

# Woodland Opportunity Plan

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November 2020



Nidderdale

Area of Outstanding Natural Beauty



[nidderdaleaonb.org.uk/treeplantingadvice](https://nidderdaleaonb.org.uk/treeplantingadvice)



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## Executive Summary

Nidderdale Area of Outstanding Natural Beauty (AONB) is a dramatic upland landscape located on the eastern flanks of the Yorkshire Dales. Woodland cover in the AONB is below the national average and, without significant action, a substantial loss of woodland cover is anticipated over the next few decades. A high proportion of ash in our woodlands and hedgerows<sup>1</sup> means that ash dieback poses a significant threat and much of our productive woodland was planted between World War II and the 1960s and will reach harvestable age by 2030<sup>2</sup>. We want to act now to help mitigate this potential local loss in woodland cover and to play our part nationally to mitigate the effects of climate change and halt species decline.

This five-year Woodland Opportunity Plan identifies new areas for woodland expansion within Nidderdale AONB by gathering together the best information available on the opportunities and constraints to tree planting. We used an innovative Geographic Information System (GIS) mapping technique to create new landscape scale maps that provide a simple assessment of the suitability of each area of land within the AONB for tree planting. This is the first time that all our environmental data has been brought together into one streamlined map and in a format where environmental constraints can be evaluated alongside environmental opportunities.

Two separate Woodland Opportunity Maps were produced for the Woodland Opportunity Plan. The first map helps identify locations for smaller scale, 'conservation' woodland while the second map focuses on larger scale 'productive' woodland.

This Woodland Opportunity Plan sets out the findings from these new landscape scale maps and suggests that 25% of the AONB has positive opportunities for the creation of 'Conservation Woodland' and 11% for 'Productive Woodland' planting. Crucially, within these wider areas we can now pinpoint where tree planting would bring the strongest environmental benefits for biodiversity, flood attenuation and mitigation of climate change. The areas with high benefit from tree planting will be the focus of our landowner engagement over the next five years.

We want to move from a reactive approach, working solely with farmers who have expressed an interest in planting certain areas, to helping landowners to identify areas of land that would provide higher environmental benefits and proactively approaching landowners to make them aware of the potential benefits of tree planting.

The analysis within the Woodland Opportunity Plan has given us confidence that we can make a valuable contribution to regional and national tree planting targets without compromising the special qualities of the AONB. We want our contribution to be measured

in terms of environmental benefit, not just an increase in woodland cover, and we will work to achieve the ambition of the Woodland Opportunity Plan Steering Group to prioritise 'quality over quantity' in our approach to woodland planting.

Over the next five years the Woodland Opportunity Plan will help to:

- Pinpoint priority areas where tree planting will have the most benefit;
- Reduce tree planting at inappropriate sites;
- Provide a platform for landowner engagement;
- Provide a comprehensive mapping at a farm scale to complement site by site appraisals;
- Provide a focus for sub-projects that can drive an increase in woodland cover;
- Allow us to move forward to set realistic local contributions to regional and national targets;
- Provide a key tool for Nature Recovery Network<sup>3</sup> mapping.

You can view the Nidderdale AONB Woodland Opportunity Maps and a supporting Story Map on our website at:  
[nidderdaleaonb.org.uk/treeplantingadvice](https://nidderdaleaonb.org.uk/treeplantingadvice)

## 1.0 Introduction

This five-year Woodland Opportunity Plan aims to identify new areas for woodland expansion within Nidderdale AONB and is needed in the face of a climate emergency and unprecedented species decline.

The Woodland Opportunity Plan was developed in consultation with a Steering Group comprised of representatives from the Woodland Trust, Forestry Commission, Harrogate Borough Council (White Rose Forest), local forestry consultants and Nidderdale AONB. It was created with funding from the Woodland Trust, and centres on new mapping created by the AONB team that brings together our knowledge of tree planting opportunities and constraints into two main landscape scale maps that will help guide where and how much tree planting is feasible within Nidderdale AONB.

The Woodland Opportunity Plan is designed to enable the Nidderdale AONB team and partner organisations to:

- Understand the extent and distribution of our current tree cover and how this relates to national and regional tree planting targets;
- Prioritise areas for future tree planting, concentrating on areas where new woodland would have multiple environmental benefits;

- Agree sensitive areas where tree planting would not be supported, providing clear justification for exclusion;
- Identify a first tranche of priority sites for landowner liaison, site appraisal and woodland planting.

## 2.0 Local, Regional and National drives for Woodland creation

Nidderdale AONB is an area of 601 km<sup>2</sup> (60,117 ha) located on the eastern flanks of the Yorkshire Dales and stretching from the high moorland of Great Whernside south and east towards the edge of the Vale of York. The AONB team works to ensure that the environment of Nidderdale AONB is protected and that the AONB continues to evolve in a sustainable way in the future.

Woodland cover in Nidderdale AONB currently stands at 4,680 ha, covering 7.8% of the AONB, and is below the national average for England of 10%<sup>4</sup>, see Figure 1. The main areas of woodland can be found in lowland areas in the north east of the AONB, on the valley floor along the River Nidd, in the Washburn Valley and close to the southern AONB boundary along the River Wharfe. Fifty-four percent of the woodland in the AONB is broadleaf, 4% mixed and 40% is conifer<sup>5</sup>. Twenty-six percent of the woodland cover in the AONB is ancient woodland (1,245

ha), of which 452 ha (9%) are semi-natural ancient woodland and 793 ha (17%) are plantation on ancient woodland sites<sup>6</sup>, see Figure 2. National Forest Inventory data suggests that the woodland cover in Nidderdale AONB has been fairly stable over the last decade or so, increasing slightly from 7.2% in 2006, when our original Woodland Plan<sup>7</sup> was published, to 8.1% in 2012 but falling slightly to 7.8% in 2018.

Without renewed tree planting, we anticipate further significant losses in woodland cover in the AONB over the next few decades. Modelled data suggests that ash trees make up a high proportion of woodland and hedgerows in the AONB, making our area particularly vulnerable to tree losses from the effects of ash dieback<sup>8</sup>. In addition, much of our conifer woodland was planted between the end of World War II and the 1960s and will reach the age of maximum economic return by 2030<sup>9</sup>. Forty percent of our woodland cover is classed as conifer plantation and harvesting of timber could mean a significant loss in tree cover in a short space of time. Harvesting of older plantations may also afford an opportunity to replant productive conifer woodland in more appropriate sites and restore the habitats, and increase the carbon sequestration potential of organic soils, beneath current conifer plantations.

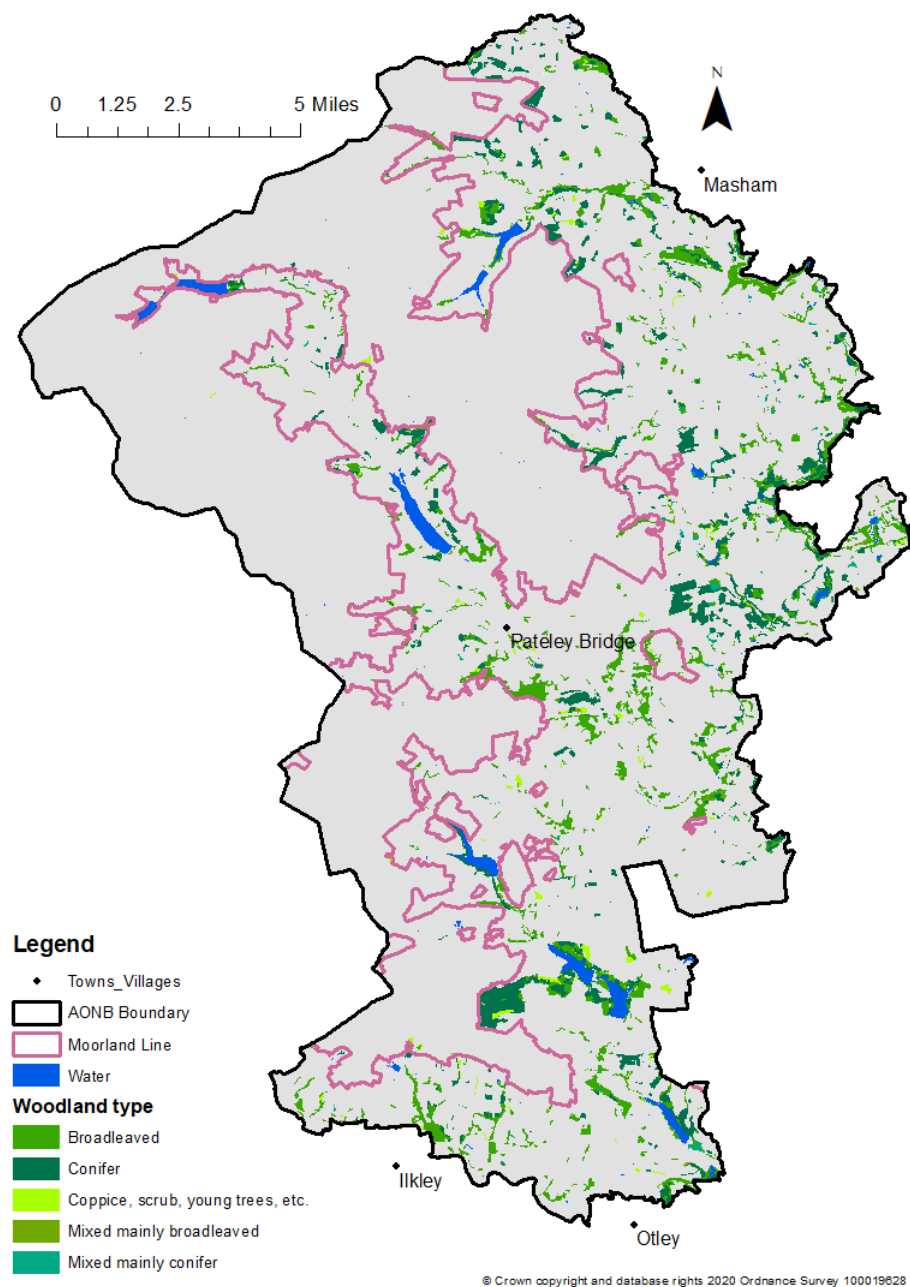


Fig. 1. Location of woodlands in Nidderdale AONB<sup>10</sup>.

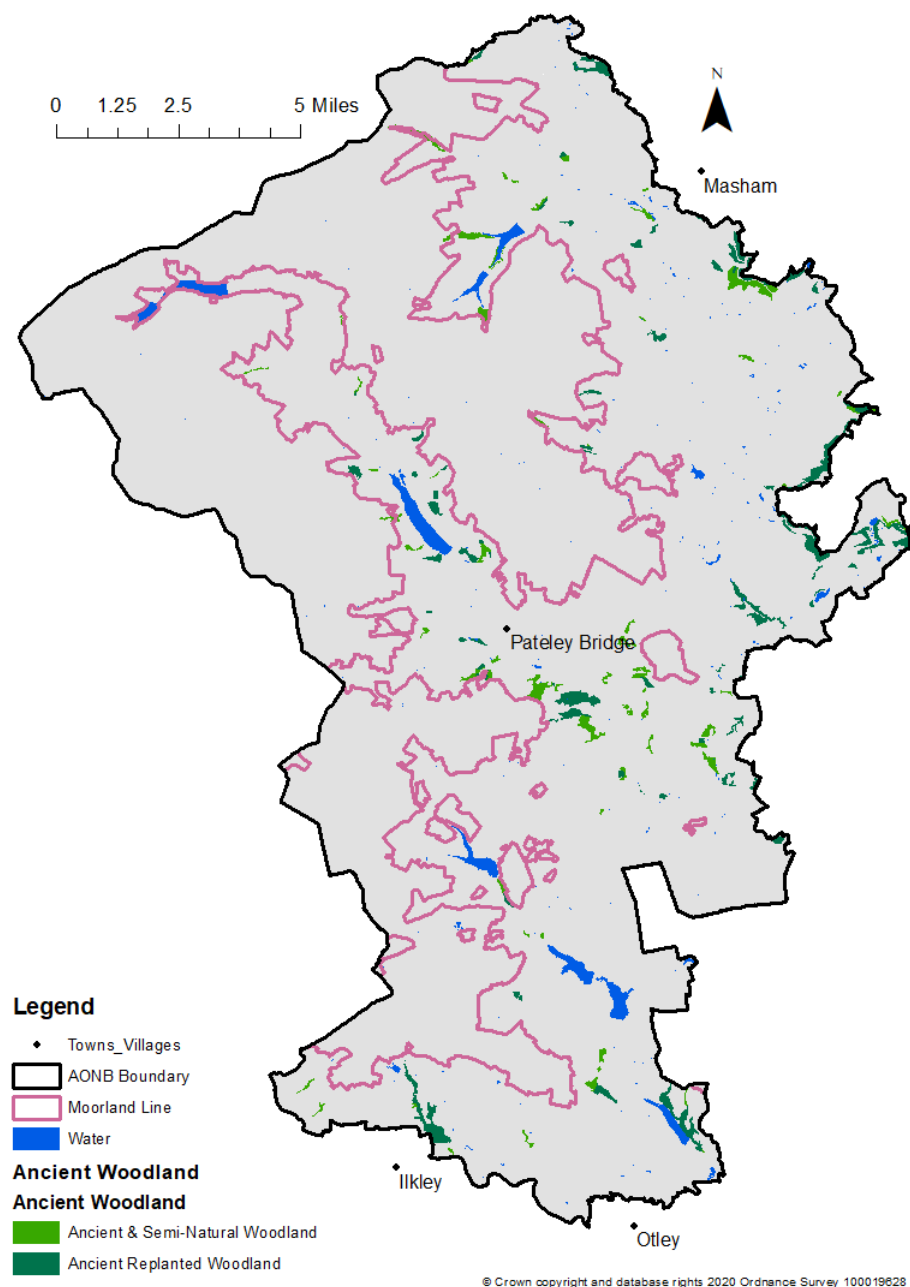


Fig. 2. Location of ancient woodland in Nidderdale AONB.

The aims and areas of work for Nidderdale AONB are set out in the AONB's Management Plan 2019-2024<sup>11</sup>.

Woodland aims from the Management Plan include:

- Increasing woodland cover and bringing the AONB into line with nationally agreed woodland targets;
- Planting new woodland designed to the UK Forestry Standard<sup>12</sup> and increasing the resilience of existing woodland threatened by climate change-related threats from invasive non-native species as well as pests and disease;
- Creating links between wildlife habitats to accommodate future changes in species' range.

The special qualities of Nidderdale AONB bring significant constraints to woodland creation and this needs to be factored in to our response to national and regional targets. For example, large areas of our upland landscape support deep peat and are not suitable for tree planting under the requirements of the UK Forestry Standard<sup>13</sup>. These peatland habitats contribute significantly to UK carbon sequestration targets and could sequester more carbon if their condition was improved.

In recognition of the unique constraints within the AONB, the emphasis of our Woodland Opportunity Plan, as agreed with the Steering Group, will be on quality, not quantity; aiming to limit the potential negative impacts of woodland planting and maximise

environmental benefits by choosing to plant in priority areas identified in this plan.

Reducing the negative impacts of tree planting includes considering the sourcing of trees and the materials used to support tree planting. We want to help ensure that "the right tree is planted in the right place" and recommend that landowners consult the AONB team and utilise Forest Research's Ecological Site Classification Decision Support System<sup>14</sup> when choosing tree species. Trees planted in Nidderdale AONB should be grown in the United Kingdom and sourced from a certified supplier. Landowners and contractors should consider the use of alternatives to plastic tree guards, including cardboard tubes or no tree tubes, where possible. Plastic tree guards already in the landscape should be removed when no longer needed, reused where possible, or responsibly disposed of.

To support the Woodland Opportunity Plan, we will employ a dedicated Woodland Project Officer who will help source local, regional and national funding for woodland creation and will advise on species selection and woodland management.

## 2.1 Regional drivers: White Rose Forest and the National Forest

The AONB falls within the White Rose Forest, a local authority based partnership which covers the Leeds City Region. Along with the Mersey Forest in Liverpool, the City of Trees in Greater Manchester and Heywoods in Kingstone upon Hull, The White Rose Forest Partnership is one of four Community Forests working together with the Woodland Trust to fulfil the Government's ambition of a Northern Forest along the M62 corridor. The Northern Forest initiative recognises that Northern England has less woodland cover than the rest of the country and aims to plant 50 million trees across the north of England over the next 25 years to generate £2.5 billion worth of social economic and environment benefits.

A Harrogate District delivery group for the White Rose Forest has been set up to develop a tree planting plan for Harrogate District which will feed into the wider White Rose Forest Plan. As part of Harrogate Borough Council, Nidderdale AONB will work as part of this wider partnership, to contribute to the White Rose Forest aim of increasing woodland cover by a third across the Leeds City Region by 2036<sup>15</sup>.





## 2.2 National drivers: national targets

Nationally, there are two overlapping targets for increased woodland cover. The first targets stems from the Government's *A Green Future: Our 25 year Plan to Improve the Environment Plan (2018)*<sup>16</sup> which aims to increase woodland cover across England from 10% to 12% by 2060. The second target originates from recommendations by the Committee for Climate Change in the *Land Use: Policies for a Net Zero UK report (2020)*<sup>17</sup> which calls for an increase in woodland cover across the UK from 13% to 17- 19% by 2050 to help the UK reach Carbon Net Zero. [Annex 1 on page 26](#) details these national targets and attempts to quantify what these targets might mean when translated into the Nidderdale AONB context. The White Rose Forest woodland cover target is also detailed in this table to provide a comparison of regional and national targets.

Nidderdale AONB intends to make a valuable contribution to these regional and national tree planting targets over the next five years.

## 3.0 Woodland Opportunity Maps

The main components of this Woodland Opportunity Plan are two maps showing 'Woodland Opportunity Scores' across the AONB: one map for 'Conservation

Woodland' and one map for 'Productive Woodland'. These maps help identify priority locations for tree planting by scoring all locations in Nidderdale AONB from high to low priority. Low scores represent sites that potentially have environmental constraints and which may require detailed site surveys. High scores represent areas where trees are likely to grow successfully and where tree planting would have multiple environmental benefits, such as extending or linking existing woodlands, reducing flood risk or improving water quality. The maps were created in GIS and have been made accessible as [web maps](#)<sup>18</sup>, allowing detailed examination of potential planting locations.

