NPA/23/020

Dartmoor National Park Authority

6 October 2023

Dartmoor National Park Authority Climate Action Plan – Progress Update

Report of the Acting Head of Forward Planning and Economy

Recommendation**: That Members:**

- **i. note progress made on the Climate Action Plan, including that the Authority has met its 2020 target to become carbon neutral against its Scope 1 and 2 emissions; and**
- **ii. endorse review of the Climate Action Plan in 2023/24, and working towards a new science-based target for carbon neutrality**

1 Introduction

1.1 In March 2020 Dartmoor National Park Authority (DNPA) produced and approved an organisational Climate Action Plan. The action plan is part of the Authority's response to its declaration of a climate emergency and establishes how the Authority as an organisation will seek to achieve its ambition to be carbon neutral against its scope 1 and 2 emissions by 2025.

1.2 This report provides Members with an update on:

- the Authority's carbon footprint for the period 2022/23
- progress against the climate action plan over the period 2022/23
- update on the carbon footprint of DNPA's land estate
- projects to be carried forward to a review of the Climate Action Plan

2 Progress on the DNPA Climate Action Plan

Rebounding emissions after the COVID Pandemic

2.1 The Action Plan was approved shortly before the COVID pandemic, during which the Authority experienced a sharp drop in emissions as operations were curtailed, staff worked from home, and offices and visitor centres closed. Following the pandemic, we have experienced rebounding emissions as work practices have returned to normal.

2.2 DNPA has worked to retain low carbon behaviours as restrictions have eased, such as introducing a corporate working from home policy, paperless processes and investment in remote working software. We have also invested in two electric pool vehicles, although their benefits will not be seen until 23/24.

2.3 Notwithstanding these changes and investments emissions have continued to rebound through 21/22 and 22/23 (see Figure 1), in particular:

- Emissions from our diesel vehicles increased 4% between 21/22 and 22/23; much of this increase is attributable to an increase in the number of vehicles as we hired additional vehicles to support externally funded projects pertaining to outreach and conservation work
- Emissions associated with our 'grey fleet' increased for the third year in a row, but are still 45% below pre-COVID levels
- Our estimate of commuting emissions increased significantly by around 30%, but this is mostly due to 22/23 being the first year in three not to include any national COVID lockdown interventions which forced homeworking

2.4 Annual monitoring against the action plan has now spanned five years of emissions data. Key overall trends between 2018/19 to 2022/23 include:

- 7% decrease in scope 1 and 2 emissions
- 14% decrease in overall emissions (excluding investments)
- 3% decrease in vehicle emissions
- 15% decrease in commuting emissions
- 54% reduction in internal printing emissions
- 6.4% reduction in investment emissions

2.5 These trends highlight that although there has been clear progress, there is still significant action needed to continue to drive emission reductions. It is now more apparent than ever how difficult it can be to influence emissions in high-cost areas, and this is compounded by the acute resourcing difficulties National Park Authorities are experiencing. The action plan has struggled to influence the following areas and reversing current trends will be important to future progress:

- Securing a renewable source of electricity through on and off-site generation, particularly due to the extreme volatility in the energy markets in recent years
- Rolling out vehicle electrification, particularly to the Ranger fleet which is responsible for the majority of DNPA's vehicle emissions
- Measuring and reducing emissions associated with the goods and services purchased by DNPA

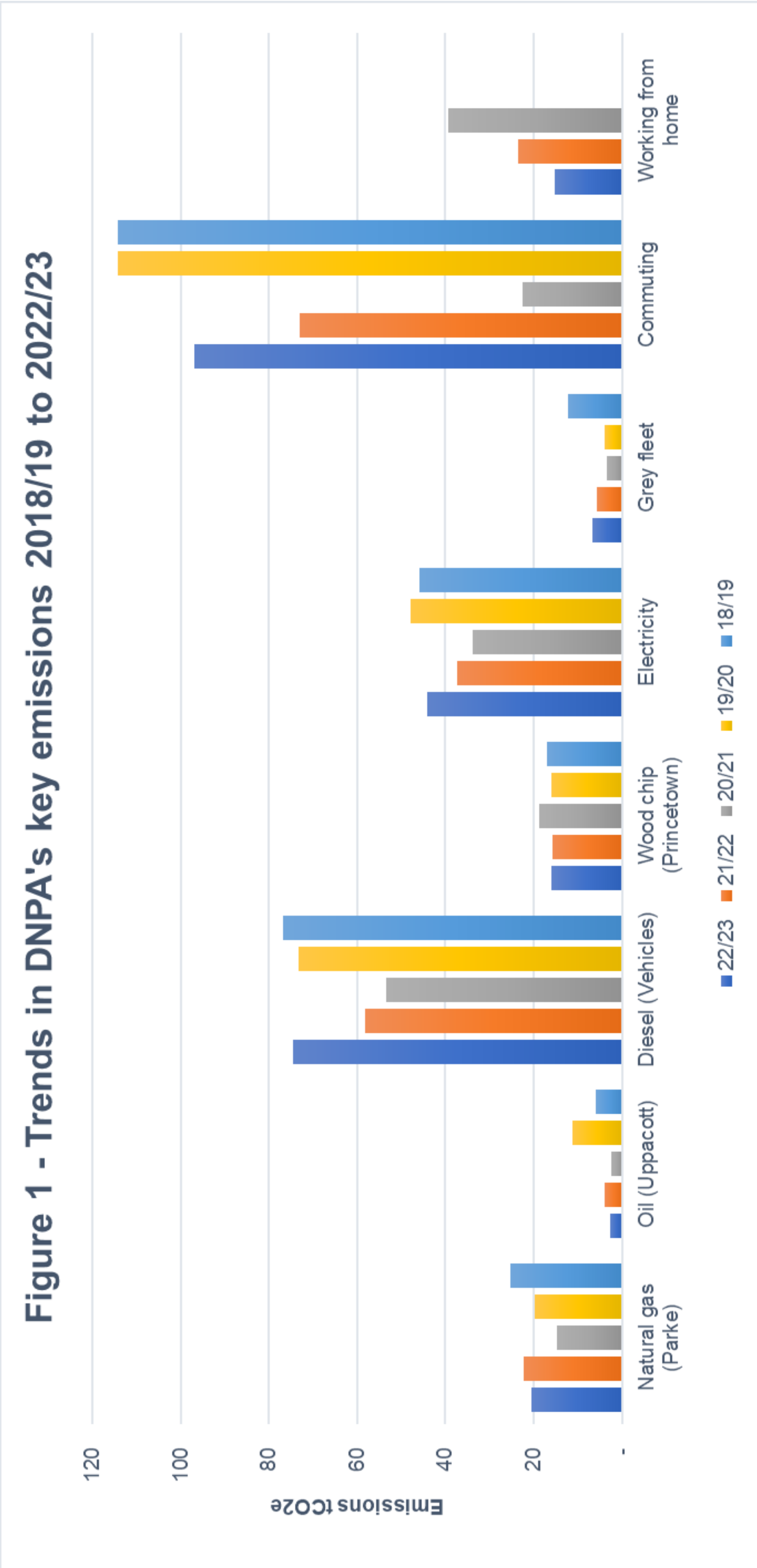


Figure 1 - Trends in DNPA's key emissions 2018/19 to 2022/23

Carbon Footprint of DNPA's land estate

2.6 A significant area the Authority has not been able to report on when reviewing its emissions was the carbon balance of its land estate, the carbon this land stores and what it likely emits or sequesters annually given its condition and management.

2.7 DNPA hold approximately 1300 hectares (ha) of land across Dartmoor, comprising a mix of conservation land, car parks and other infrastructure. Undeveloped sites are principally managed for conservation purposes in accordance with National Park purposes.

2.8 Farm Carbon Toolkit were commissioned to undertake a pilot study to investigate the carbon balance of DNPA's estate. A summary report is appended, which provides overview of the study.

2.9 There were two elements to this study, each with distinct methodologies.

1. Calculating carbon sequestration in our woodland estate; and
2. Calculating carbon stored and sequestered in our open habitat sites.

2.10 For woodland, the methodology for understanding sequestered carbon is standardised through the Forestry Commission's Woodland Carbon Code. Surveys undertaken as part of an update to the Woodland Management Plans for these sites were used to inform this assessment. This enabled robust calculation of annual carbon sequestration.

2.11 Understanding carbon flows on DNPA's open habitat sites was much more complicated. There are no standardised methods for assessing carbon stocks on open moorland, especially common land. The large, open and unbounded nature of these upland sites have therefore presented a significant challenge for methodology development. Previous to this study there has been no known attempt to determine carbon storage on the open moorland habitats of Dartmoor, with the exception of peatland.

2.12 Given these constraints the study took a pragmatic approach to understanding carbon flows on DNPA's open habitat sites, using the data available with the understanding that in some circumstances its accuracy may be limited. It was also discovered that estimating carbon sequestration for all habitats would not be possible without considerable further survey and study. Nevertheless, there was clear value to understanding carbon in broad terms, and using the exercise to identify areas for further study, both for the Authority and wider Dartmoor community looking to gain greater understanding.

2.13 The study findings were as follows:

- the total soil carbon stored in non-wooded open habitat sites is estimated to be 205,074 tonnes of carbon (equivalent to 752,610 tCO_2e[1]).
- In wooded sites, the total carbon sequestration is estimated to be 1,528 tCO_2e per annum (equivalent to 416 tonnes of stored Carbon).

