

# Phosphorus Management & Soil P Trends in Agricultural Catchments

Soil Fertility Conference  
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# Impact of Poor Soil Fertility & Nutrient Management

## Costing farms

- 3t DM/ha/yr grass growth
- Approx net €540/ha/yr
- P fertilizer wasted to Index 4 soils average €90/ha/yr



## Deterioration of the environment

- Increase emissions of potent greenhouse gases, carbon and ammonia (poor nitrogen use efficiency)
- Nitrogen & Phosphorus losses to ground and surface waters.



*Independent.ie*  
18/10/18 “€2bn per year-the potential cost of climate change for Irish farming”



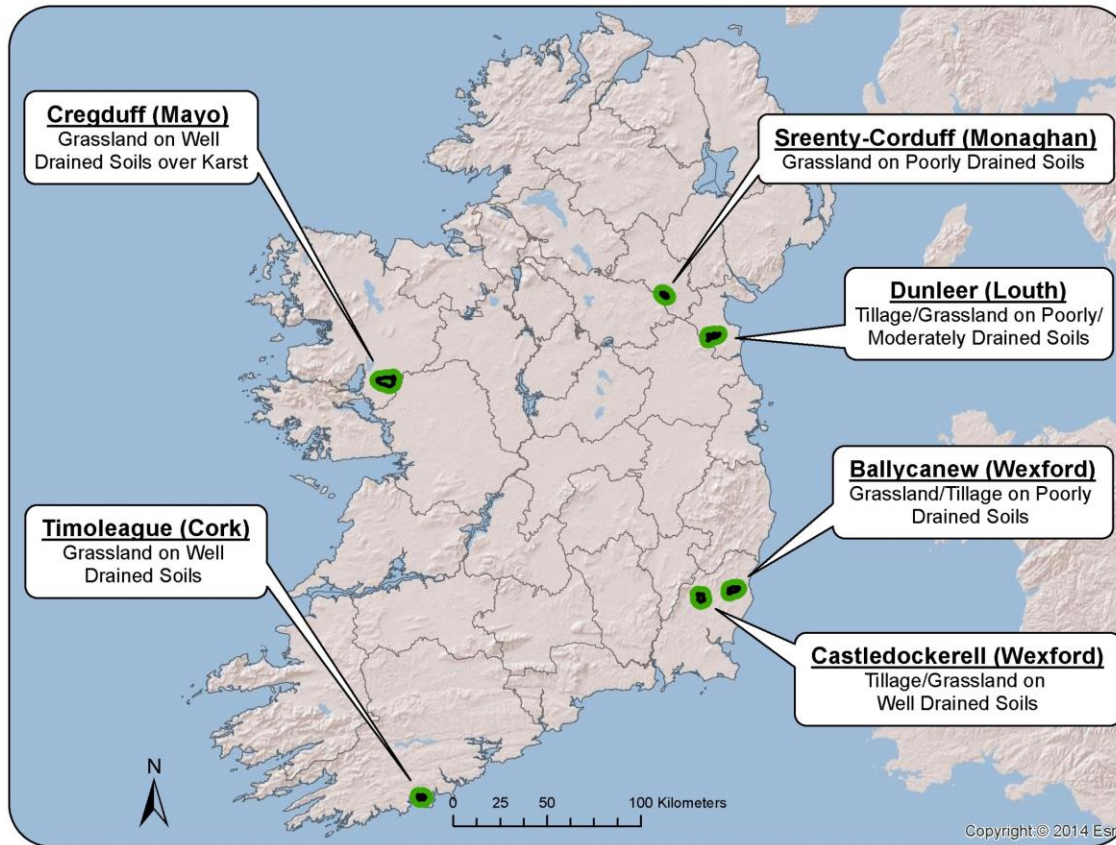
# Specifically- Phosphorus use

- 64% of Irish grassland soils are sub-optimum in P (Index 1 and 2)
- P is also recognised as a key trophic pressure in waters causing eutrophication contributing to water quality decline
- 64% of P loss from agriculture contributing to poor water quality (EPA, 2017 report)
- Trend in national water quality is static (2013-2015)
- Next water quality review is 2021, no sign of improvement or status levels decline;
  - Risk to next Nitrates Derogation (2021)
  - Risk to 2025 targets & future expansion plans?