The Woodland Opportunity Score is derived from a mix of factors that influence woodland planting (see [Annex 2 on page 27](#)). Each factor was entered into GIS as a map 'layer' using the best information available. Some of this data has emerged from past AONB projects, notably The Wild Watch<sup>19</sup>, and is unique to the AONB, and other information was derived from national datasets.

Over 80 individual parameters were considered under each of the eight groupings below to help provide a comprehensive picture of the 'opportunities' (positive factors) and 'constraints' (negative factors) affecting tree planting in Nidderdale AONB:

- Tree cover

- Biodiversity
- Heritage – built heritage, archaeological heritage and geological heritage
- Environmental limits
- Access
- Land use
- Water quality and flood risk
- Climate change

To combine the individual layers representing each factor into an overall Woodland Opportunity Score, each map layer was first converted to a ‘raster’ layer. This changed each map layer into a matrix of 10m x 10m boxes, or ‘cells’ and provides a common framework so that each map layer can be combined. For each map layer, the cells contained within an area of interest were given the weighted score for that factor while cells in the remaining ‘background’, were given a score of zero. The scores for each factor were then added together for each cell to give the cumulative Woodland Opportunity Score. See Figure 3 for a simplified example of this. The individual layers were combined using the ‘Raster Calculator’ tool in QGIS software.

Each grouping of opportunities and constraints was first considered in isolation, providing an independent ‘sub-model’ score for the eight groupings of tree cover,

biodiversity, heritage, environmental limits, etc. By building up the Conservation Woodland Opportunity Score from a series of sub-models we can provide a breakdown of the scores for different factors, helping us to understand their contribution to an overall high or low score at each location.

It is acknowledged that not all opportunities and constraints could be mapped. For example, factors

which fall largely outside the scope of the map based plan are Landscape and Recreation. Both these factors are difficult to map effectively and need to be considered on site, for example as part of a visit by our Woodland Officer, through a grant aid application or through a project specific Environmental Impact Assessment (EIA). Extensive guidance on landscape impact is provided in the UK Forestry Standard<sup>21</sup>.

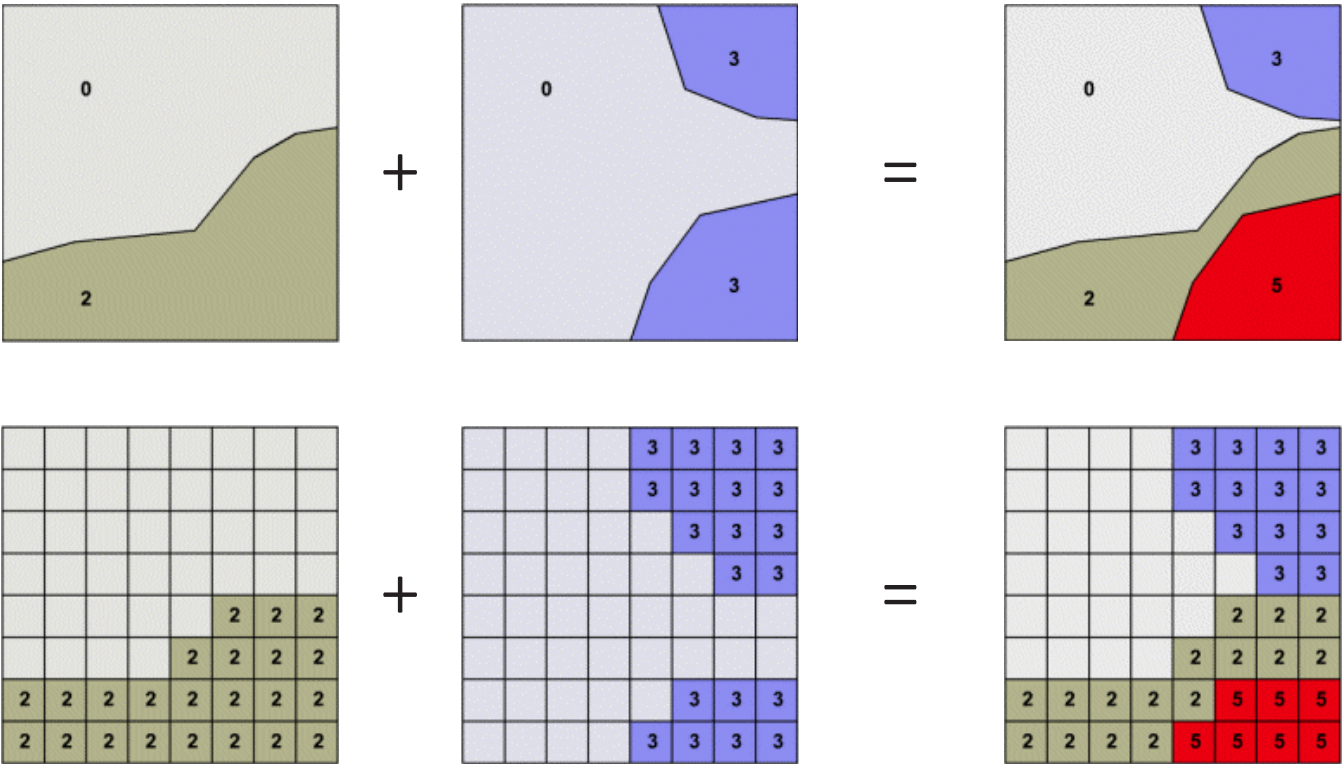


Fig. 3. Simplified example of combining scores in individual raster cells to obtain an overall Woodland Opportunity Score<sup>20</sup>.



Where possible, the mapping was carried out across a larger area than the AONB, focusing on the area within the AONB plus neighbouring land within 5km of the AONB boundary. This was to allow opportunities and constraints close to the AONB to be considered in the mapping. For example, one factor in the mapping looked at whether tree planting could create linkages that would connect large woodland blocks. At the edge of the AONB these connections could be to woodland extending beyond the AONB boundary. Some parameters were not available across the 5km perimeter area, e.g. modelled data showing the distribution of breeding ground nesting birds, so the final Woodland Opportunity Maps are made available only for areas within the AONB boundary.

### 3.1 Woodland Opportunities

Factors identified as ‘opportunities’ receive a positive score in the GIS mapping, indicating that there is a benefit to planting trees in these locations. For example, proximity to existing woodland was considered an opportunity because planting trees next to existing woodland will increase the size, and resilience, of existing habitats. Planting next to existing woodland could also increase the biodiversity value of the new woodland as the existing woodland can provide a valuable seed source to facilitate the establishment of woodland flora. To map this opportunity, areas located

within a set distance of existing woodland, were given a positive score, while areas outside this limit were given a zero score.

Similarly, we also identified locations where small areas of new woodland planting could connect two or more existing woodlands. These connecting areas received a positive score, while locations that would not connect existing sites were given a zero score. Inclusion of this factor allows us to map the benefit of creating linkages to other woodlands and facilitating movement of woodland species across the landscape.

The GIS mapping system can combine the two positive scores for proximity to woodland and woodland connections across the landscape of the AONB, allowing us to give the highest score to areas which buffer existing woodland and provide linkages between woodland. Multiple benefits can be considered together in this way to build up a complex picture of the distribution and strength of planting benefits across the AONB. [\*Annex 2 on page 27\*](#) provides a list of the opportunities which were included in the Woodland Opportunity Mapping, along with a rationale for why the factors were included and details of the datasets that have been chosen to represent them.

### 3.2 Woodland Constraints

‘Constraints’ are negative factors which represent where tree planting is likely to be less successful or to have adverse impacts (e.g. on biodiversity or water quality). These factors help identify locations where planting is not supported by the AONB, or is, at least, not high priority for planting. Constraints can be further separated by their impact or importance, either:

- ‘Category 1’ factors that suggest that tree planting is wholly impractical or would have unacceptable adverse impacts, e.g. deep peat, urban areas, existing broadleaf woodland, known locations of vulnerable species such as adders or locations of irreplaceable heritage; and
- ‘Category 2’ factors that suggest tree planting is not ideal, either from a practical or environmental viewpoint, but which do not rule out tree planting, e.g. an area currently covered by a long-term agri-environment scheme or the location of acid sensitive river catchments.

For Category 1 factors, the GIS system was used to remove their geography from the final Woodland Opportunity Map, effectively leaving an unscored space on the map where woodland planting is not supported. Category 1 areas are represented in the maps by solid blocks of colour: dark grey for urban areas, blue for water, dark green for existing woodland and pale grey for all other Category 1 factors.



Category 2 constraint factors were not removed from the map but were given a negative weighting, either because the negative impact was considered minor or because the only data available was modelled and has an element of uncertainty and needs to be verified by a site visit. The approach taken to assigning a weighting for each factor (the scoring criteria) is explained further below. Including Category 2 constraints in the overall Woodland Opportunity Score, rather than removing their geography, allows some constraints to be mitigated by the positive opportunities in an area.

Please see [Annex 2 on page 27](#) for a list of factors which have been added to the woodland mapping as Category 1 and Category 2 constraints.

### 3.3 Scoring criteria

Factors included in the mapping were given a score to reflect whether it was considered an opportunity or constraint and the significance of each factor. This scoring system attempts to take the decision making that is regularly undertaken by conservationists and landowners on a site by site basis, based on professional judgement, and apply this at a landscape scale. Each opportunity was scored from 1 – 5, and each Category 2 constraint was scored on a scale from -1 to -5, with 5 representing maximum benefit and -5 representing the maximum acceptable constraint.

The scoring criteria for Nidderdale AONB were developed in consultation with the project Steering Group and with reference to case studies and guidance, e.g. woodland grant scoring criteria from the Woodland Trust, Forestry Commission and the Yorkshire Dales Millennium Trust. Deciding on a scoring system was an iterative process, with the outputs from initial trials of the mapping feeding back and informing the scoring process.

Scores are a reflection of both the impact and certainty of the mapping layer. Factors that are believed to have a high impact, but where the certainty of the data is lower will have a moderated Woodland Opportunity Score to reflect the uncertainty in the data. These potentially high impact factors can then be confirmed by site survey. For example the distribution of breeding wading birds was included as a Category 2 constraint, scored at -5, as this relies on modelled data on the likelihood of breeding waders using a site. If we had access to empirical data giving breeding bird density for the whole of the AONB, this factor would have been included as a Category 1 factor and removed from the map. Smaller areas with recent survey records for breeding waders were included as Category 1 areas.

The scores given to each layer, and the decision as to whether constraints will be Category 1 or Category 2, are based on expert opinion and rooted in the

context of Nidderdale AONB. Though some concerns will be universal, repeating the exercise in other areas would likely yield variations in scoring criteria as each geography will have its own unique priorities and constraints.

For the final Woodland Opportunity Maps, presented in this report and available as a [web map](#)<sup>22</sup>, the Woodland Opportunity Score for both the Conservation Woodland and Productive Woodland Maps have been coloured using the same scoring categories, though the scale differs as scores are lower for Productive Woodland.

### 3.4 Conservation Woodland and Productive Woodland Opportunity Maps

Two separate Woodland Opportunity Maps were produced for the Woodland Opportunity Plan. The first map helps identify locations for smaller scale, ‘conservation’ woodland while the second model focusses on ‘productive’, larger scale woodland. Two separate maps were required because the two woodland types often have competing opportunities and constraints, e.g. broadleaf woodland is more feasible on marginal land that is less economically viable for other crops whereas more fertile land can be economically viable for Productive Woodland. Also, different value judgements are attached to the two



woodland types. For example, there are locations in the AONB where Conservation Woodland would be considered complimentary to the local ecology and therefore encouraged, e.g. gill planting in SSSIs (Sites of Special Scientific Interest), whereas conifer trees would be considered detrimental to the local ecology in the same location.

The Woodland Opportunity Maps are built up from over 80 individual environmental factors, but this list is not exhaustive and site visits will be required to fully assess the benefits and impact of tree planting. This is particularly important for factors that cannot be easily mapped. For example, as detailed previously, the visual and landscape impact of new woodland is difficult to map and has not been included in the mapping. The visual and landscape impact of new plantings will need to be carefully assessed on a site by site basis, through site visits by our Woodland Officer or through the EIA process for example.

## 4.0 Conservation Woodland

**Conservation Woodland** – smaller scale planting with a biodiversity focus and likely to be predominantly broadleaf woodland

For the Woodland Opportunity Plan, Conservation Woodland is expected to be smaller scale planting

with biodiversity benefit as the main focus of the tree planting. Trees will be predominantly broadleaf native species, though some non-native species may be included to provide a mix more resilient to climate change and tree disease.

The main broadleaf species in existing Nidderdale woodlands is oak, comprising nearly 30 % of our broadleaf woodland cover. Other significant species include ash, alder and sycamore, with lesser amounts of beech and birch<sup>23</sup>. The choice of trees for new Conservation Woodland in the AONB should be determined in consultation with the AONB team and with reference to Forest Research's Ecological Site Classification Decision Support System<sup>24</sup>.

The potential biodiversity benefits of Conservation Woodland are high, creating new habitat and extending existing habitat for woodland species, particularly when new planting is adjacent to or providing linkages between existing woodland. Conservation Woodland can also provide benefits for water quality in catchments with sediment issues<sup>25</sup> and can reduce flooding by intercepting overland flow, encouraging infiltration and soil water storage<sup>26</sup>. Conservation Woodland will likely sequester carbon at slower rate than Productive Woodland as trees are slower growing and planted at lower density, but as the woodland is not planted with an expectation of harvesting, carbon sequestration is more secure and not dependent on the

end use of timber products<sup>27</sup>.

Since 1940, planting rates for broadleaf woodland in Nidderdale AONB have rarely exceeded 100 ha per decade<sup>28</sup>, and only 58% of current woodland cover in the AONB is broadleaf or mixed woodland. New Conservation Woodland planting is a high priority for Nidderdale AONB. However, despite the biodiversity value of new Conservation Woodland, care must be taken that new woodland does not replace existing high value habitats such as heathland, moorland and species rich grassland and will not impact on vulnerable species such as adders and breeding waders.

The Conservation Woodland Opportunity Map is presented in Figure 2 and available also available as an [\*interactive web map\*](#)<sup>29</sup>.

### 4.1 Findings from the Conservation Woodland Opportunity Map

At a landscape level, the Conservation Woodland Opportunity Map (Figure 4) demonstrates that there are large areas suitable for the creation of Conservation Woodland within Nidderdale AONB. Woodland Opportunity Scores are generally lower in upland areas to the west and higher in lowland areas to the east. This reflects both the benefits from planting trees close to existing woodland and the constraints imposed by priority upland habitats and species.



These landscape level contrasts are not surprising, but the Woodland Opportunity mapping provides a unique insight into the detail within these upland and lowland areas. For example, the mapping highlights areas in the uplands which are bracken dominated, and identifies gill areas less likely to be used by adders, which allows us to quantify the potential for Conservation Woodland creation in upland areas with minimal impact upon protected habitats and species. Conversely, the mapping also shows smaller areas in the lowlands that need to be protected from tree planting, including known species rich meadow sites and heritage features.

Crucially, within both upland and lowland areas we can now also accurately pinpoint areas where tree planting will have the strongest environmental benefits.

The Woodland Opportunity Map allows us to estimate how much land in the AONB could potentially be available for tree planting. Table 1 and Figure 5 provide estimates the land potentially available for planting based on differing levels of priority for planting. Twenty-five percent of the AONB has a positive woodland opportunity score, indicated no known Category 2 constraints

or where constraints are outweighed by planting benefits, for Conservation Woodland and could potentially be used to create new woodland. In addition, 10% of the AONB a woodland opportunity score greater than 10 (equivalent to two overlapping high priority factors) though the top 30% of sites covers only 2.5% of the land area of the AONB.

The highest scoring sites, identified as land covered by the top 30% of Woodland Opportunity Scores, and land covered by a woodland opportunity score equivalent to at least 2 overlapping high priority factors, will be our initial priority focus for engaging with landowners to discuss potential woodland planting sites.

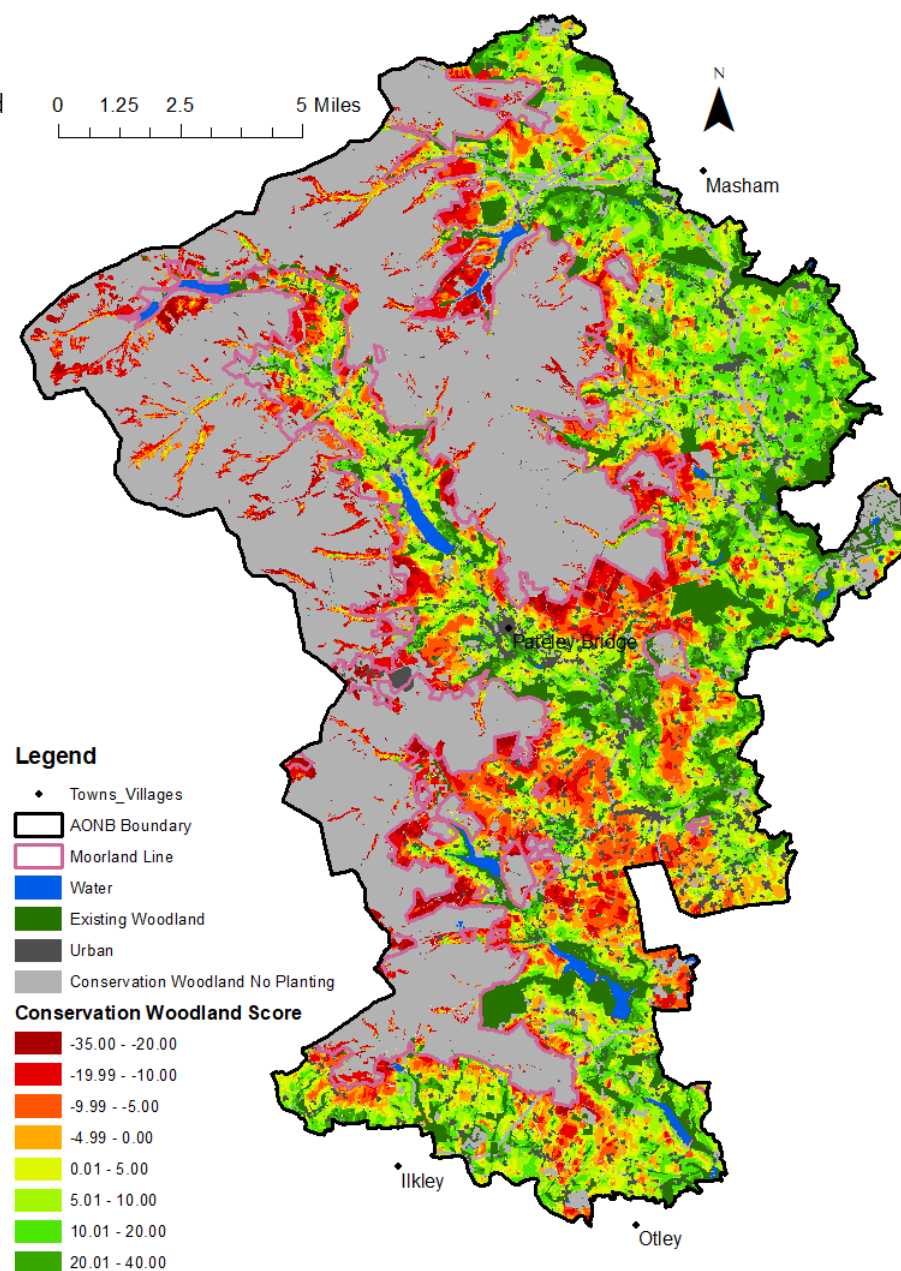


Fig. 4. Woodland Opportunity Score and Category 1 constraints for **Conservation Woodland** across Nidderdale AONB.

