Development of indicators of impact of rural payment measures on water quality in Scotland

Andy Vinten, James Sample,
Adekunle Ibeyemi and Marc Stutter
James Hutton Institute

The James Hutton Institute

RURAL DEVELOPMENT 2007-2013

LEADER AXIS

AXIS 1	AXIS 2	AXIS 3
COMPETITIVENESS	ENVIRONMENT + LAND MANAGEMENT	ECONOMIC DIVERSIFICATION + QUALITY OF LIFE

Single set of programming, financing, monitoring, and auditing rules

European Agricultural Fund for Rural Development

Scotland Rural Development Plan (SRDP) = £1.5 billion
Managing Authority : SGRIPID

AXIS 2
£900million

of which AGRI-ENVIRONMENT
£549 million

Common Monitoring and Evaluation Framework (CMEF)

…requires member states to monitor/evaluate 5 outcomes:
Business viability, Biodiversity, Water quality, Climate change and Rural communities

across 4 indicators:
Input, Output, Result and Impact

Scottish Government Rural Payments Inspectorate

Scotland Rural Development Plan (SRDP) = £1.5 billion
Managing Authority : SGRIPID

Scottish Government Rural Statistics Unit

AXIS 2
£900million

of which AGRI-ENVIRONMENT
£549 million

rural development company ltd

CMEF reporting

Common Monitoring and Evaluation Framework (CMEF)

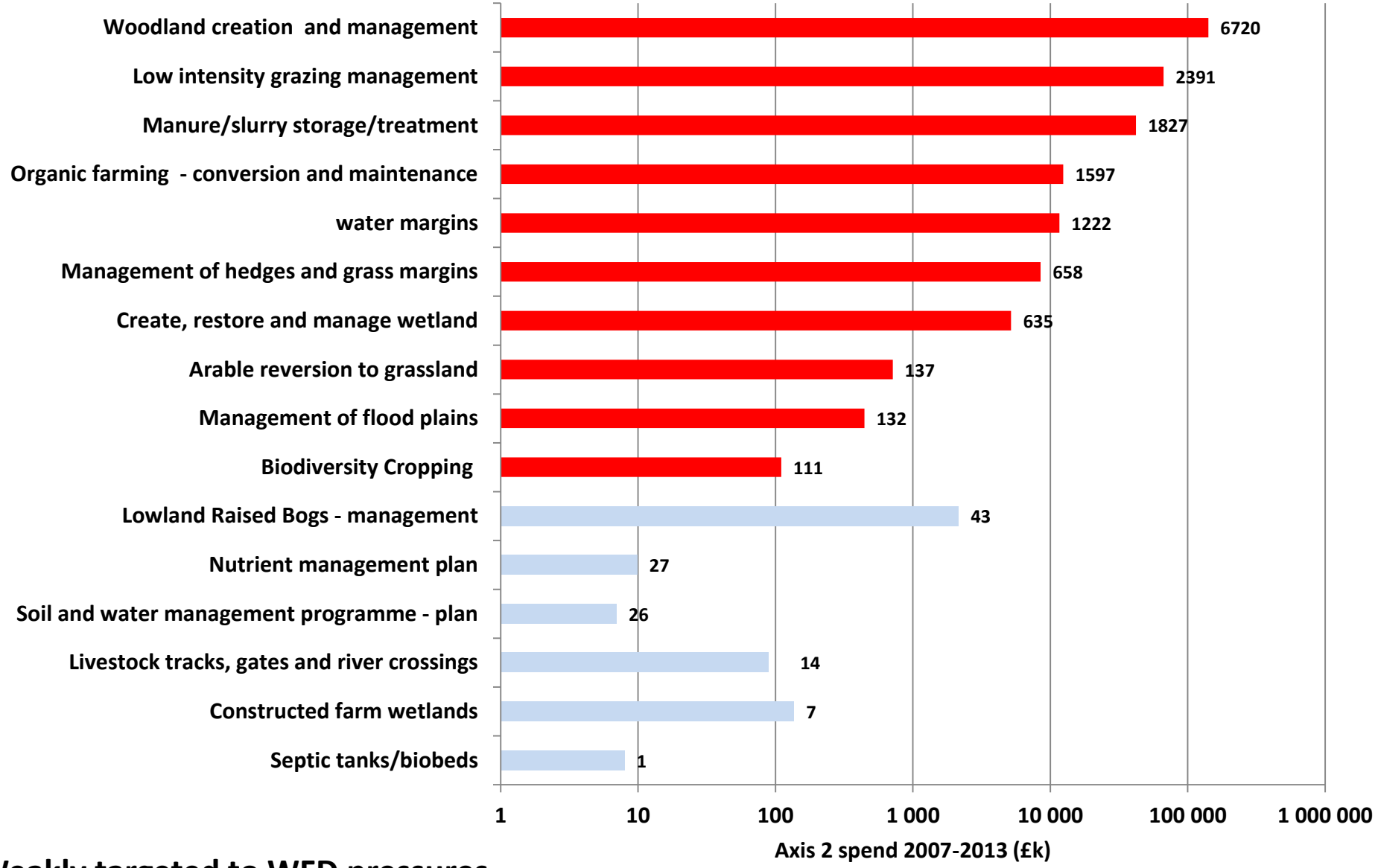
…requires member states to monitor/evaluate 5 outcomes:
Business viability, Biodiversity, Water quality, Climate change and Rural communities

