

Maize Growers Association & The Environment Agency

Part 1 – Key factors affecting the future maize production in the UK

Part 2 – Maize Growers Association and The Environment Agency trials

Part 3 – ALERT tool (Agricultural land & Environment Risk Tool)



Climate change



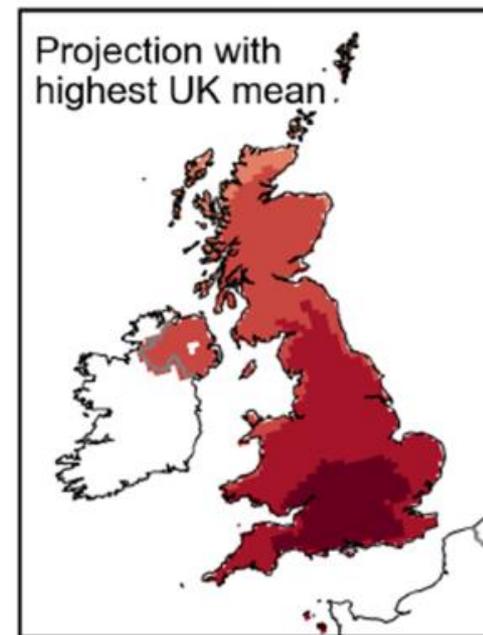
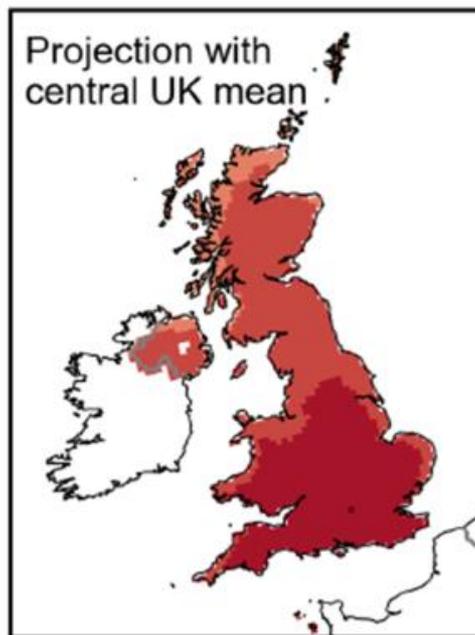
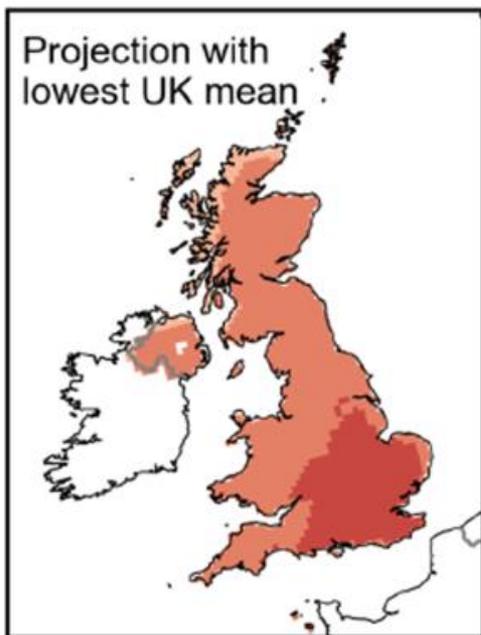
UK climate change: temperature

Change in annual mean temperature

2070s vs. present day

High emissions scenario (RCP8.5)

(12 regional projections)