**Table 1.** Area of the AONB potentially available for woodland planting based on the analysis of the **Conservation Woodland** Opportunity Score maps.

Conservation Woodland parameters	Total area	Area below the moorland line	Area above the moorland line
Area <i>not</i> covered by a Category 1 constraint	26,643 ha (47% of AONB area)	23,556 ha (66% of area <b>below</b> moorland line)	3,087 ha (13% of area <b>above</b> moorland line)
Area covered by a positive Woodland Opportunity Score (i.e. no known Category 2 constraints or where constraints are outweighed by planting benefits)	15,037 ha (25% of AONB area)	14,567 ha (41% of area <b>below</b> moorland line)	470 ha (0.8% of area <b>above</b> moorland line)
Area cover by a Woodland Opportunity Score <i>equivalent</i> to at least 2 overlapping high priority factors	5,835 ha (10% of AONB area)	5,721 ha (16% of area <b>below</b> moorland line)	114 ha (0.2% of area <b>above</b> moorland line)
Area covered by highest <b>30%</b> of Woodland Opportunity Scores	1,543 ha (2.5% of AONB area)	1,595 ha (4% of area <b>below</b> moorland line)	19 ha (0.03% of area <b>above</b> moorland line)

The land detailed as having positive woodland opportunities in Table 1 and Figure 5 (coloured green) have minimal mapped environmental constraints, but are still subject to other constraints, primarily landowner consent, but also landscape and visual constraints and constraints only identifiable by site inspection, which may limit tree planting.

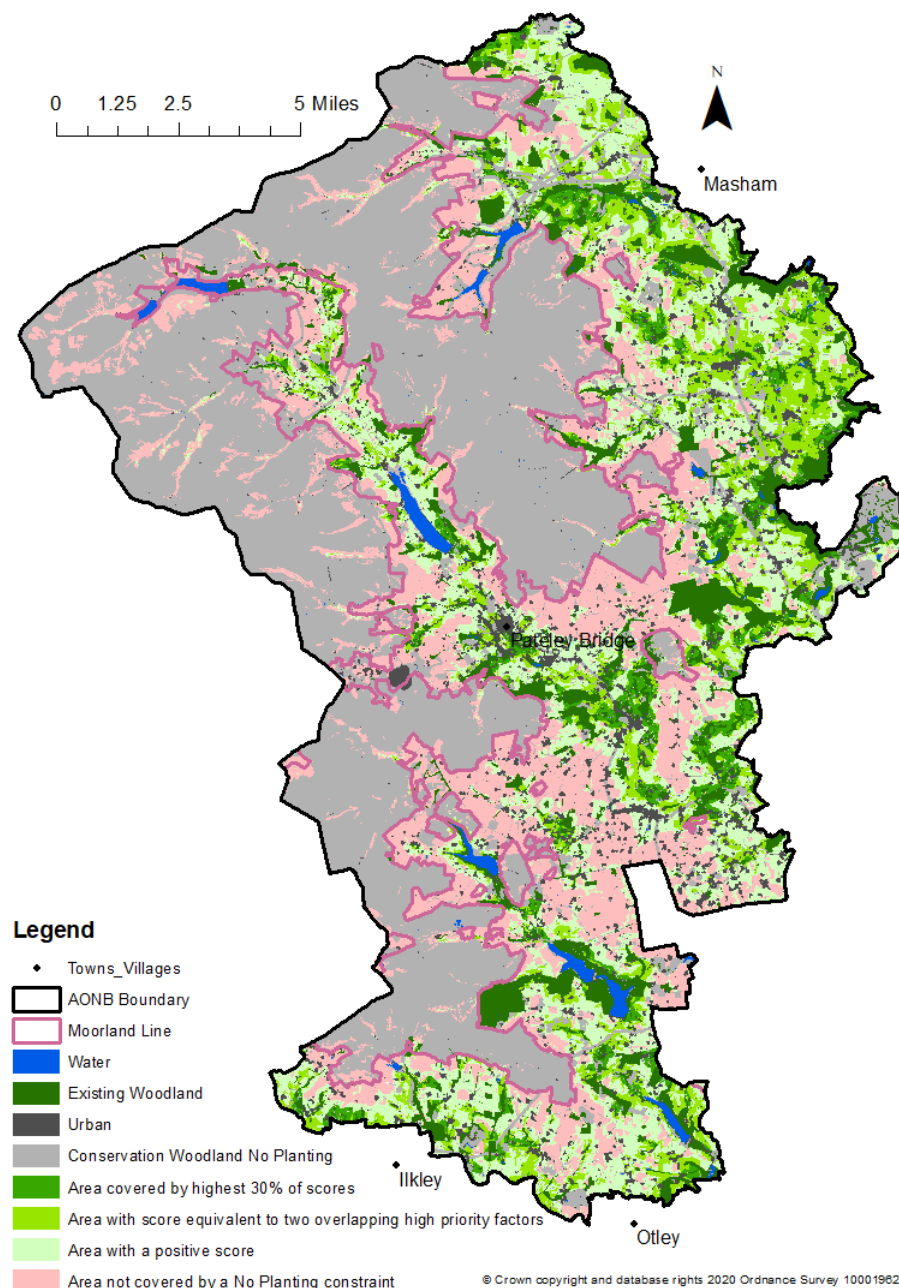


Fig. 5. Priority areas for **Conservation Woodland** planting in Nidderdale AONB.



## 5.0 Productive Woodland

**Productive Woodland** – larger scale plantations, likely conifer, which may provide some elements of biodiversity gain. Their location is primarily driven by economic viability and by stronger environmental constraints.

Productive Woodland is likely to be conifer dominated, with a proportion of broadleaf cover, but this definition could also contain longer term broadleaf dominated Productive Woodland. In this report, 'Productive Woodland' refers to woodland where the overriding motivation for tree planting is economic and it is assumed that the woodland will be felled and the timber harvested.

Key Productive Woodland species for Nidderdale AONB include Douglas Fir, Norway Spruce, Sitka Spruce, Sycamore and silver birch. Sycamore and Silver Birch could both provide an economic return on a range of site types across the AONB, but it is unlikely to be as high as the optimum conifer for the same site. In the main, broadleaf species are expected to make up a small element of a Productive Woodland, but one that could still contribute to overall productivity and profitability.

Productive Woodland provides an economic driver that could allow intensively farmed land in the AONB to be converted to woodland, something unlikely to

be possible for Conservation Woodland without heavy grant funding. Intensively farmed soils are likely to have the lowest existing soil carbon and the highest potential for carbon sequestration under new woodland<sup>30</sup>.

The biodiversity benefits of Productive Woodland for most native wildlife are lower than Conservation Woodland, as tree species will be predominantly non-native and planted at high density allowing less light through to the woodland floor. However, Productive Woodlands could help provide wider connectivity in the landscape, providing shelter for mobile woodland species as they travel. Young Productive Woodland can be a key habitat for some vulnerable native wildlife, e.g. nightjar.

Carbon sequestration benefits of Productive Woodland are potentially high as they comprise fast growing species, more often planted on productive sites, and cover larger areas, though carbon gain will be dependent on the woodland management regime and the end-use timber products<sup>31</sup>. Productive Woodland also has high potential for flood risk management in the wider catchment as evaporative losses from coniferous trees continue throughout the winter. This can allow soil moisture deficits to develop in these woodland soils during peak flood season, increasing the effectiveness of woodland soils to infiltrate and store winter rainfall<sup>32</sup>. However, large scale conifer plantations can contribute to acidification of rivers and water supplies, particularly

in catchments fed by upland acid moorland.

The majority of existing Productive Woodland in the AONB was planted during the boom in conifer planting from the end of World War II to the end of the 1960s and this means that almost half of the entire woodland resource in the AONB will reach the age of maximum economic return before 2030<sup>33</sup>. A significant reduction in woodland cover, and carbon sequestration, could reasonably be anticipated in the AONB over the next decade, though the aging profile of these trees also reduces their ability to sequester carbon<sup>34</sup>.

New Productive Woodland creation could help mitigate against anticipated losses of mature plantations (and ongoing carbon storage) and the identification of new sites could allow for replacement planting on more appropriate sites than those chosen in the past, for example freeing up ancient woodland sites or heathland sites currently covered by Productive Woodland for restoration.

Any new and replacement Productive Woodland planting within the AONB should conform to the UK Forestry Standard<sup>35</sup>. In particular:

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

- Environmental Impact Regulations must be complied with and an EIA completed where required;
- Avoid establishing new forests on soils with peat exceeding 50 cm in depth and on sites that would compromise the hydrology of adjacent bog or wetland habitats.
- Forests and woodlands should be designed to achieve a diverse structure of habitat, species and ages of trees that is appropriate to the scale, context and ecological potential of the site;
- A clear forest management plan should be produced to demonstrate that all relevant aspects of sustainable forest management have been considered and to provide a basis for implementation and monitoring;
- Consider options to extend and improve priority habitats and to increase and extend populations and ranges of priority species; plan forest operations to minimise any adverse impacts on biodiversity;
- Manage a minimum of 15% of the forest management unit with conservation and the enhancement of biodiversity as a major objective;
- Maintain or establish a diverse composition within the forest management unit; where only

one species is suited to a site and management objectives, a maximum of 75% may be allocated to a single species (see notes below). In all cases, incorporate a minimum of:

- 10% open ground or ground managed for the conservation and enhancement of biodiversity as the primary objective;
- 10% of other species;
- 5% native broadleaved trees or shrubs;
- Ensure the removal of forest products from the site, including non-timber products, does not deplete site fertility or soil carbon over the long term and maintains the site potential.

Nidderdale AONB policy is to strongly encourage the siting of the mandatory broadleaf and open ground components of Productive Woodland to maximise biodiversity benefit. For example, a negative score is not given for proximity to existing broadleaf woodland in the Productive Woodland mapping, with the expectation that the broadleaf component of the woodland would be used to buffer existing woodland and provide linkages between existing broadleaf woodland blocks, or that open ground would be provided to create woodland rides that preserve light levels around the margins of existing woodland. Similarly, riparian areas are not negatively scored for Productive Woodland, with the intention that broadleaf

elements can provide a riparian buffer. There is potential for the Conservation Woodland Opportunity Map to be used as a tool for siting the native broadleaf element of new Productive Woodlands.

Ancient woodland and Site of Interest for Nature Conservation (SINC) woodlands have a negatively scored buffer within the Productive Woodland mapping, as proximity to these woodlands has maximum biodiversity gains for Conservation Woodland and native broadleaf woodland, managed exclusively for conservation purposes, is preferred in these locations.

*Annex 2 on page 27* provides a list of the factors included in the Productive Woodland mapping and a side by side comparison to factors in the Conservation Woodland mapping. In general, more factors in the Productive Woodland Opportunity Map have been treated as Category 1 constraints (meaning that tree planting is not supported). The areas covered by these factors were removed from the Productive Woodland Opportunity Map. Similarly, Category 2 biodiversity constraints have generally received a higher negative weighting to reflect the reduced biodiversity gains from Productive Woodland creation and opportunities included in the Conservation Woodland mapping have often not been scored for Productive Woodland. Additional factors relating to yield and productivity, as an indicator of economic return, and also of carbon sequestration, have also been added to the Productive



Woodland mapping.

The Productive Woodland Opportunity Map is presented in Figure 4 and available is also available as an [interactive web map](#)<sup>36</sup>.

## 5.1 Findings from the Productive Woodland Opportunity Mapping

The inclusion of more Category 1 Constraints and stronger Category 2 constraints in the Productive Woodland Map (Figure 6) means that significantly less land area is considered suitable for Productive Woodland planting, as detailed in Table 2 and Figure 7, so that 11% of the AONB has a positive woodland opportunity score for Productive Woodland and could potentially be used to create new woodland. Less than 1% of the area of the AONB has a woodland opportunity score for Productive Woodland of greater than 10 (equivalent to one overlapping priority factor), compared to 25% for Conservation Woodland, reflecting the many more positive benefits of Conservation Woodland. The top 20% of scores has been selected as a priority measure for Productive Woodland as the top 30% would have included negative scoring areas. The top 20% of scores for Productive Woodland cover 5% of the

AONB area.

The highest scoring areas in the Productive Woodland Map are located in three main areas: i) along the southern boundary and in lowland areas of the Washburn Valley, ii) lowland areas to the east of the AONB and sections along the River Nidd. There are relatively few positive opportunity measures included in the Productive Woodland Map and the highest scoring areas for Productive Woodland are primarily driven by the highest scoring opportunities of yield class and by attenuation of flood risk. Yield class was highest in lowland areas to the south and east and along valley bottoms, while the most effective areas for flood risk attenuation were centred immediately adjacent to rivers and in flood zones.

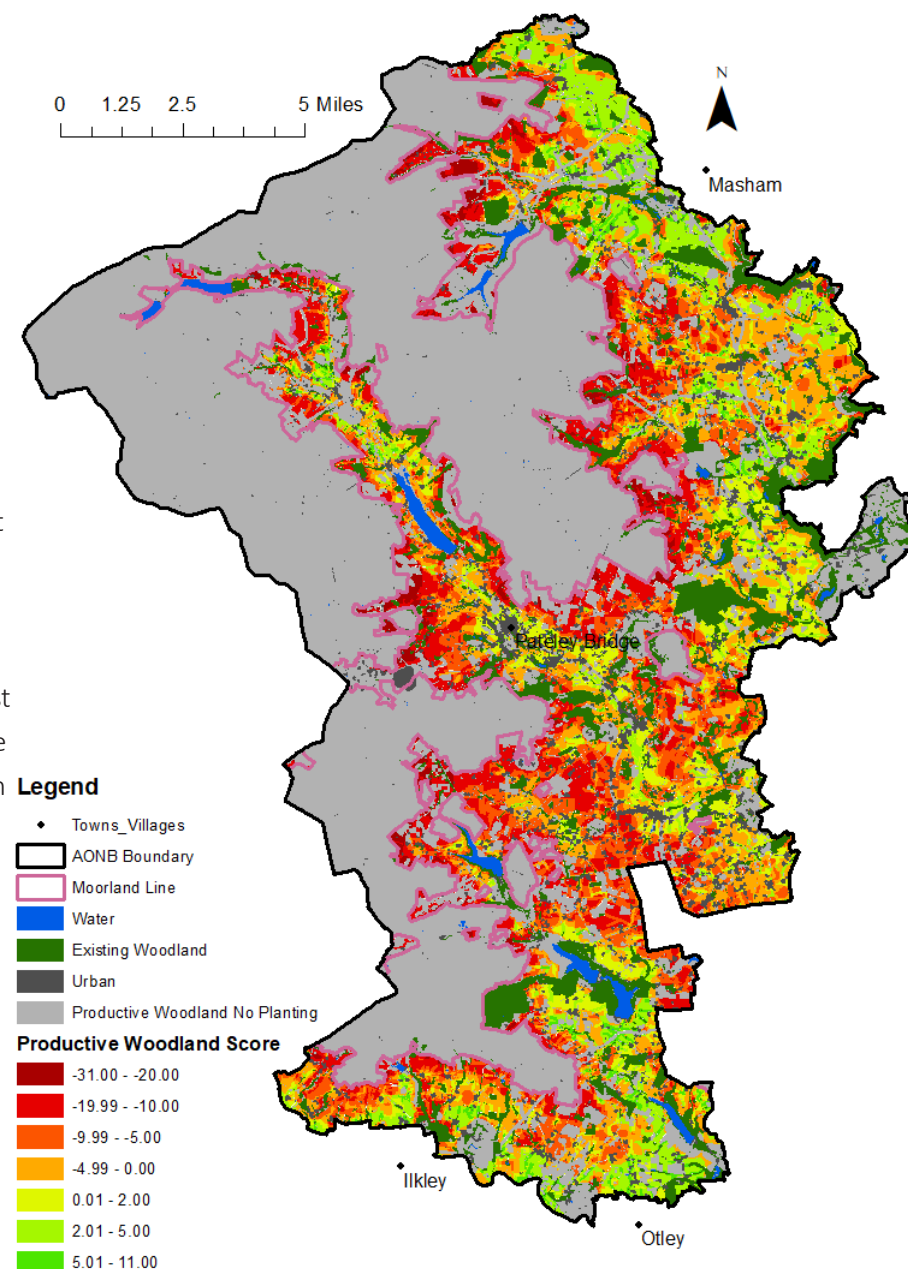


Fig. 6. Woodland Opportunity Score and Category1 constraints for **Productive Woodland** across Nidderdale AONB

**Table 2.** Area of the AONB potentially available for woodland planting based on the analysis of the **Productive Woodland** Opportunity Score maps.