across 4 indicators:
Input, Output, Result and Impact

The James Hutton Institute

Ex-post impact indicators for water quality

Categories of 2007-2013 Agri-Environment measure



Weakly targeted to WFD pressures

James Hutton Institute

impact indicators for categories of measures

The James Hutton Institute

The James Hutton Institute

livestock and Crop data

Field level RP data

RP Impact at 1km^2 scale

GIS handbook to spatially process data at field level

Rural Payments Inspectorate

Field scale land use, livestock and rural payments data

Data queries re RP spend and location at field scale

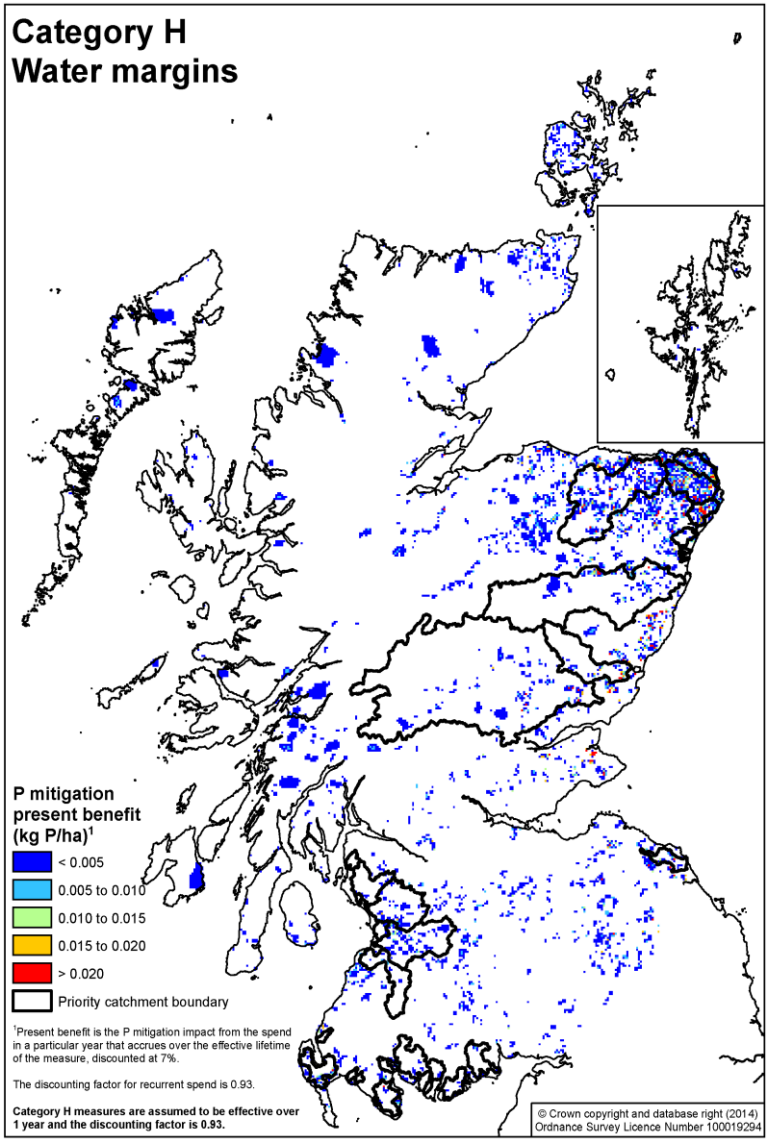
Rural Statistics Unit

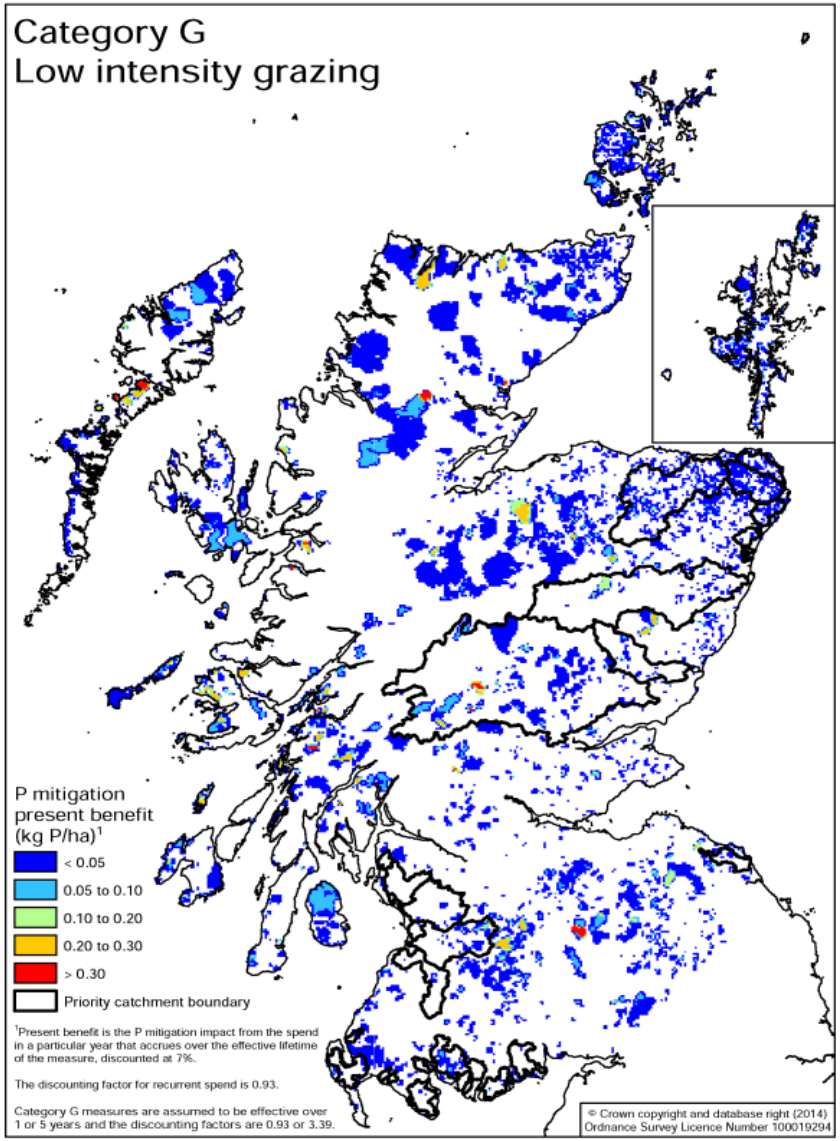
GIS processing of field level RP data giving 1km^2 impacts for each category

