

Soil sampling in the Garren Catchment

A report on some novel citizen science commissioned by WSA
and delivered with help from CPRE

*Objective: to measure soil phosphorus concentrations within the
Garren Catchment and determine if they are increasing, as predicted by the
recent RePhOKUs report (Withers et al. 2022)*

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September 2022

wye salmon
association

The Garren Brook

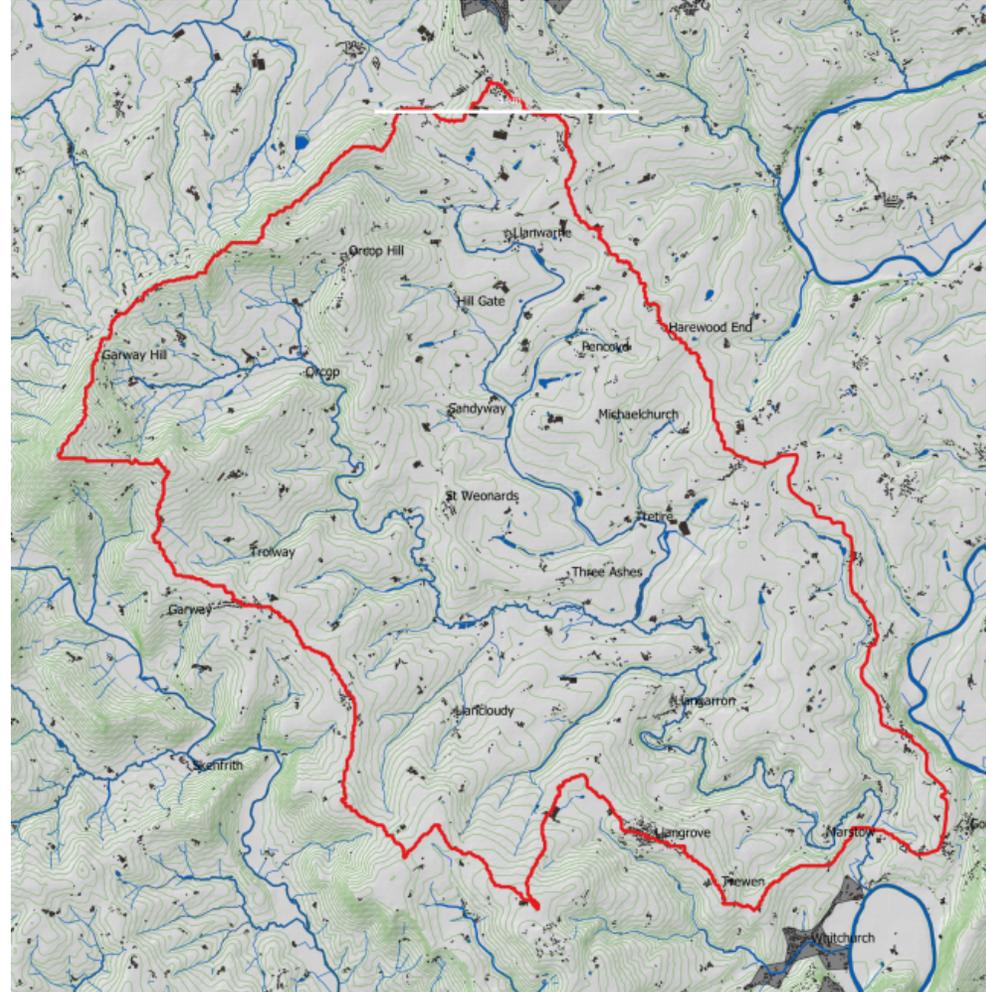
- ▶ A small lowland tributary of the River Wye
 - ▶ 29 km length
 - ▶ Joins the Wye between Goodrich and Symonds Yat
 - ▶ Tributaries: Gamber, Llanerch & Luke Brooks
- ▶ Groundwater fed, with high alkalinity
- ▶ Not within the Wye SAC, so WFD water quality targets apply
 - ▶ Achieves 'good' status for reactive phosphorus (RP) ... just
 - ▶ High turbidity is severely impacting macrophyte and fish populations



