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EU EAA Soil Sampling & Analysis Scheme:

Soil and Catchment modelling

Alex Higgins, Rachel Cassidy, Phil Jordan, Ian Thomas, John Bailey

afbini.gov.uk

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Objectives

To provide eligible livestock farmers with detailed information on their soils so that they can apply nutrients and lime in accordance with crop requirements and thus:

Improve Profitability:

- **Increased Grass and Forage yields**
- **Optimized Soil Fertility - pH, P & K**
- **Optimized distribution of Manure Nutrients – and prevent over or under-supplies of nutrients**

Improve the Environment:

- **Reducing Risk of Nutrient Loss to water-bodies**

Improve sustainability at field → farm → catchment scales

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Objectives

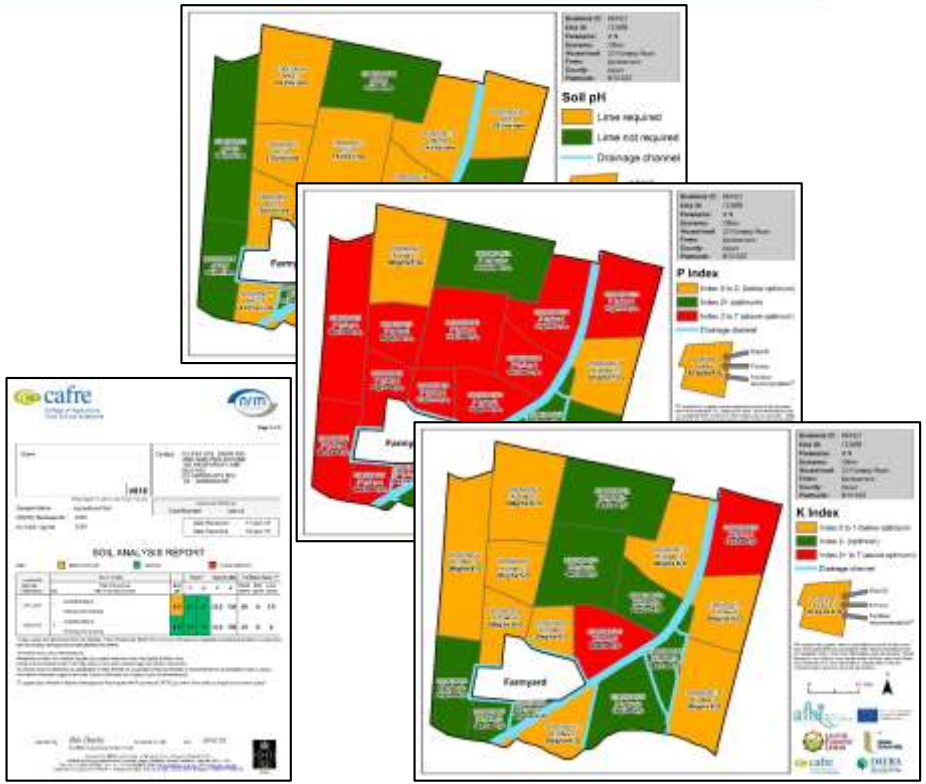
Objectives addressed by:

- Providing free whole-farm soil sampling

- Analysis and results provided through an accredited laboratory – results tailored to NI requirements

- Free training on soil report interpretation and nutrient management

- LiDAR mapping of the catchment to produce nutrient loss risk maps.



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EU EAA Scheme

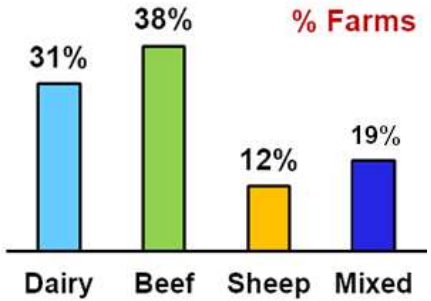
The EU EAA Scheme had two Components: (totalling approximately 20,000 fields)

