The Management of Semi-natural Woodlands

3. Lowland Mixed Broadleaved Woods

PRACTICE GUIDE

Forestry Commission

Forestry Commission

Practice Guide

The Management of Semi-natural Woodlands

3. Lowland Mixed Broadleaved Woods

Forestry Commission: Edinburgh

First published in 1994 by the Forestry Commission
231 Corstorphine Road, Edinburgh EH12 7AT.

Reprinted 2003

ISBN 0 85538 582 0

FORESTRY COMMISSION (1994).
The management of semi-natural woodlands:
3. Lowland mixed broadleaved woods.
Forestry Commission Practice Guide.
Forestry Commission, Edinburgh. i–iv + 1–28pp.

Keywords: ancient woodlands, biodiversity, lowland mixed broadleaved woods, native woodlands, nature conservation, semi-natural woodlands, sustainable forest management.

Printed in the United Kingdom
on Robert Horne Hello.

FCPG003/PPD(KMA)/LTHPT-4000/MAR03

Enquiries relating to this publication should be addressed to:

Policy & Practice Division
Forestry Commission
231 Corstorphine Road
Edinburgh
EH12 7AT

Tel: 0131 334 0303
Fax: 0131 316 4344

Acknowledgements

The compilation of this Guide was a team effort involving the following people. Dr George Peterken, acted as project adviser and drafted much of the text. Richard Britton and latterly Gordon Patterson were Project Leaders. John Clarke, Conservator Kent and East Sussex, and Graham Darrah undertook the initial research visits and prepared a report on which this Guide is based; they also commented on later drafts. Colin Tubbs, Barry Teasdale, Francis Rose and Tony Whitbread gave valuable comments and Alastair Rowan helped in various stages of the drafting. Alistair Scott and Graham Gill, provided additional editorial input. Many other organisations and individuals provided useful advice and comment at various stages.

Contents

Publishing update

This guide was first published in 1994. This edition is a reprint with a revised format and further reading section (page 20), otherwise the text has not been altered. The section on further reading has been updated to include relevant advice published since 1994. Please note that all references to *Forestry Authority* should be read as *Forestry Commission*.

Introduction

Ancient semi-natural woodlands are a vital part of our heritage. They provide a range of habitats which support a rich diversity of plants and animals. Many woodland species depend entirely for their survival on the continued existence of these habitats. Ancient semi-natural woodlands form prominent features in many landscapes and collectively constitute a significant economic resource. They are all that remain of the original forests which covered most of Britain and now occupy only 1% of land area. Concern about the continuing loss of area and character of ancient woods contributed to the Government's decision to introduce the Broadleaves Policy in 1985.

The Broadleaves Policy aims to maintain and increase the broadleaved woodland by encouraging good management for a wide range of objectives and giving special attention to ancient semi-natural woodlands to maintain their special features. It has generally been very successful in encouraging the expansion and better management of broadleaved woodland and in preventing further losses of ancient semi-natural broadleaved woodland. However, there is a need for policy guidance to take more account of local and regional factors, especially for semi-natural woodlands which vary greatly in character in response to differences in climate, soils and history.

The management guidelines for the native pinewoods of the Scottish Highlands published by the Forestry Commission in 1989 have proved a successful example of guidance for a specific type of semi-natural woodland. We have now extended this approach into a comprehensive set of advisory guides on the management of ancient semi-natural woods throughout. Britain. For this purpose, we recognise eight broad woodland types as described in the Appendix.

The advice is intended to help owners and managers to achieve the best practice which will secure the woodland's future. The guides describe the management most appropriate for each type of woodland. Devised by Forestry Commission staff working closely with foresters and ecologists with special knowledge and experience of managing British semi-natural woodlands, they form a distillation of the best advice available.

Whilst these guides are aimed primarily at ancient semi-natural woodland, much of the advice in them will also be appropriate for other semi-natural woods which are of high conservation value, and for long-established planted woods which have developed some of the characteristics of ancient semi-natural woodland, notably where native trees were planted on ancient woodland sites.

The ecological value and character of ancient semi-natural woodland varies considerably. Some, notably in less accessible upland areas, owe much of their current value to a relatively low intensity of past management, although none have been totally unaffected by human influence. Others, especially in the lowlands, have developed a distinctively rich flora and fauna through a long history of consistent silvicultural management. Some have lost many of their special characteristics through various types of disturbance and many have been reduced in size so much that their survival is at risk. All are part of the nation's heritage, and deserve forms of management which recognise their different values. Some are designated as Sites of Special Scientific Interest. These may have specific management arrangements agreed with the conservation agencies, which are outside the scope of these booklets. The advice given here is aimed at encouraging forms of management which maintain and enhance the special characteristics of all ancient semi-natural woodland.

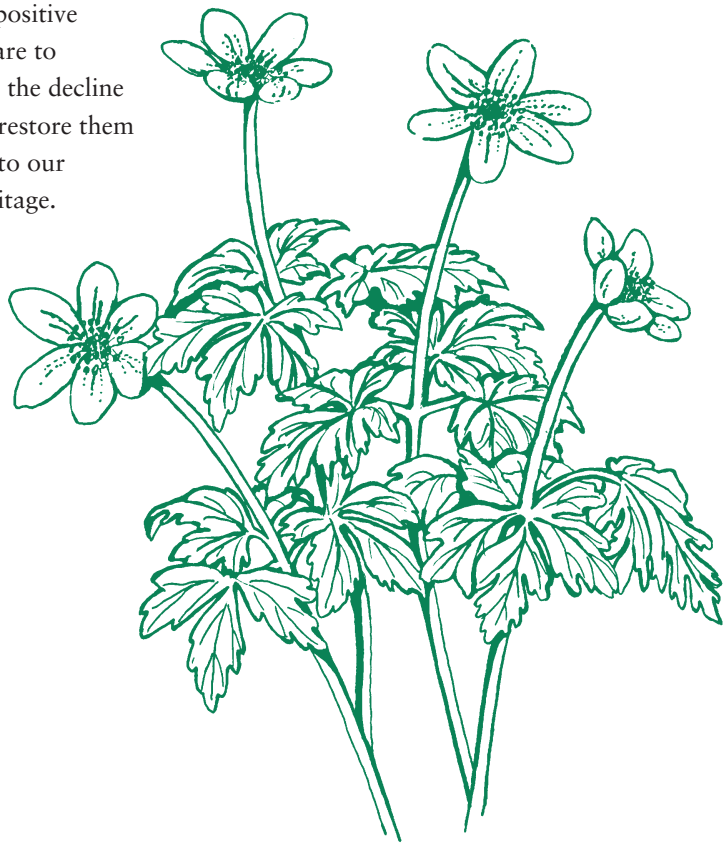
When grant aid is sought the Forestry Authority will compare management proposals with the advice contained in these booklets. Applicants are free to propose other forms of management for these woods, but must satisfy the Forestry Authority that their proposals will be effective in maintaining, and preferably enhancing, the special characteristics of the woodland. The advice given in these booklets is intended to create a flexible framework rather

than a straight-jacket, so that woods and their owners can develop their individuality as much as possible without reducing options for future generations.

Sensitive management which takes account of the individual character and circumstances of woods, and also the particular objectives of owners, is essential if their values are to be successfully maintained.

The appropriate form of management will vary considerably. In some cases, particularly some upland and many wet woodlands the most suitable management will be to reduce grazing and browsing pressures from deer or stock to levels which will allow natural regeneration or expansion of the wood to happen. More intensive forms of management may harm the unique wildlife interest of some of these woods. Elsewhere, especially in lowland woods with a long history of management systems such as coppice with standards, more active forms of silviculture will be appropriate and often necessary to conserve their character and wildlife as well as their value as an economic resource.

One thing which is certain is that positive management will be needed if we are to continue recent progress in halting the decline of our semi-natural woods and to restore them to a healthy condition to hand on to our successors as vital parts of our heritage.



Wood anemone

Management principles for semi-natural and native woodlands

Semi-natural woods are composed of locally native trees and shrubs which derive from natural regeneration or coppicing rather than planting. Because of their natural features and appearance, semi-natural woods are valuable for nature conservation and in the landscape, and many are important for recreation and for historical and cultural interest.

Management should aim to maintain and enhance these values in harmony with securing other benefits, including wood products.

Ancient semi-natural woodlands are of special value because of their long, continuous history. They are the nearest we have to our original natural woodland and include remnants of the post-glacial forest which have never been cleared. They are irreplaceable assets which support many rare plants and animals and make a vital contribution to conserving biodiversity. They also contain a wealth of evidence of our past. Many have been greatly modified in structure and composition by centuries of management, whilst retaining many natural features. Some are threatened by neglect in the face of pressures such as fragmentation and overgrazing. The Forestry Authority encourages management which seeks to maintain or restore their special characteristics, including their natural diversity of species and habitats, aesthetic and cultural values and genetic integrity, whilst taking appropriate opportunities for wood production for a range of markets.

Management proposals should be geared to sensitive and low-key methods which are suited to the natural dynamics of these woodlands. Natural regeneration will be preferred to planting wherever practicable. More detailed guidance is given in the guide for each woodland type.

Other semi-natural woodlands, which have developed from natural colonisation of open ground sometime within the last few centuries, are also normally of high environmental value, particularly in the uplands, although they are not usually so valuable as ancient semi-natural woodlands because of their shorter history.

Appropriate management will vary according to the relative importance of these woodlands. For some, for example many long-established upland woods, management should be similar to that for ancient woods, whilst in woods of lower value a greater range of silvicultural options will be acceptable.

Planted woods of native species may often acquire some of the characteristics of semi-natural woodland, especially where they are on **ancient woodland sites**, where plants and animals have survived from the former semi-natural wood. The development of a varied structure and composition, including diverse native tree, shrub and field layer vegetation and the use of locally native species and genotypes for planted trees, can also increase the naturalness of native plantations.

Where planted native woods have developed a high conservation value in these ways management should be similar to that for semi-natural woods, but generally a wider range of silvicultural systems, including a greater emphasis on planting instead of natural regeneration, will be permitted under the grant aid and felling regulations.