River Channel Length based on Q values

	National		
	2007 - '09	2010 -'12	2013- '15
%			
Unpolluted	68.9	72.9	68.9
Slight Pollution	20.7	17.4	20.0
Moderate Pollution	10.0	9.6	11.0
Serious Pollution	0.4	0.1	0.0

# Irish Agricultural Catchments Programme



- Established in 2008
- Evaluate the environmental & economic effectiveness of Nitrates Directive-Good Agricultural Practice measures
- Across 6 Catchments
- Representing dominant land-types & production systems
- Integrated advisory & research approach
- >320 farmers – individual contact
- Collaborations – national, international
- Finding the WIN:WINS e.g. Nutrient Management/Nutrient Use Efficiency

# 3 Catchments

**Moderately Drained-MD**  
(9.5km<sup>2</sup>)



**Dunleer (Louth)**

Tillage/Grassland on Poorly/  
Moderately Drained Soils

**Poorly Drained- PD**  
(11km<sup>2</sup>)



**Ballycanew (Wexford)**

Grassland/Tillage on Poorly  
Drained Soils

**Timoleague (Cork)**

Grassland on Well  
Drained Soils



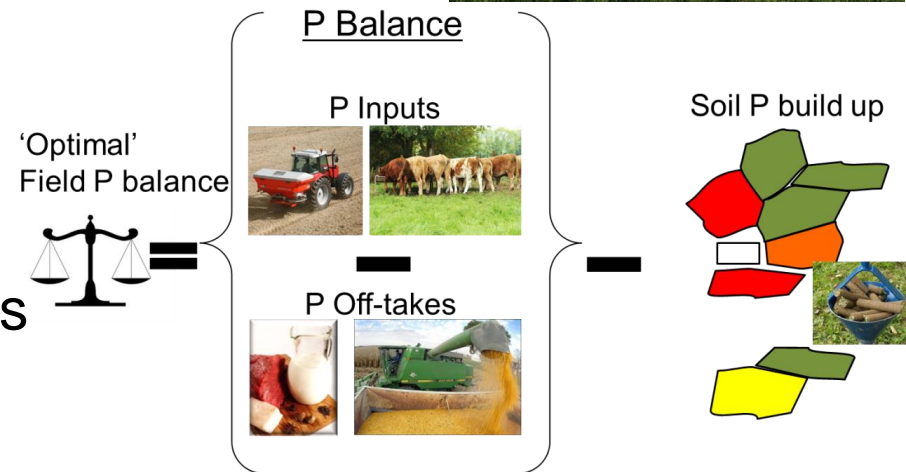
**Well Drained-WD**  
(7.5km<sup>2</sup>)