[1] It should be noted stored carbon is not equivalent to atmospheric carbon dioxide, 1 tonne of carbon dioxide is equivalent to 272kg of stored carbon.

2.14 Woodland calculations are robust where the greatest survey detail and the robust Woodland Carbon Code methodology was available. Uncertainty still exists in this data though, such as with regards pest and disease. 8.04ha of DNPA woodland has a large proportion of ash, if affected by Ash Dieback this may reduce the annual sequestration total by 53 tCO2e/year.

2.15 With regards the open habitat sites, a myriad of uncertainties exist which mean these figures are only likely a starting point. The dominant uncertainties surrounding this estimate are:

- accuracy of information on habitat type and transition;
- the lack of soil sample replication for all habitat and soil type combinations;
- accuracy of data related to soil type and soil depth;
- timing of soil samples; and
- impact of commoners' livestock on common land habitats.

2.16 This study was not able to estimate carbon sequestration on the open habitat sites with any significant degree of accuracy. This was principally due to lack of soil sample replication for soil and habitat combinations, including for transitionary habitats at different stages of succession. This data would need to be twinned with accurate habitat survey for determining annual carbon sequestration estimates for the open habitat sites. To be confident of these figures, there would also need to be high confidence that habitat succession would be protected into the future and not lost to future grazing, swaling or other management practices. This remains an area for future work and research.

Becoming carbon neutral in accordance with Climate science

2.17 In 2020 DNPA set itself an ambitious target to become carbon neutral against its Scope 1 and 2 emissions. This is defined by achieving net zero carbon dioxide emissions by either balancing emissions with carbon removal or eliminating carbon emissions altogether

2.18 The completion of the carbon footprint of our land estate brings a fuller understanding of the balance of carbon across our emitting and land conservation activities. What is clear from the above study is that, where we have confidence in the woodland figures, the total annual carbon sequestered in our woodland estate (1,528 tCO_2e) greatly exceeds DNPA's annual organisational emissions, excluding investments (281.5 tCO_2e).

2.19 On this basis DNPA has now achieved its 2020 target. It should be noted that this has been achieved over a year ahead of 2025 target.

2.20 However, during the time we have been working to this target the global climate change community has become clearer that carbon neutrality targets should be better aligned with what action the science is saying we need to do halt and reverse climate change. It is now becoming common practice for targets for carbon neutrality to be 'science-based'.

2.21 Targets are considered ‘science-based’ if they are in line with what the latest climate science deems necessary to meet the goals of the Paris Agreement – limiting global warming to 1.5°C above pre-industrial levels. Importantly the approach focusses on delivering direct emissions reductions, rather than focussing on offsetting emissions. In setting a carbon neutral pathway, offsets are generally only considered suitable for using as part of long term goals, close to the 2050 Paris objective, and shouldn’t exceed 10% of the total baseline footprint[2].

2.22 After achieving our 2020 target, it is time to reset and consider how to drive further emissions reductions into the future. It is proposed that the imminent review of the Climate Action Plan should be undertaken using a science-based target. This will likely involve a target with 6-7% year-on-year reductions for Scope 1 and 2 emissions, together with some Scope 3 emissions (e.g. business travel, water and grey fleet). Since 2018/19 DNPA have achieved around 4 years (2018/19 – 2021/22) of emissions reductions on this science-based trajectory.

2.23 Members views on this proposal are welcomed.

ALEX GANDY

[2] https://sciencebasedtargets.org/

Table 1 – DNPA's carbon footprint 2020/21

Emission source	Scope 1				Scope 2				Scope 3				Offset	Total
	Consum-ption	*Unit*	*Emission factor $kgCO_2e$*	*tCO_2e*	*Consumption*	*Unit*	*Emission factor $kgCO_2e$/unit*	*tCO_2e*	*Consum-ption*	*Unit*	*Emission factor kgCO2e*	*tCO_2e*	*tCO_2e*	*tCO_2e*
Natural gas	95,692	kWh	0.18397	17.60					95,692	kWh	0.0311	2.98		**20.58**
Oil	851	L	2.54013	2.16					851	L	0.52807	0.45		**2.61**
Diesel	23,564	L	2.55784	60.27					23,564	L	0.60986	14.37		**74.64**
Petrol	156	L	2.16185	0.34					156	L	0.61328	0.096		**0.43**
Petrol (aspen)	545	L	2.16185	1.18					545	L	0.61328	0.334		**1.51**
Wood chip	227	tonnes	39.78833	9.03					227	tonnes	30.4	6.90		**15.93**
Electricity					208,991	kWh	0.19338	40.41	208,991	kWh	0.0175	3.66		**44.07**
Grey fleet									24,882	miles	0.27039	6.73		**6.73**
Water supply									1,006	m³	0.149	0.15		**0.15**
Water treatment									1524	m³	0.272	0.41		**0.41**
Business travel flights									6,660	pax.km	0.27278	1.82		**1.82**
Business travel coach									0	pax.km	0.03379	0.00		**-**
Business travel rail									7,539	pax.km	0.04441	0.33		**0.33**
Commuting												96.84		**96.84**
Home Working												15.17		**15.17**
Enjoy Dartmoor Magazine												1.85	-1.85	**-**
Internal printing												0.68		**0.68**
Pension investments												6039.00		**6,039.00**
Total	**90.59**				**40.41**				**152.09**				**-1.85**	**6,320.92**

A pilot study into the carbon performance of Dartmoor National Park Authority owned landscapes and their potential to help deliver net zero ambitions

Summary Report

Hannah Jones, Alex Gandy, Richard Knott, Stefan Marks, Robert Purdew, Becky Willson

June 2023

1 Introduction

1.1 In July 2019 Dartmoor National Park Authority (DNPA) declared a climate emergency, signed the Devon Carbon Declaration and is seeking to become a carbon neutral organisation by 2025 against its scope 1 and 2 emissions. In 2020 DNPA produced a Climate Action Plan which provided a carbon footprint for the organisation and set out projects which would continue to reduce this footprint[1].

1.2 A significant area the Authority was not able to report on was the carbon balance of its land estate, the carbon this land stores and what it likely emits or sequesters annually given its condition and management. This pilot study looks to use a novel methodology to investigate the carbon balance of DNPA's estate. Previous to this study there has been no known attempt to determine carbon storage on the open moorland habitats of Dartmoor, with the exception of peatland.

1.3 DNPA hold approximately 1300 hectares (ha) of land, comprising a mix of conservation land, car parks and other infrastructure. The sites are principally managed for conservation purposes in accordance with National Park purposes. DNPA's larger sites (see Map 1) are within scope of this assessment and include::

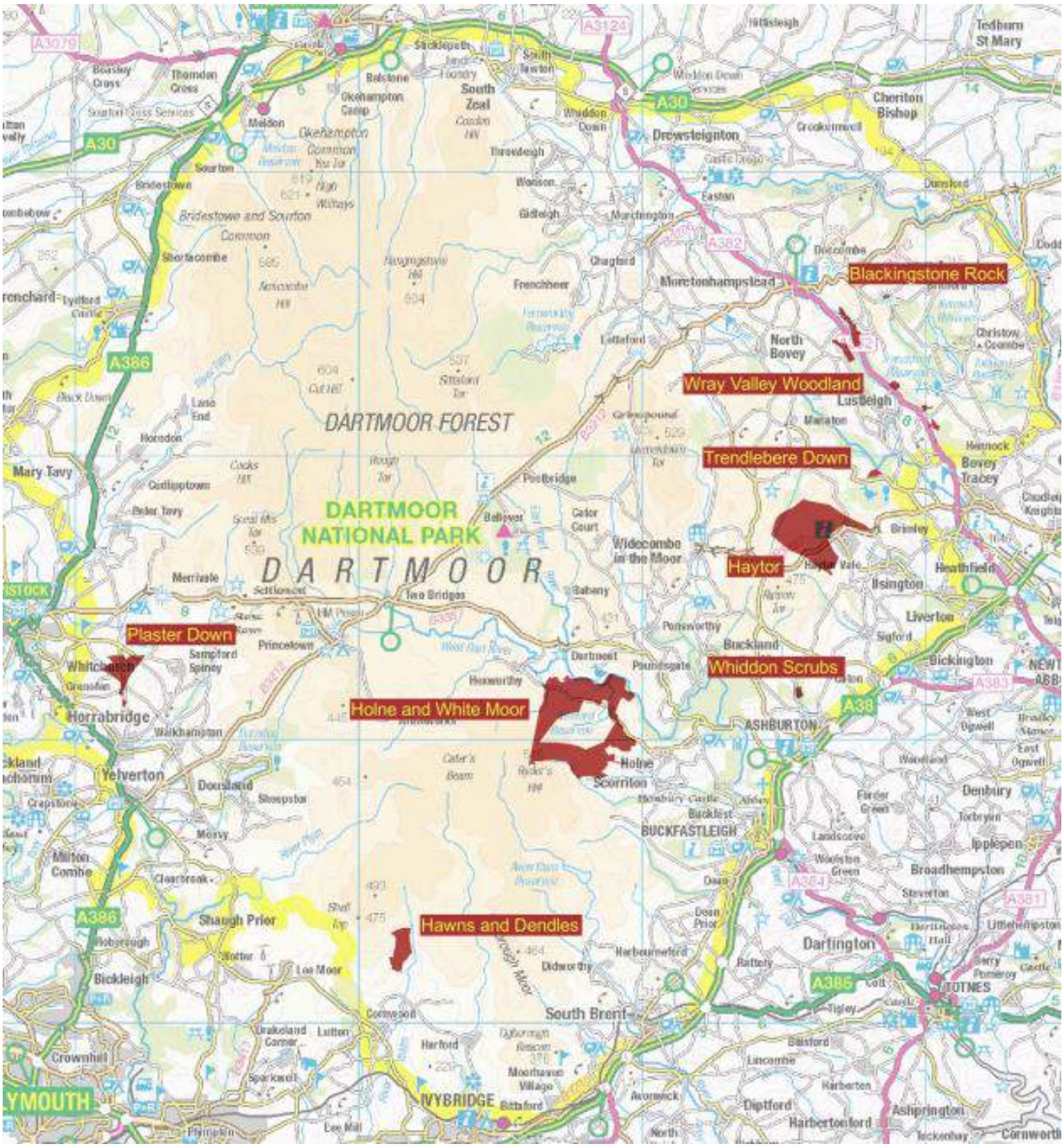
- Haytor: 425Ha of common land, comprising moorland, Haytor Rock and former quarries
- Holne Moor and White Wood: 675Ha of common land, comprising moorland and woodland
- Plasterdown: 93Ha of common land, comprising moorland and acid grassland
- Hawns and Dendles: 80Ha of woodland and moorland
- Wray Valley woodland: A number of mixed broadleaf woodland holdings in the Wray Valley including:
    - Steward Wood and Wray Cleave: 31Ha of deciduous woodland
    - Sanduck and Huntingpark Wood: 20Ha of deciduous woodland
    - Caseley Wood: 8Ha of deciduous woodland
    - Castor Copse: 5Ha of deciduous woodland
    - East Park Copse: 7Ha of deciduous woodland including some recent native woodland planting on former grassland
- Trendlebere Down: 9Ha of moorland and scrub
- Whiddon Scrubbs: 9Ha of deciduous woodland
- Blackingstone rock: 3Ha of moorland, coniferous and broadleaf woodland

