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A multisensor and multitemporal approach to assess wildfire occurrence and landscape dynamics on Marsden Moor Estate, West Yorkshire

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Photo credit: UAV image courtesy of Holme Valley Mountain Rescue Team (29/04/2021)
UKFDRS Project

GWIS - UK Wildfires

Source: UK dataset courtesy of Boschetti et al., (2020)
Importance of UK Peatlands

UK peatlands are of great environmental importance. They are a major carbon store locking-in approximately 3.2 billion tonnes of carbon and cover 12% of UK land area (CEH, 2021).

80% of UK peatlands are damaged or in a deteriorating state which are costly to restore.

Wildfire disturbance in UK peatlands is of growing concern.

2040 VISION
Our peatlands are protected, enhanced, sustainably managed and are recognised for their intrinsic value and the public benefits they provide.

2040 TARGET
Two million hectares of peatland in good condition, under restoration or being sustainably managed by 2040.

Source: Peatlands strategy for the UK (IUCN, 2018, p.12).
Marsden Moor

• The Marsden Moor Estate owned by the National Trust in West Yorkshire, is a Site of Special Scientific Interest (SSSI), a Special Area of Conservation (SAC) and Special Protection Area (JNCC, 2021).

• This blanket bog habitat is home to rare upland species such as the mountain hare and red listed Birds of Conservation Concern 4 (BoCC4) such as the lapwing, skylark and the curlew (British Trust for Ornithology, 2021).

• Since 2019, the National Trust reported a total of £700,000 worth of damage caused by wildfires on the Marsden Moor Estate with the largest wildfire damaging 705 hectares.
Ecological Impact
Research Aim & Objectives

Aim: To use multisensor and multitemporal approach to monitor wildfire occurrence and landscape disturbance from 2019 – 2021.

Objective 1: Produce a hydrological and topographic assessment using LiDAR/DTM derived products e.g. slope, aspect, hillshade, flow accumulation, Topographic Wetness Index (Beven and Kirkby, 1979) and erosion.

Objective 2: Assess the impact of wildfires on vegetation using Vision-1 and Sentinel-2 datasets by generating NDVI, EVI, Bare Soil Index and dNBR.
Preliminary results viewable on request via an ArcGIS Online web map: https://bit.ly/3dXQZah
Vision-1

- 3.5m R,G,B and NIR.
- Shows areas of Marsden Moor Estate with varying states of vegetation greenness.
- NDVI = (NIR-RED) / (NIR+RED)
- The most recent burned area Deer Hill Moss showing areas of lower NDVI.
Sentinel-2 dNBR

- NBR = (NIR-SWIR) / (NIR + SWIR).
- Lower spatial resolution (20m) than Vision-1 but highlights variation in burn severity due to SWIR channel.
- Deer Hill Moss shows are higher burn severity to the east of the burned area.
Marsden Moor/Close Flat - 2019
- Gullies/steeper slopes coincide with a more severe burn on the east area of the burn perimeter.
- There is a more severe fire in central area due to a higher fuel load as seen on the pre-fire NDVI.
- Not a distinctive pattern on TWI with burn severity.

Deer Hill Moss - 2020
- Plateau area with little slope variation and few gullies = little erosion.
- Low TWI values inferring low soil moisture with drier east side exhibiting a more severe burn on dNBR image.
Future Work

UKFDRS WP 1: Dynamic Fuels – Peak District National Park & South Pennines

- How does the fuel change with seasons and land cover management?
- How can Earth Observation be used to generate a dynamic fuel map?
- Datasets:
  - Sentinel-1A -1B, Sentinel-2A -2B and National Forest Inventory biomass data for fuel assessment
  - PDNP wildfire log and Incident Recording System data for wildfire occurrence.
  - DEFRA Moorland Change Map, MFFP Restoration Map for land management assessment
- Extracting optical indices dNBR, NDVI and SAR intensity/coherence signatures for fuel classes in PDNP & South Pennines (including Marsden Moor Estate) to obtain the phenological profile of fuel classes and also for known wildfire locations at varying stages of recovery/land management activities.
References


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