The UK Forestry Standard

The governments' approach to sustainable forestry

Forestry Commission

Scottish Forestry
Coilltearachd na h-Alba

Cyfoeth Naturiol Cymru
Natural Resources Wales

FOREST SERVICE

3. Forests and Biodiversity

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

Forest biodiversity in the UK

The UK's biodiversity is declining and this mirrors the picture globally. Forests are one of the most biologically rich terrestrial systems with many hundreds of species associated with them. However, a number of biodiversity indicators in the UK show a marked and ongoing decrease of certain species over the last 30–40 years.

All forests support some level of biodiversity and provide habitat for a wide range of flora and fauna. Ancient and semi-natural woodlands in good ecological condition are more biodiverse than other types of forest and are particularly important for rarer and specialist woodland-associated species. Forests managed for primarily commercial reasons, including those comprised of mainly non-native species, have the potential to provide habitat opportunities for a breadth of biodiversity, particularly through the networks of rides and other types of open areas they contain, retention of mature stands and deadwood, and through early growth stages.

Evidence suggests that losing biodiversity will result in ecosystems that are less resilient to challenges such as climate change, invasive species and pests and diseases. Based on available evidence, it is now widely accepted that urgent action is needed to reverse the decline in biodiversity. Increasing the diversity of forest structure and tree species will provide more opportunity for greater biodiversity and improved resilience.

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

To counter the intensification of forestry and agriculture and the consequent fragmentation of semi-natural habitats since the 1980s, forest policies have given more emphasis to environmental benefits. Forest landscapes have become more diverse in structure and more native tree species have been planted or allowed to regenerate. There has also been a focus on managing and restoring ancient woodland, creating new areas of native woodland and improving habitat conditions for priority woodland species. However, species and habitats are still at risk from inappropriate management and the long-term effects of habitat fragmentation and degradation, now intensified by the impacts of climate change, the introduction of invasive non-native species and the increased prevalence of pests and diseases.

Using an ecosystems approach

The conservation, enhancement and restoration of semi-natural habitats and priority species is a clear aim of the UKFS and in the forestry policies and strategies of England, Scotland, Wales and Northern Ireland. The UN Convention on Biological Diversity – the first treaty to provide a legal framework for biodiversity conservation – advocates the ecosystems approach, which means managing natural resources to supply environmental, economic and social benefits within sustainable limits.

As part of the UK's implementation of the Convention, the UKFS helps to further this aim by integrating the conservation and management of biodiversity into sustainable forest management practices. It does this by, for example, reducing the threats posed by climate change, non-native invasive species and pollution, and protecting and restoring forest biodiversity by conserving natural habitats and priority species, creating habitat networks and restoring and enhancing biodiversity in managed forests.

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

UKFS Requirements for Forests and Biodiversity

Protected and priority habitats and species

The forest environment hosts a number of habitats and species that are protected by law. Habitats and species are protected under UK or devolved country legislation, along with UK or country-level important sites and species.

The legal requirement below refers to the 'appropriate protection and conservation' of listed habitats and species, including those designated for their geodiversity. The UKFS follows the Common Statement made by the UK statutory nature conservation bodies by defining this as actions that bring individual protected woodland sites into 'Favourable Condition': a recognised level of the national measure of Favourable Conservation Status. Each country's statutory nature conservation body will advise on how forest owners can meet the Favourable Condition standard, and protected woodland that does not meet it (i.e. is in an unfavourable condition) should see action taken towards achieving it.

Each country within the UK has its own system of determining status and this is why, in order to comply with this legal requirement, it is crucial that advice is sought from the relevant authority about whether a site has any listed species, habitats or geodiversity features, how to minimise any potentially adverse effects of forestry activities on them, and how to help a site in unfavourable condition to recover.

Conservation legislation, first introduced as the Conservation (Natural Habitats, &c.) Regulations 1994 and since amended in devolved law, requires that an assessment is undertaken to assess the potential impact of an activity on the 'qualifying interest' of a European designated site. This is known as a Habitats Regulations Appraisal or Assessment (HRA), and is undertaken by the competent authority (e.g. forestry authority). The key determining factor of whether a HRA is required or not is the potential impact of a forestry plan or project on the conservation objectives of the qualifying features for which the site was classified.

