New Native Woodlands for Nidderdale
Area of Outstanding Natural Beauty

Opportunities Plan

Document Revisions

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Contents

Executive Summary

This opportunities plan seeks to identify priorities for new native woodlands that complement the AONB's landscape and lead to an increase in native woodland cover in the AONB. The plan assesses the policy, landscape and ecological characters of Nidderdale in relation to woodland and gives an assessment of landowners and woodland managers and their current views on native woodland creation and management. The plan identifies main areas of criteria when considering new and the management of native woodlands in Nidderdale:

Landscape: Nidderdale is a highly protected landscape and careful consideration is required when assessing the creation of a native woodland and restoration and management of existing woodlands. Sensible policies exist for the planning and design of new woodlands in the landscape and the management of existing woodlands. This includes respecting landform and landscape pattern and avoiding larger areas of clearfell. Many of the coniferous plantations and even some broadleaf blocks that are seen as novel features in the landscape follow linear boundaries and over time, these have become prominent in the landscape and can detract from the landscape character. However, woodland is not a novel feature in the landscape, and it is usually the case that there will only be limited areas where sensible woodland planting and natural regeneration is unacceptable on landscape grounds. Opportunities and methods exist to soften sight lines and linear boundaries and these should not be used or viewed as barriers to new woodlands or restoring PAWS within these boundaries.

Nature Conservation: Based on the main criteria the plan identifies the creation of native woodlands as the priority in Nidderdale with consideration for PAWS restoration, priority HAP woodlands and natural regeneration of equal importance. With the co-operation of landowners, significant areas of PAWS can be targeted for restoration to native woodland.

1. Introduction

The aim of the New Native Woodlands for Nidderdale AONB Opportunities Plan is to identify priorities for new native woodlands that complement the AONB's landscape and lead to an increase in native woodland cover in the AONB. The objectives of the plan are as listed below:

- Promote the restoration of native woodland on ASNW
- Overcome fragmentation of existing ASNW sites
- Enhance conservation value of moorland SAC/SPA by increasing gill woodland
- Reinforce the landscape character of the AONB
- Enhance the visual amenity of AONB landscapes
- Create new opportunities for recreation
- Extend carbon sequestration/woodfuel potential of woodland in the AONB
- Improve the understanding of appropriate locations for tree and woodland species
- Contribute to the economic potential of sustainable woodland management
- Contribute to BAP objectives
- Help conserve the cultural heritage associated with ancient woodland sites

Following the interim report completed in March 2006 this fourth and final report incorporates the findings of the interim report and additionally researches and recommends spatial proposals for new woodland establishment, identifies those potential mechanisms by which native woodlands may be expanded and proposes an appropriate target for AONB woodland cover.

2. Baseline Information

2.1 Overview of Nidderdale AONB

Sharing a western boundary with the Yorkshire Dales National Park, bordered by the rivers Wharfe and Ure to the north and west respectively and dropping down to the Vale of York in the east the Nidderdale AONB covers 603 square kilometres. It is influenced by the North Pennine Ridge and the landscape is dominated by the millstone grit geology. The Nidderdale AONB is characterised by steep-sided wooded valleys, upland moorland and marginal agriculture which has created a pattern of small-scale fields often bounded by dry stone walls.

The extent of woodland cover in the AONB prior to man's influence cannot be precisely determined but by 8,000 years before the present it is likely that a forest of broad-leaved, winter-deciduous trees dominated the area (*Huntley 1998*). The character of the AONB has been significantly influenced by historical and current resource management, including deforestation, mining, quarrying, reservoir construction and grouse shooting. Designated an AONB in 1994 its population is under 16,000 and the major settlement is Pateley Bridge (*Nidderdale AONB 2004*).

2.3 Extent and composition of existing woodland cover

Currently 7.2% (4,375ha) of the AONB is covered by woodland (*Nidderdale AONB 2004*). The main areas of woodland are along the north-east boundary around Swinton, Kirkby Malzeard, Grantley and Sawley; the Nidd valley from Birstwith through Pateley Bridge to Scar House Reservoir; the area around the Washburn valley from Thurcross Reservoir to Lindley Wood Reservoir and areas in the Wharfe valley, owned by the Denton Estate (*Nidderdale AONB 1995*). Of the AONB 2.2% (1298.9ha) is ancient woodland and this is mostly distributed around those areas already described.

The National Inventory of Woodland and Trees (NIWT) for Nidderdale AONB (*Forest Research 2002*) identifies the composition of woodland of two hectares and over in size and as of 1999 as at Table 2.1.

Table 2.1: Composition of woodland of 2ha and over in Nidderdale AONB

Forest Type	Area (ha)	Percentage
Conifer	2,452	56
Broadleaf	1,432	32.7
Mixed	315	7.2
Windblow	17	0.4
Open Space	160	3.7

The NIWT further found that the principal conifer species within the AONB are Scots pine; Japanese, hybrid or European larch and Norway spruce. Lesser amounts of Corsican pine; Sitka spruce, Douglas fir and lodgepole pine were also identified.

The principal broadleaf species is oak, equating to some 28% of the entire broadleaf resource. Other significant species include ash and sycamore, with lesser amounts of beech, birch and other species.

2.4 Ownership

The ownership of the woodland resource is almost entirely private. The Forestry Commission established many of the larger conifer plantations from 1945 onwards but following the government policy of transferring ownership from the public to the private sector owners of woodland in the AONB are made up entirely of private estates and companies.

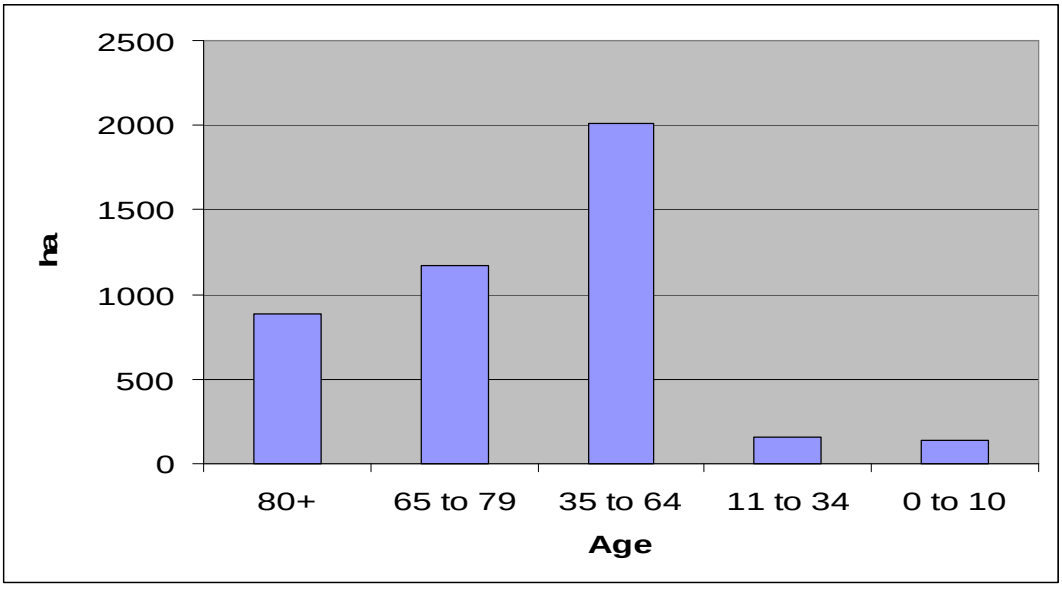
2.5 Age and history of existing woodland cover

The NIWT records no stands of high forest conifer dating before 1930. Most plantations were created in the period 1941 to 1960 when a total of 1,667ha planted; the principal species being Corsican and Scots pine with Norway and Sitka spruce and the various species of larch less well represented. Between 1961 and 1980 a further 541 ha of conifers were planted, these being primarily the two species of spruce. In the 1980s there was only a total of 14ha of conifer planting, but between 1991 and 1999 116ha were planted, with Scots pine, Sitka spruce and larch being favoured.

The broadleaf component of Nidderdale AONB's woodland cover comprises trees which are generally older than the newly created conifer plantations. Some 887ha were planted before 1930. Since that time the rate of broadleaf planting has varied, displaying particularly low areas in the 1950s and 1960s when the level of conifer planting was high. Excepting the period 1931 to 1940 when 438 ha of broadleaves were planted the amount of broadleaf species planted every decade has seldom exceeded 100ha and has dropped as low as single figures. There appears to be little chronological pattern to the species favoured for planting, mostly this has been oak, supplemented by sycamore and ash and then a variety of other species.

Overall the results of the inventory show that most trees, 3,329ha (79%), in the Nidderdale AONB are less than 80 years of age. The boom in conifer planting from the end of WWII to the end of the 1960s means that some 2,015ha (48%) of the entire woodland resource is conifer of between 35 to 65 years old. This means that most of the conifer crop is at its age of maximum economic return at some date between the present day and 2030. According to the inventory some 139ha (3.3%) of the woodland resource was less than 9 years old as of 1999.

Chart 2.1 Age Range of Woodlands in the AONB



English Nature report that within Harrogate, Hambleton, Selby and York plantations created by the Forestry Commission in the 1920s and 1930s were usually established on moorland or rough grazing land. The effect of coniferisation upon ancient woodlands was not felt until the 1950s when the Commission's dedication schemes were established to encourage private owners to help provide a greater volume of timber to offset the depredations of World Wars I and II and many semi-natural woods were felled and replanted wholly or partially with conifers (*English Nature 1994*). It is therefore probable that much of the plantation woodland within the AONB that was established in the 1950s and 1960s has ancient woodland status and relict features.

2.6 Condition

There is little current research into the condition of the woodlands of the AONB. The Agricultural and Forestry Issues Report (*Nidderdale AONB 1995*) described the management of the woodlands as having single or multiple objectives, the single objective being timber production by private companies, the multiple objectives being timber production and shooting by private estates and a range of objectives, including recreation, access and conservation by a variety of other owners. It also recognised that broadleaf and mixed upland woodlands are often characterised by a number of factors. They are often remote, inaccessible, small, even-aged, have a low stocking density and have suffered from rabbit or sheep grazing.

Outside of the AONB research into the management of privately-owned East Anglian forest and woodland (*Selman and Powell 2003*) found that some 60% of farm woodland and nearly half of all estate woodland was undermanaged in terms of timber production. The reasons postulated for this under-utilisation included not only environmental, sporting, recreational and amenity constraints but also high working costs.

As the North Yorkshire woodland initiative and with significant experience in the promotion of forest and woodland management Yorwoods has also recognised that the currently depressed domestic timber market in the UK has meant that those forestry operations which were formerly economically viable are no longer a prospect for small woodlands with little quality marketable timber. Therefore it is fair to presume that a reasonable proportion of woodland within the AONB will be undermanaged, specifically in terms of the underthinning of conifer plantations or the implementation of clearfelling at the age of maximum economic return; the upkeep or creation of forest rides or roads for timber extraction and the control of forest pests such as the grey squirrel. It is furthermore evident that should the conifer crop, which is ready now or in the immediate future for clearfelling, be removed then there would be significant opportunities for the creation of new native woodland and that by 2030 a sizeable proportion of the AONB resource would comprise young woodlands. Provide figures for woodlands under management agreements with FC/DEFRA/EN etc….

2.7 Conservation Status

Large areas of the AONB are subject to a number of nature conservation designations, including a Special Protection Area (SPA) under the EC Birds Directive and a Special Area of Conservation (SAC) under the EC Habitats Directive. Under national legislation there are nine areas designated as Sites of Special Scientific Interest (SSSI) for nature conservation purposes and locally 39 woodland Sites of Interest for Nature Conservation (SINC) are designated.

However both European designations and most of the national or local designations do not relate principally to woodland habitats. The reason for designation is largely for the upland heather moorland which characterises much of the AONB, though the importance of woodland in providing elements of the habitat mosaic for various species is highlighted. Those SSSI and SINC designations which relate principally to woodland character are at Tables 2 and 3.