Productive Woodland parameters	Total area	Area below the moorland line	Area above the moorland line
Area <i>not</i> covered by a Category 1 constraint	19,922 ha (33% of AONB area)	19,922 ha (57% of area <b>below</b> moorland line)	0 ha (0% of area <b>above</b> moorland line)
Area covered by positive Woodland Opportunity Score, i.e. no known Category 2 constraints or where constraints are outweighed by planting benefits	6,808 ha (11% of AONB area)	6,808 ha (19% of area <b>below</b> moorland line)	0 ha (0% of area <b>above</b> moorland line)
Area cover by a Woodland Opportunity Score <i>equivalent</i> to at least 2 overlapping high priority factors	3.5 ha (0.005% of AONB area)	3.5 ha (0.01% of area <b>below</b> moorland line)	0 ha (0% of area <b>above</b> moorland line)
Area covered by highest <b>20%</b> of Woodland Opportunity Scores	3,221 ha (5% of AONB area)	3,221 ha (9% of area <b>below</b> moorland line)	0 ha (0% of area <b>above</b> moorland line)

The land detailed as having positive woodland opportunity in Table 2 and Figure 7 (coloured green) have minimal mapped environmental constraints, but is still subject to other constraints, primarily landowner consent, but also landscape and visual constraints and constraints only identifiable by site inspection, which may limit tree planting. Landscape factors may be particular pertinent to any potential productive woodland sites located at the top of the Nidd Valley.

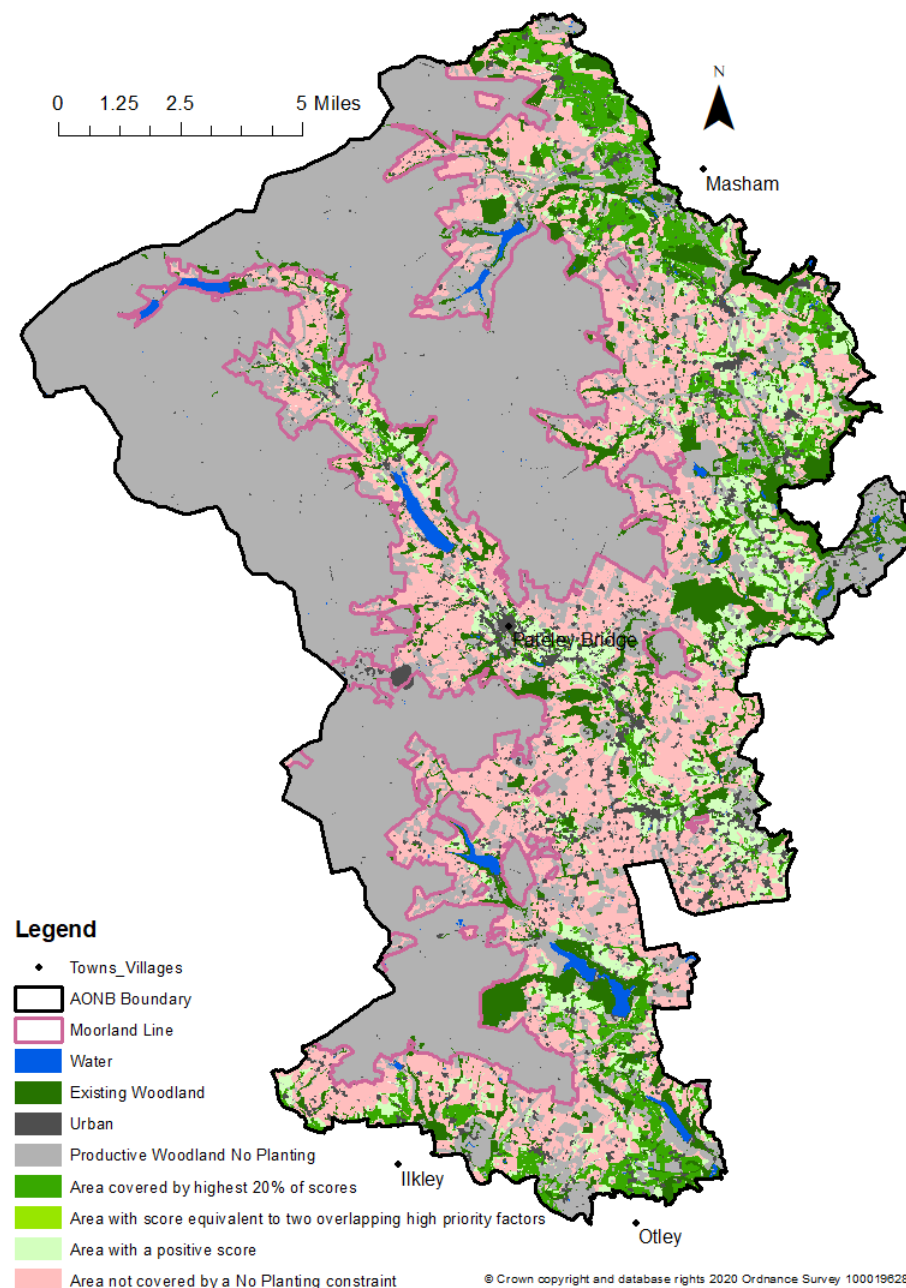


Fig. 7. Area of Nidderdale AONB potentially available for **Productive Woodland** planting.



## 6.0 Farm scale maps – helping to choose the best sites for tree planting within a landholding

As part of the development of the Woodland Opportunity Maps, the landscape scale maps in Figure 2 and Figure 4 were scrutinised at a farm scale with the aim of understanding how individual map layer scores combine to give an overall Woodland Opportunity Score. This detailed examination of sites was essential in picking up any errors in how initial maps were put together and how different factors, scored individually, interact when combined in the maps.

Three example landholdings were chosen from farms involved in our Defra sponsored Test and Trials project<sup>37</sup>. Nidderdale AONB, along with two fellow Northern Uplands AONBs, North Pennines and Forest of Bowland, are taking part in one of Defra’s nationwide Test and Trials programmes, working with six local farmers to help shape the development of the new ELM scheme and the future of farming in the UK. Our Test and Trials project focusses on the process involved in producing land management plans for upland farms and the Woodland Opportunity Plan maps were viewed as an important tool to inform the management plans, helping identify potential sites for new tree planting.

The findings at a farm scale for three of these Test

and Trials farms using the Conservation Woodland Opportunity Map are detailed below, with farms ranging from lowland sites where most of the landholding has high scores for woodland opportunity to upland sites with only limited areas potentially available for planting.

### 6.1 Farm 1

A lowland farm close to existing woodland cover in an area believed to have a high proportion of ash woodland.

Farm 1	Size (ha)	Percentage (%)
Size of landholding	67	100
Area not covered by a Category 1 constraint	60.34	90
Area covered by positive Conservation Woodland Opportunity Score	50.07	75
Area cover by a Conservation Woodland Opportunity Score equivalent to at least 2 overlapping high priority factors	37.04	55
Area covered by highest 30% of Conservation Woodland Opportunity Scores	12.64	19

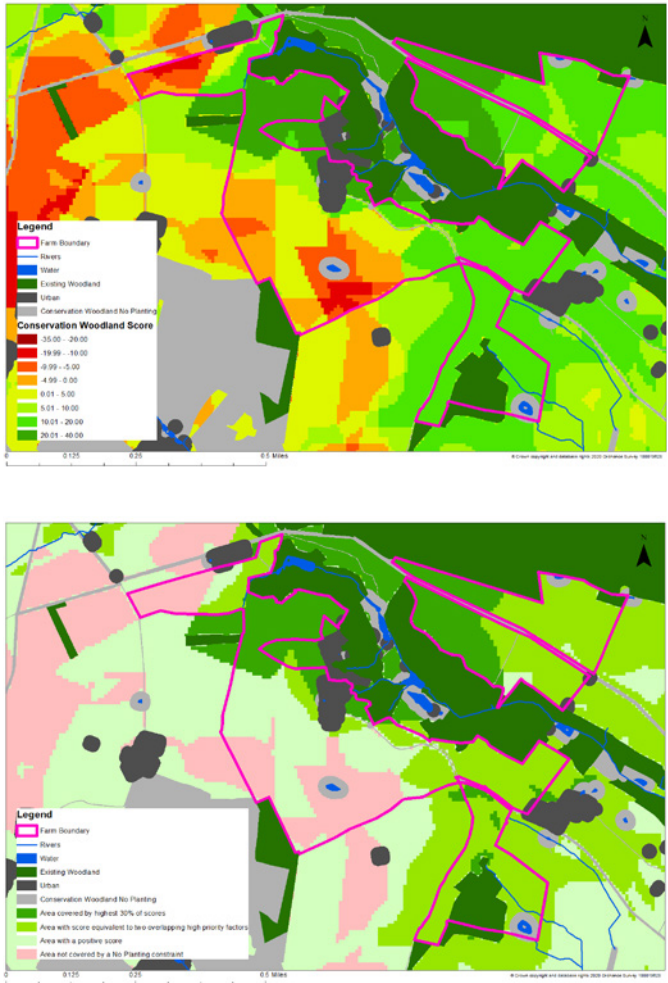


Fig. 8. **Conservation Woodland** Opportunity Score at Farm 1 **a)** as a continuum from high to low and **b)** categorised by level of priority.

### 6.1.1 Farm 1 areas excluded from tree planting

Areas identified as 'no planting' on site include the footprint of farm buildings and a small buffer around ponds.

### 6.1.2 Farm 1 priority areas for tree planting

This site generally scores highly for woodland opportunity with multiple overlapping, positive variables to the north of the site but there are some concerns over wading birds and potential to restore priority habitat to the south of the landholding where overlapping concerns combine to give a low Woodland Opportunity Score.

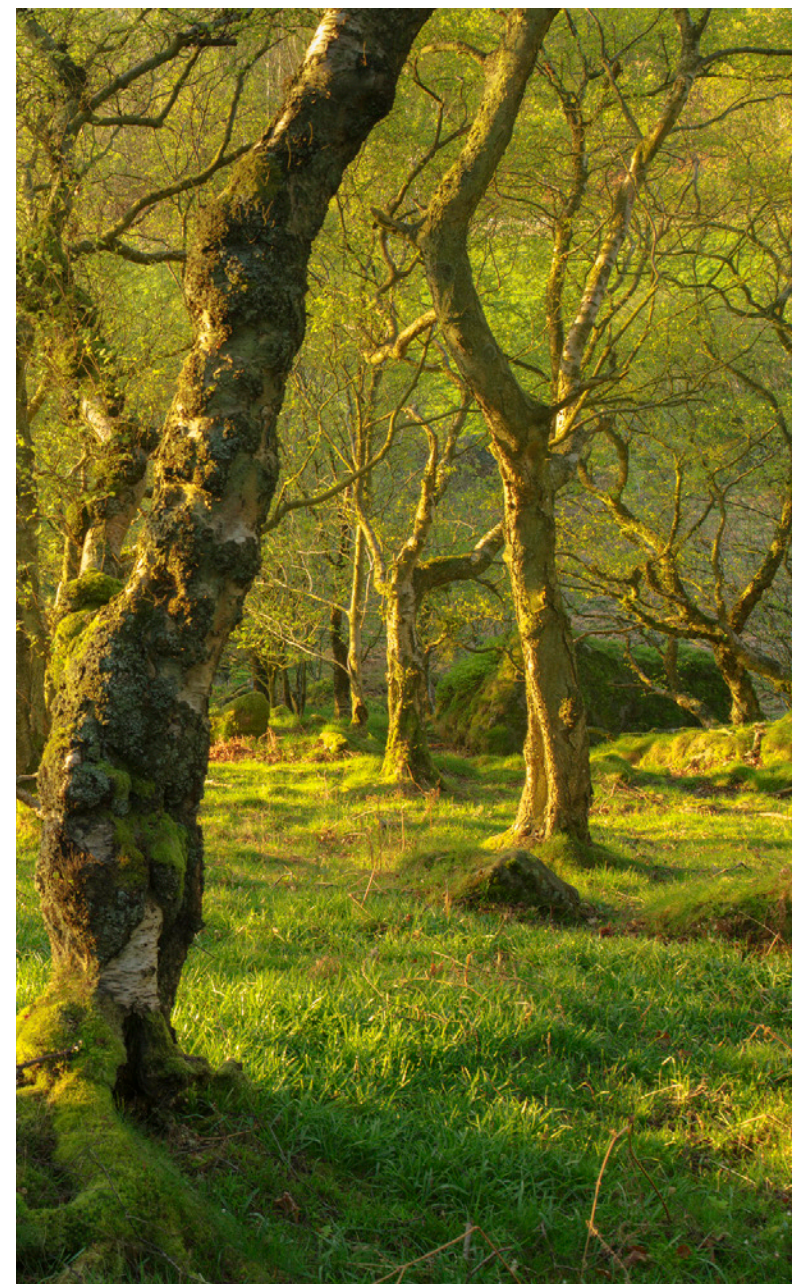
**Hedgerows and woodland connections:** The Woodland Opportunity Score on site generally increases with proximity to hedgerows and woodlands, though existing woodlands areas are mainly located on adjoining land. The highest scores are found to the north of the site and reflect the potential to connect existing woodland blocks. The score for connections on this site is particularly high, both because connections between more than two woodlands are possible and because at least one of the woodlands is a large woodland block with wider network connections. There is also a recently felled/windblow area within the southern section of the site that could provide a potential replanting site.

**Ash woodland:** The overall Woodland Opportunity Score for the northern section and most of the central section of the site is also elevated as the existing nearby woodland has a high proportion of ash trees and the area is a priority for tree planting to help offset the potential impact of ash dieback and the loss of ash trees.

**Ground nesting birds:** The southern section of the site has much lower Woodland Opportunity Scores. This is a reflection of the greater distance from woodland, but also because both the Habitat Suitability Model (HSM) and older survey data suggests there is potential for breeding waders on site. If more recent survey data were available, it is likely that this southern corner would be excluded from tree planting. Surveys for wading birds would need to be a priority for this area of the site.

**Potential for other habitats:** Data from Natural England also suggests that there is potential to restore or create priority habitat in the southern corner of the landholding.

**CSS Agreement:** One minor negative factor for tree planting across the site, is the existing Countryside Stewardship Scheme agreement, which could complicate tree planting plans as Natural England consent would be required to alter the agreement. This applies to all but the southernmost section of the site.





6.2 Farm 2

An upland farm with areas of heathland and species rich grassland with known populations of breeding waders and significant areas of underground infrastructure.

Farm 2	Size (ha)	Percentage (%)
Overall size of landholding	191	100
Area not covered by a Category 1 constraint	10.3	5.4
Area covered by positive Conservation Woodland Opportunity Score	1.7	0.9
Area cover by a Conservation Woodland Opportunity Score equivalent to at least 2 overlapping high priority factors	0.44	0.2
Area covered by highest 30% of Conservation Woodland Opportunity Scores	0.13	0.01

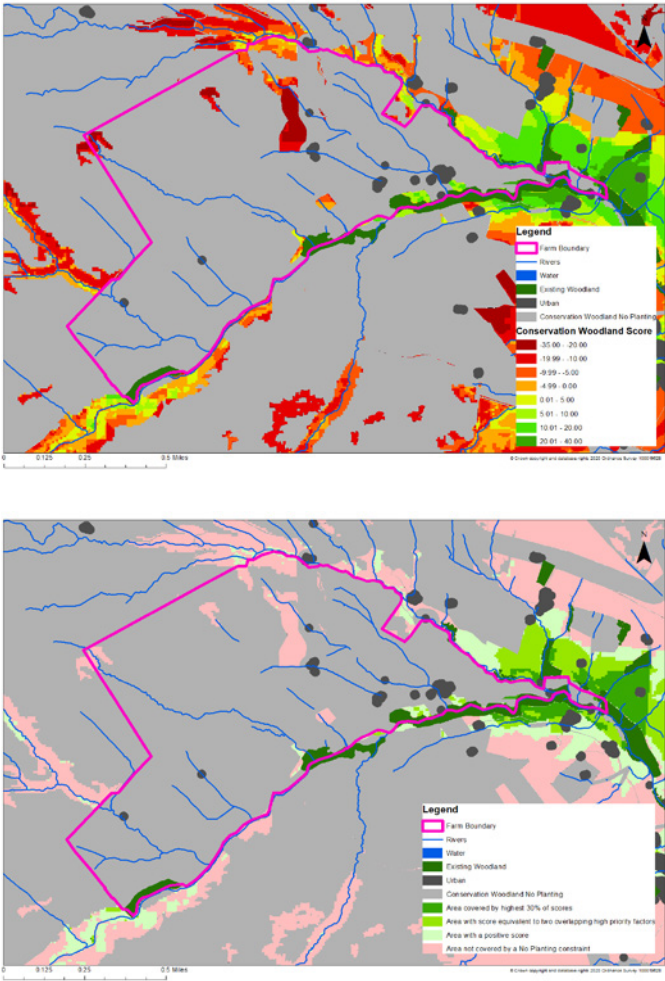


Fig. 9. **Conservation Woodland** Opportunity Score at Farm 2 **a)** as a continuum from high to low and **b)** categorised by level of priority.

6.2.1 Farm 2 areas excluded from tree planting

The Woodland Opportunity Maps suggest that the majority of this landholding is not suitable for tree planting due to strong environmental constraints. Examination of the individual variables making up the ‘no planting’ layer, shows that this is made up of several overlapping concerns.

**Priority habitats:** The northern area of the site, and a small section of land in the south east of the site, contains heathland priority habitat. Some small gill areas within the heathland are considered potentially suitable for planting but are low scoring so there would be trade-offs involved for biodiversity in planting in these areas.

**Ground nesting birds and species rich grassland:** The majority of the grassland on site is known to be suitable for ground nesting birds (survey data within last five years) and this has meant that most grassland areas are excluded. Other grassland field parcels have been excluded because they contain species rich grassland and in some cases these two exclusions overlap.

**Underground infrastructure:** A linear sweep of land within the centre of the landholding, with a similar orientation to the east-west farm track is not suitable for tree planting due to a network of underground infrastructure, relating to nearby reservoirs, which runs through the landholding. The Woodland Opportunity

Plan includes a no dig exclusion zone of 75m either side of this infrastructure. This buffer accounts for uncertainty in the location of infrastructure and the lateral growth of tree root systems.

6.2.2 Farm 2 priority areas for tree planting

**Proximity to existing woodland:** The highest scoring areas are close to the river at the south of the landholding and score highly because of proximity to existing woodland and proximity to the river to help reduce flood risk. The lower elevation within the gill location reduces the visual impact of the woodland and the impact of the woodland on nearby wading birds.

**Gill locations:** There are also three smaller gill locations where woodland planting has not been excluded. These locations are lower scoring as there is no existing woodland. The biodiversity trade-offs implicit in the low Woodland Opportunity Score would mean that site visits and surveys would be required before any tree planting could be supported.