1.4 The principal study objectives were:

1. To develop a proportionate methodology to understand carbon stocks and flows across DNPA's estate, that can be repeated in the future; and

2. Establish a 2021 baseline estimate of carbon stock and assess annual carbon flux for each land asset.

[1] Dartmoor National Park Authority Carbon Footprint and Climate Action Plan



Map 1 – Summary map of DNPA sites in scope of assessment

2 Methodology

2.1 The methods used for modelling carbon in woodlands and in open habitat were distinct.

Woodlands

2.2 In assessing woodlands the Forestry Commission's Woodland Carbon Code was used extensively for calculation of carbon sequestration. Tree data can be entered in two ways; average values for areas of forest - divided into broadleaf, coniferous or mixed. Or detailed values which provide more accurate values depending on the tree species being grown, yield class, management and the age of the wood. Detailed values were achieved over an area of 189 hectares of woodland, relative to DNPA's 208 hectares of woodland ownership.

2.3 The woodland calculations were carried out based on Woodland Management Plans. These Management Plans are based on surveys undertaken within the last 2 years and contain detailed information at the woodland compartment level. Where possible, species, age and management were defined for each woodland compartment.

2.4 In the absence of woodland management plans, the Farm Carbon Calculator[2] was used to model average values for either a given species and age when defined, or the average value in the absence of further information. The level of accuracy of these calculations varied.

Open Habitats

2.5 On DNPA's open habitat sites, soil sampling was used to provide an overall understanding of carbon stocks. Carbon stocks on open habitat sites are dictated by soil type, management, and above ground biomass.

2.6 At present there are no standardised methods for assessing carbon stocks on open moorland, especially common land. The large, open and unbounded nature of these upland sites have therefore presented a significant challenge for methodology development. Variables that have been difficult or impossible to control on DNPA's moorland and common land sites include:

- The large and open nature of these sites, the difficulties in understanding their management histories and the ways that livestock grazing influences carbon flows.
- Understanding habitat coverage, complex mosaics of different habitat types, transitional habitats and the current trajectory of habitats, including poor background literature on the carbon flux of bracken and gorse habitats
- Taking sufficient soil samples to reflect the soil types, and habitats found on all sites
- Understanding underlying soil types; detailed soil mapping was only available for Haytor and Holne, for other sites the soil type data was based on the Cranfield National Soil Map series
- Defining the confidence for soil carbon results, multiple soil samples are required to define standard deviation in soil carbon for any given soil type and habitat combination
- Soil depth greater than 0.5m was apparent on some wetter habitats. In these cases, augered depths of 50cm result in an underestimate of soil carbon.

2.7 Given these constraints the study took a pragmatic approach to understanding carbon flows on DNPA's open habitat sites, using the data available with the understanding that in some circumstances its accuracy may be limited. It was also discovered that estimating carbon flux for all habitats would not be possible without further survey and study. Nevertheless, there was clear value to understanding carbon in broad terms, and using the exercise to identify areas for further study, both for the Authority and wider Dartmoor community looking to gain greater understanding.

2.8 The methodology developed for the open habitat sites was as follows:

[2] https://calculator.farmcarbontoolkit.org.uk

1. Identify soil and habitat type for each site, and identify each unique habitat soil combination;
2. Identify a representative sample location for each habitat soil combination;
3. Extrapolate the sampling results for each combination across all sites to establish carbon stocks;
4. Where possible quantify carbon flux based on known habitat transitions that have taken place over a given time period (see appendix 1)

2.9 Habitat data was derived from a Habitat Classification tool developed by the South West Partnership for Environmental and Economic Prosperity (SWEEP). The tool uses satellite imagery combined with LiDAR data to train a random forest classifier to predict the most likely habitat class for each 10m x 10m pixel across the mapped Dartmoor National Park area.

2.10 Two types of soil data were used:

- soil maps produced by local survey as part of the Moorland Vegetation Project (Hogan et al., 1987) were the most detailed available, for Holne Moor and Haytor sites
- Cranfield National Soil Map data was used for all other sites with a higher and unquantifiable potential for error

2.11 The SWEEP habitat maps overlaid on the soil type data provided information on all soil type and habitat combinations across the sites. This information was used to guide soil sampling locations across the sites.

2.12 Soil sampling was carried out on Holne Moor, Hawns and Dendles, Haytor and Plasterdown.

3 Assumptions and uncertainty

Habitat type

3.1 Habitat data was derived from a Habitat Classification tool developed by the South West Partnership for Environmental and Economic Prosperity (SWEEP). The tool provides measures of accuracy which enables the user to acknowledge the uncertainties within the map and therefore have an appropriate level of confidence in the mapped habitats. The accuracies achieved by the tool are in line with other similar tools and suggests it is at or near the maximum achievable accuracies with remote sensing-based methods. This said, it is not perfect, the tool operates within quantifiable ranges of certainty and the project has worked to control habitat classification errors.

3.2 The SWEEP data was visually checked and adjusted by a DNPA Ecologist using aerial photography interpretation. This exercise removes some of the uncertainty associated with the SWEEP habitat data and improves its statistical accuracy. There is still potential for error and a worthwhile area of further work would be ground-truthing the habitat mapping, including identification of 'intermediate' or transitional habitats such as heathland at different successional stages. This data would be vital for determining annual flux estimates for habitat succession.

Soil type

3.3 For the majority of sites soil type information from the Cranfield National Map was used. This data is modelled nationally and based on survey, but has variable accuracy at the scale being applied in this study. More detailed soil type information was available for Holne Moor and Haytor based on detailed soil survey which was mapped as part of the Moorland Vegetation Project (Hogan et al., 1987[3]). Both sets of soil data include unknown errors within them. Furthermore, the Cranfield data set does not include all soil types surveyed by Hogan, many of which are transitionary.

Soil depth

3.4 Soil sampling depth was limited to 50cm. The sampling of permanent or temporary wetland areas characteristic of bogs, degraded bogs, and 'flushes, fens, marshes and swamps' (FFMS) frequently results in soil depths of greater than the auger length of 0.5m. Therefore for wetland areas, the defined carbon stock is likely to be an underestimate of total soil carbon. The depth of the peat areas should be assessed using a grid based- GPS logged system. This would provide below ground contours for peat depth in permanently wet areas.

Timing of soil sample

3.5 Soil sampling took place between the 30th May 2022 and 1st September 2022 with the exception of 3 additional samples taken on the 9th March 2023. There is an associated inaccuracy with extended periods of soil sampling and the ability to compare data sets. A range of studies have been carried out to determine the seasonal variation in soil carbon. However, most of these studies have been carried out in arable systems which includes the effects of tillage, growth cycles of annual crop species, and times of soil exposure. Estimates based on seasonal variation (12 months) are between 4% and 13% of mean soil carbon to 20cm depth for arable systems (Wuest, 2014). The data within this study is likely to be lower than this variation because (1) the soil was covered with permanent vegetation; (2) Soil depth was down to 0.5m with exception to Banc soil type (which was down to 30cm); and (3) sampling took place over 94 days. Temperature has a strong effect on soil respiration (Valentini et al, 2000) and taken within the time of sampling for this project from the 30th May to the 1st September. Further work is required to ascertain the annual variation in soil carbon under permanent cover in upland habitats.

Soil sample frequency and extrapolation

3.6 47 soil and habitat combinations were sampled to capture variation in habitat and management across the DNPA estate. However, generally only one sample was taken for each soil habitat combination. This soil sample data was used to extrapolate soil carbon estimates across all

[3] Hogan (1987) 'Moorland vegetation project'

DNPA non-wooded habitats. This process means that all habitat soil combinations were not assessed on each site, carbon stocks and some sites will have carbon stock information that is derived from soil samples on another site. For example, Sanduck and Huntingpark, Haytor and Holne Moor all have some Moretonhampstead soil type, but only Haytor was sampled in this study. This introduces significant and unquantifiable uncertainty.

