Yorkshire Wildlife Trust

Yorkshire Peat Partnership

Earth Observation Fact Sheet

LANDSAT 5

Background
This factsheet is part of a series produced by the Yorkshire Peat Partnership (YPP) to share the knowledge developed in the application of open source earth observation technologies for the remote monitoring of peatland habitats.

Satellite technology
Earth observation satellites provide us with the capability to analyse current and retrospective data at a landscape scale.

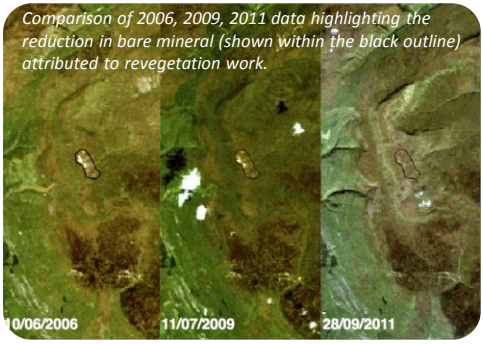
Landsat 5
A member of NASA's Landsat programme, Landsat 5 holds the Guinness World Record for "longest operational Earth Observation satellite" at 28 years and 10 months.

Thanks to its longevity, Landsat 5 allows YPP to investigate habitat change across Yorkshire's peatlands from as early as 1984. Image classifications (to quantify bare peat and burn scar extents), vegetation indices (to understand plant health), and proxy soil moisture indices (enabled by the thermal band) can all be derived from Landsat 5's data to provide insights into the changes of Yorkshire's peatland habitats over the last few decades.

SPECIFICATION

LAUNCH DATE:	1st March 1984 (decommissioned 5th June 2013)
BANDS (Resolution):	1 – Blue (30m) 2 – Green (30m) 3 – Red (30m) 4 – Near Infrared (30m) 5 – Shortwave Infrared 1 (30m) 6 – Thermal (120m) 7 – Shortwave Infrared 2 (30m)
SWATH WIDTH:	185 km
REVISIT TIME:	16 days

An artist's illustration of the Landsat 5 satellite in Earth orbit.
Credit: USGS



Comparison of 2006, 2009, 2011 data highlighting the reduction in bare mineral (shown within the black outline) attributed to revegetation work.

Data Sources
Landsat 5 data can be downloaded for free from the following sources:

- EarthExplorer USGS (https://earthexplorer.usgs.gov)
- GloVIS USGS (https://glovis.usgs.gov)
- LandViewer (https://lv.eosda.com)
- Google Earth Engine (https://earthengine.google.com)

Yorkshire Wildlife Trust

Earth Observation Fact Sheet

Yorkshire Peat Partnership

LANDSAT 7

Background
This factsheet is part of a series produced by the Yorkshire Peat Partnership (YPP) to share the knowledge developed in the application of open source earth observation technologies for the remote monitoring of peatland habitats.

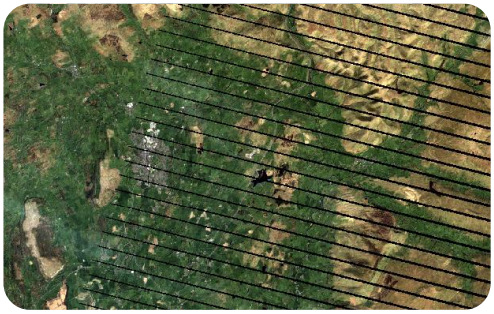
Satellite technology
Earth observation satellites provide us with the capability to analyse current and retrospective data at a landscape scale.

Landsat 7
Landsat 7 provides the same capabilities as its predecessor (Landsat 5) with an improved Thematic sensor including a panchromatic band (allowing images to be pan-sharpened to 15m resolution). Unfortunately due to a Scan Line Corrector malfunction in 2003, 25% of data is lost for each scene acquired. As a result, Landsat 7 is not a usable data source for YPP. The extension of Landsat 5 life span through to 2013 compensates for the lack of quality data from Landsat 7 until the inception of Landsat 8.