Table 2.2: Woodlands in the Nidderdale AONB which are designated SSSI or where woodland is identified as being an important component of the site

Site name	Grid Ref	Character	Area of Woodland	Condition
Cow Myers	SE270730	Alder carr woodland with species-rich flushes		
East Nidderdale Moors (Flamstone Pin-High Ruckles)	SE112854	Areas of semi-natural semi-acidic woodland within a moorland/heathland mosaic		
Hack Fall Wood	SE235772	Oak-birch acid woodland with calcareous flushes supporting bird cherry and spindle		
West Nidderdale, Barden and Blubberhouses Moor	SD985580	Restricted areas of woodland supporting silver birch, rowan and both native broadleaf oaks		

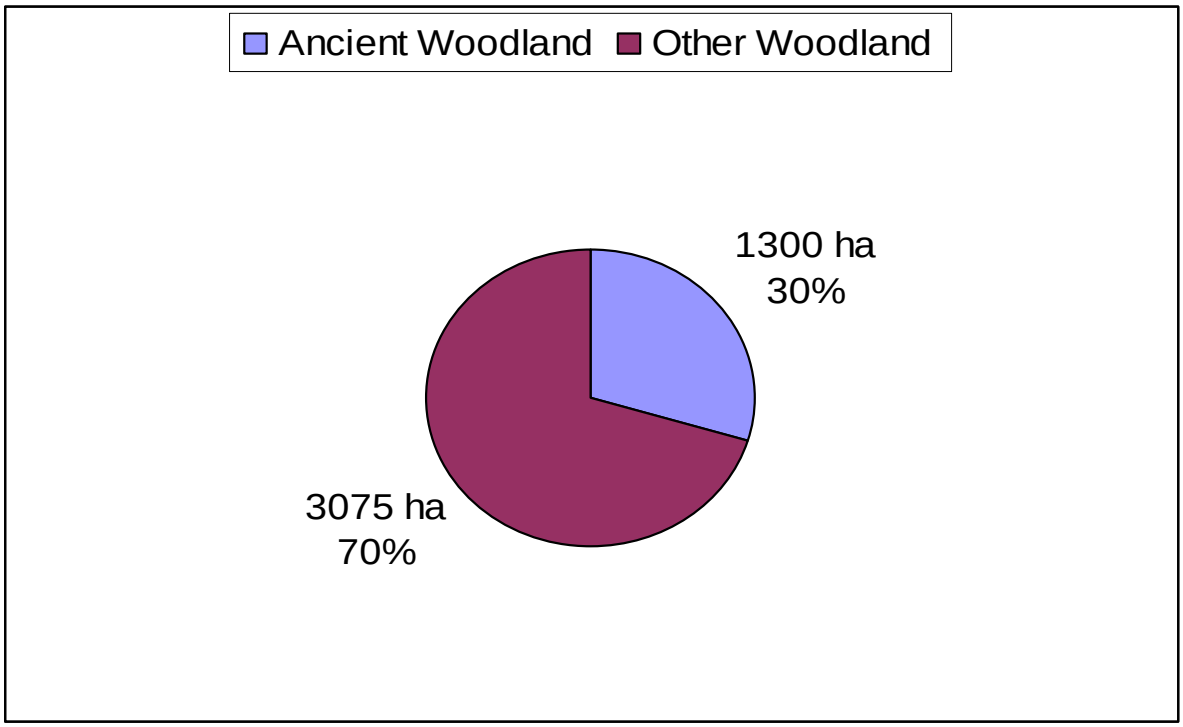
Table 2.3: Woodlands in the Nidderdale AONB which are designated SINC or are candidate SINC

Site name	Grid Ref	Character	Area	Condition
Backstone Gill Wood	SE111737	Wet Woodland		
Braisty Woods and Birch Wood	SE203632	Upland Oak Woodland		
Braythorn Wood	SE241493	Upland Oak Woodland		
Coal Bank Wood	SE250760	Neutral Woodland, Wet Woodland		
Cow Close Wood	SE151683	Upland Oak Woodland		
Deepgill Wood	SE158845	Plantation Woodland		
Dob Park Wood	SE190504	Oak Woodland, Wet Woodland		
Eavestone Lake Complex	SE224679	Upland Oak Woodland/Conifer Plantation		
Farnley Lake & Woods	SE226476	Wet Woodland, Mixed Woodland		
Fewston & Swinsty Reservoirs	SE184540	Mixed Woodland		

Fountains Abbey And Studley Royal	SE282690	Neutral Woodland, Mixed Plantation Woodland, Veteran Trees		
Great Wood	SE196650	Upland Oak Woodland, Wet Woodland		
High Thrope Wood	SE104754	Wet Woodland		
High Wood Farm Wood	SE205646	Upland Oak Woodland		
Horse Wood	SE204642	Upland Oak Woodland		
Holden Gill Wood	SE092505	Upland Oak Woodland		
Laver Banks Wood	SE265716	Neutral, Mixed Woodland		
Leighton Reservoir	SE151774	Upland Oak Woodland		
Lindley Wood Reservoir Complex	SE216495	Mixed Wodland, Plantation Woodland Wet Woodland		
Low Hall Wood	SE196609	Neutral Woodland		
Lumley Moor Reservoir	SE223711	Plantation Woodland-, Scrub		
Mickley Barras	SE245768	Neutral Woodland, Wet Woodland		
Middle Tongue Bank	SE147640	Upland Oak Woodland		
North Close Wood	SE243747	Neutral Woodland, Wet Woodland		
North Wood (Bryan's Wood)	SE187623	Oak Woodland, Wet Woodland		
River Ure Masham to Mickley	SE235779	Wet Woodland, Neutral Woodland		
Skrikes Wood	SE152640	Upland Acid Woodland		
Spring Wood (Healy)	SE178812	Upland Oak/Mixed Woodland		
Spring Wood (Riva Hill)	SE223647	Upland Oak Woodland		
Spring House Wood	SE225623	Upland Oak/Mixed Woodland		
Stainburn Gill Wood	SE243485	Mixed Deciduous Wood		
Stony Bank	SE174634	Holly Wood		
Tang Beck	SE236578	Plantation, Neutral Woodland		
Thrispin Beck Marsh	SE239480	Wet Woodland		
Throstle Nest Bridge Wood	SE133655	Upland Oak Woodland		
Thrusscross Reservoir	SE154576	Upland Oak Woodland, Coniferous Plantation		
Timble Ings	SE154533	Coniferous Plantation		
West Park/Stubbs Wood	SE130497	Mixed Woodland, Deciduous Plantation		
Winksley Banks	SE248718	Neutral Woodland		
Winsleyhurst Wood	SE226612	Oak Woodland, Mixed Woodland		

Finally the area designated as ancient woodland (being under continuous woodland cover since at least 1600) within the AONB, which is currently at 1300ha, far outstrips the broadleaf area recognised as being present prior to 1861. It must therefore be the case that a large area of ancient woodland is currently under either conifer or broadleaf plantation management. The potential for PAWS restoration is therefore significant and should be regarded as of particular interest in the future management of new native woodlands in Nidderdale.

Chart 2.2 Woodland Composition in Nidderdale AONB



3. Policy Context

3.1 National policy for the creation of native woodlands

The UK Forestry Standard (*Forestry Commission 2004*) includes Standard Notes (SN) relating to a series of forest management practices and objectives. Of these SN3 relates to the creation of new native woodland and SN5 to the management of semi-natural woodland.

SN3 describes a category of new native woodland where the intention is to develop a natural character using communities of locally native tree and shrub species matched to the site. The note recommends that advice within FC Bulletin 112 'Creating new native woodlands' be applied, recognises that the development of this new native woodland should supplement the areas of existing semi-natural woodland in the UK and states that though the primary objectives of management should be for nature conservation and the reinforcement of cultural landscapes this should not preclude management and use to deliver other benefits. SN3 highlights the necessity of suitable site selection and planting design, the desirability of natural regeneration and the implementation of continuing maintenance.

SN5 sets out national aims to:

- Maintain and restore natural ecological diversity
- Maintain and improve aesthetic value
- Maintain genetic integrity of populations of native species, so far as is practicable
- Take opportunities to produce utilisable wood
- Enlarge woods wherever possible

SN5 highlights the requirement for management planning, woodland design and favouring stock of local genetic origin,. It also addresses the necessities of ensuring that the area occupied by semi-natural woodland is not reduced, of implementing appropriate planting practice and controlling non-native species.

A policy statement for England's Ancient and Native Woodland, 'Keepers of Time' (*DEFRA and Forestry Commission England 2005*) has also been published. The policies outlined in this document are:

- The existing area of ancient woodland should be maintained and there should be a net increase in the area of native woodland
- Ancient and native woodland should make an increasing contribution to our quality of life
- Ancient and native woodland should be exemplars of sustainable development and provide opportunities for enterprise and employment
- The ecological condition of ancient and native woodland should be improved and maintained
- Rare, threatened or priority species associated with ancient and native woodland should be conserved and enhanced
- The cultural heritage associated with ancient woodland and veteran trees should be protected and conserved
- The landscape context of woodland should be improved

Under 'Keepers of Time' a practice guide for management of ancient and native woodland is currently in the consultation process. Once published the advice therein may supersede those recommendations in earlier Forestry Commission documents.

3.2 Regional policy for the creation of native woodlands

The Regional Forestry Strategy (RFS) for Yorkshire and the Humber (*Government Office for Yorkshire and the Humber 2005*) identifies a number of desired outcomes relating to ancient and native trees and woodland. These are:

- The area of ancient woodland is maintained and this irreplaceable resource is assessed and, if necessary, restored to favourable or recovering condition
- The overall condition of other protected, designated or native woodlands is assessed and, where possible, maintained or enhanced
- The region's ancient or veteran trees and historic orchards are identified, conserved and enhanced

Further to the above the RFS also identifies the following desired outcomes in relation to action for regional biodiversity:

- The region's ecosystems are enhanced through tree and woodland planting and management decisions that take account of the needs of biodiversity at the landscape scale
- Improved delivery of Local Biodiversity Action Plans through targeted tree and woodland planting and management

- The use of native species for both tree and woodland planting in both rural and urban areas is promoted as appropriate

The Harrogate Local Biodiversity Action Plan covers 95% of the Nidderdale AONB area, with the remaining 5% being covered by the Hambleton and Richmondshire LBAPs. The Harrogate Woodland Habitat Action Plan (*2005*) identifies upland oak woodland, upland mixed ash woodland, wet woodland, broadleaved and mixed woodland and conifer plantations as of interest within its area of responsibility. Of these the first three are UK BAP priority woodland habitats and the latter two are broad habitats.

The HAP identifies the need to maintain or expand current existing woodland ancient or semi-natural woodland, restore PAWS woodland and facilitate new planting. Taken from the AONB the targets highlighted below are not identified as being peculiar to the Nidderdale AONB but it would be reasonable to assume the AONB would be an ideal location to address them:

- Facilitate the planting of 5ha of small woods, particularly gill woodlands in the upland areas, to benefit black grouse
- Identify 10ha of suitable area to facilitate the planting and/or seeding of semi-natural woodland and scrub using species of local provenance

3.3 Dales Woodland Strategy

The Yorkshire Dales National Park adjoins the western boundary of the Nidderdale AONB. The National Park is developing a strategy which seeks to increase the amount of woodland cover within its area from 3.5% to 5% by 2020. The AONB should be aware of the aims and targets of the proposed woodland creation within the Park so as to develop co-operative working where appropriate.

4. Landscape Character Context

4.1 National Context – Countryside Character Areas

The Countryside Commission identified and described 159 Countryside Character Areas (CCA) that together provide a widely accepted spatial framework for the whole of England, based on shared ecological and landscape characteristics (*Countryside Commission 1998*). In partnership with English Nature these classifications were developed into Joint Character Areas (JCAs) and the system has a wide range of potential applications, including the targeting of DEFRA's Environmental Stewardship scheme.

Nidderdale AONB falls within 4 JCAs and a selection can be made of their key landscape characteristics that are particularly important to the proposal to create new native woodlands.

1. JCA 21, the Yorkshire Dales:

- Striking contrasts between wild, remote moors and sheltered dales, each with its own distinctive character.
- Very strong patterns of dry stone walls, with very large rectilinear enclosures on most fell tops, much smaller enclosures in dales and often older, irregular patterns around settlements.
- Very limited tree cover, confined to villages, sycamore clumps around farmsteads, streamsides and steep slopes.
- Sparse, ancient, broadleaved woodlands on steep gill and dale sides.

2. JCA 22, the Pennine Dales Fringe:

- Transitional landscape lying between the upland, predominantly grassland, landscape to the west and arable land to the east.
- Transitions in type of field enclosure, from dry stone walls in the west to hedges at lower elevations in the east.
- Well-wooded character with wooded valley slopes, small woodlands, plantations and hedgerow trees.

3. JCA 30, the Southern Magnesian Limestone

- Elevated ridge with smoothly rolling landform, dissected by dry valleys.
- Predominantly Magnesian Limestone geology which influences soils and ecology
- Long views over surrounding lowland.
- Large fields bounded by low cut thorn hedges creating a generally large scale, open landscape.
- Woodlands combining with open arable land to create a wooded farmland landscape in some parts.

