

Managing the Risk of Phosphorus Loss from Slurry Applications in Northern Ireland

DAERA E&I Project 17/04/08

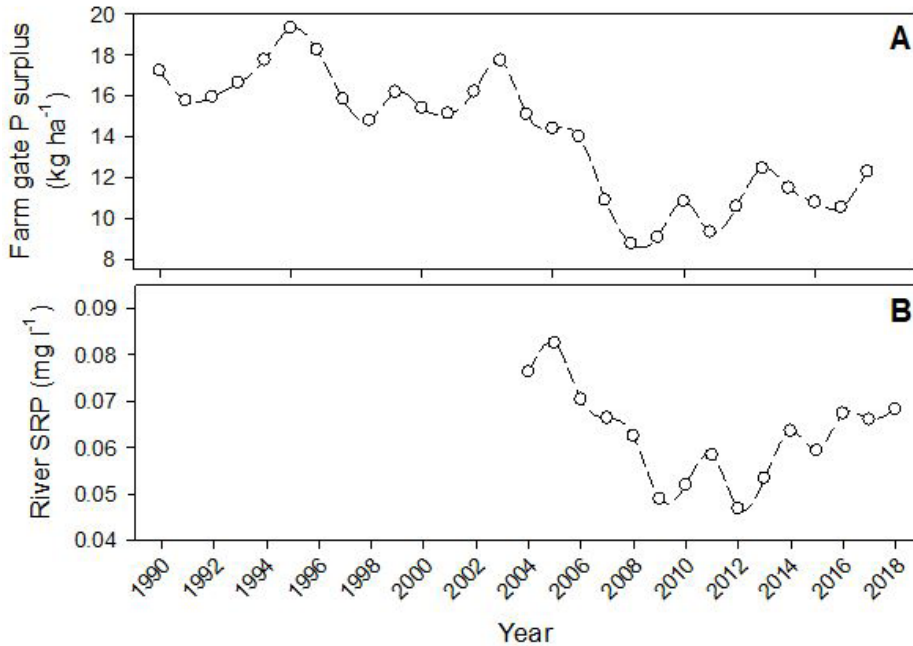
Russell Adams, Aine
Anderson, Peter Vadas, Owen
Fenton, Pat Tuohy, Donnacha
Doody.