3.7 Multiple sampling points at each site and for each soil habitat combination will quantify the standard deviation from the mean. Only with a soil sample data set of 10-15 samples for one habitat soil type combination could the number of replicates necessary for accuracy be defined.

Commoners' livestock

3.8 The study does not account for commoners' livestock on common land (present at Haytor, Holne Moor and Plasterdown). Carbon accounting practices require livestock emissions be accounted for in the farmers' carbon footprint. Commoners' livestock contributes to the maintenance of habitats and influences their carbon flux. The presence of livestock can also reduce fire risk by maintaining open, structurally varied habitats and reducing the accumulation of leaf litter (for example deciduous purple moorgrass or bracken). Thus in some situations certain types of stock may reduce the need to swale. The counter to this could be that this reduces the build up of soil carbon in the form of leaf litter. Ethically these factors need to be considered alongside the emissions associated with the animals themselves before considering how any sequestration on open common land could be used to offset DNPA's carbon footprint. The roles of grazing, swaling and mechanical management of moorland are important considerations for understanding carbon flows beyond just DNPA land, but are outside the scope of this report.

Accuracy of woodland survey information

3.9 The woodland calculations were carried out to the highest resolution possible based on woodland management plans and maps provided by DNPA. These woodland management plans are based on surveys undertaken within the last 2 years and contain detailed information at the woodland compartment level.

3.10 Inaccuracy in woodland calculations occurs in the mapping or compartment information, for example where the age of trees and the composition of a stand are not known. Areas that have a high level of uncertainty are particularly focused on areas where there is rapid woodland regeneration such as in Hawns and Dendles.

The Impact of Pests and Disease

3.11 There are various areas of woodland where impacts of pests and diseases are being seen / observed. There are currently 8.04ha of woodland parcels which are reported as having a large proportion of ash within them. If these areas were affected by Ash Dieback and needed replanting it may lose 53t CO2e from the current sequestration total.

3.12 Squirrel damage is also an identified issue in DNPA woodland. An example is in Sanduck and Huntingpark woodland where parcel 201b (a mixed broadleaf parcel totalling 0.67ha) is experiencing severe squirrel damage. Research suggests squirrel damage can means that carbon is not sequestered as trees do not grown to their full potential, but there is a lack of research available to quantify this. There is also insufficient survey information available on the degree to which squirrel is affecting DNPA woodlands.

3.13 Currently the modelling that has been done is assuming that the trees are not experiencing disease pressure.

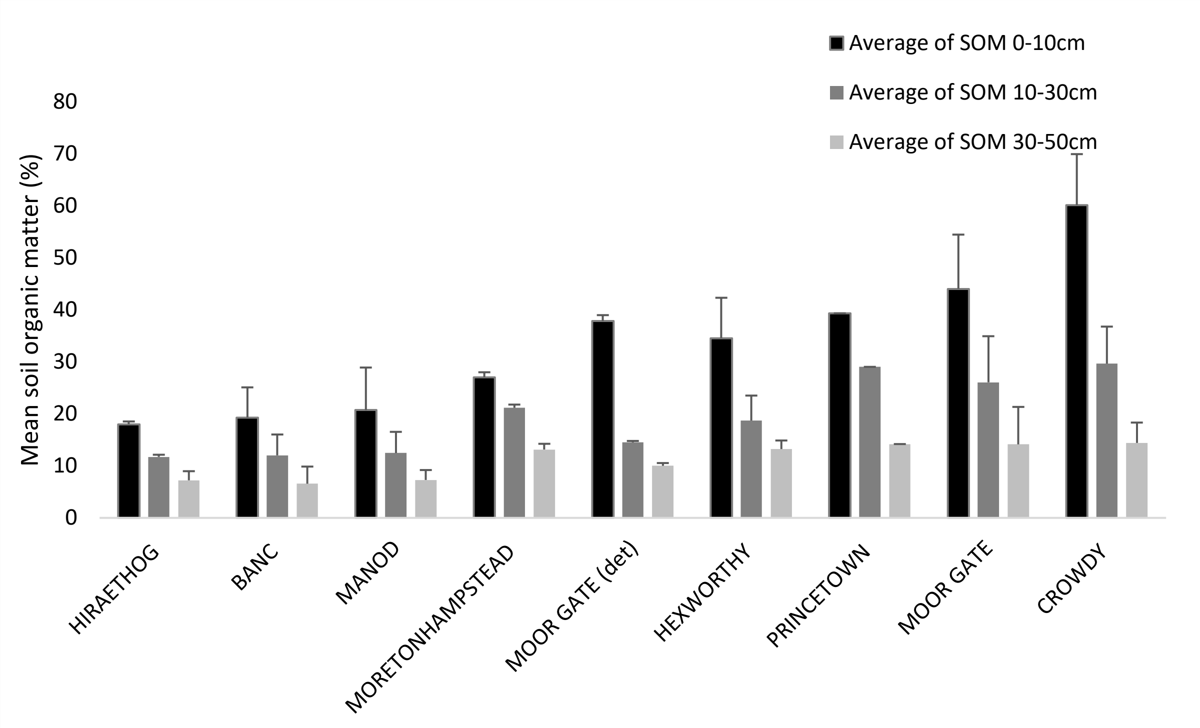
4 Results

4.1 In Table 1 the carbon sequestration is calculated. The total carbon stored across sites in habitats except woodland is estimated to be 205,074 tonnes of carbon (equivalent to 752,610 tCO_2e). In wooded sites, the total carbon sequestration is estimated to be 1,528 tCO_2e per annum (equivalent to 416 tonnes of stored Carbon). It should be noted stored carbon is not equivalent to atmospheric carbon dioxide, 1 tonne of carbon dioxide is equivalent to 272kg of stored carbon.

DNPA sites	Total estimated soil carbon (tonnes)	Total estimated woodland flux carbon (tCO_2e/year)
Blackingstone Rock	174.44	-6.81
Caseley Wood	Not assessed	-37.38
Castor Copse	Not assessed	-36.88
Eastpark Copse	Not assessed	-51.81
Hawnes & Dendles	23,413.82	-121.51
Haytor	60,669.49	-186.20
Holne Moor & White Woods	103,574.64	-924.60
Plasterdown	15,770.64	-6.21
Sanduck & Huntingpark	159.12	-115.33
Trendlebere	1,296.55	-5.94
Whiddon Scrubs	Not assessed	-44.83
Wray Cleave & Steward Woods	15.71	-233.85
TOTAL	**205,074**	**-1,528.34**

Table 1 Summary table of carbon stored in the soil to a depth of 0.5m, and sequestration of carbon by woodland per annum.

4.2 This study confirmed that soil type influences soil carbon content. Figure 1 suggests that, across habitat types, the soil over granite (Moretonhampstead, Hexworthy, Princetown and Moorgate) and Crowdy (described as amorphous peat by Hogan et al 1987) have the capacity for higher carbon storage than soils over slates and mudstones (Hireathog) or are described as slightly to very stoney (Banc and Manod).



4.3 For carbon yield per hectare, which takes into account soil density, the trend for high carbon is broadly reflected in the soils over granite (Figure 2), and those in habitats with deeper soils such as in flushes, fens, marshes and swamps.

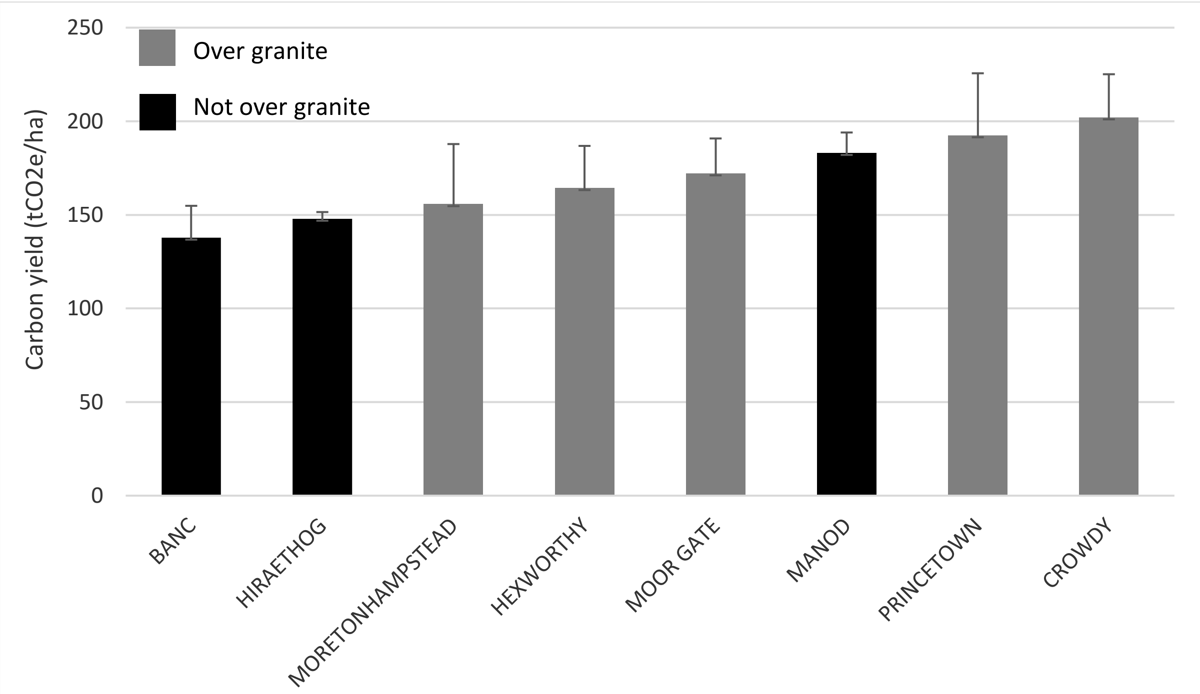


Figure 2 Carbon yield estimates across soil types. Error bars indicate standard error

4.4 Figure 3 provides a summary of the sampled habitat and soil type combinations in this study. While further sampling is required to manage for errors, this graph does begin to show how soil carbon increases as habitats move through successional phases from more open habitats of acid grassland to scrub flora such as bracken and heath, relative to soil type. With wetter mire, bog and bracken habitats having the highest carbon stores, and acid grassland and gorse offering lesser soil carbon value.