4. JCA 36, the Southern Pennines

- Large scale sweeping landform with an open character created by exposed gritstone moors at an altitude of 400-450m, deeply trenched by narrow valleys and wooded cloughs.
- Mosaic of mixed moorland and blanket bog with enclosed pasture of varying qualities at lower elevations, largely defined by drystone walls.
- Valuable wildlife habitats on the open moorland and the moorland fringe including semi-natural boggy mires, acid flashes and wooded cloughs.
- Extensive views from elevated locations in all directions.

4.2 The Nidderdale landscape – landscape assessment

In 1992, prior to the designation of Nidderdale AONB, an assessment of landscape quality was undertaken on behalf of the Countryside Commission (predecessor of the Countryside Agency). This identified eight distinct landscape character areas:

- Moorland plateau
- Upper valley
- Middle valley
- Grassland plateau
- Upland fringes
- Vale fringes
- Lower valley
- Wharfedaleside

This analysis seems to have been quite strongly based on the predominant topographical features of Nidderdale AONB. There is not an exact agreement between this landscape classification and the later classification that forms the basis of Joint Character Areas. However, in general terms the vale fringes, upland fringes, lower valley and some parts of the middle valley landscape types fall within Character Area 22, with the remainder within Character Area 21.

4.3 Harrogate District – Landscape Character Assessment

A detailed assessment of landscape character was undertaken by Harrogate Borough Council (*Harrogate Borough Council 2004*) based on a methodology

developed by the Countryside Agency and Scottish Natural Heritage. This identified 106 distinct landscape character areas within the entire Harrogate District but this does not include those parts of the AONB that fall within Hambleton and Richmondshire Districts, for which there are no current equivalent assessments.

Thirty-two of these Local Character Areas, plus the Historic Parks and Gardens landscape of Fountains Abbey and Studley Royal, fall entirely or almost entirely within Nidderdale AONB and a further seven Local Character Areas fall partly within the AONB. There is broad agreement between the boundaries of landscape character areas described in 2004 and the landscape types mapped in the 1992 report, although the more recent and more detailed assessment appears to place greater emphasis on the cultural aspects of the landscape.

4.4 The basis of landscape character

According to the Nidderdale AONB Management Plan (*Nidderdale AONB 2004*), "landscape character consists of intricate patterns formed by the interaction of people and the physical environment which give rise to a distinct sense of place". Indeed, it is considered that "landscape encompasses everything - natural and human - that makes an area distinctive: geology, climate, soil, plants, animals, communities, archaeology, buildings, the people who live in it, past and present, and the perceptions of those who visit it" (*Countryside Agency 2001*). It is also acknowledged that "the landscape is continually changing due to natural processes and humanity's needs. It is anticipated that (the landscape character assessment of Harrogate District) will need to evolve along with the landscape in order to keep pace with it and to remain a relevant and accurate source of information" (*Harrogate Borough Council 2004*).

Occasionally, the addition of a new feature can dramatically transform the landscape character of its locality. So, for example, the construction of the railway viaduct at Knaresborough, just to the east of Nidderdale AONB, clearly had a very major impact on the overall landscape character of this part of the Nidd Gorge. However, this built feature is now so much a part of the local landscape that its removal could not be seriously contemplated. Nevertheless, for the most part the evaluation of landscape character relies predominantly on an assessment of physical, biological and cultural features of an area that have an appearance of permanence and, by and large, a principal objective of such assessments is to provide a basis to resist the introduction of novel features of significant landscape impact. Consequently, it may prove problematical to seek to substantially alter the extent and distribution of major elements in the rural landscape, such as native woodlands, in the course of attempting to meet new targets, because an important aspect of the assessment of local landscape character is essentially resistant to such change. However, there is the view that woodland is not a novel feature but an important part of the landscape that has been lost and that there will only be limited areas where sensible woodland planting and natural regeneration is unacceptable on landscape grounds.

Just over one third of the total area of the AONB is moorland. Although it is managed by heather burning and grazing, this moorland landscape possesses a strong semblance to wilderness, with extensive uninterrupted views and few man-made features. For the most part, vegetation boundaries in moorland areas are subtle and complex, so that they suggest natural origins, in contrast to the obvious cultural subdivisions that prevail throughout lowland Britain. Escape from the rigidly controlled landscapes that most people experience at home, together with the sense of freedom that this can engender, is probably a forceful stimulus for visitors to Nidderdale AONB.

There are some areas of the AONB, below the moorland zone, where there are few trees and the strongest landscape features are the dry stone walls and vernacular buildings that mostly derive from new settlement during the late 18th and early 19th centuries, stimulated by Parliamentary Enclosure Act. Although essentially cultural, this landscape provides a unique sense of history, because it is totally different from modern agricultural landscapes and is given local character through vernacular styles of building and the use of native materials.

In all remaining parts of Nidderdale AONB trees and woodlands form a very strong component of the landscape and their retention will be essential if the present landscape character is to be retained. However, the size and distribution of woodlands in the landscape, together with the species and individual form of single trees, can either convey a sense of wildness or of rigid cultural control, according to their abundance, spacing and relationship to the topography and management of the land. It is essential to recognize this when considering the creation of new woodlands of native tree species. New woods could either enhance the sense of freedom that comes with an apparent lack of human control, or reinforce the image that landscape has been quite rigidly designed to serve a set of human aspirations.

4.5 Woodland in relation to landscape character

The minimum extent of individual blocks of woodland that are included in both Forestry Commission surveys and in English Nature's mapped distribution of ancient woodlands is 2ha. However, from the landscape perspective it is essential to remember that overall landscape character may most often be influenced by the abundance and distribution of much smaller clumps, lines and individual trees situated on field boundaries, around buildings and in waste places, rather than the larger blocks that are recorded in surveys and indicated on maps of the AONB. It is usually these individual and smaller groups of trees that essentially provide the underlying texture of a landscape, against which the form and distribution of larger blocks of woodland may be evaluated.

At all scales, assessments of landscape character clearly recognise the pivotal role that trees and woodlands play in defining the sense of place. However, trees can be considered as either beneficial to landscape or detrimental, depending upon their species, form, distribution and context. In part, the value ascribed to trees and woodlands often derives from perceived antiquity, semi-natural distribution and apparent permanence, as opposed to origins that are evidently of recent cultural and economic derivation. However, concern is also frequently expressed about the gradual loss of valued trees and woodlands as a consequence of neglect by woodland managers.

So, for example, in the description of CCAs it is said that "Those woods which do occur are remnants of the formerly more extensive ancient, broadleaved woodland now confined to steep valley sides. In such difficult conditions, tree growth is slow and the canopy tends to be very open, allowing the development of a rich ground flora" (Yorkshire Dales – Character Area 21). Similarly, "Hedgerow trees in places give an impression of a wooded landscape but many are over mature and likely to disappear in time. In some areas there are many broadleaved woodlands, especially on the sides of valleys, as well as coniferous and mixed plantation woodlands. These usually occur on estates and are generally under positive management for timber production and shooting interests". "Increases in the amount of woodland could be accommodated particularly by reinforcing the existing pattern of valley-side woods" (Pennine Dales Fringe - Character Area 22).

In contrast, woodland of relatively recent origin may be viewed as detrimental to landscape character. For example, the assessment provided in 'The Nidderdale

Landscape' (*Countryside Commission 1991*) indicates that "Geometric conifer plantations on the moorland contrast starkly with its open, wild character" (Area 1 - Gritstone Moor), and "Rectilinear conifer plantations detract from landscape character" (Area 3 - Upper Nidderdale Valley). It is suggested that planners should "Promote introduction of deciduous edges to existing plantations to soften their appearance", "New plantations should respect landform and landscape pattern" and that it will be important to "Concentrate native planting to the gills but ensure that the gills maintain their character and are not lost in large plantations". Moreover, it is considered that it will be vital to "Maintain the well-wooded appearance of this Character Area (Area 4 - Nidderdale valley) through appropriate new planting. In particular, (it is important to) explore ways to increase connections between woodlands" and "Encourage management of conifer woodland to introduce diversity to structure in keeping with native woodland character and avoid large areas of clear felling".

In order to provide a framework for the proposed expansion of native woodland in Nidderdale AONB it is essential to recognise the origins of significant trees and woodlands and appreciate the timeframe during which they have grown. At some time since the end of the last ice age virtually the whole area would have supported woodland. Only the very highest part of Great Whernside is now considered to lie above the natural tree line. Unless they were deliberately retained because of their economic value, during the course of settlement and agricultural expansion trees would have gradually retreated from the better drained, more fertile and flatter land, until only the agriculturally least valuable areas retained significant cover of trees. Everywhere in the world that this process has occurred, the current distribution of trees is predominantly on steep slopes, very wet areas and rocky, broken ground that is too difficult to cultivate. It is possible that the distribution of gill woodlands in Nidderdale AONB, regarded by many as a natural characteristic of the area, may reflect the outcome of millennia of agricultural development that has progressively restricted woodland to such sites.

Undoubtedly, in the process of settlement, some trees would have been retained around villages and farmsteads, both for their economic value and for cultural reasons. Indeed, when timber was the major source of both constructional material and fuel, the natural regeneration of trees on field boundaries and on areas of less valuable land would have been at least tolerated, if not directly encouraged. Given the longevity of many individual trees, this era of agricultural development and the naturalistic distribution of trees that it permitted may have been of key significance in providing an underlying pattern of tree and woodland distribution in Nidderdale AONB that has a very strong influence on its landscape character to this day.

In contrast, the rectilinear field and settlement pattern that developed as a consequence of Parliamentary Enclosure Acts in the 18th and 19th centuries, largely ignored former landscape patterns and distribution of natural features such as woodland. Trees may have been felled and utilised in the course of development, swept away because they had no agricultural value, or were gradually eliminated as a result of higher grazing pressure. Even so, it appears that some woodlands were retained in inaccessible, steep and rugged places and their species composition may have been modified or enhanced by planting to favour the more commercially valuable species (notably oak). However, perhaps the most significant legacy of this period of agricultural expansion is the present-day pattern of land ownership.

Undoubtedly, one of the dominant characteristics of 20th century plantations is their rectilinear shapes, clashing starkly with the underlying landform and drainage pattern, which can lead to the inevitable conclusion that "In several parts of the Nidderdale area twentieth century coniferous afforestation has detracted from the landscape quality" and, in the valley above Gouthwaite "the introduction of coniferous

plantations has changed the character of the dale"(*Countryside Commission 1991*). Even if composed of native tree species, there is a danger that the distribution of any new woodlands in Nidderdale AONB will unavoidably follow the linear boundaries of Enclosure Act land settlement and, consequently, would be in danger of detracting from the character of the landscape almost as much as 20th century conifer plantations. However, there are opportunities and methods to soften sight lines and this should not be used as a reason for enhancing conifer blocks or creating new woodlands within linear boundaries.

5. Ecological context

5.1 Woodland distribution and plant communities

In northern England the natural tree-line is considered to lie above the 600m contour. Higher than this there would, in the past, have been extensive areas of willow, birch and possibly juniper scrub. Since the highest point in Nidderdale AONB is the summit of Great Whernside, at 704m above sea level, under natural conditions it is likely that virtually the entire AONB could have supported some type of woodland.

Today, the semi-natural woodland that is found in Nidderdale AONB can provide clues to the type and extent of native woodland that may have existed in the past. However, since virtually all woods have been managed for many centuries to generate a variety of woodland products, the structure and species composition of modern woods may be very different from the natural woodlands from which a few of them are directly descended. The woods that remain are largely confined to a rather narrow range of site types. They lie predominantly on steep slopes, boulder-strewn areas, very wet or very infertile sites. The areas of more fertile soils with good drainage and gentle slopes have almost all been cleared for agriculture in the past, or gradually lost their woodland cover as a consequence of the grazing by domestic herbivores.

Despite the severe fragmentation and modification of woodland that has occurred as a consequence of many centuries of land management, it is still possible to find examples of a wide range of National Vegetation Classification (NVC) woodland communities within Nidderdale AONB. The following NVC types are known to occur here and it is quite possible that examples of additional woodland communities can also be found.

Code	Woodland Community type	Location
W3	*Salix pentandra – Carex rostrata* woodland	Upland
W6	*Alnus glutinosa – Urtica dioica* woodland	Lowland
W7	*Alnus glutinosa – Fraxinus excelsior – Lysimachia nemorum* woodland	Upland
W8	*Fraxinus excelsior – Acer campestre – Mercuralis perennis* woodland	Lowland
W9	*Fraxinus excelsior – Sorbus aucuparia – Mercuralis perennis* woodland	Upland
W10	*Quercus robur – Pteridium aquilinum – Rubus fruticosus* woodland	Lowland
W11	*Quercus petraea – Betula pubescens – Oxalis acetosella* woodland	Upland
W15	*Fagus sylvatica – Deschampsia flexuosa* woodland	Lowland
W16	*Quercus* spp. *– Betula* spp. *– Deschampsia flexuosa* woodland	Lowland
W17	*Quercus petraea – Betula pubescens – Dicranum majus* woodland	Upland
W23	*Ulex europaeus – Rubus fruticosus* scrub	Widespread
W24	*Rubus fruticosus – Holcus lanatus* underscrub	Lowland
W25	*Pteridium aquilinum – Rubus fruticosus* underscrub	Lowland

The following community is also widespread in Nidderdale AONB. It is considered to be derived from native woodland as a consequence of grazing by domestic herbivores and, with the right treatment, would be capable of restoration to woodland.

