Mapping Woodland Opportunity in Sussex and the South Downs National Park

Mapping the potential opportunities for woodland establishment within Sussex and the South Downs National Park, using Nidderdale AONB Woodland Opportunity Plan as a framework.

Technical Report

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Introduction

Within the context of the Climate Emergency, HM Government has identified new measures to increase tree planting - as a central pillar in the efforts to reach net zero emissions by 2050. Under this target, its ambition is to create 7000 ha of new woodland in England per year by the end of this parliament (2024) - as part of the overall target for woodland creation in the UK of 30 000 ha per year (HM Government 2021). Thus, with £640 million invested in planting more than 40 million trees in England (Ares & Uberoi, 2020), there is a great need to know 'what the right tree in the right place looks like'. The government regulatory process for woodland creation, overseen by the Forestry Commission and guided by the UK Forestry Standard, sets out to ensure that every woodland creation project achieves this. A core principle within the regulatory process is that all woodland creation projects must "fit with the landscape and accommodate features of interest".

Sussex is a lowland landscape which is experiencing a great deal of development pressure. It has a relatively high level of existing woodland cover[1] and important areas of other habitat types which also require protection, restoration and improved connectivity as part of wider strategies for nature's recovery. It has a complex and intricate landscape character with more than 58% of Sussex included within a protected landscape designation[2]. In such a sensitive landscape, large scale woodland creation opportunities may thus not be appropriate and a great deal of attention will need to be paid to understanding where and how to expand woodland cover so that no harm is done to other features of interest. However, in Sussex as elsewhere there is also a great deal of interest in the role of woodland creation in delivering a range of benefits for people and nature, including flood risk reduction, improved water quality, accessible greenspaces for recreation and so on[3].

This project sets out to draw together useful spatial datasets which reflect many of the factors which indicate positive and negative impacts of woodland creation in a location - to create a decision-making tool to assist in the identification of areas of constraint and opportunity for woodland creation within Sussex and the South Downs National Park (which spans Sussex and also covers part of Hampshire). It builds on a pilot project which produced a similar but slightly less refined woodland opportunity map for Lewes District (University of Brighton Student Project 2021).

It is intended to provide an initial guide farmers and landowners and others involved in woodland creation projects as to the likely suitability of land for woodland creation. Funding for the project was provided by The Woodland Trust (SE Region) and South Downs National Park (hence the area covered by the project area also extends beyond Sussex into Hampshire). The project was delivered by Sussex Nature Partnership (SxNP) and South Downs National

[1] Sussex has over 17% woodland cover, which is much greater than the average for counties across England (9%).
[2] Sussex is covered by parts of three Protected Landscape designations: South Down National Park, High Weald AONB and Chichester Harbour AONB.
[3] https://ecosystemsknowledge.net/apply/woodlands

Park Authority (SDNPA) with the output to be shared across partner organisations and all local authorities in Sussex.

This technical report sets out the steps followed in creating the Woodland Opportunity Map. It is accompanied by a simple 'user guide' to provide all users with important information as to how the maps should be interpreted and used. A story map illustrating the mapped output will be available online via South Downs National Park Authority and Sussex Nature Partnership websites.

Woodland Creation - Definition
The focus of this map is on native woodland creation. For the purposes of this project the term woodland creation includes native tree planting, natural colonisation/regeneration, scrub creation and individual tree planting.

Note: it does not cover opportunities for hedgerow creation - given the deficiencies in hedgerow data for Sussex and concerns that factors identifying suitability for woodland creation do not necessarily relate to hedgerow creation, which should be addressed through a different approach.

Approach

This project uses GIS and a spatial multi-criteria evaluation (SMCE) approach to develop an 'opportunity map' which brings together relevant spatial datasets in a way that can help the user to identify where woodland creation may be suitable. This map is not a 'model' but a decision-making tool designed to bring together many of the high-level datasets and weightings of factors that are required to make a preliminary judgement as to where woodland creation might be suitable. It is important to note that in all cases, this must then be followed by further desk-based analysis using locally specific information and site assessment to ensure possible sites are thoroughly investigated for other constraints - and if suitable, to ensure that the design of any woodland creation project reflects local site sensitivities. The diagram below shows the position of the 'woodland opportunity mapping' tool in the overall decision-making process.

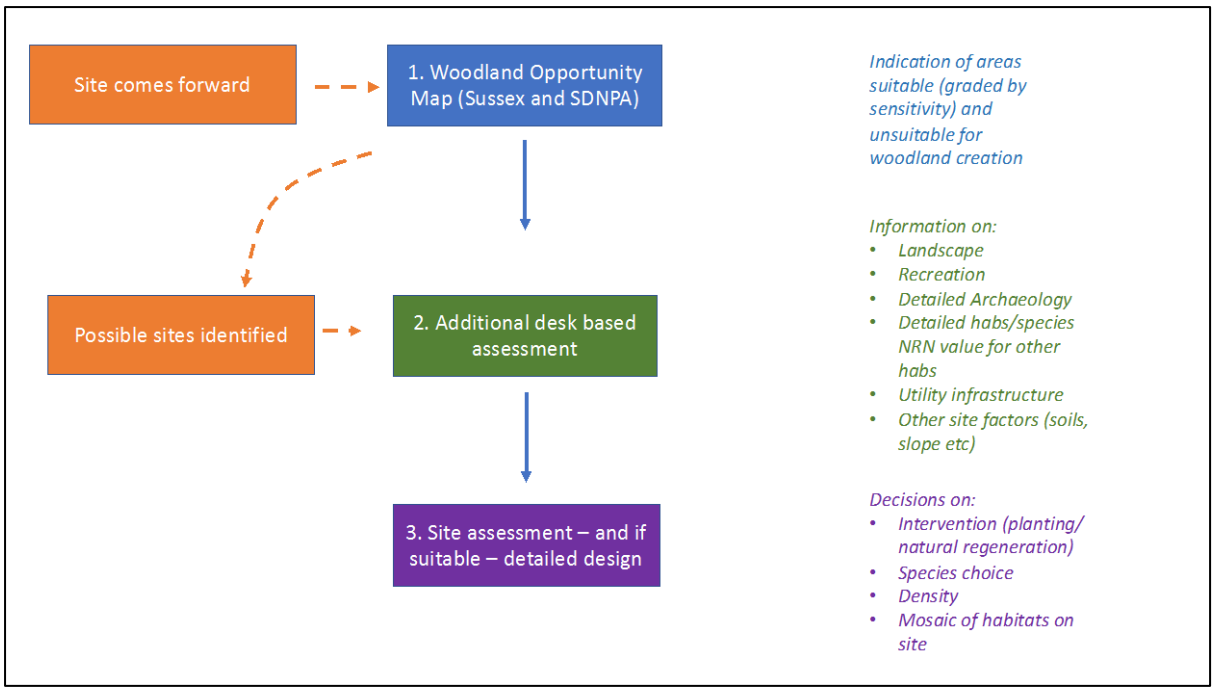

Figure 1. Role of woodland opportunity mapping in identifying sites for woodland creation

The **Nidderdale AONB Woodland Opportunity Plan (2020)** was used as a framework for the project (NAONB, 2020), with adaptations made to customise the approach to the Sussex lowland context[4]. Insights were also drawn from a variety of other mapping approaches, such as the Friends of the Earth Woodland Opportunity Mapping[5], the Northern Forest Initiative[6], InterReg ProWater project[7], and the Sussex Flow Initiative (SFI)[8]. To ensure that the methodology was appropriate, many local stakeholders were involved in critically evaluating the criteria used. This involved steering group sessions with the Woodland Trust, South Downs National Park Authority, Sussex Wildlife Trust, Sussex Biodiversity Record Centre, Forestry Commission, Environment Agency, Sussex Flow Initiative, High Weald Unit (High Weald Area of Outstanding Natural Beauty), and Southeast Rivers Trust. A full list of those consulted is included in Appendix A.

[4] This involved checking that all datasets used were relevant in the lowland setting and identifying those local datasets which were available for Sussex via Sussex Biodiversity Record Centre.
[5] https://takeclimateaction.uk/woodland-opportunity-mapping-england
[6] Personal communication with Northern Forest officer
[7] https://www.southeastriverstrust.org/prowater/
[8] http://www.sussexflowinitiative.org/

