Enabling more sustainable landscape management through the co-creation of novel remote-sensing tools

SWEEP co-created novel remote sensing tools for mapping and monitoring key woodlands, moorlands, and habitats, to help enhance the South West's natural landscapes. These tools are already supporting quicker, less costly and more effective decision-making by those tasked with managing the South West's vitally important natural resources.



SNeep Impact Summary

Tree line and natural landscape, Dartmoor



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 has the potential to revolutionise 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. These require skills not often found in organisations.

What we did

Responded directly to this issue, the University of Exeter's Dr David Luscombe, Dr Naomi Gatis, Dr Donna Carless, Dr Sara Zonneveld, Dr Karen Anderson, Prof Richard Brazier, Prof Charles Tyler worked in close collaboration with the Dartmoor National Park Authority, the North Devon UNESCO Biosphere Reserve and the Forestry Commission.

Using open source Earth Observation data they created a set of bespoke

habitat mapping methods and tools. Responding to partner's needs, the team created remote sensing workflows to develop the tools, and these produced fine resolution, robust and repeatable mapping of habitat classes within Dartmoor National Park, and wooded areas within the North Devon UNESCO Biosphere Reserve. This was achieved utilising spaceborne radar (Sentinel 1, SAR), multispectral imaging data (Sentinel 2) and Tellus LIDAR data, in combination with machine learning approaches.

This work has put us two or three years ahead of the game in terms of natural resource mapping data at landscape scale and therefore being able to deliver effectively on nature enhancement work. It simply wouldn't have happened without SWEEP in this timeframe, and quite possibly would not have happened at all."

Richard Knott, DNPA's Ecologist

The tools

Working with 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 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:

- The THAW (Tree, Hedgerow and Woodland) Mapping Toolbox – which can autonomously generate a baseline THAW map using LiDAR Data.
- The THAW Change Detection tool which dynamically maps the change/ loss of woodland and hedgerow biomass/stock over time using satelliteborne radar (SAR) data.

Impacts & benefits delivered



Attitudinal/Capacity

Building capacity and culture shits: our partner's capacity to understand and use these kind of remote sensing tools and mapping outputs has been significantly boosted, enabling them, and the partners they support, do their jobs better and embed new ways of working. Having delivered SWEEP training to more than 50 others, and with the tools now open access, this capacity is extending rapidly throughout the sector.

Organisational Function

A step-change in habitat data for

management purposes: the datasets, tools and mapping outputs have provided our partners with a unique, bespoke and repeatable evidence base, of the extent and change of habitat cover over time. This is enabling more effective natural capital decision making, policy and practice and significantly improves upon previously available data.

Organisational Function Environmental enhancement, safeguarding and increased

resilience: for the first time SWEEP's tools are providing land managers with bespoke, accurate and repeatable landscape-scale habitat data enabling better decision making. This is already benefitting a wide range of work including nature recovery, Biodiversity New Gain, natural flood management, Defra's Environmental Land Management Schemes, carbon storage interventions, woodland protection, restoration and creation - both for our partners, and wider stakeholders such as the Environment Agency, Natural England, RSPB, Devon Wildlife Trust and the MOD. See Impact Case Studies.

Policy & Legislation

Contributing to strategic direction shifts and policy development:

SWEEP's work has underpinned the development, and will be integral to the delivery and evaluation of, Dartmoor's National Park Partnership Plan 2021-2026, as well as the associated local DNPA plan and State of the Park report.

Economic

Financial and economic benefits:

SWEEP's mapping is estimated to be saving our partners at least £750k/per 5 yrs in costs e.g., reducing the need for commercial mapping and ground surveys and enabling better allocation of resources to priority areas. The tools will play a key role in enabling North Devon realise c. £40m natural capital benefits and safeguarding or creating c.700 jobs by 2030, through better woodland creation and management. The work has already leveraged £6.7m of further funding, and a further £5.8m in expected. The SWEEP experience, and tools, have widened our horizons and been a game changer for us – it's made us think more ambitiously and innovatively about what we can do rather than continuing with how we've always done things."

Ally Kohler, Previous DNPA Director of Conservation and Communities

We work in such large areas, with so few people, that having a remote sensing tool such as THaW has the potential to make a huge difference. It will allow us to be proactive, to seek out the areas that need intervention and take quick, positive action."

Mark Prior, South West Area Director, Forestry Commission

SWEEP's Habitat classification and THaW baseline tools are now the primary landscape scale data for the National Park. Both datasets are being used on a daily basis and SWEEP mapping outputs provide the mainstay of our habitat monitoring from now on."

Richard Knott, DNPA's Ecologist



SWEEP's THaW tool has already proven key to helping us provide more responsive woodland management advice, for leveraging further investment to deliver impact on a larger, wider scale, and in helping to deliver North Devon's considerable woodland targets towards 2030."

Andy Bell, North Devon UNESCO Biosphere Reserve Co-ordinator



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Knowledge/Capacity

Legacy and sustained impact: has been built into this work from the robust sciencebased open source platforms on which the tools are constructed, the co-created process of development, the embedding of tools within partner organisations and their open access location. This is enabling the benefits to be extended more widely and for the tool to be further developed, and rolled out, both regionally and nationally, e.g. via programmes like <u>NetZeroPlus</u>.

For more information contact sweep@exeter.ac.uk



Organisations we've worked with





Underpinning NERC Science

- NE/J015237/1 Fragments, functions and flows the scaling of biodiversity and ecosystem services in urban ecosystems
- NERC CASE Multi-scale predictions of soil erosion and water quality from intensively managed grasslands
- NE/H01814X/1 Impacts of farm-scale ecosystem management on water quality in intensively managed grasslands.
- NERC/TSB KTP Understanding the impact of moorland restoration on water quality
- NE/L009137/1 Testing agricultural impacts on breeding ground food resources as a driver of population decline in a brood parasite
- NE/TS/K00266X/1 Developing a New Integrated Aerial Vehicle Platform 'Quest Earthwater' for assessing hidden blue water supplies



About SWEEP

The South West Partnership for Environmental & Economical 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 and stakeholders together to solve key challenges faced by those working with our natural resources. **www.sweep.ac.uk**