General assumptions

- Indicators of impact of measure on P loads to surface waters
- Mitigation impact based on field area claimed (not spend)
- Lookup tables for ΔP loss risk=f(slope, Δ crop)
- Lookup table for 8m buffer impacts= f(slope, crop)
- Land Use based on 2009 IACS returns
- Net present benefit (NPB) approach to multi-year impact
- Connectivity from national screening tool database

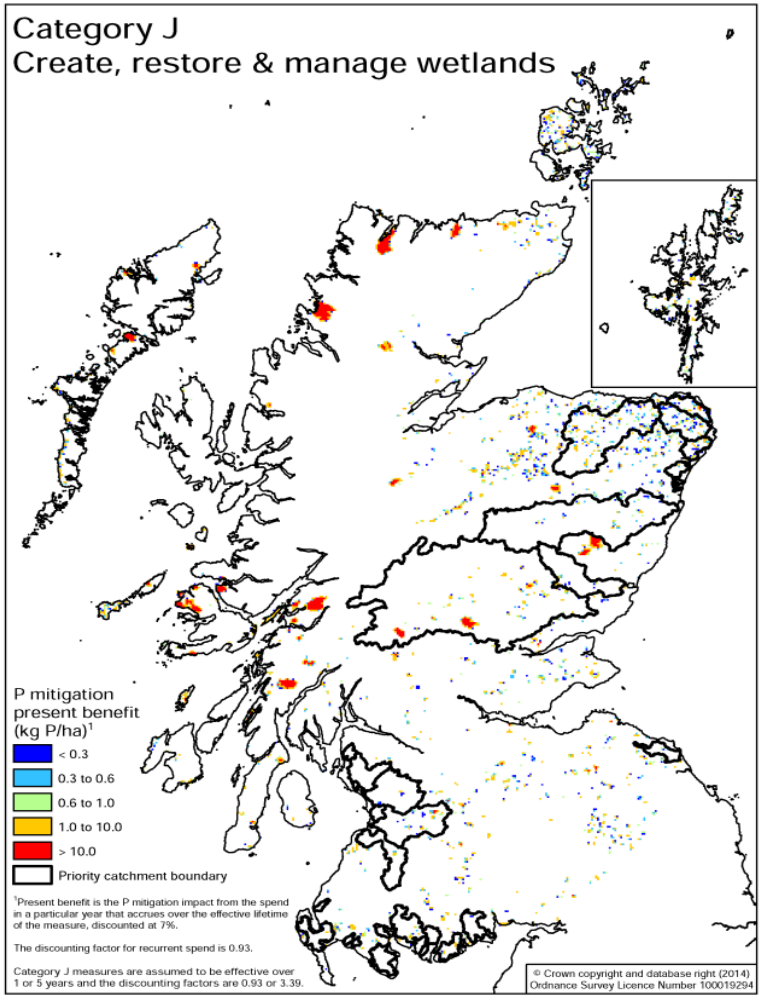
Measure	P mitigation impact
Woodland creation and management	crop risk 3 to 2 on area claimed
Low intensity grazing management	crop risk 3 to 2 on area claimed
Arable reversion to grassland	crop risk 4 to 2 (slope index 1) on area claimed
Biodiversity Cropping	crop risk 4 to 3 on 50% of area claimed
Manure/slurry storage/treatment	Look up table of change in P loss/cow; cow numbers derived from spend @£100/m^3 storage
Organic farming - conversion and maintenance	nutrient management impact on soil soluble P
water margins	8m buffer impact lookup table
Management of hedges and grass margins	25% of 8m buffer impact
Create, restore and manage wetland	30 kg P/ha claimed
Management of flood plains	13 kg P/ha claimed