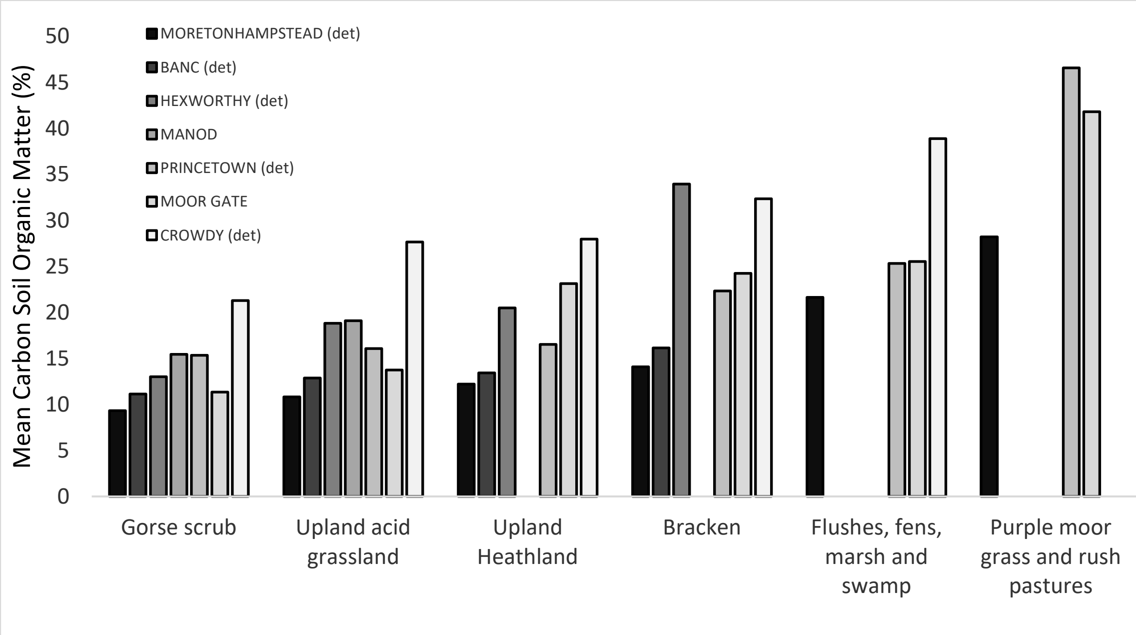


Figure 3 Average soil organic matter to a depth of 0.5m across habitats and soil sites

4.5 Carbon heat maps in Appendix 1 show how soil carbon is distributed across DNPA's open-habitat sites. Further sampling is needed to confirm these results. The initial shows trends towards higher carbon stocks in the higher more peaty soils of Haytor and Holne. Plasterdown shows considerably lower carbon stocks than the rest of the estate. Hawns and Dendles shows higher carbon stocks on areas of upland heathland, relative to bracken and gorse scrub.

5 Conclusions

5.1 This report provides the first baseline for habitat and soil carbon storage on DNPA's land estate through a novel soil sampling methodology. Prior to this report there has been no known attempt to determine carbon storage on the open moorland habitats of Dartmoor, with exception of peatland.

5.2 The data provided allows for prioritisation of activities for the DNPA in terms of management to enhance carbon storage, and how to improve the resolution of quantifying carbon across the estate.

5.3 Woodland calculations are rigorous where the greatest survey detail was available. This was achieved over an area of 189 hectares, relative to the estate's 208Ha total woodland holdings. Areas of uncertainty are focused on areas where there is rapid woodland regeneration such as in Hawns and Dendles wood.

5.4 The study estimates a total 1,528 tCO2e/year is sequestered in DNPA's woodland estate, this is equivalent to roughly equivalent to 416 tonnes of stored Carbon. 8.04ha of woodland have a large proportion of ash within them, if affected by Ash Dieback this may reduce the sequestration total by 53 tCO2e/year from the current sequestration total.

5.5 This study has estimated soil carbon stocks on the open habitat sites as 205,074 tonnes Carbon. This is roughly equivalent to 752,610 tCO_2e, and similar to Dartmoor National Park's annual CO_2e emissions from residents and visitors[4]. The dominant uncertainties surrounding this estimate are:

- accuracy of information on habitat type and transition;
- the lack of soil sample replication for all habitat and soil type combinations;
- accuracy of data related to soil type and soil depth;
- timing of soil samples; and
- impact of commoners' livestock on common land habitats.

5.6 This study was not able to estimate carbon sequestration on the open habitat sites with any significant degree of accuracy. This was principally due to lack of soil sample replication for soil and habitat combinations, including for transitionary habitats at different stages of succession. This data would need to be twinned with accurate habitat survey for determining annual carbon sequestration estimates for the open habitat sites. To be confident of these figures, there would also need to be high-confidence that habitat succession would be protected into the future and not lost to future grazing, swaling or other management practices.

5.7 Overall this pilot study has:

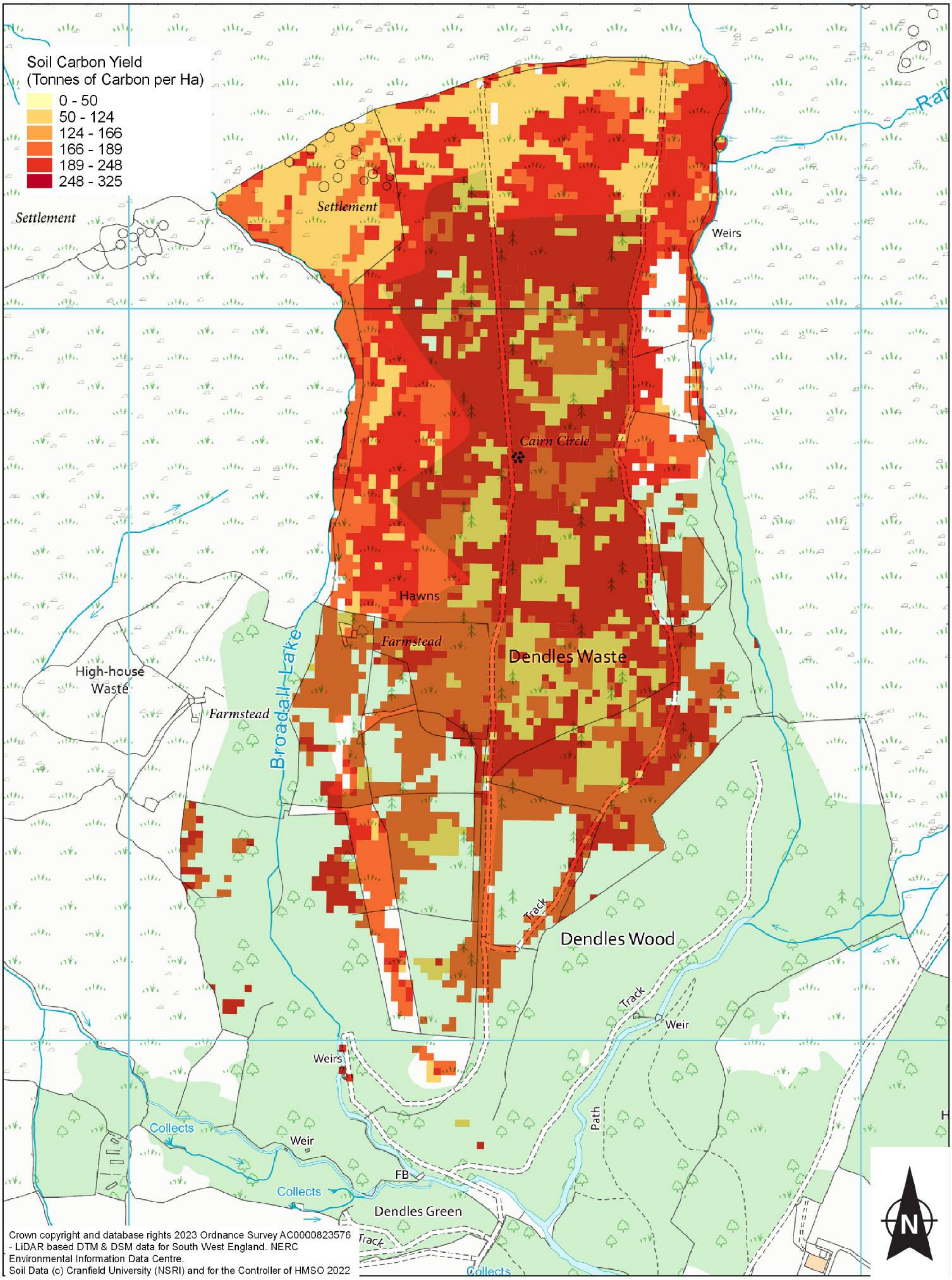
- usefully furthered DNPA's understanding of what is required to calculate and monitor carbon flows on its land estate;
- robustly modelled carbon sequestration in DNPA's woodlands;
- used a novel approach to conduct a proportionate investigation into the carbon balance of Dartmoor's moorland, not previously studied; and
- identified a number of areas for further investigation to help improve our understanding of the role Dartmoor's moorland has in climate mitigation.