U20 *Pteridium aquilinum – Galium saxatile* community Upland

5.2 Factors determining woodland community type

The type of woodland that develops on any site is largely determined by factors such as soil type, climate, exposure, wetness and drainage pattern. Indeed, the Forestry Commission (*Pyatt, Ray and Fletcher 2001*) has developed a system to enable the native woodland community that would develop on any site to be determined from a range of physical site characteristics in combination with floristic information. However, with a long history of woodland management and a lack of unmanaged woods from which to make comparisons, it is evident that, until very recently, we may have tended to underestimate the influence of other factors on the species composition and structure of native woodlands.

It is apparent that woodlands that have remained largely unmanaged throughout their development may differ very substantially in many important ways from managed woods, even those which may be sympathetically treated in order to conserve them (*Wesolowski 2005*). In Britain, the few examples of woods that have remained unmanaged for several decades are beginning to enable us to understand just how dynamic such woodlands can be and how dramatically their species composition may be altered by unpredictable events. (*Peterken and Mountford 1995*). Clearly, one very important factor, that was hitherto underestimated, is the potential impact of large herbivores on tree species composition and woodland structure (*Vera 2000*). So, in order to understand the range of native woodland types that could occur in Nidderdale AONB and to what extent the remnant semi-natural woodlands on ancient woodland sites are representative of former natural woodland, it is helpful to briefly examine evidence about the ecology and structure of natural woodland.

Each tree species possesses its own set of ecological characteristics that uniquely fits it to a particular type of site and circumstances. Perhaps the key to understanding the natural variation of native woodlands is an appreciation of the relationship between the fertility of a site, the degree of shade tolerance of the tree species and the age-structure of the woodland that is likely to develop. As gardeners have clearly demonstrated, almost any tree species will flourish on a moist and nutrient-rich site provided that it does not face competition from other trees. Since there is little competition for nutrients on such rich sites, here the principal competition between woodland trees is for access to light. Consequently, the dominant tree species in natural woodland on fertile sites are very shade-tolerant. Within Nidderdale AONB these are wych elm and, locally, small-leaved lime which is no longer common any more. Where nutrients are not restricted, the leaves of these trees are relatively easy to replace and so they are rarely protected against herbivores by thorns, spines or unpleasant chemicals. If large herbivores have free access to woods of wych elm and small-leaved lime these species can be heavily browsed and may give way to tree species with better defended leaves, such as ash and oak. In contrast, yew, which is also very shade-tolerant and found on the most base-rich sites, does need to pack its leaves with unpleasant chemicals, because, being evergreen, it could otherwise suffer severe browsing pressure in winter.

Conversely, on the most infertile sites, where there is strong competition for the nutrients required to produce new leaves, tree species are generally light-demanding and intolerant of deep shade. They also need to defend their leaves more effectively from herbivores, by physical or chemical means, because the cost of replacing lost leaves is high. Oaks flourish in such circumstances, with leaves laced with tannins to

deter both insect and mammalian herbivores. As they are principally adapted to compete for limited nutrients, oaks are so intolerant of shading that they will not readily regenerate in the shade of their own species.

Characteristic differences between species in their tolerance of shading also largely dictate the age-structure and size distribution of the trees in a wood. So, oak woods and woodlands composed of other light-demanding tree species generally regenerate by, periodically, expanding into nearby unwooded areas. Such expansion often occurs when particularly good seed years coincide with temporarily low numbers of herbivores. Consequently, natural oak woods are often made up of quite sizeable patches of relatively even-aged trees.

Major natural disruptions can also produce woodlands that consist of large patches of trees of the same age: of these, windblow is probably the predominant natural disturbance throughout the Atlantic province of Europe (*Peterken 2000a*). However, it is the most shade-tolerant trees that are often more prone to windblow. On fertile sites their roots do not normally need to penetrate deeply to harvest sufficient nutrients. In contrast, oaks are renowned for having deep roots, although the infertile sites they prefer may often be very exposed and so more likely to experience periodic windblow.

Compared to the fairly even-aged structure of oak woods, woods of mostly shade-tolerant tree species can have an intimate mix of age and size of trees, because regeneration can progressively replace individual canopy trees that may have succumbed to disease or old age (*Jones 1945*). This mixed-age structure is often, erroneously, believed to be typical of all natural woodlands and has sometimes been wrongly promoted by conservation management in woodlands where it would not naturally be found.

5.3 Characteristic woodlands of Nidderdale AONB

The modern woods of native tree species that are usually regarded as most characteristic of Nidderdale AONB are sessile oakwoods in steep-sided gills towards the upland fringes of agricultural land. Indeed, it has been claimed that "such woodland would have been the predominant vegetation cover of most of the uplands prior to clearance by humans from the Neolithic period onwards. Much of this woodland has never been cleared due to the inhospitable terrain" (*Woodland Habitat Action Plan for Harrogate District*). Furthermore, it is said that semi-natural woodlands on valley sides and tributary gills provide "a glimpse of Nidderdale as it used to be" (*Countryside Commission 1991*).

Native woodlands with a mixture of oak and birch are prevalent on podzolic soils and other soils of low base status (*Rodwell 1991*). Consequently, the stagnohumic gley and stagnopodzolic soils that predominate over Carboniferous sandstones and gritstones in many of the upland parts of Nidderdale AONB known as the Belmont Association may provide ideal conditions for the development of acidic oak woodland (NVC types W16 and W17). However, oaks only predominate on fairly free-draining sites and there are many gills on the edges of moorland in Nidderdale AONB where springs and flushes produce soils that are slightly more fertile and almost permanently waterlogged. These areas naturally support woodlands dominated by alder (especially W7). Consequently, many upland semi-natural woods are a quite intimate mosaic of oak on steeper and drier slopes with alder along the sides of streams and on poorly drained flushes. Sometimes tree cover has survived best in these wetter areas because they are difficult for domestic animals to access, so that several gill woodlands now consist of almost more alder than sessile oak.

On slightly less acidic sites other oak woodland communities (W10 and W11) are likely to occur, grading into woodlands with a wider variety of tree species, including ash and wych elm (W8 and W9) on lower and still more fertile sites. However, the long history of grazing by domestic herbivores can also tip the balance towards the development of native woodlands characteristic of more acidic soils, by displacing the more palatable woodland plant species. This is important to bear in mind because, if new native woodlands are created from which large herbivores are totally excluded, it is quite possible that they will naturally tend to develop towards woodland communities dominated by more shade tolerant but largely palatable species. Moreover, it should be noted that the current distribution of semi-natural oak woodland may not represent the true extent of this woodland community but could be partly derived form a wider range of woodland communities as a consequence of centuries of grazing.

It is also important to recognize that most blocks of woodland occupy a variety of site types with soil fertility and wetness varying significantly from place to place. In truly native woodlands this small-scale variation would be reflected in the pattern of tree species and NVC communities. If new native woodlands are intended to reflect nature then it will be important that planting patterns respect the subtleties of within-site variation.

Although it seems unlikely that areas occupying the most fertile sites will be available on which to create new native woodlands in Nidderdale AONB, it should be recognised that such places would not naturally support oak woodland. Because wych elm has been devastated by elm disease and small-leaved lime is now rare in our region, ash is likely to form a major component of native woodlands on such sites. Such places also provide excellent conditions for sycamore, often condemned because it is not truly native to the UK, although it forms mixed native woodlands with ash and wych elm in continental Europe.

5.4 Native woodland communities on protected sites

In England there is a pronounced bias towards the designation of SSSI and National Nature Reserves (NNR) in upland areas (*Oldfield, Smith, Harrop and Leader-Williams 2004*). Undoubtedly, this is a reflection of the fact that lowland areas and more fertile sites have greatest potential for economic use and so few semi-natural communities can still be found in the lowlands. This national trend is clearly reflected within Nidderdale AONB. Virtually the entire area of upland moors within the AONB have been designated as protected sites, comprising East Nidderdale Moors (Flamstone Pin - High Ruckles) SSSI, West Nidderdale, Barden and Blubberhouses Moors SSSI, both of which are included in the North Pennine Moors Special Protection Area. The much smaller Brimham Rocks SSSI also lies entirely within Nidderdale AONB. These three SSSIs have principally been designated for their extensive areas of heather moorland and blanket bog, together with populations of important breeding birds, especially golden plover and merlin. A number of areas of native woodland are included in the two bigger SSSI and are listed at Table 2.2 with other SSSI woodland.

There are also two protected sites lying at the eastern edge of Nidderdale AONB that support important woodlands – Hackfall SSSI and Cow Myres SSSI. These two provide an indication of the types of native woodland that would occur in the more fertile and low-lying parts of Nidderdale AONB.

Figure 5.1 Grimes Gill Wood within the East Nidderdale Moors SSSI. The woodland is of an up-land oak woodland type. SE 154787

Figure 5.2: Dallowgill Wood within the East Nidderdale Moors SSSI. Up-land oak woodland. SE 173721

5.5 Biodiversity in native woodlands

One of the greatest values of native woodland is that it provides the last refuge for many specialized woodland wildlife species that have all but disappeared from other areas of the countryside. Certain plant species have been characterized as indicators of ancient woodland because they are virtually confined to sites that have remained wooded since at least 1600 and are extremely poor colonizers of new woodlands (*Peterken 2000b, Rose 1999*). Some of these plant species are listed in the Woodland Habitat Action Plan for Harrogate District, notably herb paris (*Paris quadrifolia*), which occurs on fewer than ten sites in the district within woodlands on fertile, quite base-rich sites.

The plant communities of woodlands on more acidic sites are also of considerable conservation importance. Old sessile oak woods with *Ilex* and *Blechnum* form a distinct community listed in the European Union Habitats Directive and so is of particular conservation concern. Birk Gill wood in Colsterdale is listed in the United Kingdom's response to this Directive but several of the other upland oak woods within Nidderdale AONB support very similar plant communities that are particularly rich in fern, moss and lichen species. Upland oak woodland is also a national Biodiversity Action Plan priority habitat.

Several of the bird species that are particularly characteristic of upland oak woods are listed in the Woodland Habitat Action Plan for Harrogate District. However, it is the structure of woods that is most important in determining the occurrence of these species, rather than their plant species composition. Like the black grouse, which is the subject of its own Species Action Plan, the tree pipit is essentially a bird of woodland edges that may be favoured if woodland regeneration was once again promoted on the fringes of upland woods. Both wood warbler and pied flycatcher require quite open woodland and, although they are often found in sessile oak woods within Nidderdale AONB they are by no means confined to this type of native woodland. It has been shown that the pied flycatcher prefers a tree canopy cover of around 30% (*Stowe 1987*), so it may well be attracted to local oak woods because their very open nature, a result of growing on difficult boulder-strewn sites or because of the impact of sheep. In Europe its range has been artificially extended several hundreds of kilometres north by the provision of nest boxes in open birch woods (*Lundberg and Alatato 1992*).

There are also many other less well-known wildlife species that are largely restricted to remnants of ancient woodland, such as the northern wood ant (*Formica lugubris*). Their protection would be best served if sympathetic management could be applied to all woodlands on ancient woodland sites in order to prevent their disappearance from the few places where they still remain. Indeed, there may well be some urgency to restore plantations on ancient woodland sites (PAWS) back to native woodland as quickly as possible, because these sites may still retain wildlife species of ancient woodland that may soon disappear if the plantations of non-native trees persist for much longer. In addition, if ancient woodlands can be extended through the creation of new native woodlands, or re-connected to other nearby woods, this may provide the opportunity for some now very localized woodland species to expand their distribution and so increase in abundance.

5.6 Respecting the natural ranges of native species

The classification of woodlands in the NVC makes a distinction between woodland communities typical of northern and western Britain (the upland zone) and those of southern and eastern Britain (the lowland zone). If new native woodlands are to be created by planting, it will be important to recognize these distinct woodland

communities, particularly since Nidderdale AONB supports woodland communities typical of both upland and lowland zones of the UK. Tree and shrub species such as field maple (*Acer campestre*) and guelder rose (*Viburnum opulus*) are characteristic of lowland oakwoods (W10 and W16) and their natural range extends only to the eastern and southern parts of Nidderdale AONB. It would be inappropriate to introduce them into new oak woods in the more northwestern (upland) parts of the region. The local occurrence of a few plant species such as chickweed wintergreen (*Trientalis europaeus*) which is on the very southern edge of its range in Nidderdale AONB and is confined to upland types of oak woods (W11 and W17) may help to determine which associated species should be planted if new native oak woods are created in the area.