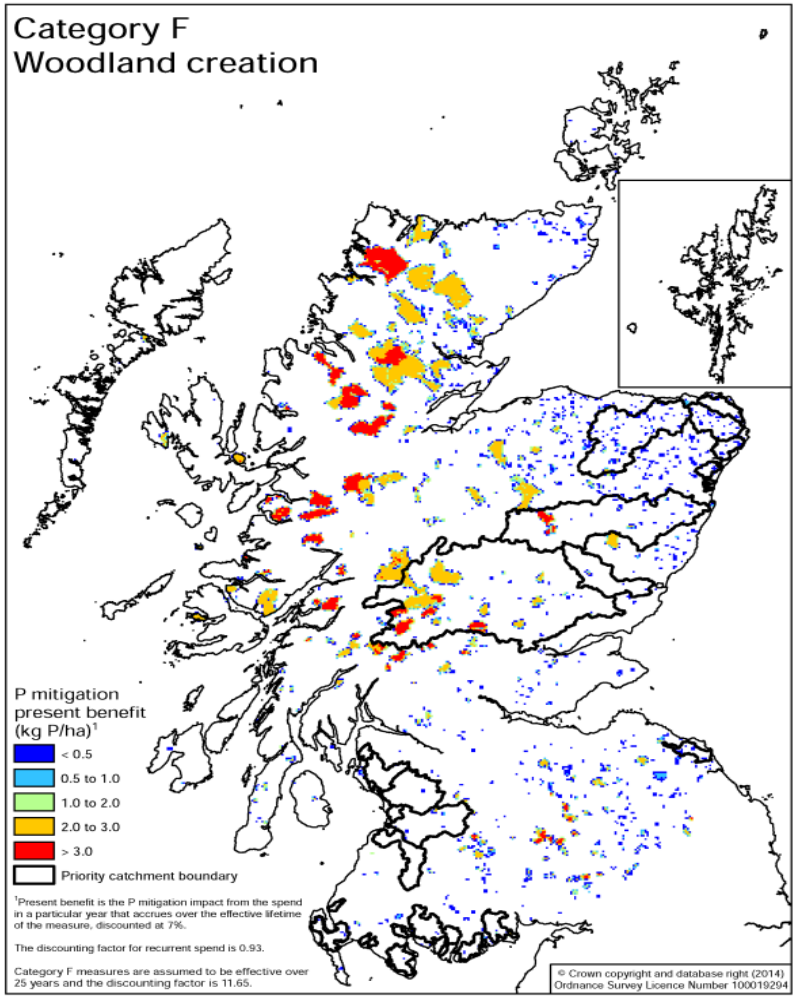




Priority catchments for diffuse pollution

Problem categories for GIS queries

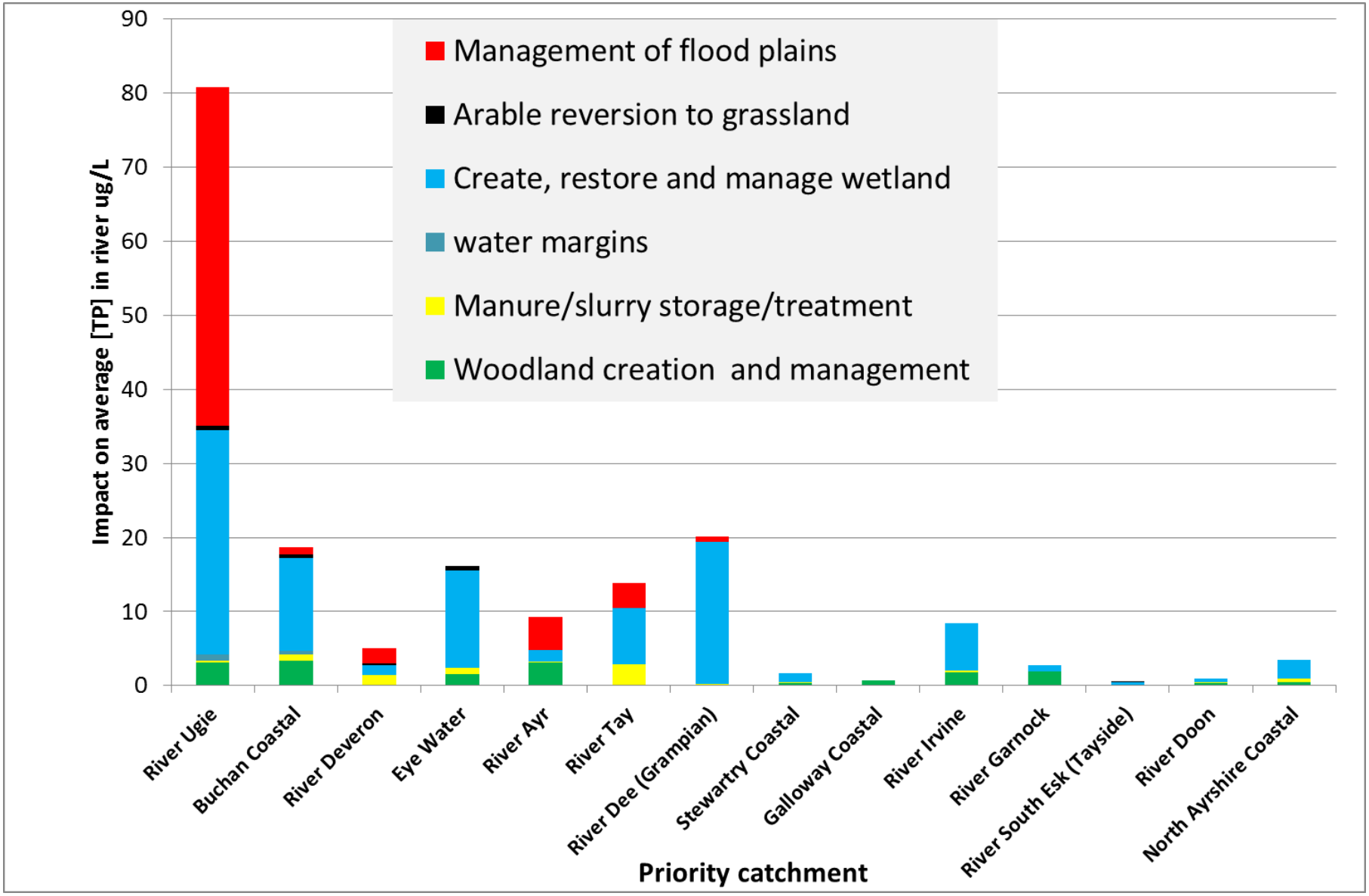




Dbase query process returned field areas, where claims occurred, not areas where spend targeted