[4] Dartmoor National Park Greenhouse Gas Assessment (2023)

Dartmoor National Park Authority

Hawns and Dendles - Carbon Heat Map

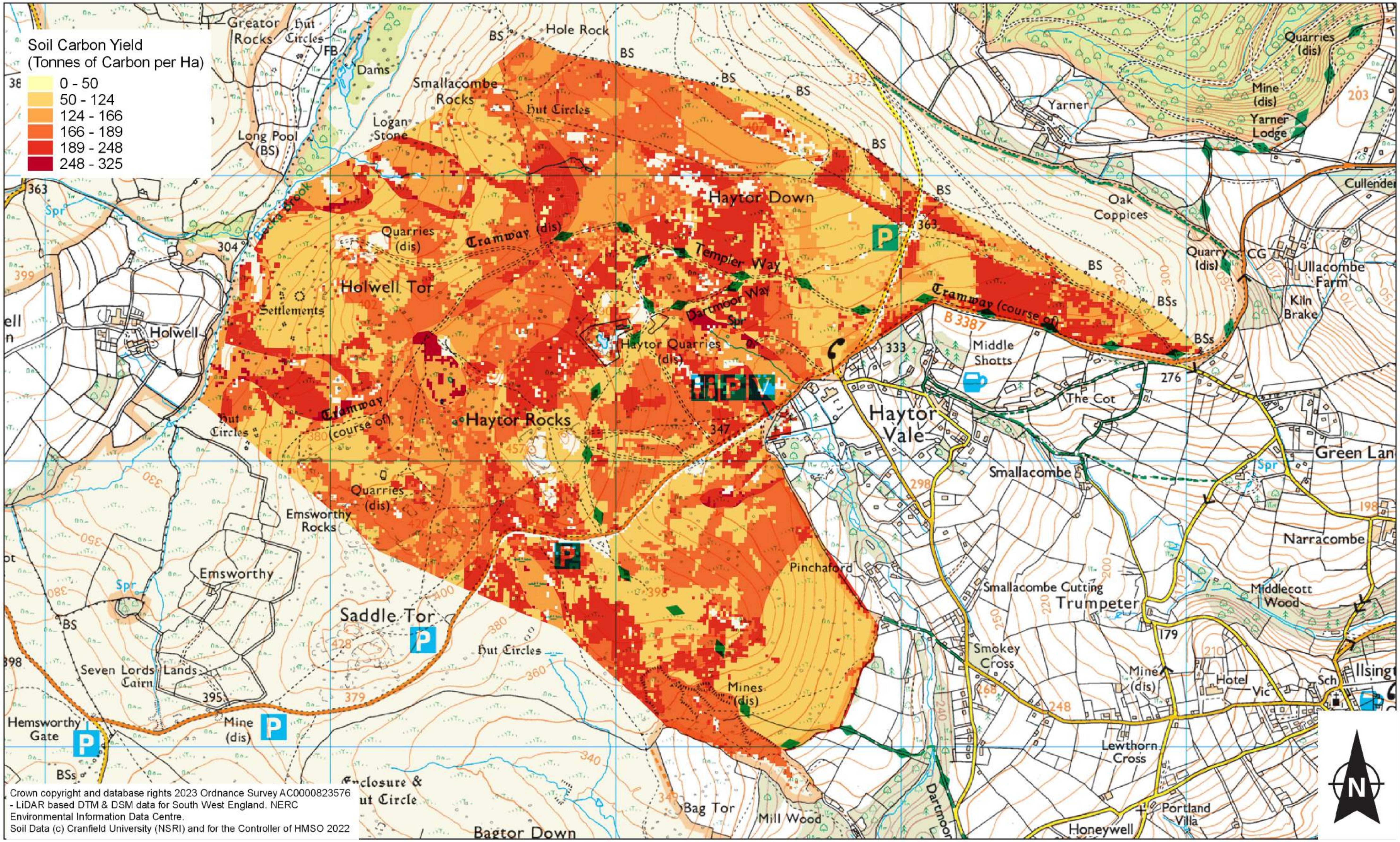
Map Scale @ A4 1:4897



Dartmoor National Park Authority

Haytor - Carbon Heat Map

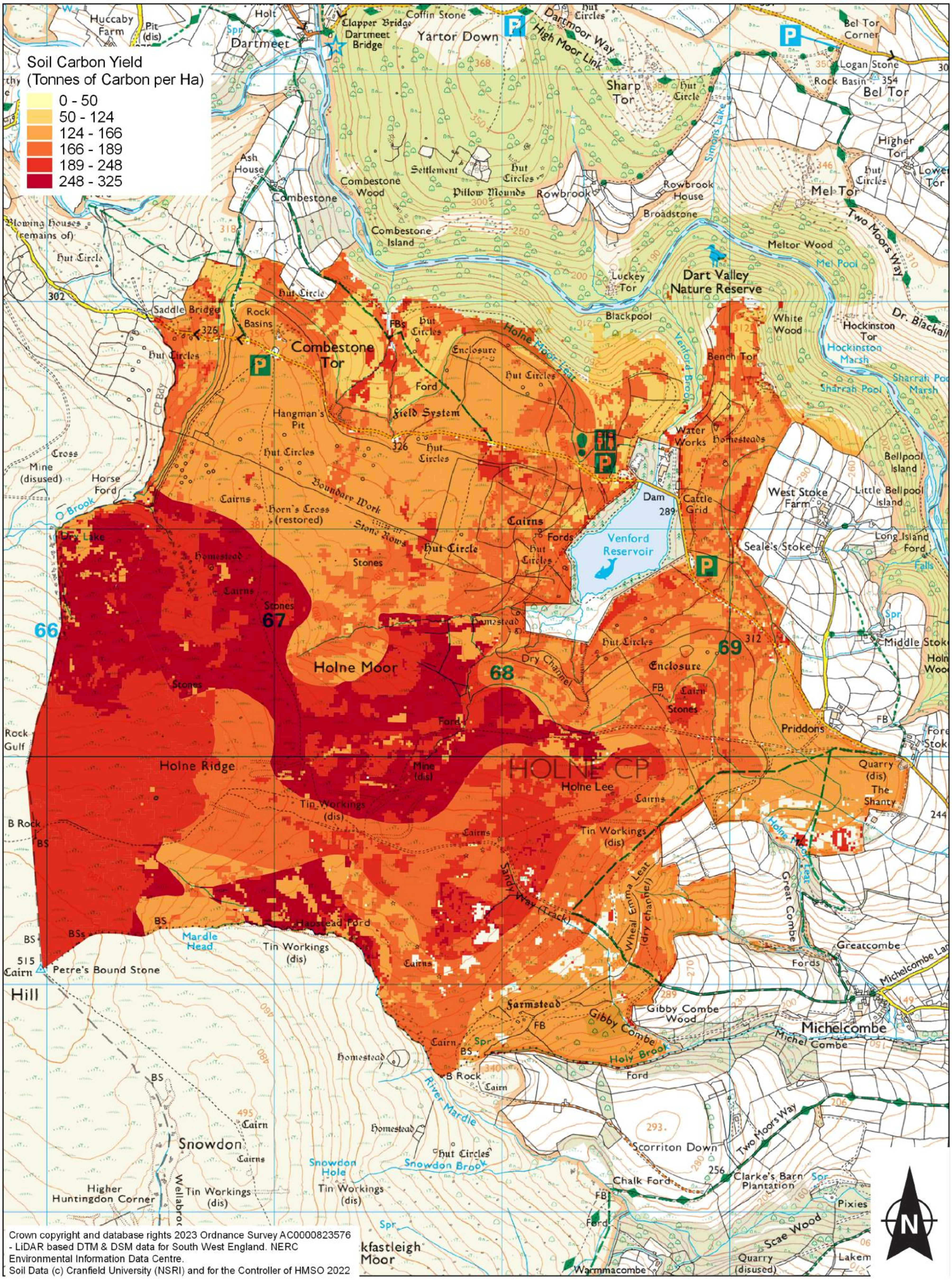
Map Scale @ A4 1:12508



Dartmoor National Park Authority

Holne Moor - Carbon Heat Map

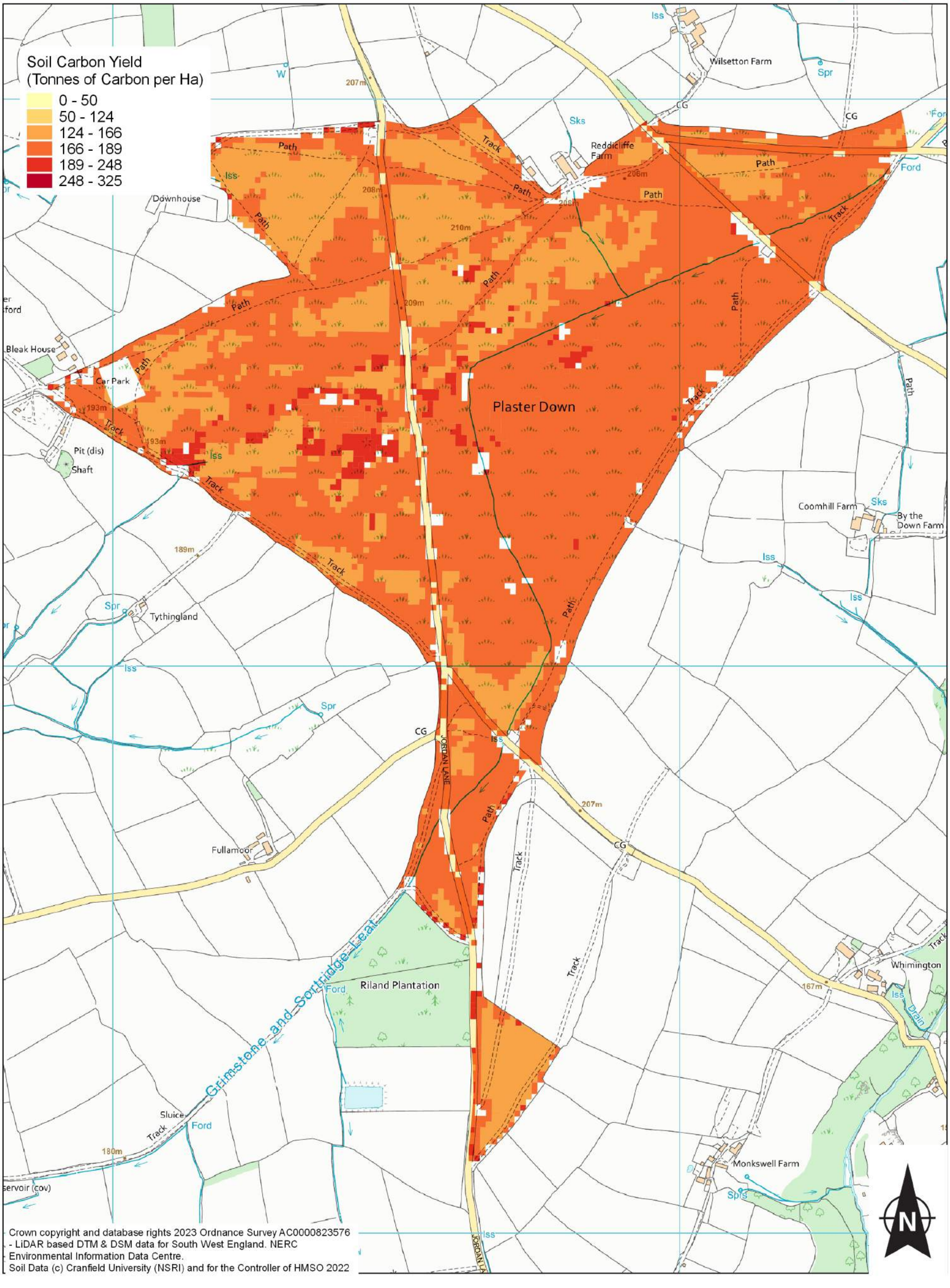
Map Scale @ A4 1:15736



Dartmoor National Park Authority

Plasterdown - Carbon Heat Map

Map Scale @ A4 1:6306



NPA/23/021

Dartmoor National Park Authority

6 October 2023

Dartmoor National Park Authority submission to the Independent Review of Protected Site Management on Dartmoor

Report of the Chief Executive (National Park Officer)

Recommendation: **That Members:**

i. **note the terms of reference for the Independent Review of Protected Site Management on Dartmoor;**
ii. **note that the Authority has been invited to attend an evidence session with the independent panel undertaking the review;**
iii. **comment on the key messages that we will communicate to the independent panel; and**
iv. **authorise the Chief Executive (National Park Officer) in consultation with the Chair of the Authority to agree and submit the Authority's formal response.**

1 Independent Review of Protected Site management on Dartmoor

1.1 The Government have appointed David Fursdon to chair an **independent review of management of protected sites on Dartmoor**. David Fursdon is currently chair of the Institute for Agricultural and Horticulture and Dyson Farming and has had numerous roles across farming, environment and land use. He is HM Lord Lieutenant of Devon and was a previous President of the Country Land & Business Association (CLA).

1.2 The review will be undertaken by a panel of experts comprising:

- Cicely Hunt – land agent and agricultural grants specialist
- William Cockbain – Cumbrian hill farmer and former Chair of the National Farmers' Union (NFU) Uplands Panel
- Jeremy Moody – Secretary of the Central Association of Agricultural Valuers (CAAV)
- Professor Matt Lobley – Professor of Rural Resource Management and Director of the Centre for Rural Policy Research at the University of Exeter

- Professor Charles Tyler – Professor of Environmental Biology at the University of Exeter
- Professor Jane K Hill – Research Scientist for Resilient Ecosystems at the University of York
- Sue Everett – highly experienced ecologist and land management adviser
- Dr Lisa Norton – agro-ecologist at the UK Centre for Ecology and Hydrology, Lancaster Environment Centre

1.3 The scope of the review includes:

- Considering recent trends in numbers and types of grazing animals on Dartmoor and the influence that this has had on its ecology.
- Reviewing the existing ecological evidence base to consider the current management of Sites of Special Scientific Interest (SSSIs) and Special Areas of Conservation (SACs) across Dartmoor to determine why some sites are seeing improvements and others are not, and how lessons might be applied across all sites on Dartmoor.
- Considering any lessons to be learned from previous approaches on Dartmoor or similar situations elsewhere in the UK by examining comparable case studies, considering the different contributing factors in each case.
- Making recommendations as to the most effective grazing and management regime or regimes to deliver improvements on the protected sites across Dartmoor, so they can maintain or achieve favourable condition whilst also contributing to the long-term, sustainable delivery of other priorities, such as agricultural production, public access and the preservation of cultural and natural heritage.
- Advising what's needed to support the delivery of an effective grazing regime, consistent with meeting existing legally binding targets and statutory requirements.
- Proposing options focusing on those sites that are currently not recovering or in favourable condition.