Temperature anomaly, °C



Climate change

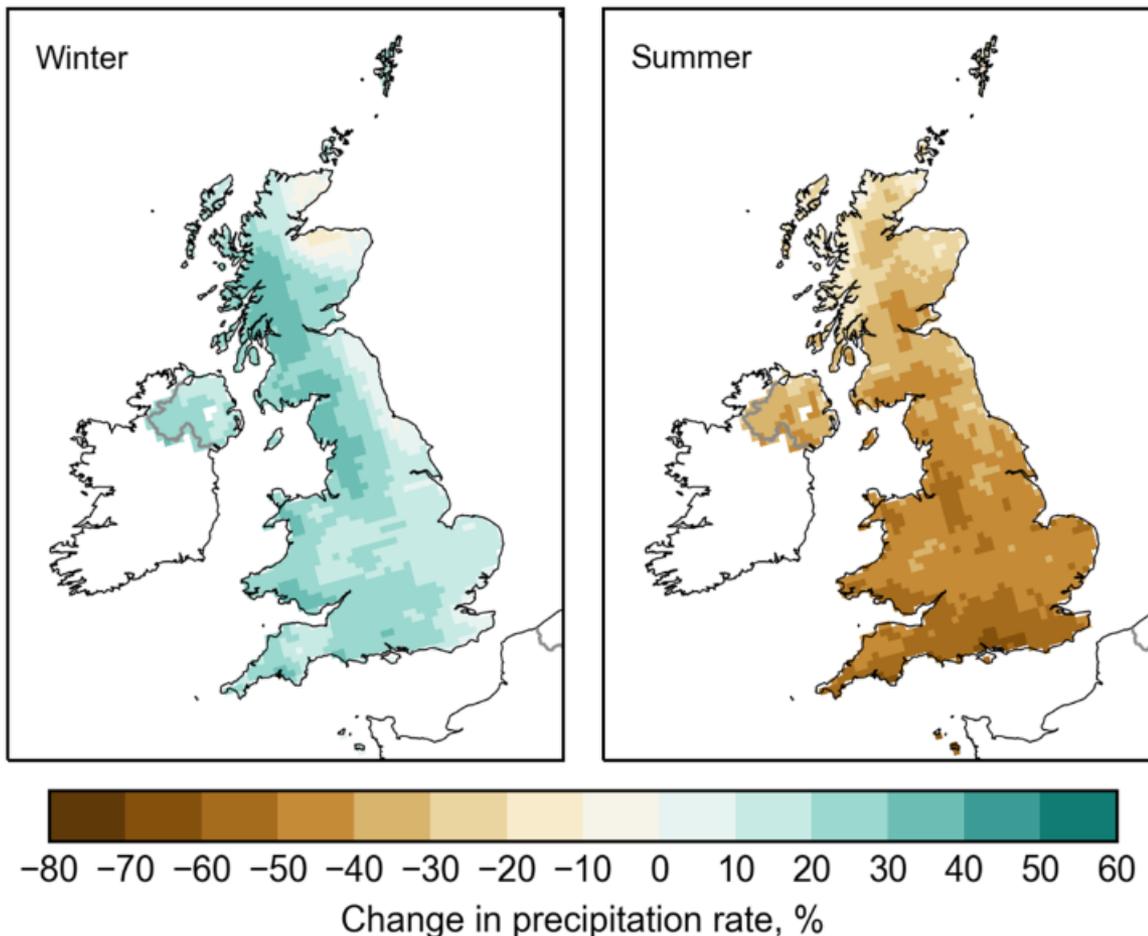


UK climate change: precipitation

% Change in seasonal mean
precipitation

2070s vs present day

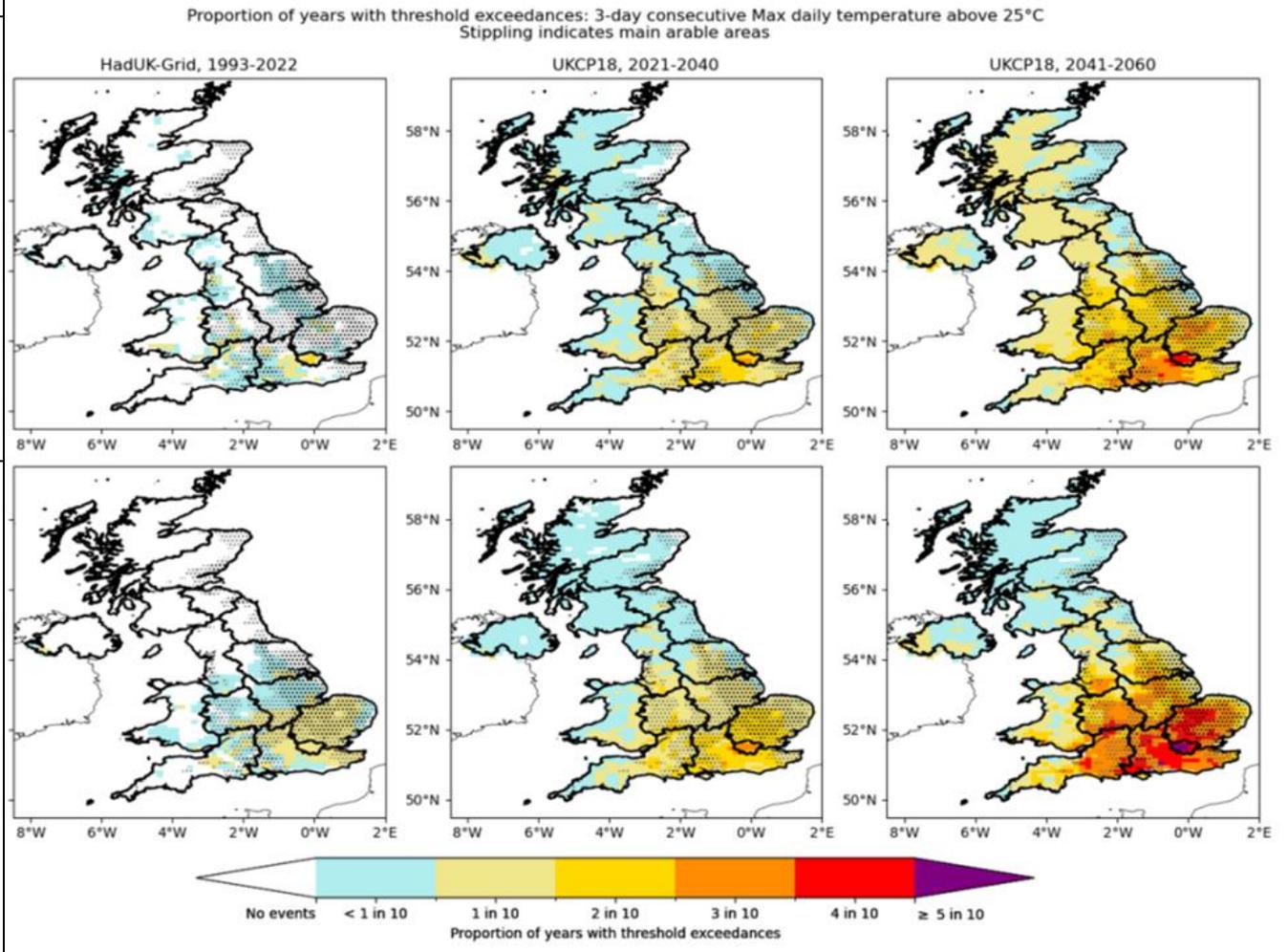
High emissions scenario
(RCP8.5)



Potential anthesis periods

18th May to 31st May

1st June to 14th June



- 25 degrees and over 3 consecutive days
- C3 crops (wheat, Barley, certain grasses) more effected than C4 crops (Maize)
- HT stress during anthesis decreases photosynthesis which can substantially reduce grain yields.

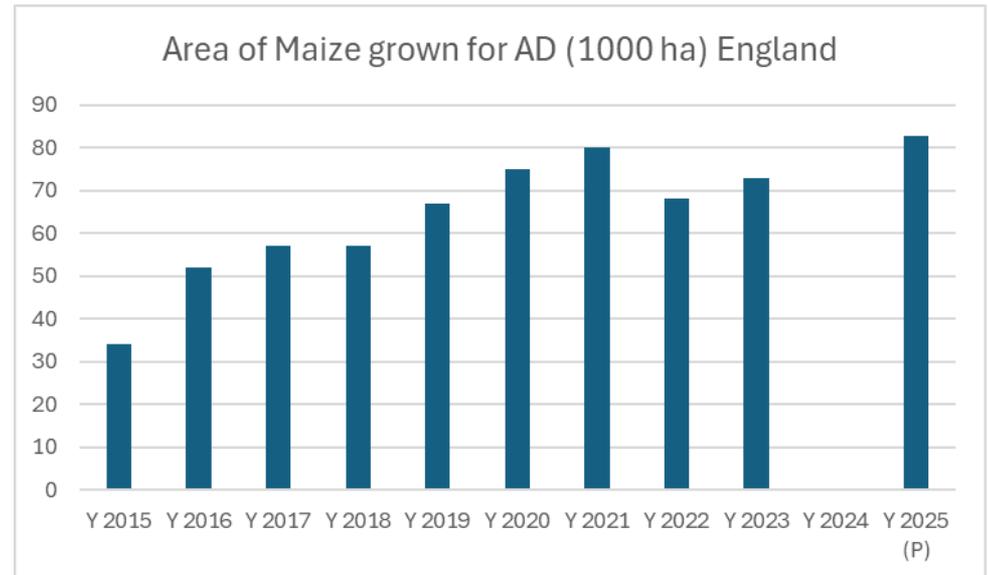
Anaerobic Digester Plants

ADBA figures for England

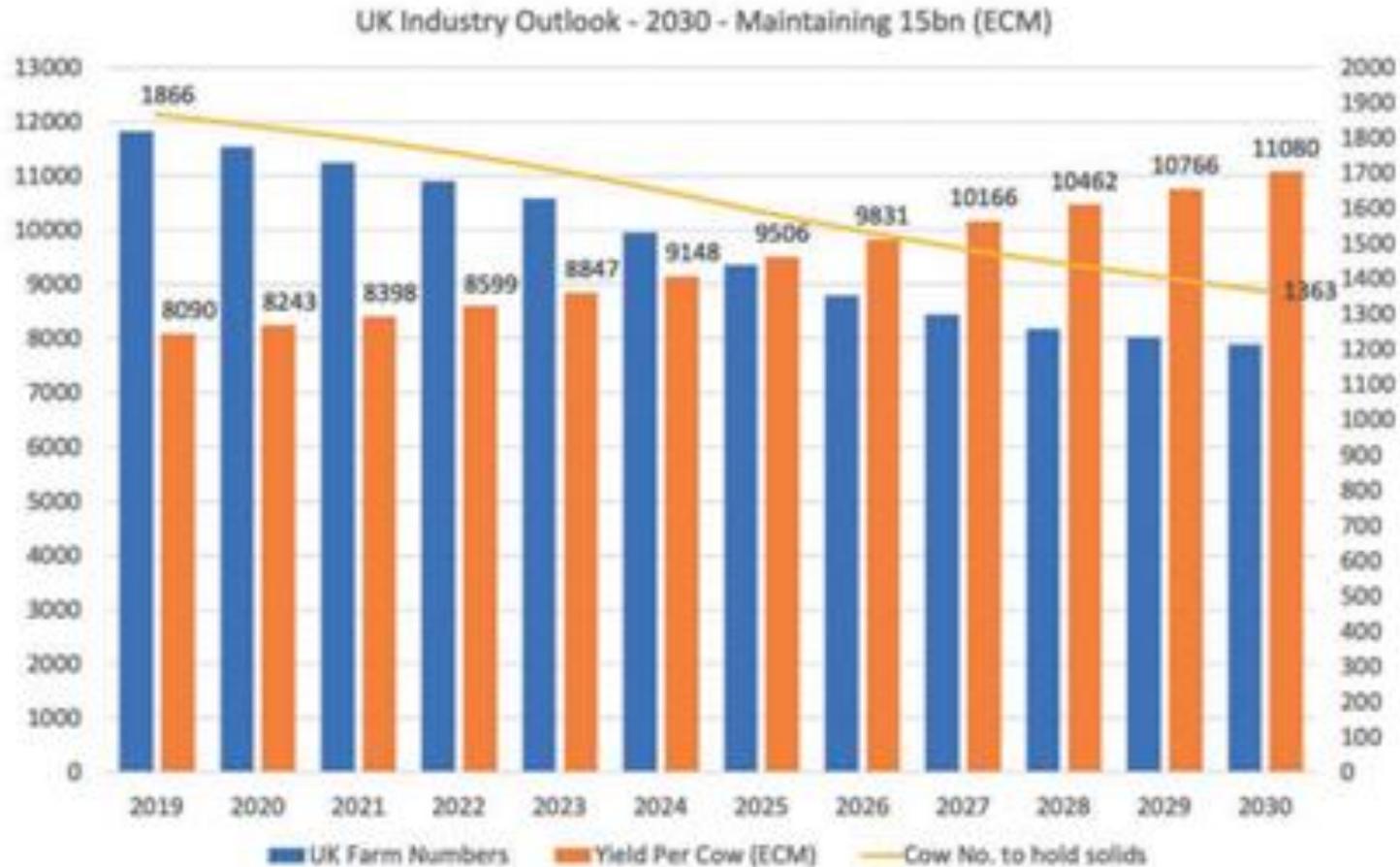
- Approximately 330 AD plants take some crop input (750 total)