The biodiversity lists of England, Scotland, Wales and Northern Ireland name priority habitats and species associated with forests, including woodland habitat, wood pasture, parkland and open habitats. Priority habitats have the potential to provide for the richest and most varied components of biological diversity. Priority species are those that are rare, at risk of extinction, threatened, or have special requirements. A high proportion of priority species are associated with forests.

Information must be sought to confirm the conservation status of a site, and appropriate protection and conservation must be afforded where sites, habitats and species are subject to the legal provisions of legislation. Information must be provided to allow an appropriate assessment to be made as part of a Habitats Regulations Appraisal or Assessment, where required.

Measures should be identified in forest plans to conserve, enhance or restore species identified in the statutory lists of priority species and habitats for England, Scotland, Wales and Northern Ireland.

Invasive non-native species

Some invasive non-native (or 'alien') species pose a significant risk of adverse impact and so they are regulated by law. Under devolved statutory instruments there are general duties to protect the environment, society and economic interests from the risks posed by certain, listed, non-native species. There is also devolved legislation, under which it is an offence to release or cause the spread of invasive non-native species, unless authorised.

For invasive non-native species subject to the legal provisions of the European Union Invasive Alien Species Regulations or others listed under devolved legislation, the requirements regarding the prevention, early detection and rapid eradication of new invasions and the management of invasions that are already widespread must be followed.

Forest management and biodiversity

While ancient semi-natural woodland (ASNW) has the highest value for biodiversity, all forests, including planted forests, can be valuable for biodiversity with appropriate management. Adjacent habitats such as hedgerows and open ground can further support forest biodiversity, as well as offering a range of other benefits such as carbon capture and reduced flooding.

Forest owners and managers also need to consider the impacts of their decisions beyond the forest boundary and engage with others if the conservation and enhancement of biodiversity is to be achieved. This has implications for the location, composition and size of woodland creation schemes.

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

The loss of ecological connectivity through the fragmentation of woodland habitat poses a significant threat to woodland biodiversity. This is particularly the case where smaller woods are isolated by development or intensively managed agricultural landscapes. Smaller habitat areas and greater isolation between them increases the likelihood that priority species will become locally extinct. Climate change poses further threats to isolated populations as the limited genetic base of small populations in isolated fragments gives them less capacity to adapt to new conditions.

Existing biodiversity in forests should be protected; opportunities to restore and enhance biodiversity should be considered and implemented in forest management plans.

The implications of woodland creation and management for biodiversity and ecological resilience in the wider environment should be considered, including the roles of forest habitats, trees outside woodland, hedgerows and open habitats, in encouraging habitat diversity and availability through ecological connectivity.

UKFS Guidelines on Forests and Biodiversity

Priority habitats and species

Many habitats that are important for biodiversity in the UK have been reduced and fragmented and so need protection, restoration and expansion. Detailed advice is available from the forestry authorities and nature conservation agencies on forestry management systems and operations that will help protect a species or maintain or enhance a habitat. Certain forest operations can be damaging to priority species and habitats – including non-woodland priority habitats – and may need to be planned for another time of year or otherwise amended.

When land-use change is proposed, the relative merits of existing habitats and the potential impacts of change on priority habitats and species must be taken into account. Where impacts due to afforestation or deforestation are likely to be significant, an EIA will be required. Existing semi-natural habitats are likely to have a high value for biodiversity and this needs to be considered when proposing woodland creation. Moreover, there is a specific presumption against the conversion of priority habitats such as deep peat or active raised bogs for reasons of climate change and biodiversity.

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

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

3. Identify sites of protected aquatic and wetland habitats and species, including spawning, and ensure protective buffer areas are established.

4. Consider the impacts of the silvicultural system(s) employed so that it is compatible with the habitat requirements of priority species.

5. Where priority species are ecologically dependent on a woodland habitat, plan felling programmes so that disturbance at sensitive times of the year is minimised.

6. For woodland creation proposals, include an assessment of the potential impacts on priority habitats and species as part of the forest design process.

Native woodland

Native woodland is broadly defined as being composed mainly of native species, and can be derived from natural seedfall, coppice and planted trees. It is among the richest habitat for biodiversity and supports a high concentration of UK priority species. All types of native woodland are priority habitat types in the country biodiversity lists, and some are of international importance.