SPECIFICATION

LAUNCH DATE:	15th April 1999
BANDS (Resolution):	1 – Blue (30m) 2 – Green (30m) 3 – Red (30m) 4 – Near Infrared (30m) 5 – Shortwave Infrared 1 (30m) 6 – Thermal (60m) 7 – Shortwave Infrared 2 (30m) 8 – Panchromatic (15m)
SWATH WIDTH:	185 km
REVISIT TIME:	16 days

Artist's rendering of NASA's Landsat 7 satellite
Credit: Wikimedia Commons



RGB image from Landsat 7. Note the extent of missing data caused by the Scan Line Corrector malfunction. Unless an area of interest is situated at the central column, Landsat 7 data is not usable.

Data Sources
Landsat 7 data can be downloaded for free from the following sources:

- EarthExplorer USGS (https://earthexplorer.usgs.gov)
- GloVIS USGS (https://glovis.usgs.gov)
- LandViewer (https://lv.eosda.com)
- Google Earth Engine (https://earthengine.google.com)

Yorkshire Wildlife Trust

Earth Observation Fact Sheet

LANDSAT 8

Background
This factsheet is part of a series produced by the Yorkshire Peat Partnership (YPP) to share the knowledge developed in the application of open source earth observation technologies for the remote monitoring of peatland habitats.

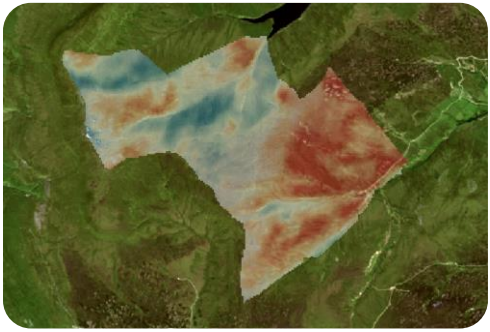
Satellite technology
Earth observation satellites provide us with the capability to analyse current and retrospective data at a landscape scale.

Landsat 8
Landsat 8 is the most current earth observation satellite of the Landsat programme, providing up to date imagery uncompromised by Landsat 7's SLC error. The satellite continues to provide applications for image classifications, vegetation indices, and soil moisture indices. The introduction of the Cirrus bands allows for improvements in atmospheric corrections. Furthermore, the addition of the 15m panchromatic band allows users to pansharpen the 30m resolution RGB images to 15m.

SPECIFICATION

LAUNCH DATE:	11th February 2013
BANDS (Resolution):	1 – Ultra Blue (30m) 2 – Blue (30m) 3 – Green (30m) 4 – Red (30m) 5 – Near Infrared (30m) 6 – Shortwave Infrared 1 (30m) 7 – Shortwave Infrared 2 (30m) 8 – Panchromatic (15m) 9 – Cirrus (30m) 10 – Thermal Infrared 1 (100m) 11 – Thermal Infrared 2 (100m)
SWATH WIDTH:	185 km
REVISIT TIME:	16 days (8 days offset from Landsat 7)

Artist's rendering of NASA's Landsat 8 satellite
Copyright: Wikimedia Commons



Soil Moisture Index (Blue = wet, Red = dry) overlaid onto a 15m pan sharpened RGB image

Data Sources
Landsat 8 data can be downloaded for free from the following sources:

- EarthExplorer USGS (https://earthexplorer.usgs.gov)
- GloVIS USGS (https://glovis.usgs.gov)
- LandViewer (https://lv.eosda.com)
- Google Earth Engine (https://earthengine.google.com)

Yorkshire Wildlife Trust

Earth Observation Fact Sheet

SENTINEL 1

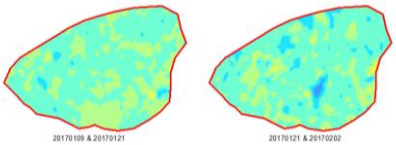
Background
This factsheet is part of a series produced by the Yorkshire Peat Partnership (YPP) to share the knowledge developed in the application of open source earth observation technologies for the remote monitoring of peatland habitats.

Satellite technology
Earth observation satellites provide us with the capability to analyse current and retrospective data at a landscape scale.

