

Mapping Tree Hedgerow and Woodland (THaW) across the Brit catchment - November 2023

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Executive Summary

- Brit catchment (and buffer) has > 1 million tonnes woody carbon.
- Dominated by broadleaf canopies > 3m.
- More hedgerow by total area than conifer canopy.
- 63% of Riparian area (<10m of river) is wooded and is exclusively greater than 3m in height.
- 42% of Riparian area (<30m of river) is wooded and 94% is Broadleaf greater than 3m in height.
- The riparian area within 30m of river holds 110K tonnes of woody carbon.

Tree Hedgerow and Woodland (THaW) baseline mapping

Available LiDAR tiles have been processed for the extent of the Brit catchment. This analysis has used both first return digital surface model (DSM) and digital terrain model (DTM) datasets obtained by the National LiDAR Program between 2017 and 2021 (see Figure 1). These data have been used as the input to the THaW (Tree Hedgerow and Woodland) model, which has derived a baseline for woody biomass across the Brit catchment. These data are supplied in the attached data folder and an example area is illustrated in Figure 2.

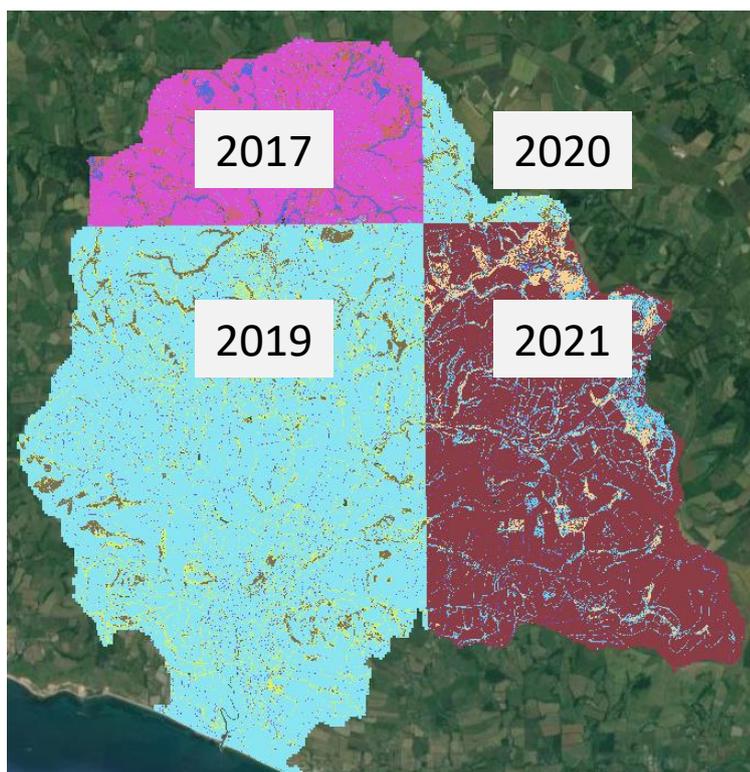


Figure 1: Summary of the areas of the Brit catchment that are covered by LiDAR data collected in years from 2017 to 2021. These data are unified in the THaW datasets provided.

Datasets Provided

Two Primary datasets are provided:

1. **Brit_THaW_23.tif**

This raster dataset forms the primary THaW dataset describing the distribution of the Tree Hedgerow and Woodland land cover within the provided Brit catchment area. The classes are described in grid code classifications 0 to 6 outlined in Table 1.

2. **Brit_THaW_23_5k_Seg.tif**

This raster dataset forms an extended THaW dataset including a 5km buffer area around the catchment and including the segregation of conifer and broadleaf THaW classes used to estimate carbon stocks, as coded in Table 1 below.

