



Department
for Environment
Food & Rural Affairs

Defra Earth Observation Centre of Excellence

Roadmap for the Defra Earth Observation Centre of Excellence 2023 to 2028

February 2023

Making the best use of Earth Observation to inform
decisions affecting the environment and society.



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Foreword by John Collins, EOCoE Chair



The Defra Earth Observation Centre of Excellence has achieved a great deal in the past seven years, providing an excellent foundation for us to build on, for which the previous Chair and members of the Centre must take great credit. I recently became Chair of the Centre, and in this Roadmap, set out our vision for how Earth Observation can maximise its offer for the environment, economy, science, and society in the next five years.

The Defra EOCoE focuses on the use of Earth Observation for policy and operational decisions relating to Defra's mission and objectives. The Centre is concerned with the science of gathering evidence remotely which can support innovation and inform environmental monitoring, management, regulation, and enforcement.

The Centre is run by Defra and brings together Defra science and policy teams, Defra's Arm's Length Bodies, devolved administrations, and associated partners. The collaboration enabled by the Centre is its great strength. The members of the Centre are those who have remit over decisions relating to the Centre's area of focus or are organisations who use Earth Observation in these areas.

The Defra Centre of Excellence will continue to lead and champion Earth Observation in environmental decision making, supporting the delivery of various policies including the 25 Year Environment Plan, Natural Capital Ecosystem Assessment Programme, and Environmental Land Management Scheme. A key focus over the next five years is for the Centre to provide a forum to continue to engage with stakeholders to share ideas, best practice, and to understand and realise the potential offered by Earth Observation.

To deliver Defra's objectives we need to be able to optimise the use of the data we collect. So, we'll work closely with other teams who are developing data systems and tools; ensuring the right systems are built to enable efficient storage and access and that we have the right tools to interrogate and present those data according to Earth Observation user requirements.

The Centre will seek to promote Research and Development in Earth Observation techniques, while also looking to drive efficiencies through new opportunities to employ Earth Observation in innovative ways. It will support the growth of skills necessary to make the most of Earth Observation.

I look forward to the Earth Observation Centre of Excellence continuing its exciting work over the next five years. If you'd like to learn more about the Centre of Excellence, please contact: Earth-obs@defra.gov.uk

Earth Observation

Earth Observation is the collection, analysis and presentation of data to better understand planet Earth. These data are collected by a range of instruments on land, in the sea or in the air.

[Earth Observation - HM Government](#)

The direct operational value of Earth Observation to government is estimated at £64 million per annum.

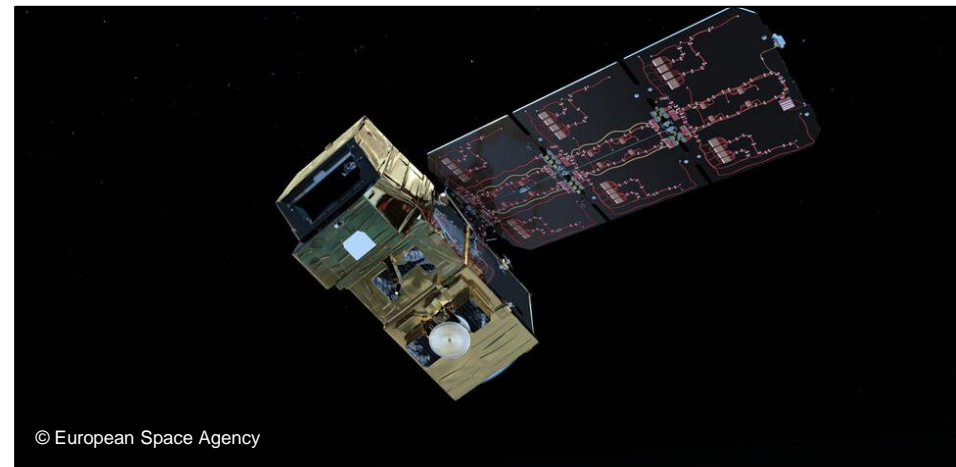
[Investigating UK public sector demand for Earth Observation technology 2022 – HM Government](#)

Our role

1. To champion Earth Observation, provide leadership, research and innovate, develop analytical skills, and set standards.
2. To assist teams working to integrate various remote sensing technologies.
3. To establish a framework to develop tools and techniques to enable the Defra Group to make the best use of Earth Observation to inform decisions affecting the environment and society.