Garren Brook from Langstone Bridge

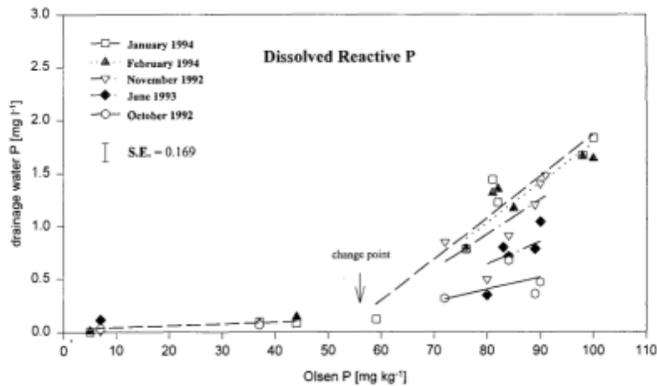
The Garren Catchment

- ▶ 90 km² of Herefordshire farmland
- ▶ No major settlements
- ▶ Land use
 - ▶ Arable & horticulture 48%
 - ▶ Improved grassland 44%
 - ▶ Woodland 4%
 - ▶ Suburban 3%

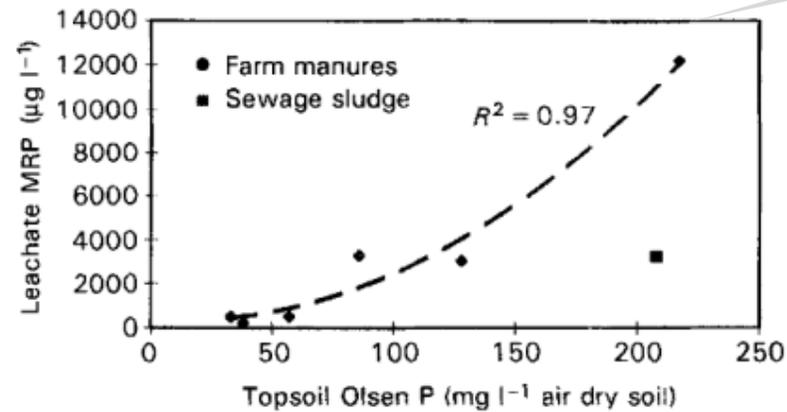


Why measure soil phosphorus?

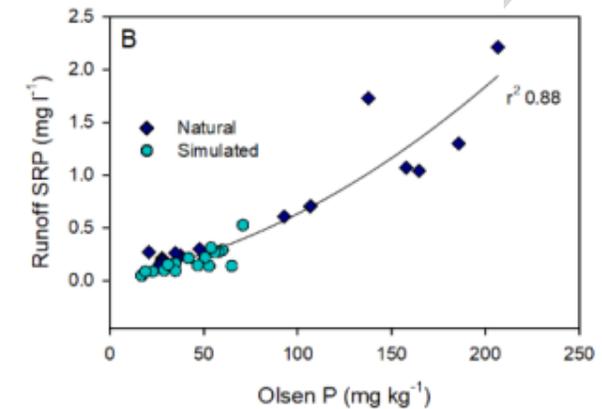
- ▶ Soil P is a driving parameter for diffuse pathways
 - ▶ Groundwater leaching
 - ▶ Bulk soil erosion
- ▶ Groundwater leaching has a non-linear relationship with soil P



Heckrath et al. 1995



Smith et al. 1998



Withers et al. 2022

Wye soil

Olsen-P

- ▶ The Olsen test for phosphorus is widely used in UK agriculture
- ▶ It does not measure total phosphorus
- ▶ It approximates:
 - ▶ Plant-available phosphorus
 - ▶ Leachable phosphorus
- ▶ Olsen-P is used in soil nutrient guidance for farmers (ADHB RB209 series)

RB209 soil indices

Soil index	P concentration (mg/l)
0	0-9
1	10-15
2	16-25
3	26-45
4	46-70
5	71-100
6	101-140
7	141-200

- Target for grassland and most arable crops is index 2 (16-25 mg/l)
- Some vegetables (e.g. potatoes) target index 3 (26-45 mg/l)

Baseline data

- ▶ Soil Olsen-P was last surveyed nationally as part of the Countryside Survey, 2007
- ▶ This is available as digital mapping data from the UK Centre for Ecology and Hydrology
- ▶ The data has been extracted across the Garren Catchment, yielding the following mean values:

Land use	Olsen-P (mg/l)
Improved grassland	31
Arable & horticulture	54

Olsen-P results

▶ Arable

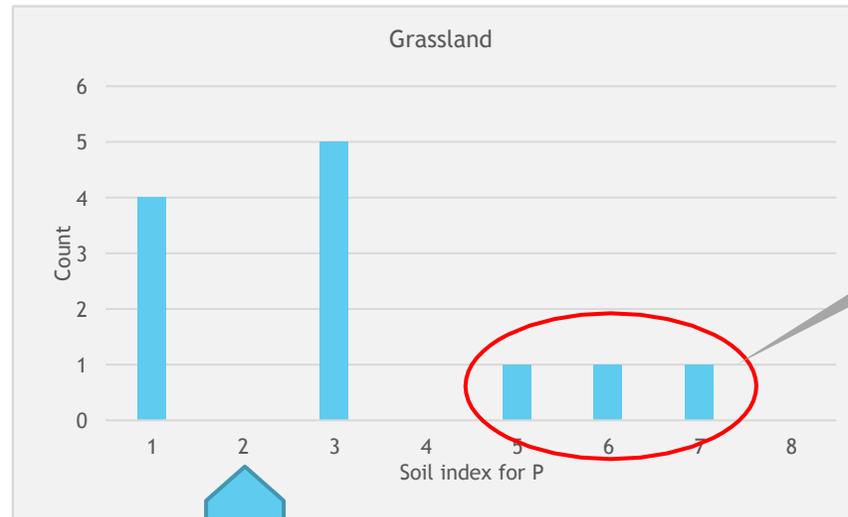
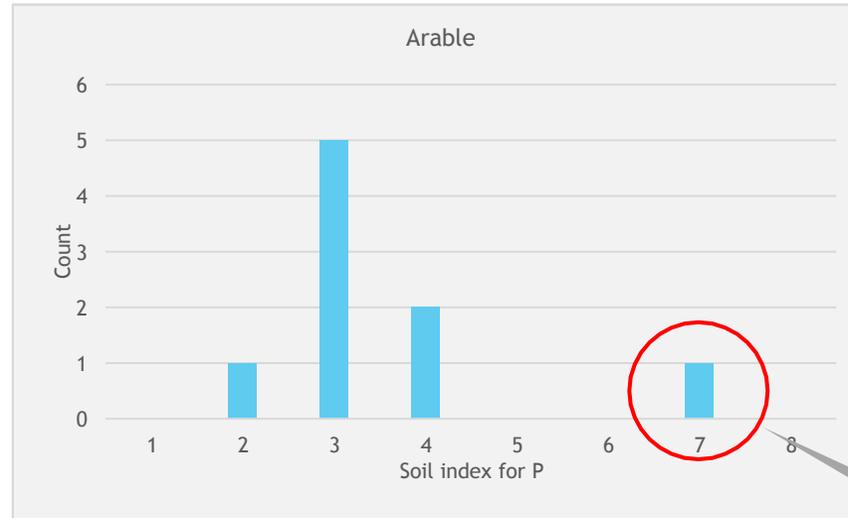
- ▶ average 54 mg/l
- ▶ Same as 2007
- ▶ 8/9 locations above target for crop (wheat, o/s rape, oats, maize)

▶ Grassland

- ▶ Average 48 mg/l
- ▶ 17 mg/l increase from 2007
- ▶ 8/12 locations above target