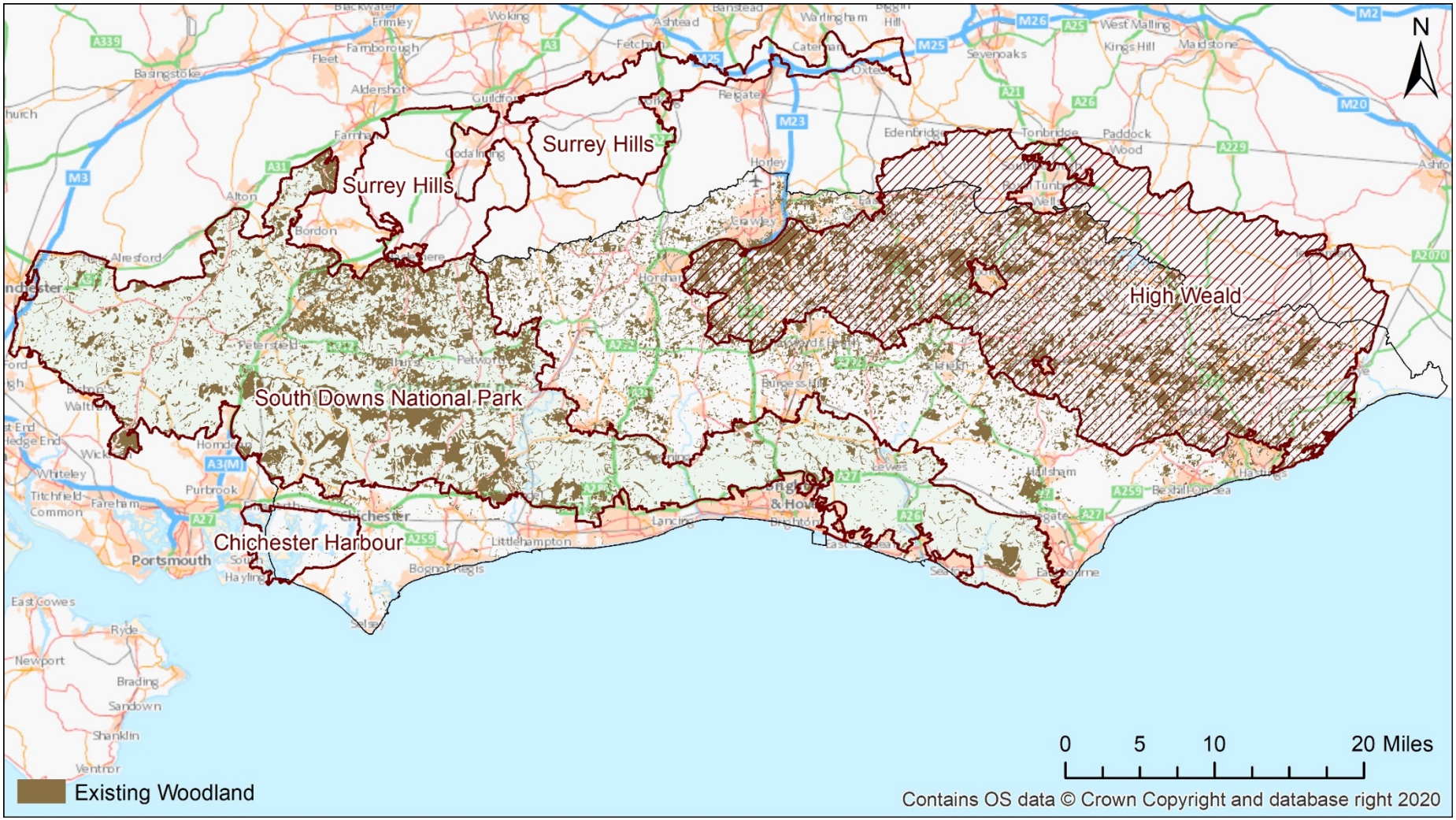

Figure 2 – The study region (Sussex and the South Downs National Park) outlined in black and showing existing areas of woodland in brown, with a base map underneath for context.

Note: High Weald AONB has been shaded on the map to highlight the specific sensitivity of its nationally protected landscape to woodland creation projects. This medieval landscape has a distinctive and complex landscape character which was not possible to represent in the tool. It has valuable low input grassland and rare wildflower grasslands, some of which are unmapped. High Weald AONB Partnership therefore requested that If considering woodland creation in this area, initial guidance should be sought from their specialist staff.

Methodology

The final mapped output of this tool consists of two elements:

- Identification of '**no woodland creation/woodland' constraint areas** (where woodland creation is not suitable due to physical constraints or presence of other factors deemed incompatible, such as other important habitat types, archaeological features, urban areas, etc.)
- Identification of **opportunity areas** where woodland creation may be suitable - and within these, identifying a simple categorization to reflect the level of suitability and sensitivity that may be present based on the balance of factors in these areas.

Collation and weighting of datasets

Datasets were gathered from project partners and national datasets, following the Nidderdale methodology as a guide but excluding those datasets for which there was not a local equivalent, or which related to factors that were not relevant in the lowland Sussex context. Most datasets were freely available although archaeological was purchased from the county/district councils. National datasets with a charge were not used in the project.

The Nidderdale methodology was used to identify datasets that clearly represented a strong/clear **constraint** to woodland creation and where woodland creation is deemed unsuitable (constraint/ no woodland creation areas). These are listed (with rationale) in Appendix B.1

Stakeholder engagement was then used to confirm locally suitable datasets to compliment that national data and to discuss whether some of the modelling and data available for Sussex could be meaningfully used in this project.

Over 40 parameters were considered under several categories (below) - to build up a comprehensive picture of factors influencing suitability for woodland creation and the datasets that could be used to represent these.

These fall into the following broad categories:

- Existing tree cover
- Biodiversity (protected sites, priority habitats, habitat network mapping)
- Built and archaeological heritage
- Land use/ownership
- Environmental limits
- Water quality, quantity, and flood risk
- Climate change

The remaining datasets were then assigned an individual score to represent whether they are a **negative factor in relation to woodland creation** (these are factors which may confer a level

of constraint to woodland creation - but not a complete constraint) **(negatively scored)** or which suggest an **opportunity for woodland opportunity (positively scored).** A range of scores (-5 to 5) was used to infer the relative influence of each factor. Most of these scores followed the Nidderdale approach but each was discussed and verified with stakeholders as suitable in the Sussex context.

The data used in this process, and the rationale for the weightings assigned is provided in Appendix B.2.

It should be noted that this project used fewer datasets than used by Nidderdale and where this was the case it was mostly related to a lack of suitable local data. Appendix B.3 sets out the datasets used in Nidderdale that were **not** used in this project alongside a rationale and recommendations for future work.

As per the Nidderdale approach, factors which fall largely outside the scope of this tool include **landscape and recreation**. Both these factors are difficult to map effectively and need to be considered on a **site-by-site basis** both through examination of locally available data and information (e.g. local landscape character assessments and recommendations) - and as part of a site assessment. In all cases, projects must comply with the UK Forestry Standard which requires these elements to be addressed.

A list of other datasets that were not available at the Sussex-wide scale or were not suitable for the 'weighted' approach used - are listed in Appendix B.4. Where applicable to a site, these may be suitable for additional desk-based study of a proposed site before proceeding to a site assessment.

Once identified, all data layers (Tables B1 - B3) were individually processed and converted to raster layers (using the Euclidean Distance tool), with 5m cell sizes, and projected in the coordinate system British National Grid (BNG). This step ensured that all the datasets aligned correctly with one another. All data were clipped within 350m of Sussex and the South Downs National Park, therefore criteria with buffers that lay just outside of the district boundary were also included, to create a more accurate picture, with no skewing of edges.

Constraint areas were identified by the Raster Calculator tool, using the criteria listed in Appendix B.1. The parameters of each criterion were assessed using a bilinear scale, 0 represents unmet criteria and 1 represents the criteria being met, therefore a constraint area. The layers created from this were then combined using the Boolean function of Fuzzy Overlay "OR" giving a rigid solution, showing all areas where criteria have been met, or not, in a singular layer.

Weighted Sum for Site Suitability Evaluation

With datasets collated and assigned weighting, a weighted sum approach was then used to create the final 'scoring' of opportunities which were presented on the final mapped outputs.

As per the Nidderdale methodology, in order 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 5m x 5m 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 (weights were assigned to every normalised criterion, ranging from -5 to +5 while cells in the remaining 'background' were given a score of zero.) The scores for each factor were combined using the weighted sum tool (Figure 2) to give the cumulative Woodland Opportunity Score.

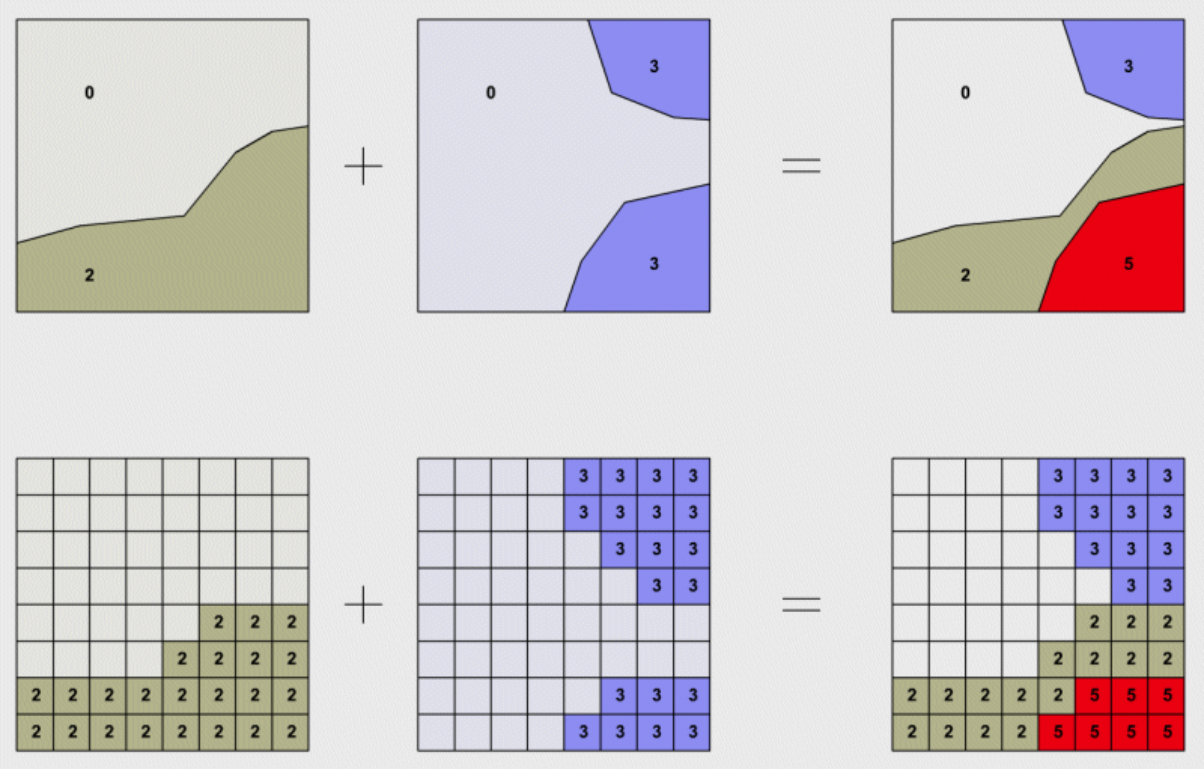

Figure 3 - Diagram displaying how weighted sum operates to combine multiple weighted layers.

Final scores were categorised to indicate the level of suitability for woodland creation and related sensitivity:

Constraint (Legend: Constraint areas/ not suitable for woodland creation) - where woodland creation is not suitable due to constraints present.

Negative scores (including 0) (Legend: Highly Sensitive areas/ likely to be unsuitable for woodland creation). These infer low suitability for woodland creation due to a number of negatively weighted factors or where negatively weighted factors outweigh any positive ones. These sites should be considered 'highly sensitive' in terms of woodland creation and are thus likely to be unsuitable for woodland creation. However, they have not been included as 'no woodland creation' areas as woodland creation may be appropriate at a certain scale and with careful design, but this must be confirmed with a detailed site assessment.