The Centre meets monthly, with Secretariat support provided by the Defra Central Science Division. The Centre provides seed-corn funding for innovative research and development projects undertaken by members. Detail about the Centre's ways of working can be requested from:

earth-obs@defra.gov.uk



Our member organisations



Department
for Environment
Food & Rural Affairs



Animal &
Plant Health
Agency



Geospatial
Commission



Historic
England



Department of
Agriculture, Environment
and Rural Affairs



Marine
Management
Organisation



National Centre for
Earth Observation
NATURAL ENVIRONMENT RESEARCH COUNCIL



Cyfoeth
Naturiol
Cymru
Natural
Resources
Wales



NatureScot
NàdarAlba
Scotland's Nature Agency
Buidheann Nàdair na h-Alba



Rural Payments
Agency



Scottish
Government
Riaghaltas
na h-Alba



Llywodraeth Cymru
Welsh Government

Our long-term priorities

Priority 1

Champion



Champion the use of Earth Observation, ensuring the potential is understood and the investment secured to realise and deliver.

Priority 2

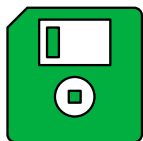
Innovate and Maximise Application Impact



Identify and quantify where Earth Observation could give the greatest impact in informing decisions on environmental policies and initiatives across Government, including the 25 Year Environment Plan.

Priority 3

Data Access



Provide leadership as an intelligent customer, to facilitate work by other teams to ensure Earth Observation data are findable, accessible, and interoperable.

Priority 4

Data Analysis



Collaborate with others to help establish tools to enable staff across Centre members to analyse and interrogate Earth Observation data, and encourage uptake of such tools.

Priority 5

Standards and Guidance



Develop standards and guidance to ensure the various types of Earth Observation data are used and integrated consistently.