New native woodlands, which are designed and managed from the start to develop a natural character, can help to offset some of the past losses of native woodland and will in time acquire a high environmental value, although they should not be seen as substitutes for any remaining semi-natural woodland.

The Forestry Authority will encourage by grant-aid the creation of new native woodlands on open land by natural colonisation or planting, where species composition and site are suitably matched, especially on areas close to existing semi-natural woods. Further guidance can be obtained in Bulletin 112, published by the Forestry Authority.

What are lowland mixed broadleaved woods?

This guide deals with the management of ancient semi-natural lowland mixed broadleaved woods. These are concentrated in the English lowlands, where they are by far the dominant type in the Midlands and East Anglia, but they also occur sparingly in the Scottish and Welsh lowlands and the upland margins. They mostly occupy 'mesic' soils, i.e. neither the extremely dry sites on limestone outcrops, nor the extremely acid, podzolised soils associated with heathlands. Typically, they occupy a wide range of fertile, moist loams and clays, and support a rich flora containing both lime-loving and lime-avoiding species. There are estimated to be 130 000–160 000 ha of ancient semi-natural woodland of this type.

Lowland mixed broadleaved woodlands include many variants, some of which are restricted in their distribution. For example, hornbeam woods are common only in Kent, Sussex and East Anglia. Lime woods are scattered mainly through the Midlands and East Anglia. A typical example is a wood of 10–30ha, growing on a flat or gently sloping site at or below 300m altitude, entirely surrounded by farmland, dominated by mixtures of oak, ash and hazel, which was treated as coppice until 30–70 years ago.

These woods have long been known as 'oak-ash' woods by ecologists. They broadly correspond with two woodland types in the National Vegetation Classification, (Rodwell, 1991[1]) namely W8, Ash–maple–dog's mercury woodland and W10, oak–bracken–bramble woodland. Some of the former occur in the uplands, where they are covered by the guide for Upland Mixed Ashwoods (Forestry Practice Guide 4).

Oak and ash dominate most of these woods, with hazel as the commonest underwood species. Although pedunculate oak is characteristic, sessile oak occurs on a variety of sites, from strongly acid, poorly drained clays (e.g. Hertfordshire hornbeam woods) and alkaline loams (e.g. Herefordshire limestone woods) to light, acid loams (e.g. some silver Lincolnshire limewoods). Field maple, wych elm, wild cherry suckering elms and sallows are frequent within W8, whilst silver birch, small-leaved lime, hornbeam and alder are often present in W10. Hawthorns, dogwood, spindle and other shrubs are frequently found in the underwood. Wild service occurs sparingly. Conifers are naturally absent, save for yew on a few limestone outcrops. Beechwoods are treated as separate types in this series of guides, though mixed woods with just a few beech can be covered by this type. Sycamores, sweet chestnut and other non-native trees have colonised many woods.

Within these two types there is considerable variation in stand composition. Although oak–ash–hazel mixtures are commonest, woods dominated by hornbeam, small-leaved lime, field maple, suckering elms, wych elm, sessile oak or alder are all found. In many woods the stand is a complex, small-scale patchwork of different dominants.

Type W8 occurs on alkaline and neutral soils, many of which are heavy and poorly-drained. Dog's mercury is the characteristic field layer dominant, but bluebell, enchanter's nightshade, bramble, yellow archangel, primrose, wood anemone and many others are often common. Type W10 occurs on acid soils ranging from poorly-drained clays to lighter, base-poor sandy loams. The ground flora is poorer than in W8, with bluebell, wood anemone, bramble, honeysuckle and bracken often dominating at different seasons.

Lowland mixed broadleaved woods overlap with several other types. Some upland mixed ashwoods on deeper soils are very similar. In some woods on chalk and limestone in southern England and the southern Welsh borderland beech forms a small proportion of mixed stands which are closely related to beech–ash woods (Guide 2). On the more acid clays and loams, oakwoods occur with a hazel-dominated underwood, which are similar to some of the oakwoods included in the lowland oak–beech type (Guide 1).

History and traditional management

Wood pasture

Mixed woodlands have been used as pasture for millennia, Prehistoric communities used the wooded waste as a source of timber and a place to graze domesticated animals. This usage was formalised in common rights, deer parks, royal forests and private chases in medieval times. Most of the modern survivors of wood-pasturing are on acid soils and are covered by the acid oak and beech guide (Guide 1), but some old deer parks are forms of mixed broadleaved woodland.

Modern relics of wood-pasture generally comprise a scatter of large oaks, many of which have been pollarded or shred, and a few ancient specimens of other trees, such as ash, maple, lime and elm. They are extremely important refuges for lichens and other epiphytes, fungi and invertebrates associated with dead wood.

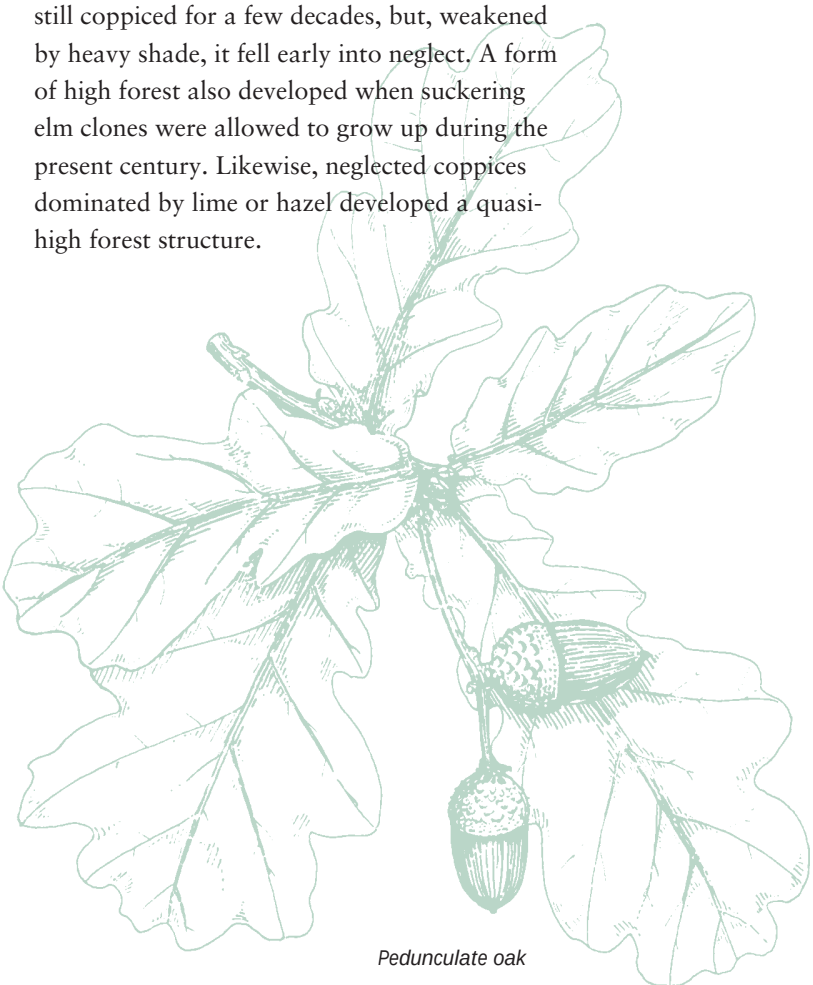
Coppice and coppice-with-standards

Since the early middle ages the great majority of lowland mixed woods have been treated as coppice or coppice-with-standards. Most coppices were cut on rotations of 5–30 years, supplying mainly local markets with fuelwood, roading material, charcoal, fencing and the basis for numerous coppice crafts. Growing amongst the coppice were timber trees, known as standards, most of which were oak. These were used to frame houses and were sometimes sold for more distant markets, though it is doubtful whether ship-building was a major influence in most woods. Standard oaks were grown for 80–100 years. Their density varied down the centuries according to market changes and the needs of individual owners, so there was a range from pure coppice and coppice with standards at up to 50 standards per hectare.

The character of coppices changed over the centuries. During the middle ages many were used to harbour deer and pasture domestic animals, once the new growth had grown tall enough to remain unbrowsed, but this practice died out in recent centuries. Species composition also changed. Until the 18th century coppices comprised those species which happened to be there already, but around 1800 many were 'improved' by planting the more useful species, especially coppices in south-east England, many of which were changed from mixtures to monocultures. The third major change has been very recent. Coppicing ceased in most woods at some point in the 20th century and the oaks were cut out during wartime. Most now stand neglected, bereft of their finest growth.

High forest

Very few lowland mixed broadleaved woods were traditionally treated as high forest. However, during the 19th century many woods were densely stocked with oaks which eventually grew into a closed-canopy stands resembling high forest. The underwood was still coppiced for a few decades, but, weakened by heavy shade, it fell early into neglect. A form of high forest also developed when suckering elm clones were allowed to grow up during the present century. Likewise, neglected coppices dominated by lime or hazel developed a quasi-high forest structure.



Pedunculate oak

Values

Landscape

Mixed broadleaved woods often show as stark, sharply-defined patches in a bare, arable landscape, yet with the decline of hedgerow trees they form one of the few reliefs from the visual monotony. In gently rolling countryside, they are mostly seen as breaks in the skyline, for many occupy sites on parish margins. Only on the upland fringes are they commonly seen as hillslope strips. Some favoured districts (e.g. parts of the Weald) still have a high density of ancient woods and numerous hedgerow trees. Here these woods preserve what must have been a more traditional appearance, almost hidden in a well-wooded landscape.

Historical and cultural

These ancient woods are usually bounded and sub-divided by banks and ditches. Many conceal moated sites, armed ponds, small quarries, disused lanes and even Roman roads and temples. They have been part of the farming landscape for millennia, during which time the tide of cultivation has ebbed and flowed. Many therefore include the remains of small fields (defined by banks and ditches) and patches of medieval cultivation remains (in the form of ridge-and-furrow) within their modern borders. Most of these woods have been identifiable and named entities in the landscape since at least early medieval times, and many have generated a legacy of historical records stretching over several centuries. As historical monuments they are no less important than the parish church.

