

## SPACE-BASED APPROACH TO MONITORING PEATLAND RESTORATION

*Sentinel-1 and -2 data allows Yorkshire Peat Partnership (YPP) to be a lead innovator in monitoring peatland restoration.*

### The challenge

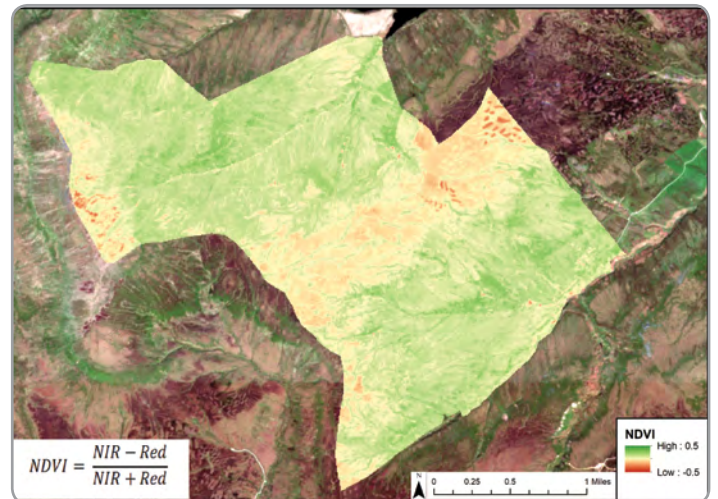
The UK contains 13% of the world's peatlands. Blanket bog, one of three types of peatland in the UK, covers 70,000 hectares in Yorkshire alone. This makes the region both nationally and internationally important. Peatland conservation is crucial when considering how to address the major environmental problems faced by society today and into the future, such as climate change. This is why it is a key area of focus for both UK and EU policy makers. Our project area is vast, the fast revisit times of Sentinel 1 and 2 allow us to quickly and accurately monitor the success of restoration work. 3,464 hectares have already been analysed using this method. YPP is managed by regional charity, Yorkshire Wildlife Trust. The free to download data allows YPP to deliver effective large scale nature conservation on a tight budget.

### The space based solution

With the launch of Sentinel 1 in 2014 and Sentinel 2 in 2015, YPP is able to access a plethora of retrospective data to understand the characteristics of our sites before and after restoration work. Sentinel 2 data is used to monitor vegetation productivity and moisture through the calculation of vegetation indices (such as the NDVI). The data is converted to reflectance, and the reflectance bands used in the vegetation indices equation (see image inset for an example of the NDVI). Interferometry techniques that investigate the signal difference between two or more Sentinel 1 passes are analysed to create surface deformation maps. These maps can indicate the extent of peatland swelling (a characteristic of successfully restored peatlands). Bare peat and burn scar maps are generated from image classification techniques (such as Maximum Likelihood and Support Vector Machine). These classifications use both Sentinel 1 and Sentinel 2 data and help to quantify the extent of damage across our sites.

### Benefits to Citizens

Functioning blanket bog, which is actively peat-forming, offers multiple benefits to wider society. UK case studies of restored peatlands suggest a reduction in flood peak of up to 33%, leading to increased attention from the UK Government's Environment Agency, who spent £24 million across Yorkshire to repair flood damage in 2016 and are starting to invest in preventative natural flood management techniques. 43% of UK drinking water comes from uplands dominated by peatlands. Acting as a natural filter to water, healthy peatlands ensure high quality water to the surrounding region. This has led to the financial support from the regional water company, Yorkshire Water, in the belief that restored peatlands will reduce the cost of expensive treatment processes that chemically remove impurities. Peat is formed by semi-decomposed plant material in a waterlogged environment.



