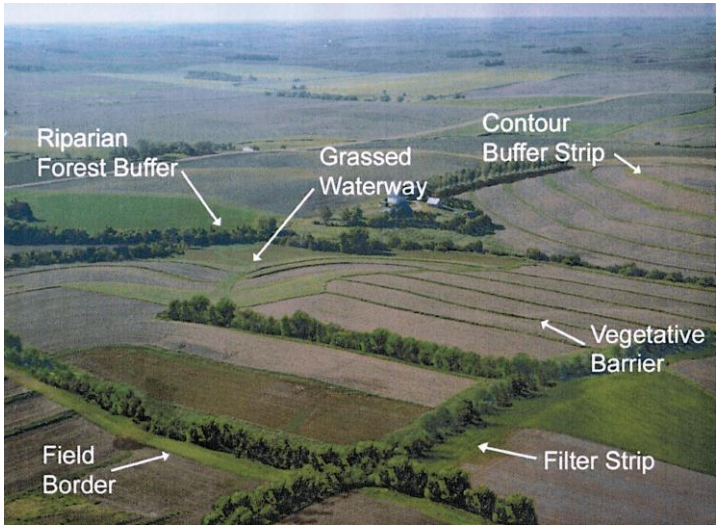
Cost-effectiveness assessment:comparison of macrophyte harvesting with other methods

Andy Vinten

Management of Catchments and Coasts

Social , Economic and Geographic Sciences



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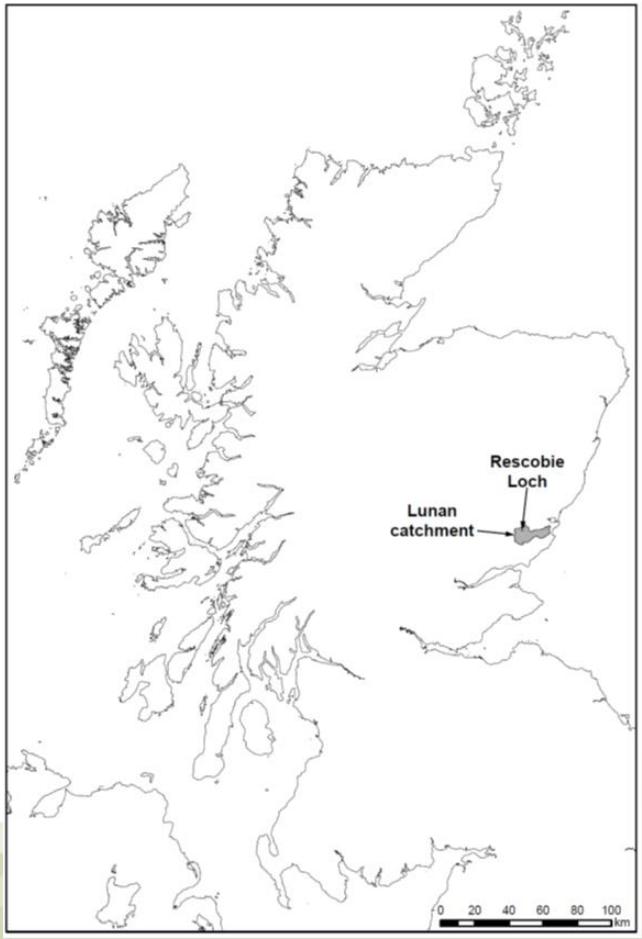
RESAS funded research

- **Lunan Diffuse Pollution Monitored catchment has been set up to assess the effects of compliance with diffuse pollution regulations and identify cost:effective methods of pollution mitigation**