Wildlife conservation

Most of these woods are relics of the original forest cover, modified by centuries or millennia of repeated cutting and some planting also. The mixtures of trees and shrubs and the intricate patterns they form are presumed to have descended directly from primeval woodland, i.e. they inherit a natural composition and relationship to site conditions from the wildwood. Some are still dominated by the most abundant trees of 5 000 years ago – small-leaved and large-leaved limes – but most have been modified by usage to have a higher representation of shrubs and light-demanding trees, such as oak and ash.

Amongst the flora and fauna are many species which occur mainly in ancient woods, i.e. these are species which have not been able to colonise secondary woodlands planted on farmland. These ancient woodland indicators include species of beetle, fly, butterfly, slug, moss, fungi and many flowering plants. Even some of the characteristic and abundant species, such as wood anemone, dog's mercury, yellow deadnettle and wood sorrel, occur mainly in the ancient woods over much of the lowlands. Prolonged coppicing has helped spring-growing species to become abundant. In fact, the spring displays of bluebell, for which British woods are internationally famous, may be partly a product of coppicing in ancient woods.

The coppice with standards system might have been designed for nature conservation. It has encouraged a wide diversity of woodland conditions and a multiplicity of edge habitats, much favoured by insects, birds such as nightingales and other warblers, and mammals such as dormice. Coppicing has enabled rides to remain open, where the sheltered, well-lit and warm conditions support a grassland flora and fauna which is often far richer in grassland species than the farmland outside the woods. The standard trees, the pollards around the margins and the large and ancient coppice stools all provide mature timber and dead wood habitats for a further suite of specialist species. The ponds, which are a feature of so many coppices, provide a refuge for aquatic and marsh species lost by agricultural intensification from farmland.

Recreation

Lowland mixed broadleaved woods are rarely far from cities and towns. In much of the English lowlands so much of the land is

cultivated that the woods represent the last vestiges of semi-wild countryside. Understandably, therefore, many have become popular places for country visits and short walks. Many, in fact, have been acquired by local authorities, conservation trusts and other organisations whose aim is partly to facilitate public access to attractive countryside. Public footpaths and bridleways often enable people to get close to or pass through other woods. Problems can arise when people use these woods heavily; the ground flora can be damaged by repeated trampling.

Game and livestock

Many mixed woodlands have only survived because they could be used as cover for pheasants, foxes and other game. Although management for sporting use frequently involved the elimination of predatory birds and mammals which are now protected species, it not only enabled many woods to survive the eras of rapid woodland clearance in the mid-19th century and 1960–1985, but also provided an incentive to keep parts of these woods open after coppicing declined.

Mixed lowland woods have rarely been important for livestock shelter and grazing in recent centuries, but some examples along the upland fringes are grazed and a few wood-pasture examples survive. Most woods have long been bordered by a bank and laid hedge, designed partly to keep livestock out of the young coppice regrowth.

Wood production

These woods have yielded a mixture of timber, small roundwood, brushwood and minor products (e.g. fungi) for centuries and a considerable amount of oak timber was cut from them during the wartime emergencies of the present century. Today, the markets for coppice products remain much less than in the heyday of woodmanship, but there are still local markets for hurdles from hazel, thatching spars, charcoal, hardwood pulp, turnery poles and fire wood. Brushwood bundles are in demand for river bed stabilisation.

The present quality of timber trees varies greatly. The traditional standard trees developed only a short butt, but where the structure has been developed more towards high forest, well-stocked stands of oak and ash with at least 5m of clean bole free from defects often produce good quality timber of high value. The long-neglected stands with only mis-shapen stems or low value species such as birch often have little value, but the next generation of trees on the site can be managed for better quality. However, even in woods of generally low-grade timber it is possible to find scattered top-quality oaks and groups of valuable stems of, e.g. cherry.

Wild cherry

Policy aims

The aims of policy are to encourage appropriate management of semi-natural lowland mixed broadleaved woodlands so as to:

- **Maintain and wherever suitable restore the natural ecological diversity;**

- **Maintain and where appropriate improve their aesthetic value.**

These two aims should be applied in every case. In the great majority of woods they should be compatible with each other but where conflicts do occur the first should tend to take priority over the second because of the national importance of ancient semi-natural woodland for nature conservation. However, each wood should be assessed according to its importance in the landscape and for nature conservation.

- **Maintain the genetic integrity of populations of native species, so far as is practicable.**

This aim is relevant for semi-natural woodlands where the genetic integrity of native tree and shrub populations has not been seriously compromised by past introductions of non-native stock within or close to the woodland.

- **Take appropriate opportunities to produce utilisable wood.**

The production of utilisable wood, including timber, is not an obligatory aim for every woodland. It is possible to achieve all the other policy aims without it, and indeed in a minority of woods, where minimal intervention is an appropriate philosophy, wood production may not be desirable. However, for many owners, securing an adequate income from their woodlands is essential in ensuring the continuity of management necessary to achieve these aims. Improving timber values, and hence the financial viability of the woodland, in ways compatible with other aims, is therefore a general strategy which the Forestry Authority encourages.

Most lowland mixed broadleaved woods are capable of yielding high quality timber products which, with good management as suggested in this booklet, can be harvested in ways which are compatible with achieving the other policy aims.

- **Enlarge the woods where possible.**

Expansion of ancient semi-natural woodlands is very often desirable especially for small woods to secure their long-term future.

Each wood is unique in its characteristics and its relationship to the surrounding landscape. Although a proportion of lowland mixed woods are fairly uniform due to past encouragement of a single useful species (e.g. hazel), most comprise a small-scale patchwork of woodland types which vary in concert with variation in site conditions. At their most diverse, small ash–maple patches give way to patches of hornbeam dominance, hazel dominance or lime dominance within a few metres. Within practicable limits, the aim should be to maintain this natural diversity in future management.

Application of this guide

This guide should be applied to all ancient semi-natural woods of this type managed under the Woodland Grant Scheme. They will normally qualify for the special rate of management grant where work is done to maintain or improve the special environmental value of the wood. It will also apply to Felling Licence applications, to management under other grant schemes and to woodlands in the management of Forest Enterprise.

Semi-natural lowland mixed broadleaves woods of recent origin are usually less valuable than ancient ones for nature conservation, so it is usually appropriate for management to place a relatively greater emphasis on timber production in recent woods but otherwise much of this guide can be used.

Much of the advice in this guide can also be applied to ancient woodlands which have been converted to broadleaved or mixed plantations. The nature conservation value of these woods is generally less than that of ancient semi-natural woods, so it is usually legitimate to place a greater emphasis on timber production. In ancient woods which have been converted to conifer plantations, but which have retained some nature conservation value, there may be opportunities to restore semi-natural lowland mixed broadleaves woodland to at least part of the wood by including appropriate native trees and shrubs in the next rotation.

Old planted woods of native species on sites which had not previously been wooded sometimes acquire conservation values nearly as high as those of ancient semi-natural woodland. Again much of this guide can be applied in these cases.

Where the woodland is designated as a Site of Special Scientific Interest (SSSI) guidance must be sought from English Nature, the Countryside Council for Wales, or Scottish Natural Heritage before carrying out any operation or change of management. Any other legal constraint on management, such as a Tree Preservation Order or a Scheduled Ancient Monument, must of course be respected.

Field maple

The management plan

For any woodland to receive grant aid from the Forestry Authority, management objectives and a programme of work must be agreed for a five year period.

In the case of semi-natural woods, especially the larger and more complex ones, it will be helpful to prepare a separate management plan, which can be used for reference when the detailed proposals are revised every five years on grant applications. The management plan should contain an assessment of the woodland, including any special characteristics, a statement of objects of management and their priorities and a long-term strategy setting out the desired future condition of the wood and how it is proposed to achieve it. This will be of great value for semi-natural woods where management should be particularly sensitive to the individual values and character of each woodland. The management plan should be brief and succinct; long descriptive essays are not likely to be read.

Here is a checklist of some of the factors to be included where relevant:

Description

- Name, location.
- Areas, with sub-divisions if these clarify management proposals.
- Historical aspects, including past management.
- Tree and shrub species, notably dominant trees and abundant underwood shrubs.
- Age class distribution of trees; stocking; composition and condition of any natural regeneration.
- Ground flora; dominant species and any unusual species.
- Fauna, especially any rare, unusual, attractive or notable species.
- Conspicuousness in the landscape.
- Cultural features.
- Statutory designations.
- Constraints.
- Existing public access and planned future access.

The description should be a brief summary of the main features, ideally based upon survey information.

Local Forestry Authority officers may be able to advise on sources of specialist advice and survey information.

Evaluation

Itemise any special values, e.g. prominent in landscape, rare species, natural features, historical associations, quality timber potential. Careful assessment of the values of the wood will help to generate suitable management objectives.

Objects of management

All the policy aims must be respected, although as explained earlier not all are relevant to every wood. The owner may have additional objects of management for a wood. The owner should express the particular policy aims for the wood, giving details of management objectives and indicating priorities. Owners may find it helpful to discuss their objectives with local Forestry Authority staff.

Management proposals

A long-term strategy should be stated, which specifies any changes in composition envisaged, the overall woodland structure which is sought and any silvicultural systems to be used. It would be helpful to state the reasons for adopting this

strategy. The timescale may be many decades or more than a century. A five year summary work plan should be proposed, itemising the areas to be worked and the main operations to be carried out in the next five years.

Monitoring

A vital stage, often omitted, is the monitoring and review of management. Has it delivered the desired results? An ideal review point is the revision of a grant scheme or plan of operations every five years. Monitoring requires that some record be made of what the wood was like at the start of the period, the work done and how the wood responded. Experience demonstrates that, even in small and well-known areas, memory seldom provides the level of detail and accuracy required.

Monitoring should be targeted to assessing how well the objectives of management are being achieved. This may mean, for example, assessing the success of natural regeneration or changes in woodland structure and species composition. Where rare habitats or species are present their progress may also be monitored in response to woodland management.

