Defra Earth Observation Centre of Excellence

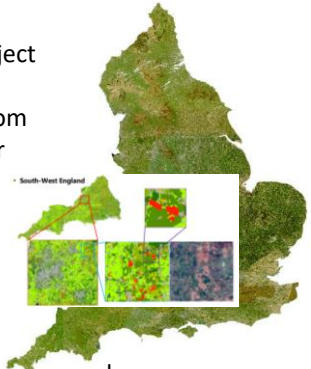
JNCC | Department for Environment Food & Rural Affairs | Space for Smarter Government Programme | UK Space Agency | Rural Payments Agency | Llywodraeth Cymru Welsh Government | Northern Ireland Executive | Forestry Commission England | Cefas | Environment Agency | The Scottish Government | Natural England | Department for Business, Energy & Industrial Strategy

Background

In November 2015 Defra established an Earth Observation Centre of Excellence to deliver an EO roadmap, developed with the UK Space Agency's Space for Smarter Government Programme. The roadmap aims for EO integration across five policy areas by 2020 to ensure ***cheaper, more effective, more customer-focused delivery***. The centre is a virtual team bringing together expertise from the surrounding departments and public bodies, across activities and funding a range of innovative projects…

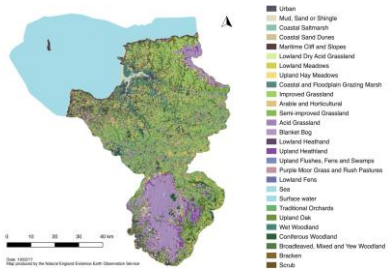
…Food & Farming – Rural Payments

RPA, using methods delivered by EOCoE project research, is now generating an annual England -wide crop classification. Derived from Sentinel-1 radar data and inspection data for training the classification and Sentinel-2 optical data for verification. The primary application is in validating rural payments, where the benefits are reduced field inspections, payment within deadlines, efficiency of Land Parcel Information System update (including helping with improving currency and reducing disallowance), and the dataset is useful to other policy areas.



…Natural Environment & Natural Capital

Using EO data and automation Natural England adapted the existing living map habitat mapping methods to support management planning for key upland protected sites. The methods use the RPA EO crop map product in classification, and production time is reduced given the availability of Sentinel analysis ready data from JNCC.

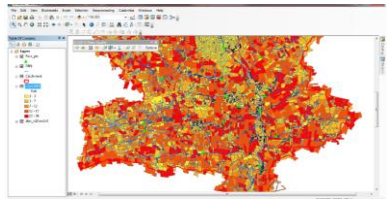


…Marine

Chlorophyll-a data are being processed into simple to use GI formats and will be delivered through the EO collaboration platform. Sentinel-3 provides an opportunity to dramatically improve detection of water clarity around the UK and plans are in place for 2017 for trial production, with immediate uptake likely in Environment Agency, Welsh Govt, Marine Scotland Science, and Cefas. Exploratory work has shown that it is very likely that vessel detection can be automated from Sentinel-1 data with applications in fisheries protection and MPA monitoring.

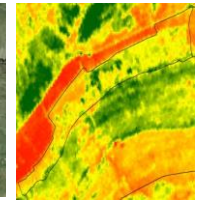
…Diffuse pollution & Water Quality Monitoring

Using EO crop data, with soils, elevation and other variables a diffuse pollution risk assessment has been developed which can be used to help target water quality monitoring at whole catchment and national scales. Complementary Scottish Government funded research lead by SEPA is determining how well EO can assess the effectiveness of measures to address rural diffuse pollution.



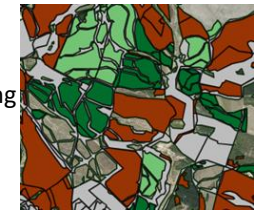
…Natural Environment & Ecosystem Services

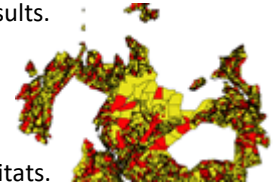
2015/16 research, jointly funded by Defra and Scottish Government with input from Business Energy and Industrial strategy, identified the potential of using parameters from both optical and radar EO data to detect the quality (condition) of habitats both at individual sites and to aid the logistically challenging task of monitoring and managing the fragmented natural environment nationally. In 2016/17 NE (for England) and JNCC (supporting Wales and Scotland) are validating the identified grassland technique across more locations. Research is now underway to extend the approach to peatland habitats.