**Ground nesting birds:** A central field that was surveyed in 2016 and no breeding waders were recorded and so has not been excluded from the Woodland Opportunity Plan. On the basis of this one year survey, planting in this field parcel would not directly remove breeding wader habitat but a one year survey can miss areas not used by birds in that particular year and planting on this

field could also lead to increased predation of ground nesting birds. The HSM model suggests that this field is suitable for wading birds and so it has a negative woodland opportunity score.

6.3 Farm 3

A diverse farm covering several land parcels. The land parcel described below is in close proximity to a SSSI and has heathland elements. There are concerns for several priority species on site: adder, water vole and ground nesting birds. However, there are also significant woodland opportunities close to existing woodland. The table below describes opportunities across the wider landholding.

Farm 3	Size (ha)	Percentage (%)
Size of landholding	330	100
Area not covered by a Category 1 constraint	187	57
Area covered by positive Conservation Woodland Opportunity Score	74	22
Area cover by a Conservation Woodland Opportunity Score equivalent to at least 2 overlapping high priority factors	25	4
Area covered by highest 30% of Conservation Woodland Opportunity Scores	2	1

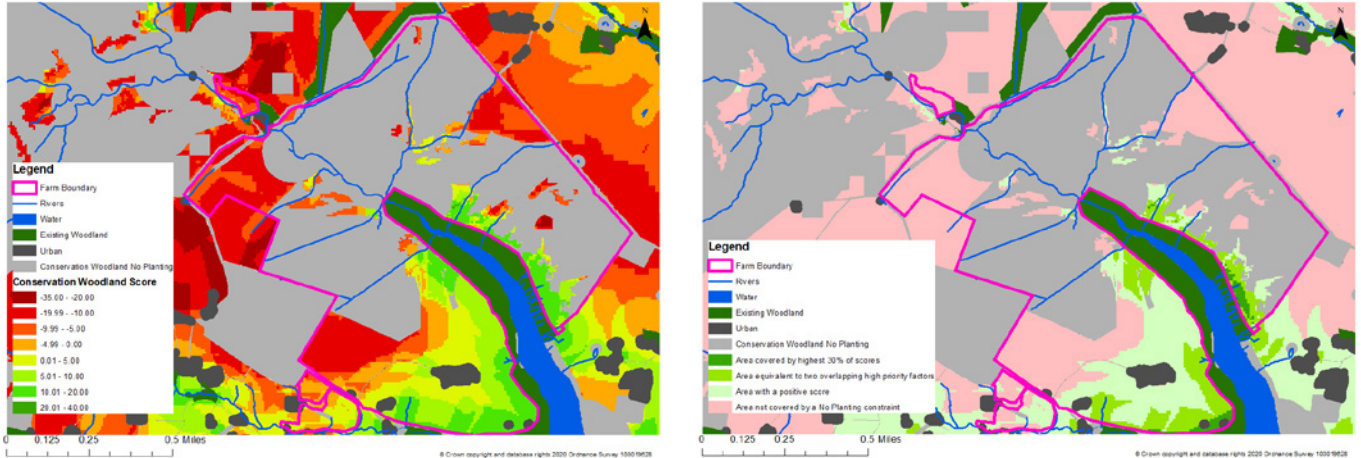


Fig. 10. Conservation Woodland Opportunity Score at Farm 3 a) as a continuum from high to low and b) categorised by level of priority.



### 6.3.1 Farm 3 areas excluded from planting

**Priority habitat:** A large swathe of land has been excluded from planting as it contains priority heathland habitat.

**Water voles and adders:** There are records for both water voles and adders on site. Both are vulnerable priority species in the AONB and can be negatively affected by tree planting. A 150 m buffer zone around the water vole and adder records has been excluded from planting to safeguard areas of likely water vole territory and adder hibernations sites. However, site surveys for both water voles and reptiles are recommended to confirm the presence of water vole and adders and more accurately safeguard their habitat.

**Urban land use:** farm buildings are excluded from planting.

### 6.3.2 Farm 3 priority areas for tree planting

**Ground nesting birds:** Much of the grassland surrounding the priority habitat scores low for woodland opportunity, mainly due to concerns about ground nesting birds both from modelled data and from old survey data.

**SSSI buffer zone and potential to restore and create priority habitat:** Part of the site is within the buffer

zone, or Impact Risk Zone, for the nearby SSSI and there is also potential to restore or create heathland habitat, based on NE data, which further reduces the score in areas close to the priority habitat.

The area not known to support wading birds or priority habitat has a much higher Woodland Opportunity Score, helped by the lack of negative features but also elevated because of positive factors such as:

**Gill location and potential to support adders:** The lower elevation within the gills on site mask the landscape impact of the woodland and reduce its impact on ground nesting birds and are given a higher Woodland Opportunity Score. However, some areas of the gills on site have been flagged as potentially supporting adder hibernation sites and are given a lower Woodland Opportunity Score. The areas identified as having potential for adders are based only on their gill location and aspect but there are records for adder nearby which add greater weight to the predicted adder potential on site. A site survey is recommended to check for adders on site and planting plans, particularly within gills, should accommodate their needs.

**Proximity to woodland and hedgerows:** Areas close to the woodland on site have a higher score, particularly because the existing woodland is SINC woodland and because the hedgerows (largely off site) are of relatively longer length and connectivity. There is some potential to connect woodland in this area but the connection

potential falls just outside the ownership boundary.

**Bracken cover:** Bracken cover has been given a positive score in the Woodland Opportunity Score, as it suggests gaps in priority habitat. However, this is modelled data and site survey will be important to confirm this.

**Flood attenuation:** There are a number of small tributaries on site which feed into the nearby reservoir, and the buffer area for each stream is given an elevated Woodland Opportunity Score to reflect the benefits of tree planting for flood attenuation.

## 6.4 Findings from the example farms

Examining the Woodland Opportunity Maps at a farm scale was crucial in refining the maps and several changes were made to the variables and scores in *Annex 2 on page 27* based on looking at familiar landholdings in detail, particularly in the weighting given to ground nesting birds.

The work at a farm scale also demonstrates the importance of being able to interpret the model with reference to the underlying layers that make up the and identify why certain areas have a low score. The maps provide a useful summary for landowners and partners as to the woodland opportunity at a site, but the underlying data behind the final scores will still be very important.

The Woodland Opportunity Plan is not intended to replace site visits, but the ground testing demonstrates some advantages of the Woodland Opportunity Plan over site survey by itself:

- Impacts can be overlooked if site visits are carried out at the wrong time of year, this is particularly important for the priority species included in the Woodland Opportunity Plan.
- With site visits, some areas off site will not be examined in as much detail, whereas the Woodland Opportunity Plan was able to pick up important woodlands and hedgerows off site that increased the benefits of planting within the landholding.
- The Woodland Opportunity Plan can quickly flag up surveys that should be undertaken, e.g. wading bird, adder and water vole surveys for Farm 3.

Additional 'ground nesting bird' layer created that can be viewed alongside Woodland Opportunity Plan – to emphasise importance of ground nesting birds in the AONB, a stronghold for birds declining nationally.

## 7.0 Putting the Woodland Opportunity Maps into practice

By applying a novel mapping approach, we have been able to quantify the potential for woodland planting across Nidderdale AONB, identify areas where tree planting would not be supported and pinpoint priority areas where tree planting could have the most environmental benefits. This is possible both a landscape scale and at the scale of individual landholdings.

Over the next five years, the new Woodland Opportunity Maps will enable the AONB team and partner organisations to:

- **Pinpoint priority areas where tree planting will have the most benefit**

Trees planted in one place will not bring about the same level of environmental benefits as trees planted in another location. The Woodland Opportunity mapping provides an important tool that can help identify the best areas to plant trees in Nidderdale AONB. Planting trees in these priority areas will maximise environmental benefits with minimal negative impacts. The priority areas identified in the woodland mapping will be the focus of our tree planting efforts in Nidderdale AONB over the next five years.

High scoring areas identified through this Woodland Opportunity mapping will also be prioritised as the focus for new woodland creation in our planned Nature Recovery Network Strategy which will be our proactive approach to nature recovery as required under the 25 Year Environment Plan<sup>38</sup>.

- **Work more effectively**

The Nidderdale AONB team is small and this plan will help magnify our impact. The Woodland Opportunity Maps will allow us to triage tree planting enquiries, quickly identifying and supporting those that fall in priority areas and providing timely advice to landowners with ambitions to plant in areas where high environmental impact is likely. We want to move from a reactive approach, working with farmers who have expressed an interest in planting certain areas, to helping landowners to choose the areas of their land that would provide higher environmental benefits and proactively approaching landowners of high priority land to make them aware of the potential benefits of tree planting.

- **Provide a platform for landowner engagement**

By making the Woodland Opportunity Maps widely available and easily accessible as [web maps](#)<sup>39</sup>, it is hoped that landowners can confidently take the



initiative and use the maps to choose areas of land that suit their farm business but that also provide the highest level of environmental benefit. Matching their land to the environmental opportunity map will help landowners to gain support from the AONB and wider stakeholders, enabling them to receive planning support, support for grant applications, and input from our Nidderdale Conservation Volunteers to help with tree planting.

- **Provide a comprehensive map based assessment of a site to complement site by site appraisals**

The new maps capture the use of the land by protected species in previous years or in other seasons, something that may be missed in a one-off site visit. The maps also take into account benefits from woodland and hedgerows outside the immediate landholding which can be difficult to achieve on site visits. This is the first time that all our environmental data has been pulled together into one streamlined map and in a format where environmental constraints can be evaluated alongside other environmental opportunities. However, though the plan augments our knowledge and helps us plan strategically, site visits are still important to assess local environmental factors that could not be mapped, to address landscape concerns and to choose the right tree species.

- **Provides a focus for sub-projects that can drive an increase in woodland cover**

As well as the two main Woodland Opportunity Maps, the individual map layers derived for the Woodland Opportunity Plan have the potential to direct targeted tree planting projects. For example, we can now identify locations where riparian planting for shading will be of most benefit, and areas where small amounts of tree planting can create much wider network connections, including connections that link and extend ancient woodland or link to large existing woodland networks. These individual layers are powerful tools for achieving specific tree planting aims.

- **Allow us to move forward to set realistic contributions to regional and national targets**

The Woodland Opportunity Maps have allowed us to estimate how much of the AONB is largely free of environmental constraints and potentially available for woodland planting. We will use this new knowledge as a basis for setting realistic targets in the Nidderdale AONB Management Plan<sup>40</sup>.

Although the Woodland Opportunity Plan mapping does show that the land available for planting without significant biodiversity concerns exceeds the area required to bring the AONB in line with regional and national targets (just over 15,000 ha

of the AONB has a positive woodland opportunity for Conservation Woodland planting and 6,800 ha for Productive Woodland planting), it is important to consider this in conjunction with the other constraints to tree planting. These include landowner consent, landscape factors and factors only identifiable by site inspection. Taken together, this means that flexibility within the AONB for tree planting is relatively low.

To articulate the challenge we would face in trying to achieve regional and national targets in the AONB, we can compare the total area with a positive woodland opportunity score to the area representing regional and national targets as a ratio (see [\*Annex 1 on page 26\*](#)). These 'success ratios' expresses the number of hectares potentially available in the AONB for every 1 ha of tree planting required to meet regional and national targets. For example, the success ratio for Conservation Woodland would be 1:12 to meet the 25 year plan target: one hectare out of each 12 potentially available would need to be planted to meet this national target. The success ratios become more challenging for higher tree planting targets, with a ratio of 1:9 to meet the White Rose Forest regional target and a ratio of 1:6 to meet the lowest threshold of the Committee for Climate Change (CCC) target.

These success ratios suggest that meeting regional and national targets in our protected upland landscape will be challenging, especially if we want to create high quality woodland in the right places for maximum environmental benefit. We will likely have to acknowledge that higher, carbon based, tree planting targets such as the CCC target will be difficult to achieve in protected landscapes like Nidderdale AONB. To deliver on climate change mitigation, we will work in parallel to improve the condition of our heathland and moorland habitats which play an equally vital role in sequestering carbon and attenuating flood risk. We will also maximise our impact by making each hectare of new woodland as effective as it can be through targeting locations that deliver high environmental benefit and cause minimal environmental harm.

Delivering enhanced levels of woodland creation requires significant financial resources, both to fund tree planting and maintenance and to provide staff time to encourage and support planting schemes. We have started to meet this challenge by employing a dedicated Woodland Officer, with funding from the Woodland Trust, to provide free advice to local landowners and to lever in as much woodland funding as possible in to the AONB

Our contribution to regional and national tree planting targets needs to take account of the

immovable environmental constraints quantified in the Woodland Opportunity Plan and the relatively high existing woodland cover in lowland areas that are most suitable for tree planting, as well as acknowledging the significant contribution of other priority habitats to carbon sequestration.

- **Provides a framework that could be adapted for other priority habitats**

The GIS analyses utilised here for woodland opportunity could also be adapted for other key habitat types in Nidderdale AONB, potentially as part of work to develop a comprehensive Nature Recovery Network for the AONB. Considering woodland in isolation is not ideal, as it may mean that trees are planted on areas that would also be suitable for priority moorland, grassland and wetland habitats. These habitats have more precise environmental requirements than woodland, and therefore less suitable land available for restoration and creation, and should perhaps be prioritised at suitable locations above woodland planting. National models exist for these priority habitats, and have been included as Category 2 constraints in both woodland maps (see [Annex 2 on page 27](#)). However, habitat data obtained through our The Wild Watch project could help improve these national initiatives for use at a local scale and the GIS technique of raster overlay could allow several

competing factors to be more effectively combined.

- **Provides a model that could be adapted for other locations**

There is potential to employ this landscape scale analyses to identify opportunities for woodland planting in other areas of the country. The flexibility of the scoring system means that weightings can be altered, and parameters substituted, to suit local priorities and local data sets. The method could be employed over a much larger area, with only minimal increase in the time needed to prepare data sets and run the raster overlay. If a similar analysis was repeated across other areas, it would be possible to build up a national picture of where planting opportunities exist and how much each area could feasibly contribute to regional and national targets. Some form of 'from the ground up' analyses to support woodland planting could really help to implement the national 'top down' targets.

You can view the Nidderdale AONB Woodland Opportunity Maps and a supporting Story Map on our website at:  
[nidderdaleaonb.org.uk/treeplantingadvice](https://nidderdaleaonb.org.uk/treeplantingadvice)



## References

- 1 Maskell, L.C.; Henrys, P.A.; Norton, L.R.; Smart, S.M.; Wood, C.M. (2013). *Distribution of ash trees within areas less than half a hectare in Great Britain*. NERC Environmental Information Data Centre. Available from <https://doi.org/10.5285/7f7c99c7-5457-444d-978a-fe7b01a85fd0>
- 2 Nidderdale AONB (2006) *New Native Woodlands for Nidderdale Area of Outstanding Natural Beauty: Opportunities Plan*. Available from <https://www.ruraldevelopment.org.uk/yorwoods/files/2012/11/Nidderdale-Woodland-Opportunities-Plan1.pdf>
- 3 Defra (2020) *Nature Recovery Network*. Available from <https://www.gov.uk/government/publications/nature-recovery-network/nature-recovery-network>
- 4 Forestry Commission (2018) *National Forest Inventory Woodland England 2018*. Available from [http://data-forestry.opendata.arcgis.com/datasets/295e0278dc2641e2935c411d28908be9\\_0](http://data-forestry.opendata.arcgis.com/datasets/295e0278dc2641e2935c411d28908be9_0)
- 5 Forestry Commission (2018) *National Forest Inventory Woodland England 2018*, as above.
- 6 Natural England (2020) *Ancient Woodland (England)*. Available from <https://data.gov.uk/dataset/9461f463-c363-4309-ae77-fdc7e9df7d3/ancient-woodland-england>
- 7 Nidderdale AONB (2006) *New Native Woodlands for Nidderdale Area of Outstanding Natural Beauty: Opportunities Plan*, as above.
- 8 Maskell et al (2013) *Distribution of ash trees within areas less than half a hectare in Great Britain*. NERC Environmental Information Data Centre, as above.
- 9 Nidderdale AONB (2006) *New Native Woodlands for Nidderdale Area of Outstanding Natural Beauty: Opportunities Plan*, as above.
- 10 Forestry Commission (2018) *National Forest Inventory Woodland England 2018*, as above.
- 11 Nidderdale AONB (2019) *Nidderdale AONB Management Plan 2019-2024*. Available from <https://nidderdaleaonb.org.uk/aboutus/management-plan-annual-review/>
- 12 Forestry Commission (2017) *The UK Forestry Standard*. Available from [https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment\\_data/file/687147/The\\_UK\\_Forestry\\_Standard.pdf](https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/687147/The_UK_Forestry_Standard.pdf)
- 13 Forestry Commission (2017) *The UK Forestry Standard*, as above.
- 14 Forest Research (2020) *Ecological Site Classification Decision Support System (ESC-DSS)*. Available from <https://www.forestryresearch.gov.uk/tools-and-resources/ecological-site-classification-decision-support-system-esc-dss/>
- 15 White Rose Forest website- see <https://www.kirklees.gov.uk/beta/white-rose-forest/index.aspx>
- 16 Defra (2018) *A Green Future: Our 25 Year Plan to Improve the Environment*. Available from <https://www.gov.uk/government/publications/25-year-environment-plan>
- 17 Committee for Climate Change (2020) *Land Use: Policies for a Net Zero UK*. Available from <https://www.theccc.org.uk/publication/land-use-policies-for-a-net-zero-uk/>
- 18 Nidderdale AONB (November 2020) *Woodland Opportunity Maps*. Available from <https://harrogatebc.maps.arcgis.com/apps/webappviewer/index.html?id=04ded7e4c3eb458ca99224cdabb1664>
- 19 Nidderdale AONB The Wild Watch project - see <https://nidderdaleaonb.org.uk/about-us/nidderdale-aonb-projects/the-wild-watch/>
- 20 Geographic Information Technology Training Alliance (2013) *Overlay*. Available from [http://www.gitta.info/Suitability/en/html/BoolOverlay\\_learningObject1.htm](http://www.gitta.info/Suitability/en/html/BoolOverlay_learningObject1.htm)
- 21 Forestry Commission (2017) *The UK Forestry Standard*, as above.
- 22 Nidderdale AONB (November 2020) *Woodland Opportunity Maps*, as above.
- 23 Nidderdale AONB (2006) *New Native Woodlands for Nidderdale Area of Outstanding Natural Beauty: Opportunities Plan*, as above.
- 24 Forest Research (2020) *Ecological Site Classification Decision Support System (ESC-DSS)*, as above.
- 25 Woodland Trust (2012) *Planting trees to protect water: The role of trees and woods on farms in managing water quality and quantity*. Available from <https://www.woodlandtrust.org.uk/media/1818/planting-trees-to-protect-water.pdf>
- 26 Environment Agency (2011) *Woodland for Water: Woodland measures for meeting Water Framework Directive objectives*. Available from [https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment\\_data/file/291522/scho0711btyr-e-e.pdf](https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/291522/scho0711btyr-e-e.pdf)
- 27 RSPB (2020) *Woodlands for climate and nature: A review of woodland planting and management approaches in the UK for climate change mitigation and biodiversity conservation*. Available from [https://ww2.rspb.org.uk/Images/Forestry%20and%20climate%20change%20report%20Feb%202020\\_tcm9-478449.pdf](https://ww2.rspb.org.uk/Images/Forestry%20and%20climate%20change%20report%20Feb%202020_tcm9-478449.pdf)
- 28 Nidderdale AONB (2006) *New Native Woodlands for Nidderdale Area of Outstanding Natural Beauty: Opportunities Plan*, as above.
- 29 Nidderdale AONB (November 2020) *Woodland Opportunity Maps*, as above.
- 30 McKay, H. (ed.) (2011) *Short Rotation Forestry: review of growth and environmental impacts*. Forest Research Monograph, 2, Forest Research, Surrey, 212pp. Available from <https://www.forestryresearch.gov.uk/research/short-rotation-forestry-review-of-growth-and-environmental-impacts/>
- 31 RSPB (2020) *Woodlands for climate and nature*, as above.
- 32 Forestry Commission (2020) *Soil moisture data for four sites from a study of the impact of woodland on water resources (TADPOLE project, Clipstone)*. Available from <https://data.gov.uk/dataset/b39f9da9-5b39-44e6-8d2d-347aa5b0b096/soil-moisture-data-for-four-sites-from-a-study-of-the-impact-of-woodland-on-water-resources-tadpole-project-clipstone>
- 33 Nidderdale AONB (2006) *New Native Woodlands for Nidderdale Area of Outstanding Natural Beauty: Opportunities Plan*, as above.
- 34 Committee for Climate Change (2020) *Land Use Policies for a Net Zero*, as above.
- 35 Forestry Commission (2017) *The UK Forestry Standard*, as above.
- 36 Nidderdale AONB (November 2020) *Woodland Opportunity Maps*, as above.
- 37 Nidderdale AONB Tests and Trials website - see <https://nidderdaleaonb.org.uk/about-us/nidderdale-aonb-projects/tests-and-trials/>
- 38 Defra (2018) *A Green Future: Our 25 Year Plan to Improve the Environment*, as above.
- 39 Nidderdale AONB (November 2020) *Woodland Opportunity Maps*, as above.
- 40 Nidderdale AONB (2019) *Nidderdale AONB Management Plan 2019-2024*, as above.