AD Planning applications

- EA not a consultant on new AD plants but is made aware of them from local authorities.
- 99 new applications over the last 3 years. Estimated 44 are farm fed.
- Very difficult to predict future maize area (yields, AD plants mixture, total energy output of new plants, etc)



UK Dairy herd predictions



Average milk yield – 8,090lt (2020) to 11,080 (2030)



EA & MGA Trials

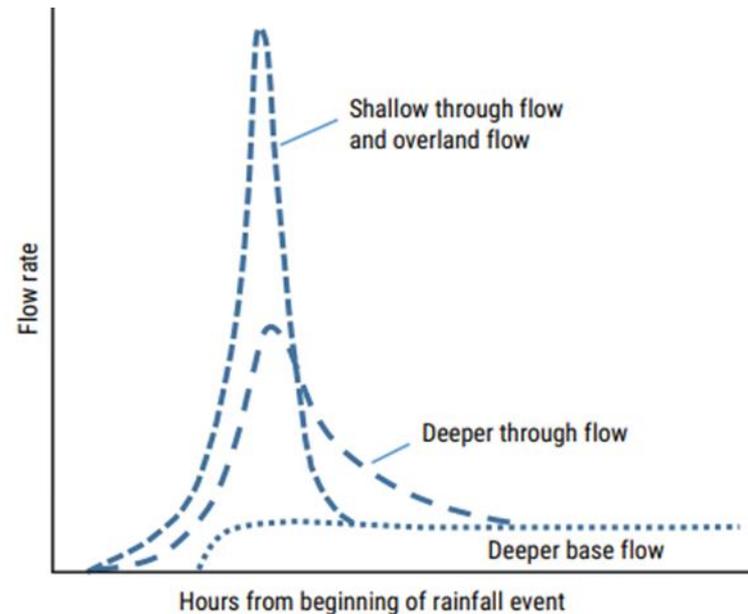


CLINTON DEVON ESTATES



Why?

- Climate change leading to an increase in flood risk
- New SFI schemes – how do these work in practice
- Land management & soil erosion contributes to poor river health (RNAGS). Of course, there are other industries and factors.



Aims of the trial

- Trial drilling directly into sprayed off grass as a technique that reduces capping risk on light soils
- Trial a range of under sowing mixtures across both soil types (drilled at 4-6 TL). CIPM3 & CSAM2.
- Trial a range of cover crop mixtures across both soil types, assessing which mixtures are quickest to establish and prevent soil loss. SOH4.
- Measure and assess water infiltration rates from the different cultivations techniques

	Treatment	Seed Rate
1	Italian ryegrass (IRG)	14kg/ha
2	Westerwold	10kg/ha
3	Clover & IRG	5 / 12kg/ha
4	Linseed & IRG	7 / 12kg/ha
5	Forage rape & IRG	5 / 12kg/ha
6	Forage rape & chicory	7 / 5 kg/ha
7	Oats & vetch	35 / 5 kg/ha
8	Oats & clover	35 / 5 kg/ha
9	Chicory & IRG	5 / 12kg/ha

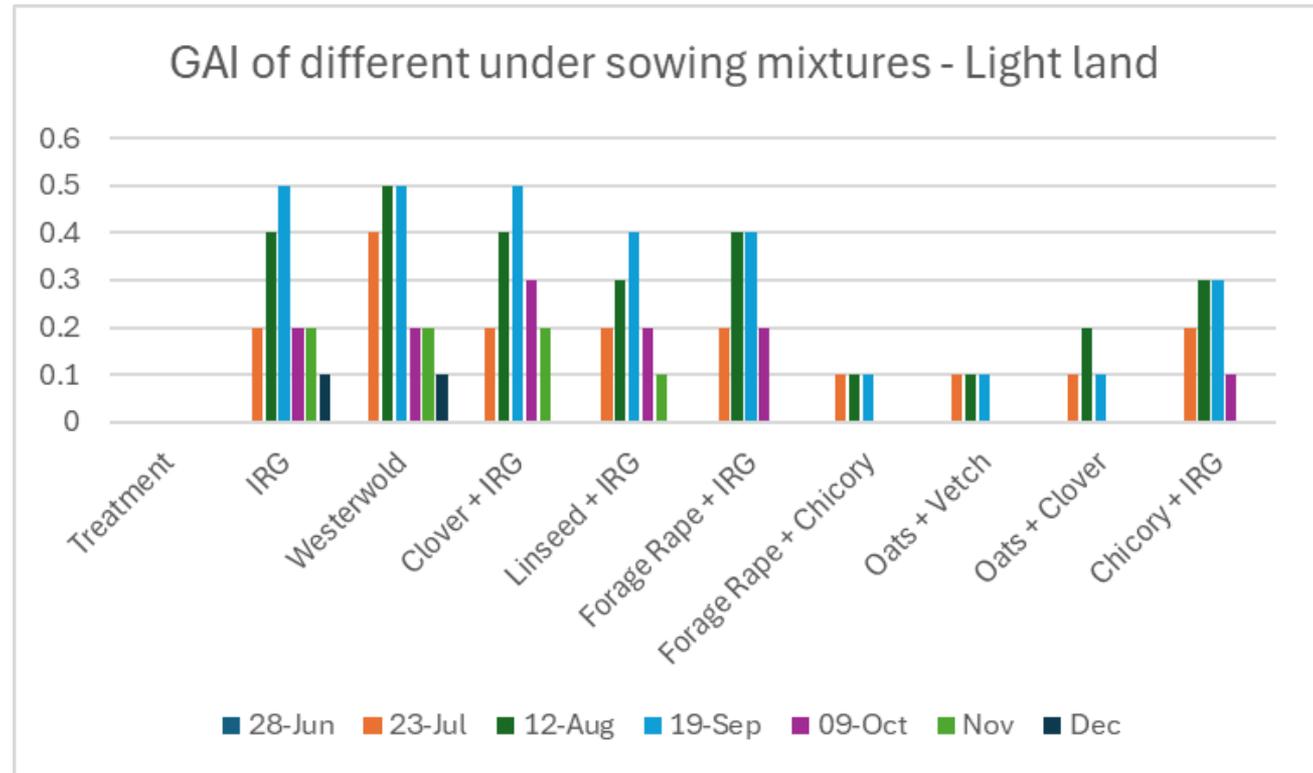


Trial – Light soils



- Maize successfully established - but had to glyphosate the old grass ley off twice.
- 7t/ha lighter on yield when compared to conventional
- Not just one pass as the whole block was subsoiled

Under sowing – Light soils



- Under sowing did not provide winter cover despite mixtures becoming established after the herbicide. Drought? No light?