6. Criteria for native woodland establishment

The historic fragmentation of the Nidderdale woodland resource must have had a significant influence upon its biodiversity. Scientific theories relating to patch isolation, island biogeography and population metadynamics (*Watts et al 2005*) postulate that reductions in areas cause local extinctions and a reduction in the exchange of individuals. Populations of both faunal species, such as red squirrel and pine marten, and floral species such as wild service tree and sweet woodruff are likely to have been affected by the drastic loss of woodland cover. The creation of new native woodland should have similar characteristics of the original habitat and it is arguable that new native woodland will only make a valuable and long lasting contribution to landscape character if either:

- It is permitted to gradually return to sites that would naturally support woodland. This would require a relaxation of the factors that currently restrict the extent and distribution of trees within Nidderdale AONB.

Or:

- New woodland is carefully sited with full consideration given to woodland ecology and the impact of natural processes. This would require its species composition and structure to be intimately designed to mimic as closely as possible the woodland that might develop under the first scenario, outlined above.

For either of these to occur it will be essential for the dynamic nature of the rural landscape to be much more widely acknowledged by landscape planners, managers and the wider public who seek to enjoy it in a variety of ways. In turn, this requires some understanding of the ecology of native woodland, so that it becomes possible to recognise the different types of woodland that may have existed when Nidderdale was managed less intensively. Without a vision of how woodland may have been distributed in the past and how different types of woodland related to site conditions and major landscape features, any attempt to re-create more extensive woodland that is in keeping with the natural aspect of the AONB is doomed to failure. A planned pattern of woodland distribution that is driven by the forces of economics or expediency, no matter how skilfully it is designed, will never be able to reinforce the remaining natural characteristics that still underpin the uniqueness of the landscape and the special sense of place that this engenders.

Essentially, it will be important to attempt, as far as possible, to encourage the creation of new native woodlands in locations that principally respect the topography, drainage patterns and distribution of natural vegetation in the landscape, rather than the current pattern of land ownership and field boundaries. Unless substantial areas are targeted for woodland restoration it will be very difficult to produce a pattern of new woodlands that will have a naturalistic appearance which could reinforce the distinctive character of Nidderdale AONB and help to maintain its element of

wildness that so many visitors seem to seek. This may prove particularly difficult to achieve since individual owners will naturally tend to consider the planting of new woodlands in patterns that fit into those of existing field boundaries.

Based on the principals discussed in this report with regard to landscape character context and the ecological context, a set of criteria should be followed when considering sites for native woodland establishment or restoration. In addition to landscape and ecological contexts, and following the principals of sustainable forest management, productivity criteria should also be considered. Table 6.1 sets out the criteria based on the three management principals and these should be followed when considering sites.

Table 6.1 Native Woodland Criteria

Nature Conservation	**Landscape Character**	**Sustainable Production**
Sites that extend existing ancient woodland sites	Plant on moorland tops in deep gills and hollows where they do not impact adversely on the skyline	Consider topography and access
Sites that support woodland flora, even if they are not identified as ancient woodlands. This also includes non wooded sites showing remnant woodland flora populations.	Plant up all slopes over a certain angle. Target bracken covered slope areas.	Consider distance to market
Woodlands less than 2ha that are not on the inventory of ancient woodlands	Consider boundary constraints and ownership. Site size could be a solution to such constraints.	Consider species suitability and future growth characteristics
Sites with correct soils and landforms such as thin soils overlying millstone grit such as the Belmont Association in upper Nidderdale	Avoid straight edges against land contours. This may not be immediately achievable, particularly where new lines of fencing are required. However, such straight edges will disappear with time where soft edges and scalloping are used within the plantation.	Consider silvicultural system to be applied
Consideration for priority BAP species such as the black grouse	Avoid straight line planting, use varied spacing and use of open ground.	Consider if the site is not important for the other two principals of nature conservation and landscape character
Other priority species in the LBAPs such as tree pipit	Follow FC guidelines for forest landscape design	Consider suitability of contractor base.
Size of site		
Sites where natural regeneration is already occurring		
Follow FC guidelines for native woodland creation and ancient woodland restoration		

Figure 6.1 New planting at Grimes Gill – SE 154787

Figure 6.2 New planting at Ladywood – SE 202722

Figure 6.3 PAWS restoration at Nutwith Common/Oak Bank Wood – SE 230774

6.1 Zonation of native woodlands

It is recognised that the New Native Woodlands in Nidderdale AONB Opportunities Plan is attempting to achieve a wide range of objectives. Table 6.1 shows that there is a comprehensive list of criteria to be considered when planning a native woodland scheme. It may be possible to simultaneously achieve several of these objectives within any one area of new native woodland. However, in many sites attempting to address a range of objectives could compromise the efficacy of implementing the key objectives of the scheme. The prioritisation of objectives for individual new native woodlands will need to be determined according to local circumstances and according to site type, location, woodland area and other parameters. Two examples are considered below, in order to give an indication of how priorities might be assigned.

6.2. New native woodlands in prominent locations

In the detailed landscape character assessment for areas lying within Nidderdale AONB (*Harrogate Borough Council 2004*) it is frequently recommended that any planting of new woodlands should preferably be situated in valleys and hollows in the landscape, avoiding skylines whenever possible. This pattern of planting would tend to emphasise the texture of the landscape. The natural distribution of acid upland oak woodland, a local and national biodiversity action plan priority habitat, follows the distribution of acid and mainly peaty-gleyed podzolic soils. It is frequently related to the distribution of crags and rocky outcrops on valley sides. These tend to occur around the break of slope on the upper edge of valley sides and, consequently, are often very prominent and characteristic landscape features within Nidderdale AONB. Unless they have been intensively grazed by farm livestock, many of these prominent sites still support at least an open cover of native trees, notably oaks and birches.

As part of any plan to create new native woodlands it would be opportune to encourage the development of additional tree cover on these sites. However, because they occupy key sites in the landscape, it would be inappropriate to engage in certain management practices on such sites, since these could have severe and detrimental landscape impacts. So, the natural regeneration of trees would be more appropriate than planting, as this would permit a rather gradual transition to woodland and would encourage natural and scenically acceptable distributions of woodland. However, the success of natural regeneration will be affected by local abundance of rabbits, deer and other browsing animals and may only be achievable in a limited range of locations. If planting was required in order to infill this regeneration, it would need to be carried out discretely, because protective tree shelters can be visually intrusive. Such prominent new woodlands would be best assigned primarily to nature conservation objectives. Their management for fuelwood production or other commercial purposes would be both difficult, because of the broken nature of the terrain, and unacceptable because commercial management would inevitably be visually intrusive in such prominent sites.

6.3. Large new native woodlands on more fertile, flatter sites

If they are to provide effective opportunities for commerce, new native woodlands should ideally be sited near to good access, relatively close to markets and, preferably, on quite flat sites where it is possible to work with large machinery. Commercial opportunities will probably take priority in such woodlands, but they can nevertheless also make some contribution to other objectives of the opportunities plan, such as recreation, landscape and biodiversity action plan objectives. Such sites will also tend to be the more fertile sites that may naturally support a mixed native woodland including ash, alder and sycamore as well as oak, and will have potentially greater yield class than native woodlands on the most acidic skeletal soils.

In these respects they would also be better suited to make a significant contribution to sustainable wood production and to carbon sequestration.

The criteria set out in Table 6.2 indicate the characteristics of sites where new native woodlands may be created that make them best suited to serve the separate purposes of nature conservation, the reinforcement of landscape character or sustainable production. These should be used as guidance in the determination of priorities for the fulfilment of multiple objectives and the pattern of zonation within the overall new woodland area that this will produce. It should be noted that in all instances the ability to create new woodland adjacent to existing woodland of any character could be regarded as beneficial in a number of ways, including cost, contiguous habitat size and species colonisation.

Table 6.2: Site characteristics and potential suitability

Site Character	**Suitable Use**	**Other factors**
Remote with poor accessibility, appropriate soil structure and potential to benefit other species which require woodland cover (i.e. black grouse).	Nature conservation	Probably marginal grazing land where landowners would see financially-supported woodland creation as a small but useful income stream. Future harvesting would be unlikely and management purely for conservation purposes.
Possibly remote or inaccessible but well-overlooked from public roads or public rights of way.	Landscape character	Species selection should not only reflect suitability within landscape context but also for other nature conservation targets.
Accessible, fertile areas of land where site conditions allow the successful establishment of tree species for eventual harvesting.	Sustainable production	Species suitability must conform with landscape character and should also address nature conservation targets. However the primary consideration would be the production of quality timber.

7. Funding Opportunities for Native Woodlands

Table 7.1: Funding Opportunities

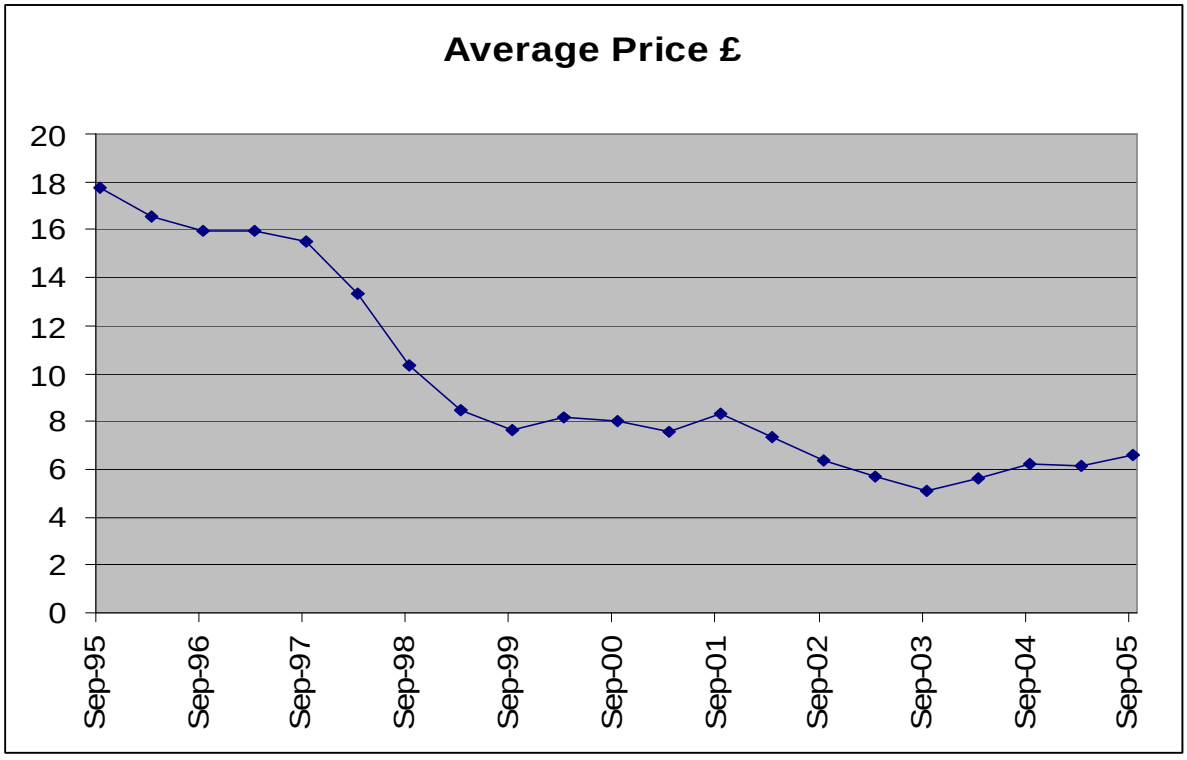
Grant Scheme	Agency	Aim/applicable to
English Woodland Grant Scheme www.forestry.gov.uk	Forestry Commission England	To improve woodland management. May specifically be used for management planning and special assessments, woodland creation and regeneration and wildlife management. The woodland regeneration grant provides a high grant rate for restocking PAWS sites with native broadleaves and the woodland improvement grants can offer up to 80% of costs for work to improve the condition of woodland SSSIs. Open to all woodland owners and tenants.
Environmental Stewardship Scheme www.defra.gov.uk	DEFRA	Entry Level Scheme includes options for protection of in-field trees and management of woodland boundaries. Higher Level Scheme includes options for maintenance of woodland, restoration of woodland and creation of woodland (for woodlands less than 1ha in size or less than 3ha across the farm). Open to all landowners.
Sustainable Development Fund www.ydmt.org.uk	Yorkshire Dales Millennium Trust (DEFRA)	To develop and test practical sustainable ways of living in and around the Yorkshire Dales National Park and Nidderdale AONB. Open to all.
Dales Woodland Restoration – Countdown 2010 www.ydmt.org.uk	Yorkshire Dales Millennium Trust (English Nature)	To plant 150 ha of BAP target woodland types in the Dales and Nidderdale areas by 2008. Open to all landowners.
Wildlife Enhancement Scheme www.english-nature.org.uk	English Nature	To facilitate appropriate management on privately- owned SSSI, particularly where the site is in unfavourable condition. Open to private landowners. Due to end December 2006.
Environmental Enhancement Scheme www.nidderdaleaonb.org.uk	Nidderdale AONB	To conserve the natural beauty of the AONB. The scheme is broad but the type of projects which may be eligible include: work to restore landscape features, schemes to protect or improve wildlife opportunities, habitat creation and restoration, management of ancient woodlands, and landscape interpretation projects. Open to a range of groups and individuals with a non-funded project proposal.

