

Exmoor Land Use Targets: A Summary for Management Plan

Dr Dmitry Yumashev, Small World Consulting

GIS support: Duncan Hornby, GeoData

Methodological support: Clare Reid, Alex Farris & Graeme McVittie, Exmoor NPA

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Introduction

This report summarises results of the latest assessment by Small World Consulting (SWC) of the recommended woodland, peatland and regenerative agriculture targets for the Exmoor National Park. The work was funded by Defra via National Parks England. Further methodological details are provided in SWC's recent Net Zero report for all UK National Parks¹.

The land use change and management targets proposed for Exmoor consider the following measures:

- Woodland creation
- Peatland restoration (focusing on deep peat only)
- Adoption of selected regenerative agriculture practices (see below for further details)

The targets are derived by apportioning UK-wide land-based carbon sequestration measures from the UK's Sixth Carbon Budget (2020)² according to present-day land use distributions in Exmoor relative to England-wide and UK-wide distributions.

We consider the following options for land use change and management that will enable carbon sequestration (or emissions reduction in the case of degraded peatland) and create wider environmental benefits such as biodiversity gains, flood mitigation, air quality improvements, and gains in recreational value, in alignment with the Sixth Carbon Budget:

- Woodland creation
 - New native broadleaf/mixed woodland
 - New productive coniferous woodland
- Peatland restoration (across all degraded types; deep peat only)
- Regenerative agriculture
 - Agroforestry

¹ <https://www.sw-consulting.co.uk/national-parks-net-zero-report>.

² <https://www.theccc.org.uk/publication/sixth-carbon-budget/>.

- Hedgerows
- Introducing species-rich grasslands with legume species
- Introducing cover crops

UK-wide land use targets

We use the Balanced pathway from the Sixth Carbon Budget to derive UK-wide targets for each of the land measures introduced above. These are apportioned to England on a simple area basis (Table 1). The England-wide targets are then apportioned to Exmoor using the opportunity mapping procedures defined in the sections below.

Table 1. UK-wide and England-wide land use target inferred from the Sixth Carbon Budget. Note that the peatland targets are defined in relative terms here and are applied to deep peat only.

	UK target (ha/yr)	England target (ha/yr)
New Woodland	50,000	26,750
Restored Peatland	80% of deep peat restored by 2050	
Agroforestry	30,150	16,500
Hedgerows	1,725	950
Legumes	120,900	66,000
Cover Crops	113,600	62,000

Woodland creation

Woodland opportunity mapping and targets

The fact that creating new woodland requires a fundamental change to land use, rather than management changes on existing land, means that the proposed woodland target has to be set by considering total areas of suitable habitats within each landscape.

As part of a recent project funded by Defra, SWC carried out a woodland opportunity mapping exercise for 10m land parcels across the whole of England using multiple datasets that capture a range of policy incentives and constraints, as well as ecological factors:

- Environment Agency: Working with natural processes to reduce flood risk;
- Forestry Commission: England Woodland Creation Full Sensitivity Map v3.0, variant 1;
- Natural England: Agricultural Land Classification;
- Natural England: Living England habitat map;
- Forest Research: National Forest Inventory;
- UK CEH: UK GHG Inventory peat data; “deep peat” layer only;

- Historic England: Principal Archaeological Landscapes; set of layers “Detailed Mapping”;
- Historic England: Scheduled Ancient Monuments;
- British National Grid, 10m raster.

The mapping procedure involved introducing England-wide statistical regressions between the various datasets above to derive a harmonized set of woodland opportunity scores, which are presented for Exmoor in Figure 1 and for the whole of England in Figure 2. The score of 0 means that a given 10m pixel is not suitable for tree planting, while the score of 1 (or 100%) means the highest relative suitability compared to all other 10m pixels across England.