19th Novemebr 2021

afbini.gov.uk

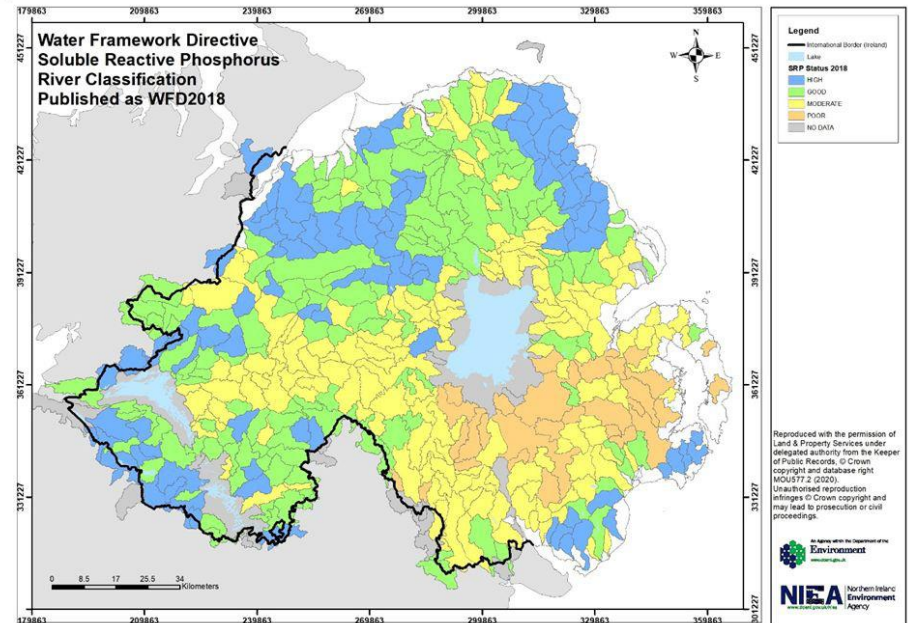


Water Quality in Northern Ireland



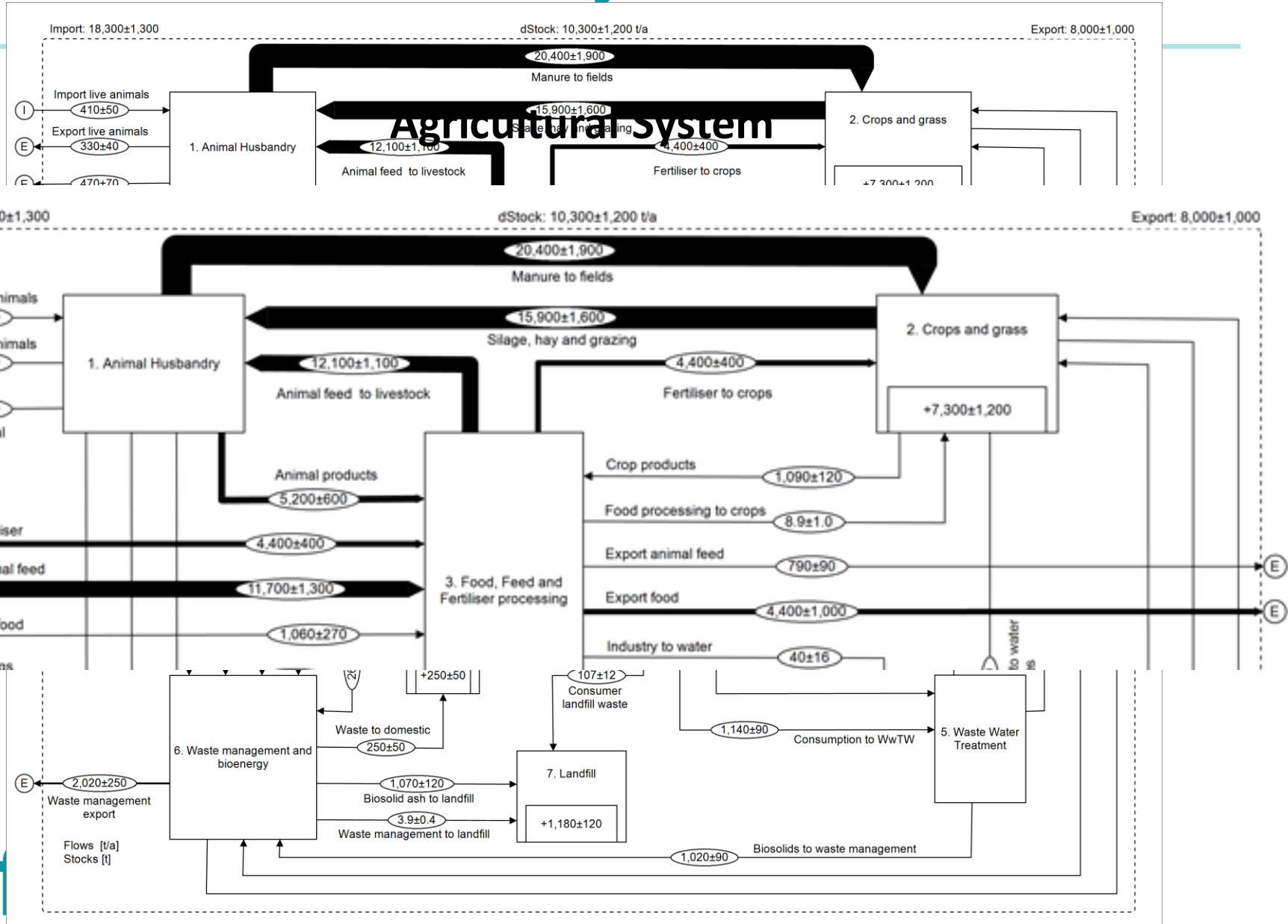
940 tonnes agricultural P lost to water

61% of waterbodies are above the target required for good status



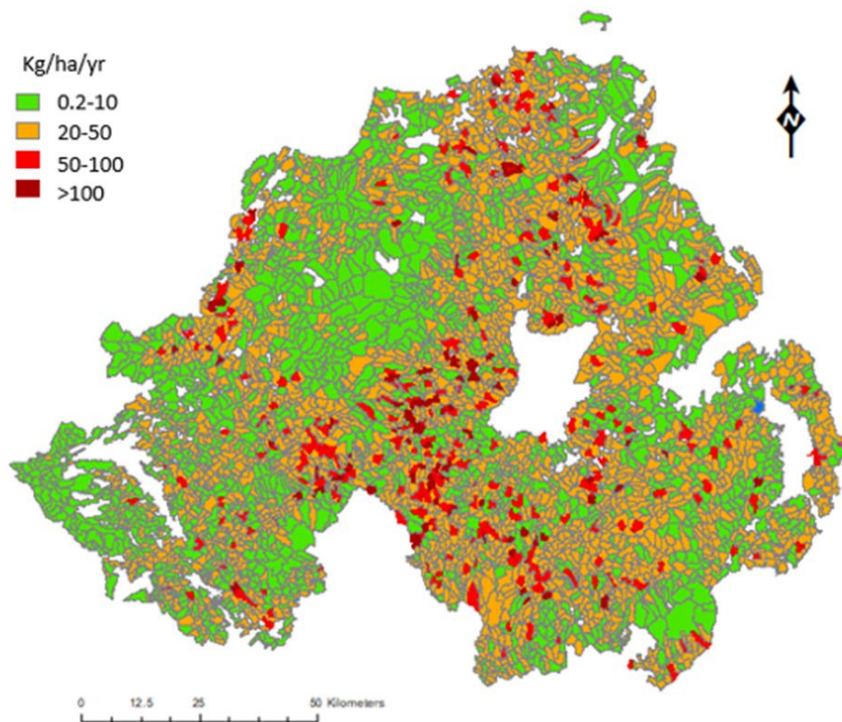
P Substance Flow Analysis.

Rothwell, et al *Resources, Conservation and Recycling*, 163, p.105065.