0 25 50 100 Kilometers

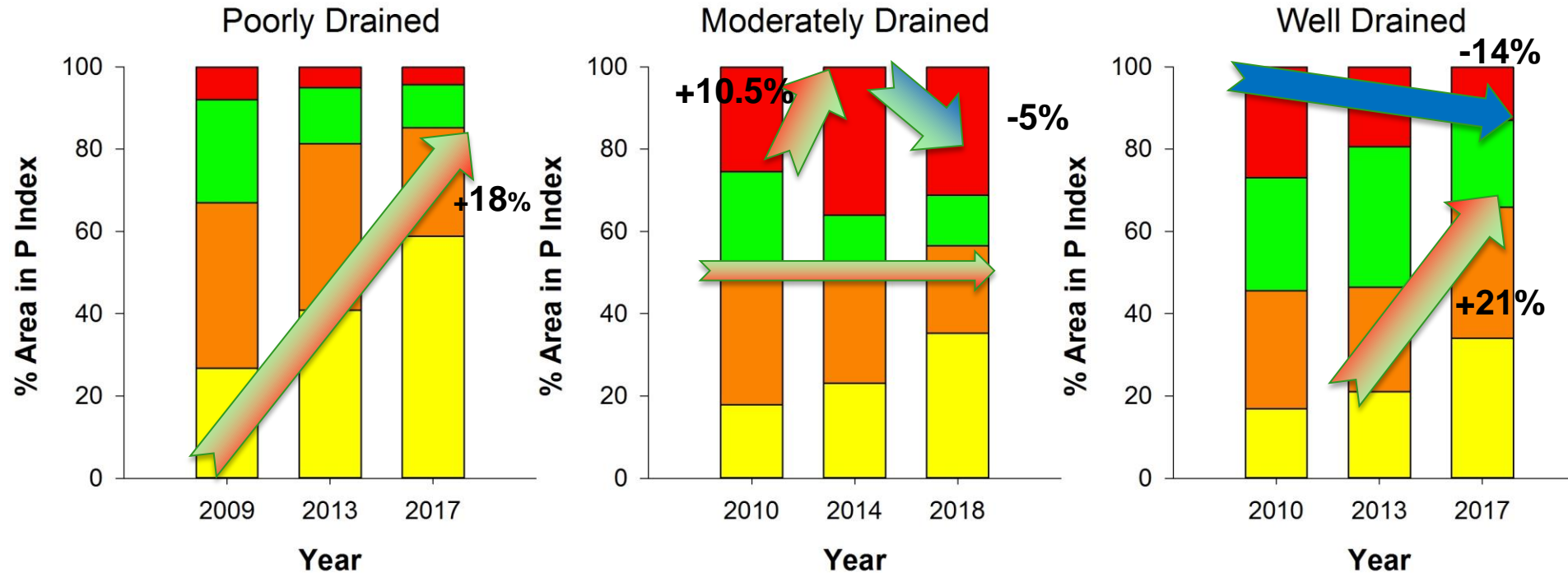
# Data collection

- Soil sampling, every 3-4 years, every approx. 2 ha
- Samples analysed for at least pH, available P & K
- ACP advisor provides results back to farmer
- Farms nutrient input records:
  - fertiliser applications per fields
  - silage yields
  - stocking rates
  - milk and meat off-takes per farm
  - Meal usage
- Farm & field scale nutrient balances



# Catchment Soil P Trends

■ STP Index 1   
 ■ STP Index 2   
 ■ STP Index 3   
 ■ STP Index 4



- Soils sub- optimum in P (Index 1 and 2) ranged from 48% to 85%
- Index 3 soils highest in the well drained catchment, but have declined from 34% to 21%.
- Index 4 soils declined in the well and poorly drained catchments; but peaked in the moderately drained catchment to 36%.
- Opportunities for improved distribution of P within fields, farms and catchments.

# P Management

Average P inputs (Mineral and Organic manures) kg/ha (units/ac)

Catchment	2010	2011	2012	2013	2014	2015	Six year Average
Poorly Drained <i>Ballycanew, Wexford</i>	18 (14)	22 (17)	23 (18)	22 (17)	30 (24)	28 (22)	24 (19)
Moderately Drained <i>Dunleer, Louth</i>	23 (18)	28 (22)	39 (31)	35 (28)	28 (22)	29 (23)	30 (24)
Well Drained <i>Timoleague, Cork</i>	34 (27)	26 (21)	47 (37)	43 (34)	39 (31)	36 (29.5)	37 (29)

Yearly records of P applied represented average of 66% (PD), 95% (MD) and 76%(WD) of the catchment grassland area





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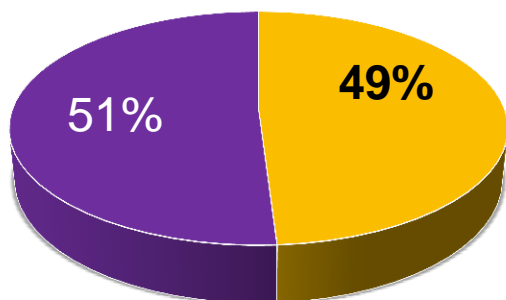
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# P fertilizer Breakdown 2010-2015