The current version of the woodland opportunity map has several simplifications that were required to produce the original England-wide dataset, but resulted in several anomalies which can be seen in localised areas such as various parts of Exmoor shown in Figure 1:

- 100m ecological buffers around existing woodlands were applied to all types of woodland, regardless of whether it is classified as ancient broadleaved or more recently planted conifers. This led to lower opportunity scores around the ancient broadleaved as would have been expected from their ecological connectivity viewpoint;
- 100m ecological buffers around riparian areas identified as prime targets for tree planting to mitigate flood risks were scored lower than would have been expected in selected upland areas with good potential for woodland creation beyond riparian zone;
- Some moorland areas, which do not have deep peat according to ground surveys and could be good for tree planting, were excluded because the UK-wide peat map used overestimates the extend to deep peat in Exmoor (see the section on peat targets below for further details);
- Some buffers around SSSIs were scored lower than expected in selected Exmoor areas due to more conservative underpinning assumptions in the England-wide Forestry Commission sensitivity map;
- Some moorland SSSIs which are not SACs and do not have deep peat appear to have greater opportunity for woodland than would be expected.

Small World Consulting is currently developing an updated version of the England-wide woodland opportunity map, due to be completed in Q1 of 2025, which will address these issues.

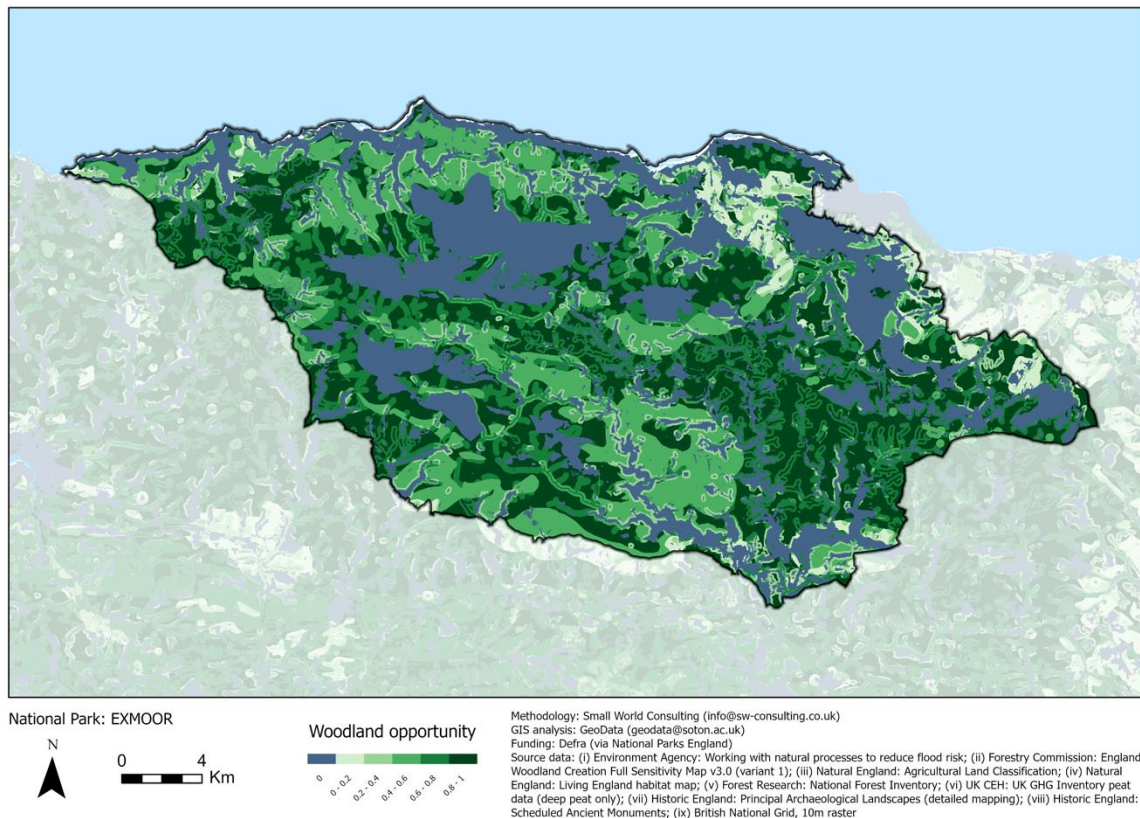
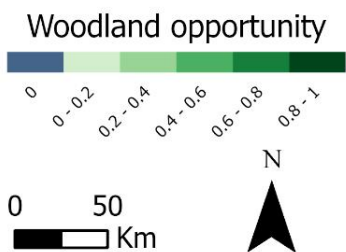
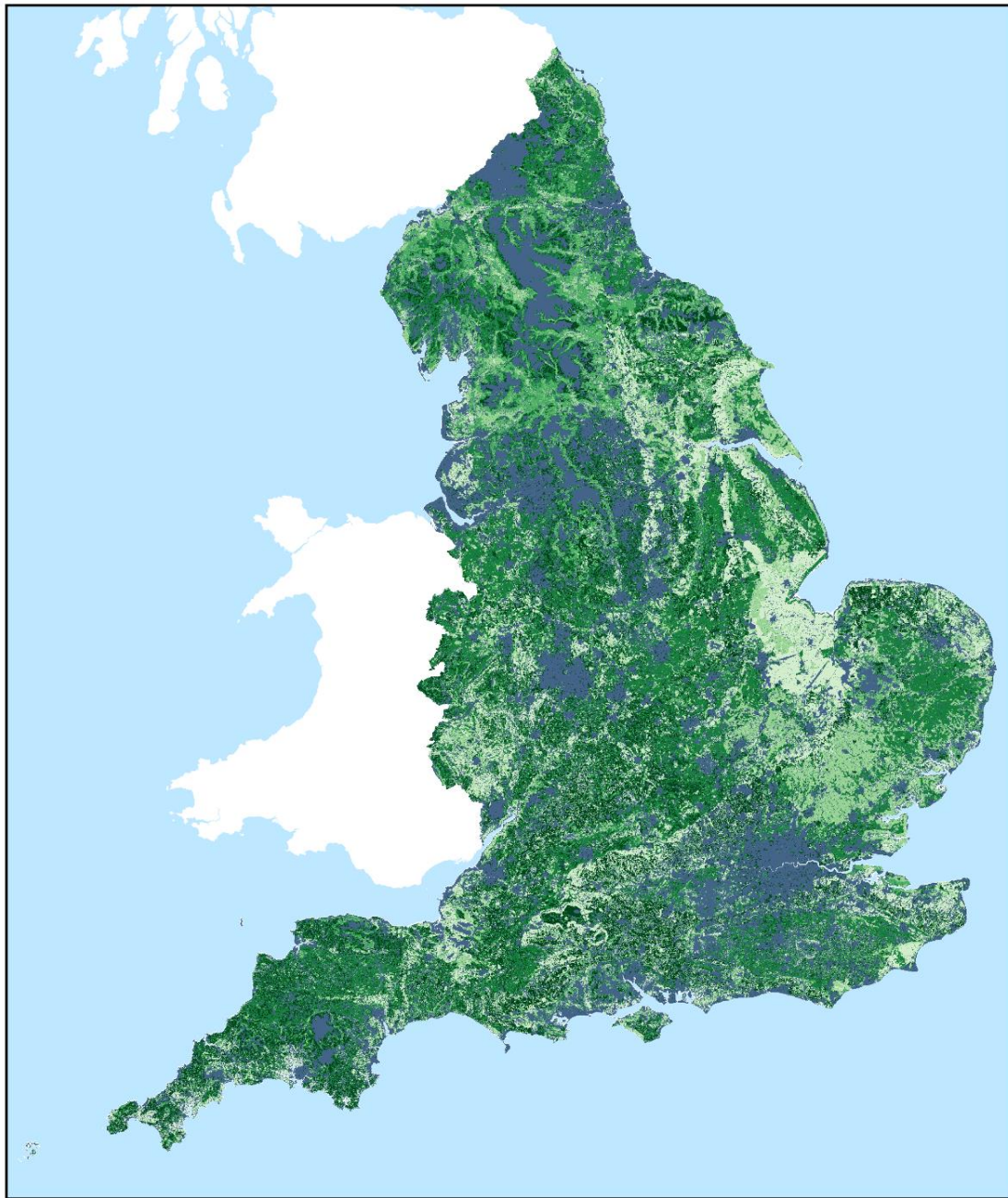


Figure 1. Normalised woodland opportunity scores based on the new opportunity mapping procedure by SWC. Coverage: Exmoor National Park.

To derive apportioned woodland target for Exmoor (or for any other area within England), one has to tally all the 10m pixel woodland opportunity scores within this area, divide this by the corresponding England-wide tally of the scores, and multiply the resulting fraction by the England-wide woodland target (26,750 ha/yr; Table 1).