Cover crops – Light land



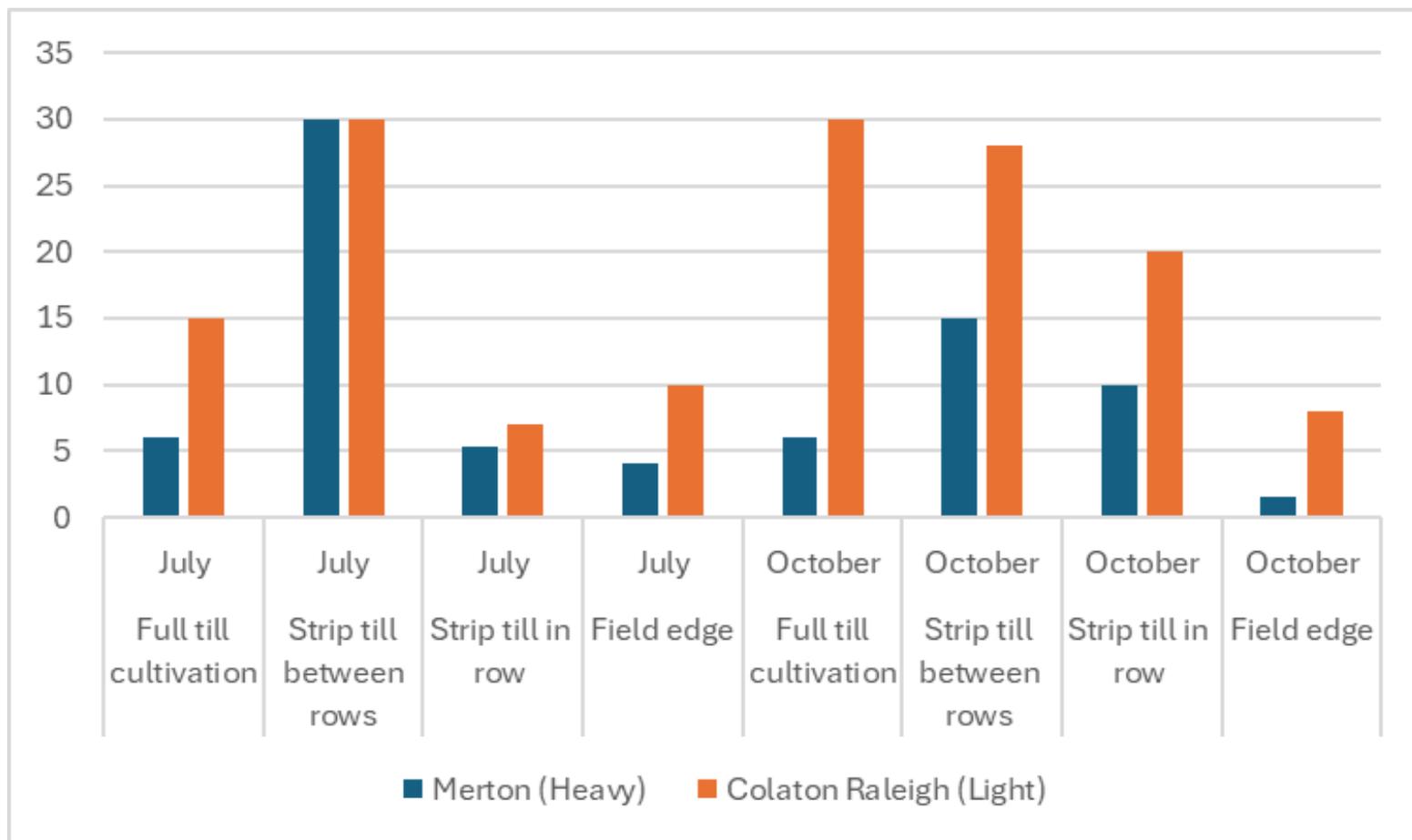
- Cover crops established mid October and data (GAI) still being collected.

	Treatment	Seed rate
1	Rye & Vetch	40kg/ha
2	Rye & Vetch & Phacelia	35kg/ha
3	Rye & Mustard	30kg/ha
4	Mustard & Radish	10kg/ha
5	Black oat & Vetch	40kg/ha
6	IRG & clover undersown in the maize crop	14kg/ha at 4-6 leaf stage