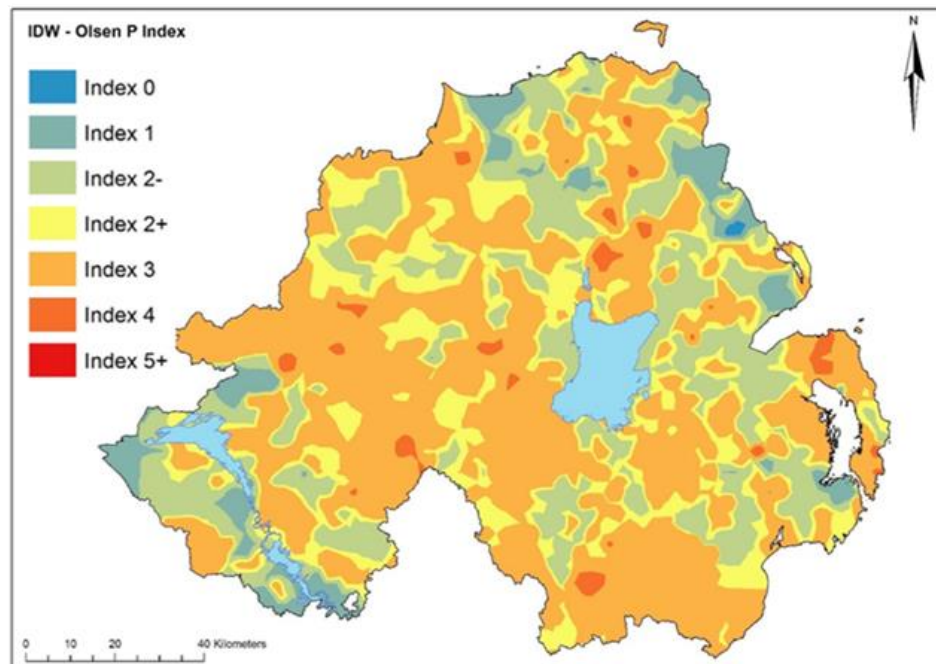


Phosphorus Surplus - Spatial Distribution

P Load -Townlands

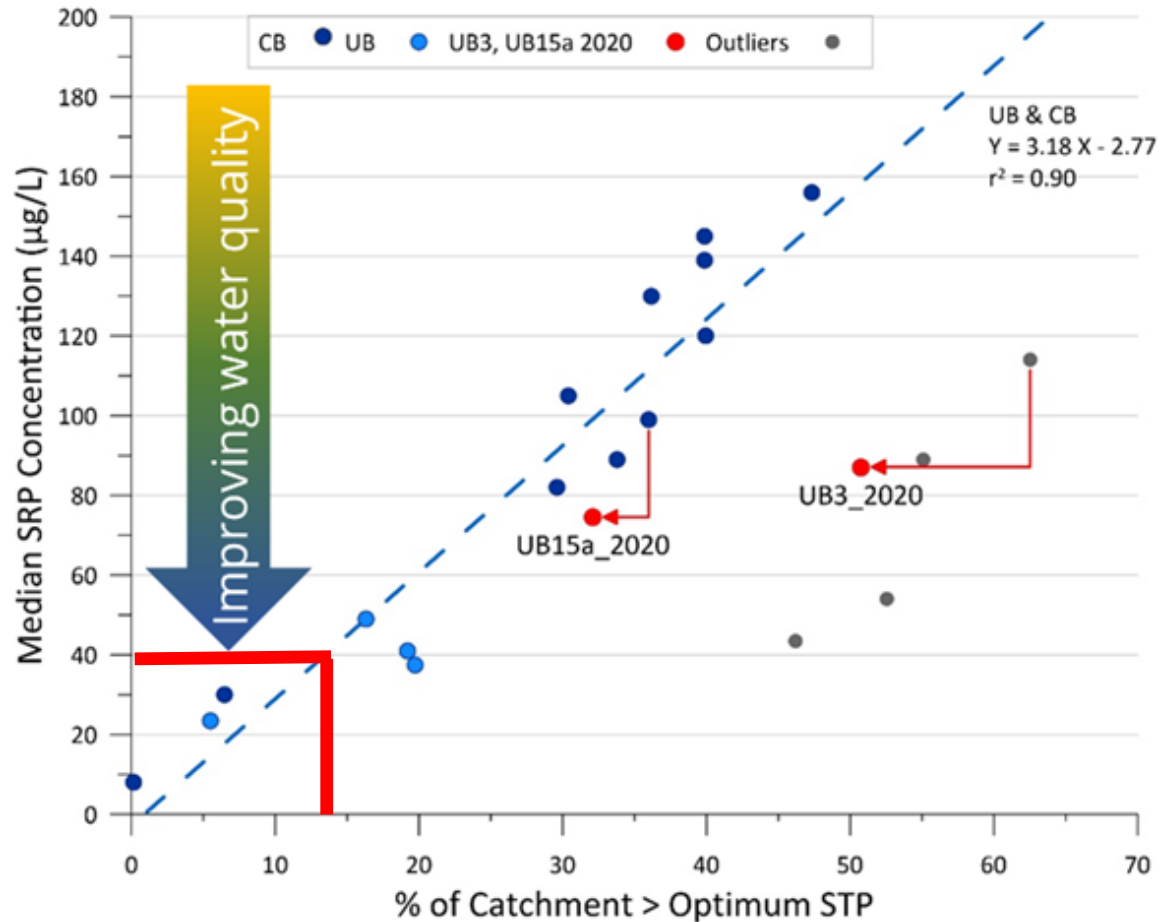


Olsen Soil P



Achieving Water Quality Targets Upper Bann Catchment

- Currently 41% of soil in the Upper Bann Catchment are above agronomic optimum soil P
- WFD Target in the Upper Bann Catchment is 40µg/l
- To achieve this target only <15% can be above agronomic optimum



Nutrient Action Programme

STATUTORY RULES OF NORTHERN IRELAND

2019 No. 81

ENVIRONMENTAL PROTECTION

The Nutrient Action Programme Regulations (Northern Ireland)
2019

Made - - - - 8th April 2019

Coming into operation - 11th April 2019

CONTENTS

Restrictions on Slurry Application

Closed Period 15th October to 31st January

No application on

- waterlogged or frozen soils
- if heavy rain (4 mm hr^{-1}) within 48hrs
- Steep slopes (average incline $\geq 20\%$)