Positive scores (1-6) (Legend: Opportunity areas with sensitivity/ may be suitable for woodland creation subject to site characteristics) indicate that there may be a range of

'positive' factors to indicate suitability for woodland creation and/or a low positive weighted sum due to the combination of both positive and negative weighted factors. These areas should be considered 'sensitive' in terms of woodland creation. Detailed site surveys will be required on all such sites to confirm any opportunity and understand the balance of factors present on the site. Careful and sensitive project design and planning will be required for these areas.

High positive scores (>7) (Legend: Opportunity areas with less sensitivity/ most suitable for woodland creation*)* represent areas where the weighted sum is overwhelmingly positive indicating areas with fewer obvious environmental constraints and where woodland creation is likely to confer a range of additional benefits. However, even in these areas a detailed site assessment will be needed to identify any constraints due to site characteristics and to inform project design and planning.

Divergence from Nidderdale AONB approach

The methodology for weighting criteria closely follows the work of the Nidderdale AONB Woodland Opportunity Plan, with the following exceptions. All of these were discussed with the stakeholder/project steering group.

1. Exclusion of buffers around Scheduled Ancient Monuments (SAMs), Local Geological Sites (LGS), and Archaeological Notification Areas (ANAs), with just the extent of these sites being used as a constraint. This change was made based on recommendations from stakeholder engagement with archaeological experts who felt that an additional buffer to these areas was not required.
2. Hedgerow criteria have not been included as the coverage of hedgerow data for Sussex is outdated and incomplete (not available for the whole study area). In addition to this, conversations with the Woodland Trust suggested caution in the use of hedgerows as a contentious proxy for woodland habitat connectivity.
3. A buffer was included along A roads - with a positive weighting - to identify desirability of woodland in these corridors in order to improve air quality and reduce noise pollution. This was not done in the Nidderdale approach but was considered to be of value in the Sussex context. It was given a low positive weighting to ensure it was only of low influence as a factor.
4. Natural England Habitat Network spatial data was used to provide a constraint to woodland creation for land identified as most suitable for enhancement and restoration of other habitat types. This is direct attempt to link this woodland opportunity map to a 'nature recovery network' approach for other habitats. For land identified as helpful but less suitable for the creation of other habitats (but that may be helpful in addressing fragmentation or expanding habitat range), a negative weighting was used to flag the importance of these areas for purposes other than woodland creation. See Tables B2 and B3 for how this was done.
5. Peaty Soils were included as a constraint - to ensure protection of these carbon rich soils from disturbance.

6. Environment Agency 'working with natural processes' data was included and given a moderate positive weighting to identify areas where woodland has the potential to contribute to reducing flood risk. Three datasets were used: riparian woodland creation; catchment wide woodland creation; floodplain woodland creation
7. Agricultural Land Classification 1 and 2 was not included as a constraint as stakeholders believed it is up to individual landowners if they want to bring forward woodland creation projects on productive land. The Nidderdale approach included ALC 1 and 2 as a constraint to woodland creation as a proxy for protecting valued agricultural land for food production. Sussex stakeholders agreed that even on such land there may be small scale opportunities for woodland creation projects - hence it was removed in this project. There were no constraints or opportunities included which relates to ALC. It should be noted though that in reality farmers may be more inclined to bring forward woodland projects on ALC 3 and 4 land, which is less productive and makes a smaller current contribution to their core farm business. If this assumption is confirmed, it may be helpful to exclude ALC 1 and 2 land from the tool in future to ensure it focuses on land more likely to be brought forward for woodland creation projects.
8. Water Framework Directive Failing Water Bodies were flagged by stakeholders as a possible useful criterion which with a slow positive weighting could help to indicate the positive role woodland could provide in these areas to contribute to slowing the water flow through the landscape whilst filtering nutrients and reducing sediment load. It is not clear whether this layer has been included in the Working with Natural Processes (WWNP) data sets and so this has not yet been included.

Outputs/Results

No Woodland Creation/constraint areas covered 192,560ha of the Sussex/SDNPA area (44%) leaving 237,437 ha (54%) of Sussex and the South Downs National Park within an **opportunity area** for woodland establishment (across three levels of sensitivity to woodland creation).

Note: 9,337ha (2%) were classified as 'no data' which simply means that for these areas, none of the spatial data sets included in the tool related to these areas of land (no positive or negatively weighted layers). Woodland creation may still be suitable in these areas and should therefore be confirmed by site visit.

The criteria with the largest coverage of the constraint areas are the Priority Habitat Inventory (PHI) which covers 106,944 ha.

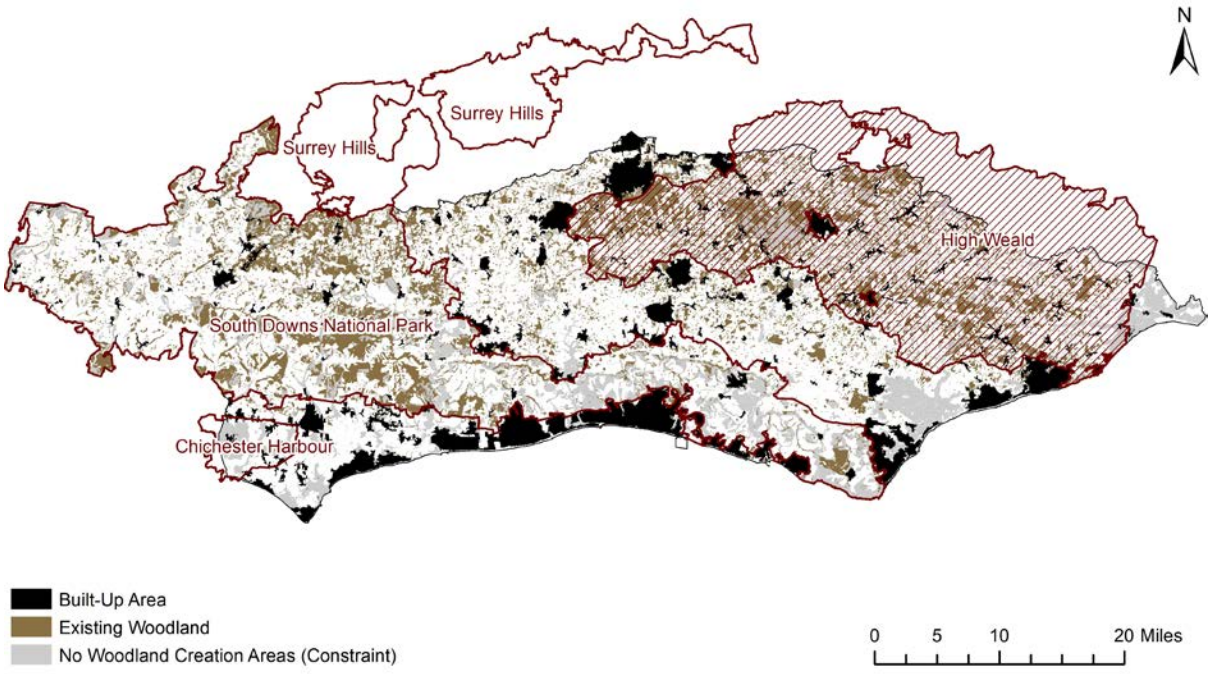

Figure 4 – the 'No woodland creation areas' (constraint areas) (shown in grey) with existing woodland (shown in brown), and built-up areas (black), for Sussex and the South Downs National Park, using criteria listed in Table 1.

Constraint Criteria	Area (ha)
Extent of PHI	106,944
Extent of Scheduled Ancient Monuments (SAM)	1,523
Extent of Local Geological Sites (LGS)	2,517
Extent of Built-Up Areas	45,159
Extent of OS Watercourse	1,191
Extent of WFD Lakes, Rivers, Canals, and Surface Water Transfer	2,452
15m Buffer Ponds	1,429
15m Buffer to Tree Preservation Orders (TPO)	7,476
Extent of Existing Woodland (NFI Mixed Mainly Broadleaved, Mixed Mainly Conifer, Broadleaved, Conifer, Coppice, Coppice with Standards, Low Density, Assumed Woodland, Shrub, Young Trees)	85,170
Extent of Battlefields	489
Extent of Landfill Sites	415
Extent of Rail and Roads	2,763
Extent of Habitat Network Existing Habitat	42,987

Constraint Criteria	Area (ha)
Extent of Peaty Soils	6,593
Total	**192,560**

Table 1 – Coverage of individual constraint criteria in hectares for comparison of overall composition of the constraint layer.

Opportunity areas for woodland creation fall into three categories:

- Highly Sensitive areas/ likely to be unsuitable for woodland creation: where weighted sum is a negative score (including 0).
- Opportunity areas with sensitivity/ may be suitable for woodland creation subject to site characteristics: where weighted sum is positive (1-6)
- Opportunity areas with less sensitivity/ most suitable for woodland creation*: where the weighted sum is positive (7 or above)*

A green colour grading system is used to illustrate these on the final output:

Opportunity Area/ Highly Sensitive Area
Opportunity Area with Sensitivity
Opportunity Area with Less Sensitivity

The distribution of these areas is shown in Figure 5 below with areas of each calculated and shown in table 3.