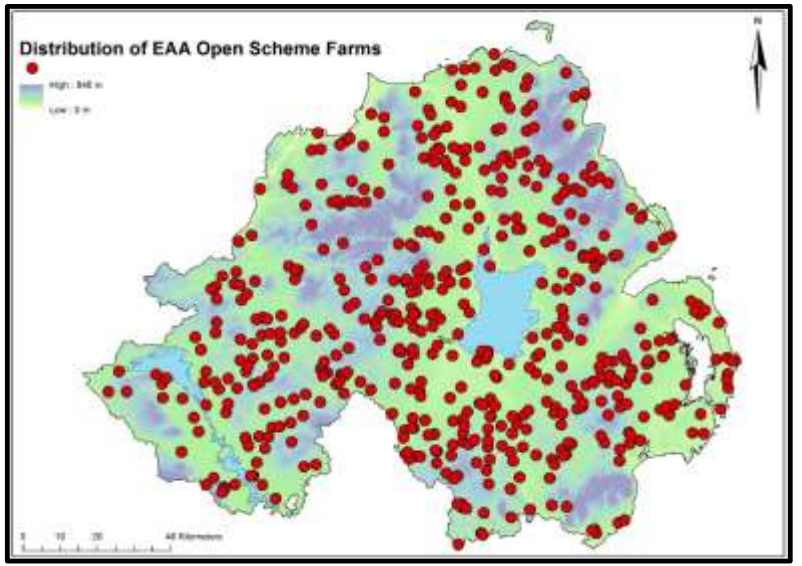
1 - The Open Scheme

522 farms participated

12,600 fields sampled

22,200 ha sampled





Dots are a graphical representation only - and are not indicative of specific farm locations

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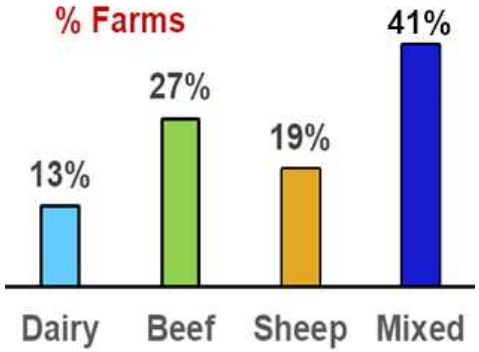
EU EAA Scheme

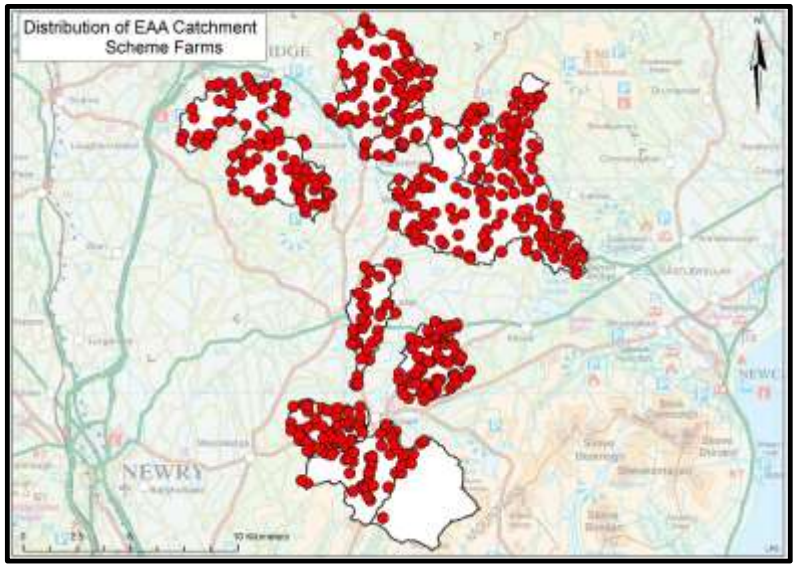
2 - The Catchment Scheme – 11 sub-catchments of the Upper Bann River system