Grid Code	Classification
0	Null/Non THaW habitats
1	Below 1.3m (Scrub, Bushes or Miscellaneous)
2	Below 3m (Managed Hedgerow, Large Bushes)
3	Broadleaf - 3m to 15m (Tree Canopy, Mature Hedgerow)
4	Broadleaf - Above 15m (Contiguous Tree Canopy)
5	Below 1.3m (Fragmented - Scrub, Bushes or Miscellaneous <10m ²)
6	Above 15m (Emergent or Isolated trees)
13	Conifer - 3m to 15m (Tree Canopy, Mature Hedgerow)
14	Conifer - Above 15m (Contiguous Tree Canopy)
15	Open water/Non THaW habitats

Table 1: Tree hedgerow and woodland classifications - Grid codes in the included THaW GeoTIFF raster datasets correspond to the above classifications

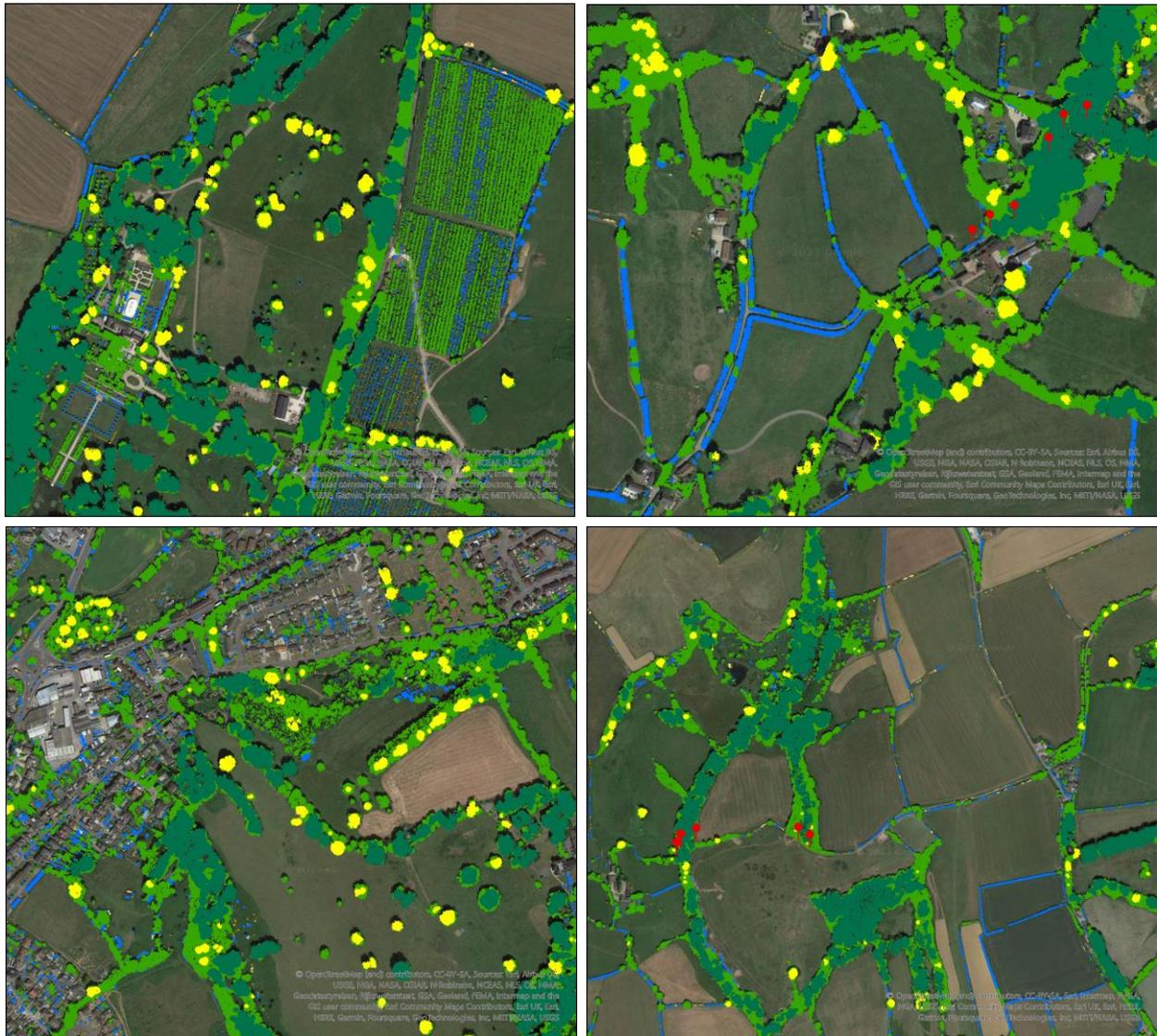


Figure 2: Examples of the THaW mapping data provided within the Brit catchment. Red locator marks identify locations surveyed during ground truthing field visits.

Web App

We have also made the above data available to explore via a google earth engine web app which can be accessed via the link below:

<https://davidjluscombe.users.earthengine.app/view/britthaw23>

This web app also allows for past canopy loss detection via the use of integrated sentinel 1 synthetic aperture radar data. A users guide for the change detection tool is also provided and should be read before this facility is used as the interpretation of data requires some user knowledge.

Above ground Carbon Stocks

Following desk-based work as part of the Net Zero+ project, suitable mapped area/carbon relationships have been established for the woody habitats included in the THaW mapping data. Table 2 summarises the values and assumptions used, the sources from which these are taken and the correspondence to the THaW mapping classes supplied above.