8. Assessment of Landowners in the Nidderdale AONB

At the outset of developing this study, it was recognised that it was important to consult with and have the co-operation and support of landowners and agents with involvement in native woodland projects. This section investigates the current attitude of landowners to native woodland creation, and assessment of recent native woodland planting schemes and costs associated with this. A questionnaire was used to steer the discussions and landowners were visited where possible to gauge a clearer picture. See appendix for copy of the questionnaire.

Over the past 9 years, the price of timber from UK forests has dropped dramatically. Chart 8.1 shows the average price paid for coniferous timber from March 1995 to September 2005.

Chart 8.1: Coniferous Standing Sales Prices for Great Britain (per cubic meter overbark)



Source: Forestry Commission 2005.

This dramatic fall in prices has been blamed on the strong pound and cheap imports. In addition to the fall in prices, the traditional markets for timber are disappearing such as the paper mills taking in less virgin fibres and recycling more paper, local panel and board factories and the smaller scale saw mills processing timber for fencing and garden products closing down.

Along side the fall in prices has been a dramatic reduction in the number of forestry contracting businesses within the sub region, from 55 in the early 1990s to only 11 now. Most of the regions forests were planted after 1950 and regional timber production has not yet reached its peak. Over the next 20 years production of softwood will increase to around 340,000m3 a year. As a result of this combined fall in prices and loss of markets, timber growers are finding it increasingly difficult to market their product. Most of the timber harvested in North Yorkshire is taken out of the region where the value added activity is. Many now see their woodland holdings

not as generators of income from timber sales but as multi-purpose assets that add value to the estate for other reasons. This is predominantly the sporting use of woodlands but many of the estates recognise their value for enhancing landscape and nature conservation which in turn can attract investment. The process of engaging with landowners in the development of this opportunities plan has provided a useful insight into their attitudes towards woodland management and creation and the drivers behind the decision to manage and create woodlands.

Eight landowners were interviewed during this process. The following is a summary of the findings:

- Over 2,500 ha of woodland in Nidderdale are owned or managed by those interviewed.
- Of this, 585 ha are thought to be ancient woodlands, either classified as ASNW or PAWS and
- 71 ha are new planting within the last 15 years.
- An average cost of creating native woodlands between those interviewed was £4,210.00 per hectare.
- All of those interviewed are currently actively managing the woodlands in one form or another but are hindered by poor timber prices, access issues, difficult terrain and lack of market opportunities. The most important management objective was for sporting with landscape and nature conservation also of importance.
- All expressed a willingness to either plant new native woodlands and/or to restore PAWS and many are currently involved in native woodland schemes.

The tables below set out the findings of the interviews in terms of management objectives, attitudes towards creating native woodlands and their views on ancient woodland management and PAWS restoration.

8.1. Management Objectives

Landowner/ agent	**Property**	**Objectives**				
		Landscape	**Nature Conservation**	**Production**	**Sporting**	**Access**
EJ Downs Forestry	Denton and Highfield Estate, Denton Park Estate and Weston Estate	✓✓	✓	✓✓	✓✓	
Keith Rawlings	Farnley Estate	✓✓	✓✓	✓		
Swinton Estate	Swinton Estate	✓✓	✓	✓✓	✓	✓
APT Countryside Management	Studley and Grantley	✓	✓✓		✓✓	
Peter Greenwood and Co	Longside Estate and Sawley Estate	✓		✓	✓✓	
Rob Mitchell Forestry	Various small farm woodlands			✓	✓✓	
Diana Kitzing	Winsley Hurst Estate	✓	✓		✓✓	
Geoff Lomas	Yorkshire Water	✓	✓	✓		✓✓

✓✓ High priority
✓ Low priority

8.2. New Woodland Creation

Agent	Property	Desire to plant new native woodlands	Barriers to planting new woodlands	Suggestions for improving opportunities
EJ Downs Forestry	Denton and Highfield Estate, Denton Park Estate and Weston Estate	Very strong desire for all estates to plant new woodland	EWGS scoring form too restrictive and low grant rates	Better rates, provide an area supplement and or more points for landscape
Keith Rawlings	Farnley Estate	Yes, landowner would consider new broadleaf planting schemes although not restricted to natives	Restrictive EWGS rates and scoring from. Farm tenancy issues.	Changes to scoring form to allow farm woodland schemes to go ahead. However, small areas can now be planted under CS which they are currently looking at.
Swinton Estate	Swinton Estate	Yes, Estate keen to create new native woodlands given the right incentives.	Restrictive EWGS rates and scoring from. Farm tenancy issues.	Additional support over and above current planting grants required, this would include comprehensive advisory service and project support/backing, particularly for tenant farmers.
APT Countryside Management	Studley and Grantley	Yes, strong desire to create new native woodlands.	Grant scheme inaccessible for most schemes. Land ownership restrictions	More flexible approach to EWGS system and more options under the scoring form.
Peter Greenwood and Co	Longside Estate and Sawley Estate	Yes, would consider planting up gill sites with natives.	Cost and access issues.	Drastic change to EWGS system. Increase awareness of other initiatives.
Rob Mitchell Forestry	Various small farm woodlands	Yes, most landowners would consider planting field corners and other unproductive land.	No incentives for private land owners.	If rates were improved, more schemes would come forward
Diana Kitzing	Winsley Hurst Estate	Yes. Would prefer to plant species mix – broadleaves with a conifer nurse but would consider only natives on some sites. Would like to create more shelter belts across the estate	Does not see current schemes as being restrictive as there are options in both EWGS and HLS	Make provision for nurse crops.
Geoff Lomas	Yorkshire Water	Not considering new woodland planting as forest holding is at capacity. Would have to plant on tenanted land which is not achievable.	Not familiar enough with schemes to comment but would like to see options for small farm woodlands.	Provide incentives for tenants via a third party.

8.3. Ancient Woodland Management and PAWS Restoration

Property	Ancient woodland management policy and views on PAWS restoration
Denton and Highfield, Denton Park and Weston Estates	Estate woodlands under formal management plans and provision made for AWS. Currently pursuing PAWS restoration policy at Denton and Highfield Estate. However, further PAWS work will depend on size of woodland block and access to the site. Would also look at linkages between sites subject to land ownership/tenancy restrictions.
Farnley Estate	Management policy is for the sustainable production from the estate woodlands and to provide for nature conservation, landscape and to manage the sites sensitively. Active PAWS restoration policy e.g. Stainburn Gill – non natives removed and restocked with oak, birch and ash mix. Would also look at linkages between sites subject to land ownership/tenancy restrictions.
Swinton Estate	Actively pursuing PAWS restoration across many of the estates woodlands. Also, favour regeneration as main method of restocking where appropriate. Currently not considering linking sites due to farm tenancy agreements and issues with informing and advising tenants.
Studley and Grantly woods	Very much part of the management of both sites to include PAWS restoration and would also consider linking sites together but would be restricted by land ownership issues
Sawley and Longside Estates	Cannot consider PAWS restoration at present due to access issues and marketability of timber. Expense of removing conifers and then restocking with natives from many sites is too great. Restock rates for PAWS restoration are attractive but cannot cover costs on many sites.
Winsley Hurst Estate	Woodlands under management agreement with FC but not currently actively managed for production or restock. PAWS are present but not considering restoring to native types.
Yorkshire Water	Active AWS management policy. Keen to see all PAWS sites restore in the long term. Several sites identified as a priority – Dallowgil, Carlsmoor and Lumley Moor. However, accessibility very poor and issues with livestock, pest control and boundaries. Would need co-operation of local landowners and facilitation of schemes.

9. Targets and Maps

The criteria for native woodland establishment have been discussed in section 6 in terms of suitable uses for woodland in areas of different landscape characteristics (table 6.2) and suggestions for the character of suitable sites. There are a number of different and often conflicting criteria for the establishment of native woodland therefore targeting suitable sites for regeneration needed to be considered carefully.

To locate suitable sites for native woodland regeneration an approach was designed using Multi Criteria Evaluation (MCE) techniques within a Geographic Information System (GIS). A group of experts and interested parties discussed the suitable criteria for targeting sites for woodland regeneration and it was decided that the sites should:

1. Be adjacent to existing Ancient or Semi Natural Woodland (ASNW).
2. Be located in Gills.
3. Be permeable to species movement.
4. Be in the wilder more remote parts of the AONB.

These four main criteria are conflicting in nature as they clearly do not describe the characteristics of similar types of landscape. MCE techniques were designed to "investigate a number of choice possibilities in the light of multiple criteria and conflicting objectives" (Voogd 1983) and therefore can provide a solution to this targeting problem.

A targeting model was designed to take in separate input layers representing the criteria outlined above and output a map displaying areas that display the best possible fit of the different criteria and hence the most suitable areas to investigate further with respect to regenerating woodland.

The following sections describe the raw data sets used to derive the input layers and the methods by which this was achieved and by which the targeting model was created. Brief explanations of the GIS based MCE technique used and the Delphi approach are also included.

9.1 Data Sources

Five basic data sources were used to generate input layers for the targeting model:

1. Current land cover – Centre for Ecology and Hydrology (CEH) land cover map 2000 (map 9.1)
2. Topography – Digital Elevation Models (DEM) of both 10m and 50m resolution acquired from the edina digimap service (map 9.2)
3. Roads and buildings – Ordnance Survey (OS) Mastermap topography layer (map 9.3).
4. Existing ASNW and PAWS sites – English Nature (http://www.english-nature.org.uk) (map 9.4).
5. Soils – NATMAP vector product from National Soil Resources Institute (NSRI) (map 9.5).

The targeting model was developed within ArcGIS which is a suite of programs designed for the storing and manipulation of spatial data.

9.2 Methods

The MCE technique used for the targeting model was a weighted linear summation which involves taking a number of input layers (in this case criterion for woodland regeneration sites) and weighting them according to their relative importance (for a full description of MCE techniques see Carver 1991). In order to acquire an objective weighting scheme the Delphi approach was undertaken whereby a number of experts were asked their opinions on the correct weighting scheme for the input layers and the targeting model was run for each individual set of weights. These separate model outputs were then combined to determine which sites are mostly agreed upon.

The four input layers for the targeting model are based upon the four criteria outlined above and a description and explanation of the derivation of each layer is described below.

Adjacency to existing ASNW sites

Description: Adjacency to existing ancient or semi-natural woodland is used to describe both proximity to a suitable seed bank for natural regeneration and proximity to existing native woodland patches that could feasibly be targeted for enlargement and connection with new woodland regeneration projects.

Method: The ASNW dataset provided by English Nature is used to define existing patches of native woodland in the study area. English Nature have captured information about ASNW from 1:25,000 scale maps using "*presence or absence of woods from old maps, information about the wood's name, shape, internal boundaries, location relative to other features, ground survey, and aerial photography*". Only those patches of ASNW over 2ha are included in the English Nature inventory. A buffer was created around the existing patches of ASNW with the first 50m given the highest value then a linear distance decay function applied to the next 150m (see map 9.6). This highlights the importance of the land in the immediate vicinity of ASNW but not discounting areas slightly beyond that could lead to the joining up of fragmented woodlands to achieve objective 2 of the New Native Woodlands for Nidderdale AONB Opportunities Plan (Section 1).

Caveats: In the creation of this layer the ASNW and Plantation on Ancient Woodland Sites (PAWS) (map 9.4) were treated in the same manner thus areas around PAWS will also be targeted for native woodland regeneration. PAWS are assumed to have the dormant seed bank of native woodland flora beneath the planted canopy and research has shown that even after longer term shading by dense coniferous forest for up to 50 years, native ground flora can emerge from a dormant seed bank (Hill and Stevens, 1981).