Simple techniques such as fixed-point photography can be used by non-specialists and provide valuable information over the years. Amateur naturalists as well as professional ecologists may be able to help with monitoring the wildlife of woods.

Some sources of advice on monitoring are listed in Further Reading and Forestry Authority staff may also be able to advise on what is needed for individual woods.

Hornbeam

Operational guidelines

General principles

The policy aims for lowland mixed broadleaves woods lead to general principles for management:

- **Maintain semi-natural woodland types.**

Management should be based on growing species native to the site and appropriate to the pattern of soils within the site. Existing abundant native species should remain a significant component.

- **Maintain or restore diversity of structure.**

A full range of age classes within each site is normally preferable to the one or two age classes which are often found at present.

- **Maintain diversity of species and increase where appropriate.**

Many lowland mixed woods in southern England have been simplified to almost pure hazel coppices.

- **Maintain diversity of habitat.**

A diverse structure and mixture of species improves habitat diversity, but open areas are also extremely important. They can be temporary (recently cut areas) or permanent (e.g. rides).

- **Maintain a mature habitat.**

This can be achieved by retaining old, dead or dying trees and/or by increasing rotation lengths.

- **Minimise rates of change.**

Wildlife takes time to adjust, so change should not be too drastic. This applies both to the scale and sequence of felling, and the layout or rides.

- **Use low-key restocking techniques.**

Intensive working methods should be avoided. The general rule should be to do the minimum necessary to ensure adequate establishment and growth of the desired tree species.

The need for management

Although a few mixed broadleaves woods within nature reserves may legitimately be left unmanaged indefinitely for scientific purposes, most woods of this type are better managed than neglected. This is obviously true if timber production is an aim, but it is also true for landscape and nature conservation. Regularly treated woods can have a mixed age-structure and retain open habitats. Overgrown former coppice woods are still common, and these could be rapidly improved as habitats by opening rides and restoring a cycle of management.

Silvicultural systems

Coppice and coppice with standards

Coppicing is particularly appropriate to lowland mixed broadleaf woods. It:

- maintains the short cycle of light and shade to which the wildlife of most lowland ancient woods is adapted;
- creates great habitat diversity and numerous edge habitats;
- enables ride grassland that have often remained stable for centuries. Displays of spring flowers – bluebells, anemones, primroses, celandines – are particularly characteristic of coppiced woods.

Coppicing is particularly recommended where:

- the coppice is still being cut;
- the underwood was coppiced within the last 50 years or so;
- the species composition of the underwood is diverse and not obviously planted;

- wildlife species which prosper in coppice (such as dormice or nightingales) are present;
- deer populations are low; and
- traditional markets still exist (such as hazel in Hampshire and Dorset).

It is also highly desirable in small woods, where cutting a small patch each year would maintain the cycle of habitats, but this may detract from the landscape.

Coppice-with-standards will produce the greatest habitat diversity and creates an opportunity to grow large oak, ash, cherry, birch or lime trees. Groups of timber trees produce an intermediate condition between coppice and high forest which combines the value of both.

No particular coppice rotation can be generally recommended. Short rotations of 5–15 years were traditional and should be maintained if markets exist. If rotations are extended to 25–35 years in order to produce pulpwood and firewood, some part of the wood should be cut every 4–5 years to help to keep rides open and maintain the growth cycle.

The size of coppice coupes should be proportional to the woodland area. Coupes of 0.4–1 ha are appropriate for small woods (less than 10 ha), but coupes of 2 ha, rarely bigger, may be suitable for larger woods. Irregular, elongated coupe shapes are preferable to square, regular shapes because they create richer edge habitats but this advantage may be lost where deer are present. In coppices where only small patches are coppiced, a rolling sequence of coupes if better for wildlife than an irregular scatter. On prominent hillsides, coupe shape should take account of the impact of cutting on the landscape.

Standard trees should achieve economic maturity by 80–120 years, depending on species and freedom of growth. In order to achieve vigorous coppice growth, their density should be kept between 30% and 50% of the canopy.

Coppicing is normally labour intensive and can be unduly expensive if there are poor markets for the produce. Voluntary labour is sometimes available locally and can be very useful in these circumstances.

When deciding what proportion of a wood if any to manage by coppicing the costs and availability of labour and prospects of sustainable markets should therefore be carefully considered.

High forest

High forest is recommended for most parts of larger woods, unless they are specially suitable for coppice (see above). It is particularly recommended for woods which are already well-stocked with timber trees of good form, growing well and free of major defects, or where there is evidence that the locally native tree species will grow well. Small patches of coppice should however be retained within large woods treated as high forest, e.g. along some ride margins.

High forest can be created either by treatment of existing coppice growth, or by felling and establishing a new stand. The rotation, scale of working and method of establishment should take account of the stand composition. Many different soil types can be found in most woods with appropriately different stand compositions, often in small patches no more than 10–20 m across. Ideally, treatment should vary according to small-scale site variation by adjusting mixtures within a compartment during regeneration, and retaining a variety of species during thinning.

A decision must be made on the age structure desired. An uneven-aged structure within sub-compartments is most appropriate for stands which are already irregular (in terms of age, diameter and height) or incompletely stocked, diverse in composition (with some shade-bearing species included), or where clear-felling is ruled out on grounds of recreational use, landscape or wildlife. An even-aged structure is more appropriate in large woods, where all age classes can be maintained as a patchwork of even-aged stands of different ages.

Where an uneven-aged system is pursued, a group structure will often evolve, but the size of the groups will vary. If shade-bearing species, notably lime and hornbeam (and, formerly,

Yellow archangel

Dormouse

elm), are to remain as the main components of the stand groups should be small. At their largest their diameter should be roughly 1.5–2 times the top height of the stand, but smaller groups of under 0.1 ha, not larger than the space occupied by one or two mature trees, are quite practicable. This produces a structure similar to that of natural lime and hornbeam woodlands, which regenerate mainly in small gaps. It creates structural diversity and a range of size classes, even in small woodlands.

Given the ability of ash, cherry, sycamore, maple and many native shrubs to grow in small canopy gaps, it is possible for a wider range of species to co-exist.

Where shade-bearing species are absent or worthless as timber trees, as in woods where the principal species are oak, birch, hazel and hawthorn, larger groups are recommended, of around 0.5–2 ha. Where these species are mixed with ash and cherry, which bear moderate shade, a small-group system is possible if the ash and cherry are suitable crop species. An alternative is to regenerate under a shelterwood of trees retained from the previous stand. This enhances structural diversity and may improve natural regeneration.

Where an even-aged stand structure is used the individual felling and regeneration areas should be fairly small, preferably less than about 2 hectares, to develop a diverse structure and avoid large impacts upon the landscape. Where larger areas are necessary an irregular structure should be introduced, either by using a shelterwood system or by retaining groups and individual trees in windfirm locations.

Woodland Pasture

Wood pasture management was infrequent in mixed broadleaved woodland, and where the old pollards survive they are often embedded in planted or naturally-sown new growth, or isolated within ploughed fields or ley grassland. Even in a modified and degraded state they form important habitats for wildlife dependent on very old or decaying timber.

Where old pollard trees survive in a woodland context it is highly desirable to prolong their lives by cutting away competing neighbouring trees and ensuring that successors of the same species (usually oak and ash) are retained under free-growth conditions. Some of these successors should be pollarded to develop continuity of habitat.

Converting coppice to high forest

Overstood coppice stands can be thinned to convert them to high forest stands. Selection of retained stems should favour well-grown, vigorous stems of valuable species, such as oak, ash and cherry, but the retained mixture should also include some stems of all canopy species, e.g. field maple, aspen and birch. Retained stems will usually be a mixture of coppice shoots, singled to promote one shoot per stool, and maiden stems. Whilst even spacing is desirable for timber production, some unevenness is desirable for habitat diversity. In patches where no worthwhile stems are available clear cutting followed by planting may be necessary although the coppice regrowth should be accepted over part of the site to maintain diversity and in case future stems are of better quality.

Harvesting

Heavy machinery exerting high ground pressure which is sometimes used during felling and extraction can damage soil structure and archaeological features. The risk of erosion and damage to the thin layer of litter, including many fungi which assist tree growth, is particularly high on the steep slopes. On poorly-drained clays heavy machinery can rut and compact the soil and generate difficult weed problems with brambles, coarse grasses and rushes. Wherever possible, heavy machinery should be kept to existing tracks and rides or used on a protective bed of lop and top. Rides however can also be damaged by extraction of wood under the wrong conditions. Winter extraction can seriously damage the ride surface but does little direct damage to plants and animals, whereas summer extraction usually causes only temporary damage.

Operators should avoid crossing watercourses and wet ground, banks, ditches and other archaeological features and avoid working when soils are waterlogged.

In uneven-aged forests greater care in felling and extraction is required as the size of groups decreases. Retained trees and any advance regeneration should be damaged as little as possible.

Retained old trees and deadwood

Many woodland wildlife species depend on large, old trees, standing dead wood and large fallen trunks and limbs. Management should aim to maintain and increase these features. This can be achieved by allowing some individual trees or groups of a range of species to grow much longer than might be commercially desirable. Some individual windblown trees can be left where they lie. Trees in difficult corners, along streamsides and on margins can be retained indefinitely provided they do not cause a safety hazard.

In coppice woods, old stools can be retained by cutting above the level of the last cut. Stub trees and pollards should be maintained by periodic cutting, including trees growing on woodland margins. Ideally, new pollards should be started on internal and external boundaries.

Methods of regeneration

Coppice regrowth and natural regeneration are preferable to planting for nature conservation reasons. Both maintain the natural distributions of tree species in relation to site conditions, allow a shrub component to grow with the trees, maintain local genotypes and usually perpetuate mixed stands. Where past management has reduced tree species diversity, however, natural regeneration from seed is better than coppice for producing diverse stands.

Coppice

Coppiced woods regenerate vigorously as a mixture of stool sprouts and seedling regeneration, provided deer are not numerous. Sprouts as high as 2 m can develop after one season on some species. Overstood stools of ash and hornbeam may not sprout until relatively late in the first season and grow weakly, but growth improves subsequently.