TN,TP and Chlorophyll a time series for Rescobie Loch

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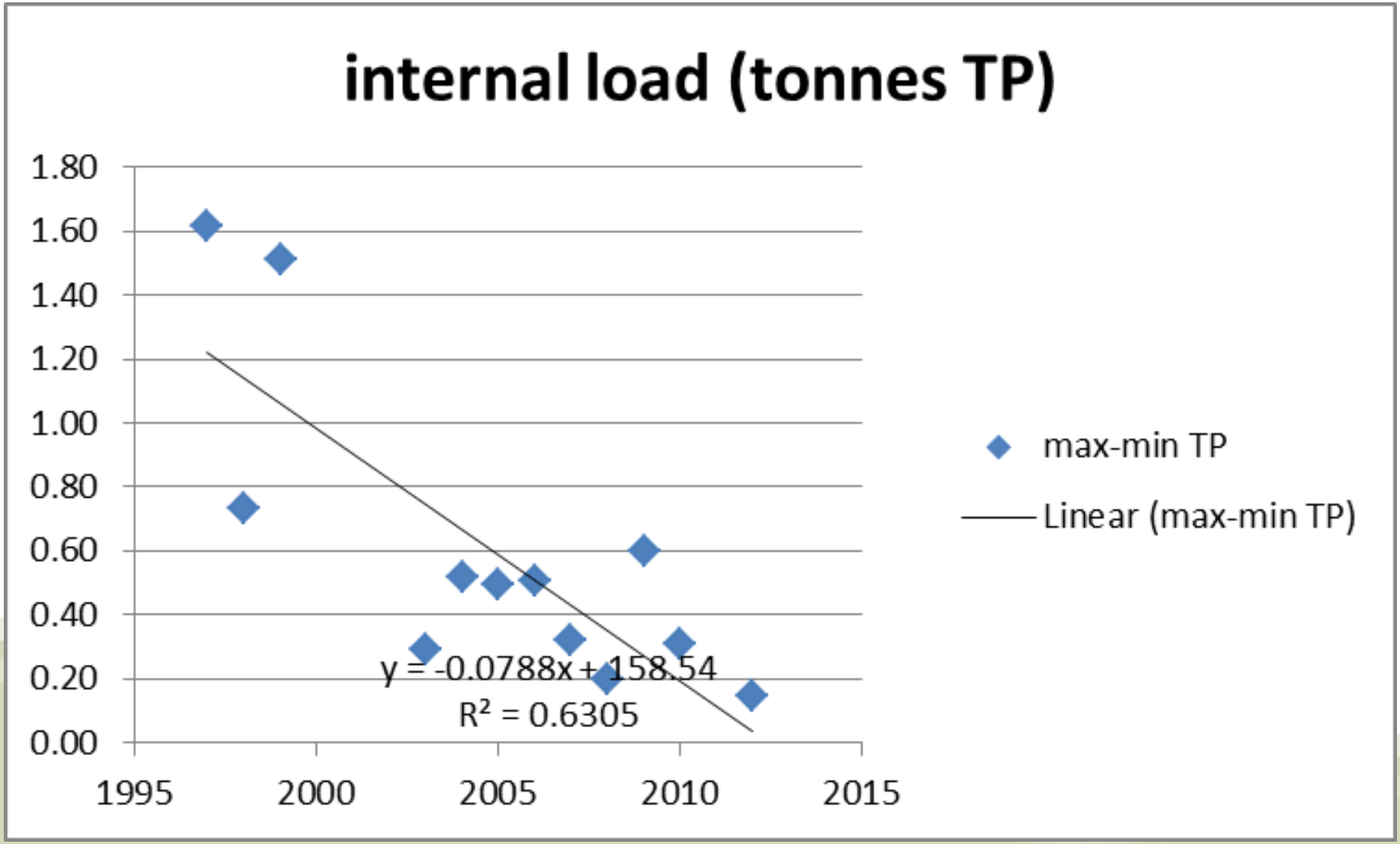
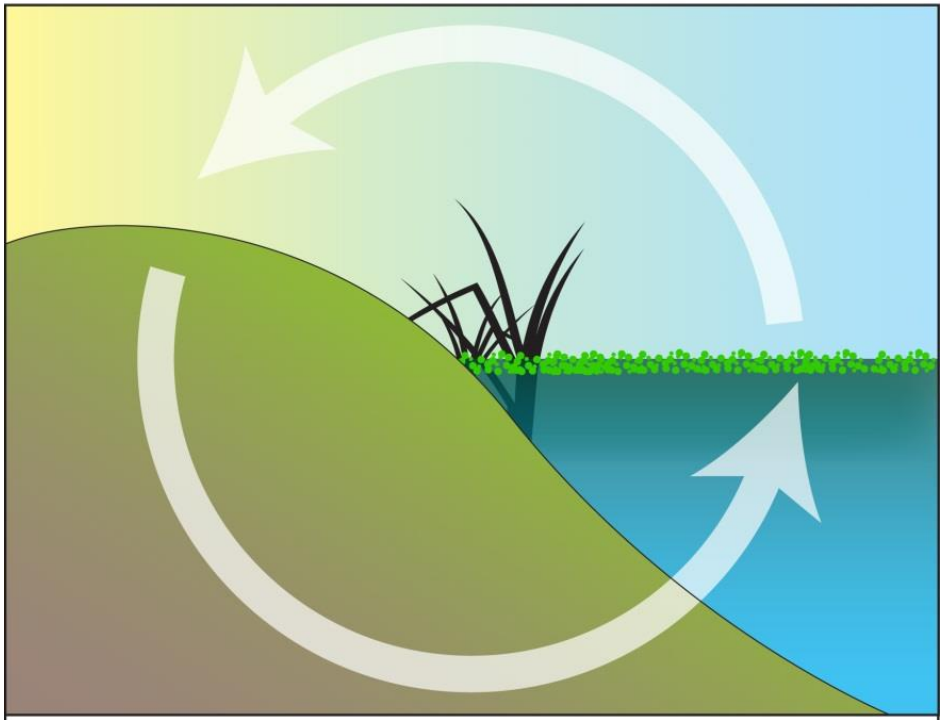
Source apportionment: internal load