Topographic index

Description: A topographic index describing the location and extent of the gill network is developed based on slope and adjacency to 1st and 2nd order streams. A gill is defined as a steep sided, often narrow valley incised into a hillside, or into the side of head of a main valley.

Method: The topographic/gill locator is generated by creating two binary surfaces, one with slopes over 5 degrees assigned the value 1 and slopes less than 5 degrees 0, the second with 100m buffers around 1st and 2nd order streams assigned the value 1 and all other areas 0. By multiplying the surfaces together the result is a surface which identifies sites adjacent to 1st or 2nd order streams that have a steep sided hillside thus detecting the gills in the AONB (see map 9.7).

Slope is derived from the OS Landform Panorama 1:50,000 scale terrain model. The same terrain model is used to derive an ordered stream network using a flow accumulation model in the ArcGIS software. The flow accumulation threshold used in deriving the stream network from the flow accumulation matrix is chosen on a empirical 'trail and error' basis so as to best represent the stream network seen on the OS 1:25,000 map series. The STREAMLINE and STREAMORDER functions in ArcGIS are used to derive an ordered vector stream network from the flow accumulation matrix. The buffer around the 1st or 2nd order stream is generated using the EUCDISTANCE function then the CON function to apply a conditional statement to acquire a standard 100m buffer.

Caveats: This is a simple topographic model that is designed to identify areas of the landscape that are both steep and in close proximity to a small stream or gill. The principle assumption made in the creation of the topographic index is the limitation of gills to 1st or 2nd order streams confined in relatively narrow and steep sided valleys. The model inputs themselves are also derived from other models that require assumptions to be made on the part of the developer. Principally, the method of defining stream networks from flow accumulation matrices requires the choice of a

threshold for upslope area beyond which a stream begins to form from accumulation of overland flow/surface runoff.

Permeability of Land Cover

Description: The fragmented nature of the ASNW in Nidderdale poses a threat to woodland biodiversity with patches of woodland becoming isolated causing a reduction in the amount of exchange of species between patches (Watts *et al* 2005). A factor exacerbating this problem is intensive use of the land between existing woodland sites because fertilisers and pesticides reduce the permeability of land to species movement whereas natural extensive habitats are much more permeable to such movement (Watts *et al* 2005).

Methods: The permeability of the land to species movement was represented on a scale of one to four with the most natural habitats being assigned the highest value and the land cover greatly disturbed by intensive agriculture being assigned the lowest. The permeability input layer was created by reclassifying the CEH land cover map according to table 9.1 giving each land cover type a value according to the naturalness of its habitat (see map 9.8).

Caveats: There are inherent limitations to the method described above as although the values in table 9.1 were assigned through consultation with an experienced ecologist this process remains relatively subjective. The LCM2000 data is not without uncertainty and is known to suffer from misclassification errors at a local scale (Fuller *et al* 2002).

Table 9.1. Reclassification of CEH land cover map for permeability

CEH Code	Land Cover	Permeability Score
1.1	Broad-leaved/mixed woodland	0 (to mask out)
2.1	Coniferous Woodland	0 (to mask out)
4.1	Cereals	1
4.2	Horticulture/non-cereal	1
4.3	Not annual crop	1
5.1	Improved grassland	1
6.1	Rough grass	3
7.1	Calcareous grass	3
8.1	Acid grass	3
9.1	Bracken	4
10.1	Dwarf shrub heath	4
10.2	Open shrub heath	4
12.1	Bog	2
13.1	Water	0 (to mask out)
16.1	Inland bare ground	2
17.1	Suburban	0 (to mask out)
17.2	Continuous Urban	0 (to mask out)

Wildland Quality Index (WQI)

Description: The concept of wilderness or wildland has attracted much interest in scientific literature (Carver, 1996; Fritz et al., 2000; Carver et al., 2002) however it remains very subjective and in order to map it we need to define it clearly. Wildland quality is assumed to be an index derived by combining factor maps describing relative values of wildness. The relative values of wildness used for this study are

remoteness from human settlement and mechanised access, lack of visual intrusion from obvious human artefacts and naturalness of the land cover. In order to generate an input layer for the targeting model representing wildness a separate MCE model was created based on adaptations of previous work (Carver 1996, Carver *et al* 2002). Descriptions of the map layers, how they are derived and how they are used to create a WQI for the Nidderdale AONB are given below.

Remoteness from human settlement

Description: Remoteness from human settlement is used to describe the wildness of the landscape in terms of lack of or absence of signs of permanent human habitation (map 9.9).

Method: All building outlines from the OS MasterMap topographic map data were extracted and the density of buildings calculated using a 2km kernel or circular filter.

Caveats: The rural nature of the Nidderdale AONB means that enumeration districts cover very large areas making census data too coarse for mapping population distribution at a resolution that is high enough for this study. The density of buildings within the landscape is therefore used as a proxy for mapping the distribution of human settlement and therefore population density. This assumes that where building density is highest, population density will also be highest. Uninhabited buildings such as outlying farm buildings (barns, byres, etc.), military installations (vehicle garages, ranges, radar domes, etc.) and buildings that are part of the road/rail infrastructure will in places affect this pattern, but because of their generally singular and isolated nature will not have a significant effect on the overall pattern of building density because of the size of the kernel (2km) used.

Remoteness from access

Description: Remoteness from access is used to describe the remoteness or distance of any point in the landscape from the nearest paved road that can be used for mechanised/vehicular access by the general public (map 9.10)

Method: A GIS-based implementation of Naismith's Rule is used to calculate the time taken to walk from the nearest paved public road to any point in the study area. This model estimates walking speeds based on relative horizontal and vertical moving angles across the terrain surface together with appropriate cost or weight factors incurred by crossing different land cover types and the effects of barrier features such as lakes and reservoirs. This is implemented within the PATHDISTANCE function of ArcGIS. The theory and practical application of this model is described by Carver and Fritz (1999, 2000).

Caveats: This model assumes a person can walk at a speed of 5km/hr over flat terrain and adds a time penalty of 30mins for every 300m of ascent and 10mins for every 300m of descent for slopes greater than 12°. When descending slopes between 5 and 12° a time bonus of 10mins is subtracted for every 300metres of descent. Slopes between 0 and 5° are assumed to be flat. This model assumes a fit and healthy individual, and does not make any allowance for load carried, weather conditions (such as poor visibility and strong head winds) and navigational skills. The model does, however, take barrier features and conditions underfoot into account. Lakes and reservoirs are considered to be impassable on foot and are included as barrier features by coding these as NoData (null values) in the model inputs. This forces the model to seek a solution that involves walking around the obstacle. The model also uses a cost or friction surface that controls the walking speed according to the land cover or conditions underfoot. A speed of 5km/hr (1.389m/s) is assumed for most land cover types, while speeds of 3km/hr (0.833m/s) and 2km/hr (0.555m/s)

are assumed for the 'dense shrub heath' and 'bog' categories, respectively. The angle at which the terrain is crossed (i.e. the horizontal and vertical relative moving angles) is used to determine the relative slope and height lost/gained. These values are input into the model using a simple look up table as shown in Table 9.2. The road network, both within and outside the AONB boundary, is used as the access points from which to calculate remoteness of off-road areas. Where the boundary of the AONB is not defined by a road, the road network out with the AONB is used so as to avoid any possible edge effects in the remoteness calculations.

Table 9.2 Naismith's Rule expressed in the VRMA field

Vertical Relative Moving Angle (degrees)	Vertical Factor
-40	2.21
-30	1.83
-20	1.53
-12	0.69
-11	0.72
-10	0.75
-9	0.72
-8	0.8
-7	0.82
-6	0.85
-5	1.0
0	1.0
10	1.76
20	2.57
30	3.49
40	4.62

Apparent naturalness

Description: The number and relative impact of human artefacts visible from any point in the landscape is used as an index of apparent naturalness (i.e. how natural the landscape appears due to the absence of intrusion from obvious manmade features such as roads, railway lines, bridges, buildings, power lines, dams, etc.) (map 9.11).

Method: Cumulative 'viewsheds' of selected points within and immediately outside the study area up to a distance of 5km are used as the basis of calculating an apparent naturalness index. A regular pattern of approximately 1500 points based on a 500m grid is used. The number of 5m cells containing any built structure represented in the OS MasterMap topographic map data are aggregated into 500m cells and used to define the view points for the analysis. The visibility analysis is distance weighted to take into account the different levels of impact associated with an object's position relative to the viewpoint. Near field (0<1500m), mid field (1500<3000m) and far field (3000<5000m) distance bands are used (adapted from Higuchi, 1975) and weighted 1.0, 0.5 and 0.333, respectively. These are shown in Table 9.3.

Caveats: Because visibility analyses are extremely computationally intensive it is necessary to reduce the number of visibility calculations to a manageable number such that the analyses may be completed in a reasonable time. This is achieved here by aggregating the human features represented in the OS MasterMap data into a relatively coarse grid of points based on a 500m regular grid and using these to calculate the required viewsheds. This will have an impact on the accuracy of the

visibility calculations as it has been shown by empirical and computational experiments (e.g. Fisher, 1993), that visibility analyses are sensitive to generalisation from various sources including choice of viewpoint, terrain model resolution and the effects of 'terrain clutter' (e.g. buildings, trees, etc.) that obscure views and can greatly affect the theoretical viewshed based on terrain alone. The weights derived from Higuchi distance bands are a further simplification, but necessary to account for the distance decay effect on relative impact of human artefacts as distance from the viewer increases. Features located more than 5km away from the viewpoint are assumed to have a negligible impact because they will appear sufficiently small and far enough away to have little or no impact on the perception of wildness. In reality, the presence of very large and/or visually intrusive features can have a significant impact over larger distances (e.g. large wind turbines, radar domes or tall chimneys). In addition, large features can exert an influence over perceptions of wildness even if they are not visible from the point in question. For example, although a main road may not be visible from a particular point (i.e. it is behind a hill), the mere knowledge of its existence a short distance away can still have an effect on a persons perception of the landscape's wildness. There is insufficient information to incorporate these elements into the visibility analysis performed here. The above caveats notwithstanding, it is maintained that inclusion of the effects of terrain and inter-visibility are essential in deriving sensible indices of apparent naturalness.

Table 9.3 Visibility zones (Adapted from Higuchi, 1975)

Zone	Distance bands (m)	Weight
Near field	0 < 1500	1.0
Mid field	1500 < 3000	0.5
Far field	3000 < 5000	0.333
Zone of negligible impact	> 5000	0

Biophysical naturalness

Description: The relative naturalness of land cover types is used to define a simple index of biophysical naturalness (map 9.12).

Method: Biophysical naturalness is defined by reclassifying the CEH Land Cover Map 2000 using the classes shown in Table 9.4.

Caveats: The LCM2000 data is known to suffer from misclassification errors at a local scale on a cell-by-cell basis. This is described by Fuller et al. (2002). However, the dataset is considered the best available basis for developing indicators of biophysical naturalness for landscape scale studies. The reclassification of the LCM2000 level 2 classes into 5 naturalness classes from natural/semi-natural to urban is based on the subjective reading of the class descriptions given by the CEH (Fuller et al., 2002). There will be differing levels of naturalness within LCM2000 land cover classes due to differing levels of management (e.g. presence of muirburn on heather moorland or coppicing within deciduous woodland) or topological relationships with other land classes (e.g. small patches of natural/semi-natural vegetation surrounded by intensively managed land) that are not accounted for within the data descriptions. This cannot therefore be incorporated within the biophysical naturalness map. The biophysical naturalness map used here is therefore quite generalised, but is felt to adequately represent this factor at the landscape scale.

Table 9.4. Defining naturalness class from LCM2000 level 2 classes

CEH Code	Land Cover	Naturalness Class
1.1	Broad-leaved/mixed woodland	4
2.1	Coniferous Woodland	3
4.1	Cereals	2
4.2	Horticulture/non-cereal	2
4.3	Not annual crop	2
5.1	Improved grassland	2
6.1	Rough grass	3
7.1	Calcareous grass	3
8.1	Acid grass	4
9.1	Bracken	4
10.1	Dwarf shrub heath	4
10.2	Open shrub heath	4
12.1	Bog	5
13.1	Water	4
16.1	Inland bare ground	4
17.1	Suburban	1
17.2	Continuous Urban	1

Wildland quality mapping

A GIS based multi-criteria evaluation MCE model similar to the one used for the targeting model itself is used to standardise, weight, then combine the individual map layers described above to produce a WQI map (map 9.13). Map layers need to be standardised (normalised) onto a common relative scale to enable cross comparison. For example, remoteness from access (map 9.10) and biophysical (map 9.12) are measured using time (seconds) and nominal naturalness class, and so cannot be directly compared. In addition, the 'polarity' of individual map layers needs to be maintained such that higher values in the standardised maps are deemed to be 'better' and lower values are 'worse'. The weights applied to the map layers are defined on the basis of discussions with the Nidderdale AONB officer and numerous other interested parties including representatives from Forest Research, English Nature and Yorwoods Table 9.5. These are then applied within a simple Weighted Linear Combination MCE model within the GIS. A separate wildland quality index input layer was derived for each of the six people consulted during the course of this project as it will form an input layer for their own personally weighted target model. It is the final combination of these individual target models that will form the basis of the principle target model.