We also explored increasing woodland targets to compensate for the UK's consumption-based footprint, which is currently approximately twice higher than the country's territorial emissions due to the UK being a major net importer of goods³. Since the Sixth Carbon Budget woodland targets were derived to compensate for the residual territorial emissions, adjusting for the consumption-based footprint implies roughly doubling the apportioned territorial-only woodland target (assuming current trade patterns and the associated emissions relative to the UK's territorial emissions remain unchanged).

³ For further details, see our recent Net Zero report for all UK National Parks: <https://www.sw-consulting.co.uk/national-parks-net-zero-report>.



Methodology: Small World Consulting (info@sw-consulting.co.uk)
 GIS analysis: GeoData (geodata@soton.ac.uk)
 Funding: Defra (via National Parks England)
 Source data: (i) Environment Agency: Working with natural processes to reduce flood risk; (ii) Forestry Commission: England Woodland Creation Full Sensitivity Map v3.0 (variant 1); (iii) Natural England: Agricultural Land Classification; (iv) Natural England: Living England habitat map; (v) Forest Research: National Forest Inventory; (vi) UK CEH: UK GHG Inventory peat data (deep peat only); (vii) Historic England: Principal Archaeological Landscapes (detailed mapping); (viii) Historic England: Scheduled Ancient Monuments; (ix) British National Grid, 10m raster

Figure 2. Normalised woodland opportunity scores based on the new opportunity mapping procedure by SWC. Coverage: England.

The resulting set of woodland targets is summarised in Table 2. We recommend going with **255 ha/yr**, which represents a halfway house between the estimated territorial-based and consumption-based targets.

Table 2. Different ways of setting woodland target for Exmoor by apportioning the relevant England-wide target.

National Park	Option 1 (ha/yr): England target = 26,750 ha/yr (territorial Net Zero)	Option 2 (ha/yr): England target = 53,500 ha/yr (consumption Net Zero)	Mean (ha/yr)
Exmoor: England-wide methodology	170	340	255

Assuming the targets are applied continuously between 2023 and 2050, the resulting additional woodland areas, expressed as percentages of the total Exmoor National Parks area (69,200 ha), are summarised in Table 3. Under the target of 255 ha/yr, the National Park will be looking to have an additional 10% of its land area covered in woodland by 2050, likely in the form of mosaic habitats in the least agriculturally productive areas. Such a transition requires adequate financial support for farmers through the various ELMS government subsidies together with appropriately vetted private sector funding.

Table 3. Projected additional woodland areas in Exmoor by 2050, expressed as percentages of the National Park's area, under the proposed annual woodland creation targets.

National Park	Option 1 (territorial Net Zero)	Option 2 (consumption Net Zero)	Mean
Exmoor: England-wide methodology	6.6%	13.3%	10.0%

Analysis of woodland opportunity scores by 20% bands

We further analysed the default woodland opportunity map in Figure 1 in each of its five 20% bands for the opportunity score values. The results are summarised in Table 4. Almost 50% of the National Park's area has woodland opportunity scores between 0% and 20% (least suitable for planting, including entirely unsuitable areas such as deep peat). These regions contribute to only 1% of the total recommended woodland target for the National Park. On the other hand, the most suitable areas for woodland with opportunity scores between 80% and 100% account for around 19% of the Exmoor area and accommodate 52% of its total recommended woodland target.

We would like to stress that the actual decisions on planting trees in each area will be made by the local farmers and land managers, and will require adequate funding to ensure there are attractive incentives to encourage more woodland. It will also be important to ensure that the changes benefit and increase the resilience of local communities. The indicative percentages in Table 4 are only a first step in this process.

Furthermore, some of the areas currently marked as unsuitable may be able to accommodate some woodland when more nuanced local data is considered, for example deep peat measurement by the Southwest Peatland Partnership (see the section below). Various other parts of the National Park may also have their relative woodland suitability scores revised once more granular data on priority habitats, SSSIs, SACs, habitat connectivity networks, protected species, soils and local climate conditions are taken into account.

As mentioned earlier, Small World Consulting is currently developing an updated version of the England-wide woodland opportunity map which will attempt to capture all these factors within a consistent and transparent framework. The map is expected to be ready in the end of Q1 of 2025 and will help inform future decisions on woodland creation in Exmoor (and elsewhere in England).

Table 4. Woodland opportunity scores for each 20% band.