Other considerations – Light land



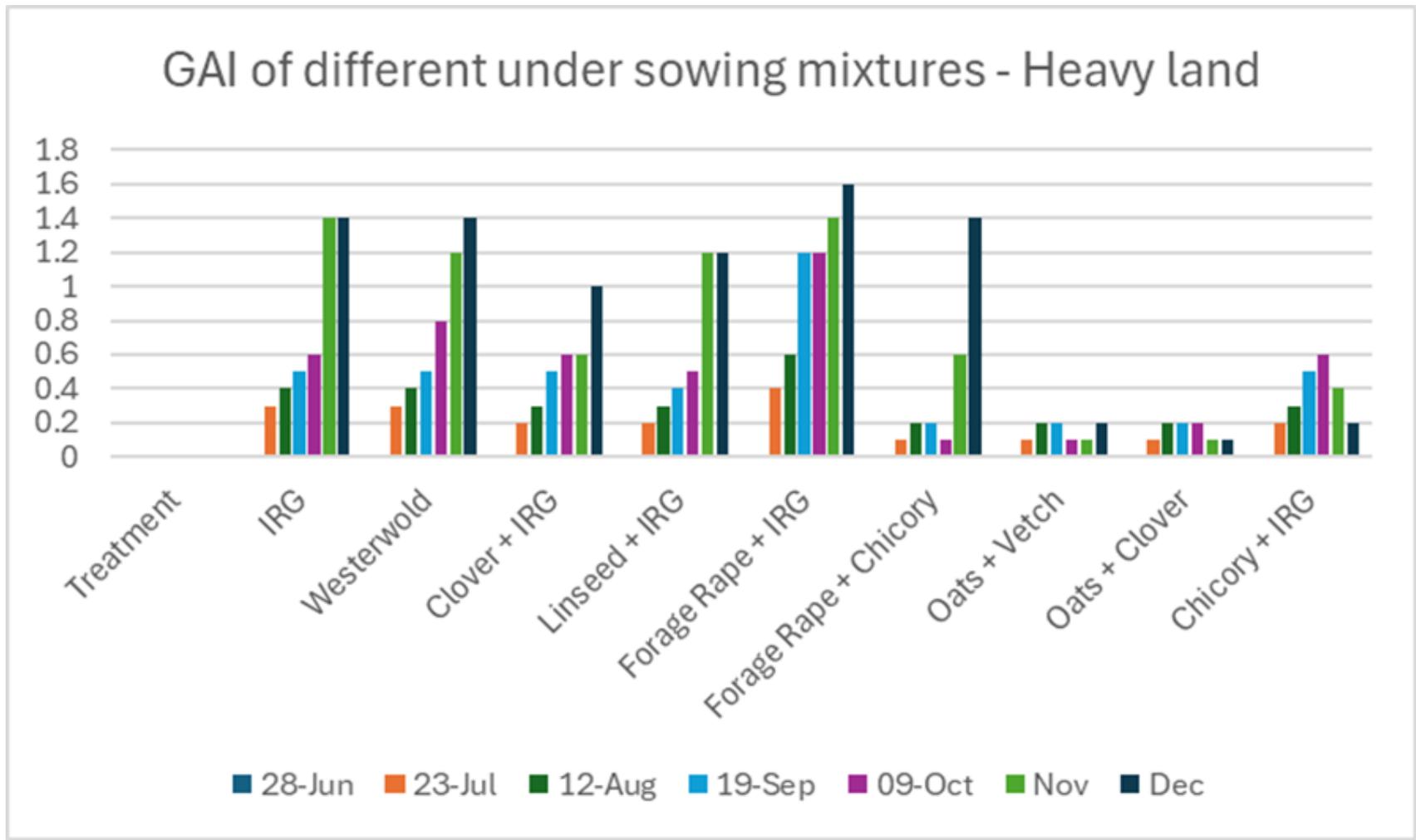
Infiltration results



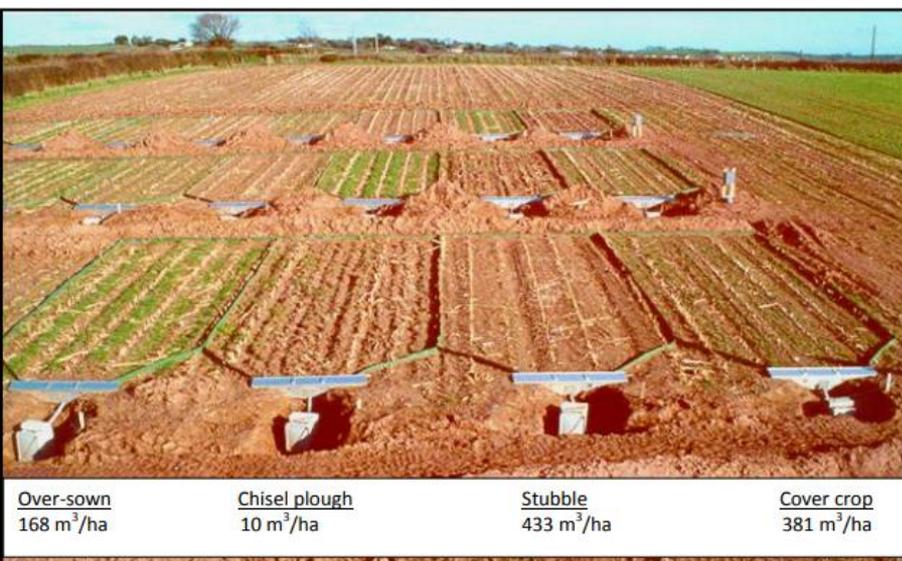
Under sowing – Heavy soil



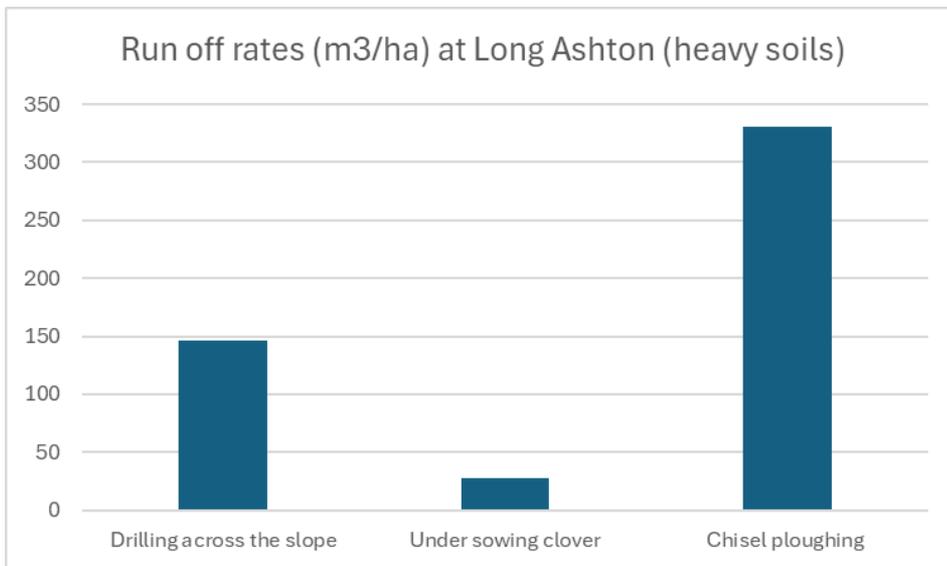
Under sowing – Heavy soil



Soil type crucial when selecting the most suitable intervention



Results – North Wyke (light soil)



