

Soil moisture on 31 December 2024 (see back page for explanatory comments).

**At the end of December, wet soil moisture conditions were maintained across much of the UK, within the typical seasonal ranges for most sites.**

December 2024 was marked by frequent rainfall and stormy conditions across the UK. Provisional data indicates rainfall was above average overall for the UK, with Scotland particularly wet (133% of the long-term average rainfall), whereas Northern Ireland was much drier (69%). Storm Darragh brought heavy rain and severe gales from the 6th to 8th, impacting coastal areas of Wales and western England. The latter half of the month saw frontal systems bringing localised rain and flooding, especially in northern and western regions. Temperatures were  $\sim 2^{\circ}\text{C}$  above the long-term average, though some frost and wintry showers occurred.

Soil moisture levels across the COSMOS-UK network were largely stable through the month, with wet conditions persisting through the winter months due to the frequent rainfall and limited evaporation. The majority of sites reported soil moisture within expected ranges for this time of year, with regional variations reflecting local precipitation patterns and soil characteristics. In Scotland, sustained rainfall led to high soil moisture levels at some sites (e.g. Balruddery, Hartwood Home). In central and southern England and Northern Ireland, relatively low rainfall rates means that some sites saw a decrease in soil moisture levels through the month (e.g. Bunny Park, Fivemiletown, Holme Lacy).

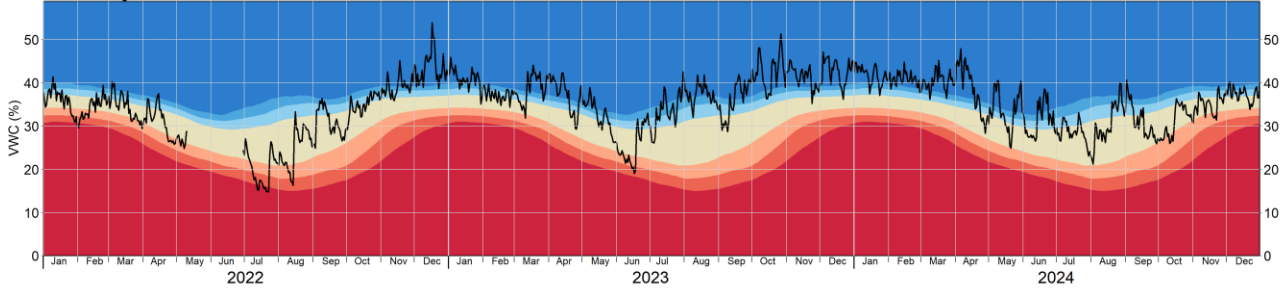
Overall, relatively frequent precipitation throughout the month has maintained soil moisture levels within typical seasonal ranges across much of the UK, though with regional variations leading to steady decreases in soil moisture at some sites.

#### Network news

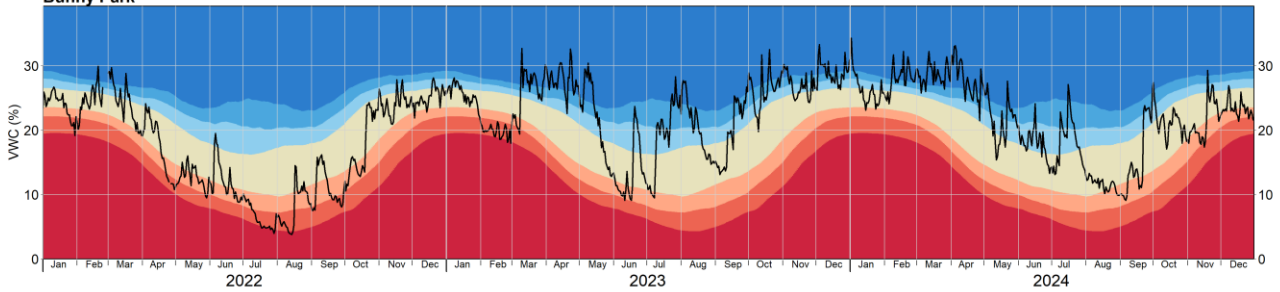
Crichton was decommissioned on 17 December; we plan to relocate to an equivalent northern UK location. Writtle will be decommissioned on 15 January. Issues with the near real time data API have now been fixed.