ReBALAN:CE



Recycling **B**iomass to **A**gricultural **LAN**d:
Capitalising on **E**utrophication

UNIVERSITY OF STIRLING

PRIFYSGOL BANGOR UNIVERSITY 1884

Dr David Oliver; Dr Richard Quilliam;
Prof Nick Hanley; Dr Nigel Willby;
Dr Melanie van Niekerk; Prof Davey Jones;
Prof Dave Chadwick; Dr Paul Cross; Dr Andy Vinten

Project Partners:

The James Hutton Institute

SEPA Scottish Environment Protection Agency

UKWIR UK Water Industry Research Limited

USDA

RESCOBIE LOCH DEVELOPMENT ASSOCIATION

AIM: Identify the breadth of key research opportunities to maximise nutrient recovery from aquatic plant & algal biomass for safe recycling to land

NATURAL ENVIRONMENT RESEARCH COUNCIL

Mitigation options: Aquatractor

Lake Zwemlust

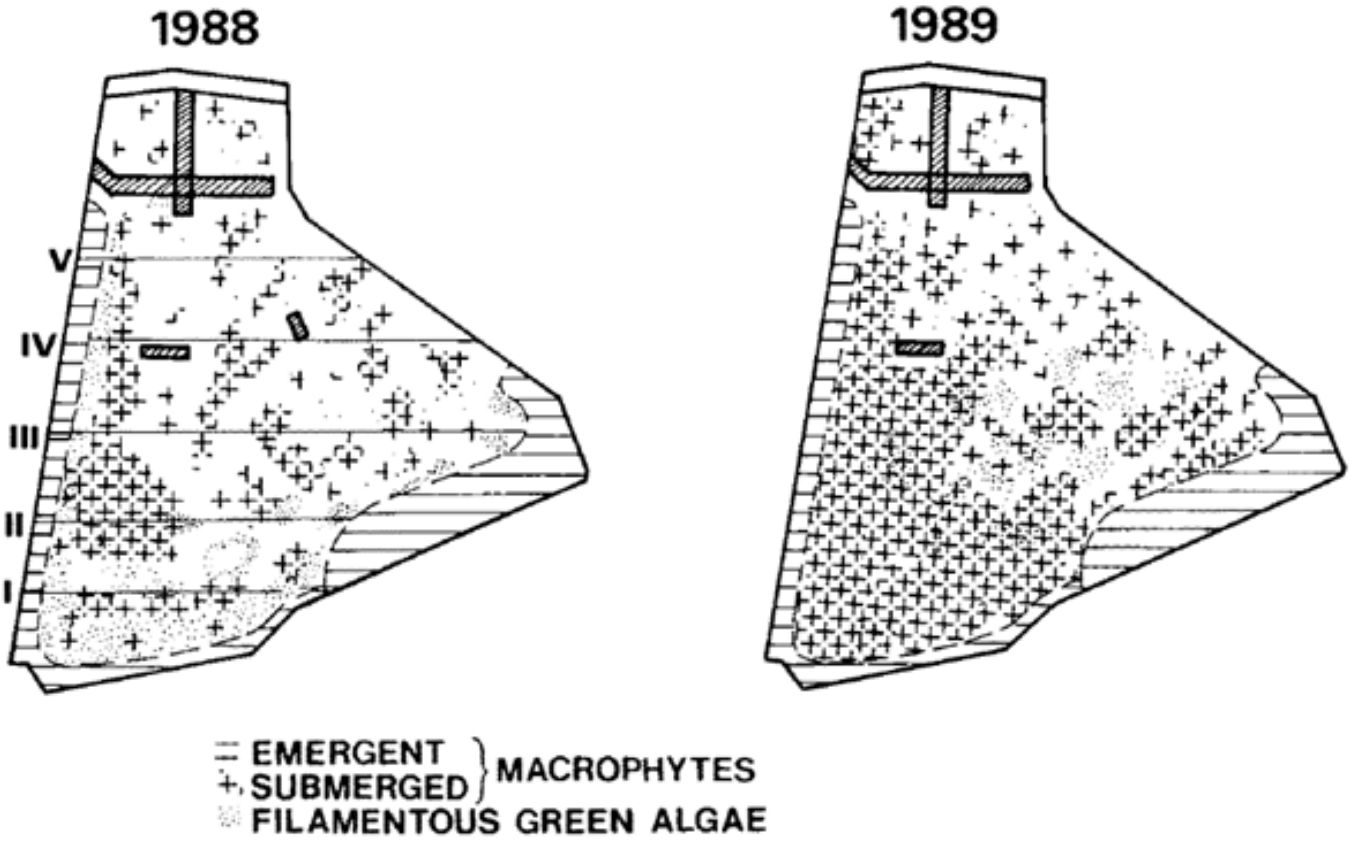
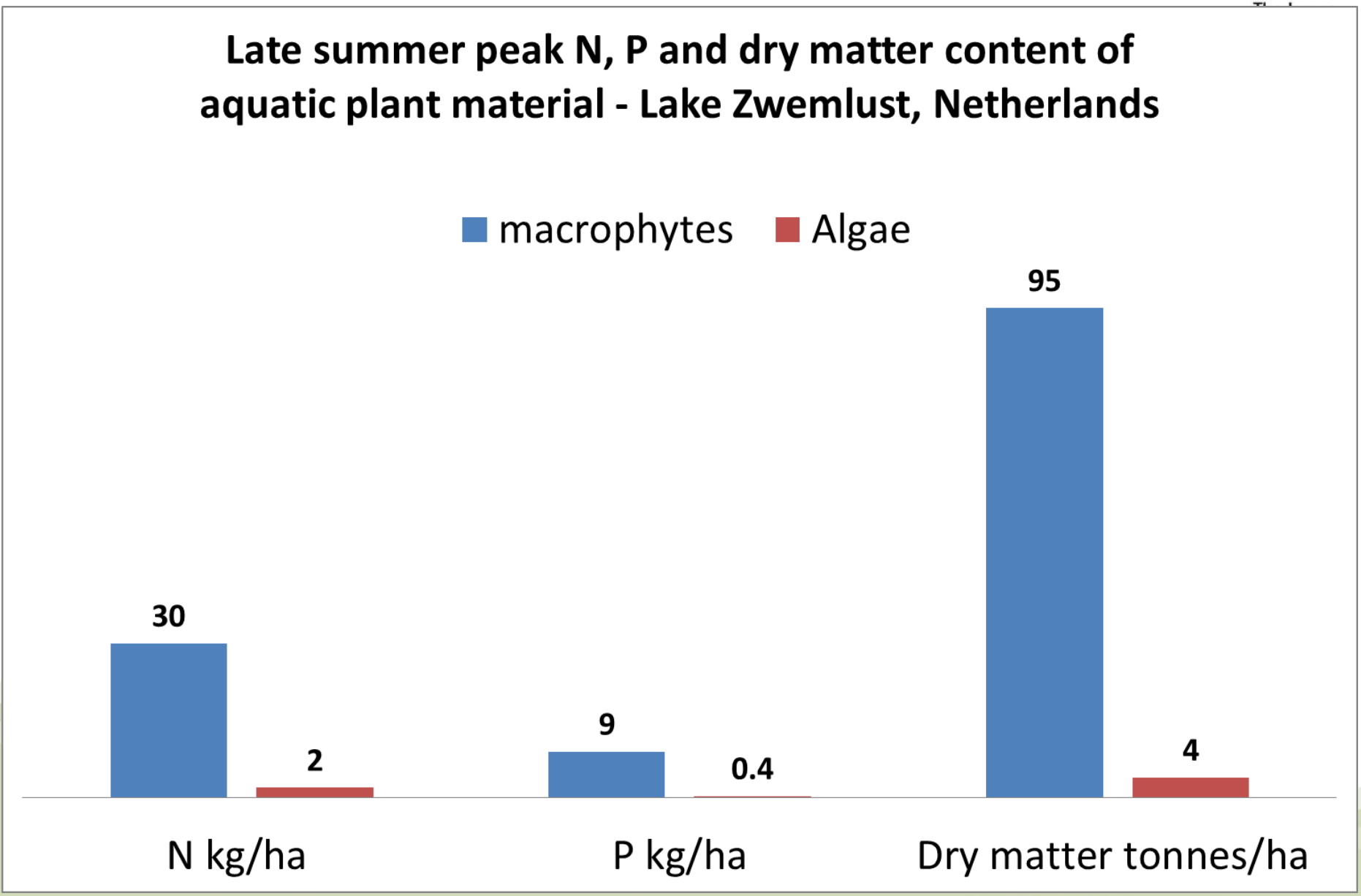


