

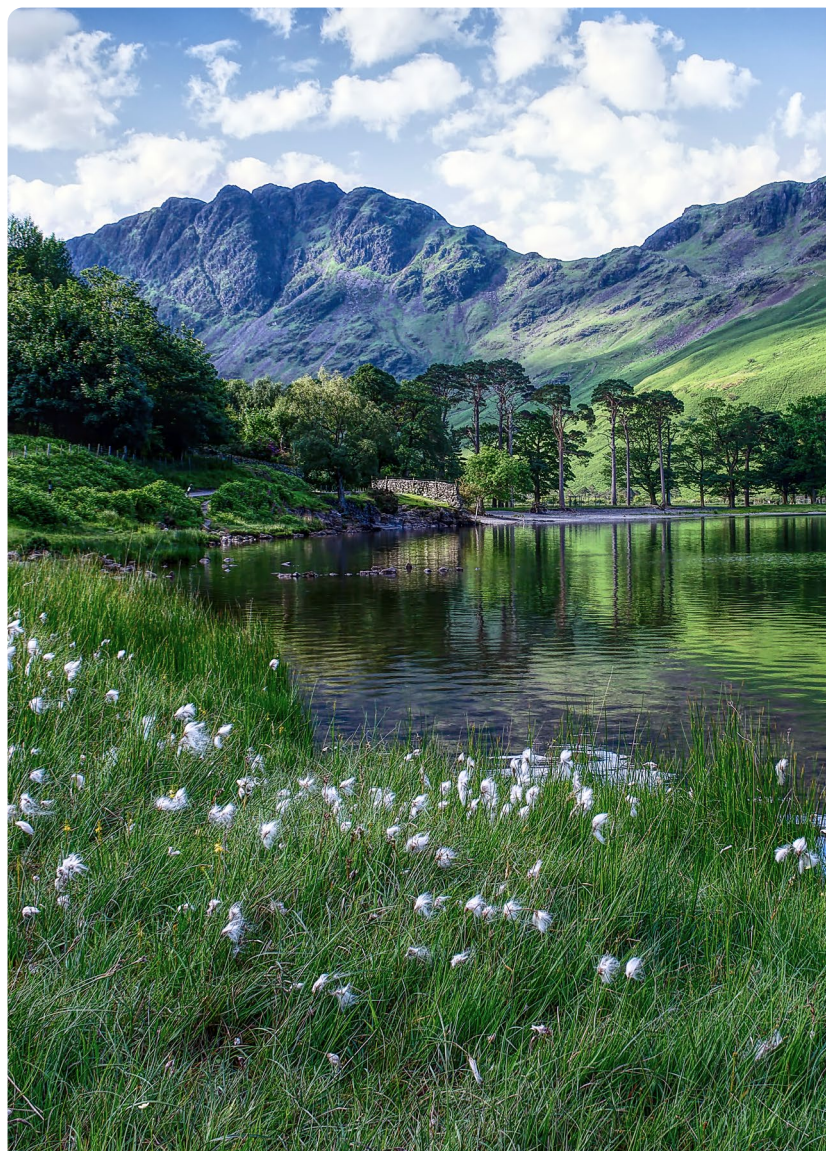
# Case study: UKCEH Countryside Survey

Over 40 years of data on the Great British countryside

## Leadership and transformation

The UKCEH Countryside Survey is the longest integrated national monitoring programme of the countryside for Great Britain. The first survey in 1978 was intended as a one-off. However, its value was recognised quickly, and it now continues as a five-yearly rolling survey of soil and vegetation. The results provide a unique insight into how our habitats, plants and soils, have changed over time.

The high-resolution datasets reveal how soils, and the common flora that we see and value in our landscape, have altered over time. By revisiting the same locations and taking the same measurements, we gather evidence of how drivers such as climate change, policy interventions, such as the Clean Air Act, and agri-environment schemes, have impacted our natural environment. For the future, the UKCEH Countryside Survey will help to inform strategies for net zero.