513 farms participated

7,300 fields sampled

11,500 ha sampled





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Results – Catchment Scheme

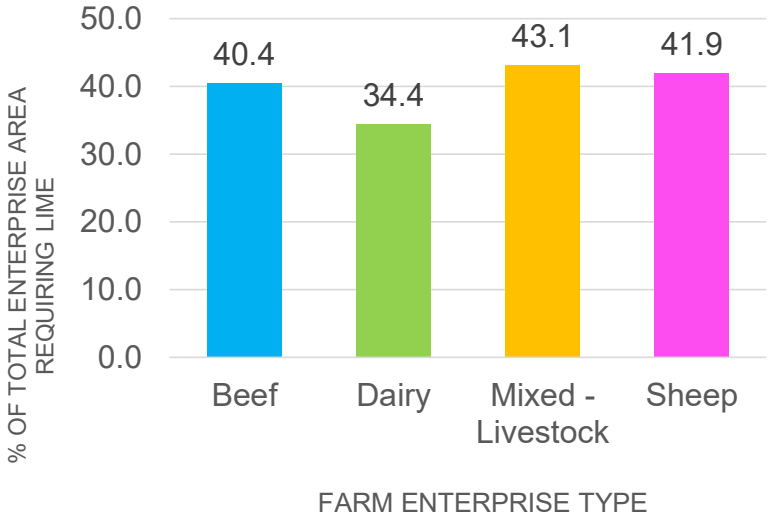
Soil pH Target:

pH 6.0 - Continuous Grassland on Mineral Soil

pH 5.3 - Continuous Grassland on Peaty Soil

pH is the most important soil parameter, ensuring that the soil environment is optimal for production.

- **40%** of the grassland area found to require lime and potentially loosing significant dry matter production



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Results – Catchment Scheme

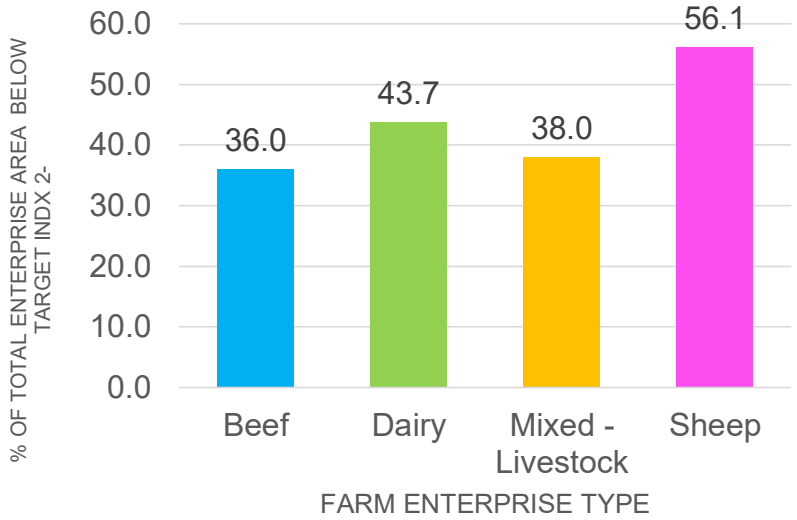
Soil available Potassium - K:

Target: Soil Index 2-

- Index 2- range (121-180mg l^{-1}) optimal to maximize grass utilization of nitrogen but avoid luxury uptake of K

  42% of the tested grassland area fell below Index 2-
- Soils at K Index >3 are too high and could trigger animal health problems (grass tetany and milk fever)

  2% tested grassland area found to be above Index 3



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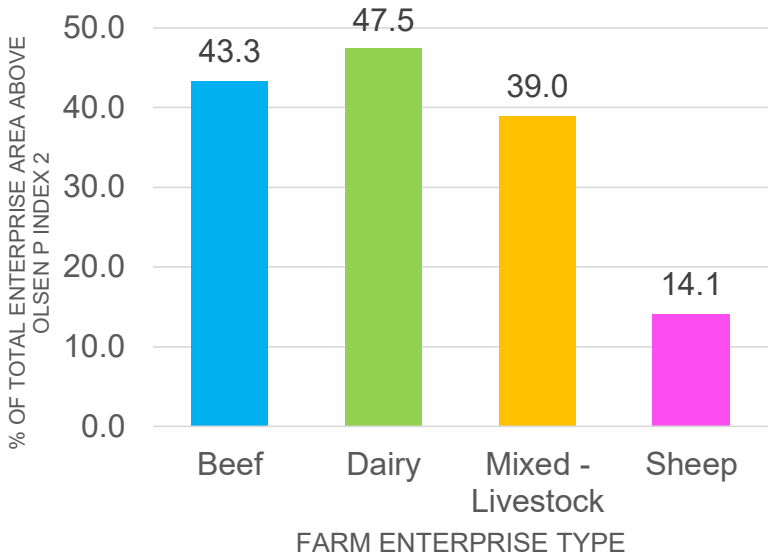
Results – Catchment Scheme

