Somerset catchment Phosphorus Project update June 2024

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Phase 1 - Work Objectives

Overall Aim

- To better understand food system P input pressures on the Somerset Levels and Moors and Dorset Stour catchments potentially impacting water quality and how they might be alleviated

Specific objectives

- Quantify food system P inputs, outputs and internal flows using Substance Flow Analysis (SFA) and links to river P loads in each study catchment

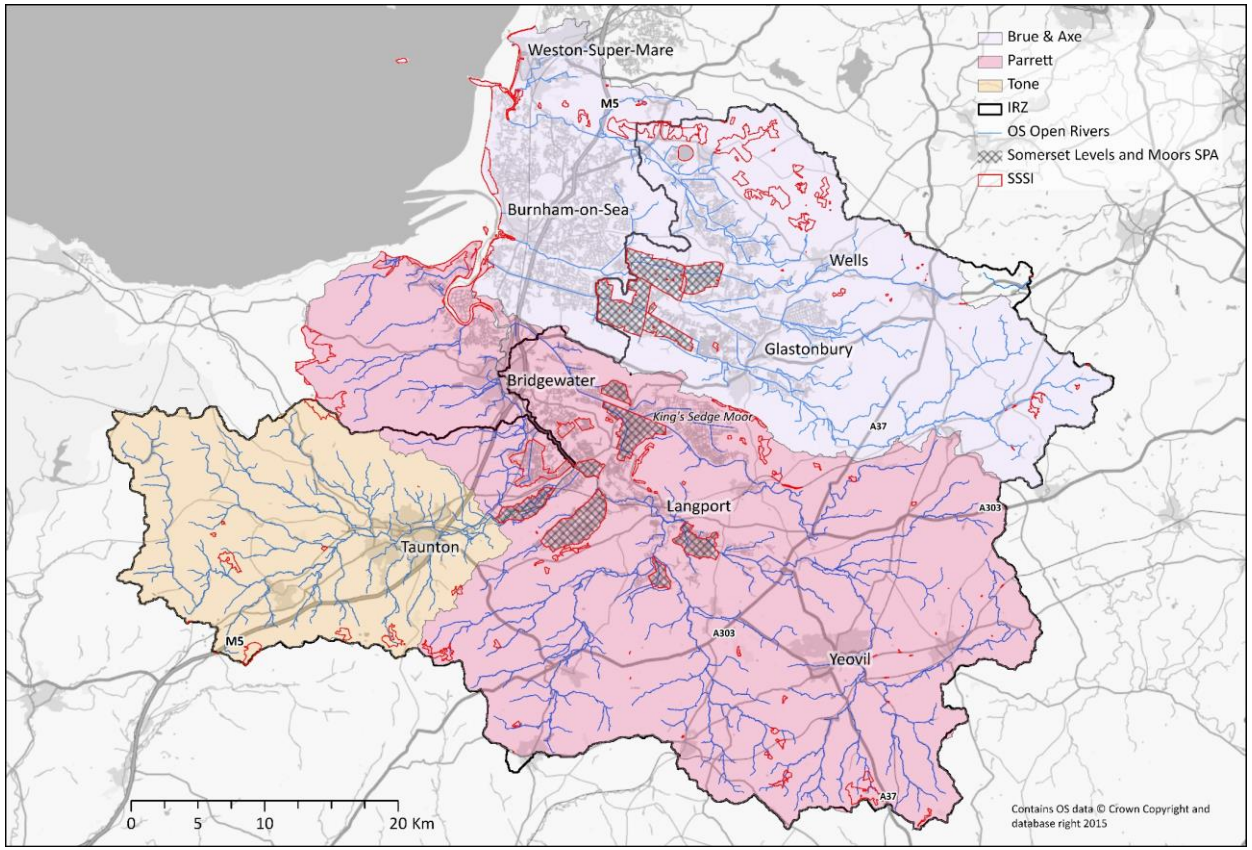
- Analyse the impact of system level change on SFA-P flows using scenario analysis