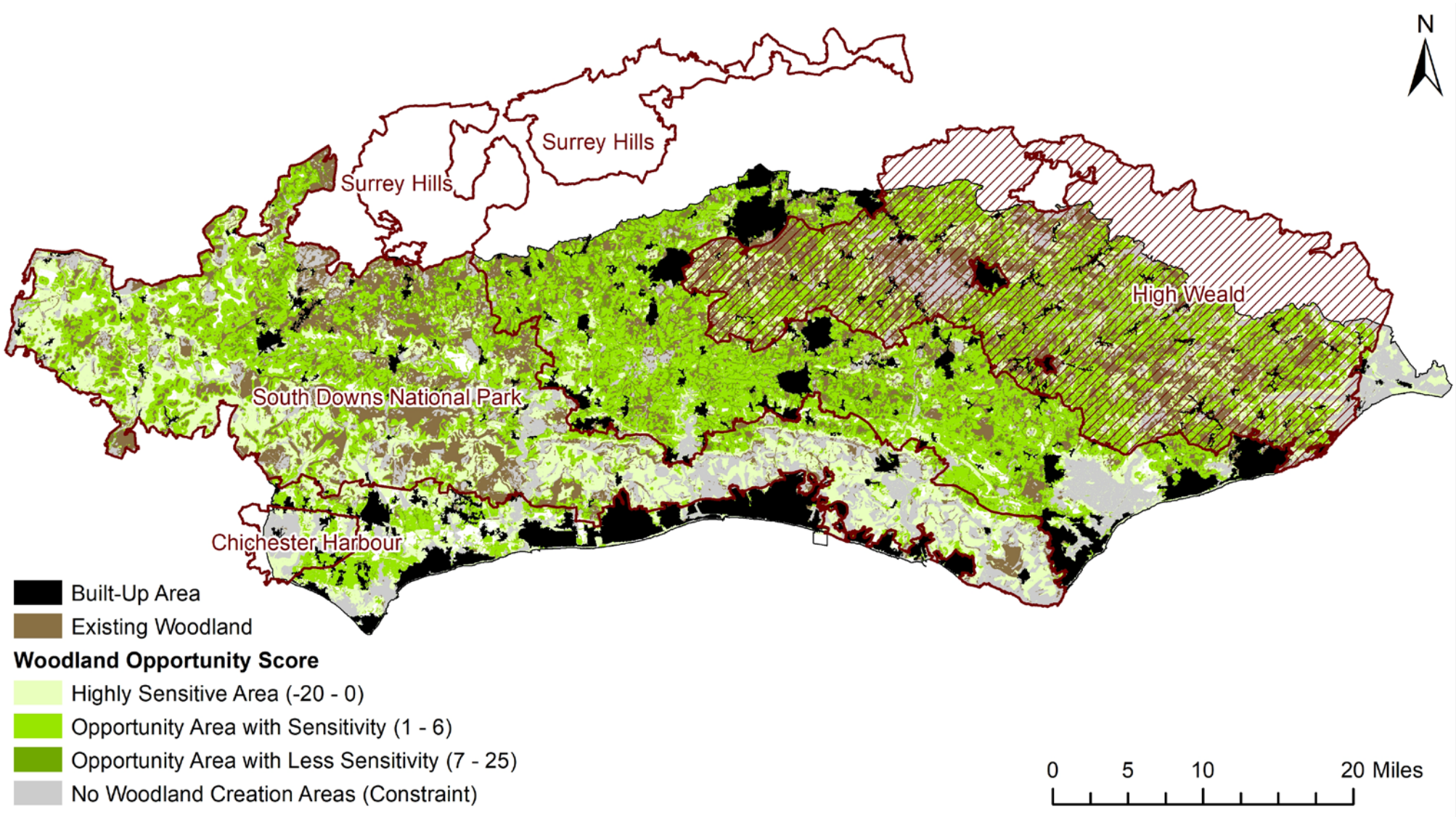

Figure 5 –Weighted sum, showing levels of opportunity with levels of green, overall negative scores (including 0) in pale green (Highly sensitive opportunity area), low positive scores in medium green (Opportunity Area with Sensitivity), and high positive scores in darker green (Opportunity Area with Less Sensitivity). Pale grey areas represent the constraint areas, and dark grey shows areas of no data. Built-up areas (black) and areas of existing woodland (brown have been separated from the rest of the constraint areas for context.

As per Figure 1: High Weald AONB has been shaded on the map to highlight the specific sensitivity of its nationally protected landscape to woodland creation projects. This medieval landscape has a distinctive and complex landscape character which was not possible to represent in the tool. It has valuable low input grassland and rare wildflower grasslands, some of which are unmapped. High Weald AONB Partnership therefore requested that If considering woodland creation in this area, initial guidance should be sought from their specialist staff.

	Area (ha)	Percentage cover of Study Region/SDNP (%)
Entire Study Region		
No Data	9,337	2%
No Woodland Creation (constraint) Area	192,560	44%
Opportunity Area/ Highly Sensitive Area	75,335	17%
Opportunity Area with Sensitivity	140,008	32%
Opportunity Area with Less Sensitivity	22,094	5%
Study Region	439,333	100%
SDNP statistics (for interest as project funder)		
No Data	3,701	2%
No Woodland Creation (constraint) Area	69,044	42%
Opportunity Area/ Highly Sensitive Area	44,041	27%
Opportunity Area with Sensitivity	42,966	26%
Opportunity Area with Less Sensitivity	5,515	3%
SDNP	165,268	100%

Table 3 – Coverage of constraint and opportunity areas in both hectares and represented as percentages for Sussex and the South Downs National Park

Once constraint areas, and areas with no data, were removed, the remaining 237,436ha of Sussex and the South Downs National Park had its potential for woodland creation scored according to negatively and positively weighted criteria (ranked from -5 to +5). All sites identified for woodland creation would need in-person ground truthing, however with a higher Weighted Sum score, sites can be treated with increased certainty that they would be suitable for this purpose.

Areas resulting in an overall negative score could potentially host woodland creation. However, these sites are likely to be very sensitive and will require diligent desk-based assessment and site assessment to confirm suitability. High opportunity areas are considered to have a Weighted Sum of 7 or above as this depicts areas meeting at least two highly weighted positive criteria (or many lower weighted criteria).

The weighted sum resulted in **5,515 ha** being identified with a high level of opportunity; these high opportunity areas tend to reside around existing woodland areas (Figure 5).

Total carbon sequestration opportunity

According to the Forestry Commissions Woodland Carbon Code (2021), after 50 years a new native woodland has the carbon sequestering ability of 300-400 tonnes of CO_2 per hectare,

and 400-500 tonnes after 100 years. Using this estimation, if the land within the study area identified with high levels of opportunity is converted to woodland, this has the potential to store up to 37,667,500 tonnes of CO_2 after 100 years.

Impact of altering specific factors

When used in GIS form, this tool allows various factors to be included/excluded and weighting to be adjusted if needed. It can therefore be used to understand the impact of certain factors on the final outputs. This may be interesting/helpful to do if policy contexts or knowledge change with time or if new datasets become available in the future.

Two examples illustrate how sensitive the output is to inclusion/exclusion of certain data sets. For example, it may be the reality that woodland is most likely to be created on land that is less productive in terms of agricultural production. In this case, it is possible to exclude land in ALC 1 and 2 from the tool (enter this as a constraint). This would reduce the overall area within woodland opportunity areas significantly (total across the three categories) from 237,437 to 227,462 ha.

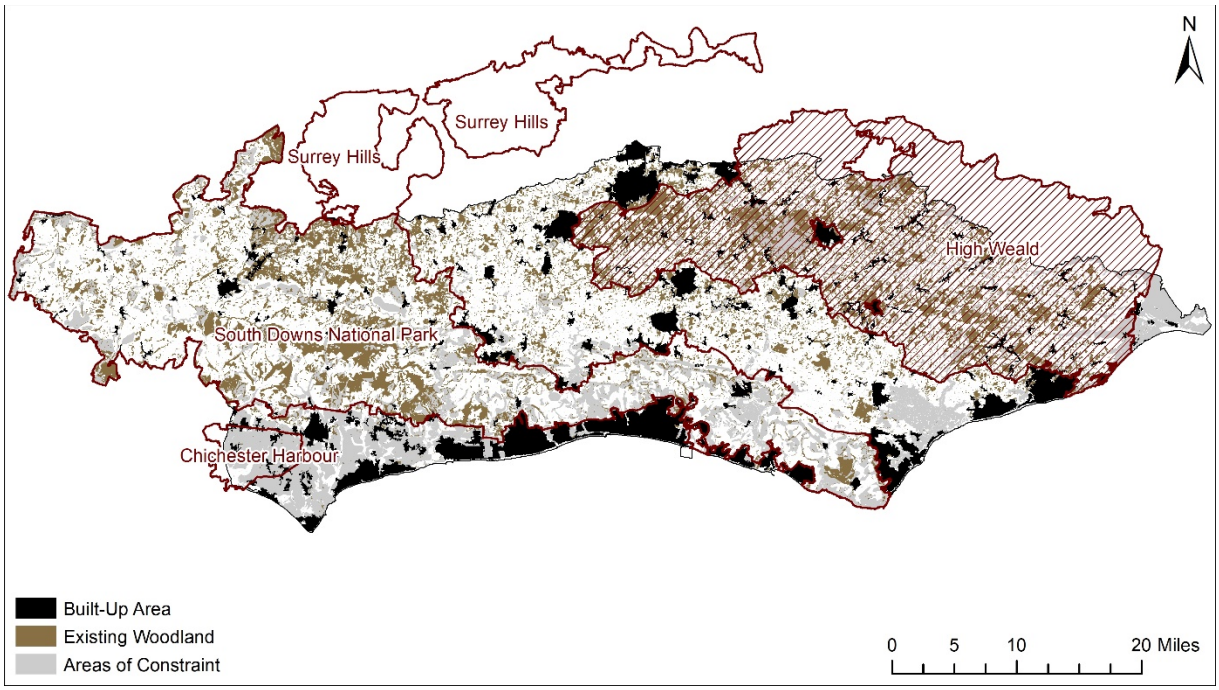

Figure 6 – a map showing the areas of constraint, including the Agricultural Land Classifications Grade 1 and 2.

Social factors (e.g. land within 350m of dwellings - as per Accessible Natural Green Space Standards) could be added as a proxy for benefit to people (where it is assumed that any woodland created near people's homes is accessible). This would increase the area of land with overall positive scores. This has not been included in the final tool produced by this project as it may be that including these sorts of positive scores may 'mask' the fact that sites are quite sensitive to woodland creation based on other environmental characteristics. But having the ability to turn on this layer may be of interest to local planners and those seeking opportunities for creation of woodland near towns for predominantly public benefits. It is also obvious that weightings of every factor will change the output. The weightings used in the tool as developed by this project were determined through stakeholder engagement. However, it is probably wise to review these weightings occasionally through re-engagement

with stakeholder to test whether they remain valid in the face of changing knowledge, environmental conditions, and available datasets. A 5 year review interval is proposed (which will be led by SDNPA) which aligns with the Nidderdale AONB approach.