## Annex 1

Regional and National planting targets set within the context of Nidderdale AONB and the **Conservation Woodland** Opportunity Mapping.

Source	25 Year Environment Plan (2018) 12% woodland cover in <b>England</b> by 2060 (planting by 2042)	White Rose Forest (2020) Increase woodland cover by <b>1/3</b> across the <b>Leeds City Region</b> by 2036	CCC Report (2020) 17 – 19% woodland cover in the <b>UK</b> by 2050
<b>National and Regional context</b>			
Current percentage (%) woodland cover	Currently 10% in England	Currently 11.2% in WRF	Currently 13% in UK
Increase in percentage (%) woodland cover	2% across England	3.4% across WRF	4 – 6% across UK
<b>Nidderdale AONB context – overall planting</b>			
<b>Overall</b> increase in woodland cover area required to meet this target in Nidderdale AONB	1,202 ha	1,560 ha	2,404 – 3,607 ha
Percentage of total Nidderdale AONB area	2% of AONB area	2.6% of AONB area	4 – 6% of AONB area
Percentage of Nidderdale AONB area with no <b>Conservation Woodland</b> Category 1 constraints	4.5% of area with no category 1 constraints	6% of area with no category 1 constraints	9% – 13.5% of area with no category 1 constraints
Percentage of Nidderdale AONB area with no <b>Conservation Woodland</b> negative score	8% of area with no negative score	10% of area with no negative score	16% – 24% of area with no negative score
<b>Nidderdale AONB context – average annual planting</b>			
<b>Annual</b> average planting required to meet this target in Nidderdale AONB	55 ha	60 ha	80 – 120 ha
Percentage of total Nidderdale AONB area	0.09%	0.1%	0.13 – 0.2%
Percentage of Nidderdale AONB area with no <b>Conservation Woodland</b> Category 1 constraints	0.2% of area with no Category 1 constraints	0.22% of area with no Category 1 constraints	0.3% – 0.45% of area with no Category 1 constraints
Percentage of Nidderdale AONB area with no <b>Conservation Woodland</b> negative score	0.36% of area with no negative score	0.39% of area with no negative score	0.5% – 0.8% of area with no negative score
<b>Nidderdale AONB context – ratio of land required to meet regional and national tree planting targets vs land available with positive Woodland Opportunity Score</b>			
Success ratios for <b>Conservation Woodland</b> planting in Nidderdale AONB	1:12	1:9	1:6 – 1:4



## Annex 2

Details of parameters included within the **Conservation Woodland Opportunity Map**, the rationale for inclusion and data sources.

Ref.	Category	Parameter	Opportunity/ Constraint	Conservation Woodland Score	Data layer description	Rationale for inclusion and score	Data source
CW1	Access	Proximity to roads and tracks	Opportunity	Not scored	Not scored	Originally included but removed in later versions. Few areas, not already covered by a Category 1 factor, are not within 500m from a road.	Not scored
CW2	Biodiversity	Bracken coverage	Not scored	Not scored	Bracken <b>below</b> moorland line- NAONB modelled NVC U20 layer	Uneconomic land with lower biodiversity value- bracken layer less accurate in lowlands so not used (often confused with acid grassland)	Not scored
CW3	Biodiversity	Bracken coverage	Category 2 Constraint	5	Bracken <b>above</b> moorland line- NAONB modelled NVC U20 layer	Uneconomic land with lower biodiversity value than surrounding upland habitat- more accurate in upland areas as less confusion with heathland habitats	Nidderdale AONB (2020a)
CW4	Biodiversity	Upland Gills	Category 2 Constraint	5	Areas above moorland line, within 100 m of a tertiary or secondary stream and above a set slope threshold	Biodiversity gains from gill woodland, topography reduces predator impact of woodland on breeding waders.	Nidderdale AONB (2020b) based on Rural Payment Agency (undated) and Environment Agency (2013a)
CW5	Biodiversity	Foraging bats- gaps in connectivity	Category 2 Constraint	3	Gaps in connectivity for foraging bats identified via HSM analysis	Increased connectivity for foraging bats	Nidderdale AONB (2015) based on Brown (2013)
CW6	Biodiversity	Buffer to designations	Category 2 Constraint	-1	SSSI Impact Risk Zones	To buffer potential impact on designated land.	Natural England (2020a)
CW7	Biodiversity	Designations	Category 2 Constraint	-2	SSSI, SPA and SAC	Designation reflects national importance of site and administrative constraints- however biodiversity value more strongly represented by PHI variable	Natural England (2020b), Natural England (2020c) and Natural England (2020d)
CW8	Biodiversity	Designations	Category 2 Constraint	-3	SINCs (Sites of Importance for Nature Conservation)	Designation given higher score than SSSI as important habitats outside SSSIs not reliably represented in PHI and can often be the only area of high biodiversity value in wider area	North Yorkshire County Council (2019a)
CW9	Biodiversity	Restoration potential for priority habitats	Category 2 Constraint	-4	Location of restoration, buffer and join zones	Shows potential for restoration of other priority habitat	Nidderdale AONB (2020b) based on Forestry Commission (2018)

Ref.	Category	Parameter	Opportunity/ Constraint	Conservation Woodland Score	Data layer description	Rationale for inclusion and score	Data source
CW10	Biodiversity	Priority Habitats	Category 2 Constraint	-5	Modelled heathland and moorland outside PHI	To protect priority habitats	Nidderdale AONB (2020b)
CW11	Biodiversity	Priority Habitats	Category 1 Constraint	No planting	Extent of Priority Habitat Inventory (PHI)- minus gills + bracken coverage	To protect priority habitats	Natural England (2019c)
CW12	Biodiversity	Priority Habitats	Category 1 Constraint	No planting	Location of known species rich hay meadows (not in PHI). Includes recently restored meadows	To protect priority habitats	Nidderdale AONB (2020b)
CW13	Biodiversity	Ground nesting birds	Category 1 Constraint	No planting	Data <b>within last 5 years</b> . Location of breeding ground nesting birds. Some surveys field parcel based others buffered grid references.	Direct loss of breeding habitat in immediate planting area and anticipated increase in predation if planted close to breeding habitat	Yorkshire Water Services (2016), Nidderdale AONB (2017) and Nidderdale AONB (2019)
CW14	Biodiversity	Ground nesting birds	Category 2 constraint	-5	Data <b>older than 5 years</b> . Location of breeding ground nesting birds. Some surveys field parcel based others buffered grid references.	Direct loss of breeding habitat in immediate planting area and anticipated increase in predation if planted close to breeding habitat	Nidderdale AONB (2012) and Natural England (2006)
CW15	Biodiversity	Ground nesting birds	Category 2 Constraint	-5	More than 2 species combined HSM modelled data for curlew, lapwing, snipe and skylark + 100 m buffer	Direct loss of breeding habitat in immediate planting area and anticipated increase in predation if planted close to breeding habitat	Nidderdale AONB (2018)
CW16	Biodiversity	Ground nesting birds	Category 2 Constraint	-5	Only 1 species combined HSM modelled data for curlew, lapwing, snipe and skylark + 100 m buffer	Direct loss of breeding habitat in immediate planting area and anticipated increase in predation if planted close to breeding habitat	Nidderdale AONB (2018)
CW17	Biodiversity	Reptiles	Category 1 Constraint	No planting	Buffer around known adder hibernation records	Adders are in decline and their habitat needs to be protected-trees create shading which could be detrimental at hibernation sites	Nidderdale AONB (2020b)
CW18	Biodiversity	Reptiles	Category 2 Constraint	-5	Gill locations identified using aspect criteria based on NAONB adder hibernation records	Adders are in decline and their habitat needs to be protected-trees create shading which could be detrimental at hibernation sites	Nidderdale AONB (2020b)
CW19	Biodiversity	Reptiles	Not scored	Not scored	Not scored	Priority habitat layers effectively cover known adder foraging records	Nidderdale AONB (2020b)



Ref.	Category	Parameter	Opportunity/ Constraint	Conservation Woodland Score	Data layer description	Rationale for inclusion and score	Data source
CW20	Biodiversity	Grasslands within woodland	Category 2 Constraint	-5	Grasslands isolated from NFI layer	Includes woodland rides and glades- assumed likely to have diverse ground flora	Forestry Commission (2018)
CW21	Biodiversity	Buffer around open water habitat	Category 1 Constraint	No planting	25 m buffer around reservoirs and ponds	Avoid planting close to ponds to reduce shading and eutrophication	Ordnance Survey (2020) and Nidderdale AONB (2019b)
CW22	Biodiversity	Moorland line	Not scored	No planting	Land above the moorland line	Land potentially available for priority habitat restoration and landscape impacts	Rural Payment Agency (undated)
CW23	Biodiversity	Water vole	Category 1 Constraint	No planting	150 m buffer around known water vole records	Trees can shade out water vole target food plants and harbour predators	Nidderdale AONB (2020b)
CW24	Climate change	Biodiversity	Not scored	Not Scored	Not Scored	To allow for species movement to mediate for climate change. Parameter difficult to capture in WOP.	Not scored
CW25	Climate change	Biodiversity	Not scored	Not scored	Not Scored	Habitat data not good enough to sufficiently differentiate habitat across AONB. Most habitats with high sequestration rate already identified as Category 1 constraint	Not scored
CW26	Environmental limits	Max elevation	Category 2 Constraint	-3	Elevation above 500 m	Potential maximum elevation for broadleaf trees	Nidderdale AONB (2020a)
CW27	Environmental limits	Slope	Not scored	Not scored	Not scored	Slope not seen as barrier to conservation woodland planting	Not scored
CW28	Environmental limits	Yield class	Not scored	Not scored	Not scored	Yield class not viewed as a key variable for conservation woodland- tree species can be chosen to best suit site	Not scored
CW29	Environmental limits	Soil wetness	Not scored	Not Scored	Not Scored	Few soils in NAONB outside heathland areas are too wet for planting- heathland areas protected as Category 1 constraint- selection of species can moderate soil constraints	Not scored
CW30	Environmental limits	Soil fertility	Not scored	Not Scored	Not Scored	Soil fertility will affect yield and growth rates not survival rate- not key criteria for conservation woodland- careful selection of species can overcome soil constraints	Not scored
CW31	Environmental limits	Preferred aspect	Not scored	Not Scored	Not Scored	Aspect will affect yield and growth rate not survival rate- not key criteria for conservation woodland- careful selection of species can moderate site constraints	Not scored
CW32	Environmental limits	Mitigation of noise/air pollution	Not scored	Not scored	Not Scored	Buffer for air pollution- would largely be a repeat of the road access buffer so not scored	Not scored
CW33	Environmental limits	Landscape impact	Not scored	Not scored	Not Scored	Landscape outside remit of the plan- parameters difficult to map effectively	Not scored

Ref.	Category	Parameter	Opportunity/ Constraint	Conservation Woodland Score	Data layer description	Rationale for inclusion and score	Data source
CW34	Environmental limits	Historical woodland extent	Not scored	Not scored	Not Scored	Current format of historic maps did not support inclusion	Not scored
CW35	Heritage	World Heritage Sites buffer zone	Not scored	Not scored	Not scored	There may be some potential for small areas of conservation woodland planting within larger area subject to site appraisal	English Heritage (2020a)
CW36	Heritage	World Heritage Sites core zone	Category 1 Constraint	No Planting	Extent of <b>Core</b> World Heritage Site layer	To protect heritage assets- highest constraints in core zone	English Heritage (2020a)
CW37	Heritage	Battlefields	Not scored	Not scored	Not scored	No battlefield on English Heritage database within NAONB	Not scored
CW38	Heritage	Scheduled Ancient Monuments	Category 1 Constraint	No planting	Extent of Scheduled Monuments + 150 m buffer	To reduce impacts on archaeological features	English Heritage (2020b)
CW39	Heritage	Historic Environment Record	Category 1 Constraint	No planting	Extent of Historic Environment Record + 150 Buffer	To reduce impacts on archaeological features	North Yorkshire County Council (2020a)
CW40	Heritage	Geological heritage	Category 1 Constraint	No planting	Extent of Local Geological Sites + 150m buffer	To reduce impact on geological features	North Yorkshire Geological Partnership (undated)
CW41	Land use/ ownership	Control of land use and management	Category 2 Constraint	-2	Land in stewardship (mid-tier), end date before 2025	Reflects added administrative burden in pursuing woodland planting	Natural England (2020e)
CW42	Land use/ ownership	Control of land use and management	Category 2 Constraint	-1	Land in stewardship (higher tier), end date before 2025	Reflects added administrative burden in pursuing woodland planting	Natural England (2020e)
CW43	Land use/ ownership	Control of land use and management	Category 2 Constraint	-2	Land in stewardship (higher tier), end date after 2025	Reflects added administrative burden in pursuing woodland planting	Natural England (2020e)
CW44	Land use/ ownership	Recreational impact	Opportunity	1	100 m buffer around PROW	Positive impact on public access to woodlands	North Yorkshire County Council (2019b), Bradford Metropolitan District Council (2019) and Leeds City Council (2019)
CW45	Land use/ ownership	Ownership	Category 2 Constraint	-2	Extent of common land	Reflects added administrative burden in pursuing woodland planting	North Yorkshire County Council (2020b)
CW46	Land use/ ownership	Economic land use	Category 2 Constraint	-3	Agricultural land classification 1 and 2 only	Productive agricultural land important for maintaining food supply	Natural England (2019d)



Ref.	Category	Parameter	Opportunity/ Constraint	Conservation Woodland Score	Data layer description	Rationale for inclusion and score	Data source
CW47	Land use/ ownership	Underground infrastructure	Category 1 Constraint	No planting	Routes of ethylene pipeline, gas networks and aqueduct data + 50 m buffer, route of culverts + 10 m buffer	No dig areas above and close to underground infrastructure	Yorkshire Water Services (2019), Sabic (2019), Northern Gas Networks (2016) and Environment Agency (2013a)
CW48	Land use/ ownership	Urban land use	Category 1 Constraint	No planting	Urban land use and rural buildings + 20m buffer	Larger scale planting not feasible in urban areas and outside the scope of the plan	Ordnance Survey (2020)
CW49	Land use/ ownership	Reservoir dams and spillways	Category 1 Constraint	No planting	Included in urban layer	Tree planting could damage reservoir infrastructure	Ordnance Survey (2020)
CW50	Tree cover	Proximity to existing woodland greater than 0.5 ha	Opportunity	5	<b>150m</b> buffer around NFI broadleaf woodland (not shrub, felled or windblow)	Provision of protective buffer for existing woodland, source of seed for ground flora, enlarges habitat for woodland fauna	Forestry Commission (2018)
CW51	Tree cover	Proximity to existing woodland >0.5 ha	Opportunity	2	<b>350m</b> buffer around NFI broadleaf woodland (not shrub, felled or windblow)	Provision of protective buffer for existing woodland, source of seed for ground flora, enlarges habitat for woodland fauna	Forestry Commission (2018)
CW52	Tree cover	Proximity to woodland 0.2- 0.5 ha in size	Opportunity	3	150m buffer around smaller woodlands	Protective buffer for existing woodland, enlarged potential habitat for woodland fauna	BlueSky (2017)
CW53	Tree cover	Proximity to recent woodland planting	Opportunity	3	150m buffer around recently planted woodland	Protective buffer for existing woodland, enlarged potential habitat for woodland fauna	Northern Upland Chain LNP (2015) and Nidderdale AONB (2020b)
CW54	Tree cover	Proximity to ancient woodland	Opportunity	3	150m buffer around ancient woodland	Protective buffer for existing high value woodland	Natural England (2020f)
CW55	Tree cover	Proximity to SINC woodlands	Opportunity	3	150m buffer around SINC woodland	Protective buffer for existing high value woodland	North Yorkshire County Council (2019b)
CW56	Tree cover	Connections between woodlands	Opportunity	3	Minor connections within 150m buffer (between 2 woodlands only)	Enlarges habitat and enhances movement	Nidderdale AONB (2020b) based on Forestry Commission (2018)