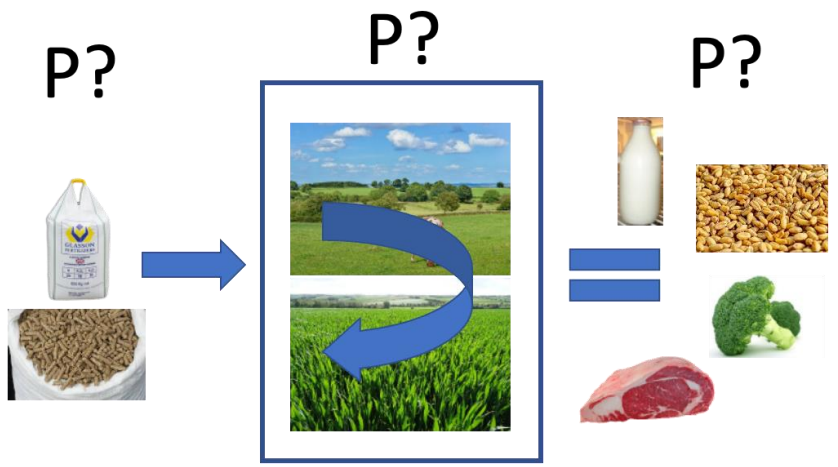
- Organise stakeholder workshop to discuss results and gather feedback

Phase 1- Phosphorus Substance Flow Analysis (P-SFA)

