Understanding the carbon performance DNPA-owned landscapes and the potential to help deliver net zero ambitions

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Farm Carbon Toolkit

1. About us

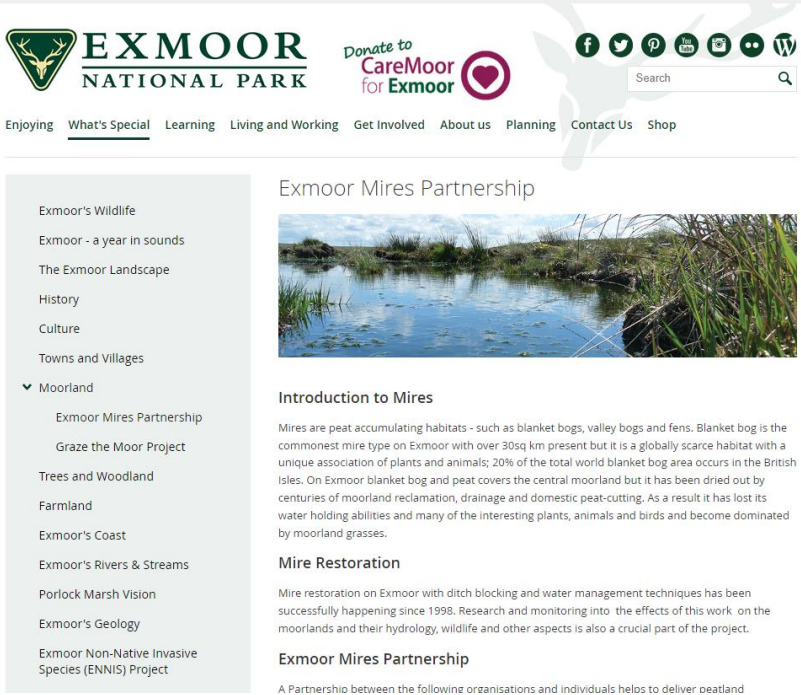
The Farm Carbon Toolkit was created by farmers for farmers.

For over a decade, we've worked to further the understanding of greenhouse gas emissions in agriculture.

We provide tools and services to measure impact and projects that inspire real action on the ground.

Contents

Mires project



- Extensive peatlands across Exmoor and Dartmoor.
- Mires project provides excellent data sets to support management and restoration on peat bogs
- Scope of this project does not include peatlands, as this is beyond the scope of the DNPA-owned land area

Commoners – challenges for carbon foot printing

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Summary | Full Results | Nitrogen | Benchmarking