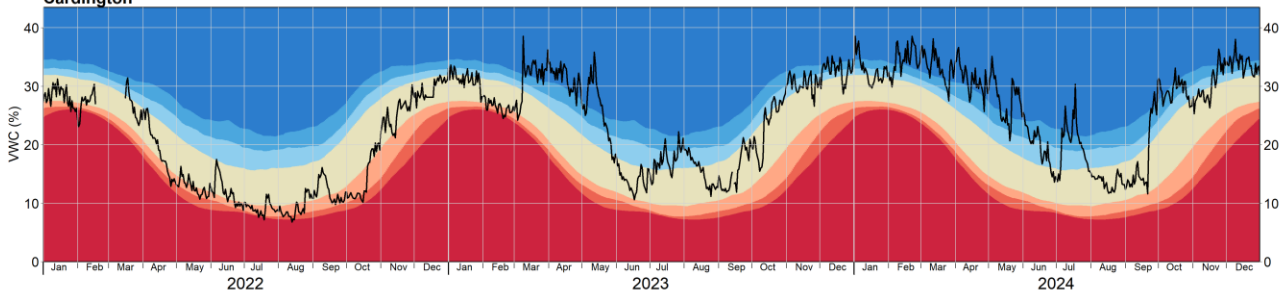
Balruddery



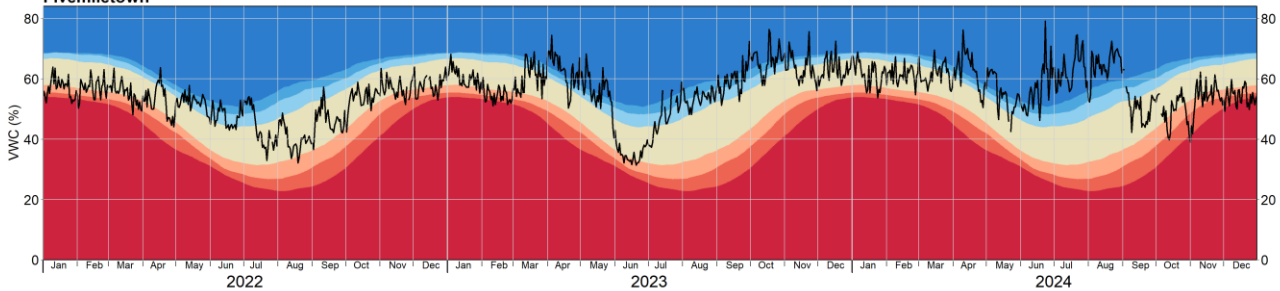
Bunny Park