no distinction of areas receiving recurrent and capital spend

Impact on [TP] in priority catchments



James Hutton Institute

impact indicators for categories of measures

The James Hutton Institute

The James Hutton Institute

livestock and Crop data

Field level RP spend

RP Impact at 1km² scale

GIS handbook to spatially process data At field level

Rural Payments Inspectorate

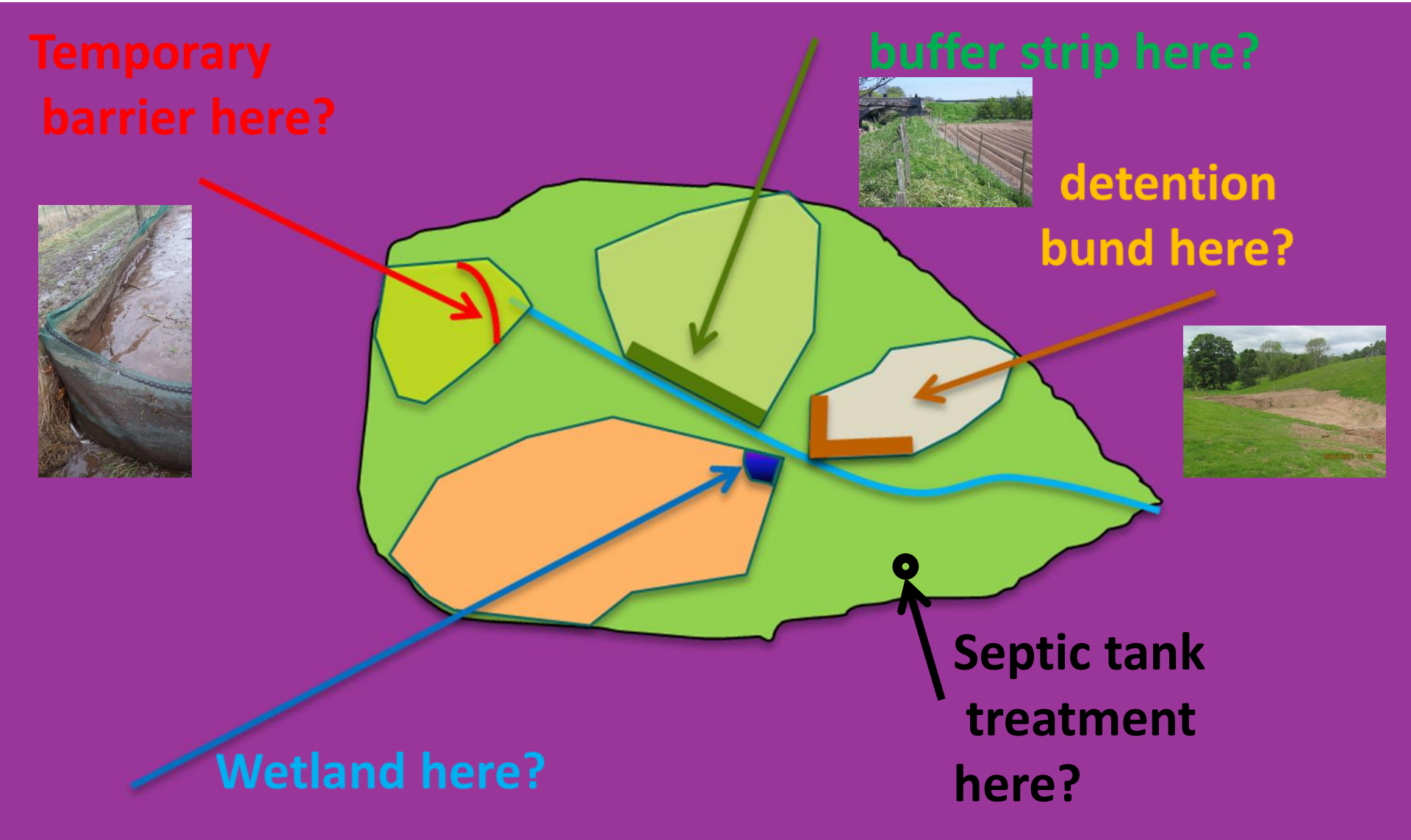
Field scale land use, livestock and rural payments data

Data queries re RP spend and location at field scale

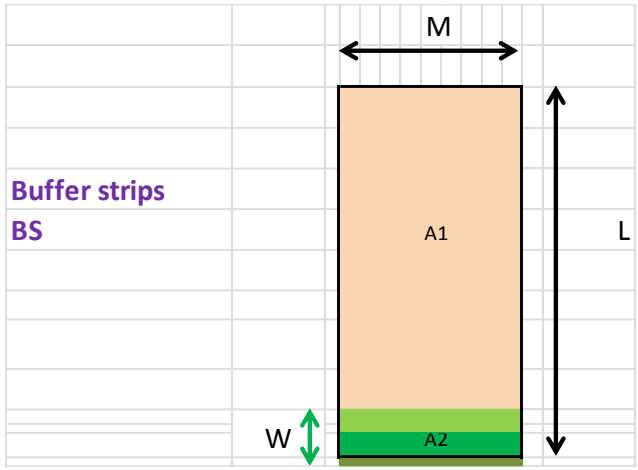
Rural Statistics Unit

GIS processing of field level RP data giving 1km² impacts for each category

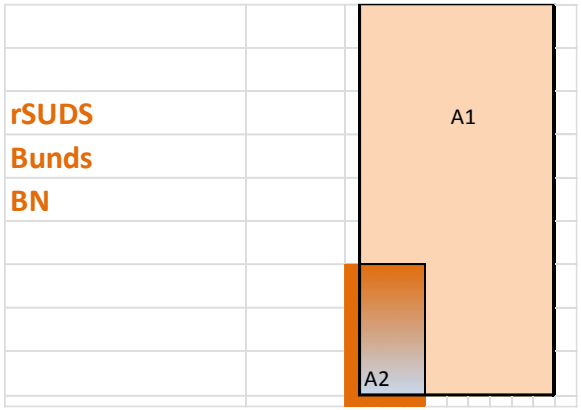
….Now focusing on ex-ante CEA of new targeted measures for 2014-2020



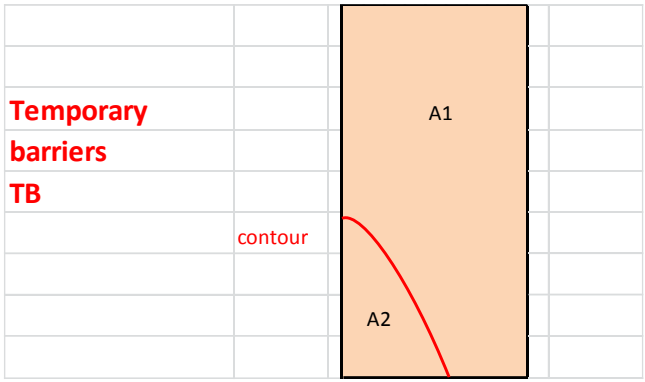
Measures differ in degree of spatial and temporal targeting and therefore costs