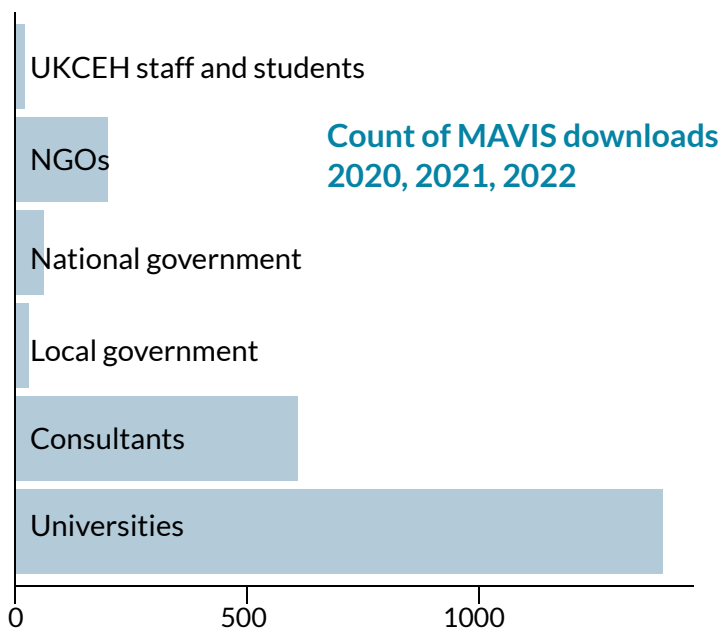
### Did you know?

- Two out of the five injurious weeds, designated by law, have increased across Britain since 1978.
- Four common plants have been estimated to make up over 50% of wild nectar supply across the countryside, while 25% of biodiversity is found in soils.

## Building capability

Countryside plant data have been combined with other datasets to produce the MAVIS (Modular Analysis of Vegetation Information System) software. MAVIS represents many different plant communities in the same standard language, allowing for comparisons across sites and scales.

A key feature of the UKCEH Countryside Survey is accessibility. Since 2000, users have been able to analyse the data from the Survey using MAVIS. MAVIS also is widely used by consultants, ecologists and statutory bodies to understand vegetation change and, increasingly importantly, to value habitats. The software has recently been modified by scientists at UKCEH. The result is MAVIS-R. It has greater functionality and usability, and is available to download and use for free.



### Did you know?

- On average MAVIS is downloaded three times a day. The main use is university teaching, helping to develop the next generation of ecologists and botanists.

MAVIS is used by:

- Students at 134 universities
- 137 consultant firms and councils
- 47 NGOs



*I was able to use MAVIS to demonstrate a negative trend in both dryness and acidity at an SAC site in the Broads, and the MAVIS output thus provided the first real, incontrovertible piece of evidence that the site was suffering deleterious impacts that could be assigned to water abstraction... We would never have got to this stage had MAVIS, or a system like MAVIS, not been available for us to use on that first, critical set of comparative data.*



Dr Jo Parmenter, Director  
The Landscape Partnership, Norwich



## Integration

The UKCEH Countryside Survey brings added value to models and datasets.

### Linking with citizen science

For example, working with the Botanical Society of Britain and Ireland, the detailed soil and vegetation data from specific habitats are combined with data from the wider area. These data then feed into models which are used to test whether habitats can be restored based on the pace of soil change and the local availability of target plant species. This integration identifies areas that have the capacity to support greater biodiversity through natural population growth, or areas that will benefit from a programme of species introduction.

### Testing Earth system models

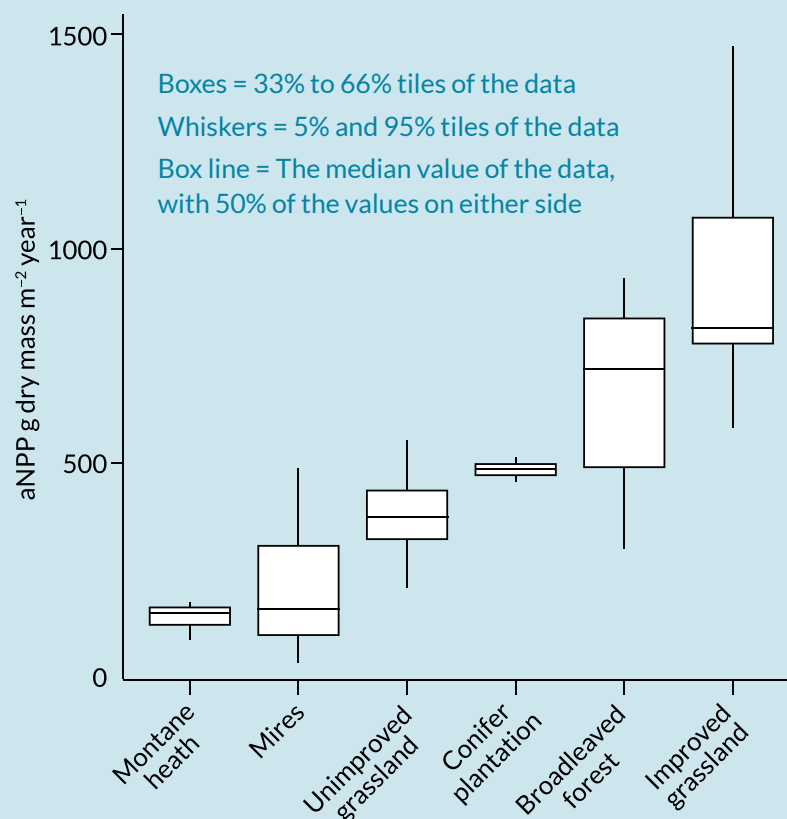
JULES is a global community model that simulates land-atmosphere flows and interactions between energy, water, and carbon, accounting for the effects of vegetation and soils. UKCEH is at the heart of its development. JULES produces fine-resolution predictions to compare with data from each year of the UKCEH Countryside Survey. This ability to compare reality with predictions will lead to improvements in the ability of JULES to simulate changes at the fine scales at which land management decisions are made.