Set back distances from watercourses

Application rates $\leq 50 \text{ m}^3 \text{ ha}^{-1}$

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Other Considerations

Storage Capacity

Next opportunity to spread

Maximise nutrient efficiency

Animal welfare

Soil compaction

Contractor availability

Timing of other farm activities

Runoff Risk - Spatial Variability



High Runoff Potential

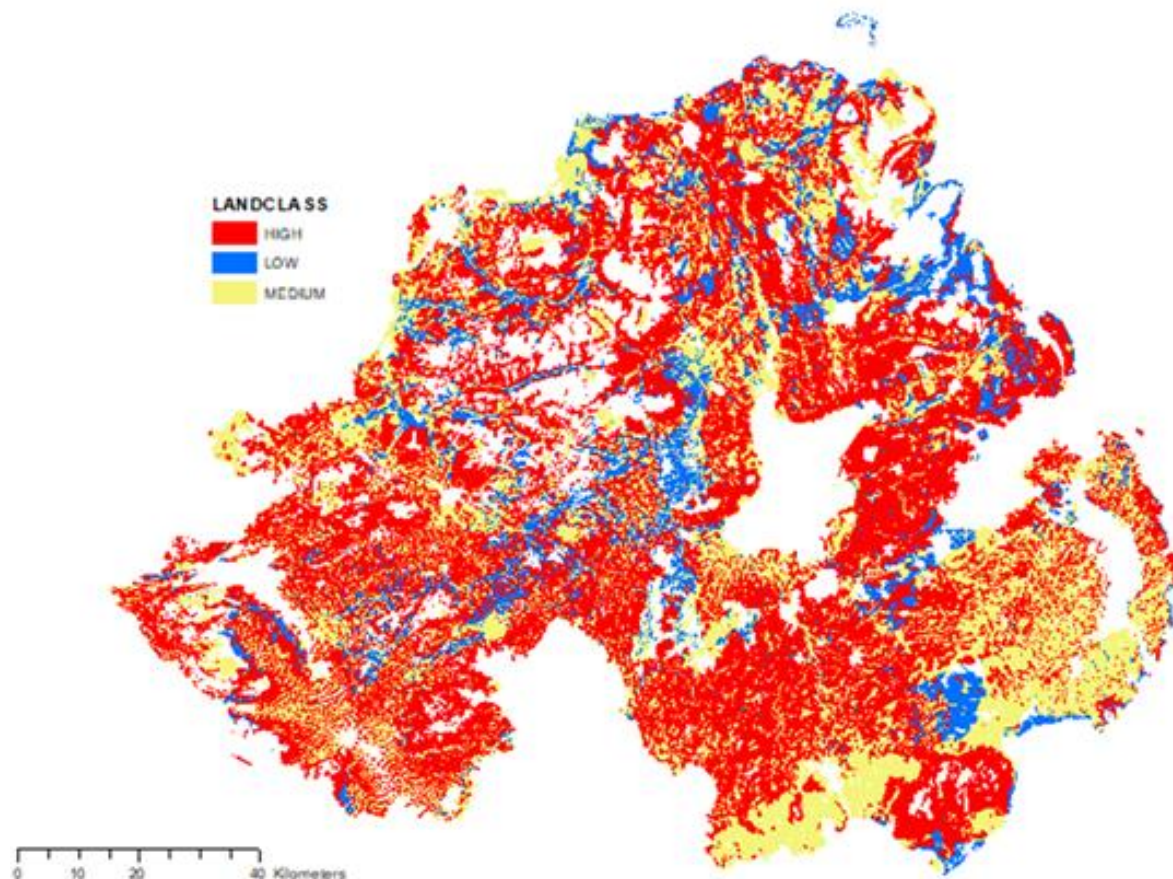
58%

Medium Runoff Potential

31%

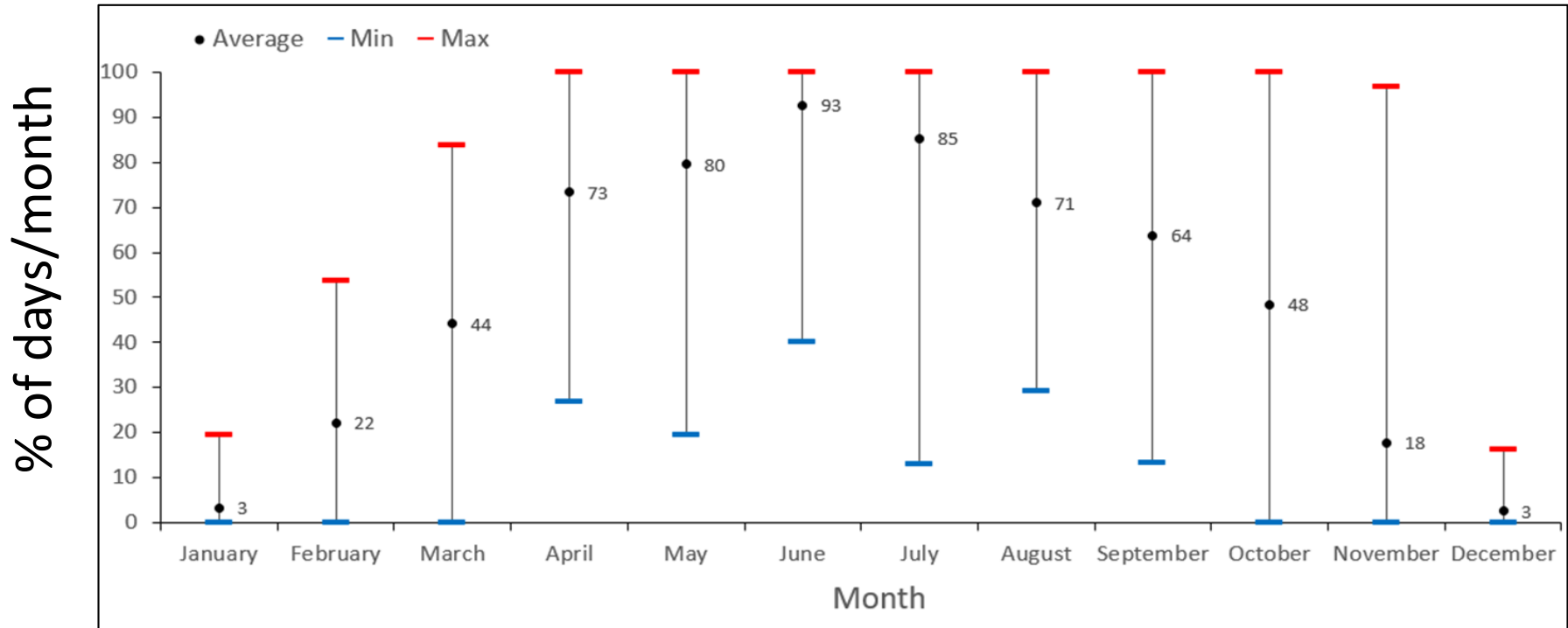
Low Runoff Potential

11%



Runoff Risk – Temporal Variability

Number of days > 0 mm soil moisture deficit



Soil Moisture Deficit (SMD)