Somerset Catchments

Brue & Axe
Parrett
Tone
Ramsar IRZ

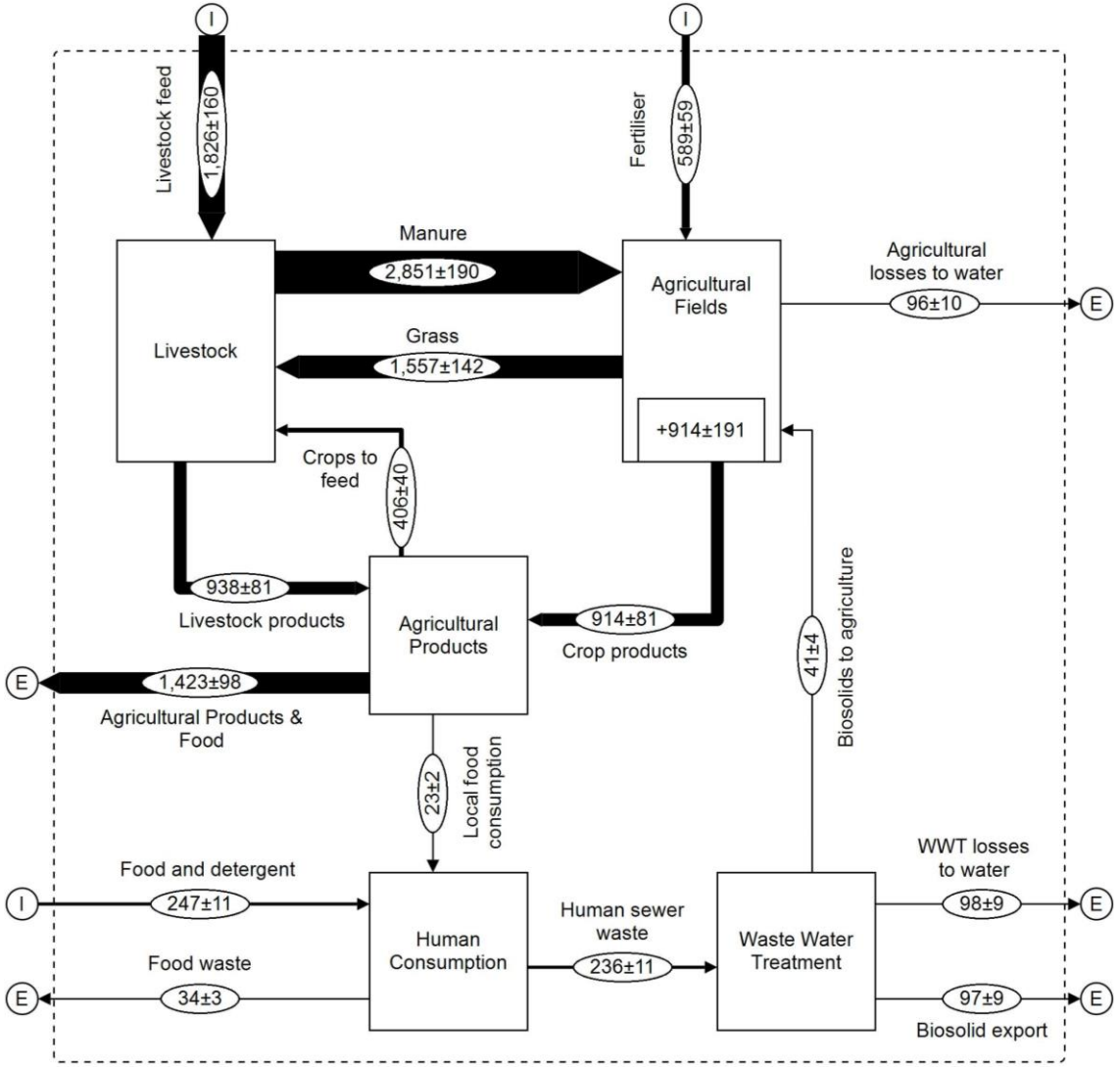




- SFA uses a mass balance approach to estimating P flows in the food system
- Modelled the system imports, stores, losses and exports of P at catchment scale by sector
- Assessed a range of metrics that describe system P efficiency, surplus P and river P pollution potential

Phase 1 - P-SFA Results

Somerset Levels and Moors IRZ 2021 baseline

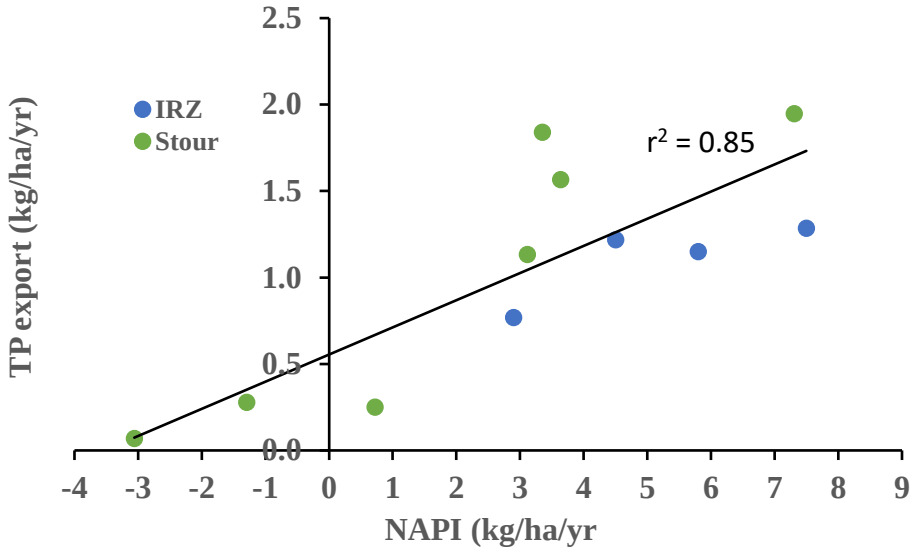


Food System P metrics (mean and range)

Metric	IRZ
Food System P Use Efficiency (%)	58 (49 - 77)
Agricultural P Surplus (kg/ha)	6.5 (2.1 - 8.6)
NAPI (kg/ha)	5.8 (2.9 - 7.5)
Total P loss to water (kg/ha)	0.91 (1.0 – 1.4)
Source Apportionment from Wastewater (%)	52 (54 – 72)

NAPI = fert P + manure P + human P – harvest P

System interventions to reduce river P pollution



A strong link between NAPI and measured river SRP/TP load – suggests that reducing NAPI could lower river pollution risk

Why is there a link?