Sentinel 1
Part of the European Space Agency's (ESA) Copernicus Programme, Sentinel 1 is a C-Band Synthetic Aperture Radar (SAR) satellite. Unlike the Landsat and Sentinel 2 satellites, Sentinel 1 is an active radar satellite; acquiring data by transmitting a signal to the Earth's surface and measuring its return. Active radar signals are capable of penetrating clouds, meaning all data is cloud free! SAR data can be used to generate elevation data, measure surface deformation, and quantify areas of wildfires. Due to the cloud free data, vast quantities of imagery can be used to develop comprehensive time series.

SPECIFICATION

LAUNCH DATE:	3rd April 2014
FREQUENCY:	C Band at 5.405 Ghz (wavelength: 5.6cm)
POLARISATION:	Single: HH & VV (WV) Dual: HH + HV and VV + VH (IW, SM, EW)
IMAGE MODES (RESOLUTION):	Interferometric Wide Swath (5 x 20m) Strip Map (5 x 5m) Expanded Wide Swath (20 x 40m) Wave (5 x 5m)
SWATH WIDTH:	Interferometric Wide Swath (250 km) Strip Map (80 km) Expanded Wide Swath (400 km) Wave (20 x 20km vignettes)
REVISIT TIME:	6 days



Surface displacement maps

VH multi-temporal image: Red 21/05/2017; Green 08/06/2017; Blue 20/06/2017

Artist's rendering of the Sentinel 1 satellite. Credit: ESA

Data Sources
Sentinel 1 data can be downloaded for free on the Copernicus Open Access Hub:
https://scihub.copernicus.eu

Yorkshire Wildlife Trust

Earth Observation Fact Sheet

SENTINEL 2

Background
This factsheet is part of a series produced by the Yorkshire Peat Partnership (YPP) to share the knowledge developed in the application of open source earth observation technologies for the remote monitoring of peatland habitats.

Satellite technology
Earth observation satellites provide us with the capability to analyse current and retrospective data at a landscape scale.

Sentinel 2
Part of the European Space Agency's (ESA) Copernicus Programme, Sentinel 2 provides the highest resolution optical data (10m) of any open source satellite. The 10m resolution data allows for the acquisition of higher detailed imagery, resulting in more accurate analysis than the Landsat satellites. However, one drawback of the Sentinel 2 platform is the absence of a thermal band present in the Landsat satellites.

Data Products
Level 1C is the most available data product and features top of atmosphere reflectance. Radiometric and geometric corrections are made before the data is uploaded.

Level 2A is derived from Level 1C and features bottom of atmosphere reflectance. Users can create Level 2A through the Sen2Cor plugin for Sentinel Applications Platform (SNAP) software.

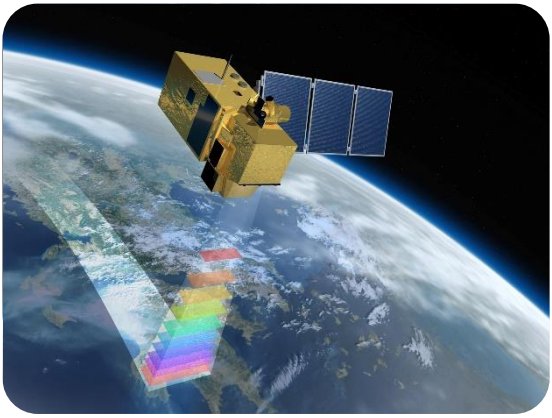

Original RGB


Cirrus band (10)


Converted RGB

SPECIFICATION

LAUNCH DATE:	23rd June 2015
BANDS (Resolution):	1 – Coastal aerosol (60m) 2 – Blue (10m) 3 – Green (10m) 4 – Red (10m) 5, 6, 7 – Vegetation Red Edge (20m) 8 – Near Infrared (10m) 8A – Narrow Near Infrared (20m) 9 – Water vapour (60m) 10 – Shortwave Infrared – Cirrus (60m) 11 – Shortwave Infrared 1 (20m) 12 – Shortwave Infrared 2 (20m)
SWATH WIDTH:	290 km
REVISIT TIME:	10 days



Artist's rendering of the Sentinel 2 satellite.
Credit: ESA

Data Sources
Sentinel 2 data can be downloaded for free on the Copernicus Open Access Hub:
https://scihub.copernicus.eu