Band range of scores	Woodland suitability interpretation	Area (ha)	% of total area of Exmoor	Relative contribution of each band to Exmoor-wide woodland target
0% – 20%	Lowest	34,010	49.5%	1%
20% – 40%	Low	3,936	5.7%	5%
40% – 60%	Medium	9,625	14%	18%
60% – 80%	High	8,270	12%	24%
80% – 100%	Highest	12,833	18.7%	52%

Peatland restoration

UK GHG Inventory peat data

The recommended uptake of peatland restoration measures is based on the assessment of deep peatland coverage and condition across Exmoor, which we based on UK GHG Inventory’s deep peat dataset by UK CEH. Its geographical extent matches the widely used BGS NSRI map for deep peat across England (Figure 3), which is then supplemented by assessment of peat condition using vegetation categorisation inferred from remote sensing data. The peat condition is categorised in line with the classification developed by the CEH to account for the UK-specific types and modifications of peat in the national GHG Inventory⁴. The UK GHG Inventory’s deep peat results for Exmoor are summarised in Table 5. In England, peat depths greater than 40 cm are classed as deep peat.

⁴ https://uk-air.defra.gov.uk/reports/cat07/1904111135_UK_peatland_GHG_emissions.pdf.

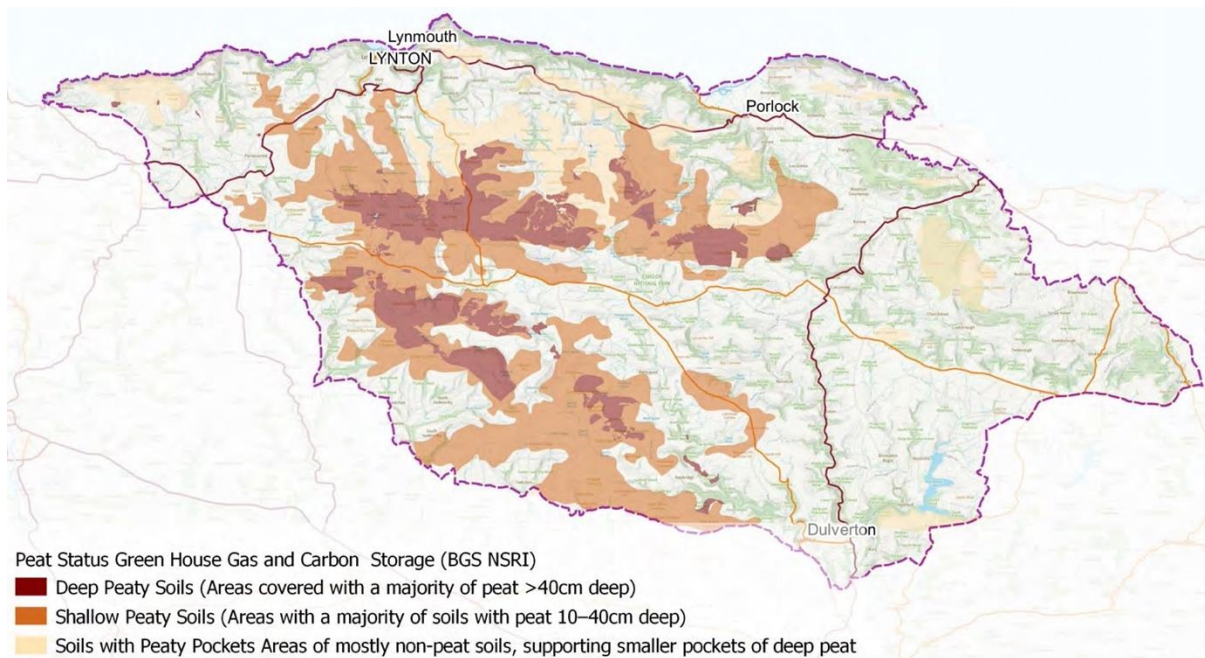


Figure 3. Peatland areas in Exmoor according to BGS NSRI dataset. The deep peat layer (> 40 cm) in this dataset defines the GHG Inventory deep peat extent, which we used to set peatland restoration target for Exmoor and other designated landscapes in the UK.

Table 5. UK GHG Inventory results for deep peat in Exmoor. Peat types follow the classification developed by UK CEH.