- Wastewater effluent P loss is high relative to inputs
- Annual P surpluses increase legacy soil P stores = high soil P increases P loss in storm runoff
- Annual P surpluses increase the amounts of P circulating in the system two-fold = greater opportunity for direct loss of applied P in runoff

Potential system interventions assessed by scenario analysis using SFA:

1. Reducing feed P content
2. Reduce catchment P surplus to zero
3. Recover more P from wastewater effluent
4. Combine 1, 2 and 3
5. Soil P drawdown (negative P surplus)

Phase 1 - Impacts of Interventions

% change in each metric

	Intervention	System P efficiency (%)	Agric. Surplus P (kg/ha)	Total P loss to water (kg/ha)
IRZ	(S1) Reduce feed P	+7	-18	-2
	(S2) Zero P surplus	+60	-95	-4
	(S3) Wastewater P removal (AMP 7)	+2	+1	-21
	(S4) Combined	+74	-108	-25
	(S5) Soil P drawdown	+137	-190	-13

Source apportionment scenario 4 (combined)	%
Agriculture	59
Waste water	41

Scenario messages

- Reducing feed P had limited impact
- Reducing ag. surplus improved system P efficiency
- Improving wastewater P recovery (AMP 7) reduced P losses to water
- Combined actions most effective

Workshop Feedback

- Skeptical of the need for radical system change
- Combined management adaptations sufficient?
- Lack of knowledge/direction to make major system change

Phase 1 – Messages and Recommendations

- Preliminary research identifying sector contributions to the P input pressure on the landscape
- SFA outputs and link to river P suggests major food system change may be required to reduce the river pollution threat – this focuses on the livestock industry and manure P excess
- Wastewater P losses are very high relative to P inputs and clearly need to be reduced (Targeted in AMP 7 and 8)
- Greater clarity required on how the surplus P inputs from agriculture impact river P pollution (Phase 2 for the IRZ)

Phase 2 - Work Objectives

Overall Aim

To quantify how the past (Historic analysis) and present (SFA) P input pressures from the agricultural sector link to river P status, and the prospects for reducing the P pollution threat

Part 1 - Quantification of legacy soil P dynamics

(a) Historic analysis of agricultural P inputs/offtake and surplus P in Somerset
(b) Catchment soil sampling programme to assess potential soil P release

Part 2 - Surplus reduction impacts on river P status

(a) Quantify the links between agricultural P surplus and measured river SRP/TP
(b) Collate available soil P results across the IRZ catchments
(c) Model links between ag. surplus P, soil P build-up and soil P release to runoff
(d) Review rundown rates of legacy soil P and implications for recovery timescales (literature)
(e) Assess impact on river P of reducing surplus P and soil P drawdown

Part 3 - Workshop and Phase 2 report - Autumn 2024

Phase 2 - Legacy Soil P Dynamics – Historic P surpluses

Objectives:

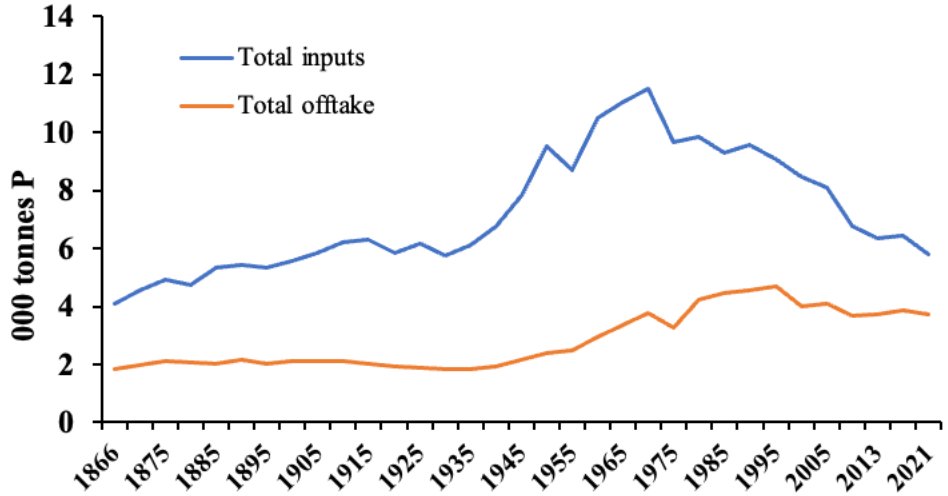
- Estimate potential legacy soil P reserves
- Understand legacy soil P release dynamics