Carbon balance

Emissions

298.21

tonnes CO_2e per year

Offset

-39.09

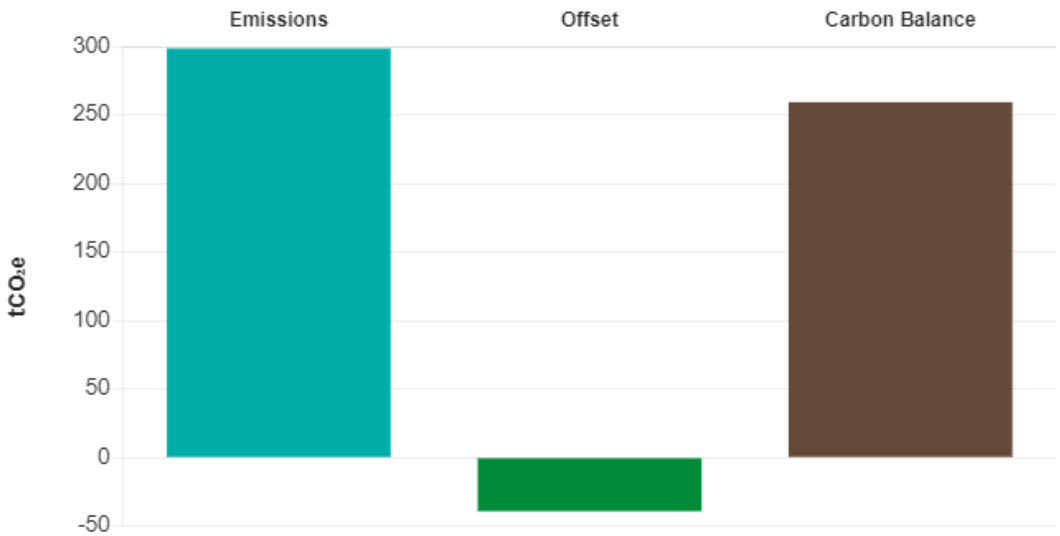
tonnes CO_2e per year

Carbon Balance

259.12

tonnes CO_2e per year

Download



https://calculator.farmcarbontoolkit.org.uk/

1. Objectives

Understand carbon stocks and flows across its land assets

Baseline soil carbon stock

Assess the current carbon footprint

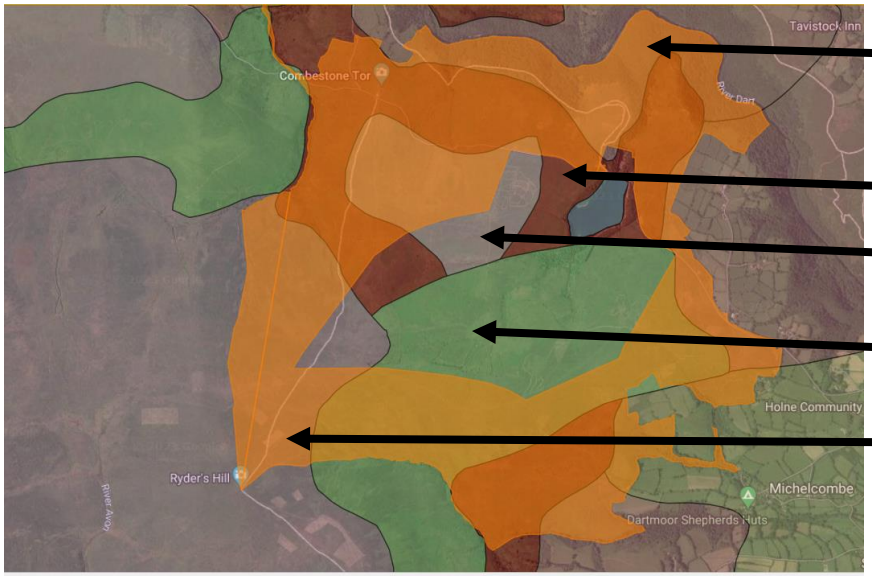
Model management change across the land area

Understanding interactions affecting soil carbon

Habitat x Soil type x management

Methodology

Holne Moor & White wood



Owned by DNPA

Moorgate soil type

Hexworthy soil type

Princetown soil type

Crowdy soil type

Moorland Vegetation project Hogan (1987)

Cranfield soil data set

Plasterdown, Hawnes & Dendles wood, Haytor, Holne Moor & White wood

12 land parcels

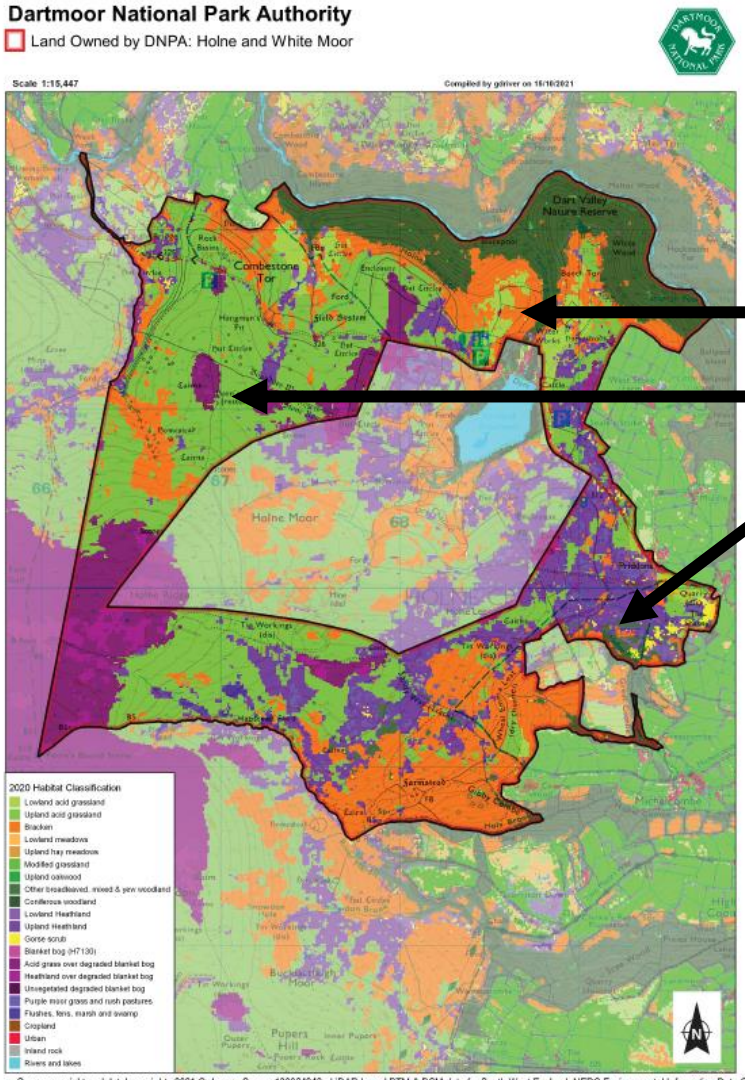
Background: soil

Soil Association	Subsidiary soil series
Banc	Manod
Moretonhampstead	Moorgate
Parc	Manod
Moorgate	Moretonhampsted
Hiraethog	Hafren
Hexworthy	Moorgate, Rough Tor, Princetown
Princetown	Hexworthy, Rough Tor, Crowdy
Laploy d	Crowdy
Crowdy	Princetown, Laploy d, Winter Hill