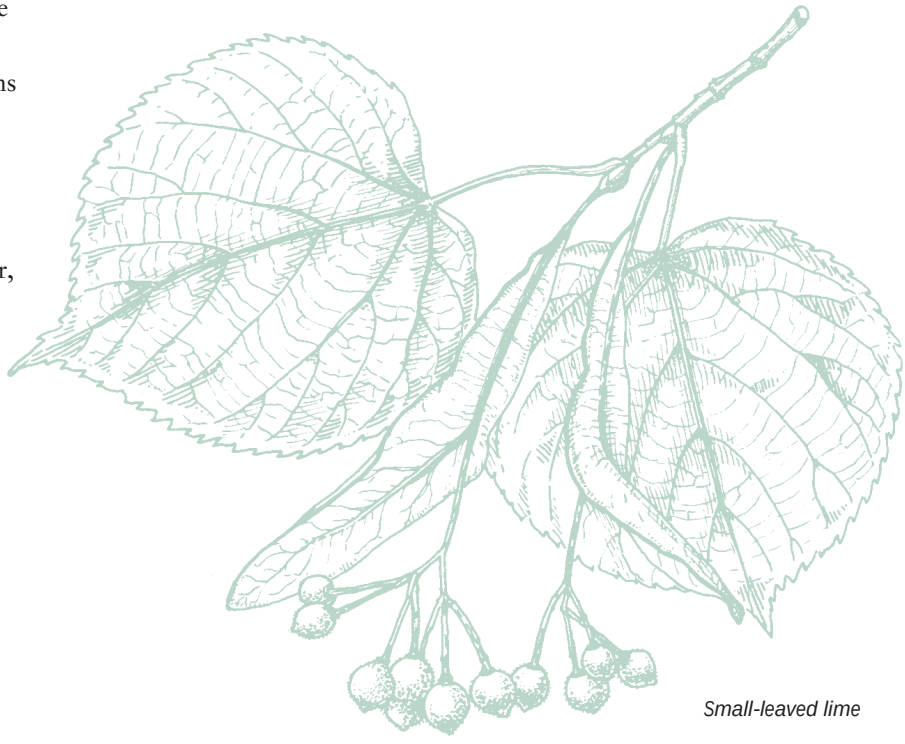
Coppice regrowth of oak and cherry is unpredictable and often weak, particularly if the felled stems are over 20 cm dbh.

Planting of a few oaks will safeguard against poor natural regeneration of this valuable timber species.

Natural regeneration

Ash, cherry, maple, alder, willows and birch set seed in most years and often regenerate well. Hornbeam and hazel are less reliable. Cherry also regenerates from stump sprouts. Lime and elm (English and narrow-leaved) rarely regenerate from seed, but stump sprouts are vigorous and capable of forming large trees. Oak can regenerate prolifically in some years on the lighter soils, but is unreliable on heavier soils.

Ash, lime and hornbeam usually germinate or sprout well enough to restock small gaps in high forest systems. Ash and hornbeam can produce advance regeneration which should be accepted where it is present. Felling and regeneration groups should ideally be created by enlarging the openings around patches of advance regeneration. Where stands contain little advance regeneration, felling should be timed and designed carefully to give the best chance of obtaining the desired amount and composition of subsequent natural regeneration.



Small-leaved lime

Larger openings between about 0.5 ha and 2 ha provide greater opportunities for light-demanding species, such as birch and oak, and provide good growing conditions for other species. Smaller openings generate groups of regeneration with mainly ash, maple and shrubs. Dense bramble growth may develop in the larger openings but this may provide some protection of saplings from deer. Mixed broadleaved woods often have a nearly-invisible scatter of very small 1–3 year old ash seedlings, which, if they survive felling and extraction, can grow through bramble.

Natural regeneration and stump sprouts can be accepted as a supplement to planted stock in even-aged high forest stands.

Planting

Planting can be justified where natural regeneration or coppice regrowth is not practicable or does not fully meet the objectives for the wood. This may occur where these preferred methods have been adequately tried and failed or where current species are unsuited to the site. Where timber production is an important aim, poor genetic quality of an existing timber species may also justify planting but care should be taken to distinguish whether the cause of poor quality in the current trees is really genetic or due to site or silvicultural factors. Planting should not often be necessary in these woods where timber production is not an important aim, especially in uneven-aged stands.

Planting should be combined with both natural regeneration and coppice regrowth to ensure diversity and continuity of species. Planting at wide spacing (3–5 m) or in clumps is generally recommended where timber production is not an important aim. Natural growth can be used to nurse planted stock. Alternatively, enrichment planting 2–3 years after felling will ensure a stock of desired species within a matrix of natural growth. If natural growth will not adequately promote good form, trees planted for timber production should be close-spaced (1.5–2 m).

Where 'nurse' species are required to improve the early growth and form of broadleaved timber species, they should themselves be broadleaved, and could take the form of coppice regrowth or natural seedlings. Conifer 'nurses' will rarely be appropriate in ancient semi-natural woodlands of this type because they tend to deplete the diversity of naturally regenerating native trees and shrubs and the ground flora as well as associated animals, due to their shade and litter.

Planting can be done with individual plants or by groups, distributed in an irregular manner across the site. Individual planted groups should be large enough to generate at least one final crop tree. Planting a variety of species in each group provides safeguards against failure and options for mid-rotation treatment. If tree shelters have to be used, the cost should be weighed against future benefit. In the absence of deer, single trees planted in accessible spots may be the simplest way of establishing a broadleaves crop.

Oak, ash and possibly cherry are usually the species which may need to be planted. Other locally native tree species, such as lime, alder, hornbeam, may also be planted, but any planting of lime should be recorded in order not to confuse its value for ecological and historical research. Understorey species should normally be left to regenerate naturally. Where hazel or chestnut coppice is being gapped up to ensure complete cover, planting is acceptable, but layering is to be preferred.

Site preparation

Lowland mixed woods are often poorly drained. Wet areas can occur behind banks and in depressions, especially on heavy soils. Drainage of these patches is undesirable; wet areas and temporary puddles are essential elements of habitat diversity on which many woodland species depend. Drainage of the woodland as a whole usually brings only marginal and temporary benefits for tree growth, but cleaning of existing ditches may be worthwhile.

Site preparation after felling should usually be limited to burning or possibly heaping lop and top. Both can lead to nutrient enrichment and beds of nettles, so the area used for such disposal should be as small as possible. In order to avoid this and damaging coppice stools during mechanical heaping, it may actually be

better to leave the material spread around. On the other hand thick lop and top can be difficult to plant through and heaping it can protect coppice stumps from deer.

Decisions on treatment of lop and top should take account of the relevant factors locally.

Weeding

Ground vegetation consists of native plants and provides a substrate for woodland fauna, so weeding should be kept to the minimum necessary. Vigorous growths of bramble, bracken or coarse grasses, which will inhibit regeneration and growth, can be avoided or reduced if regeneration is carried out under a shelterwood, or by adopting continuous cover systems. Nevertheless weeding is normally required for the first 3–4 years in order to ensure that transplants are not smothered. Herbicides should be spot applications limited to one metre diameter around the planted trees. Where grasses are not dominant hand-cutting is preferable for wildlife conservation reasons, especially if it can be delayed until late June. Exceptionally dense stands of bracken or bramble may be treated with herbicides.

Tending and thinning

Where timber production is an aim, cleaning and respacing operations are likely to be needed later on where there is an abundance of natural regeneration or coppice regrowth. These should aim to release the better stems of the most productive and valuable species, whilst still maintaining the semi-natural component. The respacing should aim to relegate non-timber species to the understorey, rather than totally remove them from the crop. As for thinnings, the selection should ensure that the more unusual species are favoured.

Coppice does not usually require thinning but decisions must be taken when cutting about which poles to retain as standards. Oak is preferred, both for timber value and as habitat. Ideally, a few individuals of other species should also be retained as standards. A high density of standards weakens the growth of coppice. Their density should usually remain below 30% canopy. An uneven distribution of standards reduces the impact on the coppice, so some grouping allows a slightly higher density. If the coppice is over 20 years it may be safer to open up around potential standards a few years ahead of felling.

In high forest, heavier crown thinnings with an interval of 10 years would be preferable. This will increase the light reaching ground level and help to develop a multi-layered canopy structure. Stems of better timber quality and potential should generally be favoured, but small amounts of minor species (such as birch and aspen) should be kept to maintain diversity.

Exotic species

Several non-native tree species have colonised or have been planted into mixed broadleaved woodland, including beech (which is native in other forest types), several conifers and well-established denizens such as sycamore, chestnut and Norway maple. Chestnut and beech may be retained as part of the mixture on the ground they occupy, i.e. their spread should not be extended by planting. Others should be eradicated if they occupy less than 10% of the wood. If they are more widely and abundantly established, they should be controlled during thinning as minority constituents of the mixture. Mature sycamore stands often contain much ash advance regeneration, which should be retained for restocking. Non-native tree species should not be planted in ancient semi-natural woods where they are not already present.

Nutrition

Fertilising mixed broadleaves woods brings little or no benefit to tree growth and merely increases weed competition, whilst suppressing the diversity of woodland ground flora.

Grazing and browsing

Low intensity grazing and browsing is a natural feature of woodlands which helps to maintain diversity in composition and

structure. However, protection from deer, rabbits and domestic stock is often necessary for successful restocking, even where coppice regrowth is vigorous. Deer are now a big problem in the management of many lowland broadleaved woods.

Ideally, rabbits, hares and deer should be controlled at low population levels, combined with protection for seedlings and saplings if and when damage becomes significant. The most effective form of protection is by fencing, tree guards or shelters. Shelters, which are usually cheaper than fencing for irregular areas and small groups, can be used for both planted and naturally regenerated saplings. They also stimulate growth and help during weeding by making protected trees – both planted and naturally regenerated – more visible. They should not be used as a substitute for weeding however.

Deer damage can also be controlled by erecting temporary deer fences around felling coupes and thinned areas for up to 5 years. Alternatively, a limited amount of protection is afforded by dead hedges, constructed of lop and top, around small coppice patches, or by brash heaped over stools. Deer are particularly favoured by a high density of edges. Their effects could perhaps be mitigated by cutting sizeable compact coupes, but this approach may compromise the overall value of the wood, so that strict control is the best solution.