Soil available Phosphorus - P:

Target: Soil Index 2

Intensively managed grassland soil P should be maintained at Olsen Index 2+ (21-25 mg P l^{-1}) on more extensively managed grassland P should be Olsen Index 2- (16-20 mg P l^{-1})

- **34%** tested grassland area found to be at the target Index 2
- **38%** tested grassland area found to be above Index 2



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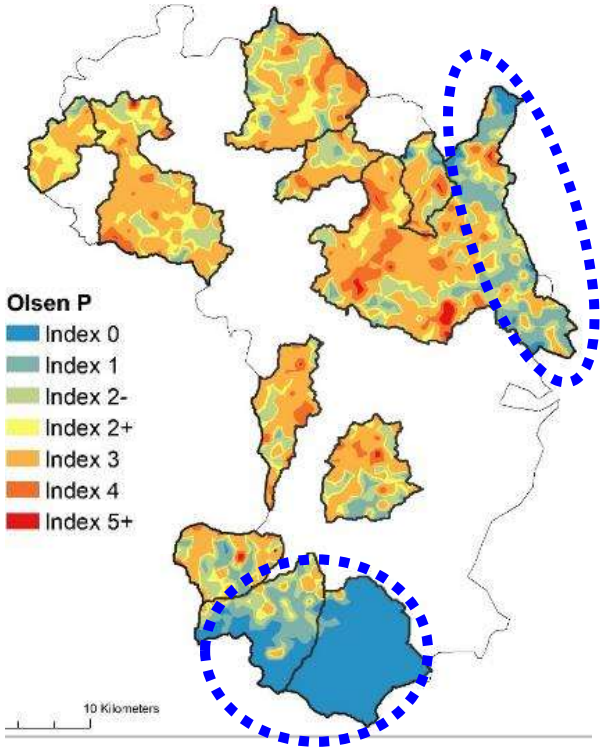
Catchment Scheme - P

Crop excess soil P is an issue because:-

- P is a growth limiting nutrient in aquatic systems
- Soils found to be at or above Olsen Index 3 have been shown to loose higher rates of P, primarily through surface processes
- The distribution of excess soil P is spatially uneven throughout the catchment
- To focus on the potential management of this issue LiDAR imagery was obtained for the catchment