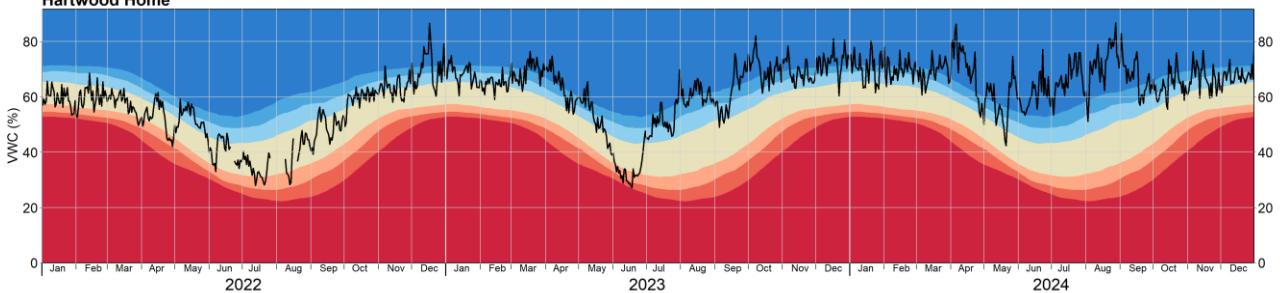
Cardington

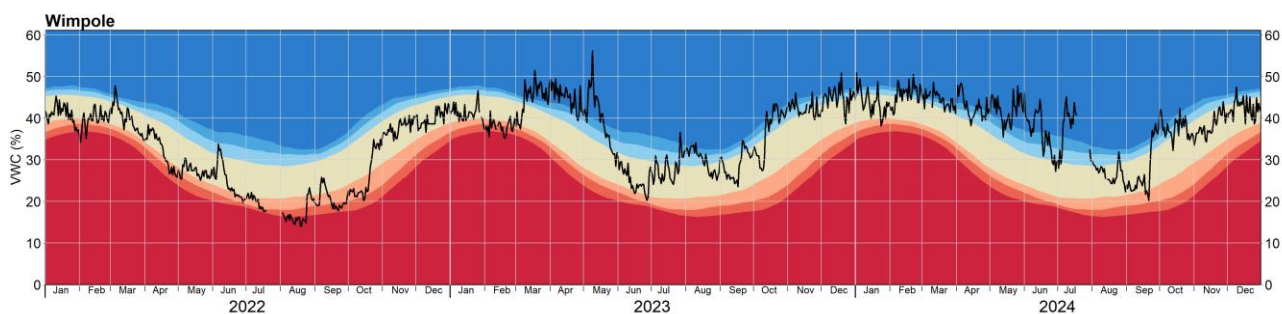
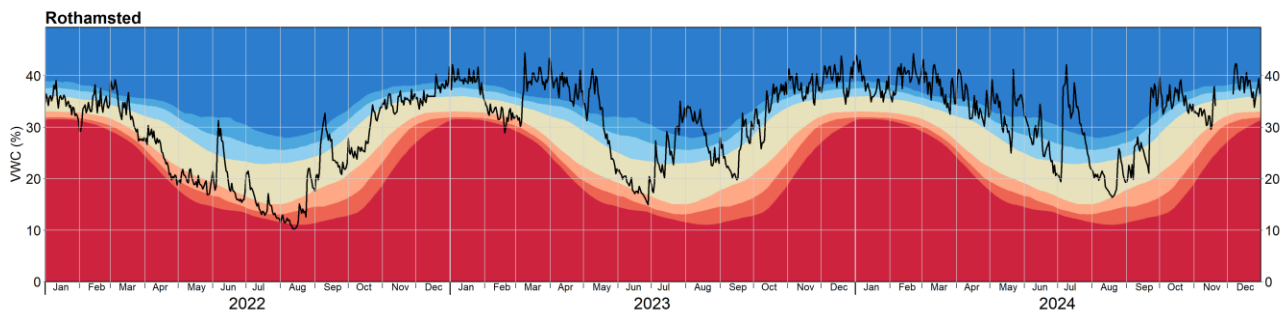