Soil Association = Soil maps are based on the most common soil type

Subsidiary soil types = less common type which are not mapped

Background: SWEEP Habitat data



Bracken

Acid grassland

Broadleaf, mixed and yew woodland

Pilot study

- 42 soil by habitat combinations
- 126 soil samples
- 630 augered holes
- 126 soil pits

Unreplicated for individual soil by habitat combinations

Unknown variability around data points

Soil sampling

Area sampled > 0.25 ha
*Purple moor grass and rush pasture & flushes fens marshes and swamps

10mm bore auger, 0-10cm, 10-30cm and 30-50cm depths

15 cores per location - bulked to give one carbon assessment per depth

Loss of Ignition

GPS logged

Bulk density core taken at each depth for one of 3 pits per soil type and site

Habitat diversity

Background: Habitat data uncertainty

Actual habitats	Similar habitats	Common SWEEP misinterpretations	Notes
Upland acid grassland	Lowland acid grassland	Purple moorgrass & rush pasture	
Bracken			Generally accurate
Upland heath	Lowland heath		Commonly mixed with gorse scrub
Acid grassland over degraded bog	Heathland over degraded bog	Eroded paths within acid grassland	Common on Haytor and Eastern Holne moor
Purple moorgrass & rush pasture		Tussocky acid grassland	
Gorse scrub		Heathland	
Flushes, fens, marshes and swamps			Overrepresented

Woodland

Two methods:

Management plans from < 2 years ago based on compartment description
*species, age, management

Farm Carbon Calculator model - age and species within parcels.
Assumptions have been are made of average yield class, average spacing and no thinning is applied

<u>Both based on woodland carbon code</u>

Scope 3 Emissions

Indirect emissions associated with management of the site

Activity	Detail
Volunteer conservation groups working in Hawnes and Dendles	10 volunteers visiting once per month with a DNPA ranger.
FCT completing the baselining and soil sampling across DNPA habitats	Travel to complete soil sampling visits and project meetings - mileage
Fencing Contractor in Hawnes and Dendles	Materials for fencing and travel
Vegetation surveys completed by ecologists	Travel to complete work at Hawnes and Dendles and Holne.
Woodland management plan	travel to complete Wray Valley woodland management plans
Leat repairs at Holne Moor / White Wood	Contractor time, vehicle and materials
Grazing completed at Hawns and Dendles	5 ponies

Results

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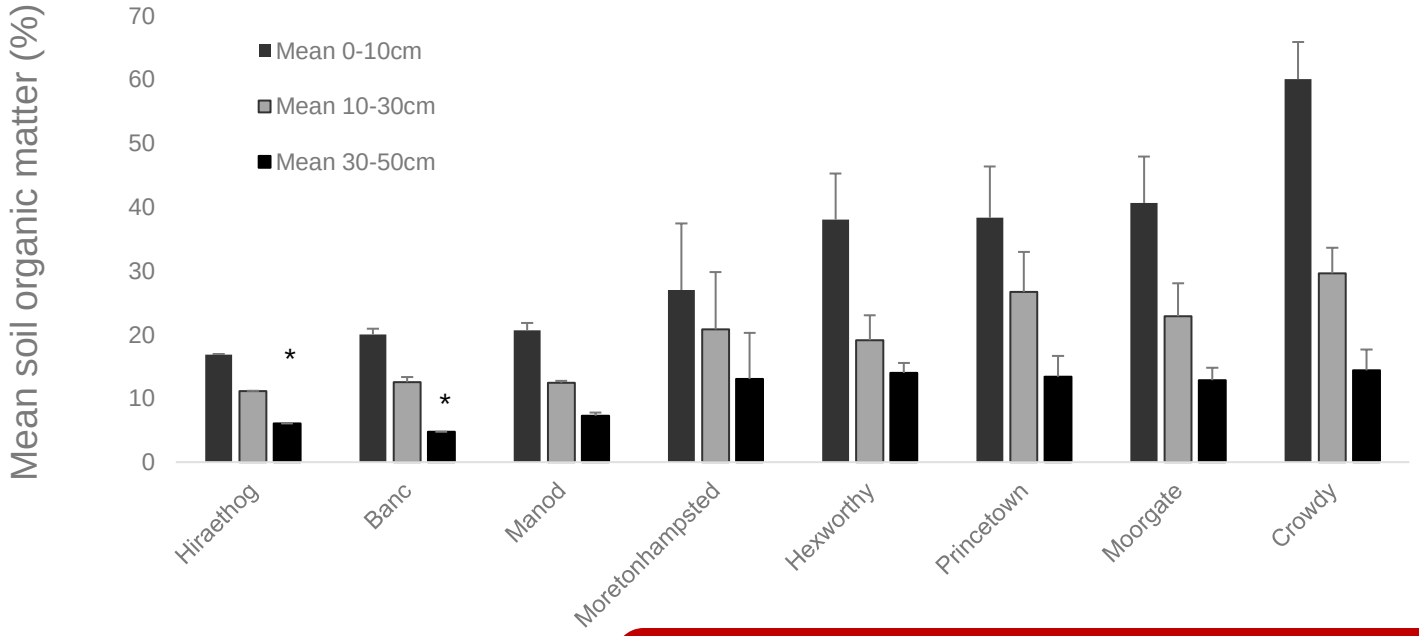
Results – scope 3 emissions