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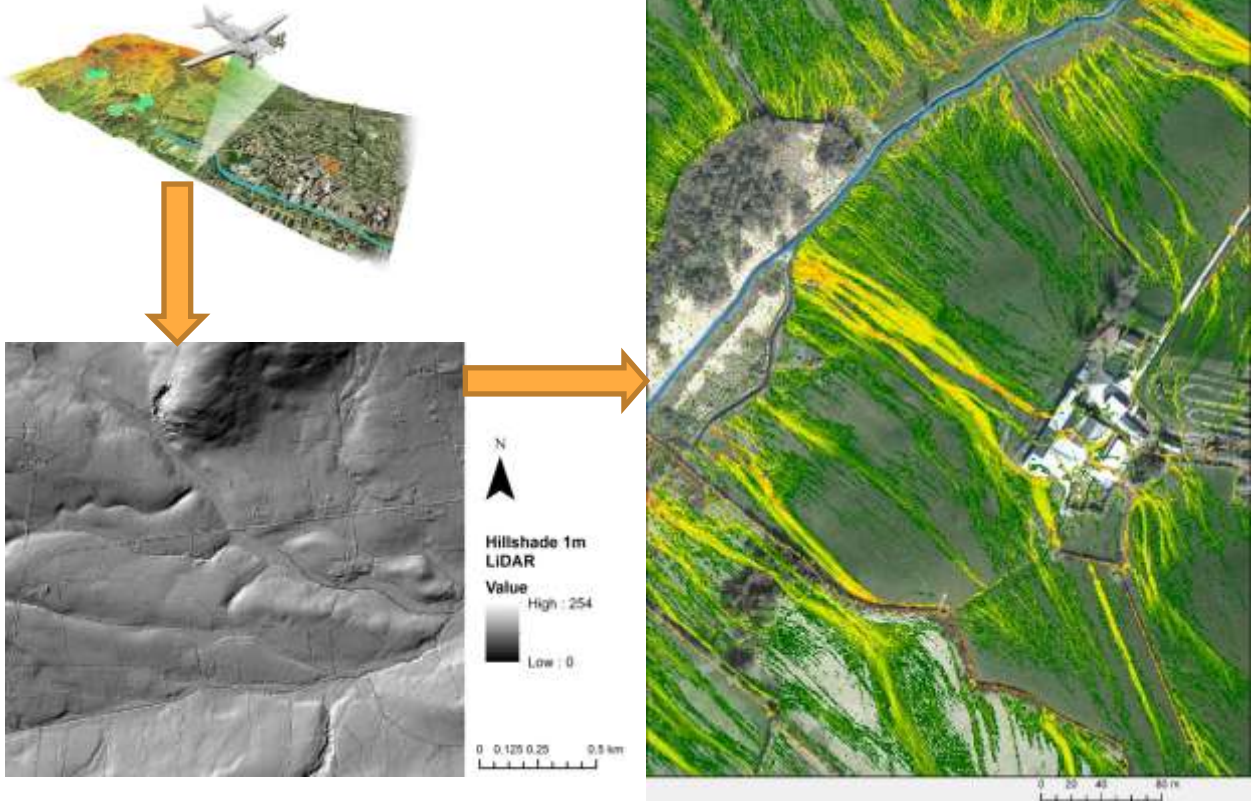
Catchment Scheme – P - LiDAR

- Detailed – 4-6 points per m^2 with associated elevation data
- This allows the production of a seamless water flow computer model for the catchment
- Identification of those areas where overland flow generation will take place - Hydrologically Sensitive Areas



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Catchment Scheme – P - LiDAR

Hydrologically Sensitive Areas – HSA

- Zones of prolonged saturation and ephemeral surface water accumulation

- Primary route for surface delivery of dissolved and suspended nutrients to aquatic systems

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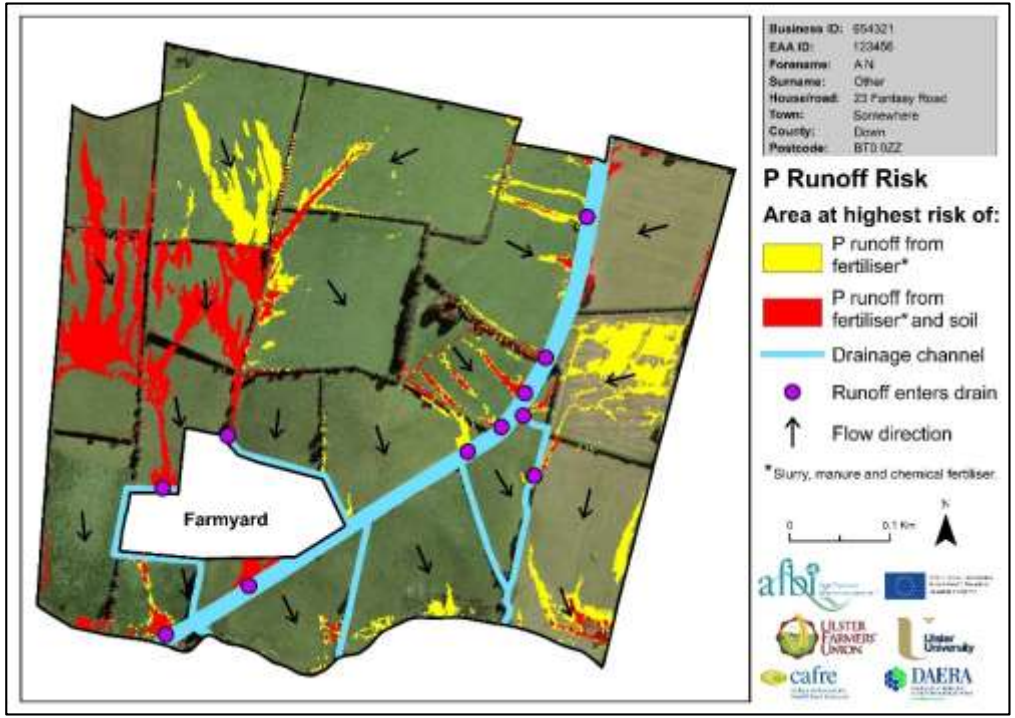
Catchment Scheme – P - LiDAR