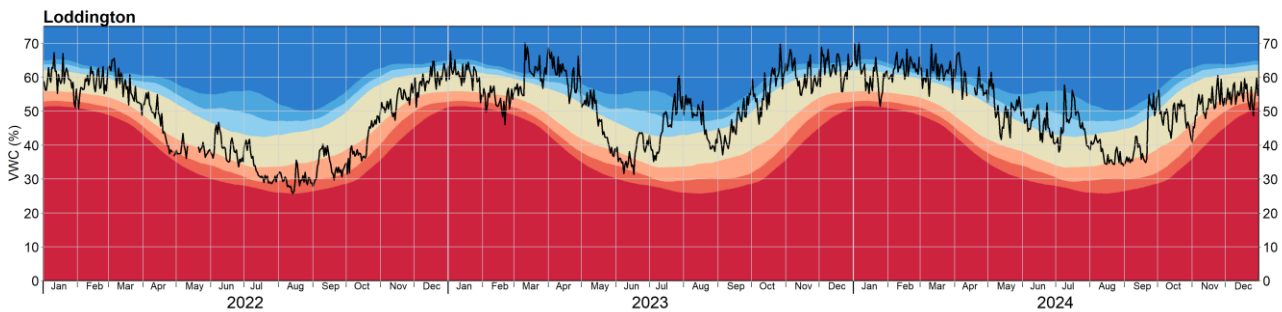
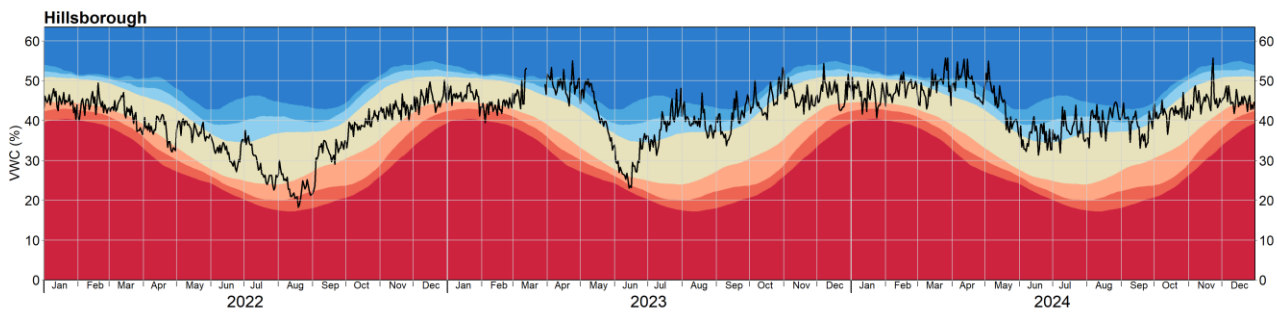
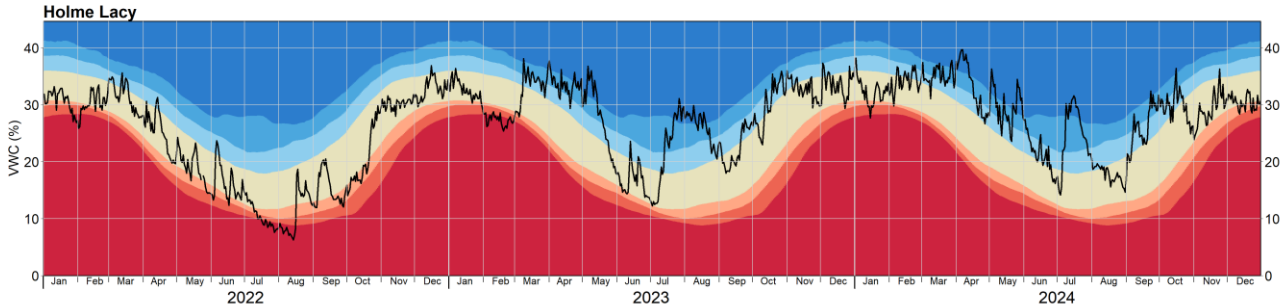