Emissions category	Tonnes CO2e	%ge of total emissions
Fuels	1.46	21.89
Materials	0.45	6.8
Inventory	1.52	22.72
Livestock	3.24	48.59
Total	6.67	100

There is also -0.51t CO2e being offset through the recycling of the plastic tree guards from Hawnes and Dendles. This provides the carbon balance of 6.16 t CO2e.

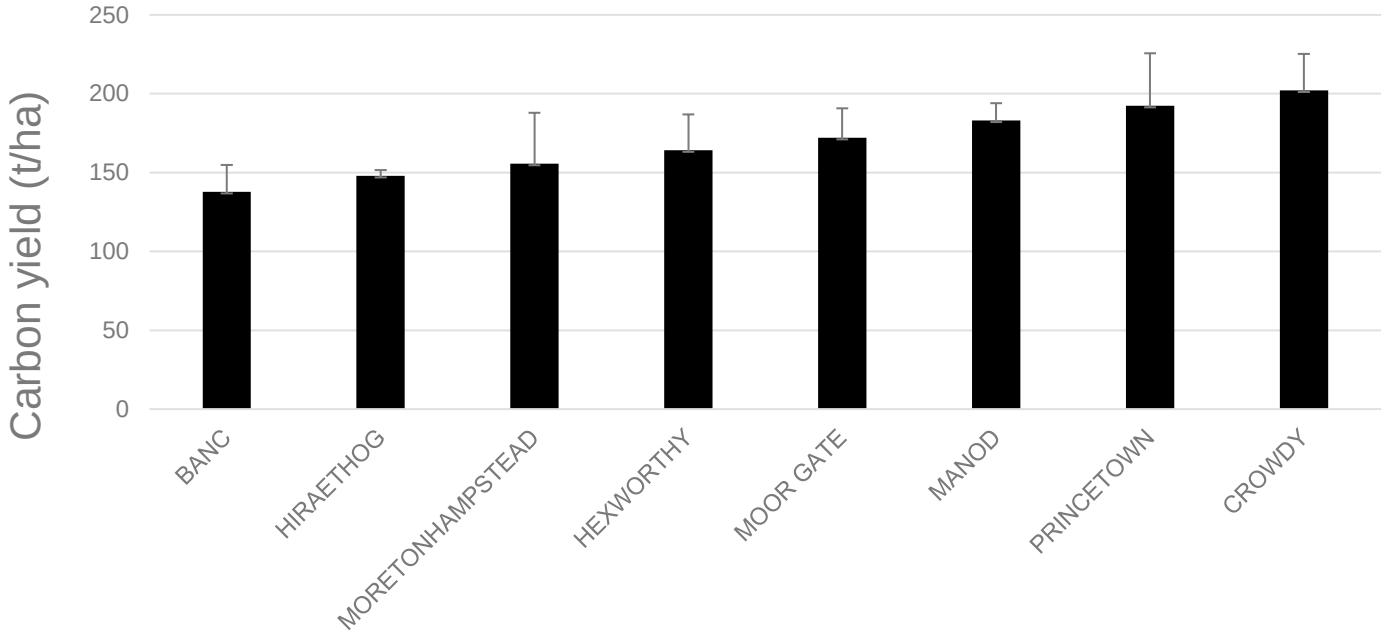
Soil type influences percentage organic matter up to 50 cm depth



Soil series								
	Over slates & mudstones	Very stoney	Slightly/ modestly stoney	Over granite	Over granite	Over granite	Over granite	Amorphous peat