Ancient woodland, and ancient and/or veteran trees, are irreplaceable and have a very high biodiversity and cultural value. The term 'ancient woodland' is used to describe ancient wood pasture and parkland, infilled wood pasture and parkland, plantations on ancient woodland sites (PAWS) and ancient semi-natural woodland (ASNW) that are characterised by predominantly natural features. These features include a range of native, naturally regenerated tree and shrub species, old trees and deadwood, woodland flora, and rich and undisturbed woodland soils. Sites with a long continuous history of woodland use are listed as ancient woodland.

Woods that are both ancient and semi-natural have the greatest value for biodiversity, and although they are still widespread, they are fragmented. They serve as valuable refuges for woodland biodiversity, particularly for sedentary species that, once lost, do not readily recolonise. They often retain characteristics of previous management such as coppicing and other traces of cultural history.

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

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

7 Manage native woodland to improve ecological condition; base management proposals on protecting or extending semi-natural features characteristic of that woodland type, controlling invasive non-native species and managing deer; place special emphasis on ancient semi-natural woodland.

8 In ancient semi-natural woodland, avoid introducing non-native trees and understorey species.

Ecological connectivity

The effect of fragmentation on different species depends on their modes of dispersal, habitat requirements and ability to migrate through the surrounding landscape. Many woodland species, especially those associated with ancient woodland, disperse slowly and so their ability to move between areas of suitable habitat may be low.

Options to restore or promote connectivity include expanding existing wooded areas and creating new woodland adjacent to them. Wood pastures, parkland, orchards and open semi-natural habitats can be created or managed to act as a link between woodland

habitats. Because of their linear nature, riparian zones offer good opportunities to increase connectivity. Hedgerows and diverse uncultivated field margins can also serve in creating cover and developing connections.

However, consideration also needs to be given to wider aspects of biodiversity as other important habitats such as semi-natural open ground can be fragmented when new woodland is established, and pests and diseases can find increased mobility. The location and composition of forests and appropriate design of edge margins can facilitate the migration of species. Those comprising a diverse range of habitats and sites will help enhance the ability of individual species to endure as climate change progresses because they will contain more varied gene pools, facilitating adaptation.

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

Ecological processes

The ecological processes that shape natural forest ecosystems include vegetation succession, natural regeneration, windthrow, flooding, drought, the activities of herbivores, predation and change caused by reintroduced species such as Eurasian beaver, insect attack, disease and fire. These processes can make a positive impact by introducing a degree of unpredictability, encouraging structural diversity to develop and assemblages of new species to establish. Allowing ecological processes to operate, and mimicking them within silvicultural systems, can therefore benefit biodiversity – provided this is done within the framework of a forest management plan with clear management objectives.

Within a managed forest, the areas with the most potential for this approach will have had limited recent intervention (for example by using a LISS such as continuous cover forestry), and will be linked to areas of high biodiversity value such as semi-natural habitat. Designated sites such as Sites of Special Scientific Interest (SSSIs) and other areas can also be set aside as 'minimum intervention' reserve areas, where silvicultural management is designed to maintain ecological processes and enhance the site. Intervention may still be necessary in these areas to manage deer, remove invasive species such as rhododendron, or to ensure that particular characteristics are favoured, for example. Risk assessments may reveal that some management of access may be needed as retained dead trees and branches can become safety hazards.

Identify areas for minimum silvicultural intervention and, where it is appropriate, encourage or replicate ecological processes as a way of delivering biodiversity objectives within a forest management plan.

If the reintroduction of a native species is being considered, guidelines from the International Union for the Conservation of Nature (IUCN), country guidance, long-term management plans and appropriate funding need to be in place to ensure that the positive impacts of reintroductions are maximised, while permitting early intervention when problems arise.

Tree and shrub species selection

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

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

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

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

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

The Forest Reproductive Material (Great Britain) Regulations 2002, and equivalent legislation in Northern Ireland, provide a system of mandatory identification and control of the seeds, cuttings and planting stock of 12 major species used for forestry. They ensure that planting stock is of traceable origin (and provenance). A voluntary scheme for the certification of native trees and shrubs is also available to help users identify and source suitable stock for all native species, including 41 native trees and shrubs that are not

controlled by the regulations. The voluntary scheme uses 24 native seed zones and two altitude bands.