This carbon stock extrapolation is assumption based and is thus inherently uncertain on a site-by-site basis. However, this method uses published values and should provide suitable landscape scale estimation of C stocks. No values are included for fragmented or mixed scrub, as these values are not robustly available in the literature. To accommodate the differing carbon density of plantation conifer woodland, these extents have been extracted by integrating the respective habitat classes from existing land-use mapping. These values have been used in conjunction with the THaW mapping data to derive the estimated carbon stocks for the Brit catchment THaW dataset (and buffer) as detailed in figure 3/4 below.

Table 2: Summary of the metric tonnes of carbon per hectare values used to extrapolate THaW mapping data into a landscape estimate of woody carbon stocks. NE refers to R Gregg et al (2021) Natural England Report. WCC refers to West, V (2021) WCC Carbon Calculation Spreadsheet version 2.4.

THaW/ Habitat mapping class	Soil Carbon t C ha ⁻¹	Vegetation Carbon t C ha ⁻¹	Soil and Veg Carbon t C ha ⁻¹	Source and Assumptions
'Below 1.3m (Scrub, Bushes or Misc)'	NA	NA	NA	No suitable value
Below 1.3m (Fragmented - Scrub, Bushes or Misc e.g. fence/dry stone wall <10m ²)'	NA	NA	NA	No suitable value
Below 3m (Managed Hedgerow, Large Bushes)'	50	45	95	NE Assuming soils contribution is lowest limit of 100 year broadleaf woodland, mixed composition. Veg C stock refers to minimally managed hedgerow
3m to 15m (Broadleaf Tree Canopy, Mature Hedgerow)'	55	114	169	NE Assuming Soil C at 15cm, 30 year age, mixed composition
3m to 15m (Conifer Tree Canopy)'	55	54	109	WCC using WCC carbon calculator for Sitka Spruce at 20 (half rotation) years and FR soil carbon lookup table. Assuming soil C at 15cm is 50% of C at 30cm.
Above 15m (Broadleaf Contiguous Tree Canopy)'	55	203	258	NE Assuming Soil C at 15cm, 100 year age, mixed composition
Above 15m (Conifer Contiguous Tree Canopy)'	49	102	151	WCC using WCC carbon calculator for Sitka Spruce at 40 years (full rotation) and FR soil carbon lookup table. Assuming soil C at 15cm is 50% of C at 30cm.
Above 15m (Individual Trees)'	55	203	258	NE Assuming Soil C to 15cm, 100 year age, mixed composition

