allow two options for the approval 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 will be 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

The Forestry Commission and the Forest Service offer a range of incentives for woodland creation, woodland management and related activities. Each country in the UK has grant programmes aimed at supporting the delivery of their 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 and through the approval of a forest management plan. However, the approval required by the Forestry Commission or the Forest Service to proceed with proposals may be separate from the offer of a grant.

In Great Britain, the offer of incentives for forestry will be conditional on meeting the UKFS Requirements. This will have to be demonstrated through the submission and approval of a forest management plan. In Northern Ireland, there is no general requirement for forest management plans at the current time. However, essential planning information including maps, a statement of objectives and establishment prescriptions is required for forest and woodland 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 environmental, social 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 (for example, the current National Forest Inventory), and projects such as the Native Woodland Survey of Scotland will improve the scope of data collection and future reporting.

In Great Britain, the Forestry Commission has prepared a digital base map for all woodlands over 0.5 hectares, 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 hectares.) 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 is in the process of completing an analysis of data on woodland area and type and will, in the future, provide and maintain a register of woodland.

Monitoring of individual forests and woodlands

Within the framework of the UKFS, the Forestry Commission in England, Scotland and Wales and the Forest Service in Northern Ireland will develop their own 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 re-submitted 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 – Appendix 3), 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, a new representative sampling survey will be introduced 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. UKFS monitoring will therefore be done with a lighter touch where additional assurance is provided by independent certification. All the forests and woodlands managed by the Forestry Commission 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 Section 4 of the UKFS). 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 (see above).

Further reading and useful sources of information

Detailed information and resources for the UK Forestry Standard and each of its supporting series of Guidelines can be found at:

www.forestry.gov.uk/ukfs
www.forestry.gov.uk/ukfs/biodiversity
www.forestry.gov.uk/ukfs/climatechange
www.forestry.gov.uk/ukfs/historicenvironment
www.forestry.gov.uk/ukfs/landscape
www.forestry.gov.uk/ukfs/people
www.forestry.gov.uk/ukfs/soil
www.forestry.gov.uk/ukfs/water

Forestry Commission and Forest Service publications

Forestry Commission publications can be viewed and downloaded from: www.forestry.gov.uk/publications

Forest Service publications can be viewed and downloaded from: www.dardni.gov.uk/forests-service/publications

Other publications

The future for Scotland's water. Guiding principles on the technical requirements of the Water Framework Directive. Scottish Environment Protection Agency, Stirling. (2002).

The water environment (controlled activities) (Scotland) regulations 2005: a practical guide. Scottish Environment Protection Agency, Stirling. (2008).

Forests and surface water acidification. Department of the Environment, London. (1991).

Pesticides: code of practice for using plant protection products. Defra, London. (2006).

Pollution prevention guidelines. Safe storage and disposal of used oils. Environment Agency, Bristol. (2004).

Protecting our wildlife. Guidance on the control of non-native invasive weeds in or near freshwater. Environment Agency, Bristol. (2007).

Forestry Commission and Forest Service websites

Water

For research information on **forests and water**:
www.forestry.gov.uk/fr/water

General

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 about **forest research**:
www.forestry.gov.uk/forestresearch

For information on plant health and biosecurity issues:
www.forestry.gov.uk/planthealth

For information and guidance on **Environmental Impact Assessments**: www.forestry.gov.uk/eia
www.dardni.gov.uk/forests-service/environment

For information and guidance on **felling**:
www.forestry.gov.uk/felling
www.dardni.gov.uk/forests-service

For information and guidance on **grant schemes**:
www.forestry.gov.uk/grants
www.dardni.gov.uk/forests-service

To view the **public registers** on grants and felling applications, and Environmental Impact Assessments:
www.forestry.gov.uk/publicregister

Other useful websites

www.environment-agency.gov.uk
Environment Agency (England and Wales)

www.naturalengland.org.uk
Natural England

www.sepa.org.uk

Scottish Environment Protection Agency (SEPA)

www.snh.gov.uk

Scottish Natural Heritage

www.ccw.gov.uk

Countryside Council for Wales

www.doeni.gov.uk/niea

Northern Ireland Environment Agency

www.jncc.gov.uk

The Joint Nature Conservation Committee (JNCC) provides information and listings of priority habitats and species.

www.metoffice.gov.uk

The Meteorological Office

www.legislation.gov.uk

All enacted legislation and revisions for the United Kingdom, Scotland, Wales and Northern Ireland.