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

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

Forest and stand structure

Forest structure and stand structure are fundamental to woodland biodiversity. Forest structure is determined by the ages and species of trees and shrubs, the patterns of open space and internal and external edges, and other woodland features. Together, they shape the character of the canopy, vegetation layers and the intensity of light reaching the forest floor.

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

Many broadleaved woodlands have been simplified in their composition and structure through past management and, in some cases, neglect. Using management regimes that increase the diversity of age classes and allow old or veteran trees and deadwood to develop will enhance the structure for biodiversity, as will regular coppicing of those species for which continuity of the conditions created is vital to their habitat. Leaving some windblown trees will provide nesting sites, decaying wood and structural micro-sites.

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

15 Identify sites for long-term forest cover and thin them appropriately.

Deadwood

Up to one-fifth of woodland species depend on dead or dying wood for all or part of their life cycle and it is an important indicator of the level of biodiversity in forest ecosystems. Generally, the greater the volume of deadwood, the higher the biodiversity value. Deadwood occurs as whole standing trees, fallen branches and stumps, while veteran or ancient trees – although alive – have rot holes, dying limbs and heart rot. All of these different deadwood types have their own characteristic fungi, flora and fauna.

The most valuable areas for deadwood are where linkages can be made with existing deadwood habitats to develop ecological connectivity, which is why it is important to leave deadwood concentrated in high value areas and not dispersed evenly across a felling coupe. High value areas might be found in long-term forest cover areas and wood pasture, parklands and ASNW with veteran trees. Deadwood retained close to sunny glades and edges will provide a useful habitat for insects in particular, while in riparian or wet woodland it provides special humid habitats.

There are numerous opportunities to develop decaying wood habitats and increase the quantity of deadwood in all forests, particularly in very old stands (more than 120 years old). The long-term provision of deadwood can be assured by protecting current and future veteran trees from loss or harm.

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

However, forest managers will need to be aware of the potential risk posed by deadwood (and stressed trees) of aiding the spread of pests and diseases. Where exotic pests such as *Ips typographus* may be present, dead and stressed trees of host and potential host species (Norway spruce and Sitka spruce in the case of *Ips typographus*) should be removed at the earliest opportunity and stands of host tree species inspected for damage after storms or drought.

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

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

17 To reduce the amount of suitable habitat for specific pests and diseases, inspect the deadwood of host tree species for damage after storms or drought and remove it from site if necessary.

Open, scrub and edge habitats

The open, scrub and edge habitats within or adjacent to forests are especially important for biodiversity. These unplanted areas may contain valuable habitats, such as shrubs, open and stunted forest at the natural treeline, grasslands, crags, heaths, limestone pavements,

bogs and a range of aquatic habitats. Open areas such as utility wayleaves, roads and rides add to and interconnect these open habitats.

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

Forest edges that move along a gradient into open ground and, where possible, contain mixtures of native trees and shrubs are far more beneficial to biodiversity than abrupt edges. They provide, for example, bird nesting and feeding areas and sources of nectar for pollinators and other insects. Many birds nest in edge habitats, and some, such as black grouse, depend on the maintenance of a diverse edge structure. Forest edge habitats often have better coning/fruiting and so are good for species such as red squirrel and dormice, and butterflies require nectar sources and food plants associated with edges and open areas.

Distinctive open habitats and species associations have developed in wood pastures, parklands and woodland with a long history of grazing, and these have specific management requirements.

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

19 Consider practical opportunities to restore open habitats where their value could be maintained and enhanced.

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

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

22 Consider how open areas and areas with partial tree or shrub cover, including encroaching seedlings, can be managed to maintain or enhance their value for biodiversity.

Habitat creation and restoration

Significant gains for biodiversity can arise from creating new habitats and restoring degraded ones, to help reverse the effects of habitat fragmentation. Restoration of former habitats is most beneficial where the original features survive and the re-establishment and management of a functional ecosystem over the longer term is a practical possibility. It normally involves enhancing remnant native ecological features by natural regeneration and colonisation, and in some cases removing non-native and invasive species.