THaW for Brit catchment area of interest

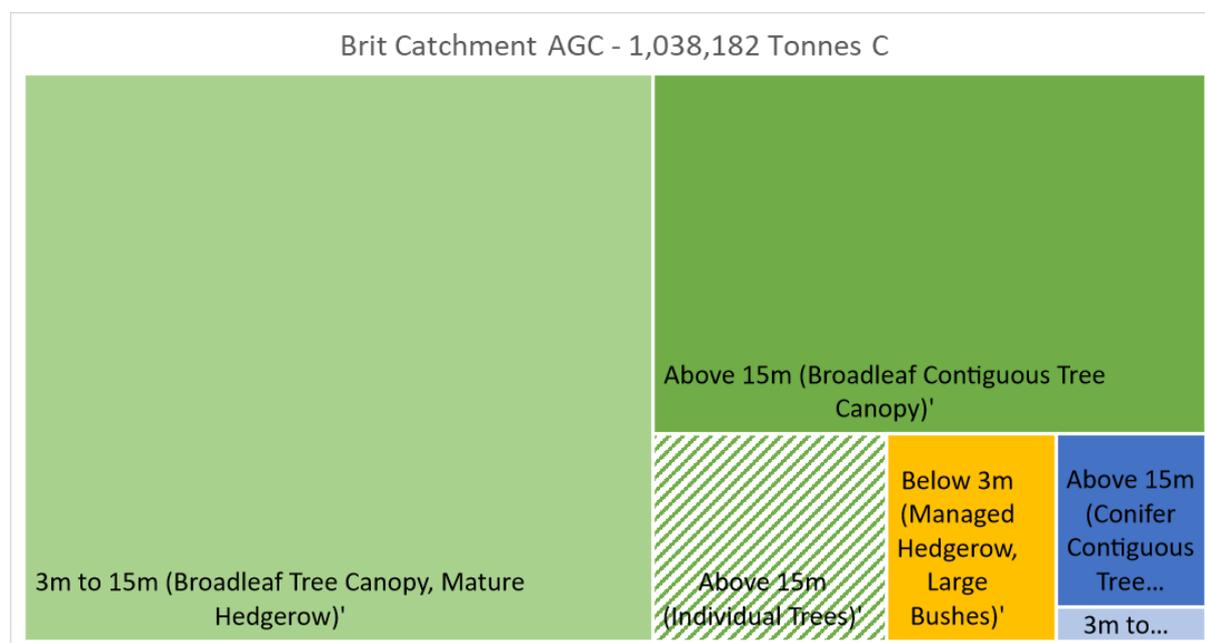


Figure 3 Tree-map illustrating the proportion of the total woody carbon stock in the study area, within each of the mapped THaW classes.

Table 3 Table summarising the estimated tonnes of carbon (and area) associated with each of the mapped THaW classes within the study area.

Class	Area Ha	Tonnes C	% Cover
Below 3m (Managed Hedgerow, Large Bushes)	573	54454	10%
3m to 15m (Broadleaf Tree Canopy, Mature Hedgerow)	3270	552555	58%
Above 15m (Broadleaf Contiguous Tree Canopy)	1194	308000	21%
Above 15m (Individual Trees)	292	75225	5%
3m to 15m (Conifer Tree Canopy)	72	7894	1%
Above 15m (Conifer Contiguous Tree Canopy)	265	40053	5%
Total	5665	1038182	100%

Woody carbon stocks for the study area have been derived using the values shown in Table 2. Figure 3 illustrates that, of a total carbon stock of >1 million tonnes, the majority are within broadleaf species and the conifer species only contribute ca. 6% of the total. This extent also includes more hedgerow by total area than conifer canopy. Table 3 also includes the area (in hectares) of the respective mapped classes converted to C stocks.