Contact addresses

Forestry authorities

Forestry Commission (GB)
Silvan House
231 Corstorphine Road
Edinburgh EH12 7AT
T: 0131 334 0303
E: enquiries@forestry.gsi.gov.uk
www.forestry.gov.uk

Forestry Commission England
620 Bristol Business Park
Coldharbour Lane
Bristol BS16 1EJ
T: 0117 906 6000
E: fcengland@forestry.gsi.gov.uk
www.forestry.gov.uk/england

Forestry Commission Scotland
Silvan House
231 Corstorphine Road
Edinburgh EH12 7AT
T: 0131 334 0303
E: fcscotland@forestry.gsi.gov.uk
www.forestry.gov.uk/scotland

Forestry Commission Wales
Welsh Assembly Government
Rhodfa Padarn
Llanbadarn Fawr
Aberystwyth SY23 3UR
T: 0300 068 0300
E: fcwenquiries@forestry.gsi.gov.uk
www.forestry.gov.uk/wales

Forest Service
Department of Agriculture and Rural Development
Dundonald House
Upper Newtownards Road
Ballymiscaw
Belfast BT4 3SB
T: 02890 524480
E: customer.forests@ardni.gov.uk
www.dardni.gov.uk/forests@ardni.gov.uk

Water authorities

Environment Agency
National Customer Contact Centre
PO Box 544
Rotherham S60 1BY
T: 03708 506 506
E: enquiries@environment-agency.gov.uk
www.environment-agency.gov.uk

Scottish Environment Protection Agency
Erskine Court
Castle Business Park
Stirling FK9 4TR
T: 01786 457700
E: info@sepa.org.uk
www.sepa.org.uk

Environment Agency Wales
Cambria House
29 Newport Road
Cardiff CF24 0TP
T: 0870 8506506
E: enquiries@environment-agency.gov.uk
www.environment-agency.gov.uk

Northern Ireland Environment Agency
17 Antrim Road
Lisburn BT28 3AL
T: 028 9262 3100
E: waterinfo@doeni.gov.uk
www.doeni.gov.uk/niea

Forest Research

Forest Research is the agency of the Forestry Commission and the UK leader in forestry and tree-related research.

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E: research.info@forestry.gsi.gov.uk
www.forestry.gov.uk/forestresearch

Appendix 1 – Legislation and conventions

Water Framework Directive

www.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

www.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

www.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 bioaccumulable substances into groundwater.

Nitrates Directive

www.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

www.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

www.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, formerly the Ministerial Conference on the Protection of Forests in Europe (MCPFE), is an inter-governmental 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.

- 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 2005 (as amended)
- Water Environment (Diffuse Pollution) (Scotland) Regulations 2008
- Water Environment (Water Framework Directive) Regulations (Northern Ireland) 2003
- Water (Northern Ireland) Order 1999 (including amendments up to 2004)

Additional regulatory controls over potential polluting activities, including General Binding Rules, were introduced in Scotland under the following regulations and amendments:

- Water Environment (Controlled Activities) (Scotland) Regulations 2005
- Water Environment (Controlled Activities) (Scotland) Amendment Regulations 2007
- Water Environment (Diffuse Pollution) (Scotland) Regulations 2008

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

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

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

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.

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
- Waste Management Licensing Regulations (Northern Ireland) 2003

Appendix 2 – Strategies and delivery mechanisms

Strategies

Water – general

The natural choice: securing the value of nature (2011). HM Government.

Natural environment framework – a living Wales. Welsh Assembly Government, Cardiff.

Water – forestry related

The Scottish forestry strategy (2006). Forestry Commission Scotland, Edinburgh.

Woodlands for Wales: the Welsh Assembly Government's strategy for woodlands and trees (2009). Welsh Assembly Government, Cardiff.

Northern Ireland forestry. A strategy for sustainability and growth (2006). Northern Ireland Forest Service, Belfast.