Limitations of the project

Interpretation of the outputs

main limitation of Multi Criteria Decision Making (MCDM) approaches is that they do not enable interrogation to identify which factors are causing the resultant scores within the final weighted sum. This makes it difficult to understand the relative role of various weighted layers and understand exactly what is driving the overall score. However, a knowledge of how the decision-making tool was built, along with local knowledge, will help the user to interpret the results with more confidence. Most important to understand is that the combination of all positively and negatively weighted layers to create an overall score means **that some areas may result in a positive total which masks the fact that there are some negative layers within the 'sum'**. Therefore, a positive score must not be assumed to mean that a site is definitely suitable for woodland establishment and vice versa. All sites should be treated with both caution but also a sense that woodland creation may be possible provided site assessments are used to confirm suitability and inform project design. The tool is therefore more about reflecting a broad level of caution that should be applied, with low scores flagging sensitivity and the need for great caution, and high scores suggesting fewer likely constraints to be considered and a greater number of positive reasons to explore woodland creation options.

Datasets excluded

It has already been noted above that this mapping did not attempt to incorporate consideration of landscape as this factor must always be considered on a site by site basis and cannot be adequately reflected in a high level analysis such as this.

Other factors were also excluded, particularly where it was not possible to clearly understand what their impact on the final output would be (there must be a clear link between inclusion of a factor and the final mapped outcome).

For example, it was a concern that including social factors (such as positive weighting for areas close to settlements as per Accessible Natural Greenspace Standards for example) may mask out important environmental negative weighted factors by converting a negative weighted sum to a positive figure. Therefore, these layers should be used separately to facilitate additional assessment of possible sites, rather than being built into the tool.

Urban areas are included as a constraint and as such this tool cannot identify opportunities for urban woodland creation. Hence it is recommended that future work could use a similar methodology but work on a finer spatial scale within villages, owns and cities. This could include adding positively weighted areas to represent areas of historic 'lost' woodland, such as areas lost to Dutch Elm Disease or Ash Dieback.

Archaeological Notification Area (ANA) and Archaeological Alert (orange and yellow) data has been included in the tool (negatively weighted) to reflect the need to protect these areas of

archaeological interest in Sussex from potential harm. However, the detailed point data included in the Historic Environmental Record data was not included due to the vast number of sites this includes. This will also have to be considered on a site-by-site basis as part of the desk and site assessments required.

Water infrastructure data was not included due to security concerns but will have to be considered in more detailed stages of site consideration.

Datasets showing Tree Preservation Orders (TPO) were included but only where this information was made available by the relevant district/borough councils. Most districts across Sussex were able to assist with this but several gaps do remain. No TPO data was obtained for Brighton and Hove, Horsham, Crawley, and Wealden, and incomplete TPO datasets were obtained for Arun and Hastings (polygon data has been included for these two, but point data is missing). These datasets can be added to this tool as and when they become available.

Accuracy of datasets

Different datasets may have varying degrees of accuracy, for example the Urban (Built-Up Areas) dataset is from 2011 and is relatively coarse, therefore things may have changed or are simply not included. Similarly, the National Forestry Inventory (NFI) data used is from 2019 and changes to woodland may have occurred since then. The woodland data is also limited to areas of 0.5ha and larger, therefore small areas of woodland may be overlooked entirely. There may be other data sources which could be used to include these smaller woodland areas within the tool at a later stage.

Use of modelled/composite datasets

Two national 'composite' data layers were used in the tool - the 'habitat network' layers developed by Natural England and the 'Working with Natural Processes' datasets from Environment Agency. These are both built up from multiple datasets and so there is a possibility that they replicate some of the layers already included within tables B1-B2. This means there may be some duplication within the final weighted sum which may exaggerate the final total. More understanding of how these datasets are built will be necessary to understand whether this is the case.

Additional datasets that could be included

High Weald AONB has proposed future inclusion of "GS2 Permanent grassland with very low inputs" - weighted to reflect that these areas are less suitable/ more constrained for woodland creation. This dataset can be included at the time of next review.

Conclusions

The results of this project have demonstrated the potential for a tool for evaluating the levels of opportunity for woodland establishment within Sussex and the South Downs National Park. The opportunity mapping identified 44% of Sussex and the South Downs National Park to be unsuitable for woodland creation according to 14 constraint criteria. Areas with high opportunity covered 5,515ha.

The outputs of this project are intended to assist the following audiences in understanding the potential of land in Sussex and the South Downs National Park for woodland creation:

- Landowners - understanding whether land falls in areas which at first analysis are suitable for woodland creation
- Local planning authorities - providing additional information for inclusion in the evidence base for local plans
- All local authorities -
  - Providing high level analysis of the woodland creation potential of their area within the context of 'climate action planning'
  - Identifying areas which must be excluded from woodland creation due to their importance for other factors (e.g., archaeology, protection of other habitats etc.)
- Responsible authorities for Local Nature Recovery Strategies - providing additional information for inclusion in the preparation of these strategies (particularly in relation to protecting areas from negative impact from woodland creation and promoting woodland creation in areas where this is appropriate)
- Organisations seeking to create additional woodland habitat within Sussex and the South Downs National Park - ensuring that the principle of 'the right tree in the right place' is predominant
- Organisations seeking to deliver nature-based solutions/ natural capital investment to address issues such as carbon storage, accessible nature, natural flood management and so on.

Next steps

Sussex Nature Partnership, Woodland Trust and South Downs National Park will continue to work together to maintain and disseminate the Woodland Opportunity Map and advise all audiences on its use and application.

Short-term next steps will include carrying out some 'ground truthing' of the accuracy of the tool using a number of South Downs National Park / Woodland Trust existing/emerging woodland creation projects and using this to tweak the underlying weightings used within the tool as necessary.

A standard review period of 5 years will be used to ensure that the datasets underpinning the tool as up to date as possible.

As Local Nature Recovery Strategies (LNRS) are prepared for Sussex and Hampshire, any new mapping data that is created about where land is earmarked for creation/restoration of other habitat types will be added to the tool. This can be done in association with the relevant LNRS Responsible Authorities in Sussex and Hampshire.

Appendix A

List of stakeholders involved in Woodland Opportunity Mapping (x2 meetings/workshops held online in late 2021) and 1-2-1 input with project team.

Name	**Organisation**
Sonia Lorenzo Martín	South Downs National Park
Bob Epsom	Woodland Trust
Paul Day	South Downs National Park
Veronica Craddock	South Downs National Park
Kate Aulman	South Downs National Park
Gerry Sherwin	High Weald Unit
Andrew Lawson	Sussex Biodiversity Record Centre
Matthew Woodcock	Forestry Commission
Luke Everitt	Forestry Commission
Martin Hügi	Woodland Trust
Jenny Schofield	Woodland Trust
Rina Quinlan	Sussex Wildlife Trust
Sam Buckland	Sussex Wildlife Trust/ Sussex Flow Initiative
Fran Southgate	Sussex Wildlife Trust
Kathi Bauer	South East Rivers Trust
Peter Currell	Environment Agency
Gareth Williams	Environment Agency

Thanks also to the following for engaging with this project and providing advice.

Name	**Organisation**
Kelly Harmar	Nidderdale AONB
Dr Ewan McHenry	Woodland Trust
Dr Heather Gilbert	Northern Forest

Appendix B: Details of parameters included in the Woodland Opportunity Map with rationale

B.1 No woodland creation areas (complete constraint)

Category	No Woodland creation areas (complete constraint)	Rationale
Biodiversity	**Extent of PHI (Priority Habitat Inventory)**	To protect Priority Habitats (i.e. those included in section 41 of the Natural Environment and Rural Communities Act). Many PHs lie outside designated sites but will lie at the core of future nature recovery networks. The assumption is thus made here that these areas must remain as their existing habitat type and should not be converted to woodland. Note: orchards and types of woodlands are included in the PHI - but existing woodland areas are included as a constraint anyway in this project (as it is not possible to create new woodland where it exists already). See below.
	Extent of Habitat Network: Existing Habitat (primary habitat, associated habitat, habitat creation,)	To protect land needed for creation and restoration of other important habitat types on the basis that these often have specific environmental needs and conditions (soil, geology etc)- whereas woodland is a relatively 'flexible' habitat type in the south east and can take place in most environmental conditions. The aim is thus to specifically reserve the most important areas for priority habitat creation and restoration by identifying them as constraints - and target woodland outside these network creation areas. Within the NE Habitat Network map for England - this includes all elements of the 'Existing Habitat' components[9]: - **primary habitat, associated habitat**, **habitat creation** (where habitat creation effort is already underway, **restorable habitat** (where small fragments exist and restoration is possible) Three of these (primary habitat, associated habitat and habitat creation) have been categorised as constraints for woodland creation given the presence of other habitat priority types and where efforts are currently underway to restore these habitat

[9] https://s3-eu-west-1.amazonaws.com/data.defra.gov.uk/Natural_England/Habitat_Species/Habitats/Habitat_Network_England_NE/Habitat_Networks_England_Version_2_Guidance.pdf

Category	No Woodland creation areas (complete constraint)	Rationale
		types. Restorable habitats is given the highest negative weighting (see table B.2 below) as woodland creation may be appropriate as part of a habitat mosaic but only after detailed site survey. The other zones included in this NE habitat network mapping work are also given negative weightings (see Table B.2 below) to indicate that woodland creation may be suitable in these zones as part of a habitat mosaic but that this must be carefully checked on-site. The decision was also made not to use the 'combined layer' of all habitat types as this includes woodland, the impact of which on this mapping output was not clear. Hence the disaggregated layers of the other individual habitats were used for all habitats relevant in Sussex context.
Environmental Limits	**Extent of Built-up Areas**	Urban areas in general do not provide opportunities for woodland creation 'at scale' and so have been excluded from this mapping approach. Alternative approaches should be used to identify opportunities for creation of small woodland areas or individual tree planting in urban areas.
	Extent of Roads	Woodland creation not feasible on roads
	Extent of Peaty Soils	Excluded because of their carbon storage potential and biodiversity value - and general importance of protecting deep peat sites from disturbance.
Heritage	**Extent of Battlefields**	To protect cultural and heritage assets of historic battlefields
	Extent of Scheduled Ancient Monuments (SAM)	To protect SAMs from damage or degradation caused by woodland creation.
	Extent of World Heritage Sites (WHS)	To protect the cultural or landscape heritage of any World Heritage Sites from any impacts form woodland creation (None within Sussex and the South Downs National Park)
	Extent of Local Geological Sites (LGS)	To protect LGSs from damage or degradation due to woodland creation.
Tree Cover	**15m Buffer to Tree Preservation Orders (TPO)**	To protect veteran or important trees from being subsumed within woodland creation projects.
	Extent of Existing Woodland (NFI Mixed Mainly Broadleaved, Mixed Mainly Conifer, Broadleaved, Conifer, Coppice, Coppice with Standards, Low Density, Assumed Woodland, Shrub, Young Trees)	Woodland creation at scale not feasible within existing woodland
Water quality and quantity	**Extent of River Network**	To exclude the actual rivers/water courses from the mapped area (woodland creation not feasible within the watercourses).
	15m Buffer to Lakes and Ponds (open water habitat)	To reduce risk of eutrophication from over-shading of these types of water bodies.
	Extent of WFD Lakes, Rivers, Canals, and Surface Water Transfer	To exclude the actual rivers/water courses from the mapped area (woodland creation not feasible within the watercourses).