Error bars indicate standard error

Carbon yield per hectare

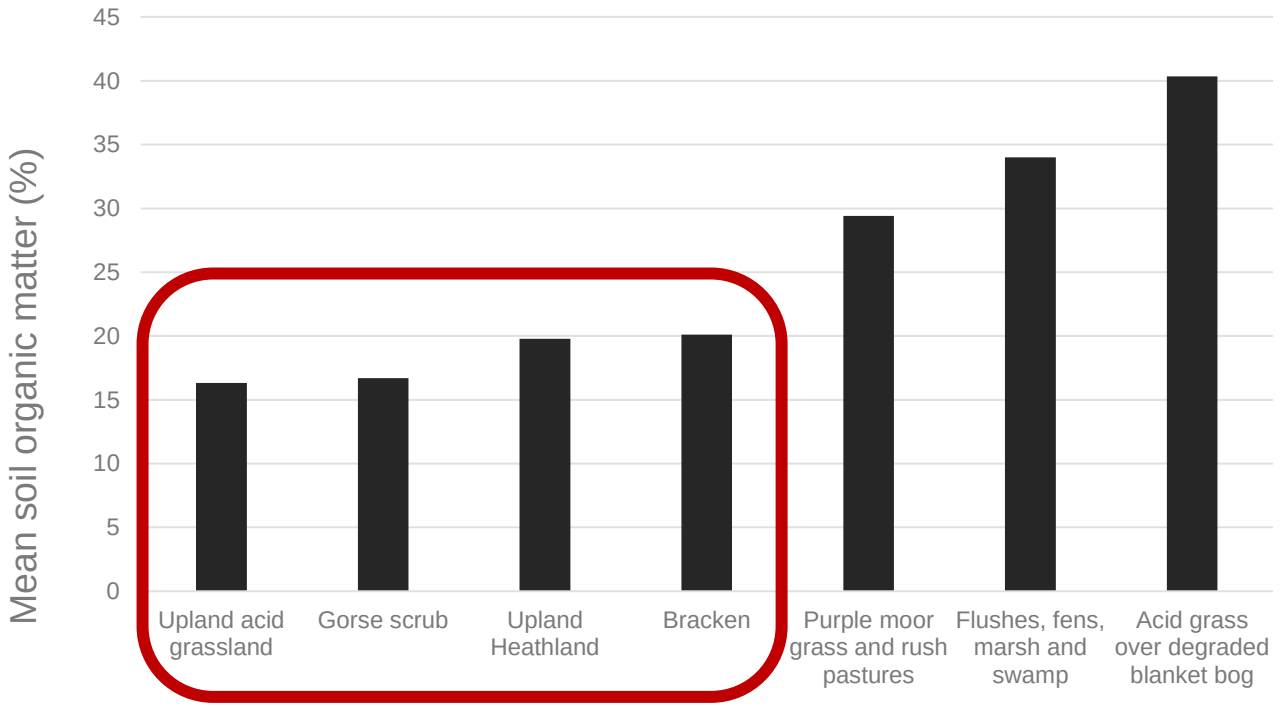


Auger depths of 50cm are likely to **under-estimates of** carbon stored in peats and some soil types over granite

Soil series								
	Very stoney	Over slates and mudstones	Over granite	Over granite	Over granite	Slightly/ modestly stoney	Over granite	Amorphous peat