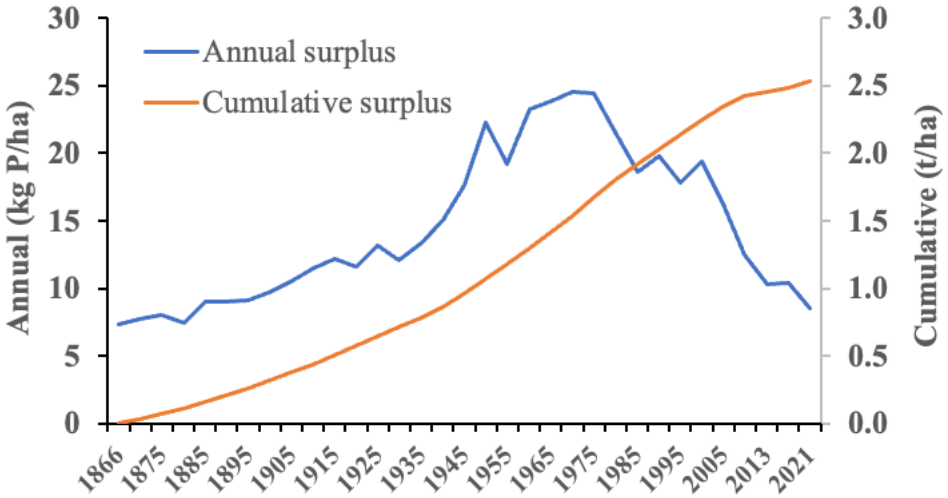
Methodology:

- Quantify fertilizer/manure P inputs against crop P offtake every 5 years from 1870 for Somerset
- Estimate annual and cumulative P surplus

Results:

- P Inputs have always exceeded P outputs
- Annual P surplus ranged from 7 – 20 kg P/ha/yr
- Cumulative P surplus ~ 2500 kg P/ha
- Equivalent to soil total P of +625 mg/kg total P





Phase 2 - Legacy Soil P Dynamics – Soil sampling programme

Objectives:

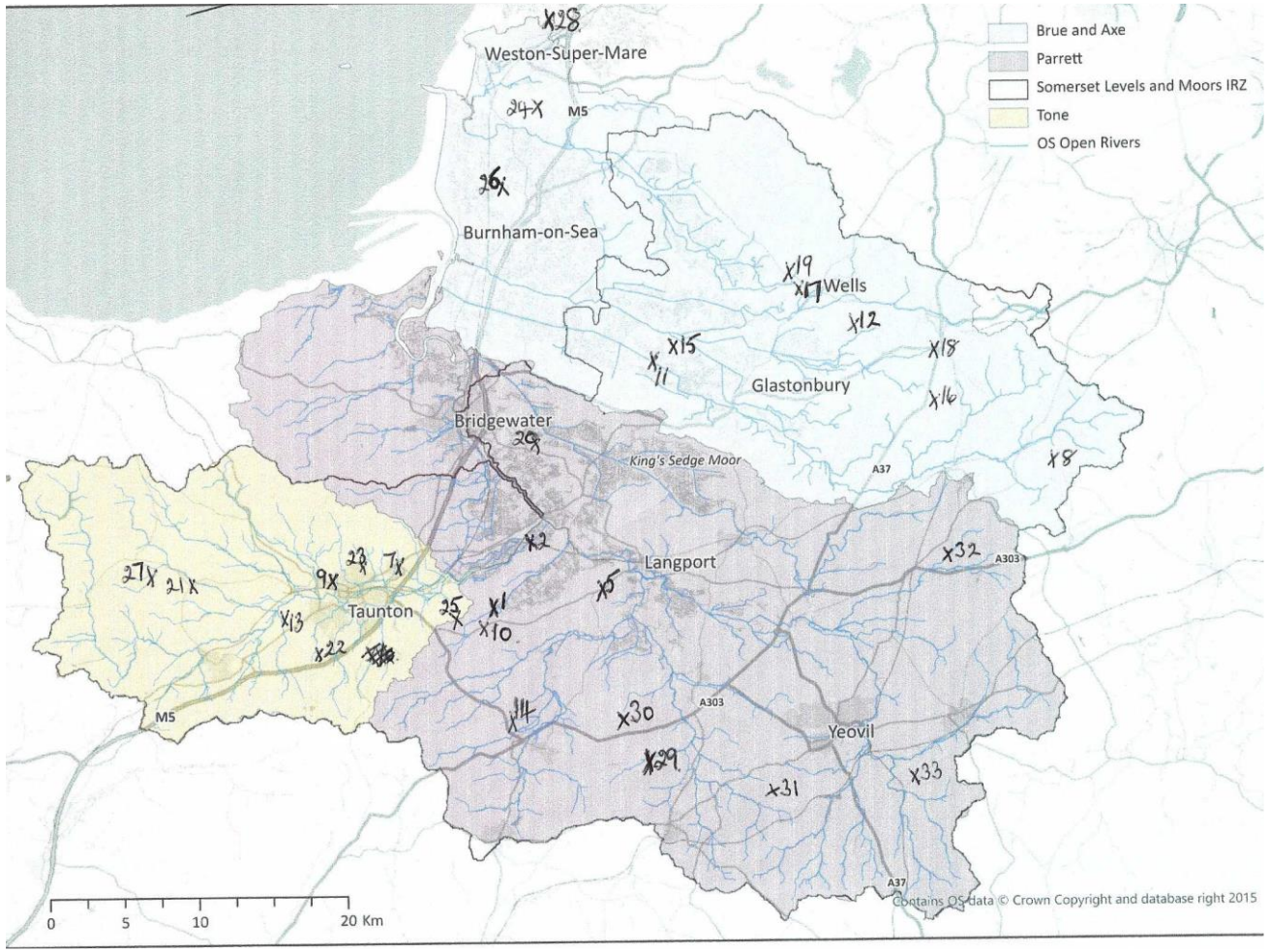
- Estimate legacy soil P in IRZ catchments
- Understand soil P release