Table 9.5. Weighting schemes for WQI MCE models

Initials of individual	Remoteness from access	Remoteness from settlement	Biophysical naturalness	Apparent naturalness
NS	4	(INVERT) 5	5	5
WR	2	2	3	2
BW	0	0	5	2
PB	3	3	4	3
AC	2	2	3	2
FC	2	4	3	3

Native woodland regeneration target model

The final targeting model was created by inputting the separate layers representing the criteria for targeting sites for woodland regeneration into a weighted linear summation MCE model. In total six separate target models, one for each of the interested parties, were generated using the weights suggested by the individuals summarised in table 9.6.

Table 9.6. Weighting schemes for individual target models

Initials of individual	Adjacency to ASNW	Location of Gills	Permeability to species movement	WQI
NS	4	3	3	5
WR	5	4	3	2
BW	3	2	5	3
PB	5	4	3	3
AC	5	4	5	2
FC	5	4	3	3

All four input layers were standardised across a common relative scale as described above (wildland quality mapping section) prior to the weights being applied, then the resultant individual target maps were also standardised.

9.3 Targets and Outputs

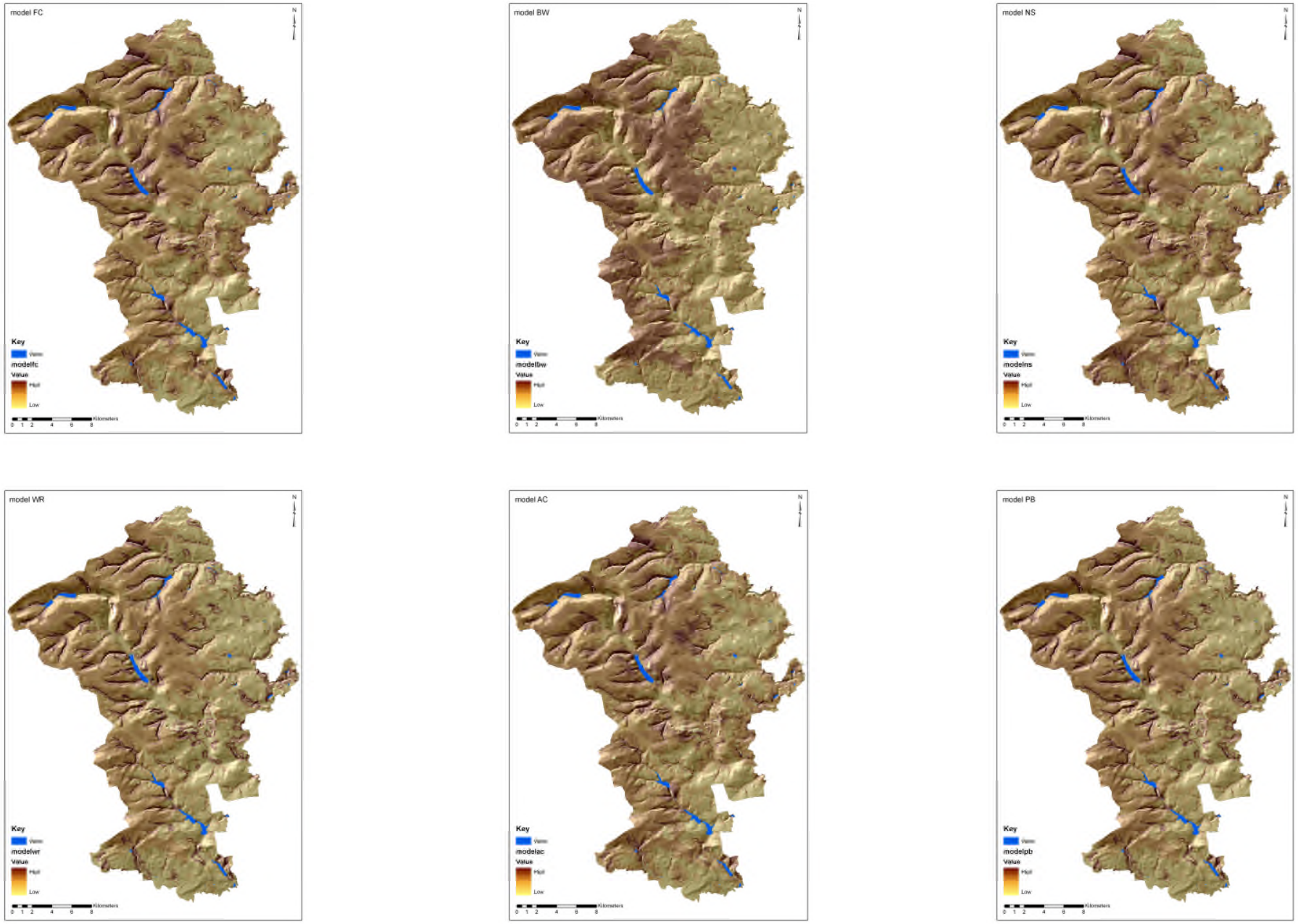
The individual target maps are shown in figure 9.1 and the final target map representing a combination of all six maps is shown as map 9.14. It is important to mention at this point that the targeting model is designed to pick out sites that should be investigated further in terms of their suitability for native woodland regeneration and should not be viewed as a definitive indication of exact sites and extent of possible regeneration. For this reason the final output map has been filtered using a 5 metre circular averaging filter in ArcGIS to smooth the edges of the targeted sites to visually soften their boundaries in the hope that the fuzzy nature of this GIS based MCE process is appreciated.

To further investigate the suitability of targeted sites two other layers were created to overlay onto the target map (map 9.15). The first overlay consists of sites where woodland existed in 1850 but did not now (suggesting areas with a suitable seed bank). The second overlay is flood zones because it is widely documented that woodland is a highly effective soft engineering method for the reduction of flood risk (Nisbet & Broadmeadow 2003, Hall & Cratchley 2005).

Maps 9.14 and 9.15 clearly display a number of sites that have been targeted by the model. Some of these sites lie within or on the boarder of the SSSI East and West Nidderdale moors however it has been mentioned that some native woodland regeneration is feasible within the SSSI if suitably located. Below is a list of just three of the areas targeted by the model along with the nearest British National Grid coordinates:

- Birk Gill Beck and Birk Gill Wood – 413,482. Targeted area largely within SSSI however there is an existing deciduous woodland that has the potential to be expanded further up the gill and around the stream's floodplain.
- North Gill Beck – 417,472. Another targeted area with existing woodland that could possibly be expanded or extended further up into the gill.

Figure 9.1 Delphi approach to MCE based native woodland regeneration targeting



- Redshaw Gill Beck, just South of Thruscross Reservoir – 416,457. Similar features as the last two in terms of landscape character but this time away from SSSI.

Using Map 9.15 there are three sites that require special attention because not only are they targeted by the model but they also contain areas where native woodland existed in 1850 and lie within the flood zone:

- 2km North West of Pateley Bridge – 413,466. Figure 9.2 shows that within this targeted area there is a flood zone and a number of sites where woodland existed in 1850. This site should therefore be investigated further to determine its suitability for native woodland regeneration.
- Middle Tongue – 415,464. This site contains flood zone land and 1850 woodland in an area adjacent to existing woodland which would be perfect for expansion if the land is deemed suitable on closer inspection (see figure 9.3)
- March Gill Reservoir – 412,451. From figure 9.4 it is clear to see that the targeted area runs along Bow Beck Gill and to the North East of the Reservoir. Much of this land is in the flood zone and a patch of 1850 woodland exists in the vicinity also.

Figure 9.2, recommended site 1.

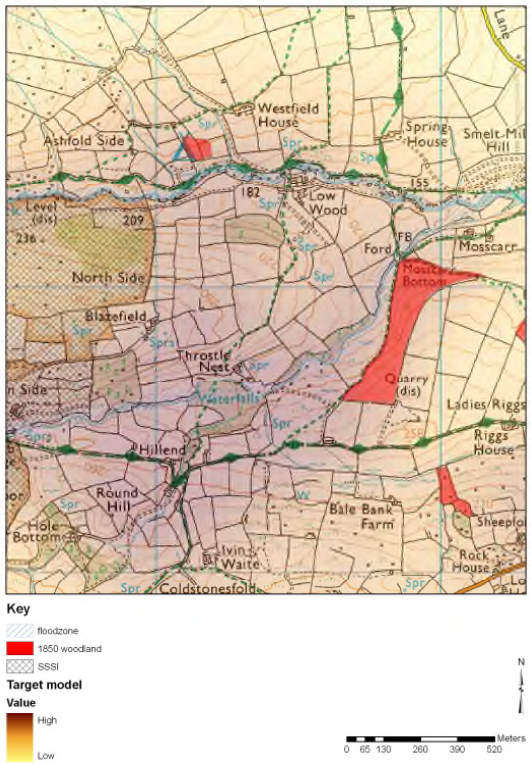


Figure 9.3, recommended site 2.

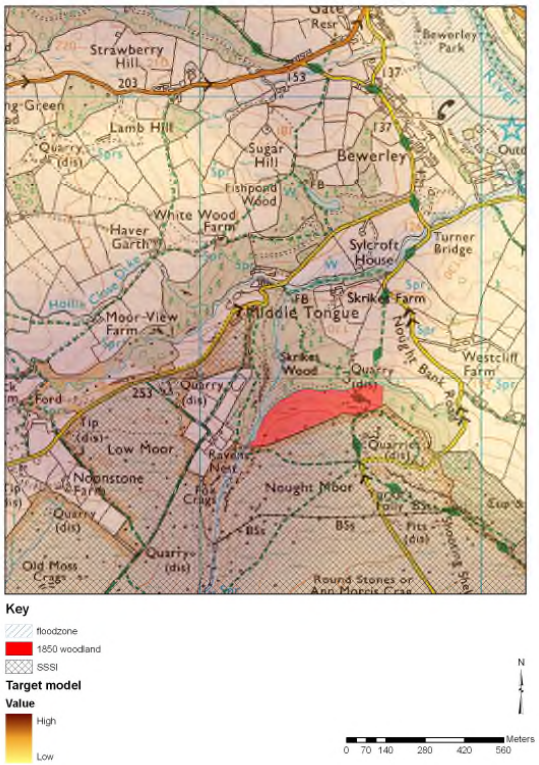
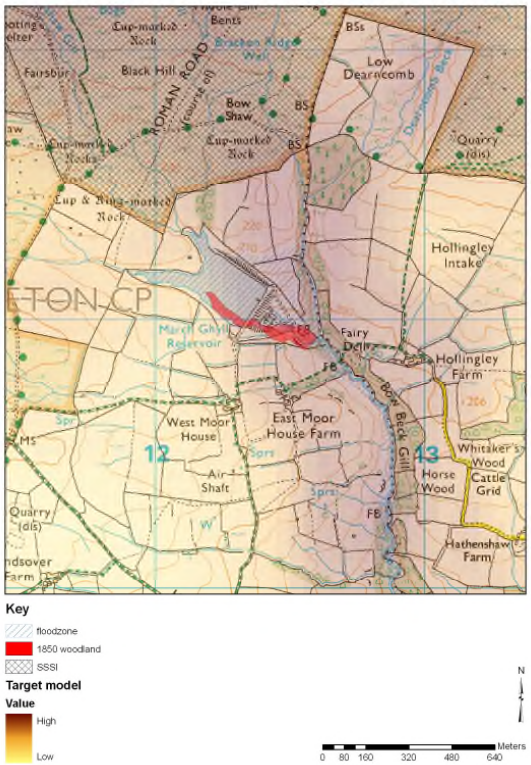


Figure 9.4, recommended site 3.



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Appendix

Landowner Questionnaire

Contact Name	
Business Name	
Address	
Tel	
E-mail	
1. Woodland holding Description Type Amount Amount in AONB Management objectives	
2. Ancient woodland Areas of ancient woodland. Management policies	
3. Areas of new planting (last 10 years) WGS Other grant aid Costs (include ground prep, plants, planting, maintenance for 10 years)	
4. Desire to plant new woodlands Type Where Consideration of buffering and linkages Concept of Forest Habitat Networks	
5. PAWS restoration Policy on PAWS restoration	
6. Mechanisms required to carry out new planting and barriers to existing schemes EWGS and HLS Other schemes	