This is a Frequently Asked Questions document covering outputs from both the SWEEP Habitat Classification tool and Habitat Change Detection tool.

Drawing on freely available satellite imagery (Sentinel-2) and LIDAR data, this remote sensing-based SWEEP project worked in close collaboration with the Dartmoor National Park Authority to create two tools – the Habitat Classification tool and the Habitat Change tool.

- **The Habitat Classification tool** enables habitat types across the entire extent of the National Park area to be classified and mapped to a fine resolution in a consistent and repeatable way.
- **The Habitat Change Detection tool** enables the detection of change in these habitat types over time.

These tools have been designed to assist in landscape scale management and are now being used by Dartmoor National Park and partners.

1 What is the aim of the Habitat Classification map?

The project aimed to create up-to-date habitat map across the whole extent of Dartmoor National Park (955km^2), not previously possible by traditional field survey methods.

The Habitat Classification map shows the most likely habitat class for each 10 m^2 pixel across the whole extent of the National Park.

It uses the finest scale (10m^2) freely available satellite data, meaning the maps can be updated annually. However, they may be coarser than other maps derived from e.g. field survey or aircraft based survey. The tool is designed for decision making at a landscape scale, rather than a field scale, including the planning of more detailed but expensive field survey work.

2 How was the Habitat map derived?

The Habitat Classification map shows the most likely habitat class for each 10 m^2 pixel across the whole extent of the National Park. The tool uses 4127 pixels of known habitat classes (assigned by looking at aerial photographs) to train a computer algorithm (random forest classifier) which uses freely available Sentinel-2 satellite imagery combined with freely available Tellus LiDAR data products (slope, aspect and elevation), to predict the most likely habitat class for each pixel.

The tool also 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.

3 What do the different habitat classes mean?

The classification scheme is based on the UK Habitat Classification System and categorises to levels 3 and 4, as appropriate, with the exception of f1a5 blanket Bog and f1a6 degraded blanket bog which were mapped to level 5 due to the extent and importance of this habitat type within the National Park. Degraded blanket bog was then subdivided based on the overlying vegetation type.

Table 1
Classification scheme used by this tool and how it relates to the UK Habitat Classification scheme

UK Hab Level	UK Hab Code	UK Habitat Label	SWEEP Habitat Class Code	SWEEP Habitat Class Label
4	g1a	Lowland dry acid grassland	1	Lowland acid grassland
4	g1b	Upland acid grassland	3	Upland acid grassland
4	g1c	Bracken	2	Bracken
3	g2	Calcareous grassland	Negligible/no extent of this habitat within DNP	
4	g3a	Lowland meadows	6	Lowland meadows
4	g3b	Upland hay meadows	7	Upland hay meadows
4	g3c	Other neutral grassland	Not distinguishable from upland hay and lowland meadows	
3	g4	Modified grassland	9	Modified grassland
4	w1a	Upland oakwood	10	Upland oakwood
3	w1	Broadleaved mixed and yew woodland	11	Other broadleaved, mixed and yew woodland
3	w2	Coniferous woodland	12	Coniferous woodland
4	h1a	Lowland Heathland	13	Lowland Heathland
4	h1b	Upland Heathland	14	Upland Heathland
4	h1c	Mountain heaths and willow scrub	Not distinguishable from upland and lowland heathland	
2	h2	Hedgerows	Not distinguishable from other broadleaves, mixed, yew or conifer woodlands	
4	h3e	Gorse scrub	18	Gorse scrub
5	f1a5	Blanket bog (H7130)	19	Blanket bog (H7130)
5	f1a6	Degraded blanket bog	303	Acid grass over degraded blanket bog
			314	Heathland over degraded blanket bog
			328	Unvegetated degraded blanket bog
4	f2b	Purple moor grass and rush pastures	23	Purple moor grass and rush pastures
3	f2	Fen marsh and swamp	25	Flushes, fens, marsh and swamp
2	c	Cropland	26	Cropland
2	u	Urban	27	Urban
3	s1	Inland rock	28	Inland rock
3	s2	Supralittoral Rock	Negligible/no extent of this habitat within DNP	
3	s3	Supralittoral Sediment		
2	r	Rivers and lakes	29	Rivers and lakes
2	t	Marine inlets and transitional waters	Negligible/no extent of this habitat within DNP	

4 How was the extent of blanket bog defined?

In a functioning state, blanket bog has characteristic vegetation (e.g. *Sphagnum* moss) that can be observed via satellites. However, in a degraded state, blanket bog is often overlain by other types of vegetation e.g. purple moor grass. It was therefore decided to use an existing map of Dartmoor's peat extent greater than 50 cm thick to define the area of blanket bog (intact and degraded).

The map of Dartmoor's peat extent was produced from the relationship between peat depth, as measured, and slope (from LiDAR) and radiometric dose (from airborne radiometric survey). Peat is thicker in flatter areas and where more of the radiation emitted from the granite is attenuated by the overlying thickness of peat.

5 How was the extent of uplands defined?

The UK Habitat Classification uses elevation to define some classes e.g. upland heathland being above 300 m, and lowland heathland below. The upland area was defined as all pixels above 300 m in elevation in the 2013 Tellus SW LiDAR based digital terrain model.

6 How good is the map?

The tool outputs use accuracy values for the map as a whole, and for each class. This tells the user the probability that a pixel mapped as, for example, modified grass actually is modified grass - so a value of 71 % indicates that if a user looks at 100 pixels mapped as modified grass 71 of them are mapped correctly and 29 mapped incorrectly.

The tool produces a table output (confusion matrix) which highlights where pixels have been mis-classified as other habitat classes, which they have been confused with. For example, there is commonly confusion between upland heathland and upland acid grassland as these habitats have many species in common.

Although no official mapping standards exist, a common benchmark is for an overall accuracy of 85 %, with no class less than 70 % accurate. This is a stringent aim rarely achieved especially where there are many habitat classes that differ only subtly.

The 2019 Habitat Classification map has an overall user's accuracy of 78.4 % with class-based user's accuracies ranging from 50 % (gorse) to 100 % (rivers and lakes). Out of the 22 habitat classes 13 have a user's accuracy of >70%.

For comparison, Natural England's Living Maps over Dartmoor National Park and the North Devon Biosphere Reserve (Evidence Project SD1705 Final Report) obtained an overall accuracy of 67 %. Class based accuracy ranged from 16.7 % (lowland meadows) to 100 % (arable and horticultural; blanket bog; coastal and floodplain grazing marsh; coniferous woodland; mud, sand or shingle; sea and surface water) with 10 out of 27 classes achieving > 70 % accuracy.

The Center for Ecology and Hydrology Land Cover Map 2019 which also uses Sentinel data and a random forest classifier reports overall accuracy of 79.4 % and class-based user's accuracies of between 41.4 % (heather grassland) and 97.8 % (fen, marsh and swamp).

7 This pixel is incorrect, does this mean the whole map is worthless?

The Habitat Classification map shows the most likely habitat class for each 10 m^2 pixel across the whole extent of the National Park. For each habitat class there is a user's accuracy which tells us the probability that a pixel has been mapped correctly. Some pixels will have been mapped incorrectly.

We have tried to quantify, understand and reduce these errors but they are inevitable with the methods used. The tool is able to cover the whole extent of the national park area (not possible by field survey method), using a consistent approach (unlike gathering multiple maps created for varying purposes) and can be updated annually. It has been designed to assist in landscape scale management including targeting of more accurate but expensive field survey.