Peat Type / Habitat Type on Peat Soils	Area (ha)
Forest	84.4
Cropland	8.0
Eroding Modified Bog (bare peat)	0.0
Modified Bog (Heather + Grass dominated)	3,328.6
Extensive Grassland	117.4
Intensive Grassland	154.1
Domestic Extraction	105.2
Industrial Extraction	0.0
Settlement	7.4
Near Natural Bog (including rewetted)	824.1
Near Natural Fen (including rewetted)	0.0
Total	4,629.3

The UK CEH peatland map has considerable uncertainties, particularly when it comes to drainage status. The accuracy of the peat data is expected to be improved when Natural England publishes its new peatland map in the end of Q1 of 2025⁵.

South-West Peatland Partnership data

⁵ <https://naturalengland.blog.gov.uk/2024/08/06/with-a-lot-of-help-from-our-friends-assembling-an-england-peat-map/>.

To ground-truth the UK GHG Inventory peat data, we analysed a local dataset provided by the South-West Peatland Partnership (SWPP), which has carried out peat surveying and restoration work in the area for over a decade. This dataset is point-depth measurements (over 12,000 unique samples) manually recorded using a peat depth probe across all blanket and valley mire habitats on Exmoor.

The point records of 40cm peat depth and over have been manually converted to polygons and shown in Figure 4. It provides a more likely distribution of deep peat within Exmoor, with the total area being around 1,200 ha, which is considerably lower than in the UK GHG Inventory dataset (around 4,600 ha). We expect that the forthcoming updated Natural England peatland map will be closer to the SWPP map, helping inform future decisions on peatland restoration in Exmoor (and elsewhere in England).

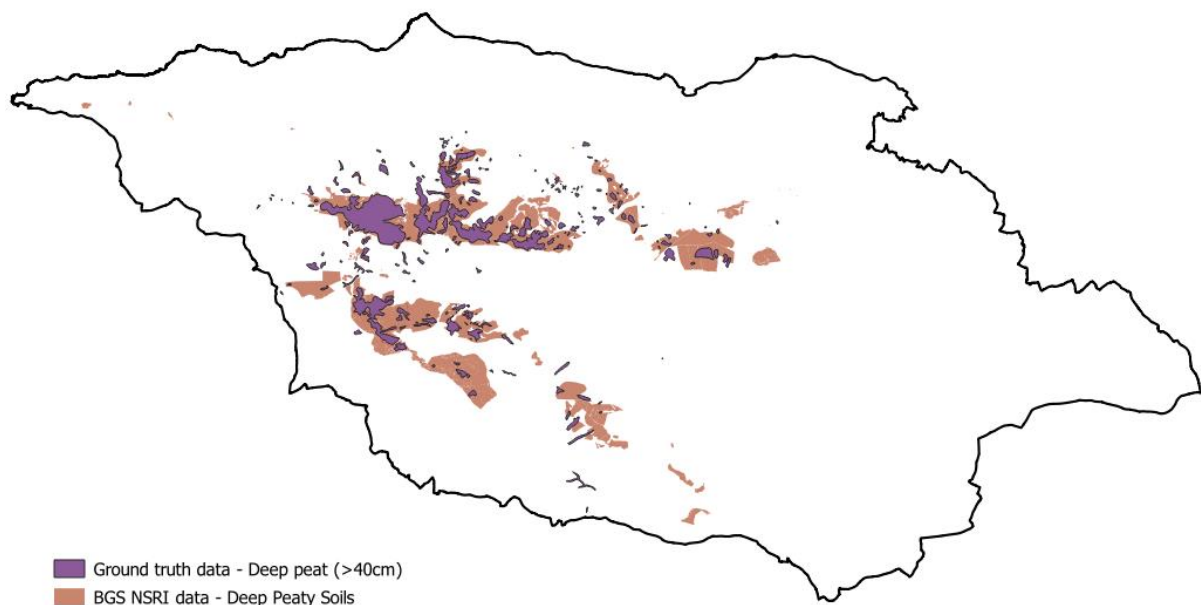


Figure 4. Intersect between BGS NSRI and SWPP ground-truthed data.