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

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

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

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

Some forests have been established on what are now recognised as priority open-ground habitats, such as bogs and heaths. Although there is a general presumption against deforestation, some of these sites may have potential for restoration where this offers significant and demonstrable benefits for biodiversity and climate change mitigation. Any change from woodland to non-woodland habitat needs to be compliant with the country's policy on woodland removal and, where deforestation is proposed, an EIA is likely to be required. All the various implications, including the practicality of habitat restoration, will need to be considered in the context of policies at country level on woodland removal.

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

On plantations on ancient woodland sites (PAWS), ensure that ancient woodland remnant features are protected and consider progressive restoration to native woodland; refer to country guidance, where available, on PAWS restoration.

25 On ancient woodland sites, ensure features are protected and appropriately managed.

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

Invasive species

An invasive species is any animal or plant that has the ability to spread and be detrimental to the environment, the economy, or our health and well-being. In the UKFS they are categorised separately from tree pests and diseases (defined as organisms which specifically harm trees and which are dealt with in the General Forestry Practice section).

Some invasive species are native (e.g. bracken) but most are non-native (e.g. grey squirrel and rhododendron). The effects of invasive species on the biodiversity of forests and their associated habitats are wide ranging. Those that pose the most significant risk are subject to control provisions under legislation. Because invasive species can quickly colonise and dominate areas, and are expensive to eradicate, early action to prevent populations establishing will be more cost-effective than later attempts at control. A collaborative eradication strategy across a defined geographic area is likely to be more effective for more mobile species. Advice on practical control measures is available from the forestry authorities or nature conservation agencies.

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

28 Participate in collaborative actions to control invasive species at appropriate spatial scales.

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

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

31 Where there is a risk of spreading invasive species, take action to clean footwear and vehicles before moving between sites and avoid moving gravel between rivers and catchments.

Grazing and browsing

Natural woodland ecosystems have evolved together with a range of grazing animals. The effective management of grazing and browsing is important in achieving objectives for woodland and open-ground habitats. While low grazing pressure can be advantageous, in the absence of control, herbivore populations (in particular deer, but also other wild or feral species such as goats, and livestock including cattle and bison) can increase to a level where biodiversity is impoverished and the growth of alternative species planted or regenerated to increase species diversity is limited. This is particularly significant for biodiversity in semi-natural woodland where the target community is composed of species

that are especially palatable, such as hornbeam, field maple, oak, ash, hazel, honeysuckle and certain ground flora species, and where management is reliant on natural regeneration.

The key stages to managing grazing are to assess the impacts, determine if control measures are needed, work with others at the landscape scale to find solutions, and monitor the effect of interventions, adjusting the control measures as needed.

Livestock can sometimes play a role in maintaining the structural diversity of open habitats: they can scarify the ground, which encourages seedling establishment, but this needs to be tightly controlled. Uncontrolled grazing by livestock or horses is invariably detrimental and will eventually lead to loss of woodland habitat. In wood pastures and parkland, light grazing is an essential element of maintaining the characteristics of the habitat. Where there is no grazing or browsing at all, the development of coarse vegetation and scrub eliminates less competitive plants. By contrast, heavy grazing can prevent woodland regeneration and dramatically reduce the quantity or diversity of woodland ground flora and dependent fauna.

Trees can be temporarily protected from grazing by fencing; tree guards or tubes offer protection to individual trees, but not the entire habitat. Other management techniques, such as piling brushwood on a small scale or establishing thorny species, can allow tree species to establish. Wider habitat protection may require herbivore populations to be reduced, possibly in conjunction with fencing. Landowners and managers should be aware of the need to maintain fencing in good condition. Deer fences are rarely completely deer-proof, but they do reduce negative impacts for a period of time. Consider the potential adverse effects of using fences, such as the long-term decline in vegetation diversity, increased shading and the problem of birds striking fences during flight.

32 Assess grazing and browsing impact levels on woodland habitat by making a regular survey of impact indicators.

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

34 Consider using controlled grazing by livestock as part of the planned management for biodiversity, including for open habitats within the forest.

35 Consider the potential impacts of fencing on wildlife and minimise adverse effects.