Clover impacted the maize yield

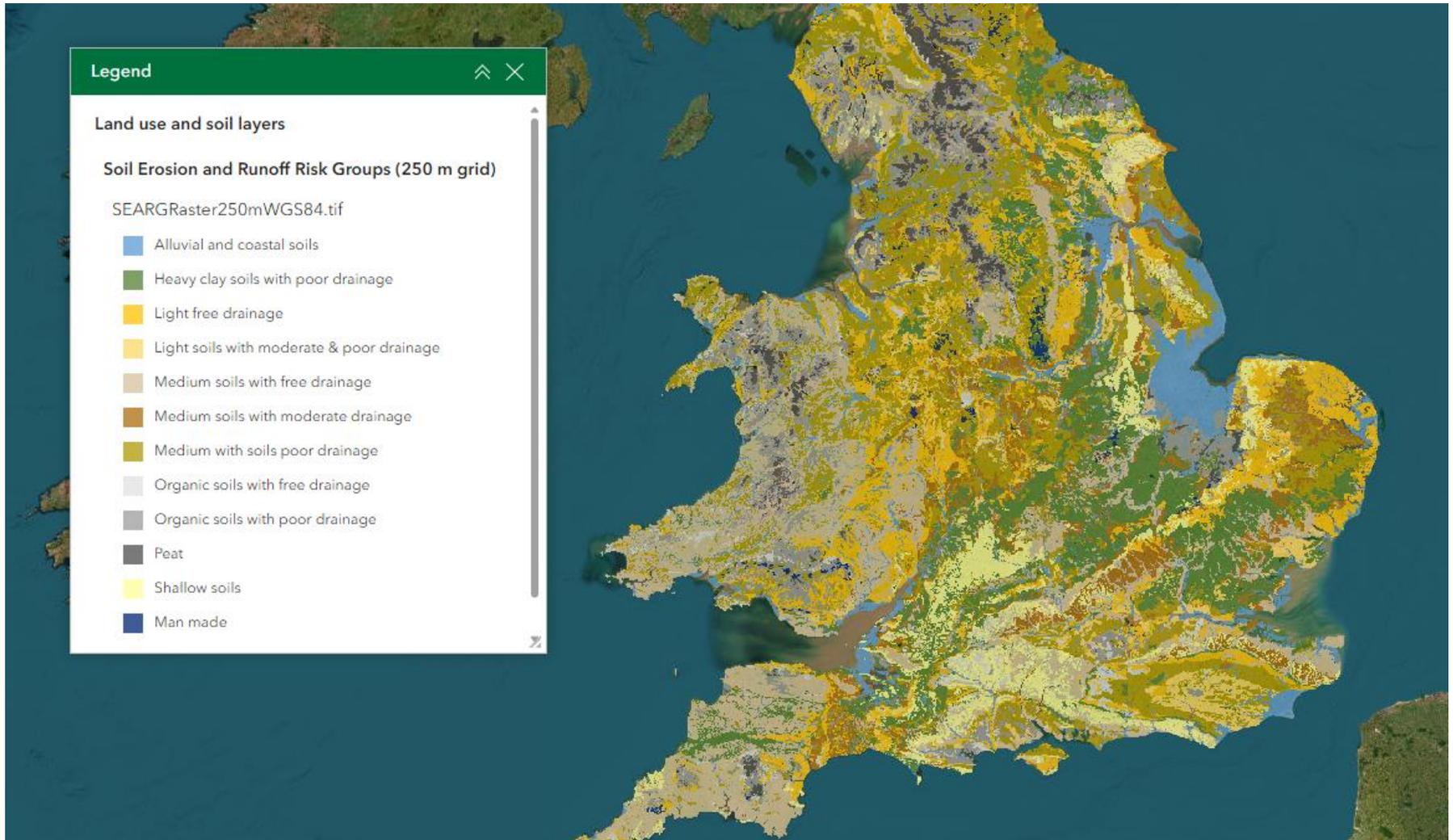
ALERT tool

Open access tool to assess risk - ALERT

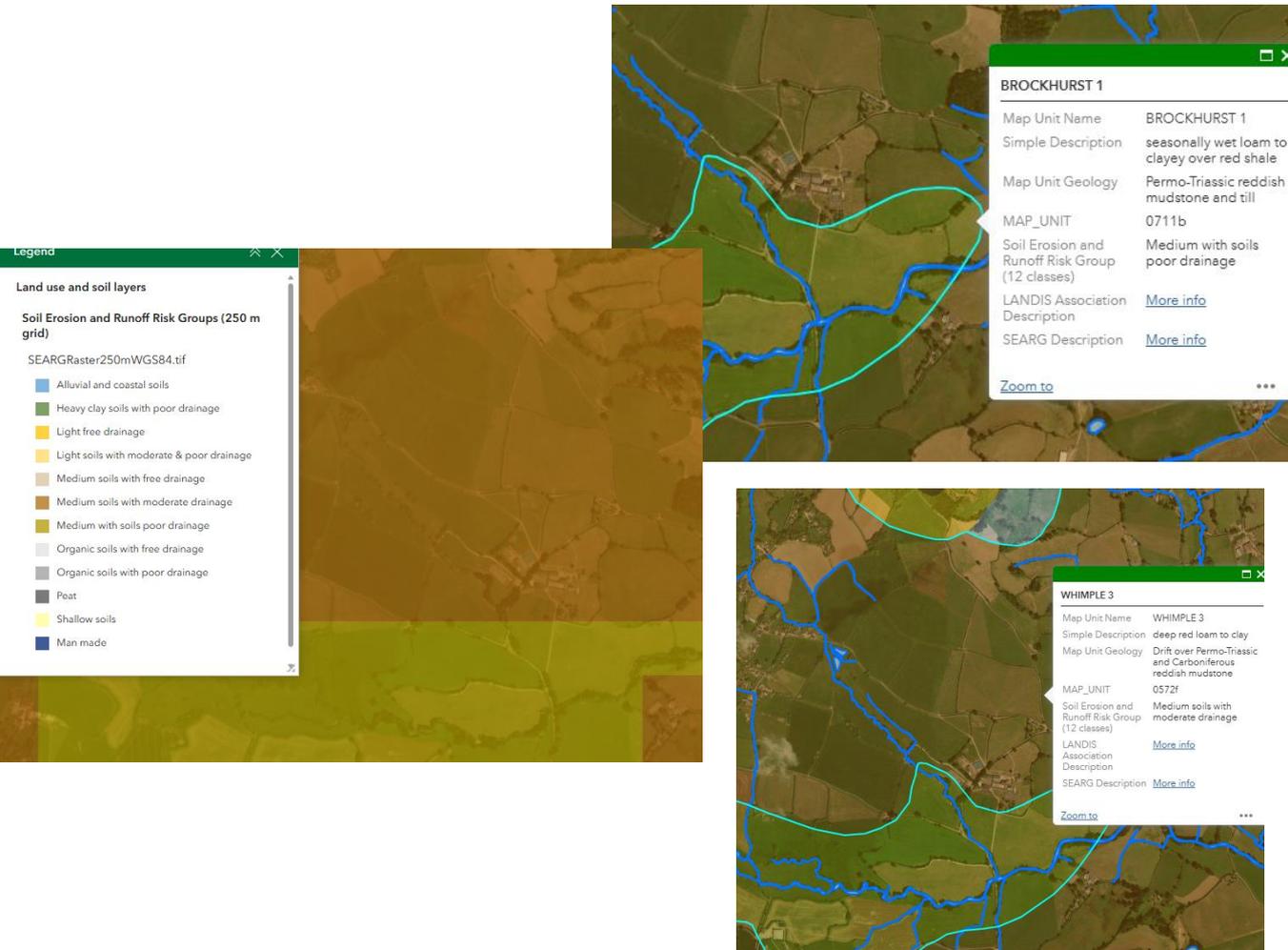


[ALERT | PublicALERT Environment AgencyLargeScreen20240813](#)

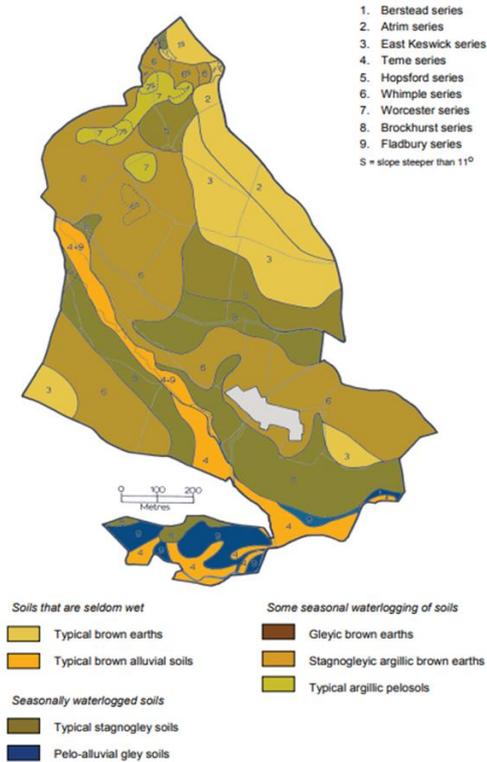
Open access ALERT tool – Soils



Soil association maps - limitations (resolution)



Soils of Farwood Barton



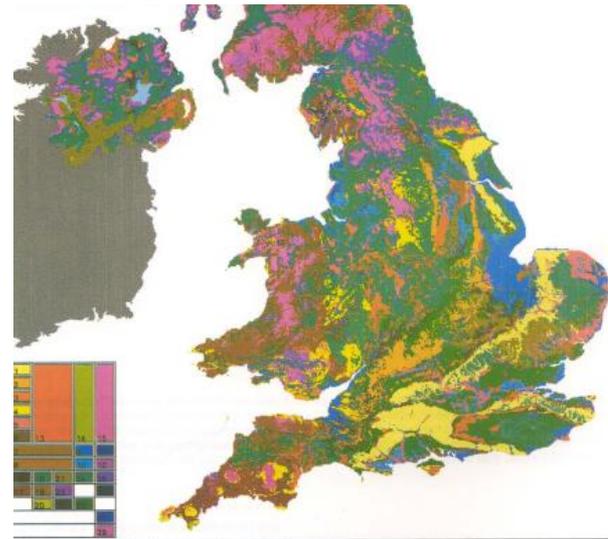
Soil survey by T.R. Harrod, 2004

Thank you for listening – questions

Flooding slides

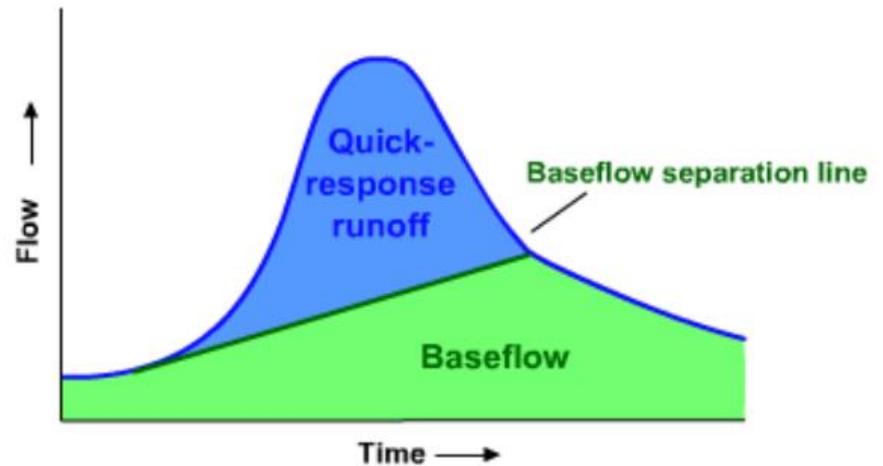
Host – Standard percentage run-off & Base flow index (catchment scale study)

- Britain has over 700 different soil types. All perform differently hydrologically depending on
 - Soil composition (sand, silt and clay)
 - Soil depth
 - Geology
 - Slope
 - Drainage
 - Groundwater level



- Host system has rationalised this soil types into 29 soil-hydrological classes

- Host system (catchment scale)
 - **SPR (Standard percentage runoff)** is based on the analysis of flood event data on a catchment scale. SPR is the percentage of rainfall that causes the short-term increase in flow seen at the catchment outlet.
 - **BFI (Base flow index)** is the long-term average proportion of flow that occurs as baseflow



Denbigh (loam over shale) is the most common soil series in Cornwall

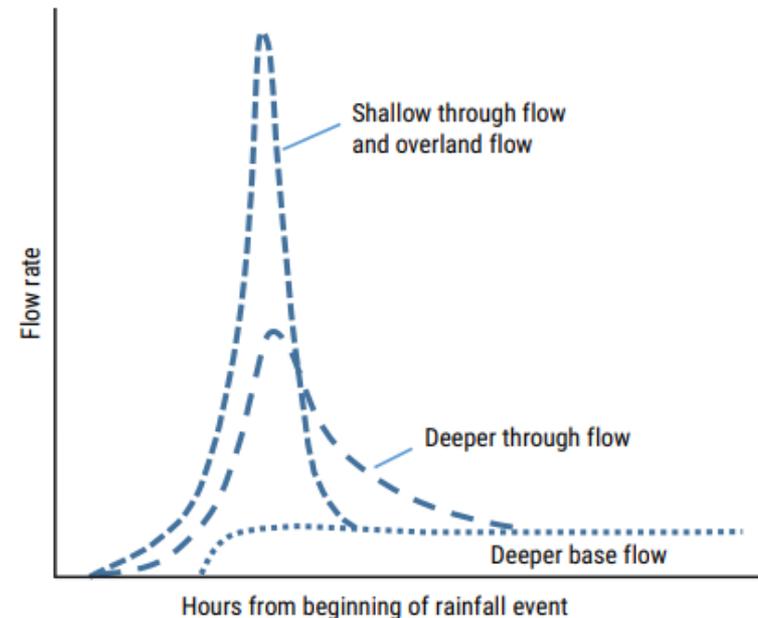
- Host class 5 (BFI=0.65, SPR=30%)