Grey squirrel control

Grey squirrels can cause serious bark stripping damage to many trees between about 10 and 40 years of age, particularly to beech, sycamore and to a lesser extent oak.

Control methods are described in FC Research Information Notes 180[2], 191[3] and 232[4]. The most effective method is the use of Warfarin bait in hoppers which are designed to prevent non-target animals from entering and being poisoned.

Poison cannot legally be used for grey squirrel control in Scotland or in some counties in England and Wales where red squirrels are present. In these areas cage-trapping and spring trapping are the only suitable methods.

Open ground

Open areas in semi-natural woodlands provide exceptionally important habitats. In mixed broadleaved woodlands rides often support many of the herbs which were once characteristic of pastures, meadows and mires in the surrounding farmland. On their margins they have concentrations of shrubs and small trees, such as dogwood, whitebeam, sallow and hazel. Together with the adjacent woodland, they form a mixture of habitats which generate concentrations of wildlife. Maintaining these open and edge habitats is an important reason why woodland nature conservation generally requires management, not neglect. Annual cutting will usually be necessary to maintain a herb-rich sward. The scrub margin is best cut every 2–5 years. Rides and roadside can be improved by judicious widening or scalloping, and by creating large open areas at junctions.

Minimum intervention areas

Whilst wildlife generally benefits from management in accordance with this guide, it is not necessary for environmental gains for every part of all woodlands to be actively managed. Awkward or remote corners, steep-sided streamsides, very wet areas and sites with very shallow and drought-prone soils can be left completely unmanaged to grow large trees and build up accumulations of dead wood, which would provide habitats for specialised and often rare species. Where such non-intervention areas are explicitly maintained within the management plan the need for retained old trees elsewhere in the wood may be correspondingly reduced.

Expanding lowland mixed broadleaved woods

Expansion of individual woods onto adjacent farmland will help to safeguard woodland species and may be the most efficient method of creating more managed woodland. Whilst a gradual expansion by natural regeneration is best for wildlife, planting will often be necessary to ensure an adequate stocking. An optimal design would be to plant groups, leaving space between them and the existing wood to fill naturally. Choice of species for planting should be governed by similar considerations to planting within the wood.

Further advice on the establishment of new native woods is found in Forestry Commission Bulletin 112[5].

References

1. RODWELL, J. S. (Ed) (1991). British plant communities. Volume 1, *Woodlands and scrub*. Cambridge University Press.

2. FORESTRY COMMISSION (1990). *Grey squirrel damage control with Warfarin*. Forestry Commission Research Information Note 180. Forestry Commission, Edinburgh.

3. FORESTRY COMMISSION (1990). *Grey squirrels and the law*. Forestry Commission Research Information Note 191. Forestry Commission, Edinburgh.

4. FORESTRY COMMISSION (1993). Grey squirrel control using modified hoppers. Forestry Commission Research Information Note 232. Forestry Commission, Edinburgh.

5. FORESTRY COMMISSION (1994). *Creating new native woodlands*. Forestry Commission Bulletin 112. HMSO, London.

6. PETERKEN, G. F. (1993). *Woodland conservation and management* (2nd edition). Chapman and Hall, London.

Useful sources of information

Forestry Commission publications

The UK Forestry Standard (1998).

Guidelines

Forest nature conservation (1990).
Forest recreation (1992).
Lowland landscape design (1992).
Community woodland design (1992).
Forest landscape design (2nd edition) (1994).
Forests and archaeology (1995).
Forests and soil conservation (1998).
Forests and water (3rd edition + amendments) (2000).

Guideline Note

1 Forests and peatland habitats (2000).

Practice Guide

Restoration of native woodland on ancient woodland sites (2003).

Practice Notes

4 Controlling grey squirrel damage to woodlands (2003).
6 Managing deer in the countryside (1999).
8 Using local stock for planting native trees and shrubs (1999).

Bulletins

62 Silviculture of broadleaved woodland (1984).
73 Rhododendron ponticum as a forest weed (1987).
78 Natural regeneration of broadleaves (1988).
91 The timbers of farm woodland trees (1990).
105 Roe deer biology and management (1992).
106 Woodland management for pheasants (1992).
108 Monitoring vegetation changes in the conservation management of forests (1992).
112 Creating new native woodlands (1994).
123 Managing rides, roadsides and edge habitats in lowland forests (2001).
124 An Ecological Site Classification for forestry in Great Britain (2001).
125 Climate change: impacts on UK forests (2002).

Information Notes

15 Creating new native woodlands: turning ideas into reality (1999).
23 Using natural colonisation to create or expand new woodlands (1999).
28 Domestic stock grazing to enhance woodland biodiversity (1999).
32 Plant communities and soil seedbanks in broadleaved–conifer mixtures on ancient woodland sites in lowland Britain (2000).
35 Natural regeneration in broadleaved woodlands: deer browsing and the establishment of advance regeneration (2000).

36 The impact of deer on woodland biodiversity (2000).

Handbooks

Lichens in southern woodlands (1989).
Forestry practice (1991).
Tree shelters (1991).
Growing broadleaves for timber (1993).

Field Book

The use of herbicides in the forest (3rd edition) (1994).

Woodland Grant Scheme

Applicants' pack (2002).
(www.forestry.gov.uk)

Scottish Forestry Grants Scheme

Applicants' Booklet (2003).
(www.forestry.gov.uk/scotland)

For further information and details of new Forestry Commission publications visit:
www.forestry.gov.uk/publications
Electronic (pdf) versions of many titles are available to download.

Other publications

ANDERSON, M.L. (1967). *A history of Scottish forestry*. Nelson, London.

ANON. (1995). Biodiversity: the UK Steering Group report. Volume 2: *Action Plans*. HMSO, London.

BUCKLEY, G.P. (Ed) (1992). *Ecology and management of coppice woodlands*. Chapman and Hall, London.

ENGLISH NATURE (1998). UK Biodiversity Group Tranche 2 Action Plans. Volume II: *terrestrial and freshwater habitats*. English Nature, Peterborough.

HALL, J.E. and KIRBY, K.J. (1998). *The relationship between biodiversity action plan priority and broad woodland habitat types, and other woodland classifications*. JNCC Report No. 288. Joint Nature Conservation Committee, Peterborough.

HARDING, P.T. and ROSE, F. (1986). *Pasture woodlands in lowland Britain*. Institute of Terrestrial Ecology, Monk's Wood, Huntingdon.

KIRBY, K.J. (1988). *A woodland survey handbook*. Research and Survey in Nature Conservation No 11. Nature Conservancy Council/Joint Nature Conservation Consultative Committee, Peterborough.

KIRBY, K.J., PETERKEN, G.F., SPENCER, J.W. and WALKER, G.J. (1989) (2nd edition). *Inventories of ancient semi-natural woodland* (Focus on Nature Conservation No 6). Nature Conservancy Council/Joint Nature Conservation Consultative Committee, Peterborough.

KIRBY, K.J. and SPENCER, J.W. (1992). An inventory of ancient woodland for England and Wales. In: *Biological Conservation* **62**, 77–93.

LINNARD, W. (1982). *Welsh woods and forests: history and utilisation*. National Museum of Wales.

MARREN, P. (1992). *The wild woods*. A regional guide to Britain's ancient woodland. David and Charles, London.

PRESTON, C.D., PEARMAN, D.A. and DINES, T.D. (2002). *New atlas of the British and Irish flora*. Oxford University Press, Oxford.

RACKHAM, O. (1980). *Ancient woodland: its history, vegetation and uses in England*. Edward and Arnold, London.

ROBERTS, A.J., RUSSELL, C., WALKER, G.J. and KIRBY, K.J. (1992). Regional variation in the origin, extent and composition of Scottish woodland. In: *Botanical Journal of Scotland* **46** (2), 167–189.

THE WOODLAND LEAD COORDINATION NETWORK FOR THE JOINT NATURE CONSERVATION COMMITTEE (2002). *Objective setting and condition monitoring within woodland Sites of Special Scientific Interest*. English Nature Research Report 472. English Nature, Peterborough.

VERA, F.W.M. (2000). *Grazing ecology and forest history*. CABI Publishing, Oxon.

WALKER, G.J. and KIRBY, K.J. (1989). *Inventories of ancient long-established and semi-natural woodland for Scotland*. Nature Conservancy Council.

WATKINS, C. (1990). *Britain's ancient woodland. Woodland management and conservation*. David and Charles, London.

WHITBREAD, A. M. and KIRBY K. J. (1992). *Summary of National Vegetation Classification woodland descriptions*. UK Nature Conservation No. 4. Joint Nature Conservation Committee, Peterborough.