Error bars indicate standard error

Habitat effect on soil organic matter to 50 cm

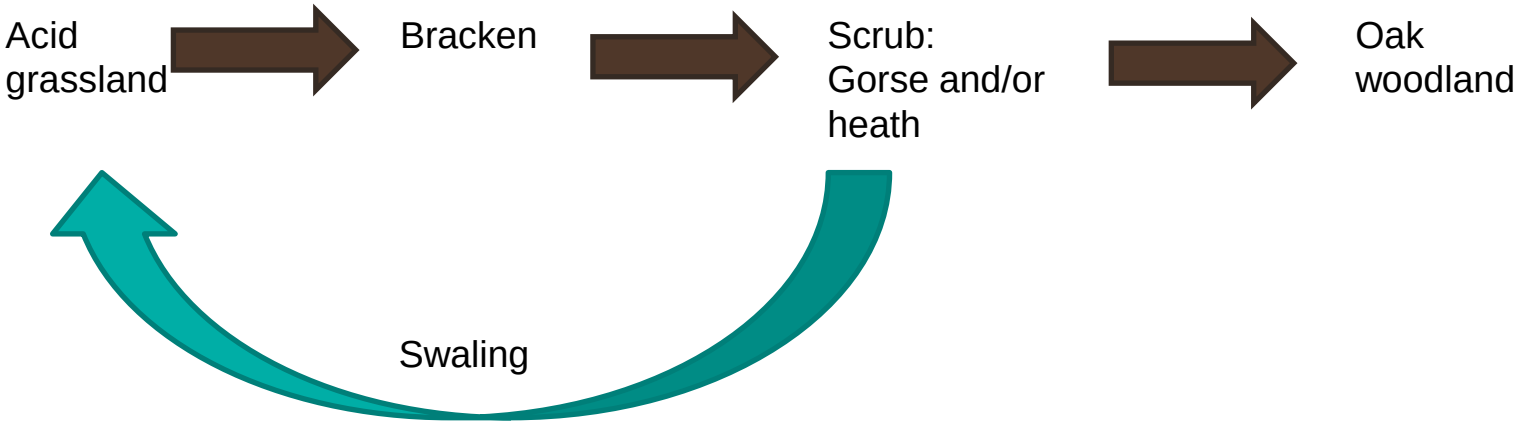


Further data sets are required

But

Early indications highlight acid grassland having on average the lowest soil organic matter to a depth of 50cm

Better drained land



Focus on grass, bracken and gorse

Carbon yield (tonnes/ha) below ground

	Hexworthy	Banc	Moorgate	Moretonhampsted	Princetown	Manod
Acid grassland	161.8	124.0	103.0	180.2	173.1	182.5
Bracken	186.9	88.7	174.3	98.2	162.5	160.0
Gorse scrub	220.8	175.7	188.8	202.7	193.2	206.6
	59.0	51.7	85.8	22.5	20.1	24.1

	Carbon yield (t/ha)	No. of farms	No. of fields
Dartmoor farms	254	11	33

*In some of these habitats bracken would not be an intermediate habitat type

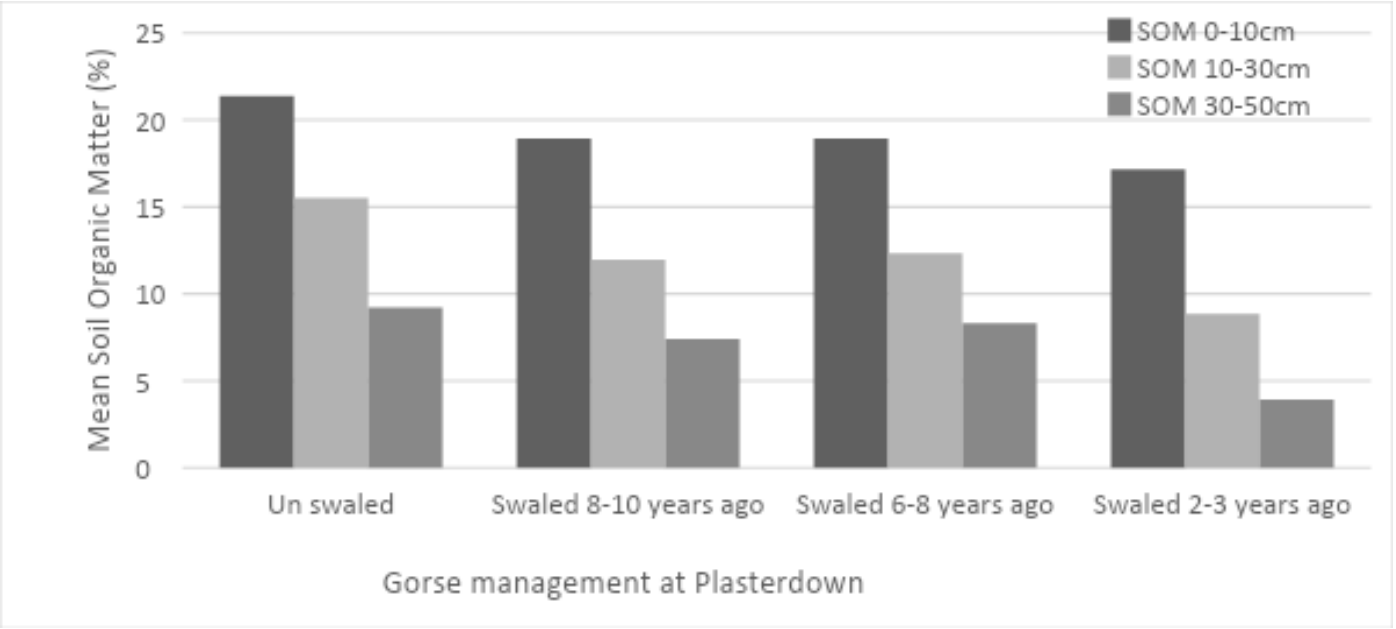
1. Flux estimates – based on habitat x soil data

Based on habitat x soil type

- Flux between acid grassland and gorse scrub ranges between an estimated 20 to 86 tonnes of carbon/ha below ground