*An NDVI (Normalised Difference Vegetation Index) generated from Sentinel-2 satellite data. This index shows vegetation productivity, as is particularly well suited in identifying areas of bare peat and burn scars (red and orange areas). Credit: Contains modified Copernicus Sentinel data [2017]*

Thematic Area



CLIMATE, WATER AND ENERGY

Region of Application



NORTH YORKSHIRE

Sentinel mission used



S1  
S2

Copernicus Service used



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Usage Maturity Level

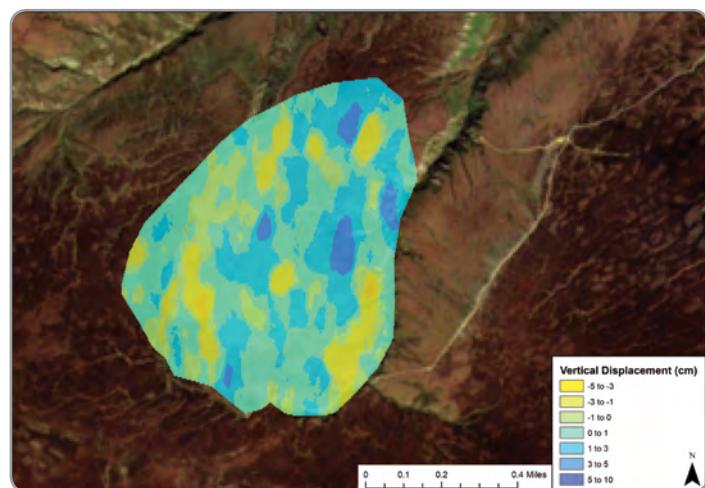


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Due to the lack of normal decomposition processes, carbon from the atmosphere is locked up in these systems, estimated at 550 gigatonnes on a global scale (twice that stored by global forests). In a damaged state, this leads to the release of carbon dioxide, a significant greenhouse gas, so it is important to restore and conserve healthy peatlands to reduce this impact. Successful peatland restoration can therefore impact on climate change, one of the most serious challenges facing humanity today.

## Outlook to the future

Going forward, we will continue to use Sentinel satellite data for monitoring our sites. In particular, the higher resolution of Sentinel 2 (10m) compared to Landsat 8 (30m) will continue to improve our monitoring capabilities. As Sentinel 1's life span increases, our ability to investigate bog swelling (through surface deformation techniques) will continue to grow. Finally, the launch of Sentinel 5P in 2017 is of great interest to our future applications. The ability for Sentinel 5P to capture air pollutant data means we can investigate the effects of air pollution on peatland health and the impacts of upland burning. This growing capability will complement our ongoing unmanned aircraft monitoring to better inform peatland management plans.



Surface deformation map showing vertical displacement (cm).  
Credit: Contains modified Copernicus Sentinel data [2017]

“The innovation and enthusiasm the YPP team bring in terms of utilising and developing remote sensing techniques ensures that our customers get the best possible value from our peatland restoration programme.”

*Andrew Walker, Yorkshire Water*

## Acknowledgements

YPP has run successfully since 2009 and for this, we would like to thank Yorkshire Wildlife Trust, Natural England, Yorkshire Water, IUCN UK Peatland Programme, Yorkshire Dales National Park, North York Moors National Park, Nidderdale AONB and the Environment Agency for their support.

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## ABOUT COPERNICUS4REGIONS

This Copernicus User Story is extracted from the publication “**The Ever Growing use of Copernicus across Europe's Regions: a selection of 99 user stories by local and regional authorities**”, 2018, Edited by NEREUS, the European Space Agency and the European Commission.

The model cases focus on local and regional authorities who successfully applied Copernicus data in 8 major public policy domains. The views expressed in the Copernicus User Stories are those of the Authors and can in no way be taken to reflect the official opinion of the European Space Agency or of the European Commission.

Funded by the European Union, in collaboration with NEREUS. Paging, printing and distribution funded by the European Space Agency. IPR Provisions apply. Copernicus4Regions material may be used exclusively for non commercial purposes and provided that suitable acknowledgment is given.