B.2 List of weighted criteria used in the scored opportunity areas within the non-constraint zones.

Category	Weighted Criteria *(where negative values are constraints and positive values are opportunities)*	Justification	Nidderdale Weighting	Proposed Sussex Weighting
Biodiversity	**Designation: Extent of Local Wildlife Sites (LWS)**	To protect these sites from unsuitable impacts of woodland creation. Given a higher score than SSSIs as per Nidderdale rationale (i.e. that important habitats outside SSSIs not reliably represented in PHI) - and these sites carry less protection and can often be the only area of high biodiversity in wider area. Note: areas within these sites that are PHI and 'habitat networks: existing habitat components' are already included as constraints in order to protect them so this weighting will only flag those areas within these sites that are not covered by these constraints.	-3	-3
	Designation: Extent of Special Protection Area (SPA), SAC and SSSI, Ramsar Site and NNR	To protect these sites from unsuitable woodland creation. Designation reflects national importance of site and administrative constraints - however biodiversity value more strongly represented by PHI variable. Note: areas within these sites that are PHI and 'habitat networks: existing habitat components' are already included as constraints in order to protect them so this weighting will only flag those areas within these sites that are not covered by these constraints.	-2	-2
	SSSI impact risk zones	To buffer potential impact on designated areas	-1	-1
	Grassland within woodland: Grasslands isolated from NFI layer	Includes woodland rides and glades - assumed likely to have diverse ground flora	-5	-5
	Habitat Networks: Restorable Habitat **(NE Habitat Networks National Maps)**	To protect land needed for creation and/or enhancement of other habitat types Land in tis zone is predominantly semi-natural habitat where priority habitats may be present in a degraded and fragmented form and which are likely to be suitable for restoration). Woodland creation may not be suitable in this area given its importance for other priority habitats - but there may be opportunities as part of a habitat mosaic. But the suitability of any land in this area should be confirmed only after detailed site survey and consideration of the needs of other habitats.		-5

Category	Weighted Criteria *(where negative values are constraints and positive values are opportunities)*	Justification	Nidderdale Weighting	Proposed Sussex Weighting
	Habitat Networks Enhancement Zone 1	To protect land needed for enhancement of other important habitat types. Land in this zone includes land connecting existing patches of primary and associated habitats which is likely to be suitable for creation of the primary habitat. Woodland creation may therefore be suitable as part of habitat mosaic but should be scrutinised carefully in relation to needs of other habitats.	N/A	-3
	Extent of NE: Habitat Network Enhancement Zone 2	To protect land needed for enhancement of other important habitat types. Land in this zone connects existing patches of primary and associated habitats which is less likely to be suitable for creation of the primary habitat. Action in this zone that improves the biodiversity value through land management changes and/or green infrastructure provision can be targeted here. Woodland creation may be suitable as part of habitat mosaic but should be scrutinised carefully in relation to needs of other habitats.	N/A	-1
	Extent of NE Habitat Network: Network Expansion Zone	This zone includes land beyond the Network Enhancement Zones with potential for expanding, linking/joining networks across the landscape. This was not included as a weighted criteria as the total area for all habitat types covered by this expansion zone covered a significant area of the mapping area. However, this information should be referred to in any further assessment or design of woodland creation projects (see table B4 below)	N/A	Not scored
Environmental Quality	**50m Buffer to A Roads**	Improve access and reduce noise/air pollution. 50m buffer (with low positive score) agreed via stakeholder group discussion.	Not scored	2
Tree Cover	**Extent of wood pasture and parkland outside NFI**	To protect biodiversity, landscape and heritage value of these areas from impacts of conversion to woodland; some individual or small group tree planting may be suitable	-3	-3
	Extent of Traditional Orchards	To protect biodiversity and heritage of these traditional orchards from impacts of conversion to other woodland type; some additional tree planting may be suitable	-4	-4
	Extent of Felled and Windblown Trees	Area of past woodland creation, may potentially contain remnant flora	2	2

Category	Weighted Criteria *(where negative values are constraints and positive values are opportunities)*	Justification	Nidderdale Weighting	Proposed Sussex Weighting
	15-50m Buffer to Tree Preservation Orders (TPO)	To protect veteran or important trees from encroachment of new woodland and thus loss of landscape and other value of these trees;	-5	-5
	150m Buffer to Hedgerows <150m long	Nidderdale included hedgerow layers with positive weightings to indicate "Potential seed source for ground flora and enhanced movement of woodland fauna to and from woodland" However, these layers were not included in the Sussex project for two reasons: 1. Hedgerows are an important habitat and landscape feature in their own right and existing hedges should thus be used to help identify opportunities for new hedgerow creation (rather than woodland creation- which may not be appropriate alongside hedgerows as a wide buffer in all cases). i.e. hedges not a useful proxy for woodland opportunity 2. The datasets for hedges in Sussex are very patchy and thus not helpful at a Sussex-wide scale	1	Not scored
	150m Buffer to Hedgerows 150m - 500m Long	As above	3	Not scored
	150m Buffer to Hedgerows >500m Long	As above	5	Not scored
	50m Buffer to Ancient Woodland	Protective buffer for high value woodland	3	3
	150m Buffer to Existing Woodland	Improved habitat connectivity	5	5
	350m Buffer to Existing Woodland	Improved habitat connectivity	2	2
	150m Buffer to LWS Woodland	Protective buffer for high value woodland	3	3
	3 or More Connections to Woodland within 150m buffer	Enlarges habitats and enhances movement	5	5
Water Quality and Quantity	**Extent of Flood Zone 2**	Woodland creation in flood zone helps slow flow Layer not included as the WWNP data on areas suitable for woodland within the floodplain was thought to give a more accurate and nuanced insight into woodland establishment for flood mitigation.	3	Not scored

Category	Weighted Criteria *(where negative values are constraints and positive values are opportunities)*	Justification	Nidderdale Weighting	Proposed Sussex Weighting
	50m Buffer to Rivers	Mitigation of flood risk. Woodland creation in riparian zone helps slow flow Layer not included as the WWNP data on areas suitable for woodland within the riparian and wider catchment areas was thought to give a more accurate and nuanced insight into woodland establishment for flood mitigation.	3	Not scored
	Flood Risk/Working with Natural Processes[10]: areas suitable for tree planting - riparian areas	Environment Agency mapping indicating areas of **potential for riparian woodland creation** where this would have flood risk benefits (e.g. benefits for interception, slowing string and filtering water and reducing flood frequency). *Note: positive weighting of 3 used to mirror the weighting given to watercourse and flood risk datasets in the Nidderdale project designed to replicate this.*	-	3
	Flood Risk/Working with Natural Processes: areas suitable for tree planting - wider catchment	Environment Agency mapping indicating areas of potential for **woodland creation across a catchment** where this could provide flood risk benefits (e.g. interception, slowing string and filtering water and reducing flood frequency). *Note: positive weighting of 3 used to mirror the weighting given to watercourse and flood risk datasets in the Nidderdale project designed to replicate this.*	-	3
	Flood Risk/Working with Natural Processes: areas suitable for tree planting - floodplain	Environment Agency mapping indicating areas with potential for **woodland creation in flood plains** where this could provide flood risk benefits (e.g. slowing flood waters and increasing water depth, reduction of flood peaks and delay timing, de-synchronisation of flood peak and reduction of peak height), interception, slowing string and filtering water and reducing flood frequency). *Note: positive weighting of 3 used to mirror the weighting given to watercourse and flood risk datasets in the Nidderdale project designed to replicate this.*	-	3
	Source protection zones	To protect water availability Inner Source protection Zone Outer Source Protection Zone Total catchment Source Protection Zone		 -2 -1 -1

[10] https://assets.publishing.service.gov.uk/media/6036c730d3bf7f0aac939a47/Working_with_natural_processes_one_page_summaries.pdf
https://assets.publishing.service.gov.uk/media/6036c5468fa8f5480a5386e9/Working_with_natural_processes_evidence_directory.pdf

Category	Weighted Criteria *(where negative values are constraints and positive values are opportunities)*	Justification	Nidderdale Weighting	Proposed Sussex Weighting
	Extent of WFD failing water bodies (chemical)	Woodland creation in these areas could help to slow the flow, reduce sedimentation and improve water quality. Low weighting included to ensure positive impact of woodland on this parameter is not over represented. May be overlap with WWNP - and not able to source the correct data layer.	Not included	Not scored
Land Use/ ownership	**Land in stewardship scheme: higher- tier**	Reflects added administrative burden in pursuing woodland creation projects (these areas already covered by a scheme that may restrict additional funding or options for the land use) Ideally data would have been separated into schemes ending before and after 2025, however no schemes in the study region ended before 2025	-1	-1
Heritage	***Extent of Archaeological Notification Area (ANA)/Archaeological Alert Areas (Orange and Yellow)***	To protect the whole area of Archaeological Notification Areas from any degradation or damage related to woodland creation. Hampshire's archaeology data is recorded differently to the rest of the study region (hence the inclusion of Archaeology Alert Areas for this county). Red and Green Archaeology Alert Area data were not included as Red is the same as SAM and Green has unknown extents and unknown importance. Whereas Orange and Yellow data has a known extent, is thought to be of great importance (will need planning permission much like SAM), and differs from the locations of SAM sites.	Constraint	-5

B.3 Parameters included in Nidderdale mapping but not scored/mapped in this Sussex project

Category	Weighted Criteria	Nidderdale rationale	Nidderdale Weighting	Reason not included in Sussex map and recommendation
Biodiversity	*Foraging bats - gaps in connectivity.* Gaps in connectivity for foraging bats identified via HSM analysis	To buffer potential impact on designated land.	-2	Nidderdale used a modelled dataset for its area. There is some foraging bat data for Sussex not but not for the whole area covered by the mapping.
	Ground nesting birds. Location of breeding ground nesting birds. Some surveys field parcel based others buffered grid references (**data within last 5 years**).	Direct loss of breeding habitat in immediate tree planting area and anticipated increase in predation if planted too close to breeding habitat	Constraint - no woodland creation	The need to identify these areas was flagged by stakeholder group. Depended on whether there was local data available (Nidderdale used local data).