Sampling strategy:

- Target soil type/soil P variation + native P
- 0-15 and 15-30 cm
- Span the three catchments

Soil analysis:

- pH, OM, PSD
- Water-P, Olsen-P, Total P
- Oxalate Fe, AL, P (P saturation)
- Single point isotherm (Buffering Index)
- DESPRAL analysis



26 farms participating, 236 samples in total

Phase 2 - Agricultural Surplus P v River P status – ongoing

Agricultural Surplus P v River SRP/TP

Objectives:

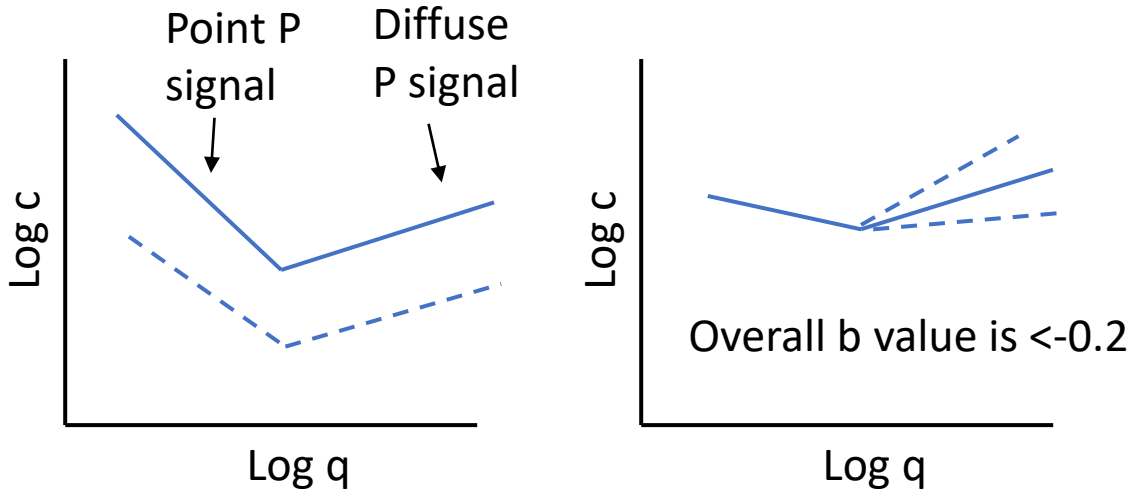
- To assess the impact of agricultural P surpluses on river P status