### Modelling how ecosystems support life

By combining plant species trait data and measured abundance in UKCEH Countryside Survey vegetation

quadrats, we developed a new statistical model to estimate Net Primary Production (NPP) in habitats across Britain – shown below. This is important because NPP is a fundamental measure of the life support capability of planet Earth. It underpins food production, carbon storage and climate regulation. NPP also influences and is influenced by biodiversity.

Distribution of measured NPP values



## Did you know?

- Soils store more carbon than plants and forests, helping to regulate climate.
- Soil is a reservoir for antibiotic discovery, for which two Nobel Prizes have been awarded.
- Recovery from acid rain has seen soil pH increase by as much as half a unit in areas across Great Britain mediating recovery in plant biodiversity.

## Co-development

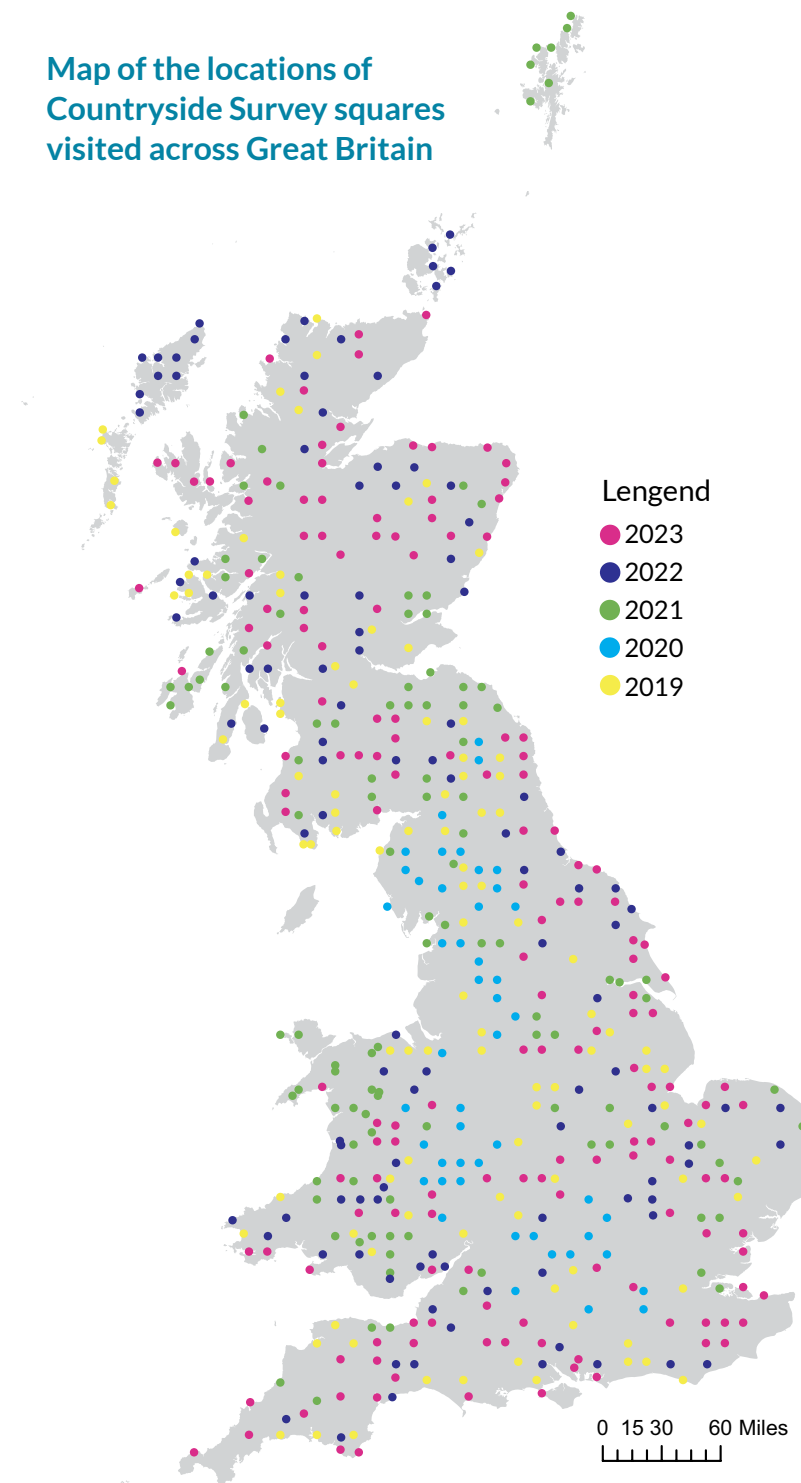
The UKCEH Countryside Survey continues to respond to technological change and the evolving needs of stakeholders and society. In 1978, data were recorded onto paper. Today, recording is via phone-based apps that have been co-developed with Esri, a global leader in geographic information systems. Each entry is time and location-stamped before being submitted to a central database.