…Forestry

A Defra-funded proof of concept is developing a method to detect young trees using Sentinel-1 SAR data. Innovative techniques using feature engineering and machine learning have already yielded promising results. If successful this method would increase monitoring efficiency by alerting and guiding operational activities and be applicable to the management of other natural habitats.





The key to these projects

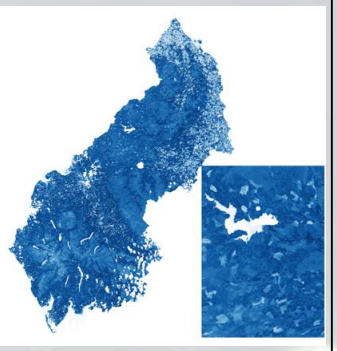
is collaboration between experts and the central pre-processing and delivery of satellite data. JNCC is pre-processing Sentinel-2 data and making this, and other EO data, available through the EOCoE collaboration node also developed by JNCC.

Investment to date:

- £410K Defra CSA research allocation
- £400K SSGP
- £580K aligned from Scottish Govt, Defra Data Programme, Catapult, JNCC, RPA, NE
- Two competitive commissioned research rounds, 10 providers
- Research projects led by NE, FC, RPA, EA, JNCC, CEFAS
- Research projects aligned led by SEPA, BEIS

…doing things once, centrally:

- Increases efficiency
- Creates opportunities for cost-savings and innovation
- Eliminates duplication
- Ensures shared standards and experience



There are now six cross cutting products, each with up to five use cases across the Centre of Excellence …this already indicates up to a five-fold cost-saving in production alone. Some of the projects are highlighted overleaf. The products are: Crop Map, Living Map, pre-processed Sentinel 1 and Sentinel 2, Normalized Difference Vegetation Index and Normalized Difference Wetness Index.

Some of the benefits of EO data and collaboration through the Centre of Excellence…

Contact: Earth-obs@defra.gsi.gov.uk

…for RPA

Improving operational efficiency with CROME Crop Map

- Annual savings (inspections and data process) over £500K savings. Improved operational efficiency removes the need for manual crop diversification inspections and the new method is also most cost effective.

Addressing disallowances under Common Agricultural Policy

- Improvements to the Land Parcel Information System for common land representation through use of Living Maps methods
- Quantification difficult but 2015/16 Defra accounts qualified by £65.8M

…and others

- Enables country-wide crop diversification check
- Check for permanent grassland (not verified at present)

…for EA

- Informs national sampling strategy
- Creates visual intelligence to investigate Water Framework Directive failures (agricultural and rural land management responsible for 30% of "Not Achieving Good Status")
- Enables more cost effective discussions with land owners: annual costs to third parties of agricultural water pollution (spill over effect of poor water quality £1 billion per annum)
- More effective use of remaining monitoring resources (being cut by 15% by 2020, currently ~£50M)

…opportunities for the natural environment

- Single mapping product for incorporating biodiversity/natural capital into decision making, regulation and planning
- Protected site management and targeting fieldwork effort: Natural England has planned savings of £300K to £400K over 2 years partly based on the role of EO data
- Landscape context and spatial planning
- Green infrastructure mapping
- Habitat connectivity/fragmentation and ecological network mapping
- Threat maps for non-native species
- Opportunity mapping and planning habitat restoration
- Habitat Directive Reporting
- Much wider policy benefits not yet quantified, but it should be noted that many requirements such as effective monitoring of large areas of remote uplands are possible for the first time

…for FCE

- Improving efficiency and effectiveness of day to day management including timely monitoring of new planting, restocking, natural colonisation, illegal felling, wind blow and plant health
- Reduced violation of planting/felling agreements – e.g. current estimates ~10% of new planting/restocking fails (equating to several million pounds in grants)