0 mm SMD = Field Capacity

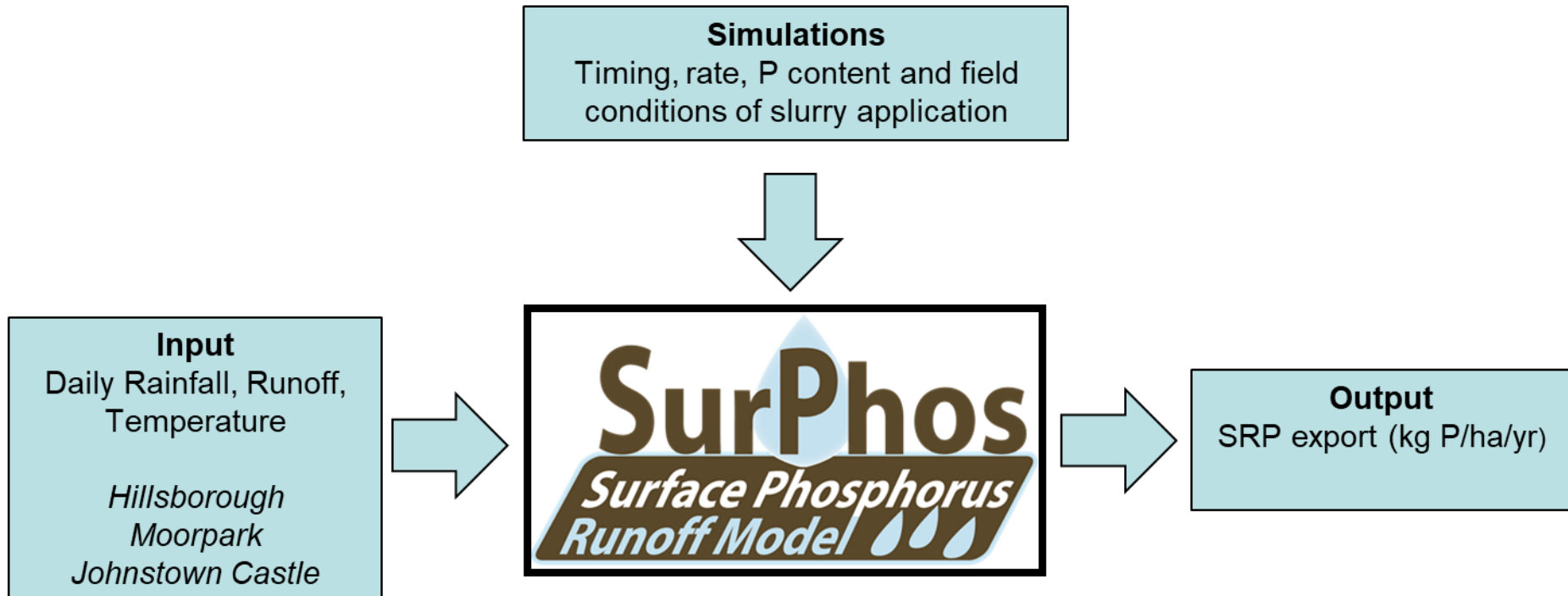
-10mm SMD = Saturated Soil

> 0mm SMD = Soil Getting Drier

For Slurry Spreading

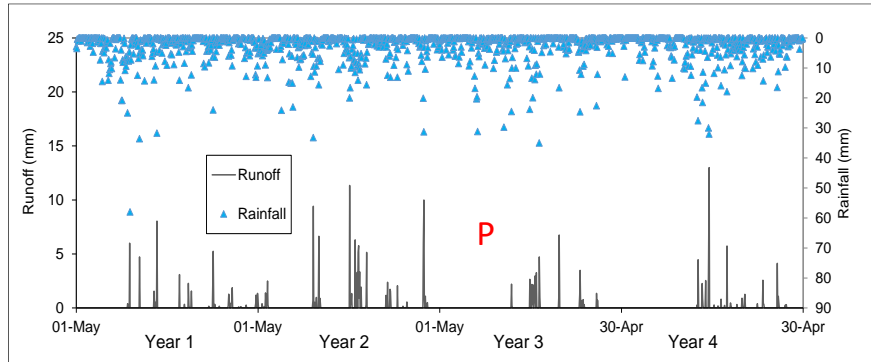
0-5mm SMD

How well do the current NAP regulations mitigate the risk of P loss due to slurry applications in Northern Ireland?

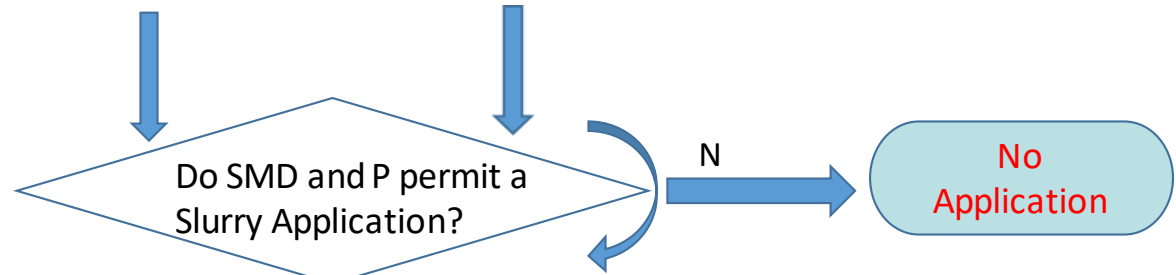
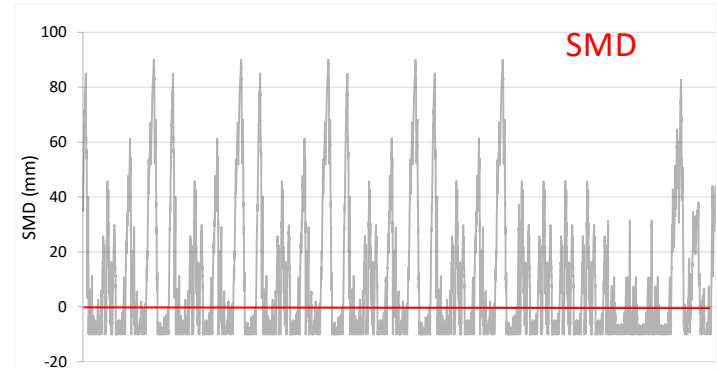