1.4 The review is not allowed to:

- Commission primary ecological data;
- Make recommendations on the existing legal framework;
- Consider any changes to existing commons legislation;
- Comment on landlord-tenant relationships on Dartmoor and those between rights holders and Common owners.

1.5 The review will report in autumn 2023 and help inform the environmental schemes and protected site management across Dartmoor.

1.6 The idea of an independent review emanated, in part, from meetings of agri-environment stakeholders on Dartmoor that the Authority facilitated in response to the proposed reductions in stock numbers being proposed by Natural England as part of a rollover process for agri-environment agreements on common land (see NPA/23/012).

1.7 The Authority has welcomed the 'Fursdon Review'. We have stressed the importance of giving the panel time to conduct their review before reporting to

Ministers. The review provides an opportunity to ensure that agri-environment agreements contribute to the collective vision in the Dartmoor Partnership Plan to make Dartmoor better for people, place, nature and climate.

2 Background to the Independent Review

2.1 Authority Report NPA/23/012 provides the background to the issues that led to the 'Fursdon Review'. The Authority has no formal role in agri-environment agreement negotiation, monitoring and delivery. However, agri-environment agreements are a key tool for delivering National Park purposes and duty and the vision in the Dartmoor Partnership Plan

2.2 The Authority has hosted and chaired three meetings of key stakeholders (Dartmoor Commoners' Council, Dartmoor Common Owners' Association, Duchy of Cornwall, Rural Payments Agency, Natural England, Historic England, Dartmoor Hill Farm Project, National Farmers' Union and Farm Community Network). There was agreement from all present on the need for an independent review. Feedback from these meetings was provided to the four MPs who have constituencies that include the National Park and helped inform the Westminster Hall debate held on 18 April 2023. These meetings also helped identify issues for the review to consider and develop the 1 plus 4 model for agri-environment rollovers on Dartmoor commons.

3 Key Messages for the Independent Review

3.1 As noted above, the Authority has no formal role in the administration of agri-environment agreements. Nevertheless, these agreements are an important tool to help deliver National Park purposes, sustain farm businesses and contribute to the local economy. It is estimated that the current value of agri-environment agreements on Dartmoor is £4-5m per annum.

3.2 The Authority's position is as outlined in the Dartmoor Partnership Plan. This statutory document was produced following a process of consultation and engagement. The vision for Dartmoor is clear about farming (and forestry) businesses playing a key role in delivering a high-quality environment and local products, alongside a range of other public benefits. The challenge identified in the Plan is to ensure future farming practice is economically viable, helping to protect and manage Dartmoor's special qualities and contributing positively to nature enhancement and the climate crisis.

3.3 Our submission will include case studies of projects like Dartmoor Farming Futures, the Dartmoor Hill Farm Project, and the Environmental Land Management Test and Trials. We will also distil lessons to learn from the Dartmoor Moorland Vision, Premier Archaeological Landscapes and Farming in Protected Landscapes.

3.4 Outlined below are the key points which will help shape our submission to the independent review. Whilst addressing the terms of reference for the review, officers feel that the review needs to take a holistic approach and our key messages have been drafted as a set of 'principles' that might underpin an approach to agri-environment on Dartmoor.