Recommended peatland targets

In setting the level of ambition, we follow the UK-wide target from the Sixth Carbon Budget which aims for 80% of peatland to be in a healthy condition by 2050. According to the results in Table 5, only around 18% of deep peat in Exmoor could be described as being in a healthy condition at present. The corresponding annual restoration target for deep peat apportioned to Exmoor is **103 ha/yr**, based on the UK GHG Inventory peatland map. Its breakdown into targets for individual peat types is provided in Table 6. These targets are likely going to be revised following the publication of the updated Natural England peatland map.

We do not consider any shallow peat restoration targets in this assessment due to higher uncertainty in the feasibility of such restoration compared to that for deep peat.

Table 6. Breakdown of the total deep peat restoration target for Exmoor into different degraded peat types.

Peat Type / Habitat Type on Peat Soils	Target (ha/yr)
Forest	2.3
Cropland	0.2
Eroding Modified Bog (bare peat)	0.0
Modified Bog (Heather + Grass dominated)	90.0
Extensive Grassland	3.2
Intensive Grassland	4.2
Domestic Extraction	2.8
Industrial Extraction	0.0
Settlement	0.2
Total	102.8

Regenerative agriculture targets

Table 7 summarises regenerative agriculture measures considered in this assessment and provides their definitions according to the UK's Sixth Carbon Budget⁶.

Table 7. UK Sixth Carbon Budget definitions of selected regenerative agriculture measures.

Regenerative agriculture measure	UK Sixth Carbon Budget definition
Agroforestry	Integration of trees and/or shrubs on to cropland (silvoarable: trees and crops) and grassland (silvopastoral: trees and livestock)
Hedgerows	Trees and/or shrubs planted on field boundaries
Legumes	Mix of herbal species such as clover that fix nitrogen into the soil thereby reducing the need for synthetic nitrogen fertiliser
Cover Crops	Non-cash crops that are incorporated into the main crop rotation to minimise soil erosion and maintain soil carbon

The recommended regenerative agriculture targets are based on apportioning the relevant UK-wide targets from the Sixth Carbon Budget (Table 1) according to the extent of the habitats within Exmoor that are deemed to be suitable for each regenerative agriculture measure. The assumed relative suitability scores for each habitat are summarised in Table 8. A score of 100% does not imply that the entire area of a given habitat will be converted to the suggested new agroecological management regime (e.g. agroforestry), but rather that this habitat is the most suitable of all for this particular type of management.

Table 8. Assumed relative suitability of regenerative agriculture measures for different habitats (excluding peat soils).

CEH LCM habitat (subset)	Agroforestry	Hedgerows	Legumes	Cover Crops
Broadleaved Woodland	0%	0%	0%	0%
Coniferous Woodland	0%	0%	0%	0%

⁶ <https://www.theccc.org.uk/wp-content/uploads/2020/12/Sector-summary-Agriculture-land-use-land-use-change-forestry.pdf>.

Arable and Horticulture	100%	100%	0%	100%
Improved Grassland	100%	100%	100%	0%
Neutral Grassland	50%	50%	50% ⁷	0%
Calcareous Grassland	50%	50%	0%	0%
Acid Grassland	50%	50%	0%	0%
Fen, Marsh and Swamp	0%	0%	0%	0%
Heather	0%	0%	0%	0%
Heather Grassland	0%	0%	0%	0%
Bog	0%	0%	0%	0%
Saltmarsh	0%	0%	0%	0%
Urban	0%	0%	0%	0%
Suburban	0%	0%	0%	0%

The resulting regenerative agriculture targets for Exmoor are given in Table 9. The combined level of intervention across all four measures is **171** ha/yr. By design, the proposed uptake levels of regenerative agriculture measures double-count some parts of cropland and grassland within a given landscape, for example when agroforestry and species-rich grassland systems (legumes) are rolled out in the same area.

Table 9. Recommended regenerative agriculture targets for Exmoor. Note that some areas might have more than one measures applied, for example agroforestry and legumes.

Measure	Target (ha/yr)
Agroforestry	50.3
Hedgerows	2.9 (9.7 km/yr assuming 3m width)
Legumes	82.7
Cover Crops	35.8

⁷ The management measure “legumes” was extended to semi-improved and rough grassland areas characterised as “neutral grassland” under the assumption that transitioning to agroecological grazing regimes in upland areas (e.g. in line with the Nethergill principles) will lead to a greater plant species diversity and have similar effects on soil carbon sequestration as introducing legume species in improved grasslands.