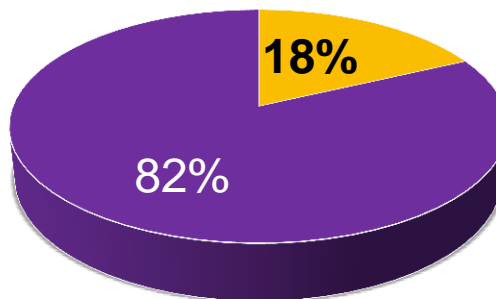
■ Mineral P  
■ Organic P

**Poorly Drained  
Ballycanew**



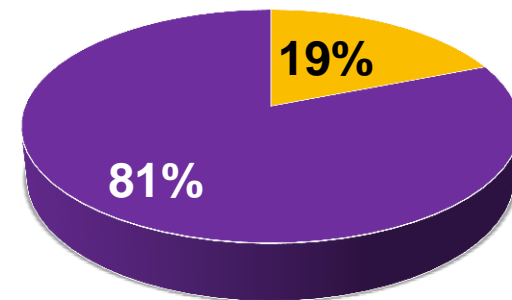
- FYM
- Cattle Slurry
- Soiled water

**Moderately  
Drained, Dunleer**



- FYM
- Cattle Slurry
- Poultry Manure
- Soiled water

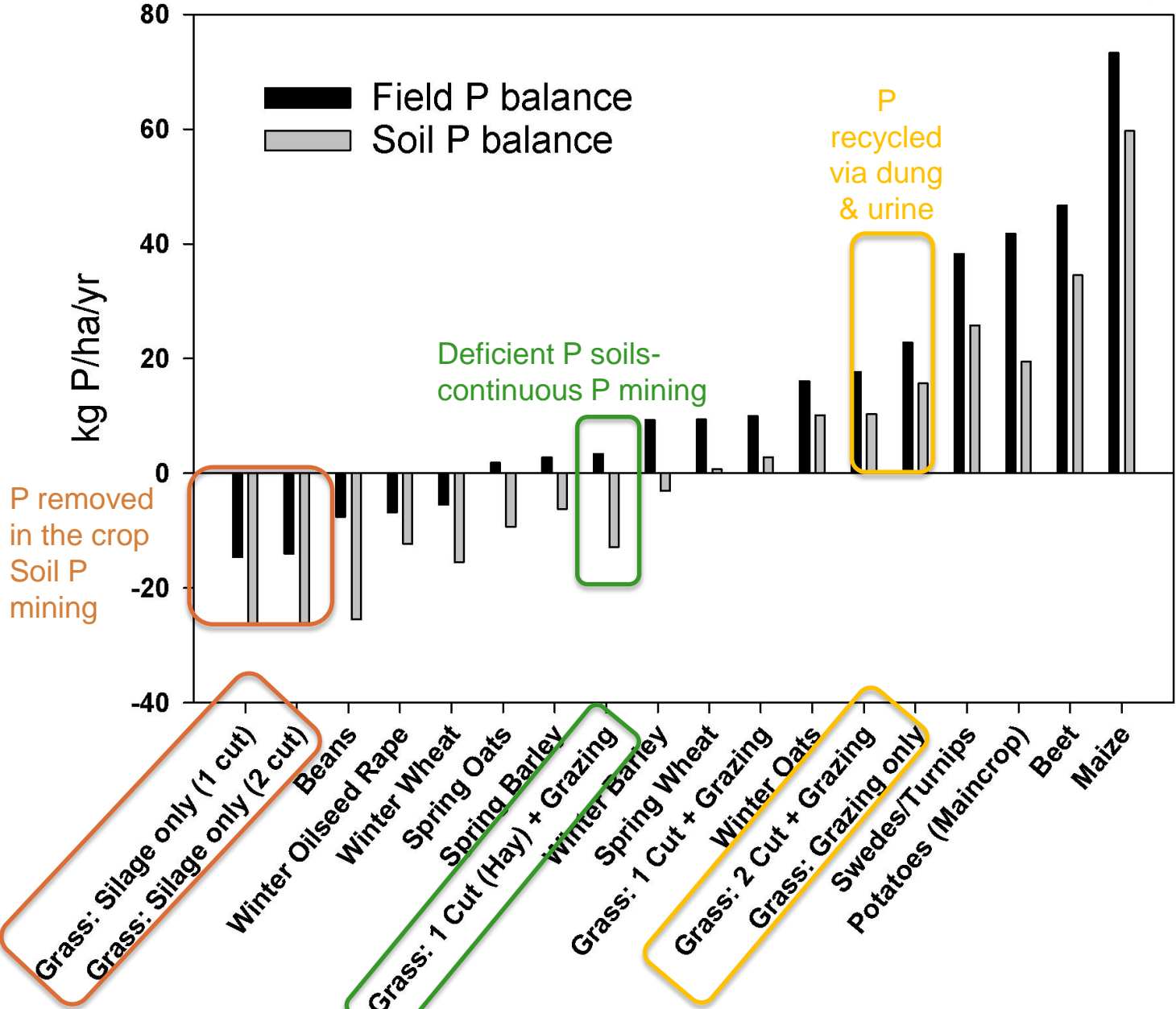
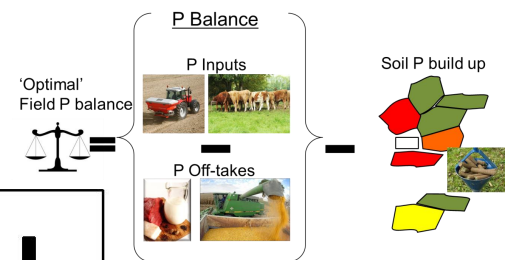
**Well-Drained  
Timoleague**