Identification of Hydrologically Sensitive Areas (HSA) allowed the production of nutrient loss risk maps

- Sub-field identification of risky areas
- Identify target areas for mitigation measures (interception)
- Avoid blanket measures



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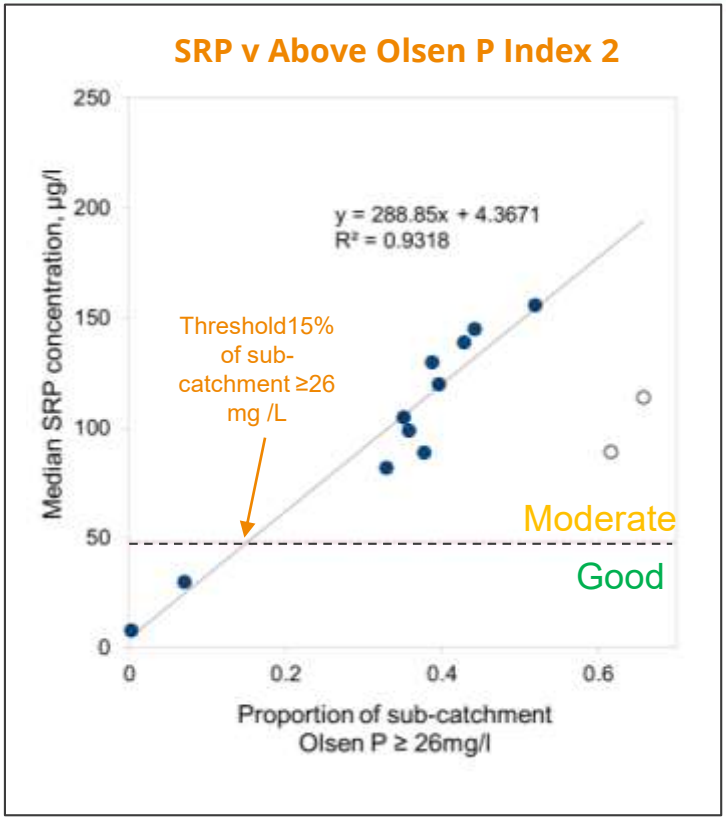
Water Quality

AFBI have an established water chemistry sampling network within the Upper Bann sub-catchments

- Fortnightly sampling in 13 sub-catchments
- Examine relationships between in-stream P (SRP) and soil and runoff risk distributions for the catchments
    - Annual median SRP in the measured catchments ranges from 8.5 to 145 µg P L^{-1}
    - Strong seasonal variation