Moretonhampsted (light soil over granite) is also commonly found

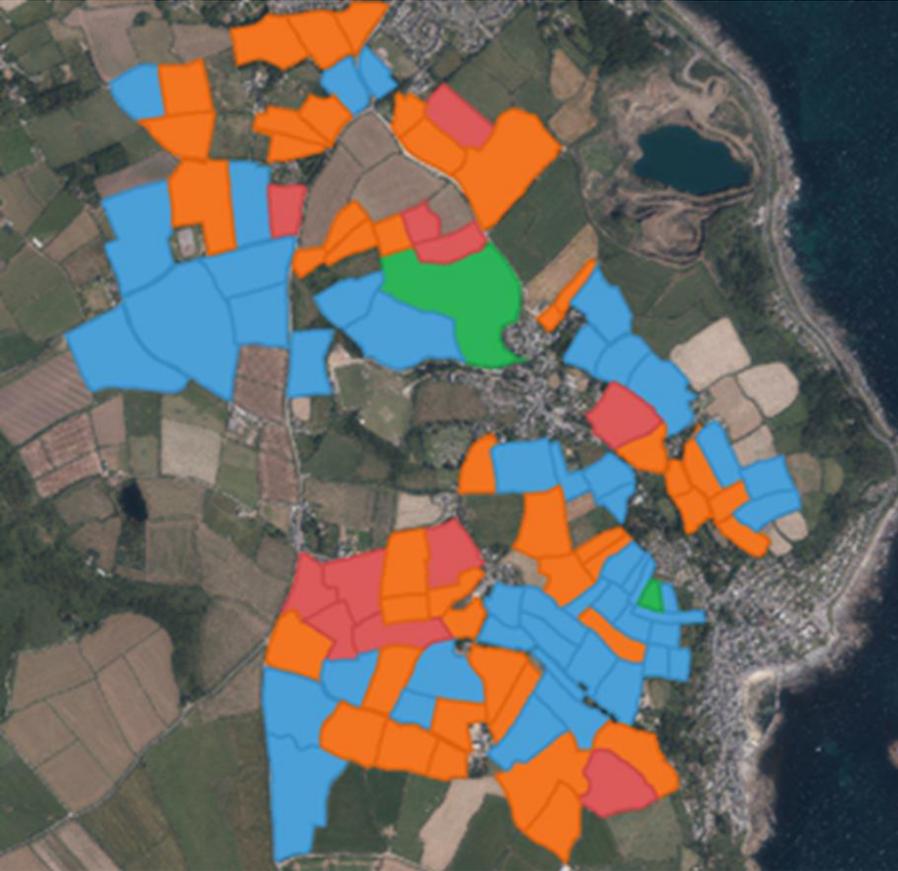
- Host class 4 (BFI=0.95, SPR=10%)

The influence of soil compaction

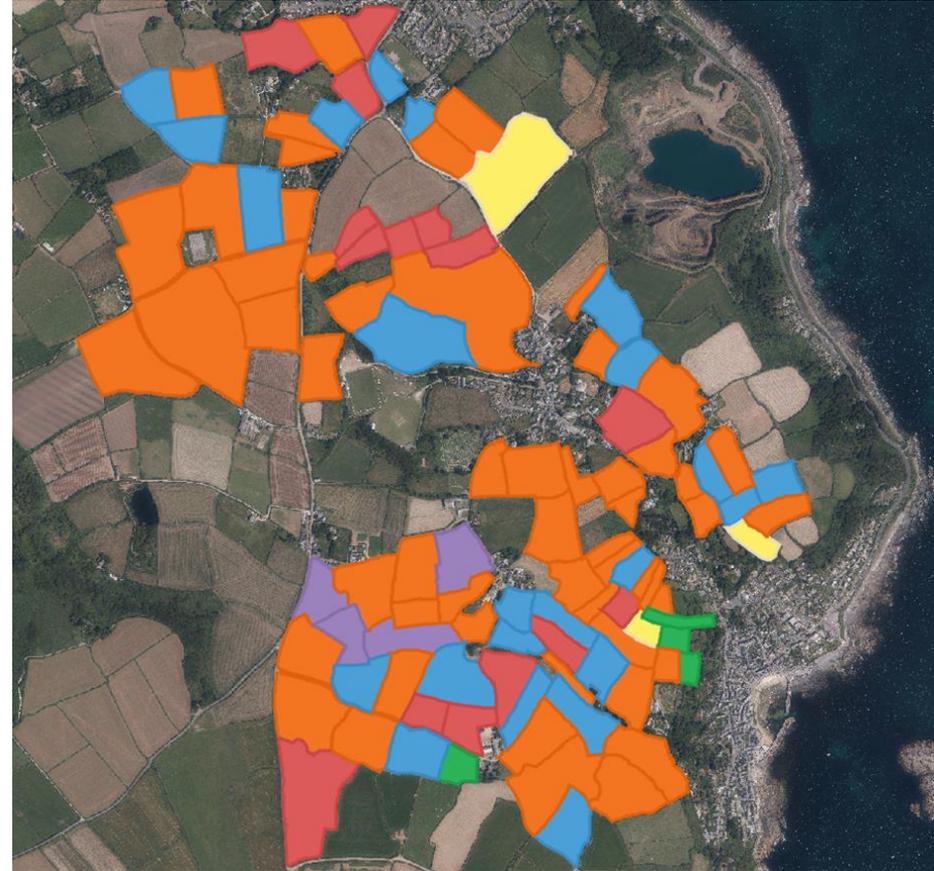
- Individual plot work with a rain simulator quantified the effect soil compaction has on SPR figures. This investigation was undertaken on a Bromsgrove soil series (SPR=10%)
 - VESS 1 – 10%
 - VESS 2 – 35%
 - VESS 3 – 60%
 - VESS 4 – 85%
 - VESS 5 / Severe cap – 95%