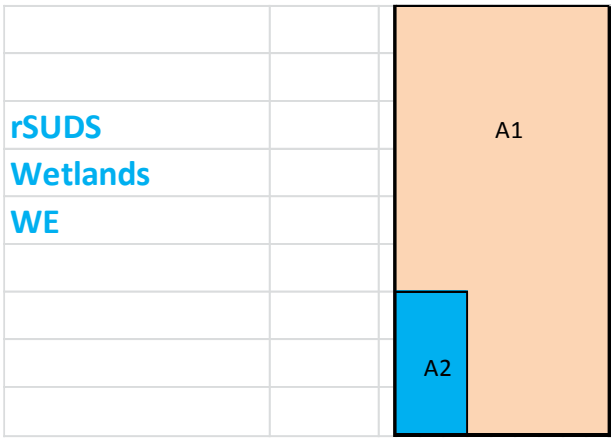
Buffer strips
BS



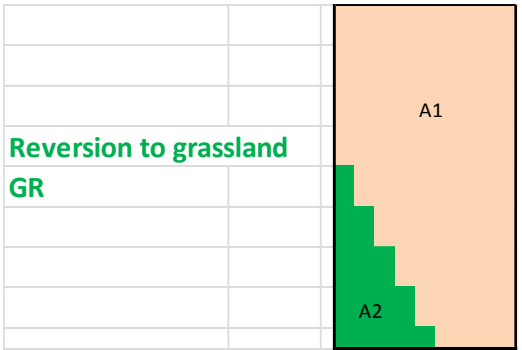
rSUDS
Bunds
BN



Temporary
barriers
TB



rSUDS
Wetlands
WE



Reversion to grassland
GR

Costs and effects of measures

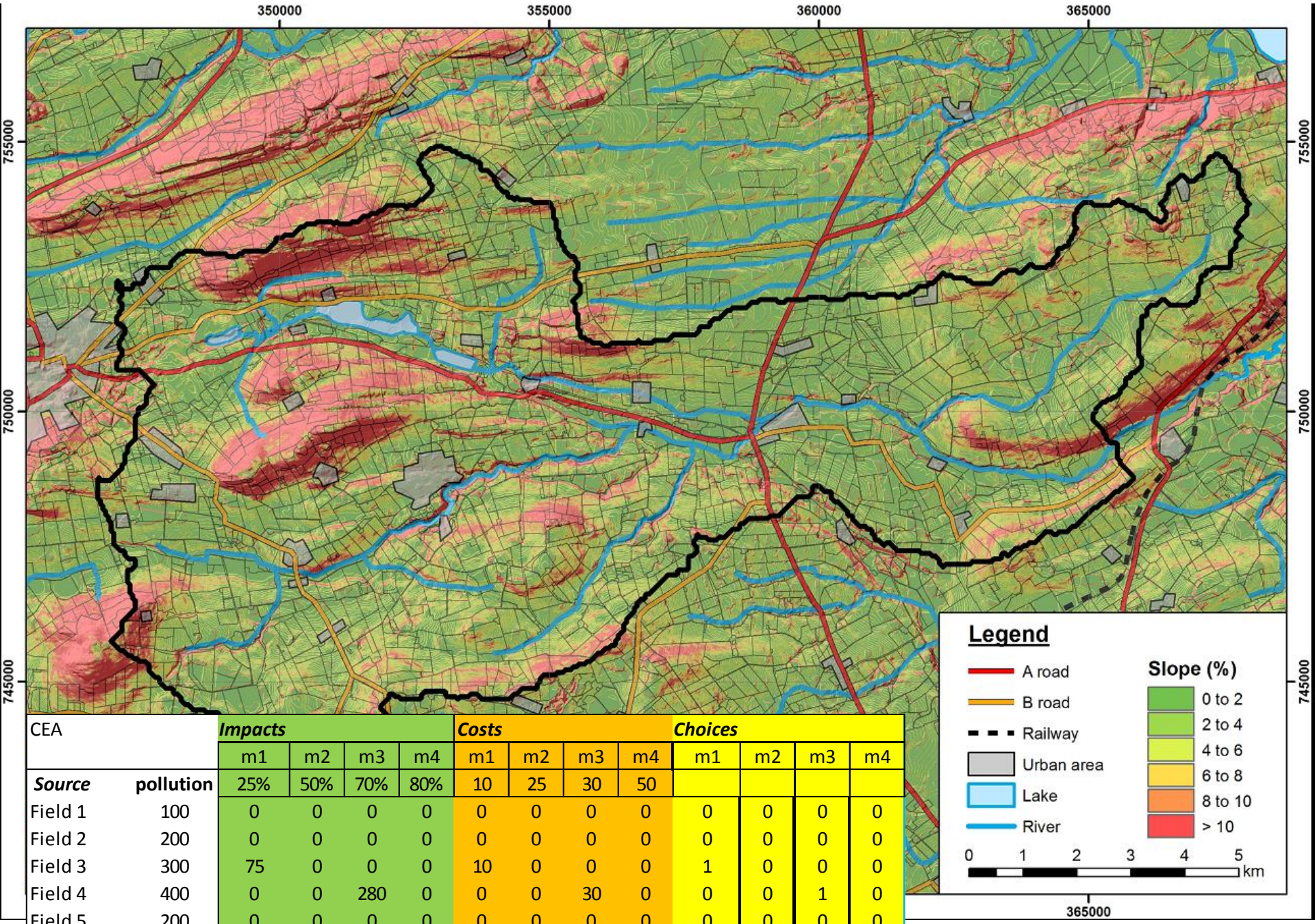
	Width	Area used	Cost		Effect	
	m	A2 as % A	£/m structure	£/ha of A2	kg P/tonne erosion	kg P/ha rSUDS
Riparian Buffer Strips	2-20	variable	-	Gross Margin loss	USLE and VFS model	-
Temporary Barriers	-	5% (but arable land use retained)	1-10 (high risk years only)	-	1**	-
Bunds	-	2-4%	7*	Gross Margin loss	-	30***
Wetlands	-	2-4%	-	10,500*	-	30***
Permanent Grass	-	7%	-	Gross Margin loss	1**	-