- If swaling takes place on a 10 year cycle, annual flux varies between 2 and 8.6 tonnes of carbon/ha/year

2. Flux estimates – based on swaled data



Maximum time duration: 8 years

Flux = 2.1 tonnes of carbon/ha /year

Minimum: 6 years

Flux = 2.9 tonnes of carbon/ha/year

Estimates of flux for grass>(bracken)>gorse

Based on habitat x soil type

- An estimated 20 - 86 tonnes of carbon/ha below ground for change in habitat
- If swaling takes place on a 10 year cycle, annual flux varies between 2 and 8.6 tonnes of carbon/ha/year

Based on swaled data

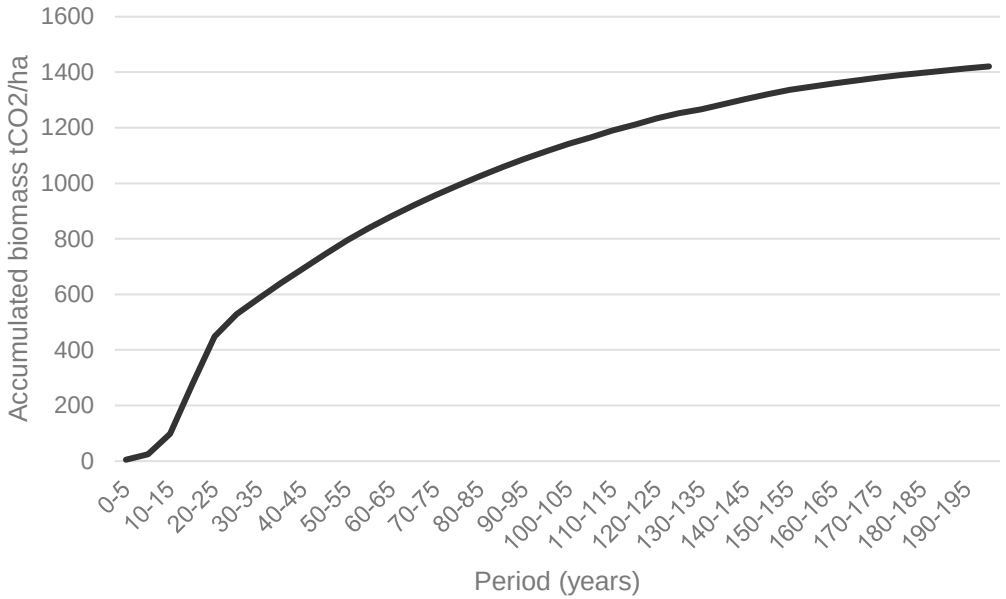
- Maximum time duration: 8 years, flux = 2.1 tonnes of carbon/ha /year
- Minimum: 6 years, flux = 2.9 tonnes of carbon/ha/year

Published data from Warner et al, 2020

- Flux for transitions from rough grassland to scrub = 0.049 tonnes fo carbon /year**