3.5 An integrated approach that focuses on all public benefits

3.5.1 Agri-environment schemes and individual agreements need to be about delivery of a suite of public benefits and not narrowly focused on one benefit or objective. In terms of Dartmoor National Park those public benefits include:

- Nature
- Landscape
- Access
- Cultural heritage
- Water management
- Carbon management
- Wildfire prevention and management

3.5.2 There will be a need for priorities but in many instances, you can effectively layer public benefits (i.e. deliver multiple benefits from a parcel of land). This approach offers, we believe, best value for public money and supports delivery of National Park purposes.

3.5.3 The current debate about agri-environment agreements and SSSI condition is an example of focusing on one public benefit without considering others such as cultural heritage, public access etc.

3.5.4 There must be consensus between government agencies, key stakeholders and those that deliver the land management on what is being sought and where (see point about shared vision – 3.12 below).

3.5.5 For too long agri-environment schemes (and thus agreements) have been developed and delivered in a silo that separates this policy area from wider issues pertaining to farm productivity, sustainability and the rural economy. An integrated approach is required that makes the connections between agri-environment and the farm business and with the wider rural economy. Such an approach offers the potential for efficiencies, greater effectiveness and an opportunity to develop the circular economy (i.e. to use the public money spent on agri-environment agreements as a 'multiplier' for the local economy).

3.5.6 For agreements on common land there is a need to make the connection to the home farms.

3.5.7 Whilst recognising that food production is not a public benefit to be paid for via agri-environment agreements it should be considered alongside other public benefits.

3.6 A shared vision based on outcomes – clarity on what is sought and where

3.6.1 There is value in a shared vision of what is being sought and where – one that is ambitious. A vision that identifies the outcomes sought. When the vision is formed by all who will be guided by it, it's shared; people are engaged and bought in – their actions are part of achieving the vision. The Dartmoor Moorland Vision provides a case study in the value of a shared vision but also demonstrates areas that need to be addressed notably how the vision is promoted, kept alive, monitored and used to inform decision-making.

3.6.2 The National Park Management Plan (the Dartmoor Partnership Plan) should provide the shared vision and there is the potential to develop this spatially. The Dartmoor Partnership Plan can provide the strategic vision and help identify priorities. It can then provide a framework for advice and more detailed work at a landscape-scale.

3.7 Engagement and Partnership to deliver agreed Outcomes

3.7.1 There is considerable evidence that farmer engagement in design, delivery and monitoring of agri-environment agreements delivers better outcomes than a prescriptive approach that effectively 'dictates' management actions. Buy-in[1] is a prerequisite for success and can help drive ambitious delivery[2]. Many farmers, land managers and other stakeholders want to be engaged in the whole process, from design through to delivery and monitoring, to foster shared ownership of the system rather than being faced with a finalised product that ignores their respective knowledge, experience and skills.

3.7.2 On Dartmoor, the Dartmoor Farming Futures (DFF) pilot sought to develop an approach based on engagement and delivery of agreed outcomes.

3.7.3 Too often current agri-environment agreements are prescriptive – they specify the management required. In terms of agri-environment agreements on common land this is demonstrated by stocking densities and calendars. We need to move to a system that enables farmers/commoners to design the management required to deliver agreed outcomes. The experience of DFF demonstrates the need for access to trusted advice and facilitation – farmers and agencies working in partnership.

3.7.4 Regular, agreed monitoring is essential in order to help build trust, de-risk agreements (for all sides) and provide evidence of delivery (or non-delivery). Engaging farmers in this monitoring can help build trust, understanding and a sense of pride. Costs would form part of an agreement. Farmers could do some of the monitoring themselves and/or commission the monitoring. Monitoring needs to be across all public benefits to be delivered and to an agreed methodology. Natural England (or the relevant agency) would then quality assure the monitoring – a role akin to external audit within the public sector (an independent quality assurance). There may be a need to budget for training to develop monitoring skills and knowledge amongst the farming community. This approach should help embed delivery of environmental outcomes within farm businesses.

3.7.5 Monitoring data should be held centrally and accessible by all. We suggest that the National Park Authority should act as the 'library' as this then links to the requirement to prepare a 'State of the Park' report.

3.8 Trusted facilitation and advice

3.8.1 The importance of access to trusted facilitation and advice cannot be over-stated. If we want high quality outcomes, we need to provide high quality advice and see this

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[1] Lastra-Bravo, X. B. et al (2015) What drives farmers' participation in EU agri-environment schemes? Results from a qualitative meta-analysis, Environment Science and Policy, 54, pp. 1-9.

[2] McCracken, M. E. et al. (2015) Social and ecological drivers of success in agri-environment schemes: the roles of farmers and environmental context, Journal of Applied Ecology, 52, pp. 696-70

as an investment in delivery of outcomes and not a cost or overhead to be continually reduced. Advice should be provided locally where possible and face to face. There is an opportunity to develop an integrated local team that offers advice from all of the relevant agencies via one point of delivery. We believe that the National Park Authority is well placed to host and deliver such advice. It could build on existing initiatives such as the Dartmoor Hill Farm Project, the Headwaters Project and the joint post between the National Park Authority and Historic England.

3.8.2 This initial 'one stop and shop' advice would not negate the need for access to more specialist advice. The model could easily develop a 'mixed economy' approach that combines a combination of public, NGO and private actors. More specialist advice could be signposted.

3.8.3 Advisors need to be knowledgeable in local farming systems. We suggest a training course that is developed and delivered in partnership with the farming and wider land management community. Such a model – the Hill farm Training Scheme - was developed with the Foundation for Common Land.

3.8.4 We also need to foster and encourage learning within the farming community and jointly with the agencies. The National Park Authority used to organise regular 'Moorland Management Forums'. These were largely site-based – hosted by a specific common with the focus on the management issues faced by that common with an invitation to all commons associations and all of the relevant agencies. The Moorland Management Forum provided an informal opportunity to raise issues, for discussion and learning. Reductions in funding and staff meant that there was no capacity to support this initiative.

3.9 Combining National Priorities and Local Delivery

3.9.1 Even within a small and relatively unform area, an approach that prescribes, in advance, a standard set of management prescriptions, to deliver a desired outcome, will not necessarily succeed because local conditions will vary. Conditions on Dartmoor vary from those on Exmoor and more northly uplands. Conditions also vary across Dartmoor – from farm to farm, common to common. Research for the Dartmoor ELM Test and Trial phase 2 identified circa 19 different farming types within the National Park.

3.9.2 Local flexibility can still deliver national priorities but also provides for: innovation, engagement in designing the management to deliver agreed outcomes; monitoring can be based on local circumstances and there is scope to have a partnership approach to governance at a local level.

3.10 Moving Beyond SSSIs and the notion of 'Favourable Condition'

3.10.1 SSSIs have provided the basis for our system of nature conservation in England and favourable condition is now being used as a measure for nature recovery. SSSIs were never intended for this purpose and there is a need to research and develop a new approach which is cognisant of climate change.

3.10.2 There is a need to review all of Dartmoor's landscapes to consider future viability, opportunity and ecological coherence. This exercise should transcend current SSSI boundaries and reflect a landscape scale approach (as reflected in the Dartmoor

Partnership Plan). Results would inform a review of existing SSSI features, how they are monitored and how actions would be undertaken within and across commons. By looking forward rather than back to the original notification/designation, it would make decision making more transparent, objective and explicable to all. It also provides an opportunity to engage all stakeholders.

3.10.3 We need a new approach to monitoring of 'condition', one that:

- Looks at a wider basket of indicators (e.g., diversity and numbers of invertebrates and condition of habitats);
- Ideally the approach is an integrated one that monitors across all public benefits;
- Considers the role of external factors such as climate change, atmospheric pollution, plant disease (e.g., heather beetle);
- Is linked to expected sensitivity to change and the expected speed of change as a result of potential management adjustments and the legacy of past management;
- Is robust but also easy to understand and provides for engagement by farmers and others (see point above).

3.11 Rewarding delivery, encouraging innovation

3.11.1 Our current system of agri-environment payments is a combination of fixed annual and capital payments. A payment by results or a performance related payment approach offers a number of potential benefits, including:

- Encourages and potentially rewards innovation, whilst the current system mitigates against innovation;
- Incentivises improvement or enhancement of the environment rather than just paying for management;
- Supports a more 'entrepreneurial approach' – farmers are used to the idea that stock on good condition get best price and will seek to improve the condition of their stock.

3.11.2 The Dartmoor Environmental Land Management Test and Trial is exploring the development of a payment by results system for common land. There are potential disadvantages, but these could be mitigated by a system that combined a floor (a minimum payment) and a ceiling (a maximum payment). The level of the floor (and potentially the ceiling) would be subject to periodic review.

3.12 The Tools to do the Job

3.12.1 Mixed grazing emanates natural processes. It is important that agri-environment agreements facilitate grazing by cows, sheep and ponies - mixed grazing emanates natural processes. Swaling is also an important tool for delivery of public benefits. There is a need for further research into the climate change implications of swaling (the net effect in terms of greenhouse gas emissions) but removing this tool would significantly increase the risk of wildfires and would put delivery of other public benefits at jeopardy.

4 Conclusion

4.1 The key messages outlined above take a wider perspective than perhaps suggested by the terms of reference for the review. We think this is really important. We share the priority to do more for nature on Dartmoor but this needs to be done within a framework that looks at all public benefits, is focused on delivering National Park purposes and recognises the importance of viable farm businesses.

4.2 The independent review provides an important opportunity to shape a new approach to agri-environment and our key messages have been drafted to provide the principles that should underpin this new approach.

KEVIN BISHOP