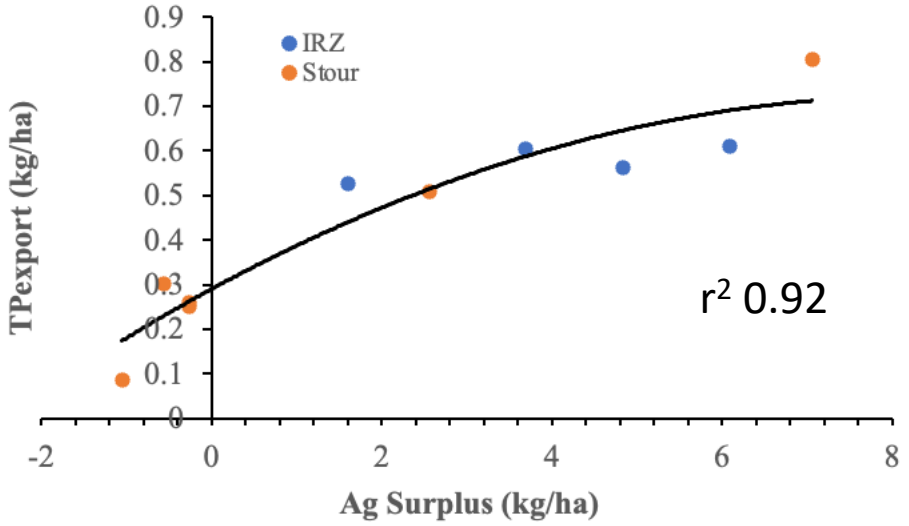
Methodology:

- CQ analysis of diffuse river P loads
- Compare with sub-catchment P surpluses
- Compare to national data

Results:

- Apparent relationship established
- Holds firm across Stour/IRZ





Predicting Legacy Soil P Release

Objectives:

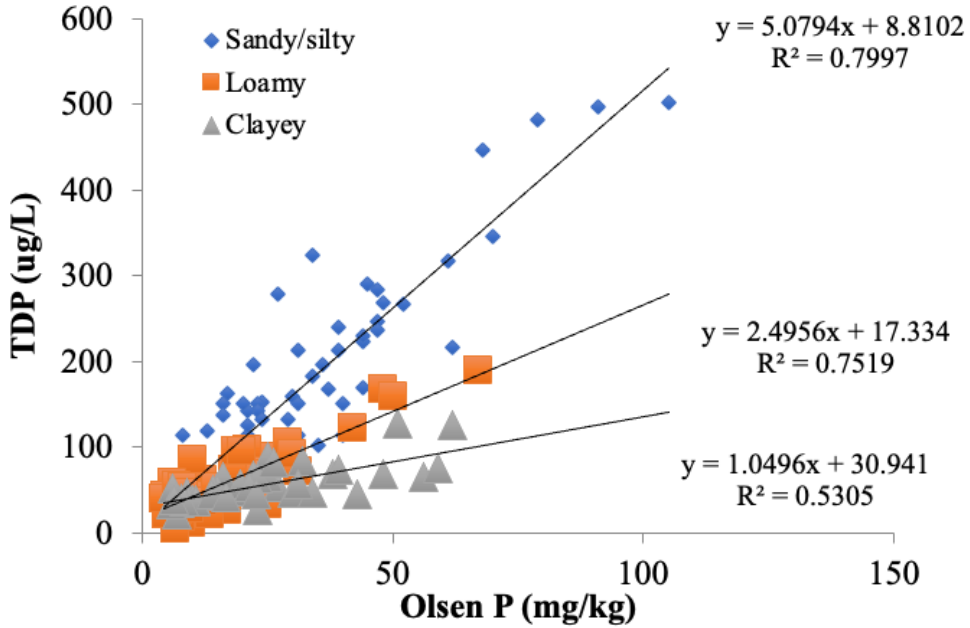
- To collate catchment soil P data and model soil P release to runoff

Methodology:

- Collate available catchment soil P data
- Predict soil SRP release based on soil type and land use
- Compare to DESPRAL data

Results:

- Soil P data still being collected
- Soil type v SRP release established under PLT
- Establish distribution of soil types
- DESPRAL analysis still to do.



Questions