* Rates of payment for 2014-2020 Scotland Rural Payments Scheme measures

** Based on observations of sediment capture by temporary barriers (Vinten et al., 2014)

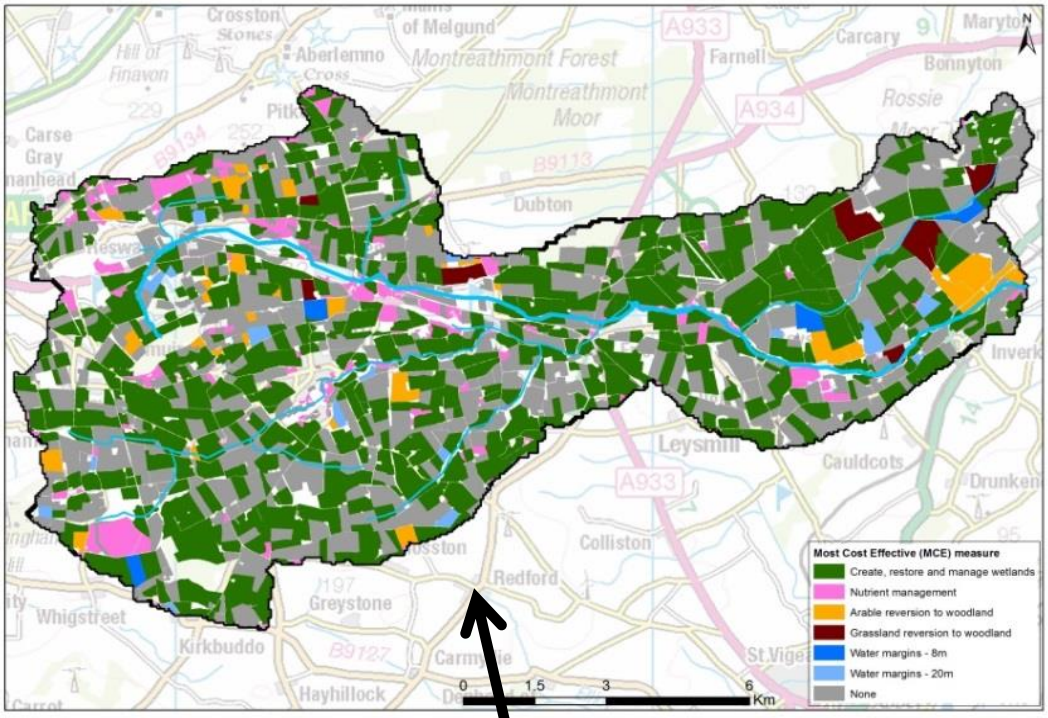
*** Weller et al., 1996

NOTE: First 2m of buffer strip are unfunded, but assumed to be in place for all cases (Regulatory measure)