Delivery mechanisms

The Water Framework Directive and River Basin Management Plans

River Basin Management Plans are available from the following bodies:

England
www.environment-agency.gov.uk

Scotland
www.sepa.org.uk

Wales
www.wales.gov.uk

Northern Ireland
www.doeni.gov.uk/niea

The European Union Water Framework Directive, which came into force on 22 December 2000, establishes a new, integrated approach to the protection, improvement and sustainable use of Europe's rivers, lakes, estuaries, coastal waters and groundwater. It is transposed into UK legislation by Regulations in each country of the UK.

The Directive introduced two key changes to the way the water environment must be managed. The first relates to the types of environmental objectives that must be delivered. Previous European water legislation set objectives to protect particular uses of the water environment from the effects of pollution and to protect the water environment itself from especially dangerous chemical substances. These types of objectives are taken forward in the Directive's provisions for Protected Areas and Priority Substances, respectively. However, the Directive also introduced new, broader ecological objectives, designed to protect and, where necessary, restore the structure and function of aquatic ecosystems themselves, and thereby safeguard the sustainable use of water resources.

The second key change is the introduction of a river basin management planning system. This is the principal mechanism for ensuring the integrated management of groundwater, rivers, canals, lakes, reservoirs, estuaries and other brackish waters, coastal waters and the water needs of terrestrial ecosystems that depend on groundwater, such as wetlands. The planning system and process provides the decision-making framework for the setting of environmental objectives and the opportunity for public involvement. The costs and benefits can be assessed and a range of measures developed to deliver the environmental objectives. River Basin Management Plans are approved by the relevant environment minister(s).

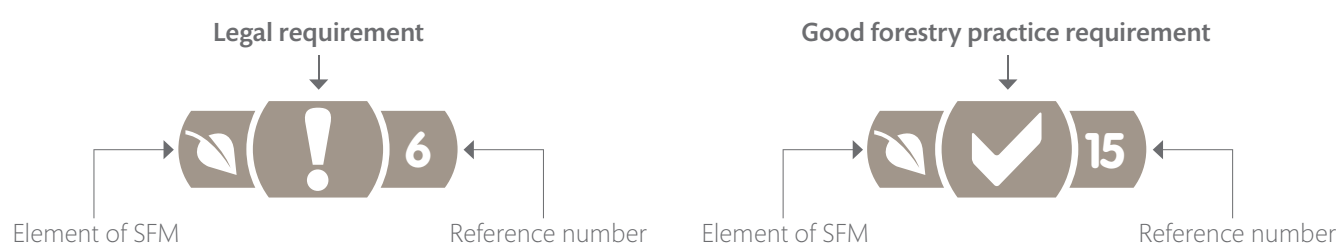
Appendix 3 – General Forestry Practice

General Forestry Practice Requirements

This section replicates the Requirements for General Forestry Practice set out in the UKFS (see Section 2 for more information). General Forestry Practice is covered by the UKFS itself and not by an individual Guidelines publication because the Requirements and supporting Guidelines describe aspects of management that apply to most forest and woodland situations and that are common to the other elements of sustainable forest management (SFM).

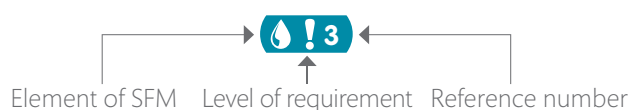
Key to symbols









Requirements



Cross-references

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







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

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.

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 and in the supporting series of Guidelines.

-  **1** Forestry activities and businesses must comply with all relevant laws and regulations.
-  **2** Operations must be authorised by the legal owner.
-  **1** Reasonable measures should be taken to ensure no illegal or unauthorised activity takes place within the forest or woodland.
-  **2** 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 (in Northern Ireland, the Planning Service of the Department of the Environment) can apply Tree Preservation Orders (TPOs) 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. 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).



-   **3** 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: trees under a specified size, trees proved to be dangerous, fruit trees and small-scale felling may not require a felling licence. Priority habitat restoration proposals 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.
- EC Directive 97/11 provides *inter alia* that 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 hectares or more, through granting of felling licences which include felling management plans to control necessary replanting.

-   **4** 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.

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

-   **3** 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.

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

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





Environmental impact

EC Directive 85/337/EEC 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. 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 Environmental Statement.

