

# Enabling sustainable landscape management through novel remote-sensing tools for mapping woodlands, moorlands and key habitats

## SWEEP services provided



### Why it mattered

We are working in an age of open access geospatial data that is free to use and available at fine spatial resolutions. This is revolutionising the way we understand and monitor patterns and dynamics across landscapes.

However, highly complex, technical remote sensing workflows are required to translate these data into user-friendly, up-to-date, fine spatial resolution maps that can inform more robust, evidence-based land management decision making. This work requires specialist skills not often available in-house within those organisations that stand to benefit most from such tools.

### What we did

In May 2019, Prof. Richard Brazier, Prof. Charles Tyler, Dr David Luscombe, Dr Naomi Gaitis, Dr Donna Carless and Dr Karen Anderson from the University of Exeter began work with key partner organisations the Dartmoor National Park Authority, the North Devon UNESCO Biosphere Reserve and the Forestry Commission on the [SWEEP Quantitative Habitat Mapping project](#) which responded directly to this issue.

Working closely with our partners to understand their needs and incorporate their expertise, the team set about using open source Earth Observation data to create a set of bespoke habitat mapping methods and tools. They used spaceborne radar (Sentinel 1, SAR), multispectral imaging data (Sentinel 2) and Tellus LIDAR data, in combination with machine learning approaches.

This produced fine resolution, robust and repeatable mapping outputs of land cover across two key landscapes; habitat classes within Dartmoor National Park and wooded areas within the North Devon UNESCO Biosphere Reserve.

### The tools

Our partners fully informed the project approach and outputs and the following unique tools have now been finalised and transferred to them.

#### Working with the Dartmoor National Park Authority

Habitat cover across the whole park extent was mapped using a classification system adapted from Level 4 of the national UKHab classification scheme. This led to the development of the following tools.

- The [Habitat Classification tool](#) - this classifies habitat types across the entire extent of the National Park area and enables the annual production of habitat classification maps.
- The [Habitat Change Detection tool](#) - this enables the detection of change in these habitats over time.

#### Working with the North Devon UNESCO Biosphere Reserve and the Forestry Commission

Outputs focused on baseline mapping the extent and height of trees across both woodland and hedgerow habitats. This led to the development of two further tools.

- The [THaW \(Tree, Hedgerow and Woodland\) Mapping Toolbox](#) – which can autonomously generate a baseline THaW map using LiDAR Data at a 2km spatial resolution.
- The [THaW Change Detection tool](#) - which dynamically maps the change/loss of woodland and hedgerow biomass/stock over time using satellite-borne radar (SAR) data.

Image taken from the THaW mapping and change detection tool



## Outcomes and Impacts



### Capacity building

The datasets produced can be easily accessed, used and reproduced by our partners as and when needed. This has been made possible by using open source software platforms for the key data processing workflows and transferring the know-how behind the tools and their outputs to our partners via the delivery of User Guides and a series of training workshops. Ongoing support with this process will help to ensure these tools become fully embedded within our partner organisations.

“ The technical handover and User Guides were extremely thorough and efficient. We have been very impressed with the final product, the supporting information, and the efforts taken throughout to accommodate our requests. ”

Richard Knott, Ecologist, Dartmoor National Park Authority



### New and improved data for management purposes

The datasets, tools and mapping outputs offer our partners a unique and bespoke, repeatable evidence base to support more robust land-management policy, practice and decision making. This significantly improves on previously available data.

“ The data the SWEEP team has extracted is unprecedented compared to what has been available to DNPA previously. ”

Richard Knott, Ecologist,  
Dartmoor National Park Authority

### Anticipated impacts

The tools and the mapping outputs are currently being used by our partners. The impact of these are being tracked, but our partners hope to benefit from them across a variety of areas:



Improved understanding of the extent, state and change over time, of natural capital assets, enabling more robust and sustainable decision making.