Appendix

Definitions and classification of ancient and semi-natural woodlands

Definitions

Ancient woods

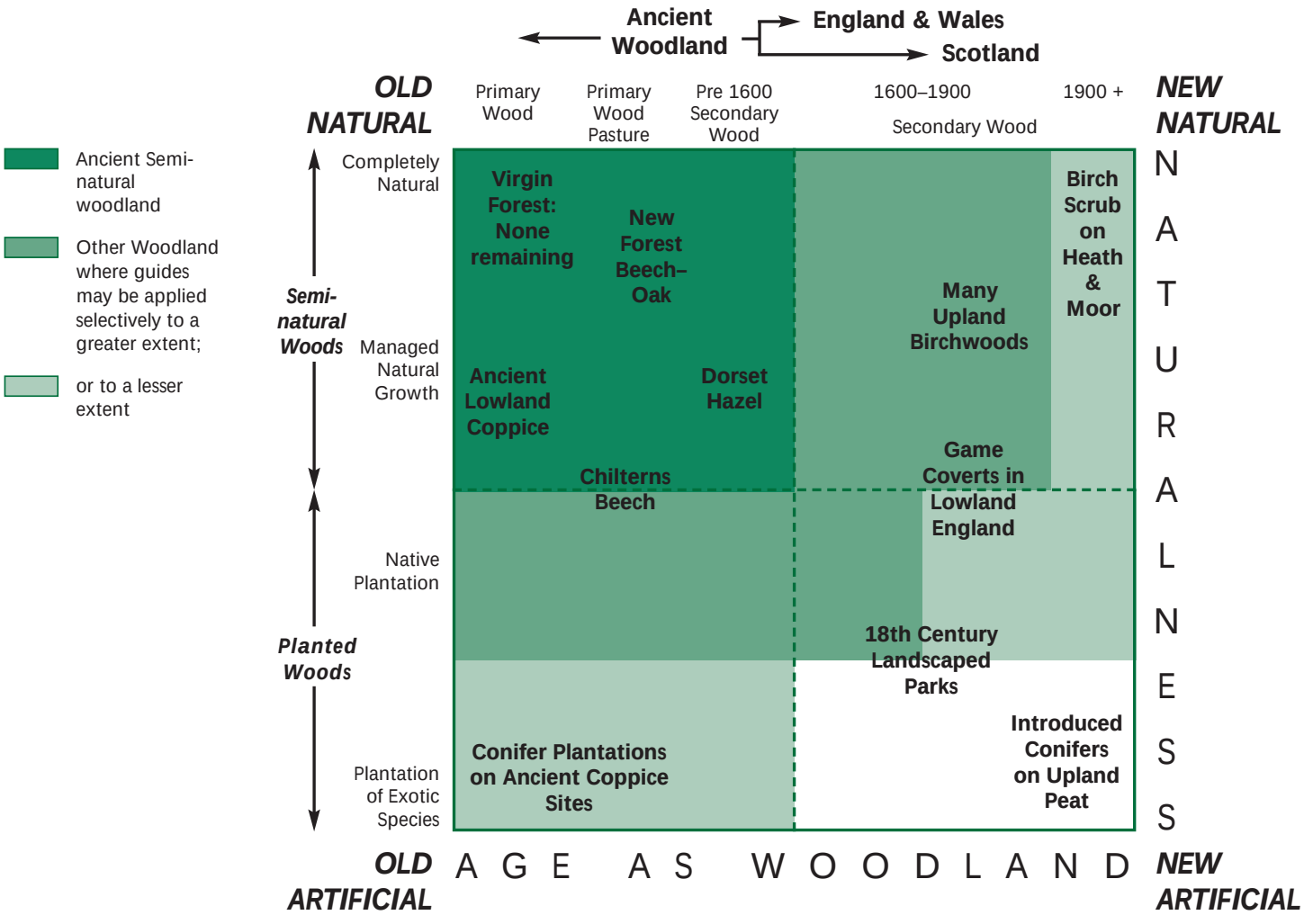
Ancient woods are those occupying sites which have been wooded continuously for several hundred years at least since the time when the first reliable maps were made. In England and Wales ancient woods are those known to have been present by around 1600 AD. In Scotland ancient woods are those which were present before 1750 when the first national survey was made by General Roy.

In both cases the dates correspond roughly with the time when new woodland planting first became commonplace so that ancient woods are unlikely to have been planted originally. Some may be remnants of our prehistoric woodland (primary woods) whilst others arose as secondary woodland on ground cleared at some time in the past.

An ancient woodland may be over 400 years old but this does not mean that the present trees are as old as that, although in some woods this is the case; rather that woodland has been present on the site continuously without intervening periods under other land-uses.

In fact many ancient woods have been cut down and regrown (or been replanted) several times in recent centuries, and during this century many have been converted from native species to plantations of introduced trees.

Figure 1 **Classification of woodlands according to age and naturalness**



Semi-natural woods

Semi-natural woods are stands which are composed predominantly of native trees and shrub species which have not been planted. By 'native' we mean locally native, e.g. beech is not native in Scotland and Scots pine is not native in England. Many woods are semi-natural even though they contain a few planted trees, for the latter do not change the character of the wood. The problem lies with woods dominated by native trees which were planted long ago on sites where they grew naturally, such as the many beech woods on the southern chalklands. Another ambiguous type is the chestnut coppice, dominated by an introduced species, often planted about 1800, but containing an admixture of native broadleaves and managed by the traditional coppice system. Both these 'intermediate' types are usually classified as 'semi-natural' by ecologists.

'Ancient' and 'semi-natural' have sometimes been used as synonyms, but this is quite wrong. Ancientness refers to the site as woodland, whereas naturalness refers to what is growing on that site.

Combining ancient with semi-natural

The age of the site as woodland and the naturalness of the stand on a site are independent of each other. This is illustrated in Figure 1. The vertical axis of the diagram shows a range of naturalness from completely natural at the top (i.e. people have had no influence on its composition) to completely artificial at the bottom. The horizontal axis shows a range of age-as-woodland, from primary woods on the left (i.e. surviving remnants of prehistoric woodland which have never been completely cleared) to woods of very recent origin on the right.

Ancient woods are simply those in the left-hand half of the diagram: those in the right-hand half are recent woods (except in Scotland where ancient woods extend further to the right). Recent woods are often called secondary woods, but this is slightly inaccurate, for there are secondary woods originating in the Middle Ages or earlier, which are included with the ancient woods. Semi-natural woods are those in the upper half of the diagram. Those in the lower half are planted woods. Ancient, semi-natural woods are those in the top-left quarter.

Within the diagram various examples of woodland types are placed according to their degrees of ancientness and naturalness. Top left would be virgin forest, if it still existed in Britain. At the other extreme, bottom right, is the most artificial form of recent woodland, a conifer plantation on drained peat in the uplands. Such forest comprises an introduced species, planted in regular formation on sites modified by management, where trees may not have grown naturally for several millennia. In the other corners are two kinds of intermediate condition. In the top right corner, newly and naturally-regenerated birch scrub on heaths or moors exemplifies woods which are relatively natural, but which are extremely recent in origin. In the bottom left corner is a conifer plantation, often for Norway spruce or Corsican pine, growing in a wood which had been treated as coppice continuously for several centuries. This is a common condition in lowland England: the site has been woodland continuously for a millennium or more, but the stand is almost wholly artificial. The diagram also shows roughly where several other woodland types fit.

Ancient semi-natural woods

Figure 1 makes clear that ASNW as a class contains many types of woodland. Some are very ancient, but others originated in historic times. Some are much more natural than others. Borderline types exist, and for different reasons.

Ancient semi-natural woods, because of their combination of naturalness and a long continuous history, are generally richer for wildlife and support more rare habitats and species than more recent or less natural woods.

However, all these divisions are somewhat arbitrary points on a spectrum and mature 'recent' semi-natural woods and old plantations of native species can also develop a high ecological value and of course landscape value, which may justify similar management to that of ancient semi-natural woods as Figure 1 indicates. This is particularly the case in the uplands where in general the ecological differences between ancient and younger woods are less marked than in lowland areas.

Inventories of ancient and semi-natural woodland were prepared by the former Nature

Conservancy Council (NCC) from map and historical records and some survey information.

Owners can refer to these to check the status of their woods either by consulting the NCC's successor bodies (English Nature, Scottish Natural Heritage and Countryside Council for Wales) or local Forestry Authority offices each of which holds copies of the inventory.

Classification of ancient semi-natural woodlands

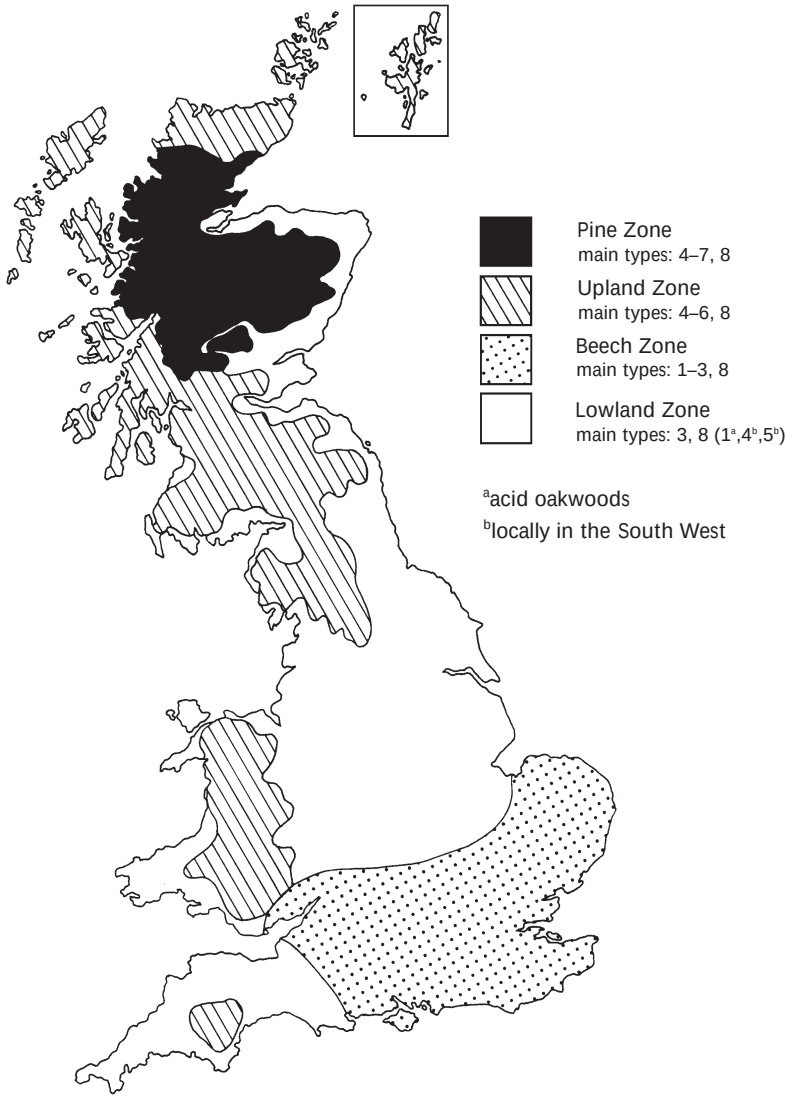
Outline

For the purposes of these management guides, Britain's ancient semi-natural woodlands have been divided into 8 types. This gives the best balance between straight-forward, practical guidance and the specific needs of the various types of native woodland. Many more types are recognisable, but fine distinctions would over-complicate the advice. With fewer types important ecological and silvicultural distinctions would be lost.