-   **6** 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 Great Britain, 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 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 and Rural Development 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 supports these objectives.

-  7 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, and access must be given to Plant Health Inspectors and their instructions followed.
-  6 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.
-  7 Information should be reported to the forestry authority that might assist in preventing the introduction or spread of forest pests and diseases.
-  8 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 and Rural Development. The Forest Service maintains a National Register of Basic Material for Northern Ireland.

-  8 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, 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). These 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 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 forest management unit (FMU).

-   **9** Forest management plans should state the objectives of management, and set out how the appropriate balance between economic, environmental and social objectives will be achieved.
-   **10** 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.
-   **11** 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.
-   **12** At the time of felling and restocking, the design of existing forests should be re-assessed and any necessary changes made so that they meet UKFS Requirements.
-   **13** Consultation on forest management plans and proposals should be carried out according to forestry authority procedures and, where required, the Environmental Impact Assessment Regulations.
-   **14** Forests should be designed to achieve a diverse structure of habitat, and species and ages of trees, appropriate to the scale and context.
-   **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** Management of the forest should conform to the plan, and the plan should be updated to ensure it is current and relevant.
-   **17** 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.



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



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

General Forestry Practice Guidelines

This section replicates the Guidelines for General Forestry Practice set out in the UKFS (see Section 2 for more information). General Forestry Practice is covered by the UKFS itself and not by an individual Guidelines publication because the Requirements and supporting Guidelines describe aspects of management that apply to most forest and woodland situations and that are common to the other elements of sustainable forest management (SFM).

Key to symbols









Guidelines



Cross-references

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



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

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 expected 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

At its most simple, 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 A3.1).

Table A3.1 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 address:

- potential hazards to workers;
- potential hazards to forest users – by making them aware of operations and putting diversions in place;
- machine access, refuelling and timber stacking;
- how to safeguard sensitive or easily damaged parts of the site;
- how to ensure only the intended trees and shrubs are felled;
- how the site will be left on completion, including the disposal of waste materials;
- how to modify operations in case of bad weather.

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. 









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.  **9**
-  **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.  **16**
-  **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.  **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 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 the UKFS Guidelines on *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.

-  **8** Diversify forest composition so that no more than 75% of the forest management unit is allocated to a single species and a minimum of the following are incorporated:
 - 10% open space;
 - 10% of other species or ground managed for environmental objectives;
 - 5% native broadleaved trees or shrubs.

Note: (i) Where more than one species is suited to the site and matches the management objectives, opportunities must be taken to further diversify the above species composition: this is important in the context of climate change. (ii) In woodlands of less than 10 hectares and in native woods the above proportions may be relaxed providing the adjacent land uses provide landscape and habitat diversity. 🦋 11 ☁️ 23

- 🌿 9 Develop a long-term forest structure of linked permanent habitats, such as riparian woodland, open space and broadleaves. 🦋 19
- 🌿 10 Leave a proportion of standing and fallen deadwood: concentrate it 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. 🦋 23 ☁️ 10
- 🌿 11 Retain and manage existing veteran trees and select and manage suitable individuals to eventually take their place. 🦋 24 🏰 16
- 🌿 12 Manage a minimum of 15% of the forest management unit with conservation and the enhancement of biodiversity as a major objective. 🦋 20

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.





- 🌿 13 Consider alternatives to clearfell systems, such as continuous cover forestry, where suitable sites and species combinations allow and management objectives are compatible. 🦋 18 ☁️ 17
- 🌿 14 Maintain a range of stand structures and silvicultural approaches across the forest as a whole, including veteran trees, open-crowned trees, open space and areas of natural regeneration. 🦋 17

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 bringing forward felling in some areas and delaying felling and restocking in others. 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 Guidelines, 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.




-  **15** 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.
-  **16** 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.
-  **17** Take the opportunity provided by felling and restocking to redesign forests to meet UKFS Requirements and address issues such as buffer areas, drainage systems, biodiversity habitats and forest landscape design.
-  **18** 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 management plans – often incorporating culling – allow a strategic approach to be taken. Keeping records of both deer culled and levels of damage will help inform plans so 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 the Environment for Northern Ireland.