Catchment survey – compaction

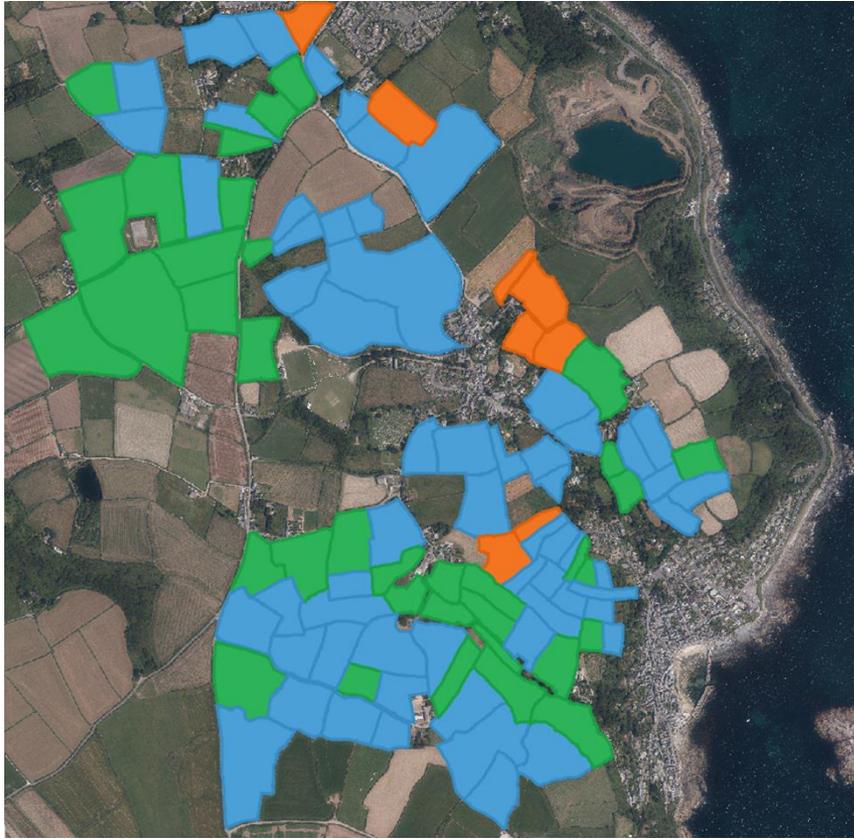


VESS score map – Mousehole catchments
1 – Green, 2 – Blue, 3 – Orange, 4 - Red

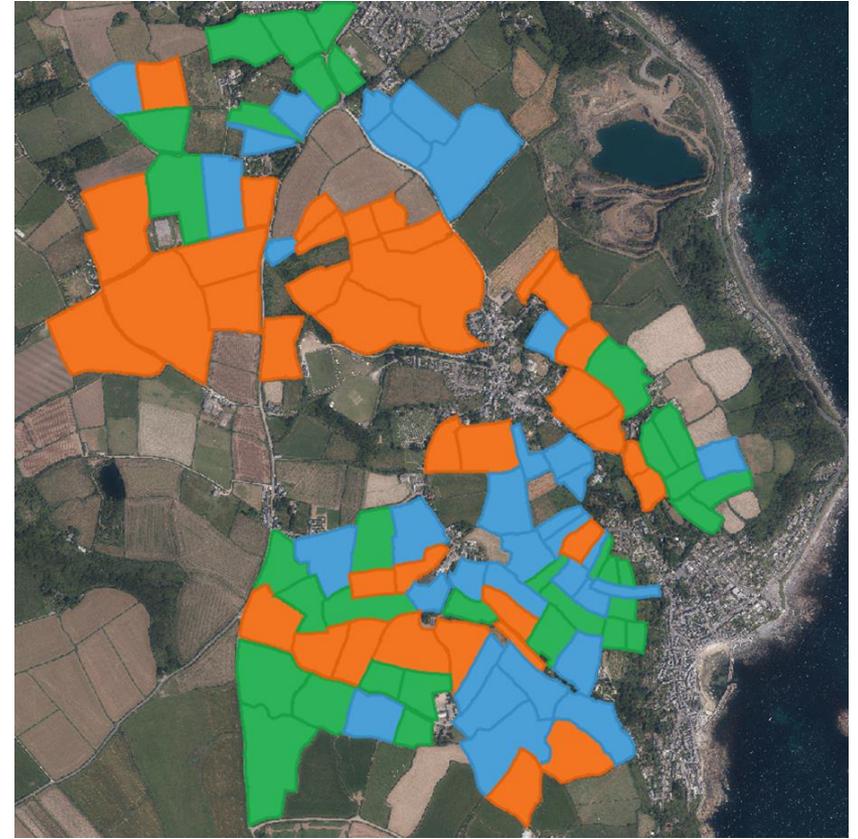


Subsoil score map – Mousehole catchments
Green – Good, Blue – Good / Moderate,
Orange – Moderate, Red – Moderate / Poor,
Purple – Poor, Stone - Yellow

Catchment survey – Soil health

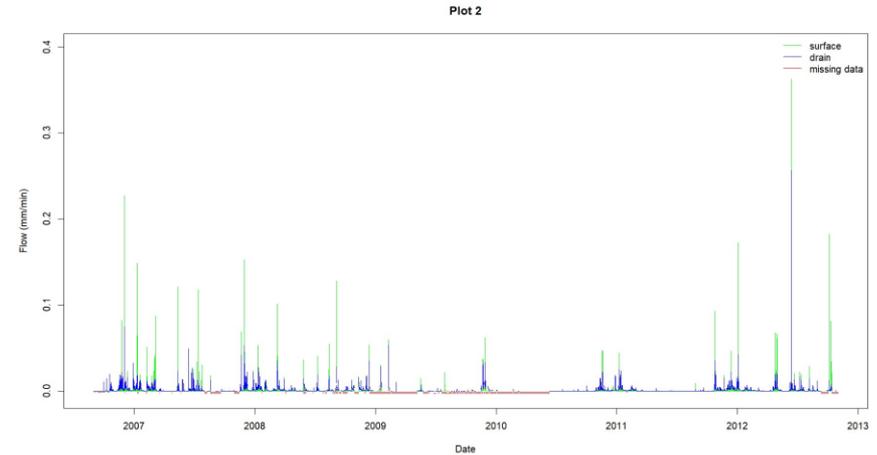
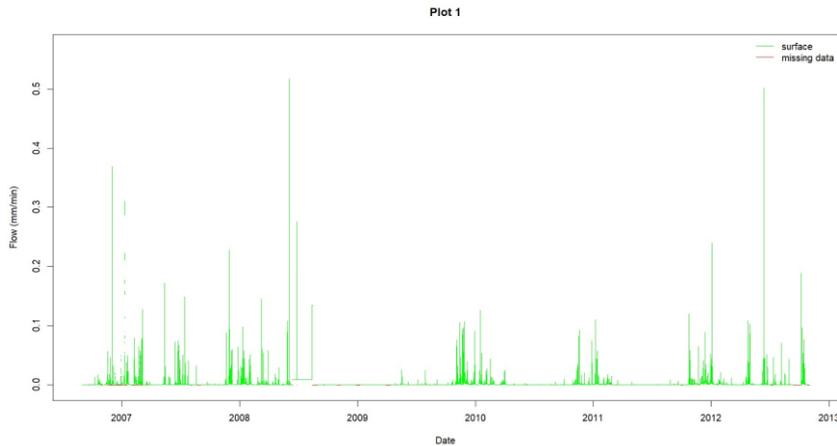


Soil organic matter benchmarking
(AHDB)
Green – High, Blue – Average, Orange –
Low



Earthworm benchmarking
Green – high, Blue – Average, Orange -
low

The importance of drainage - Rothamsted



Heavy soil poor drainage - The undrained plots have a

- quicker hydrological response so rapid rising and falling limbs (flashy).
- These patterns will to some extent be dependent on the rainfall intensity and antecedent soil moisture status.
- Also, because the drained plots were mole drained over the underlying deep pipe drains, there is a gradual decrease in their effectiveness as they begin to degrade over their typical lifetime (~5 years). **When freshly moled, the drained plots typically had about ~10-20% of the water exiting via the surface/surface lateral pathway and ~80-90% via the drains pathway** but the difference will narrow over time as the mole drains collapse.
- This data is gathered at the field exit therefore may not represent the true hydro curve for communities if the water is drained into a channel that accelerates flow.
- This data was conducted on heavy soils not alluvial soils.

Tillage important for increasing SOM?

Highlights

- At higher SOC:SIC ratios (>3.0), intensive tillage increases SOC stock up to fourfold.
- SOC-SIC interactions may offset SOC loss from disturbance.
- Cover crops and intensive tillage increase SIC by $\sim 0.7 \text{ kg m}^{-2}$.
- Up to 1 kg m^{-2} SIC gain for every 1 % increase in SOC.
- Compelling indications of microbial involvement in the accrual of SIC.

[Soil organic and inorganic carbon interactions under tillage and cover cropping determine potential for carbon accumulation in temperate, calcareous soils](#)

Previous trial work – run off from maize

Results at IGER, North Wyke & Frithelstock (light)

At North Wyke chisel ploughing was very effective at reducing run-off during the winter 1999/00. A total of 433 m³/ha of water run-off was measured from compacted maize stubble, whereas only 10 m³/ha of water ran off the stubble that had compacted soil shattered by chisel ploughing. A winter ryecorn cover crop established by direct drilling reduced water run-off marginally to 381 m³/ha, whereas an understorey of grass reduced water run-off to 168 m³/ha.

Chisel ploughing was not as effective during winter 2000/01 at North Wyke but still halved the run-off (231 m³/ha compared to 470 m³/ha measured from maize stubble). During this increased the ryecorn cover crop actually increased run-off (to 552 m³/ha). Field conditions were not ideal for chisel ploughing to completely shatter compacted soil, and it seems likely that establishment of the ryecorn cover crop caused further compaction (probably due to direct drilling when soil moisture was too high).

Growing of a winter cover crop of ryecorn greatly increased runoff at Frithelstock during winter 2001 (with 1052 m³/ha of water run-off from the cover crop plots compared to 270 m³/ha from bare stubble). The soil was very wet after maize harvest in North Devon, and it is likely that direct drilling of ryecorn caused further compaction. Chisel ploughing or undersowing had little effect at reducing run-off at Frithelstock.

Results at IACR, Long Ashton (heavy)

At Long Aston during the 1998/99 winter, drilling across the slope reduced water runoff by 40%. An understorey of clover within the maize drilled across the slope also reduced run-off during winter 1999/00 (only 28 m³/ha of water run-off from the clover plots compared to 146 m³/ha from bare stubble). Clover was just as effective during winter 2000/01. However during both years the clover understorey reduced maize yields.

Chisel ploughing during late November at Long Ashton increased run-off in 2000/01 (to 331 m³/ha) which was probably due to smearing and compaction of wet soil in the chiselled soil, and the subsequent forming of channels (acting as effective waterways).