- FYM
- Cattle Slurry
- Pig slurry
- Soiled water



# P balance According to Crop Type



ACP data, 2 catchments  
2010-2013  
McDonald et al,  
Agriculture Ecosystems &  
Environment (In-review)

# Catchment Water Quality



Catchment	Phosphorus		Nitrate-N		Ecology 2015-2017	
	Mean	EPA	Mean	EPA	Macro invertebrates	
	(mg/L)	EQS	(mg/L)	EQS	Spring	Autumn
Poorly Drained Ballycanew, Wexford	0.076	X	2.5	✓	X	X
Moderately Drained Dunleer, Louth	0.112	X	4.9	✓	X	X
Well Drained Timoleague, Cork	0.063	X	5.8	✓	X	X

Phosphorus- Reactive P concentrations

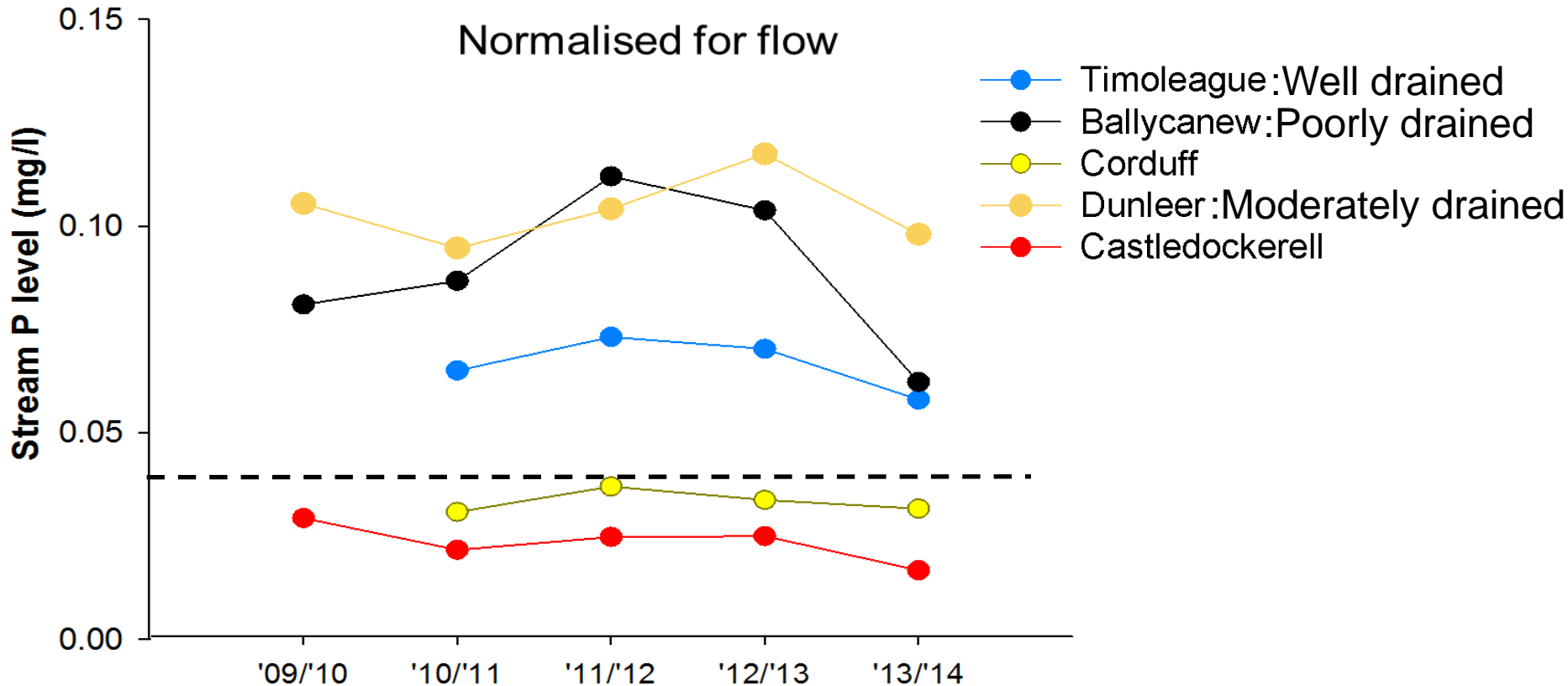
EQS= Environmental Quality Standards



# Catchment Water Quality



--- EQS for TRP= 0.035mg/l

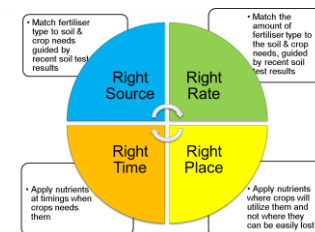
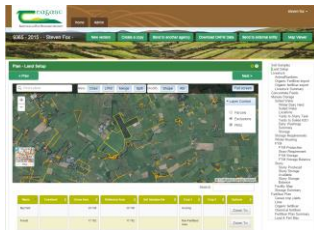


# Summary

- High Index 4 soils have declined in most catchment soils (2 to 14%)
- Approx. >50% of the soils in each catchment were sub-optimum in P (Index 1 & 2)
- Average P inputs (2010-2015) were 1.5 times higher in the well drained catchment compared to the poorly drained catchment
- Organic P was calculated as the main P source applied in these catchments
- Calculating P balances (P input-crop and animal off-takes):
  - Silage fields with no stock remove the highest levels of P -14 kg/ha/yr, causing P deficits
  - Grazed only will remove less P up to 10kg P/ha/yr, animal recycles P back to land
- Since monitoring began, P concentrations have exceed the environmental quality standard (EQS) threshold in all 3 catchments, with indications of improving trends from 2013-2014.

# Take Home Messages

- The main drivers of P losses in these catchments are different
  - Poorly-drained, Ballycanew: **Hydrology**
  - Moderately-drained, Dunleer: **Management**
  - Well-drained, Timoelague: **Mobilisation (P leaching)**
- **Continued focus to improve P management** is on-going within these catchments, which is also reflective of national efforts that are also needed.
- **Monitoring** soil P levels, inputs-outputs = **effective nutrient management strategies**, which has an essential part to play across all farms
  - one-to-one advice advocating Nutrient Management Planning (NMP),



- Soil and catchment **specific nutrient advice** could help to **achieve better agronomic and environmental outcomes** on Irish farms



## Acknowledgements/thanks:

## Farmers, ACP Team, Teagasc colleagues



[www.teagasc.ie/agcatchments](http://www.teagasc.ie/agcatchments)  
Twitter: @TeagascACP