THaW within 30m of a watercourse within Brit Catchment

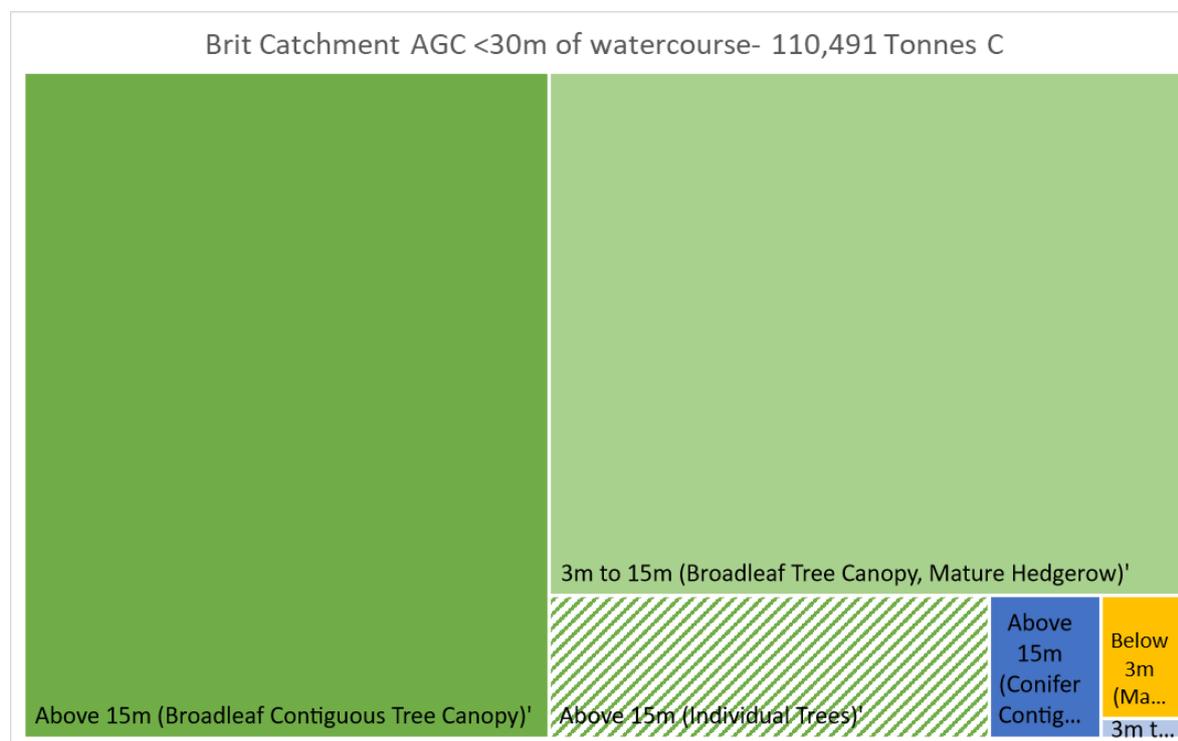


Figure 4 Tree-map illustrating the proportion of the total woody carbon stock within 30m of a watercourse, within each of the mapped THaW classes.

Table 4 Table summarising the estimated tonnes of carbon (and area) associated with each of the mapped THaW classes within 30m of a watercourse.

Class	Area Ha	Tonnes C	% Cover
Other	753	0	58%
Below 3m (Managed Hedgerow, Large Bushes) ¹	15	1448	1%
3m to 15m (Broadleaf Tree Canopy, Mature Hedgerow)	281	47517	22%
Above 15m (Broadleaf Contiguous Tree Canopy) ¹	194	50040	15%
Above 15m (Individual Trees) ¹	35	8961	3%
3m to 15m (Conifer Tree Canopy) ¹	2	231	0%
Above 15m (Conifer Contiguous Tree Canopy) ¹	15	2294	1%
Total	1296	110491	100%

Woody carbon stocks for the areas less than 30m from a mapped watercourse within the Brit catchment, have been derived using the values shown in Table 2. Figure 4 illustrates that a total carbon stock of ca. 110K tonnes, which amounts to approximately 10% of the total carbon stock. Again, the majority are within broadleaf species and the conifer species only contribute ca. 1% of the total. Table 4 also includes the area (in hectares) of the respective mapped classes converted to C stocks.