▶ Orchard

- ▶ 1 site at Index 1



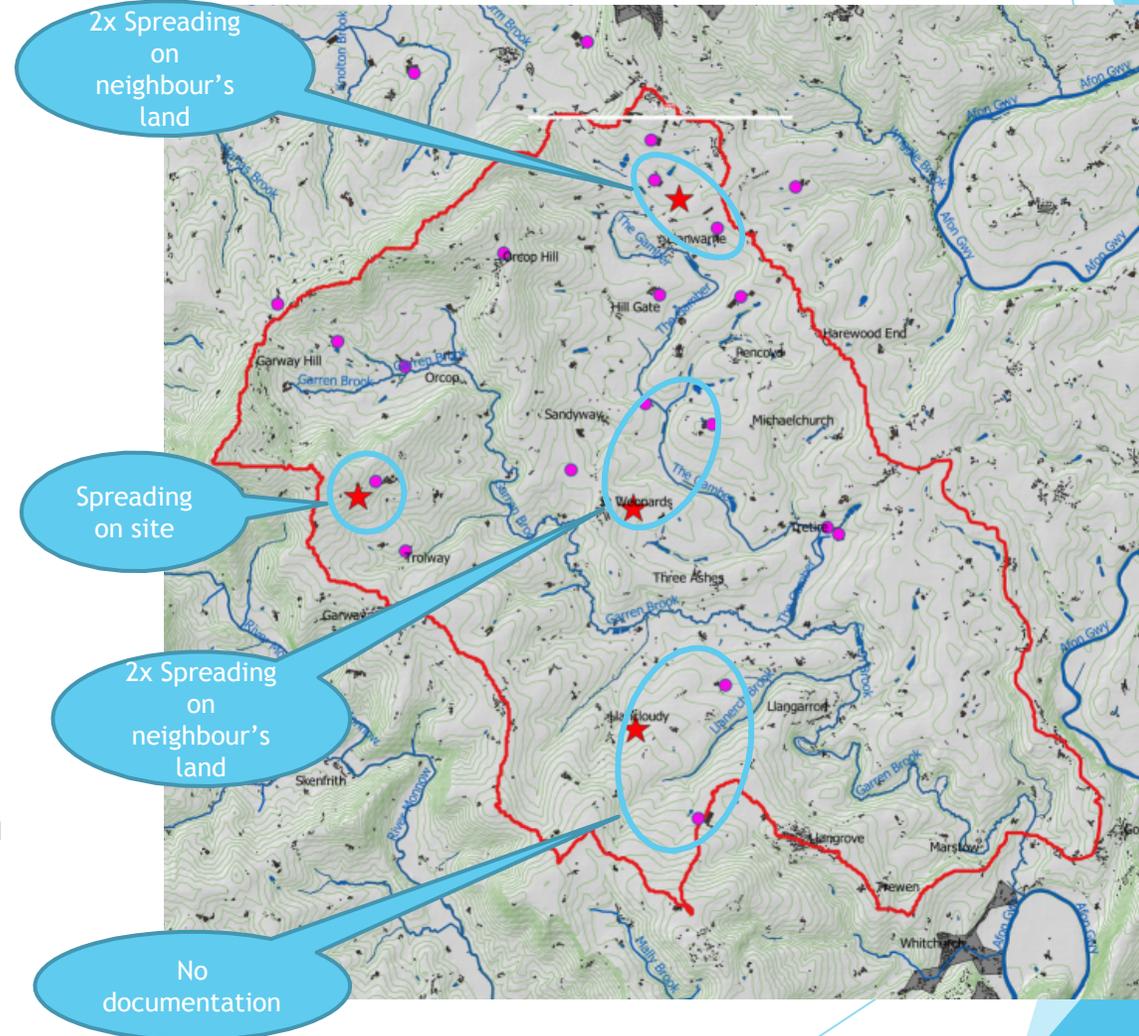
Note
4 outliers



Target
index

Outlier locations

- ▶ All outlier locations are in proximity to one or more IPUs
- ▶ There are ≈ 17 IPUs in the catchment, containing over 2M birds
- ▶ Manure management plans are informative
- ▶ The majority of IPUs either spread on site or on neighbours' land, often at the NVZ maximum rate for N



Conclusion

- ▶ Arable land is well above target index, but appears stable
- ▶ Grassland is the principal challenge (as found by RePhOKUs)
 - ▶ Mean Olsen-P increased from 31 mg/l (index 3) in 2007 to 48 mg/l (index 4) in 2022
 - ▶ Livestock farmers have a lot of manure to dispose of
 - ▶ A high concentration of IPU adds significantly to this burden
- ▶ 4 sites at index 5-7 correlate with IPU locations and spreading practices
 - ▶ These result are consistent with spreading at NVZ maximum rates for 15-20 years
- ▶ To reduce diffuse phosphorus pollution we need to reduce soil phosphorus:

... therefore we must measure it