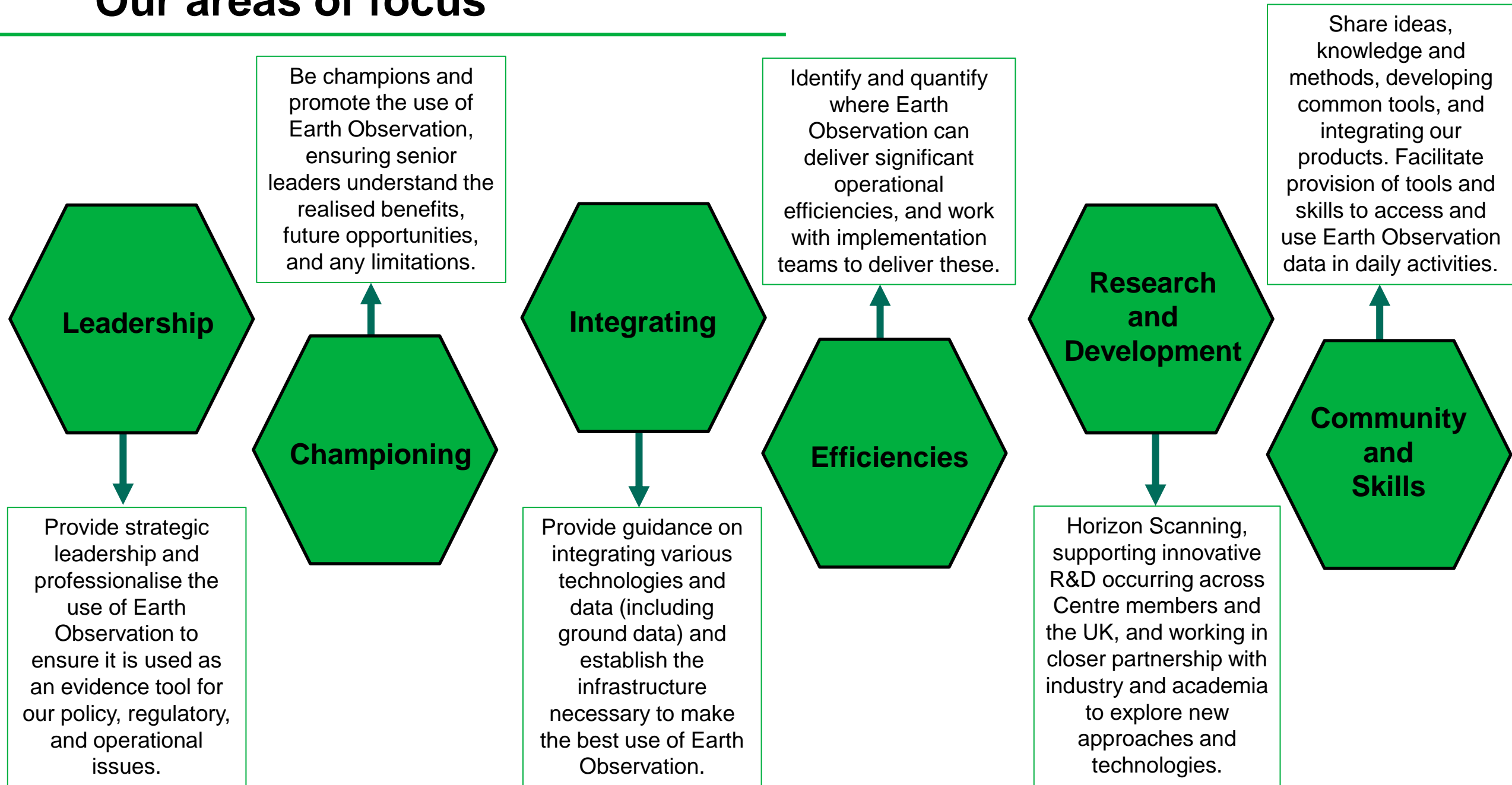
Priority 6

Build Capacity



Bring together internal and external expertise, to build a community for sharing ideas, knowledge, and methods, developing common tools, and integrating products.

Our areas of focus



Topics being progressed

Over the next 5 years, members of the Centre will continue to use Earth Observation in an operational capacity, and work to develop innovative uses of Earth Observation.

A selection of the topics that will be progressed from across member organisations include:

- The Defra Earth Observation Data Service.
- Innovative research and development projects, including proof of concept studies.
- Operational systems for agriculture, such as the Crop Map of England.
- Operational systems for nature protection, including Living England, Living Wales, and habitat change.
- Operational systems for the environment and society, including flood mitigation and response, detection of illegal fishing activity, and drought and fire risk early warning evaluation and response.
- Providing Earth Observation support to maximise impact across policy areas, including the Natural Capital Ecosystem Assessment programme, the development of a Data, Analytics and Science Hub Platform, and the Environmental Land Management Scheme and Sustainable Farming Initiatives.
- Scoping for the potential advancements using Artificial Intelligence with Earth Observation data.



Portfolio Champions

Portfolio Champions are being introduced to facilitate the delivery of our plan for 2023, and ensure all members of the Centre are engaged with our long-term priorities.

The Portfolio Champions will act as focal points within the Centre for each of the long-term priorities.

The Champions are members of the Centre who are particularly engaged in a priority area.

Their engagement and subject-matter expertise makes the Portfolio Champions well placed to collate the views of other members on issues relating to that priority, feed them back into the Centre, and recommend actions.

If you'd like to learn more about the Centre of Excellence, please contact: Earth-obs@defra.gov.uk

1

Standards & Guidance

Matt McArthur and
Lisa Hecker and Pauline Burke (role shared)



2

Research & Development

Jon Hicks



3

Maximising Impact

Keith Tokeley and Oli Vaughan



4

Data Access and Data Analysis

Alice Brick and Brian O'Toole



5

Integrating and Enabling

Andrew Richman and Paul Robinson



6

Building Capacity

Beth Cole and Helena Sykes



Success stories

Over the past 7 years, the EOCoE has facilitated and supported multiple projects using Earth Observation across a wide range of use cases. Some of these successes are briefly outlined here.