More effective management, and increased resilience, of natural capital assets, as a result of strengthening activities in some of the following areas - nature recovery, rewilding and biodiversity net gain; Environmental Land Management Schemes; carbon storage assessments and values; development of management plans, e.g. for ancient woodlands; archaeological work; tree felling compliance inspections; tree planting, and biodiversity planning and monitoring; leveraging further funding.



Cost savings on commercial mapping; reducing staff time for habitat surveying and mapping; more effective and efficient targeting of resources to priority areas.



Contributing to local and national policy improvements.

### Wider benefit

Although specifically designed for our partners and the habitats they manage, some of these tools and methods also have the potential to be adapted to other areas and larger geographical extents, where data are available. Funding has recently been secured to begin work on a national roll-out of the THaW tool.

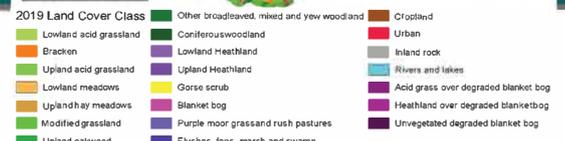
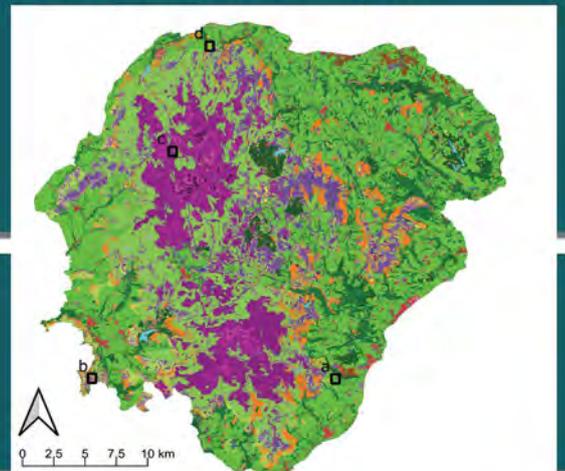


Image from the Habitat Classification Tool

### The team

To find out more please contact:

- Dr David Luscombe (d.j.luscombe@exeter.ac.uk); or
- SWEEP (sweep@exeter.ac.uk).

### Underpinning NERC science

1. NERC BESS fragments, functions and flows in urban ecosystems – Anderson - NERC reference: NE/J015237/1
2. NERC DRIVING-C project (£800k to Brazier as PI, Anderson as CO-I)
3. NERC CASE PhD award (£60,000 to Brazier) Multi-scale predictions of soil erosion and water quality from intensively managed grasslands.
4. NERC CASE PhD award (£66,945 to Brazier) Impacts of farmscale ecosystem management on water quality in intensively managed grasslands.
5. NERC/TSB and South West Water Knowledge Transfer Partnership (£200,000 to Brazier as PI and Anderson as CO-I) Understanding the impact of moorland restoration on water quality.
6. NERC/RSPB Effects of agricultural land use on breeding success of the Cuckoo (£70,000, to Tyler)
7. NERC (£70,000 to Brazier as PI, Anderson as CO-I) Impacts of fluvial land degradation on the spatial dynamics of soil organic carbon
8. NERC (£12,000 to Brazier as PI) Catchment Management Knowledge Transfer to the Water Industry
9. Technology Strategy Board/NERC (£107,368 to Anderson as PI, Brazier as CO-I) Developing an integrated unmanned aerial vehicle platform "QuestEarthWater" for assessing hidden blue water supplies
10. EPSRC (£3.9M) to Boxall, Sheffield, as PI and Brazier as one of 18 CO-I's Twenty65
11. NERC (£35,000) to Hester, National Trust, as PI, Brazier as CO-I. Tackling climate change: Exploring the science behind Natural Flood Risk Management with local communities in SW England

### About SWEEP

The South West Partnership for Environment & Economic Prosperity (SWEEP) is a partnership between the University of Exeter, the University of Plymouth and Plymouth Marine Laboratory. Funded by the Natural Environment Research Council, SWEEP brings experts and stakeholders together to solve challenges faced by those working with our natural resources.