Modelling Overview

Rainfall Data



Soil Moisture Data



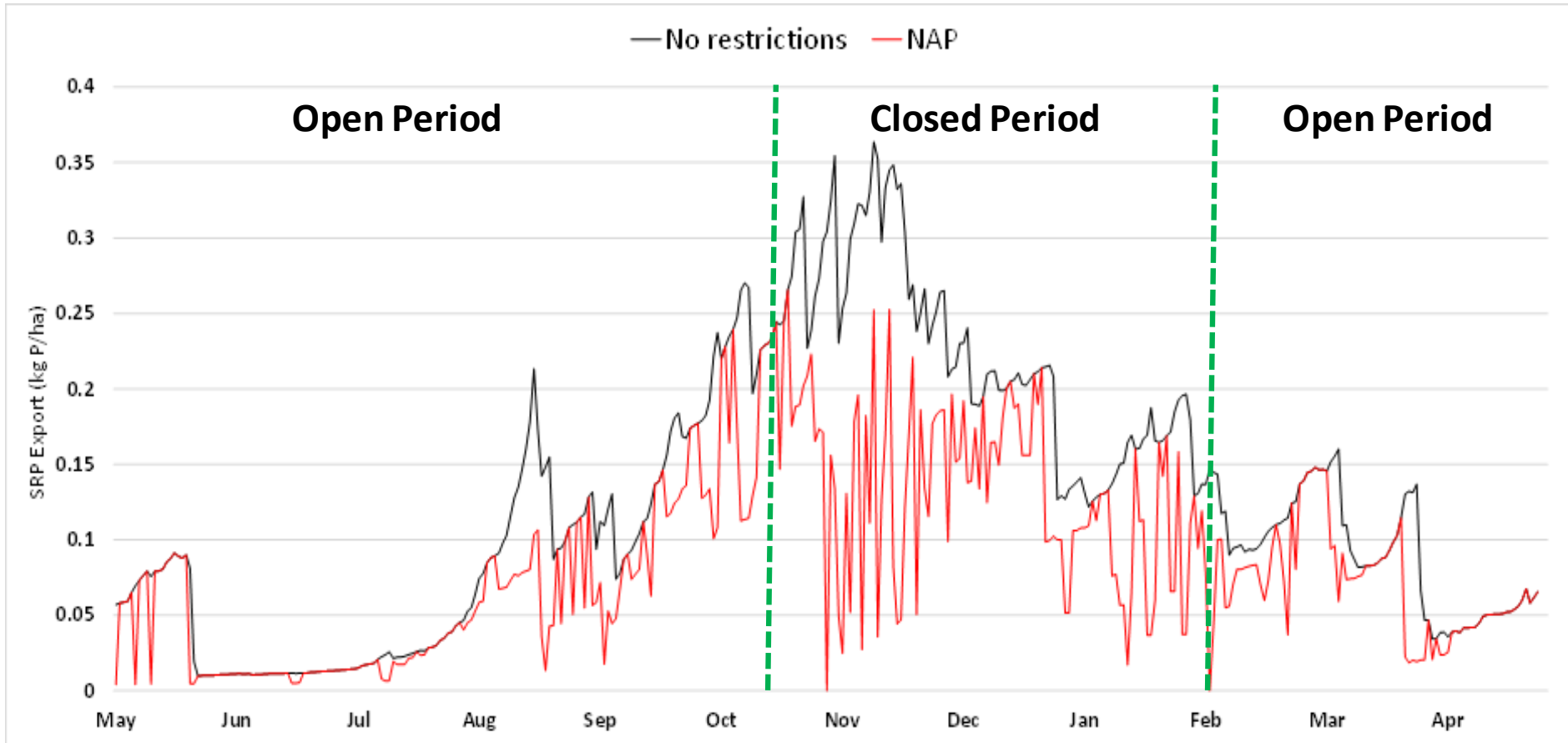
Repeats 365 times from 1st May to 30th April



Application Rate According to Scenario

Surphos Model Simulates Application

Mean SRP Loss



Key Findings

- NAP regulations result in 24% reduction in P loss during the open period
- If slurry spreading was allowed during the closed period P losses would be 52% higher than in the open period
- Even with the NAP Regulation significant losses of P are occurring

Additional Mitigation Measures

- **Right Time, Right Place**

- Access to high resolution soil and weather data

- **Phosphorus content of slurry**

- Reducing the P content of slurry by 10% (P10) & 30% (P30)

- **Application rates**

- Application rates of 50 m³ ha⁻¹ (A50) 30 m³ ha⁻¹ (A30) 10 m³ ha⁻¹ (A10)

- **Longer closed period**

- Extension of the closed period from the 1st October to 28th February

Right Time, Right Place

Compared to Poorly Drained Soils

- 46% less P loss from moderately drained soils
- 87% less P loss from well drained soils



Limit applications to ≥ 0 mm SMD in the Open Period - 44% reduction in SRP export