Rural Payments Agency

The Rural Payments Agency use Earth Observation to create the Crop Map of England (CROME), which covers over 15 crop types, grassland, and non-agricultural land covers, with up to 95% accuracy in classification. Using CROME for Basic Payment Scheme (BPS) Greening and crop diversification as part of the Common Agricultural Policy schemes, crop classifications have seen a 9% improvement, rapid field visits were reduced by 34%, and follow-ups reduced by 8.5%. CROME resulted in savings of £12.3 million per year, with less need for field inspections and random checks. Technical and policy discussions in the EOCoE supported the Rural Payments Agency in developing CROME. With the end of the BPS in sight, CROME is being adapted to support the monitoring of the current and new agri-environmental schemes such as Sustainable Farming Incentive, and Local Nature Recovery.



The Environment Agency use Earth Observation as part of the emergency response to flooding, including satellite images, flying aeroplanes using LIDAR (light detection and ranging) technology, and drones, all to map the affected areas. The data can aid both incident response and recovery, such as mapping flood water and better targeting of post-event inspections. The EOCoE provided a space for the Environment Agency to share this use of Earth Observation skills and data with other member organisations, to expand considerations of using Earth Observation in emergency response.



NatureScot, with support from JNCC and Copernicus User Uptake funding, have developed an operational system for mapping wildfires and muirburn across the full extent of Scotland. The information is developing an understanding of how burning is changing over time, how different habitats are affected, and could aid implementation of muirburn licensing. The process would not be possible without 3 key ingredients – consistent analysis ready Sentinel-2 data that the EOCoE was instrumental in developing, computing power supplied by JASMIN via JNCC, and python code developed by NatureScot. JNCC have now also applied the same process in Northern Ireland.



EOCoE funding to Cefas (Centre for Environment, Fisheries and Aquaculture Science) supported a proof-of-concept project to trial an Earth Observation approach for better understanding the impact of water quality on nearshore coastal habitats. Using satellite imagery and ground reference data, Cefas mapped the change in coastal habitats (saltmarsh, intertidal mud, seagrass) extent over time, and the condition and carbon storage potential of the saltmarsh. Coastal water quality was assessed using the Forel Ule water colour index generated from Sentinel-3 data, and the proportion of the saltmarsh exposed to reduced water quality was estimated using a proximity-based risk mapping approach.

Case Study: Monitoring Habitat Change

JNCC, November 2022

Problem: Habitat mapping from satellite imagery is well established but evidence on habitat condition and change over time is lacking. Monitoring landscape change is vital to the evidence base for environmental policy delivery.

Outcome: JNCC developed a Landscape Monitoring app which enables non-specialist users to interact with satellite data to detect both gross and subtle changes in habitat condition at different spatial and temporal scales.

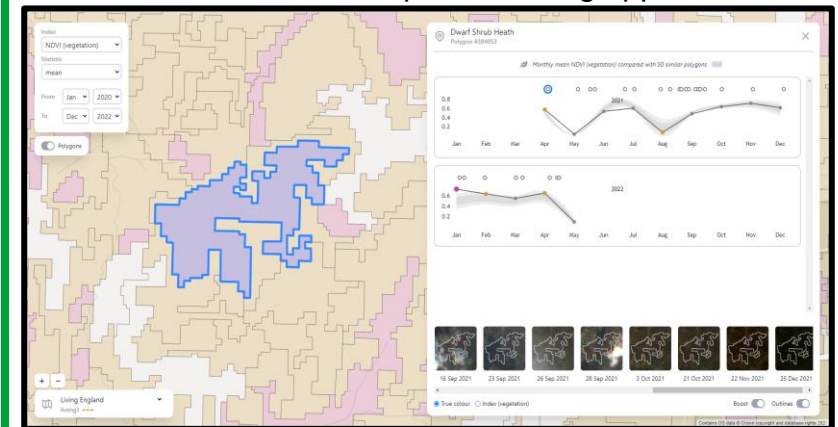
Output: [JNCC Technical Report](#)

Building on earlier proof-of-concept work, JNCC developed a web-delivered app in 2020 which provides automated analysis of satellite data, enabling users to track change over time at selected sites and highlight changed areas on a map. Indices are derived from Sentinel-1 and Sentinel-2 time-series data to quantify vegetation productivity, plant moisture content, vegetation structure and surface water. The indices are combined with habitat maps to highlight land parcels where change is taking place.