-  **19** Monitor forest damage, and intervene to protect vulnerable trees from browsing and grazing mammals, including voles, deer, rabbits, hares, grey squirrels and livestock.
-  **20** In areas where deer are a threat, develop deer management plans – ideally in co-operation with local deer management groups.  **43**

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 damage, keeping abreast of emerging threats and deciding when intervention is necessary.

-  **21** Consider the susceptibility of forests and woodlands to pests and diseases; take specialist advice and develop strategies for protection.
-  **22** Be vigilant for pests and diseases in forests and woodlands, particularly in urban areas where the risks of new problems are high.  **33**

Use of chemicals




The use of artificial pesticides and fertilisers is generally a last resort in practising sustainable forestry, although they can have more of a role in energy crops, such as short rotation coppice. Pesticides and fertilisers are expensive, and only 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.

-  **23** Minimise the use of pesticides and fertilisers in accordance with Forestry Commission and Forest Service guidance.  **13**  **5**  **57**

Fencing

The alignment and design of forest fences can have major impacts on wildlife, access, landscape and archaeology. Fence lines 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.






-  **24** Consider the impacts of fencing on biodiversity, landscape, archaeology and access, and minimise adverse effects.  **45**
-  **25** Consider removing old and redundant fencing rather than leaving it in place.

Forest roads and quarries

Forest roads, quarries and associated infrastructure works can be highly visible in the landscape and therefore come within the scope of the Environmental Impact Assessment

(EIA) Regulations. In areas with landscape designations, roads and quarries that do not form part of an approved afforestation scheme may be subject to planning controls. 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 the UKFS Guidelines on *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.
















-  **26** 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.
-  **27** Design road surfaces, drainage and harvesting machine access points to avoid erosion and other adverse impacts on soils, watercourses and water quality.
-  **28** Plan forest operations, civil engineering and timber transport to minimise energy use; consider using sustainable biofuels.  **12**
-  **29** 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 allowed is 10 tonnes in any 24-hour period. 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.

-  **30** 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**
-  **31** Maintain adequate brush mats throughout extraction operations.  **11**
-  **32** 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**
-  **33** Keep streams and buffer areas clear of brush as far as practicable; avoid felling trees into watercourses and remove them or any other accidental blockages that may occur.  **39**
-  **34** Install culverts or log bridges to avoid crossing and blocking drains; restore the site and drains as extraction progresses.
-  **35** Avoid burning brush 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.  **11**  **25**
-  **36** Liaise with the highway authority when felling near public highways or when lorries emerging onto the highway might pose a threat to road users.

Glossary

- 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.
- 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**
- Alkaline** The property of a solution to neutralise acids to the equivalence point of carbonate or bicarbonate.
- 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).
- 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 Special Scientific Interest (ASSI)** An area or site designated in part IV of The Environment (Northern Ireland) Order 2002 as having special scientific interest.
- 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.
- Biodiversity Action Plan (BAP)** A programme of action to conserve and enhance biological diversity. The UKBAP articulates the UK response to the UN Convention on Biological Diversity. This is implemented at country, regional and local levels and co-ordinates action plans for key habitats and species (known as Habitat Action Plans (HAPs) and Species Action Plans (SAPs)) and cross-sectoral programmes to encourage biodiversity conservation within all land uses and businesses.
- 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.
- 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.
- 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 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.
- 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 forest 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 ha). Sometimes a scatter or small clumps of trees may be left standing within the felled area.
- Community (of interest)** All the people living in one district or a group of people with shared origins or interests.
- 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.
- 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 UK Forestry Standard.
- 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, the Countryside Council for Wales and the Northern Ireland Environmental 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 2005. 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.
- 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).
- 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.
- 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)**
- 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 by 97/11/EC and 2003/35/EC. 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.
- Erosion** The wearing away of the land surface by rain, wind, ice, or other natural or anthropogenic agents that abrade, detach and remove geologic parent material or soil from one point on the Earth's surface and deposit it elsewhere.
- 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.
- Fish fry** Young fish leaving spawning grounds.
- 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 certification *see* **Certification scheme**

Forest Europe Until 2010 known as 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 European Union on how to protect and sustainably manage forests.