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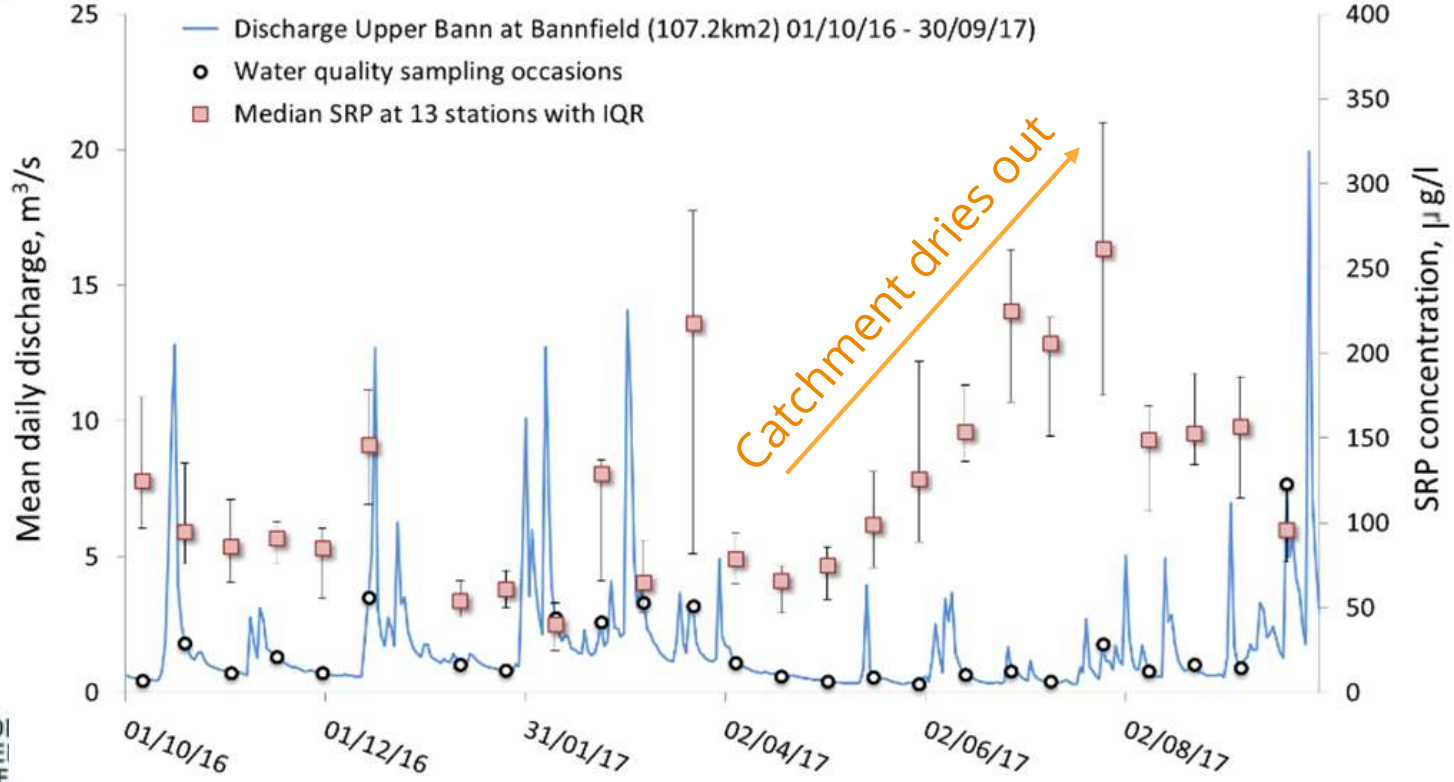
Water Quality

As the catchments dry out in summer the SRP concentration increase significantly.



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Water Quality

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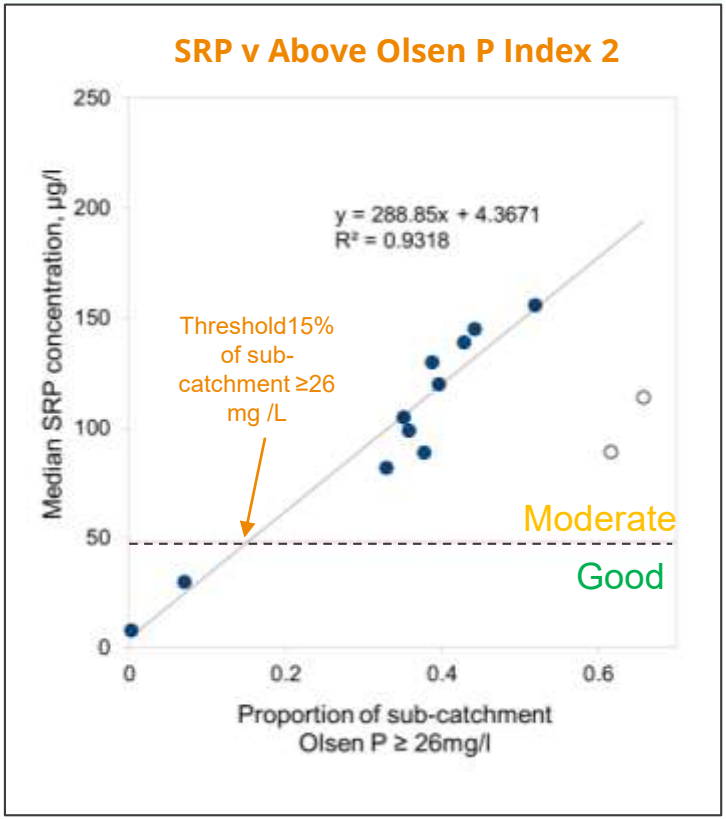
- Linear relationship between in-stream SRP and proportion of catchment above Olsen P Index 2
- Threshold SRP to avoid eutrophication <15% of sub-catchment above Olsen P Index 2