The app was tested at 11 pilot sites across the UK, successfully detecting gross change such as tree felling, flooding and upland burning, as well as subtle changes such as scrub encroachment, nutrient enrichment or drought impacts. Users agreed the app could reduce costs and improve environmental policy delivery through effective targeting of survey and management resources. One user commented: “It has gone beyond what I expected, and I did have high expectations! This app is providing statistical information on the fly in an easily visual and readable way.”

The technical infrastructure has now been scaled up to enable cost-effective and user-friendly delivery at a national scale. Ongoing user dialogue will ensure successful operational delivery. The ability to monitor landscape change and habitat condition on a monthly basis will make a significant contribution to policy areas including agri-environment scheme delivery, site management, natural capital assessment, biodiversity conservation and nature recovery.

Screenshot of Landscape Monitoring app © JNCC



The first development phase of the Landscape Monitoring app was funded by the Caroline Herschel Framework Partnership Agreement on Copernicus User Uptake.

Subsequent development and scaling up was funded by Defra under the NCEA programme.

User testing was carried out by habitat and site specialists at Natural England, NatureScot, Historic Environment Scotland, Natural Resources Wales and the Northern Ireland Environment Agency.

Case Study: Tackling Surface Run-off Pollution

Environment Agency, 2017 – Ongoing

Problem: Soil run-off from bare earth pollutes rivers, reducing oxygen in water and increasing phosphate loads.

Outcome: The Environment Agency produced an app that enables use of remote sensing data to identify areas of concern. The data allows preventative measures to be developed for water pollution. The app allows targeted field inspections, reducing the time and work expended compared to the traditional random visit methodology.

Output: [Environment Agency - Resource Centre | Esri UK & Ireland](#)

This project uses Sentinel-2 satellite imaging at key points during the year to detect bare soil locations which are vulnerable to erosion. These cause harmful impacts on water quality during times of heavy rain through soil runoff, river silt-up as well as providing a key mechanism for phosphate release into the water. The phosphates trigger proliferations of algae in the water. The aim of the project was to work with farmers and help them devise strategies to reduce soil erosion through preventative and enforcement measures. This project has been rolled out more widely since the original specifically focused Herefordshire project. Herefordshire has a particularly acute problem where fine sediments combined with steep slopes lead to significant soil erosion.

The project allows targeted field inspections, and has increased operational efficiency; rather than having to hunt for potential sources of pollutants across the entire trial area of 140 km², we could refine the search to just the 4% of the catchment that was most likely to pose a threat.

The innovative app encourages social and environmental responsibility amongst landowners, and the potential for better management and agricultural practices by landowners due to a greater understanding of regional variation in pollution. The more targeted interventions have reduced the amount of time required in-vehicle which has helped reduce operational carbon footprint.

Funded by Environment Agency



Case Study: Moorland Change Map and Reactive Fire Mapping

Natural England, November 2022

Problem: It is impractical to monitor all managed and unmanaged moorland burning using traditional techniques.

Outcome: Natural England developed a method to annually monitor change in the burn season and created a reactive service to map ad-hoc fires as land managers required information, both using Sentinel-2. Research has also been undertaken to investigate how Sentinel-1 could enhance moorland monitoring.

Natural England annually produces the Moorland Change Map. This has been developed to support the detection of change (burning or cutting) and enables monitoring at a national scale. We also map fires on an ad-hoc basis. This provides land managers with faster information on the extent and severity of a fire.

These products have benefited from EOCoE R&D funding, researching the use of Sentinel-1. This has looked at whether Sentinel-1 could allow in season monitoring and whether it can date the occurrence of annually detected changes.

National mapping of change in the uplands is considered as unachievable by ground methods alone, due to high levels of staffing required, difficult terrain and access to be granted by land owners. For each year of use of these products, it is estimated that £100,000 in cost has been avoided.

Burns have considerable harmful impacts on peatland habitat quality, carbon storage and water quality. The benefits of greater awareness of change include broader positive effects on the UK carbon budget, through preserving carbon sinks.

R&D funded by Defra EOCoE, Products funded by Natural England