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 Service An agency within the Department of Agriculture and Rural Development in Northern Ireland responsible for the regulation of forestry and the management of state forests in Northern Ireland.

Forestry The science and art of planting, managing and caring for forests.

Forestry authorities The Forestry Commission and Forest Service are the principal forestry authorities in the UK. Other bodies also have roles in regulating forestry in particular circumstances.

Forestry Commission The government department responsible for the regulation of forestry, implementing forestry policy and management of state forests in Great Britain. Forestry policy is devolved, with the exception of some reserved issues, such as international forestry, plant health and forestry standards, and a range of common issues addressed on a Great Britain basis. The abbreviations FCE, FCS and FCW refer to the respective parts of the Forestry Commission in England, Scotland and Wales.

Forestry operations Work or procedures carried out within a forest such as felling, extraction, cultivation and planting.

Freshwater pearl mussel *Margaritifera margaritifera* Long-lived mussels that live in the bottom of clean, fast-flowing rivers; designated as a protected species.

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 (H₂O), carbon dioxide (CO₂), nitrous oxide (N₂O), methane (CH₄) and ozone (O₃). Forests exchange all of these GHGs with the atmosphere to a larger or smaller extent. There are also a number of man-made greenhouse gases. The Kyoto Protocol deals with six of

these: CO₂, N₂O and CH₄ as well as sulphur hexafluoride (SF₆), hydrofluorocarbons (HFCs) and perfluorocarbons (PFCs). Others are dealt with under the Montreal Protocol on Substances that Deplete the Ozone Layer.

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.

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.

Ironpan A soil with a hardened impervious layer, in which iron oxides are the chief cementing agents, that impairs drainage and plant growth.

ISO 14001 An international standard for environmental management systems (EMS) 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, 2002).

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.

Locally native *see* **Native species**

Main River Designated stretches of river in England and Wales where the Environment Agency has 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.

MCPFE Ministerial Conference on the Protection of Forests in Europe. *see* **Forest Europe**

Mineralisation The production of inorganic ions such as nitrate in the soil by the oxidation of organic compounds.

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.
- 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.
- Natural regeneration** Plants growing on a site as a result of natural seed fall or suckering. The term is also used to describe the silvicultural practices used to encourage natural seeding and establishment.
- 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 heath land, 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.
- Peat** A largely organic substrate formed of partially decomposed plant material. The Forestry Commission soil classification defines peat as soil having an predominantly organic (peat) layer of depth greater than 45 cm.
- 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.
- 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.
- 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 habitat or species** Habitats or species protected by EU Directives and transposed into UK law by the Habitat 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.
- Public Register** Public listing by the Forestry Commission of grant schemes, felling proposals and Environmental Impact Assessments to allow public comment.
- Regeneration** The regrowth of a forest through sowing, planting or natural regeneration, or regrowth following coppicing.
- 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.
- 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 seed bed for natural regeneration.
- 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**

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.

Site plan *see* **Operational plan**

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 100 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 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.

Spinney A small area of trees and bushes traditionally surrounded by a hedge.

Statutory body(ies) The authorities and bodies responsible for nature conservation (Natural England, Scottish Natural Heritage, Countryside Council for Wales and the Northern Ireland Environment Agency); environmental protection (Environment Agency (England and Wales), Scottish Environment Protection Agency and Northern Ireland Environment Agency); and the historic environment (English Heritage, Northern Ireland Environment Agency, Historic Scotland and Cadw).

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.

Transpiration The evaporation of water through the stomata on the surface of leaves.

UK Biodiversity Action Plan (UKBAP) *see* **Biodiversity Action Plan**

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.

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.

Notes



www.forestry.gov.uk/ukfs/biodiversity



www.forestry.gov.uk/ukfs/climatechange



www.forestry.gov.uk/ukfs/historicenvironment



www.forestry.gov.uk/ukfs/landscape



www.forestry.gov.uk/ukfs/people



www.forestry.gov.uk/ukfs/soil



www.forestry.gov.uk/ukfs/water

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 the UK Forestry Standard and its supporting Guidelines. 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. The Guidelines publications define sustainable forest management in the UK under a series of subject areas. The UK Forestry Standard requirements have been set out in each and guidance given on how to achieve them.

 www.forestry.gov.uk/ukfs/water



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