**On wetter soils with periods of water logging and clay soil, this is likely to be an underestimate

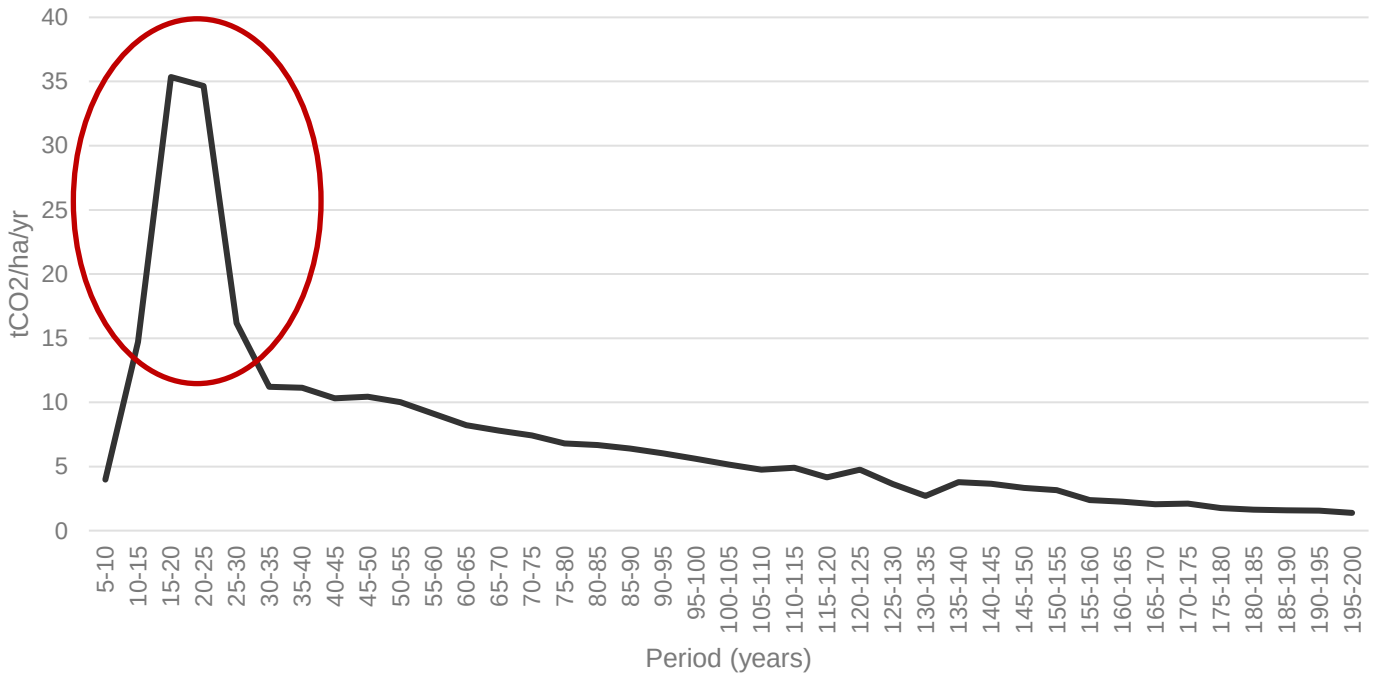
Woodland – total carbon stored



Data for oak, growth class 8, 2.5m spacing no thinning

Data taken from UK Woodland Carbon Code: https://woodlandcarboncode.org.uk/

Woodland – annual fluxes



Data for oak, growth class 8, 2.5m spacing no thinning

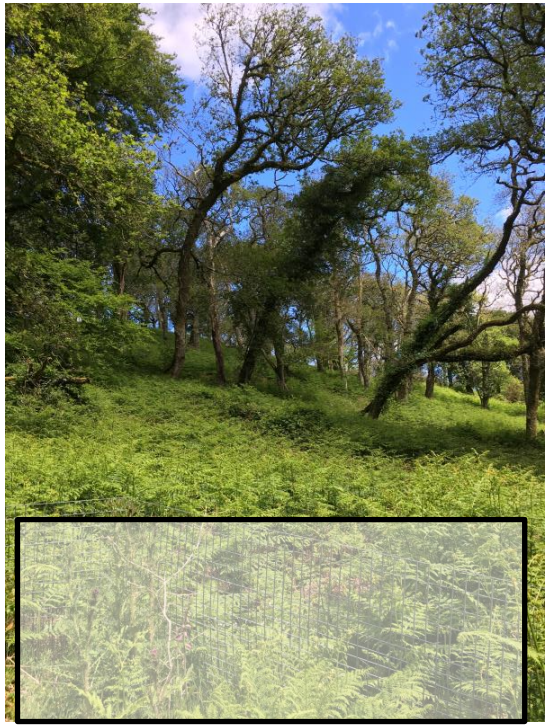
Data taken from UK Woodland Carbon Code: https://woodlandcarboncode.org.uk/

Woodland: regeneration and management

Accurately monitored to include growth rate, spacing, management and age.

Adjust projections for pest and disease risk

Woodland regeneration



Carbon calculations based on compartment data

Area_Ha	Species	Comments	Age of trees	Total carbon tonnes pa	Tonnes/ha
1.54	Oak	Transition: planted mixed native broadleaf (80%), open space over bracken (20%)	20-25	98.2	63.8

Broad conclusions

- Soil type influences soil carbon
- Habitat type influence soil carbon
- Habitat succession may provide opportunities for increased carbon storage
- There may be opportunities to focus carbon capture on soil types over granites, as opposed to mudstones.

1. Areas of particular management focus

Succession from grass into bracken then gorse is likely to increase carbon storage

Heathland, particular young heath has some grazing value, and potentially higher biodiversity value and is better for accessibility than gorse or bracken

To favour heath, management needs to change

- mixed grazing
- cutting bracken
- avoid swaling (favours gorse seed germination)

Mixed grazing and carbon footprint

2. Areas of particular management focus

Focus on assessment of areas of woodland regeneration for monitoring, management and development

Ground proofing is vital to gain accuracy

Replication is necessary to increase confidence in data sets, and allow feed into carbon foot printing tools

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Thank you

Soils Data from the National Soil Resources Institute, Soil data © Cranfield University (NSRI) and for the Controller of HMSO 2022

Data prepared by National Soil Resources Institute Information Services Group, 2022

Hogan (1987) ‘Moorland vegetation project’

Habitat Classification tool developed by the South West Partnership for Environmental and Economic Prosperity (SWEEP).