The first survey captured detailed information from 256 1x1km squares that each contained an average of 11 fine-resolution quadrats. The latest survey has successfully recorded 500 representative 1x1km squares over a 5-year period. As the number of locations has increased, so have the types of information that are collected. The newest addition is genetic profiles of soils. In the future, this will lead to a soil archive to complement other UKCEH DNA archives.



Emily Upcott and Lucy Ridding, Spatial Ecologists, UKCEH

Map of the locations of  
Countryside Survey squares  
visited across Great Britain





## Impacts

For nearly 50 years, the UKCEH Countryside Survey has played an invaluable role in our understanding of the national landscape during a time of intense change. The very first dataset captured the end of post-war land use intensification and a period of very high sulphur deposition, which more recent datasets show has declined due to economic changes and national policy intervention.

The 4 per 1000 Initiative – Soils for Food Security and Climate, was launched at COP21. It aims to reduce the rate and impact of climate change by increasing the carbon in the top 30-40 cm of agricultural soils by 0.4% per year. This aims to reduce CO<sub>2</sub> in the atmosphere while improving soil health, biodiversity, and food security. Data from the UKCEH Countryside Survey are being used by the Office of National Statistics to monitor progress towards this goal.

Soils data from UKCEH Countryside Survey contribute to the UK Soil Observatory (UKSO.org) which attracts more than 100,000 visitors annually to its free to view maps on the web portal. Important soil health metrics can also now be viewed by habitat and soil type in the online UKCEH Countryside Survey Soil Health Webtool.

Moreover, the soil monitoring data are unique, representing the only long-term (1978-present) data set across Great Britain capturing soil change, and are supporting the development of new statistical AI tools. These tools will analyse data and produce map products capturing the state and change of important soil properties such as carbon and pH that support habitat health.

### Impacts in numbers 2018-2023

- 368 article citations
- 22 policy engagements
- £29.5m funding leveraged by external organisations drawing on UKCEH Countryside Survey data

All Countryside survey data can be accessed on the EIDC

MAVIS software for plant community comparisons

## Behind the science: meet the experts

### Dr Simon Smart

Simon is an ecologist at UKCEH. His interests are in answering four key questions about ecological change with an emphasis on temperate ecosystems over the last 100 or so years of human domination: What has changed and where? Why have the changes occurred? Do they matter? Can we use the answers to these questions to develop models that may help us estimate future states? His abiding passion is land plants.



### Professor David Robinson

David is a soil scientist at UKCEH and leads soils research in the catchment to coast group. The focus of the group is on national monitoring of soil, water, flora and fauna, integrated landscape and hydrological modelling, and long-term soil and vegetation experiments. His personal research focuses on soil physical function and its interplay with biology, within the wider context of natural capital and ecosystem service delivery in response to climate and land use change drivers.