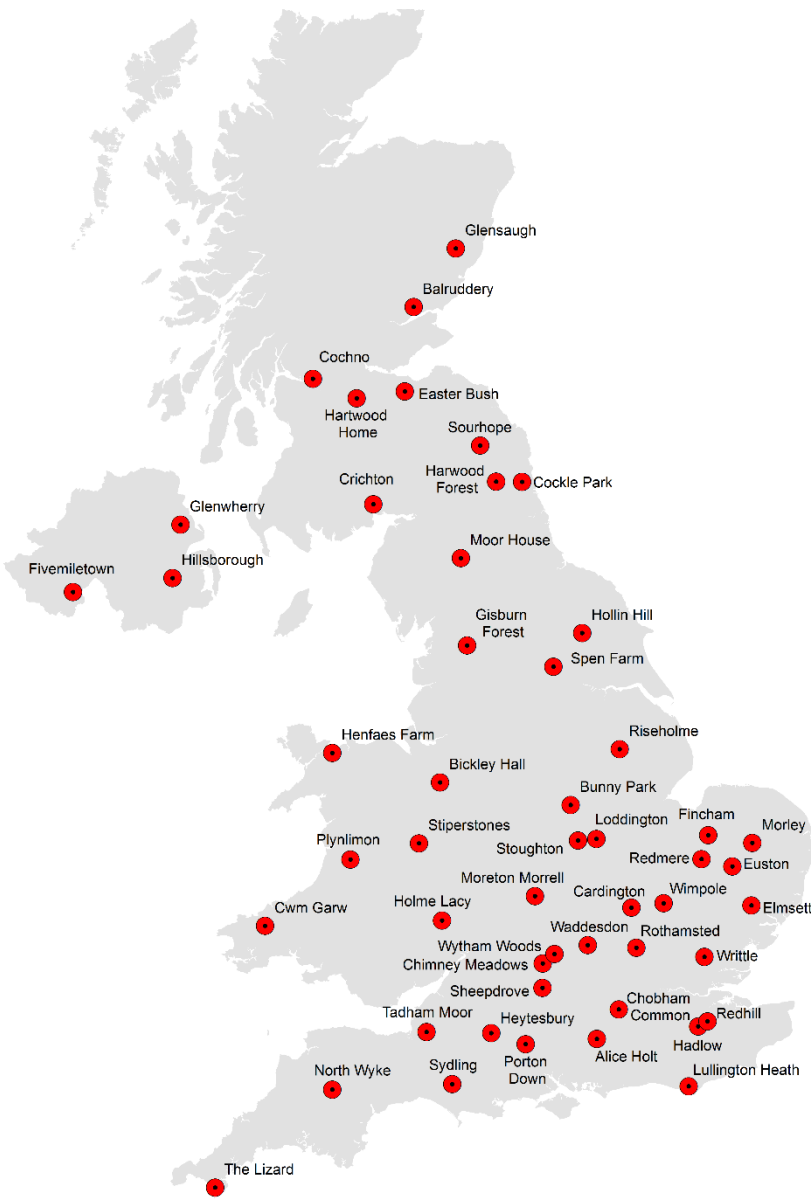
Fivemiletown



Hartwood Home







**About the maps on page 1:** The maps show daily mean soil moisture on the last day of the month. Colours indicate wetness as in the legends.

The map on the left shows wetness as the volumetric water content (VWC) of the soil which is constrained by soil type, i.e. some soils are able to hold more water than others as indicated by the shape of the symbol.

The map on the right presents soil wetness adjusted for site specific characteristics, i.e. taking account of the possible range of soil wetness at each site. Field capacity (FC) is a key point in this range. When soil moisture is below FC soil moisture is said to be in deficit, i.e. there is a (positive) soil moisture deficit (SMD).

Grey shaded areas on these two maps represent principal aquifers.

**About the graphs on pages 2 and 3:** The black line shows VWC. The coloured bands indicate how VWC compares to historical variability for the site and time of year.

- exceptionally dry
- notably dry
- drier than normal
- normal
- wetter than normal
- notably wet
- exceptionally wet

**About soil moisture:** Soil moisture varies in the short term (hours to days) with rainfall and as water drains through the soil. Longer term variation is driven by the seasonal difference between rainfall and evaporation. Thus soil moisture decreases in the summer when evaporation exceeds rainfall but increases when this is reversed. In most winters under UK conditions, soil moisture reaches a relatively constant value, known as the field capacity. Field capacity is a measure of how much water the soil can hold against gravity and is strongly dependent on the soil type. Soils are expected to be around field capacity after being wetted to above field capacity and the excess water (e.g. from macropores) has drained away under gravity, which can take several days after heavy rain, to reach a near steady state. Differences in soil type and weather patterns cause variations in soil moisture between sites including when the soil returns to field capacity in autumn/winter and when soil moisture decreases in the spring/summer.

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