The 8 woodland types are based on 4 major regional divisions of Britain shown approximately in Figure 2:

- **The uplands of the north and west (Upland zone);**
- **The 'boreal' region of the Scottish Highlands within the Upland zone, in which pine is native (Pine zone);**
- **The lowlands of the south and east (Lowland zone);**
- **The southern districts of the lowlands within the natural range of beech (Beech zone).**

Figure 2 **The main semi-natural woodland zones**



These geographical divisions are further divided to recognise the ecological differences between acid and base-poor soils on the one hand and alkaline and base-rich soils on the other. Wetland woods constitute an additional type found in all regions.

The result is 8 types whose main characteristics are summarised below and in Table 1. They can be related to existing classifications, particularly the National Vegetation Classification (Rodwell 1991[1]) and the stand types described by Peterken (1981[6]). Insofar as the complexities of native woodlands can be reflected in a simple scheme, each type has a distinctive ecological and regional character, different history of management and exploitation, and different management requirements in the future. The guides have been drawn up for typical examples of each type.

The classification helps to relate British woodlands to those of continental Europe. The boreal pine and birch woods form an outlier of the sub-arctic coniferous forests. The beechwoods are the extremity of the central European broadleaved woods. Upland broadleaved woods have their counterpart in the oceanic woods of Ireland, Brittany and Galicia. The lowland mixed broadleaved woods form an outlier of a zone of mixed woodland lacking beech which extends throughout central Europe and deep into Asia.

Descriptions of each type

Lowland acid beech and oak woods

NVC types W15, W16
Stand types 6C, 6D, 8A, 8B

Beech and oak woods on acid, generally light soils. South-eastern, mainly in Weald, London and Hampshire basins. Mostly treated as high forest or wood-pasture in the immediate past. Many had a more distant history of coppicing, and in the Chilterns and the south-east some still have this character. Many were planted with chestnut around 1800 and are still worked as coppice. Includes a scatter of strongly acid

Table 1 **Summary of the main ecological and silvicultural characteristics of the eight semi-natural woodland types**

Semi-natural woodland type	Ecological characteristics		Silvicultural characteristics	
	NVC communities	Peterken stand types	Main historic management	Emphasis in future management
South and East Britain				
1. Lowland acid beech and oak woods*	W15, W16	6C, 6D, 8A, 8B	C or WP	HF
2. Lowland beech–ash woods*	W12, W13, W14	[1A], [3C], 8C, 8D, 8E	C or HF	HF
3. Lowland mixed broadleaved woods	W8 (A–D), W10	1B, 2A, 2B, 2C, 3A, 3B, 4A, 4B, 4C, 5A, 5B, 7C, 9A, 9B, 10A, 10B	C	C or HF
North and West Britain				
4. Upland mixed ashwoods	W8 (E–G), W9	1A, 1C, 1D, 3C, 3D, 7D, [8A–E]	C or HF	HF(C)
5. Upland oakwoods	W11, W17 (Oak dominant)	6A, 6B, [8A–B]	C or HF grazed	HF(grazed)
6. Upland birchwoods	W11, W17 (Birch dominant)	12A–B	HF grazed	HF(grazed)
7. Native pinewoods**	W18, W19	11A–C	HF grazed	HF(grazed)
All regions				
8. Wet woodlands	W1, W2, W3, W4, W5, W6, W7	7A–B, 7E	C neglect	Minimum intervention

NVC: National Vegetation Classification C: Coppice WP: Wood Pasture HF: High Forest
*Restricted to zone where beech is native (SE Wales and S England) **Restricted to zone of native pine (Scottish Highlands)

oak-dominated coppices found throughout the English lowlands. Also includes associated birch woods, self-sown Scots pine woods, holly scrub. Enclaves of hornbeam on acid soils best regarded as part of this type.

Lowland beech–ash woods

NVC types W12, W13, W14
Stand types 8C, 8D, 8E and parts of 1C, 3C

Beech woods on heavy and/or alkaline soils and associated ash woods. Southern distribution, grouped in South Downs, North Downs, Chilterns, Cotswold scarp, Lower Wye Valley and south Wales limestones, but sparingly elsewhere. Most had a medieval history of coppicing with limited wood-pasture, but most have long since been converted to high forest, often with extreme dominance of beech. Coppice survives in western districts. Woods often on steep slopes, but they extend on to Chiltern and Downland plateaux. Associated ash woods usually mark sites of past disturbance or formerly unwooded ground. Yew common in the driest beech woods and as distinct yew woods on open downland.

Lowland mixed broadleaved woods

NVC types W8(a–d), W10
Stand types 1B, 2A, 2B, 2C, 3A, 3B, 4A, 4B, 4C, 5A, 7C, 9A, 10A and 10B

Often known as 'oak–ash woods' by past ecologists, these are largely dominated by mixtures of oak, ash and hazel, but other trees may be dominant, notably lime (4A, 4B, 5A and 5B), hornbeam (9A and 9B), suckering elms (10A), wych elm (1B), field maple (2A, 2B and 2C) and alder (7C). Occur throughout the lowlands and upland margins, with enclaves on fertile soils in SW Wales, NE Wales and E Scotland. Most treated as coppice until 20th century, some still worked. Many still have a stock of oak standards growing with a mixture of other species grown from coppice and seedling regeneration. The various stand types occur as intricate mosaics which present silvicultural problems. Many have been invaded by sycamore or chestnut. Disturbed ground often marked by abundant ash, hawthorn or birch.

Upland mixed ashwoods

NVC types W8(e–g), W9
Stand types 1A, 1C, 1D, 3C, 3D, 7D with 8A–E where beech has been introduced.

Dominated by ash, wych elm and/or oak, usually with hazel underwood, sometimes with scattered gean. Found throughout the uplands on limestone and other base-rich sites. Also characteristic of lower slopes and flushed sites within upland oak woods. In the very oceanic climate of the north and west, increasingly take the form of ash–hazel woods with birch and rowan containing lower slopes dominated by alder. Lime is regular and sometimes common north to the Lake District. Like other upland woods, many have a history of coppicing which was displaced by grazing. Sycamore is a common colonist and in many woods is a naturalised part of the mixture.

Upland oakwoods

NVC types W11, W17 (oak-dominated woods)
Stand types 6A, 6B with 8A, 8B where beech has been introduced.

Woods dominated by sessile oak and, less often, pedunculate oak, growing on base-poor, often thin soils in upland districts from Sutherland to Cornwall. Sometimes absolutely dominated by oak, but more often oak forms mixtures with birch and rowan on very acid soils and hazel on the more fertile sites. Oak was planted in many woods, even those which now seem remote. Coppicing was characteristic, but not prevalent in N Wales and NW Scotland. Most now neglected and heavily grazed by sheep and deer. Includes small enclaves of birch, ash, holly, hawthorn and rowan-dominated woodland.

Upland birchwoods

NVC types W11, W17(birch-dominated woods)
Stand types 12A, 12B

Woods dominated by birch, but sometimes containing many hazel, sallow, rowan and holly. Birchwoods occur throughout Britain. Some are secondary woods which can sometimes develop naturally into native pinewoods or upland oakwoods. This type covers 'Highland Birchwoods' together with the extensive birchwoods of upland England and

Wales. Most are now heavily grazed by sheep and deer. Lowland birch stands are usually temporary phases or small enclaves and are included in Types 1 and 3.

Native pinewoods

NVC types W18, W19
Stand types 11A, 11B, 11C

Scots pine-dominated woods and the associated enclaves of birch and other broadleaves in the Highlands. Tend to be composed mainly of older trees, with natural regeneration often scarce. Most subjected to exploitive fellings during the last 400 years and heavy deer grazing during the last century.

Wet woodlands

NVC types W1, W2, W3, W4, W5, W6 and W7
Stand types 7A, 7B and 7E

Woodland and scrub on wet soils and flood plains. Usually dominated by alder, willow or birch. Generally take the form of scrub or coppice. Fragments of the prehistoric flood plain woods of black poplar, pedunculate oak, ash, elm, alder tree willows, and occasional black poplar survive in some southern districts.

Problems in using the classification

Semi-natural woodlands are complex systems which throw up many problems in the construction and use of classifications. These may seem unwelcome to managers used to managing plantations of one or two species, with clearly defined stand boundaries, but management of complexity is unavoidable if the small-scale diversity of semi-natural woodlands is to be successfully conserved. The commonest problems and their solutions are:

Intermediates

Stands falling between two or more types. Examples include;

- **a sessile oakwood on the Welsh borderland (between types 1 and 5);**
- **a mixed woodland with a limited amount of beech (between types 1 or 2 and 3–5);**
- **a birch-rich pinewood (between types 6–7);**
- **Managers should use the Guides appropriate to both types.**

Mosaics

Woodlands may include more than one of the 8 types within their border. Example: lowland acid beech woods and upland oak woods commonly include patches of birch-wood.

Ideally, each patch should be treated separately, though this is impractical with small inclusions of less than 0.5 ha.

Outliers

Good examples of each type can occur outwith their region. Examples: good lowland mixed broadleaved woods occasionally occur in N Wales and SW Wales; birchwoods occur throughout the lowlands.

Management of outlying examples should be based on the guidance for their core regions, but some adaptation may be required for local circumstances.

Introductions

Semi-natural woods often contain trees growing beyond their native range. Common examples are beech in northern England, north Wales and Scotland, and Scots pine south of the Highlands.

Unless the introduced species is dominant, such woods should be treated in the same way as the original type, using the guidance given on introduced species within that type. Thus, for example, a beech wood on acid soils in the Lake District should be treated as an acid beech wood (type 1) if beech is dominant, but otherwise should be treated as an upland oakwood (type 5).

Notes

Forestry Commission

231 Corstorphine Road
Edinburgh
EH12 7AT

www.forestry.gov.uk

£3