Ref.	Category	Parameter	Opportunity/ Constraint	Conservation Woodland Score	Data layer description	Rationale for inclusion and score	Data source
CW57	Tree cover	Connections between woodlands (ancient woodland)	Opportunity	5	Connections to ancient woodland within 150m buffer	Enlarges habitat and enhances movement, increases resilience of existing high quality woodland	Nidderdale AONB (2020b) based on Forestry Commission (2018) and Natural England (2020f)
CW58	Tree cover	Connections between woodlands (multiple)	Opportunity	5	Multiple connections within 150m buffer (3 or more connections)	Enlarges habitat and enhances movement	NAONB (2020b) based on Forestry Commission (2018)
CW59	Tree cover	Connections between woodlands (large woodlands)	Opportunity	5	Connections to large woodland networks within 150m buffer (woodland greater than 5000m in perimeter)	Enlarges habitat and enhances large scale movement	NAONB (2020b) based on Forestry Commission (2018)
CW60	Tree cover	Extent of felled and windblow trees	Opportunity	2	Mapped layer isolated from NFI layer	Area where past planting was supported, may potentially contain remnant flora	Forestry Commission (2018)
CW61	Tree cover	Proximity to hedgerows	Opportunity	1	150m buffer around hedgerows greater than 150m in length	Potential seed source for ground flora and enhanced movement of woodland fauna to and from woodland	Scholefield <i>et al.</i> (2016)
CW62	Tree cover	Proximity to hedgerows	Opportunity	3	150m buffer around hedgerows greater than 150m- 500m in length	Potential seed source for ground flora and enhanced movement of woodland fauna to and from woodland	Scholefield <i>et al.</i> (2016)
CW63	Tree cover	Proximity to hedgerows	Opportunity	5	150m buffer around hedgerows greater than 500m in length	Potential seed source for ground flora and enhanced movement of woodland fauna to and from woodland	Scholefield <i>et al.</i> (2016)
CW64	Tree cover	Conifer PAWS sites	Category 2 Constraint	-4	PAWS sites isolated from AWI layer	Constraint to NEW planting- however a potential opportunity for restoration of PAWS through planting of broadleaf trees	Natural England (2020e)
CW65	Tree cover	Existing conifer woodland	Category 2 Constraint	-4	Conifer woodlands isolated from NFI layer	Constraint to NEW planting but potential opportunity to replace with broadleaf trees to enhance biodiversity	Forestry Commission (2018)
CW66	Tree cover	Existing mixed woodland	Category 2 Constraint	-5	Mixed woodland isolated from NFI layer	Constraint to NEW planting but potential opportunity to replace with broadleaf trees to enhance biodiversity	Forestry Commission (2018)
CW67	Tree cover	Mitigation for potential loss of ash trees	Opportunity	1	Ash tree coverage 0.8- 1 ha/km2	To promote tree planting in areas with moderate concentration of ash trees as mitigation for expected tree loss	Maskell, <i>et al.</i> (2013)
CW68	Tree cover	Mitigation for potential loss of ash trees	Opportunity	2	Ash tree coverage 1- 5 ha/km2	To promote tree planting in areas with high concentration of ash trees as mitigation for expected tree loss	Maskell, <i>et al.</i> (2013)



Ref.	Category	Parameter	Opportunity/ Constraint	Conservation Woodland Score	Data layer description	Rationale for inclusion and score	Data source
CW69	Tree cover	Mitigation for potential loss of ash trees	Opportunity	3	Ash tree coverage > 5 ha/km2	To promote tree planting in areas with very high concentration of ash trees as mitigation for expected tree loss	Maskell, <i>et al.</i> (2013)
CW70	Tree cover	Veteran trees	Category 2 Constraint	-5	15- 50m buffer around veteran tree records	Larger preferred buffer to protect veteran trees	NAONB (2012)
CW71	Tree cover	Veteran trees	Category 1 Constraint	No planting	0- 15m buffer around veteran tree records	Minimum buffer required to protect veteran trees	NAONB (2012)
CW72	Tree cover	Wood pasture and parkland	Category 2 Constraint	-3	Extent of wood pasture and parkland BAP layer outside NFI	Constraint for biodiversity and heritage reasons	Natural England (2019a)
CW73	Tree cover	Orchards	Category 2 Constraint	-4	Extent of traditional orchards BAP layer	Constraint for biodiversity and heritage reasons	Natural England (2019b)
CW74	Tree cover	Extent of existing broadleaf woodland > 0.2 ha and hedgerows	Category 1 Constraint	No planting	Location of broadleaf woodland - NFI- NTM	Already existing broadleaf trees	Forestry Commission (2018)
CW75	Tree Cover	Extent of woodland creation grant areas	Category 1 Constraint	No planting	CSS grant layer	Woodland already planned and funded	Natural England (2020e)
CW76	Tree cover	Extent of recent woodland planting	Category 1 Constraint	No planting	Extent of known new broadleaf tree planting	Already existing broadleaf trees	Forestry Commission (2018), Blue Sky (2017), Northern Upland Chain Local Nature Partnership (2015) and Nidderdale AONB (2020b)
CW77	Water quality and quantity	Water supply to wetlands	Category 2 Constraint	-5	250m buffer around lowland Fen priority habitat	To protect complex hydrology of priority habitat	Nidderdale AONB (2020b) based on Natural England (2019c)
CW78	Water quality and quantity	Riparian shading	Opportunity	3	50m buffer around tertiary and secondary streams aligned east west (woodland cover removed)	Riparian shading needed to cool rivers and help mitigate effects of climate change	Nidderdale AONB (2020b) based on Environment Agency (2013a), Forestry Commission (2018) and Bluesky (2017)

Ref.	Category	Parameter	Opportunity/ Constraint	Conservation Woodland Score	Data layer description	Rationale for inclusion and score	Data source
CW79	Water quality and quantity	Mitigation of flood risk	Opportunity	3	50m buffer around river	Tree planting in riparian zone helps slow flow	Environment Agency (2017a)
CW80	Water quality and quantity	Mitigation of flood risk	Opportunity	3	Extent of Flood Zone 2 (outside of riparian zone)	Tree planting in flood zone helps slow flow	Environment Agency (2017b)
CW81	Water quality and quantity	Mitigation of flood risk	Opportunity	3	Gleyed soil (outside riparian and flood zone)	Tree planting on gleyed soils could reduce overland flow	Environment Agency (2017c)
CW82	Water quality and quantity	Acidification	Category 2 Constraint	-1	Extent of acid sensitive surface water bodies	Significant new woodland may increase acid loads in catchments	Environment Agency (2013b)
CW83	Water quality and quantity	Suspended sediment	Opportunity	3	Extent of catchments with sediment (T1) and phosphates from rural areas (T3) pressures	Conservation woodland may reduce sediment loads in catchments	Environment Agency (2013b)
CW84	Water quality and quantity	Water abstraction and availability	Category 2 Constraint	-2	Inner Source Protection Zone	To protect water availability	Environment Agency (2020)
CW85	Water quality and quantity	Water abstraction and availability	Category 2 Constraint	-1	Outer Source Protection Zone	To protect water availability	Environment Agency (2020)
CW86	Water quality and quantity	Water abstraction and availability	Category 2 Constraint	-1	Total Catchment Source Protection Zone	To protect water availability	Environment Agency (2020)
CW87	Water quality and quantity	Water- ponds/ lakes/reservoirs/ rivers	Category 1 Constraint	No planting	Extent of open water and river network	Tree planting not feasible	Ordnance Survey (2020) and Environment Agency (2013a)

Details of parameters included within the **Productive Woodland Opportunity Map**, the rationale for inclusion and data sources.

Ref.	Category	Parameter	Opportunity/ Constraint	Productive Woodland Score	Data layer description	Rationale for inclusion and weighting	Data source
PW1	Access	Proximity to approved roads	Not scored	Not scored	Not Scored	Proximity to road access not seen as a limit to location of Productive Woodland- economically viable to create access tracks	Not scored
PW2	Biodiversity	Bracken coverage	Not scored	Not scored	Bracken <b>below</b> moorland line	Uneconomic land with lower biodiversity- bracken layer less accurate in lowlands (often confused with acid grassland) so not used	Not scored
PW3	Biodiversity	Bracken coverage	Not scored	Not scored	Bracken <b>above</b> moorland line	Productive woodland in these areas would not create enough biodiversity gain to offset potential biodiversity losses	Not scored
PW4	Biodiversity	Upland Gills	Category 1 Constraint	No planting	Areas above moorland line, within 100 m of a tertiary or secondary stream and above a set slope threshold (not south facing)	Productive woodland in these areas would not create enough biodiversity gain to offset potential biodiversity losses	Nidderdale AONB (2020b) based on Rural Payment Agency (undated) and Environment Agency (2013a)
PW5	Biodiversity	Foraging bats- gaps in connectivity	Category 2 Constraint	-5	Gaps in connectivity for foraging bats identified via HSM analysis	Though conifer planting would provide connectivity, broadleaf woodland is preferred in this location	Nidderdale AONB (2015)
PW6	Biodiversity	Buffer to designations	Category 2 Constraint	-5	SSSI Impact Zones	To buffer impact on designated land- higher negative score for conifer woodland	Natural England (2020a)
PW7	Biodiversity	Designations	Category 1 Constraint	No planting	SSSI, SPA and SAC	Plantation woodland not acceptable within designated sites	Natural England (2020b), Natural England (2020c) and Natural England (2020d)
PW8	Biodiversity	Designations	Category 1 Constraint	No planting	SINCs (Sites of Importance for Nature Conservation)	Designation reflects importance of site- productive woodland not suitable	North Yorkshire County Council (2019a)
PW9	Biodiversity	Restoration potential for priority habitats	Category 2 Constraint	-5	Location of restoration, buffer and join zones	Shows potential for restoration of other priority habitat	Nidderdale AONB (2020b) based on Forestry Commission (2018)
PW10	Biodiversity	Priority Habitats	Category 1 Constraint	No planting	Modelled heathland and moorland outside PHI	To protect priority habitats	Nidderdale AONB (2020b)
PW11	Biodiversity	Priority Habitats	Category 1 Constraint	No planting	Extent of Priority Habitat Inventory (PHI) (minus gills and bracken coverage)	To protect priority habitats	Natural England (2019c)



Ref.	Category	Parameter	Opportunity/ Constraint	Productive Woodland Score	Data layer description	Rationale for inclusion and weighting	Data source
PW12	Biodiversity	Priority Habitats	Category 1 Constraint	No planting	Location of known species rich hay meadows (outside PHI). Includes recently restored meadows	To protect priority habitats	Nidderdale AONB (2020b)
PW13	Biodiversity	Ground nesting birds	Category 1 Constraint	No planting	Data <b>within last 5 years</b> . Location of breeding ground nesting birds. Some surveys field parcel based others buffered grid references.	Direct loss of breeding habitat in immediate planting area and anticipated increase in predation if planted close to breeding habitat	Yorkshire Water Services (2016), Nidderdale AONB (2017) and Nidderdale AONB (2019)
PW14	Biodiversity	Ground nesting birds	Category 1 constraint	No planting	Data <b>older than 5 years</b> . Location of breeding ground nesting birds. Some surveys field parcel based others buffered grid references.	Direct loss of breeding habitat in immediate planting area and anticipated increase in predation if planted close to breeding habitat	Nidderdale AONB (2012) and Natural England (2006)
PW15	Biodiversity	Ground nesting birds	Category 2 Constraint	-5	More than 2 species combined HSM modelled data for curlew, lapwing, snipe and skylark + 100 m buffer	Direct loss of breeding habitat in immediate planting area and anticipated increase in predation if planted close to breeding habitat	Nidderdale AONB (2018)
PW16	Biodiversity	Ground nesting birds	Category 2 Constraint	-5	Only 1 species combined HSM modelled data for curlew, lapwing, snipe and skylark + 100 m buffer	Direct loss of breeding habitat in immediate planting area and anticipated increase in predation if planted close to breeding habitat	Nidderdale AONB (2018)
PW17	Biodiversity	Reptiles	Category 1 Constraint	No planting	Buffer around known adder hibernation records	Adders are in decline and their habitat needs to be protected-trees create shading which could be detrimental at hibernation sites	Nidderdale AONB (2020b)
PW18	Biodiversity	Reptiles	Category 1 Constraint	No planting	Gill locations identified using aspect criteria based on NAONB adder hibernation records	Adders are in decline and their habitat needs to be protected-trees create shading which could be detrimental at hibernation sites	Nidderdale AONB (2020b)
PW19	Biodiversity	Reptiles	Not scored	Not scored	Not scored	Priority habitat layers effectively cover known adder foraging records	Not scored
PW20	Biodiversity	Grasslands within woodland	Category 1 Constraint	No planting	Grasslands isolated from NFI layer	Includes woodland rides and glades likely to have diverse ground flora	Forestry Commission (2018)
PW21	Biodiversity	Buffer around open water habitat	Category 1 Constraint	No planting	25 m buffer around reservoirs and ponds	Avoid planting close to ponds to reduce shading and eutrophication	Ordnance Survey (2020) and Nidderdale AONB (2019b)

Ref.	Category	Parameter	Opportunity/ Constraint	Productive Woodland Score	Data layer description	Rationale for inclusion and weighting	Data source
PW22	Biodiversity	Moorland line	Category 1 Constraint	No planting	Land above the moorland line	Land potentially available for priority habitat restoration and landscape impacts	Rural Payment Agency (undated)
PW23	Biodiversity	Water vole	Category 1 Constraint	No planting	150 m buffer around water vole records	Trees can shade out water vole target food plants and harbour predators	Nidderdale AONB (2020b)
PW24	Climate change	Connectivity north/south or low/high elevation	Not scored	Not Scored	Not Scored	To allow for species movement to mediate for climate change. Parameter difficult to map.	Not scored
PW25	Climate change	Carbon benefits of woodland relative to existing habitat	Not scored	Not scored	Not Scored	Habitat data not good enough to sufficiently differentiate habitat across AONB. Priority habitats with high sequestration rate already identified as Category 1 constraint	Not scored
PW26	Environmental limits	Max elevation	Not scored	Not scored	Not Scored	No max elevation in the study area for conifer trees	Not scored
PW27	Environmental limits	Slope	Not scored	Not scored	Not scored	Slope not seen as barrier- areas of steepest slopes in uplands already excluded for biodiversity reasons- local areas of steep slope can be used for broadleaf component	Not scored
PW28	Environmental limits	Yield class	Opportunity	1- 5	Areas where ESC predicts yield class exceeds Woodland Carbon Fund minimum. 5 key productive tree species chosen: score increases progressively from 1-5 as species layers overlap.	Areas likely to sequester carbon at a higher rate given a higher score and areas that will support several species also scores higher	Not scored
PW29	Environmental limits	Soil wetness	Opportunity	Considered within yield class	Considered within yield class	Few soils in NAONB outside heathland areas are too wet for planting- heathland areas already category 1 constraint- selection of tree species can moderate soil constraints	Not scored
PW30	Environmental limits	Soil fertility	Opportunity	Considered within yield class	Considered within yield class	Soil fertility will affect yield and growth rates	Not scored
PW31	Environmental limits	Preferred aspect	Opportunity	Considered within yield class	Considered within yield class	Aspect will affect yield and growth rate not survival rate	Not scored
PW32	Environmental limits	Mitigation of air pollution	Not scored	Not scored	Not Scored	Buffer for air pollution but, on reflection, this would be a repeat of the road access buffer so not scored	Not scored
PW33	Environmental limits	Landscape impact	Not scored	Not scored	Not scored	Landscape outside remit of the plan- parameters difficult to map effectively	Not scored
PW34	Environmental limits	Historical woodland extent	Not scored	Not scored	Not Scored	Format of historic maps did not support inclusion	Not scored
PW35	Heritage	World Heritage Sites buffer zone	Category 1 Constraint	No planting	Extent of <b>Buffer Zone</b> World Heritage Site layer	To protect heritage assets	English Heritage (2020a)

Ref.	Category	Parameter	Opportunity/ Constraint	Productive Woodland Score	Data layer description	Rationale for inclusion and weighting	Data source
PW36	Heritage	World Heritage Sites core zone	Category 1 Constraint	No Planting	Extent of <b>Core</b> World Heritage Site layer	To protect heritage assets	English Heritage (2020a)
PW37	Heritage	Battlefields	Not scored	Not scored	Not Scored	No battlefield on database within AONB	Not scored
PW38	Heritage	Scheduled Ancient Monuments	Category 1 Constraint	No planting	Extent of SAM + 150 m buffer	To reduce impacts on archaeological features	English Heritage (2020b)
PW39	Heritage	Historic Environment Record	Category 1 Constraint	No planting	Extent of HER + 150 Buffer	To reduce impacts on archaeological features	North Yorkshire County Council (2020a)
PW40	Heritage	Geological heritage	Category 1 Constraint	No planting	150m buffer around Local Geological Sites	To reduce impact on geological features	North Yorkshire Geological Partnership (undated)
PW41	Land use/ ownership	Control of land use and management	Category 2 Constraint	-2	Land in stewardship (mid-tier), end date before 2025	Reflects added administrative burden in pursuing woodland planting	Natural England (2020e)
PW42	Land use/ ownership	Control of land use and management	Category 2 Constraint	-1	Land in stewardship (higher tier), end date before 2025	Reflects added administrative burden in pursuing woodland planting	Natural England (2020e)
PW43	Land use/ ownership	Control of land use and management	Category 2 Constraint	-2	Land in stewardship (higher tier), end date after 2025	Reflects added administrative burden in pursuing woodland planting	Natural England (2020e)
PW44	Land use/ ownership	Recreational impact	Opportunity	1	100 m buffer around PROW	Positive impact on public access to woodlands	North Yorkshire County Council (2019b), Bradford Metropolitan District Council (2019) and Leeds City Council (2019)
PW45	Land use/ ownership	Ownership	Category 2 Constraint	-2	Extent of common land	Reflects added administrative burden in pursuing woodland planting. Higher-ve score for productive as covers larger area.	North Yorkshire County Council (2020b)
PW46	Land use/ ownership	Economic land use	Category 2 Constraint	-3	Agricultural land classification 1 and 2 only	Avoid planting on productive agricultural land	Natural England (2019d)
PW47	Land use/ ownership	Underground infrastructure	Category 1 Constraint	No planting	Routes of ethylene pipeline, gas networks and aqueduct data + 50 m buffer, route of culverts + 10 m buffer	Ensures a no dig buffer around important underground infrastructure	Yorkshire Water Services (2019), Sabic (2019), Northern Gas Networks (2016) and Environment Agency (2013a)