Lower Phosphorus Content of Slurry

Lower P in Diets

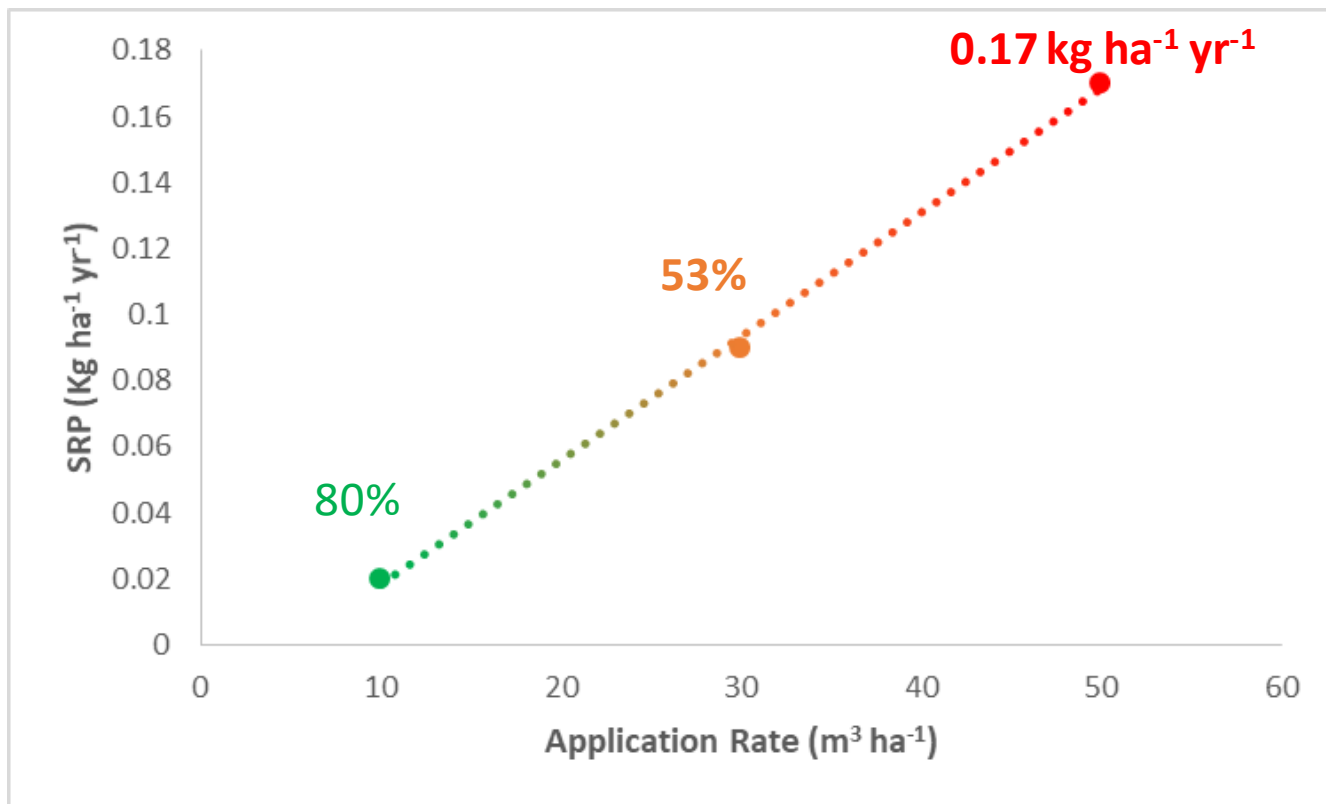


Lower P in Slurry

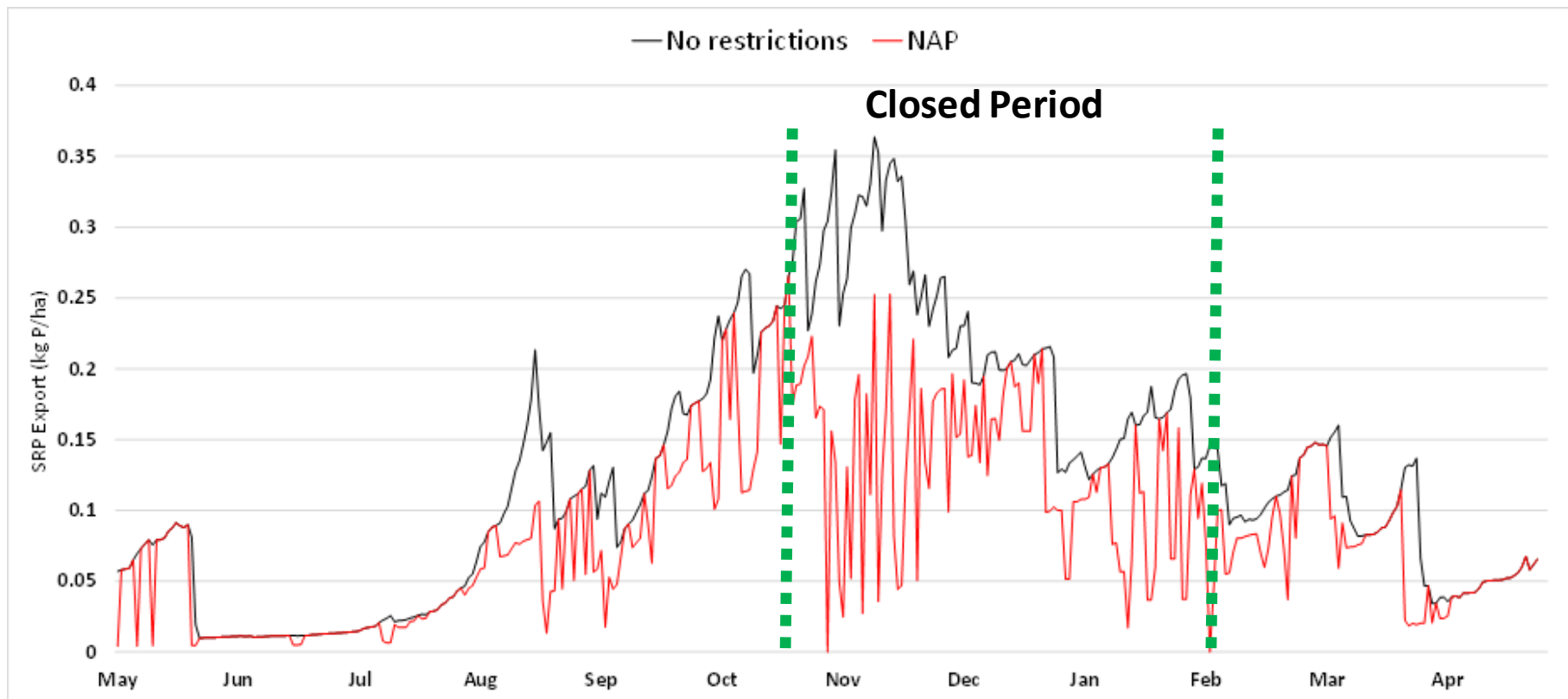


Reduction in P Content	Reduction in P loss
10%	11%
30%	29%

Reduced Application Rates

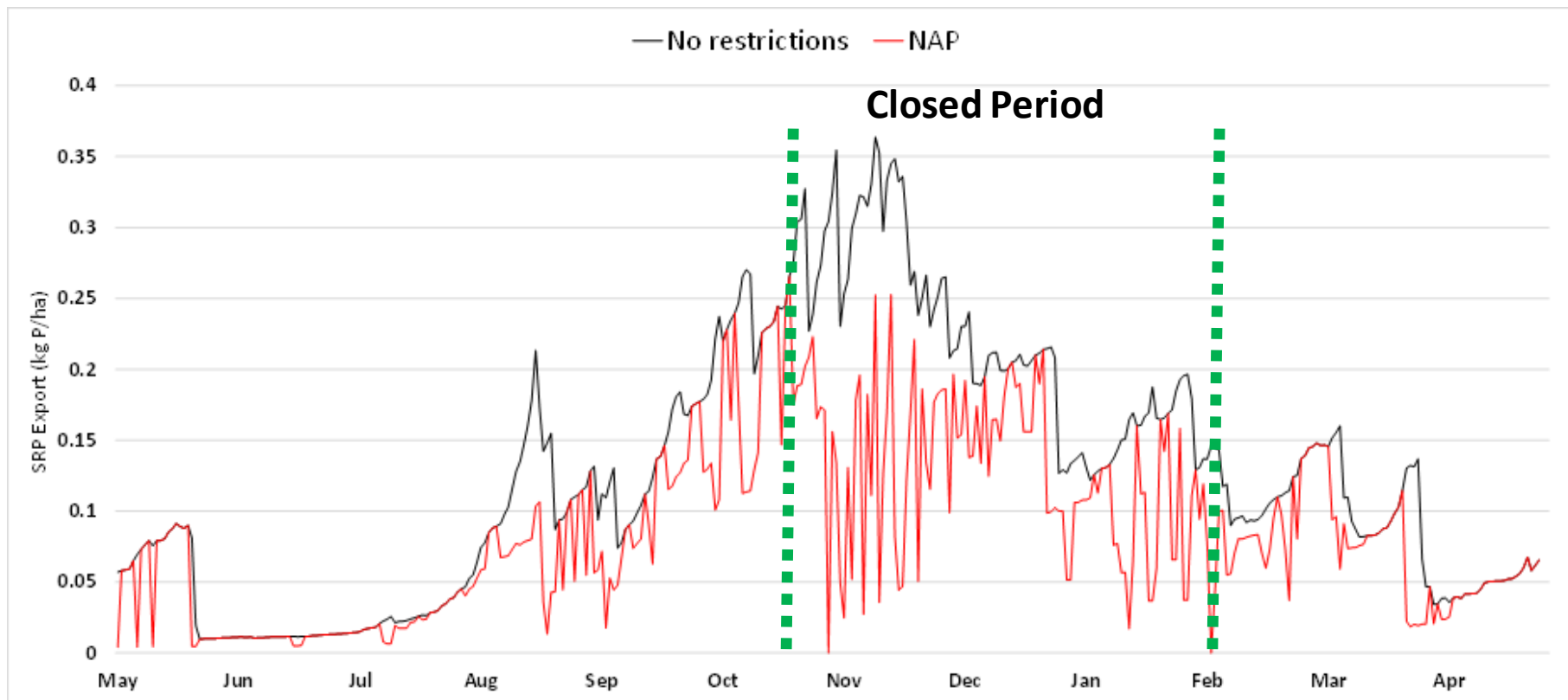


Longer Closed Period



Dates	SRP Open Period	% Change
15 th Oct- 31 st Jan	0.065 kg ha ⁻¹ yr ⁻¹	-
1 st Oct – 29 th Feb	0.056 kg ha ⁻¹ yr ⁻¹	-14%

Shorter Closed Period



Dates	SRP Open Period	% Change
15 th Oct- 31 st Jan	0.065 kg ha ⁻¹ yr ⁻¹	-
1 st Oct – 29 th Feb	0.056 kg ha ⁻¹ yr ⁻¹	-14
15 th Oct – 31 st Dec	0.068 kg ha ⁻¹ yr ⁻¹	+4.5

Reducing the National P Surplus

SFA Scenario Analysis

- Fertiliser P import and use reduced by 75%
- Animal feed P concentration reduced to 0.35%
- Export 20% of the manure P



- Surplus (kg/ha) 1.6 (-81%)
- **Predicted river SRP (ug/l) 35 (-40%)**
- P import (t/yr) 12,269 (-33%)
- Food system efficiency % 58 (+20%)

Doody et al 2020

<https://www.afbini.gov.uk/publications/rephokus-report-oct-2020>

Take Home Messages

- Slurry spreading inherently risky practice
- NAP Regulation are making a difference
 - Dependant of Right Time, Right Place
 - Need high resolution rainfall and soil moisture data
- Only ~5% of the P lost to water, will causes water quality decline
- More P in slurry than is required for agronomic purposes



Thank You



Any Questions?