Category	Weighted Criteria	Nidderdale rationale	Nidderdale Weighting	Reason not included in Sussex map and recommendation
				Was not able to progress this. Recommendation - investigate further with SxBRC
	Ground nesting birds. Location of breeding ground nesting birds. Some surveys field parcel based others buffered grid references (**data older than last 5 years**).	Direct loss of breeding habitat in immediate tree planting area and anticipated increase in predation if close to breeding habitat.	-5	As above
	Ground nesting birds: More than 2 species combined HSM modelled data for curlew, lapwing, snipe and skylark + 100 m buffer	Direct loss of breeding habitat in immediate tree planting area and anticipated increase in predation if close to breeding habitat	-5	This used Nidderdale modelled data that was not available in Sussex
	Ground nesting birds: Only 1 species combined HSM modelled data for curlew, lapwing, snipe and skylark + 100 m buffer	Direct loss of breeding habitat in immediate tree planting area and anticipated increase in predation if close to breeding habitat	-5	This used Nidderdale modelled data that was not available in Sussex
	Reptiles: 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	**Constraint - no woodland creation**	
	Reptiles: 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	-5	This used Nidderdale modelled data that was not available in Sussex
	Water vole: 150 m buffer around known water vole records	Trees can shade out water vole target plants and harbour predators)	Constraint - no woodland creation	Used Nidderdale AONB records. Sussex data on water voles?
Climate Change	Biodiversity role in sequestration	Most habitats of value for sequestration already identified as complete constraint	Not scored	

Category	Weighted Criteria	Nidderdale rationale	Nidderdale Weighting	Reason not included in Sussex map and recommendation
Environmental Limits	Maximum elevation	Elevation above 500m - to reflect potential maximum elevation for broadleaved trees.	-3	No elevation of this height in Sussex/SDNPA so this criterion was not included
	Slope	Slope not seen as a barrier to woodland creation for non-commercial purposes).	Not scored	
	Yield class	Yield class not viewed as key variable for conservation woodland - tree species can be chosen to best suit the site	Not scored	
	Soil wetness	Few soils in NAONB outside heathland areas are too wet for tree planting - heathland areas protected as Category 1 constraint - selection of species can moderate soil constraints	Not scored	
	Soil fertility	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	
	Preferred aspect	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	
	Mitigation of noise/air pollution	Buffer for air pollution - would largely be a repeat of the road access buffer so not scored	Not scored	
	Landscape impact	Landscape outside remit of the plan - parameters difficult to map effectively	Not scored	
	historic woodland extent	Current format of historic maps did not support inclusion	Not scored	
Heritage	World Heritage Sites buffer zone	There may be some potential for small areas of conservation woodland planting within larger area subject to site appraisal	Not scored	There were no World Heritage Sites within the study region
Land Use/Ownership	Land in stewardship scheme: mid-tier, end date before 2025	Reflects added administrative burden in pursuing woodland planting	-2	Close to end of these schemes so didn't include

Category	Weighted Criteria	Nidderdale rationale	Nidderdale Weighting	Reason not included in Sussex map and recommendation
	Land in stewardship scheme: higher- tier, end date after 2025	Reflects added administrative burden in pursuing woodland planting	-2	Data not available
	Recreational impact. 100 buffer around PROW.	Reflect positive impact on public access to woodlands	1	This was not included in the Sussex approach due to the very localised suitability of woodland along PROW and concern that this would block important views.
	Extent of common land	Reflects added administrative burden in pursuing woodland planting	-2	Not included - but could be so at a later date if thought to be useful.
	Economic land use - Agricultural Land Use Classification 1 and 2	Productive agricultural land important in maintaining food supply.	-3	Sussex stakeholder engagement exercise agreed not to include this as woodland creation, especially at small scale, can be compatible with agricultural land use and each farmer/landowner can make a decision as to what type of land in their ownership to use for woodland creation
	Underground infrastructure (routes of ethylene pipeline, gas networks and aqueduct data and 50m buffer, route of culverts and 10m buffer)	No dig areas above and close to underground infrastructure	Constraint - no woodland creation.	Not included in Sussex approach due to security issues related to sharing of data by utility companies.
	Reservoir, dams and spillways	Woodland creation could damage reservoir infrastructure.	Constraint - no woodland creation.	As above
Tree Cover	Proximity to woodland 0.2-0.5 ha in size	Protective buffer for existing woodland, enlarged potential habitat for woodland fauna.	3	Required use of data from Bluesky (20178) - which has a charge and so was not included in this approach. It could be added later if required and if data available.
	Minor connections within 150m buffer (between 2 woodlands only)	Enlarges habitats and enhances movement	3	
	Connections to ancient woodland within 160m buffer	Enhances habitat and enhances movement. Increases resilience of high-quality woodland.	5	

Category	Weighted Criteria	Nidderdale rationale	Nidderdale Weighting	Reason not included in Sussex map and recommendation
	Connections between woodland (large woodland)	Enhances habitat and enhances large scale movement	5	
	Mitigation for potential loss of ash trees	To promote tree planting in areas with moderate concentration of ash trees as mitigation for expected tree loss (Ash tree coverage 0.8 - 1 ha/km2)	1	Data on lost ash trees not available for whole project area
	Mitigation for potential loss of ash trees	To promote tree planting in areas with high concentration of ash trees as mitigation for expected tree loss (Ash tree coverage 1-5 ha/km2)	2	As above
	Mitigation for potential loss of ash trees	To promote tree planting in areas with very high concentration of ash trees as mitigation for expected tree loss (Ash tree coverage >5 ha/km2)	3	As above
	Extent of woodland creation grant areas	Woodland already planned and funded	Constraint - no woodland creation	Not included
	Extent of recent woodland creation/ tree planting	Already existing broadleaved woodland	Constraint - no woodland creation	Not included
	Extent of felled and windblown trees	Area where past planting was supported, may potentially contain remnant flora	Not scored	Not scored
Water Quality and Quantity	Water supply to wetlands. 250m buffer around lowland fen	To protect hydrology of priority habitat	-5	Not included as very little lowland fen in Sussex - but could be included if felt to be useful
	Riparian shading. 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	3	Not included as assumed this is already within the WWNP layers (Table B2)

Category	Weighted Criteria	Nidderdale rationale	Nidderdale Weighting	Reason not included in Sussex map and recommendation
	Mitigation of flood risk. Gleyed soils (outside riparian and flood zone)	Trees planted on gleys soils could reduce overland flow	3	Not included as assumed this is already within the WWNP layers (Table B2)
	Acidification. Extent of acid sensitive surface water bodies.	Significant new woodland may increase acid loads in catchments	-1	
	Suspended sediment. Extent of catchments with sediment (T1) and phosphates from rural areas (T3) pressures.	Conservation woodland may reduce sediment loads in catchments	3	This is a potentially very useful layer in the Sussex context. Requires more discussion with EA to identify if data layer is available.

B.4 Other local datasets not included in this tool that may be useful for desk-based assessment of possible woodland sites.

Several data sets were identified during this project that were not suitable for inclusion in the woodland opportunity mapping exercise but will be very helpful for further desk-based analysis of potential woodland creation sites - providing information further negative or positive factors that should be considered.

Criteria	Data Set	Rationale
Biodiversity	Arun and Western Streams - Habitat Potential Models Similar (but older) models for the Ouse. Held by Sussex Wildlife Trust and Sussex Biodiversity Record Centre	These models include potential for 'wet woodland'. Not included as only covers part of Sussex (Arun and Rother catchment) and this layer may duplicate other factors already included in the Woodland Opportunity Mapping approach.
	University of Exeter - Open Beaver Network and Beaver Habitat Index. Contains data layer for the southeast	May help to understand if an area is considered suitable as Beaver habitat - which in turn may inform woodland creation project.
	Bat foraging areas Held by Sussex Wildlife Trust/ Sussex BRC	There is some data for bat foraging areas for parts of Sussex which could be used in site analysis.
Land Use/Ownership	National dataset. Land under Agri Environment Scheme - Mid and Higher Tiers	Provides information on land under these schemes which is therefore already committed to other activity and so may have constraints on new woodland creation projects
Climate Change	NE dataset - climate vulnerability for deciduous woodland	Shows areas of England where woodland would be vulnerable from changing climatic conditions, flooding etc. Would be useful to consider as a possible constraint.
Water Quality and Quantity	Surface water flow paths for Sussex - showing where water flows and accumulates to a 2m accuracy. Held by Sussex Flow Initiative and Sussex Wildlife Trust	Very detailed information that is more useful in informing project design at the site level.
Access	Accessible Natural Greenspace Standards - spatial data indicating presence of accessible natural greenspace within various distances of settlements/homes etc.	Can use to identify if new woodland lies within certain ANGSt distances of people's homes and therefore could provide useful additional natural greenspace.
	People and Nature Network evidence base (SDNPA)	Useful collation of spatial data identifying 'natural capital investment areas' where new habitat creation could deliver multiple benefits
	Indices of Multiple Deprivation	

Appendix C

All criteria that were used within the project, showing the type of criteria (constraint, negative weighting, or positive weighting) and where the dataset was sourced from.