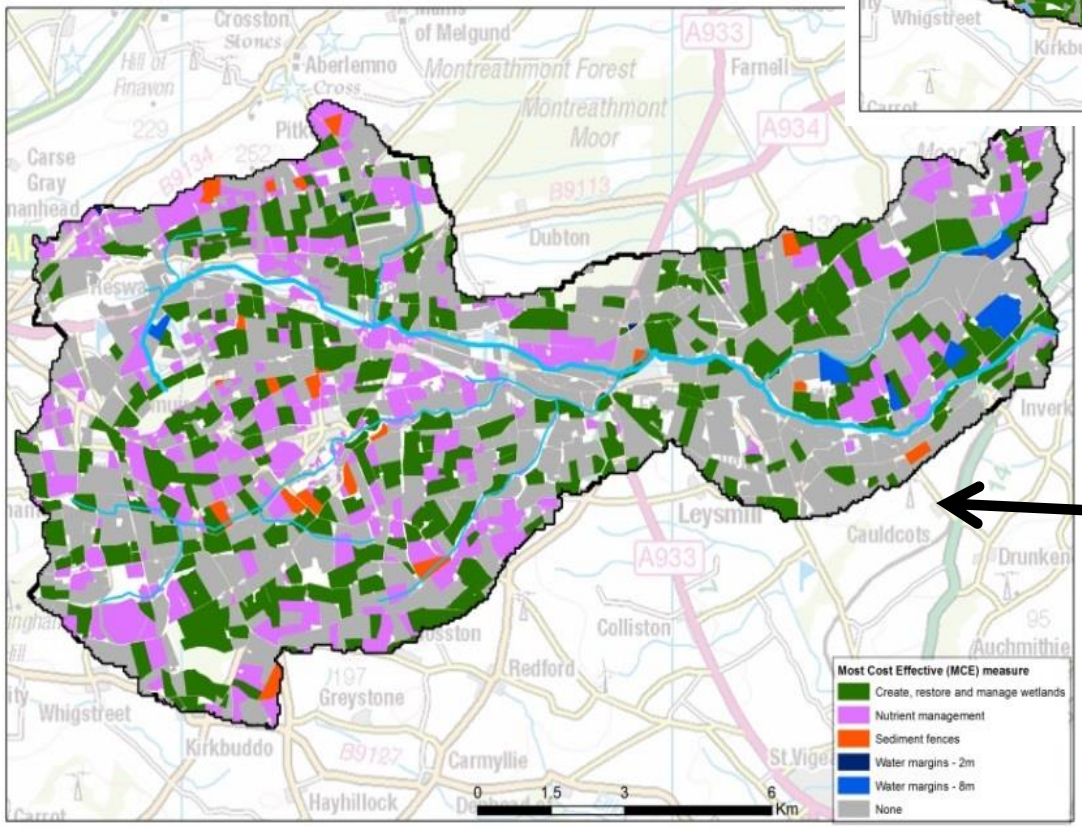


CEA		*Impacts*				*Costs*				*Choices*			
		m1	m2	m3	m4	m1	m2	m3	m4	m1	m2	m3	m4
Source	**pollution**	25%	50%	70%	80%	10	25	30	50				
Field 1	100	0	0	0	0	0	0	0	0	0	0	0	0
Field 2	200	0	0	0	0	0	0	0	0	0	0	0	0
Field 3	300	75	0	0	0	10	0	0	0	1	0	0	0
Field 4	400	0	0	280	0	0	0	30	0	0	0	1	0
Field 5	200	0	0	0	0	0	0	0	0	0	0	0	0
Field XXXX	200	50	0	0	0	10	0	0	0	1	0	0	0

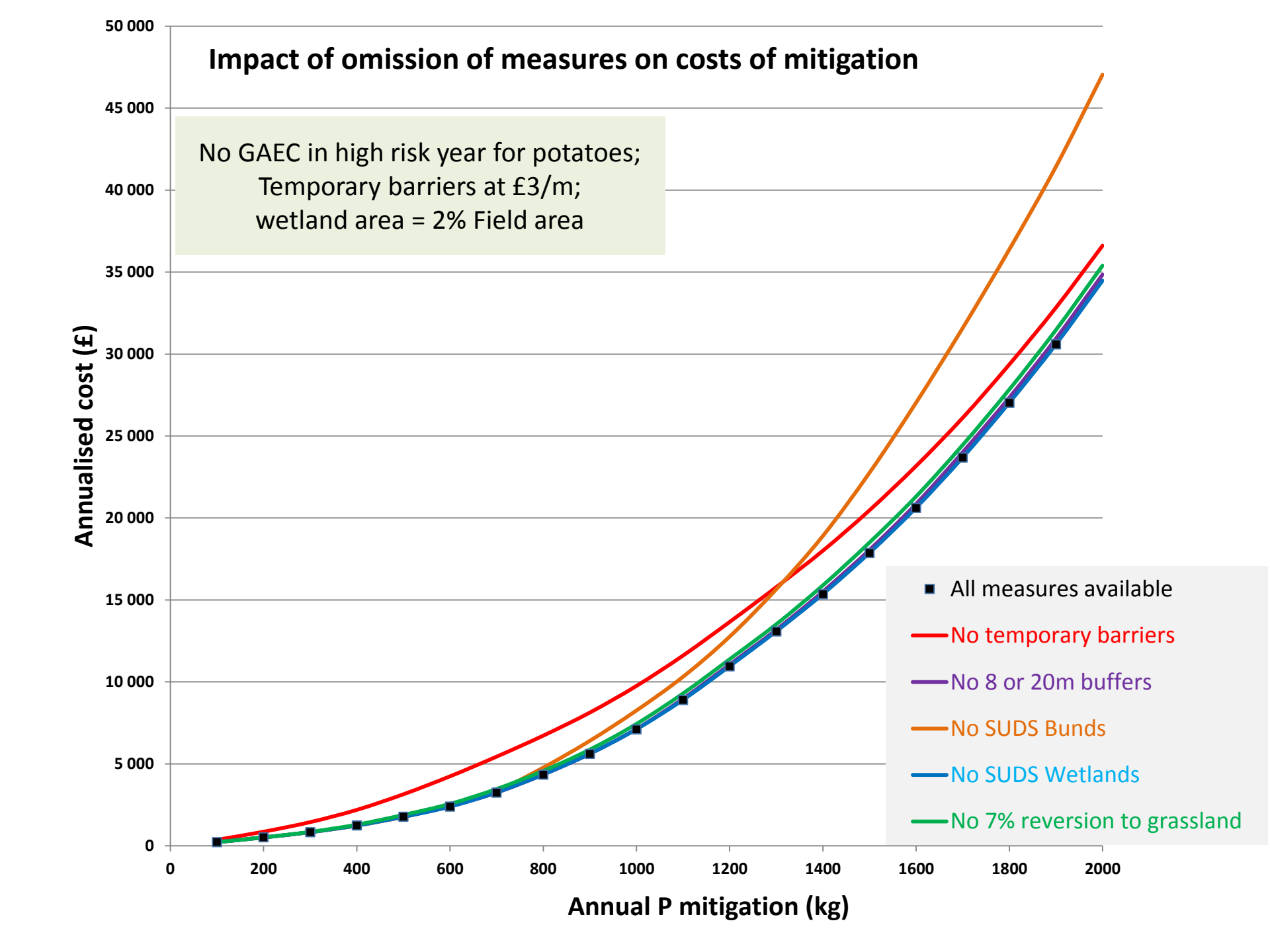
CEA optimised measures to achieve target impact



SRDP 2007-2013 measures only



SRDP + septic tank treatment and sediment fences as options


Impact of omission of measures on costs of mitigation
No GAEC in high risk year for potatoes;
Temporary barriers at £3/m;
wetland area = 2% Field area
Annualised cost (£)
50 000
45 000
40 000
35 000
30 000
25 000
20 000
15 000
10 000
5 000
0
0
200
400
600
800
1000
1200
1400
1600
1800
2000
Annual P mitigation (kg)
All measures available
No temporary barriers
No 8 or 20m buffers
No SUDS Bunds
No SUDS Wetlands
No 7% reversion to grassland

Conclusions

The James Hutton Institute

2007-2013 Ex-post impact

- poor targeting of measures to priority catchments
- Need further clarification of areas where spend was focused if these are at lower than field scale

2014-2020 Ex-ante CEA

spatial CEA allows effective targeting

additional measures may enhance cost-effectiveness of SRDP

Cost analysis is as important as effectiveness analysis