Ref.	Category	Parameter	Opportunity/ Constraint	Productive Woodland Score	Data layer description	Rationale for inclusion and weighting	Data source
PW48	Land use/ ownership	Urban land use	Category 1 Constraint	No planting	Urban land use and rural buildings + 20m buffer	Larger scale planting not feasible in urban areas and outside the scope of the plan	Ordnance Survey (2020)
PW49	Land use/ ownership	Reservoir dams and spillways	Category 1 Constraint	No planting	Included in urban layer	Larger scale planting not feasible in urban areas and outside the scope of the plan	Ordnance Survey (2020)
PW50	Tree cover	Proximity to existing woodland > 0.5 ha	Not scored	Not scored	Not Scored	Neutral score assumes broadleaf portion of woodland will border existing broadleaf woodland	Not scored
PW51	Tree cover	Proximity to existing woodland > 0.5 ha	Not scored	Not scored	Not Scored	Neutral score assumes broadleaf portion of woodland will border existing broadleaf woodland	Not scored
PW52	Tree cover	Proximity to woodland 0.2- 0.5 ha in size	Not scored	Not scored	Not Scored	Neutral score assumes broadleaf portion of woodland will border existing broadleaf woodland	Not scored
PW53	Tree cover	Proximity to recent woodland planting	Not scored	Not scored	Not Scored	Neutral score assumes broadleaf portion of woodland will border existing broadleaf woodland	Not scored
PW54	Tree cover	Proximity to ancient woodland	Category 2 Constraint	-5	150 m buffer around ancient woodland	Strong preference for conservation woodland close to existing high quality woodland	Natural England (2020f)
PW55	Tree cover	Proximity to SINC woodlands	Category 2 Constraint	-5	150 m buffer around SINC woodland	Strong preference for conservation woodland close to existing high quality woodland	North Yorkshire County Council (2019b)
PW56	Tree cover	Connections between woodlands	Not scored	Not scored	Not Scored	Neutral score assumes broadleaf portion of woodland will connect existing broadleaf woodland	Not scored
PW57	Tree cover	Connections between woodlands	Category 2 Constraint	-5	Connections to ancient woodland within 150m buffer	Strong preference for conservation woodland close to existing high quality woodland	NAONB (2020b) based on Forestry Commission (2018) and Natural England (2020f)
PW58	Tree cover	Connections between woodlands	Not scored	Not scored	Not Scored	Neutral score assumes broadleaf portion of woodland will connect existing broadleaf woodland	Not scored
PW59	Tree cover	Connections between woodlands	Not scored	Not scored	Not Scored	Neutral score assumes broadleaf portion of woodland will connect existing broadleaf woodland	Not scored
PW60	Tree cover	Extent of felled and windblow trees	Not scored	Not scored	Not Scored	Area where past planting was supported, may potentially contain remnant flora	Not scored

Ref.	Category	Parameter	Opportunity/ Constraint	Productive Woodland Score	Data layer description	Rationale for inclusion and weighting	Data source
PW61	Tree cover	Proximity to hedgerows	Not scored	Not scored	Not Scored	Neutral score assumes broadleaf element of woodland will border existing hedges	Not scored
PW62	Tree cover	Proximity to hedgerows	Not scored	Not scored	Not Scored	Neutral score assumes broadleaf element of woodland will border existing hedges	Not scored
PW63	Tree cover	Proximity to hedgerows	Not scored	Not scored	Not Scored	Neutral score assumes broadleaf element of woodland will border existing hedges	Not scored
PW64	Tree cover	Conifer PAWS sites	Category 1 Constraint	No planting	PAWS sites isolated from AWI layer	Already conifer woodland	Natural England (2020e)
PW65	Tree cover	Existing conifer woodland	Category 1 Constraint	No planting	Conifer woodlands isolated from NFI layer	Already conifer woodland	Forestry Commission (2018)
PW66	Tree cover	Existing mixed woodland	Category 1 Constraint	No planting	Mixed woodland isolated from NFI layer	Already conifer woodland	Forestry Commission (2018)
PW67	Tree cover	Mitigation for potential loss of ash trees	Not scored	Not scored	Ash tree coverage 0.8- 1 ha/km <sup>2</sup>	To promote tree planting in areas with moderate concentration of ash trees- broadleaf preferred so lower score for productive	Not scored
PW68	Tree cover	Mitigation for potential loss of ash trees	Opportunity	1	Ash tree coverage 1- 5 ha/km <sup>2</sup>	To promote tree planting in areas with moderate concentration of ash trees- broadleaf preferred so lower score for productive	Maskell, <i>et al.</i> (2013)
PW69	Tree cover	Mitigation for potential loss of ash trees	Opportunity	2	Ash tree coverage > 5 ha/km <sup>2</sup>	To promote tree planting in areas with moderate concentration of ash trees- broadleaf preferred so lower score for productive	Maskell, <i>et al.</i> (2013)
PW70	Tree cover	Veteran trees	Category 1 Constraint	No planting	15- 50m buffer around veteran tree records	Larger preferred buffer to protect veteran trees	NAONB (2012)
PW71	Tree cover	Veteran trees	Category 1 Constraint	No planting	0- 15m buffer around veteran tree records	Minimum buffer required to protect veteran trees	NAONB (2012)
PW72	Tree cover	Wood pasture and parkland	Category 1 Constraint	No planting	Extent of wood pasture and parkland BAP layer outside NFI	Constraint for biodiversity and heritage reasons	Natural England (2019a)
PW73	Tree cover	Orchards	Category 1 Constraint	No planting	Extent of traditional orchards BAP layer	Constraint for biodiversity and heritage reasons	Natural England (2019b)
PW74	Tree cover	Extent of existing broadleaf woodland > 0.2 ha and hedgerows	Category 1 Constraint	No planting	Location of broadleaf woodland - NFI- NTM	Already existing broadleaf trees	Forestry Commission (2018)
PW75	Tree cover	Extent of woodland creation grant areas	Category 1 Constraint	No planting	CSS grant layer	Woodland already planned and funded	Natural England (2020e)

Ref.	Category	Parameter	Opportunity/ Constraint	Productive Woodland Score	Data layer description	Rationale for inclusion and weighting	Data source
PW76	Tree Cover	Extent of recent woodland planting	Category 1 Constraint	No planting	Various	Already existing broadleaf trees	Forestry Commission (2018), Blue Sky (2017), Northern Upland Chain Local Nature Partnership (2015) and Nidderdale AONB (2020b)
PW77	Water quality and quantity	Water supply to wetlands	Category 1 Constraint	No planting	250m buffer around lowland Fen priority habitat	To protect hydrology of priority habitat	Nidderdale AONB (2020b) based on Natural England (2019c)
PW78	Water quality and quantity	Riparian shading	Opportunity	3	50 m buffer around tertiary and secondary streams aligned east west (NFI removed)	Riparian shading needed to cool rivers and help mitigate effects of climate change	Nidderdale AONB (2020b) based on Environment Agency (2013a), Forestry Commission (2018) and Bluesky (2017)
PW79	Water quality and quantity	Mitigation of flood risk	Opportunity	3	50 m buffer around river	Tree planting in riparian zone helps slow flow	Environment Agency (2017a)
PW80	Water quality and quantity	Mitigation of flood risk	Opportunity	3	Extent of Flood Zone 2	Tree planting in riparian zone helps slow flow	Environment Agency (2017b)
PW81	Water quality and quantity	Mitigation of flood risk	Opportunity	3	Gleyed soil	Tree planting on gleyed soils could reduce overland flow	Environment Agency (2017c)
PW82	Water quality and quantity	Acidification	Category 2 Constraint	-5	Extent of acid sensitive surface water bodies	Woodland may increase acid loads in catchments- higher score for productive woodland	Environment Agency (2013b)
PW83	Water quality and quantity	Suspended sediment	Category 2 Constraint	-4	Extent of catchments with sediment (T1) and phosphates from rural areas (T3) pressures	Conservation woodland may reduce sediment loads in catchments- productive may increase sediment loads during harvesting	Environment Agency (2013b)
PW84	Water quality and quantity	Water abstraction and availability	Category 2 Constraint	-5	Inner Source Protection Zone	To protect water availability	Environment Agency (2020)



Ref.	Category	Parameter	Opportunity/ Constraint	Productive Woodland Score	Data layer description	Rationale for inclusion and weighting	Data source
PW85	Water quality and quantity	Water abstraction and availability	Category 2 Constraint	-3	Outer Source Protection Zone	To protect water availability	Environment Agency (2020)
PW86	Water quality and quantity	Water abstraction and availability	Category 2 Constraint	-1	Total Catchment Source Protection Zone	To protect water availability	Environment Agency (2020)
PW87	Water quality and quantity	Water- ponds/ lakes/reservoirs/ rivers	Category 1 Constraint	No planting	Extent of open water and river network	Tree planting not feasible	Ordnance Survey (2020) and Environment Agency (2013a)

## Annex 2 Data References

Bluesky (2017) *National Tree Map™* © Bluesky copyright. Available from <https://www.bluesky-world.com/ntm>

Bradford Metropolitan District Council (2019) *Public Rights of Way* © Bradford Metropolitan District Council copyright

Brown, Eloise (2013) *Multiscale habitat suitability models for bats in the Yorkshire Dales. Are site-specific models more accurate than those transferred from other geographic regions?* Masters Project, The University of Leeds © Eloise Brown

English Heritage (2020a) *World Heritage Sites* © English Heritage copyright. Available from <https://services.historicengland.org.uk/NMRDataDownload/default.aspx>

English Heritage (2020b) *Scheduled Monuments* © English Heritage copyright. Available from <https://services.historicengland.org.uk/NMRDataDownload/default.aspx>

Environment Agency (2013a) *Detailed River Network* © Environment Agency copyright. Available from <https://data.gov.uk/dataset/14f5ab89-3b46-41e3-854b-ca0392136b82/detailed-river-network-nodes-afa036>

Environment Agency (2013b) *Catchments of river and lake water bodies failing, or at risk of failing, Good Ecological Status due to acidification* © Environment Agency copyright

Environment Agency (2016) *Classification Data Humber River District* © Environment Agency copyright. Available from <https://environment.data.gov.uk/catchment-planning/RiverBasinDistrict/4>

Environment Agency (2017) *Working With Natural Processes Riparian Woodland Potential* © Environment Agency copyright. Available from <https://environment.data.gov.uk/dataset/960926b5-84e7-45f0-a38f-8ef58004820e>

Environment Agency (2017) *Working With Natural Processes Floodplain Woodland Potential* © Environment Agency copyright. Available from <https://environment.data.gov.uk/dataset/d1b028b8-6090-4621-8645-034f01b32403>

Environment Agency (2017) *Working With Natural Processes Wider Catchment Woodland Potential* © Environment Agency copyright. Available from <https://environment.data.gov.uk/dataset/7b6c23f0-200e-453d-b3f9-1ace36974bce>

Environment Agency (2020) *Source Protection Zones Merged* © Environment Agency copyright. Available from <https://environment.data.gov.uk/dataset/6fd0120f-d465-11e4-abee-f0def148f590>

Forestry Commission (2018) *National Forest Inventory Woodland England 2018* © Forestry Commission copyright. Available from [http://data-forestry.opendata.arcgis.com/datasets/295e0278dc2641e2935c411d28908be9\\_0](http://data-forestry.opendata.arcgis.com/datasets/295e0278dc2641e2935c411d28908be9_0)

Forestry Commission (2020) *ESC Woodland Carbon Fund assessment - area in which the ESC model (Ecological Site Classification) predicts yields will exceed the Woodland Carbon Fund minimum productivity thresholds* © Forestry Commission

Leeds City Council (2019) *Public Rights of Way* © Leeds City Council copyright

Maskell, L.C.; Henrys, P.A.; Norton, L.R.; Smart, S.M.; Wood, C.M. (2013). *Distribution of ash trees within areas less than half a hectare in Great Britain. NERC Environmental Information Data Centre*. Available from <https://doi.org/10.5285/7f7c99c7-5457-444d-978a-fe7b01a85fd0>

Natural England (2006) *Breeding bird surveys across SSSI land in Nidderdale AONB 2016* © Natural England copyright

Natural England (2019a) *Wood Pasture and Parkland (England)* © Natural England copyright. Available from <https://naturalengland-defra.opendata.arcgis.com/datasets/wood-pasture-and-parkland-england>

Natural England (2019b) *Traditional Orchards HAP (provisional) (England)* © Natural England copyright. Available from <https://naturalengland-defra.opendata.arcgis.com/datasets/traditional-orchards-hap-provisional-england>

Natural England (2019c) *Priority Habitat Inventory (North) (England)* © Natural England copyright. Available from <https://naturalengland-defra.opendata.arcgis.com/datasets/priority-habitat-inventory-north-england>

Natural England (2019d) *Agricultural Land Classification (ALC) Grades - Post 1988 (England)* © Natural England copyright. Available from <https://naturalengland-defra.opendata.arcgis.com/datasets/agricultural-land-classification-alc-grades-post-1988-england>

Natural England (2020a) *SSSI Impact Risk Zones (England)* © Natural England copyright. Available from <https://naturalengland-defra.opendata.arcgis.com/datasets/sssi-impact-risk-zones-england>

Natural England (2020b) *Sites of Special Scientific Interest (England)* © Natural England copyright. Available from <https://naturalengland-defra.opendata.arcgis.com/datasets/sites-of-special-scientific-interest-england>

Natural England (2020c) *Special Areas of Conservation (England)* © Natural England copyright. Available from <https://naturalengland-defra.opendata.arcgis.com/datasets/special-areas-of-conservation-england>

Natural England (2020d) *Special Protection Areas (England)* © Natural England copyright. Available from <https://naturalengland-defra.opendata.arcgis.com/datasets/special-protection-areas-england>

Natural England (2020e) *Countryside Stewardship Scheme 2016 Management Areas (England) – geographic extent and location of all land under management within the Countryside Stewardship Scheme from 01/01/2016*. © Natural England copyright. Available from <https://naturalengland-defra.opendata.arcgis.com/datasets/countryside-stewardship-scheme-2016-management-areas-england>

Natural England (2020f) *Ancient Woodland (England)* © Natural England copyright. Available from <https://naturalengland-defra.opendata.arcgis.com/datasets/ancient-woodland-england>

Ordnance Survey (2020) *Mastermap Contains OS data* © Crown copyright and database right 2020

Nidderdale AONB (2012) *Veteran tree survey in Nidderdale Area of Outstanding Natural Beauty 2006 – 2012* © Nidderdale AONB

Nidderdale AONB (2012) *Breeding wader survey 2007 – 2012* © Nidderdale AONB

Nidderdale AONB (2015) *Priority areas for creation of foraging bat habitat in Nidderdale Area of Outstanding Natural Beauty*. © Nidderdale AONB

Nidderdale AONB (2017) *Breeding bird surveys across selected farms in Upper Nidderdale 2016 -2017 as part of the Upper Nidderdale Landscape Partnership Project* © Nidderdale AONB copyright

Nidderdale AONB (2018) *Habitat Suitability Modelling Preliminary models for curlew, lapwing snipe and skylark in Nidderdale Area of Outstanding Natural Beauty as part of the Wild Watch Project* © Nidderdale AONB copyright

Nidderdale AONB (2019) *Breeding bird surveys 2017-2019 as part of the Wild Watch Project* © Nidderdale AONB copyright

Nidderdale AONB (2019b) *Pond locations collated to support an eDNA survey for Great Crested Newts as part of the Wild Watch Project* © Nidderdale AONB copyright

Nidderdale AONB (2020a) *The Wild Watch Project: National Vegetation Classification Modelling in Nidderdale Area of Outstanding Natural Beauty. NVC final output layers and contributing data* © Nidderdale AONB copyright

Nidderdale AONB (2020b) *GIS layers created for Nidderdale Area of Outstanding Natural Beauty Woodland Opportunity Plan.* © Nidderdale AONB copyright

Northern Gas Networks (2016) *Northern Gas Networks high pressure pipeline data* © Northern Gas Networks copyright

Northern Upland Chain Local Nature Partnership (2015) *Recent tree planting in the Northern Upland Chain Local Nature Partnership* © Northern upland Chain Local Nature Partnership copyright

North Yorkshire County Council (2109b) *Sites of Interest for Nature Conservation (SINCs)* © North Yorkshire County Council copyright

North Yorkshire County Council (2019b) *Public Rights of Way* © North Yorkshire County Council copyright

North Yorkshire County Council (2020a) *North Yorkshire County Council Historic Environment Record* © North Yorkshire County Council copyright. Available from <https://www.heritagegateway.org.uk/gateway/chr/herdetail.aspx?crit=&ctid=92&id=4733>

North Yorkshire County Council (2020b) *Common Land boundaries* © North Yorkshire County Council copyright

North Yorkshire Geological Partnership (undated) *Local Geological Sites* © North Yorkshire Geological Partnership

Rural Payment Agency (undated) *Moorland Line (England)* © Rural Payment Agency copyright

Sabic UK Ltd. (2019) *Trans Pennine Ethylene Pipeline* © Sabic UK Limited copyright

Scholefield, P.A.; Morton, R.D.; Rowland, C.S.; Henrys, P.A.; Howard, D.C.; Norton, L.R. (2016). *Woody linear features framework, Great Britain v.1.0. NERC Environmental Information Data Centre.* Available from <https://doi.org/10.5285/d7da6cb9-104b-4dbc-b709-c1f7ba94fb16>

Yorkshire Water Services (2016) *Breeding bird survey 2016 Humberstone Bank Beyond Nature Farm* © Yorkshire Water copyright

Yorkshire Water Services (2019) *Underground infrastructure network* © Yorkshire Water Services copyright



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