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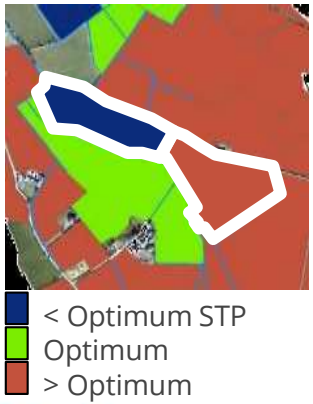
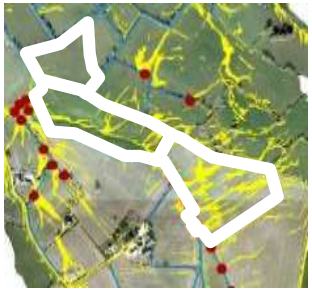
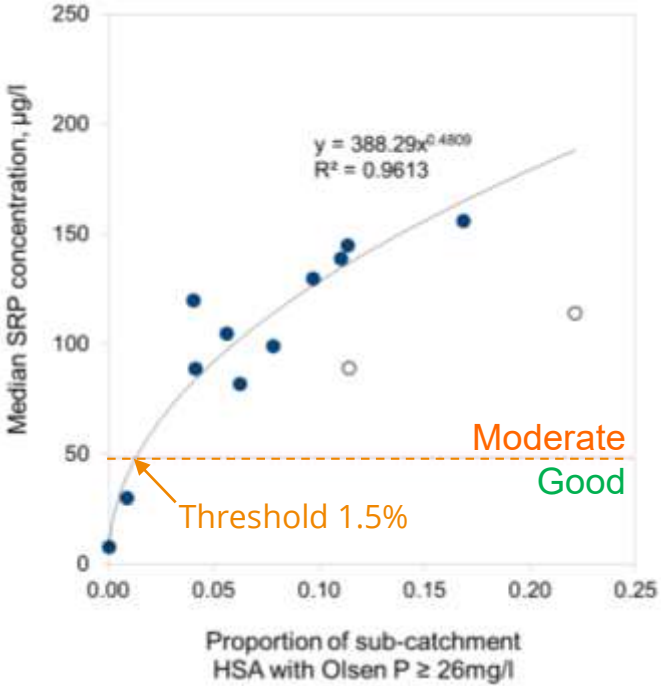
Water Quality

- Power relationship between area with high soil test P and runoff risk and SRP concentration in-stream.
- Catchments with high HSA & >optimum soil P will require reduction to ~1.5% of sub-catchment





SRP v HSA & Above Olsen P Index 2



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Conclusions

- Highly successful scheme, over 70% participation – we would like to thank again all the participating farmers for allowing AFBI to collect this highly useful data.
- Sustainable increase in quality and quantity of grass could be achieved through correcting sub-optimal soil pH (40% of grassland tested) and soil K status (42% of grassland tested).
- Soil P levels excessive to plant requirement are a concern because of their potential impact on aquatic systems (38% of grassland tested Olsen >Index 2).
- Water sampling indicates a strong relationship to the proportion of the catchment with excess soil P levels and HSAs in combination with excess soil P in relation to overall river water quality.
- Soil nutrient and runoff risk mapping can be a potentially useful tool to target and manage nutrients at farm scale, both to protect the environment and conserve a valuable nutrient.

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Thank You