Parameter	Constraint/ Weighted Layer	Data source	Licence	Acknowledgements
Extent of PHI	Constraint	Natural England	Open Government Licence	© Natural England copyright. Contains Ordnance Survey data © Crown copyright and database right [2022]. The Resource Locator links are: PHI North, PHI Central and PHI South. 2 links are provided for each, Natural England Open Data Geoportal and transferbigfiles.com download. By merging all three datasets together you can create a full coverage dataset of England. These datasets do not overlap to facilitate this. Attribution statement: © Natural England copyright. Contains Ordnance Survey data © Crown copyright and database right [2022].
Extent of Scheduled Ancient Monuments (SAM)	Constraint	Historic England	Open Government Licence	© Historic England [2022]. Contains Ordnance Survey data © Crown copyright and database right [2022] The Historic England GIS Data contained in this material was obtained on [25/06/2021]. The most publicly available up to date Historic England GIS Data can be obtained from HistoricEngland.org.uk.
Extent of Local Geological Sites (LGS)	Constraint	Sussex Biodiversity Record Centre		Local Geological Site data reproduced with permission of Sussex Biodiversity Record Centre, acting on behalf of Sussex Geodiversity Group. © Crown Copyright. All rights reserved [2022]

Extent of Archaeological Notification Area (ANA)	Constraint	East Sussex County Archaeology Team, South Downs National Park Authority,		
Extent of Built-Up Area	Constraint	Office for National Statistics	Open Government Licence	
Extent of water and river network	Constraint	Ordnance Survey	Open Government Licence	Contains OS data © Crown copyright and database right 2021
15m buffer to lakes and ponds	Constraint	Sussex Biodiversity Record Centre, South Downs National Park Authority, Ordnance Survey		Sussex Pond Inventory data reproduced with permission of Sussex Biodiversity Record Centre. © Crown Copyright. All Rights Reserved [2022].
15m buffer to veteran trees/TPO	Constraint	District Councils (no data obtained from Horsham, Crawley, Wealden, and Brighton and Hove City Council)		
Extent of existing broadleaf woodland	Constraint	National Forest Inventory	Open Government Licence	Contains, or is based on , information supplied b y the Forestry Commissi on. © Crown copyright and database right 201 9 Ordnance Survey [100 021242]
Extent of Battlefields	Constraint	Historic England		
Extent of Landfill Sites	Constraint	Environment Agency	Environment Agency Conditional Licence	© Environment Agency copyright and/or database right 2015. All rights reserved.
Extent of NE Habitat Network: Existing Habitat (primary habitat, associated habitat, habitat creation, restorable habitat)	Constraint	Natural England	Open Government Licence	© Natural England copyright.
Extent of Peaty Soils	Constraint	Natural England		Derived from 1:50 000 scale BGS data under licence 2006/072 British Geological Survey. © NERC. National Soils Map © Cranfield University (NSRI) © Crown Copyright and database rights [2022]. © Natural England copyright [2022], reproduced with the permission of Natural England, https://www.gov.uk/he lp/terms-conditions © Crown Copyright and database right [2022]. Ordnance Survey

				licence number 100022021.
Extent of Environmental Stewardship Scheme Higher Tier	Negative Weighting	Rural Payments Agency	Open Government Licence	© Rural Payments Agency copyright. Contains Ordnance Survey data © Crown copyright and database right [year].
Extent of Conifer	Negative Weighting	National Forest Inventory	Open Government Licence	Contains, or is based on , information supplied b y the Forestry Commissi on. © Crown copyright and database right 201 9 Ordnance Survey [100 021242]
Extent of Mixed Woodland	Negative Weighting	National Forest Inventory	Open Government Licence	Contains, or is based on , information supplied b y the Forestry Commissi on. © Crown copyright and database right 201 9 Ordnance Survey [100 021242]
15-50m veteran/TPO trees	Negative Weighting	District Councils (no data obtained from Horsham, Crawley, Wealden, and Brighton and Hove City Council)		
Extent of Traditional Orchards	Negative Weighting	Natural England	Open Government Licence	© Natural England copyright. Contains Ordnance Survey data © Crown copyright and database right [2022].
Extent of Pasture and Parkland	Negative Weighting	Natural England	Open Government Licence	© Natural England copyright. Contains Ordnance Survey data © Crown copyright and database right [2022].
Extent of Local Wildlife Sites (LWS)	Negative Weighting	Sussex Biodiversity Record Centre		
Extent of Special Areas of Conservation (SAC)	Negative Weighting	Natural England	Open Government Licence	© Natural England copyright.
Extent of Special Protection Area (SPA)	Negative Weighting	Natural England	Open Government Licence	© Natural England copyright. Contains Ordnance Survey data © Crown copyright and database right [2022].
Extent of Site of Special Scientific Interest (SSSI)	Negative Weighting	Natural England	Open Government Licence	© Natural England copyright. Contains Ordnance Survey data © Crown copyright and database right [2022].
Extent of Ramsar Site	Negative Weighting	Natural England	Open Government Licence	© Natural England copyright. Contains Ordnance Survey data © Crown copyright and database right [2022].
Extent of National Nature Reserve (NNR)	Negative Weighting	Natural England	Open Government Licence	© Natural England copyright. Contains Ordnance Survey data

				© Crown copyright and database right [2022].
SSSI impact risk zones	Negative Weighting	Natural England	Open Government Licence	© Natural England copyright. Contains Ordnance Survey data © Crown copyright and database right [2022].
Grassland within woodland: Grasslands isolated from NFI layer	Negative Weighting	National Forest Inventory	Open Government Licence	Contains, or is based on , information supplied b y the Forestry Commissi on. © Crown copyright and database right 201 9 Ordnance Survey [100 021242]
Extent of NE Habitat Network: Habitat Network Enhancement Zone 1	Negative Weighting	Natural England	Open Government Licence	© Natural England copyright.
Extent of NE Habitat Network: Habitat Network Enhancement Zone 2	Negative Weighting	Natural England	Open Government Licence	© Natural England copyright.
Extent of NE Habitat Network: Network Expansion Zone	Negative Weighting	Natural England	Open Government Licence	© Natural England copyright.
Source protection zones	Negative Weighting	Environment Agency	Open Government Licence	© Environment Agency copyright and/or database right 2016. All rights reserved.
Working with Natural Processes[11]: **riparian areas woodland potential**	Positive Weighting	Environment Agency	Open Government Licence	© Environment Agency copyright and/or database right 2015. All rights reserved.
Working with Natural Processes: **wider catchment woodland potential**	Positive Weighting	Environment Agency	Open Government Licence	© Environment Agency copyright and/or database right 2015. All rights reserved.
Working with Natural Processes: **floodplain woodland potential**	Positive Weighting	Environment Agency	Open Government Licence	© Environment Agency copyright and/or database right 2015. All rights reserved.
50m buffer to A roads	Positive Weighting	Ordnance Survey	Open Government Licence	Contains OS data © Crown copyright and database right 2022
50m buffer around ancient woodland	Positive Weighting	Natural England	Open Government Licence	© Natural England copyright. Contains Ordnance Survey data © Crown copyright and database right [2022].
150m buffer around broadleaf woodland	Positive Weighting	National Forest Inventory	Open Government Licence	Contains, or is based on , information supplied b y the Forestry Commissi on. © Crown copyright and database right 201

11 https://assets.publishing.service.gov.uk/media/6036c730d3bf7f0aac939a47/Working_with_natural_processes_one_page_summaries.pdf
https://assets.publishing.service.gov.uk/media/6036c5468fa8f5480a5386e9/Working_with_natural_processes_evidence_directory.pdf

				9 Ordnance Survey [100 021242]
350m buffer around broadleaf woodland	Positive Weighting	National Forest Inventory	Open Government Licence	Contains, or is based on , information supplied b y the Forestry Commissi on. © Crown copyright and database right 201 9 Ordnance Survey [100 021242]
3 or More Connections to Woodland within 150m buffer	Positive Weighting	National Forest Inventory	Open Government Licence	Contains, or is based on , information supplied b y the Forestry Commissi on. © Crown copyright and database right 201 9 Ordnance Survey [100 021242]
Extent of Felled or Windblown Trees	Negative Weighting	National Forest Inventory	Open Government Licence	Contains, or is based on , information supplied b y the Forestry Commissi on. © Crown copyright and database right 201 9 Ordnance Survey [100 021242]
150m buffer around LWS woodland	Positive Weighting	Sussex Biodiversity Record Centre		Local Wildlife Site boundaries maintained by Sussex Biodiversity Record Centre on behalf of Sussex Local Wildlife Site Initiative. Contains Ordnance Survey data © Crown Copyright and database rights [2022]

Appendix D

Tools used in the project

ArcGIS 10.7.1		
Conversion Tools		
Tool Name	**Tool Description**	**Use in Report**
Raster to Polygon	Converts raster datasets into polygon features (ESRI, 2020).	For conversion of outputs of constraint areas and levels of opportunity, in order to quantify the areas.
Data Management Tools		
Tool Name	**Tool Description**	**Use in Report**
Project	Converts datasets from one coordinate system another coordinate system (ESRI, 2020).	Ensuring all datasets were projected in British National Grid (BNG)
Spatial Analyst Tools		
Tool Name	**Tool Description**	**Use in Report**
Euclidean Distance	Uses the source feature to calculate the Euclidean distance of every cell from it (ESRI, 2020).	Used on all features, in order to convert vector datasets to raster datasets for interrogation within the site suitability analysis.
Raster Calculator	In order to carry out map algebra expressions, by using python syntax, producing raster outputs (ESRI, 2020).	Used to form layers interrogate the data and create new layers for each criteria.
Extract by Mask	Uses one layer to extract the corresponding cells of a raster, resulting in a cropped result according to the mask extent (ESRI, 2020).	Used on all raster datasets to crop them to the extent of the study region.
Weighted Sum	Several overlaying rasters are multiplied by their given weight and then a sum is produced from this.	Used to create the levels of opportunity for woodland establishment in the non-constraint areas.
Fuzzy Overlay	Combines overlaying raster layers in multi-criteria overlay analysis.	Used to combine the criteria the create the areas of constraint within the study region.

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