Fig. 1. Schematic distribution of submerged macrophytes and filamentous green algae in Lake Zwemlust in August 1988 and July 1989.

Ozimek et al. 1990. Hydrobiologia 200/201: 399-407

Main findings

- macrophytes can act as source of P in summer
- but always a sink for N
- early active growth at low temp
- release of allelopathic substances
- high capacity for nutrient absorption
- 30% storage of nutrients over winter
- low P release rates from winter storage


Late summer peak N, P and dry matter content of aquatic plant material - Lake Zwemlust, Netherlands
macrophytes
Algae
30
2
9
0.4
95
4
N kg/ha
P kg/ha
Dry matter tonnes/ha

Cost:effectiveness of macrophyte removal for P mitigation

Costs of aquatractor	
600	£/day
2	days/ha
5	ha
6000	£ for 10% of loch surface
Potential removal of nutrients and dry matter	
20	kg N/ha (70% removal)
7	kg P/ha
70	tonnes DM/ha
Cost:effectiveness	
60	£/kg N
171	£/kg P
Value of nutrients	
based	20:10:10 £300/tonne
£150	

How does this compare with mitigation of other sources?

Source apportionment: septic tanks

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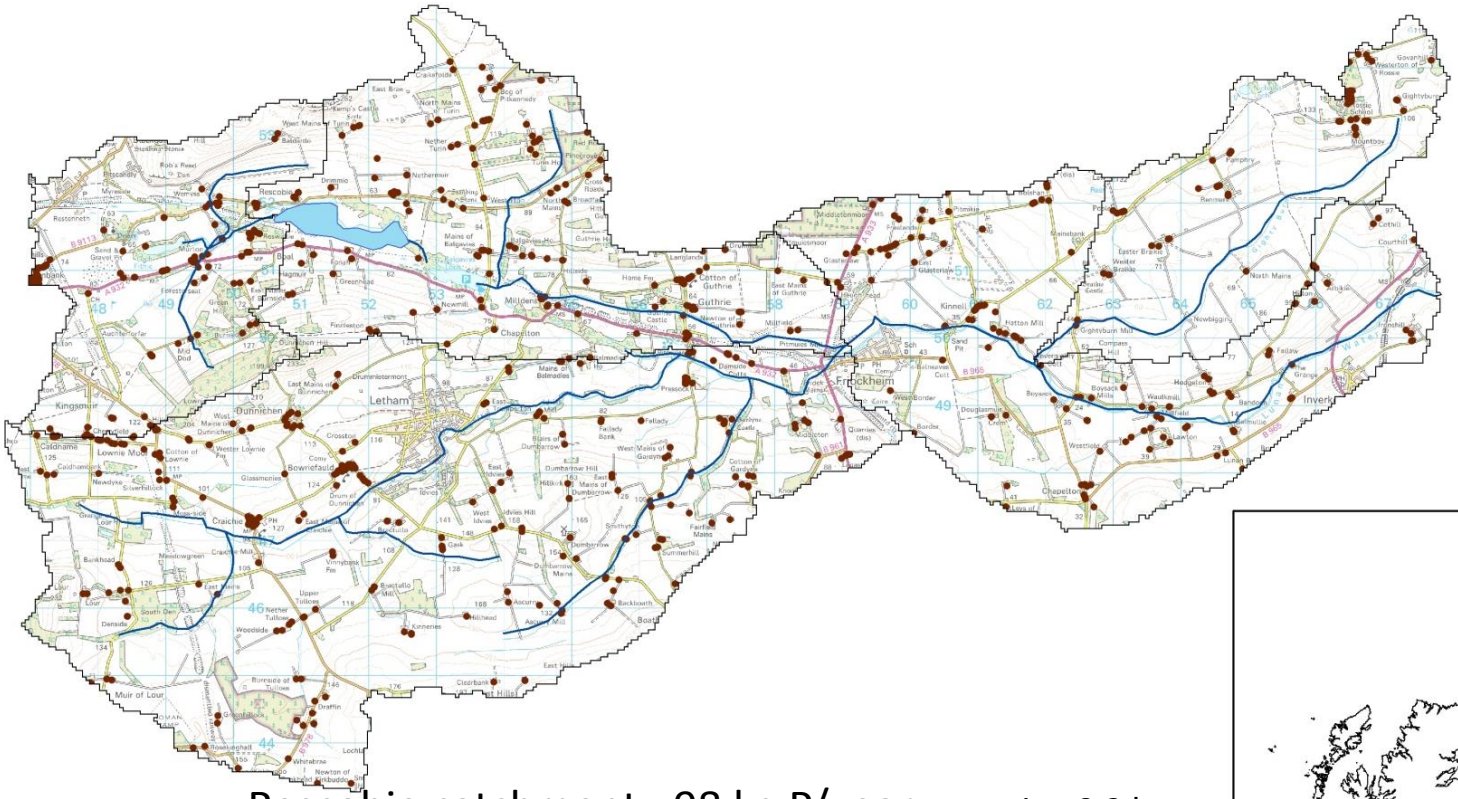
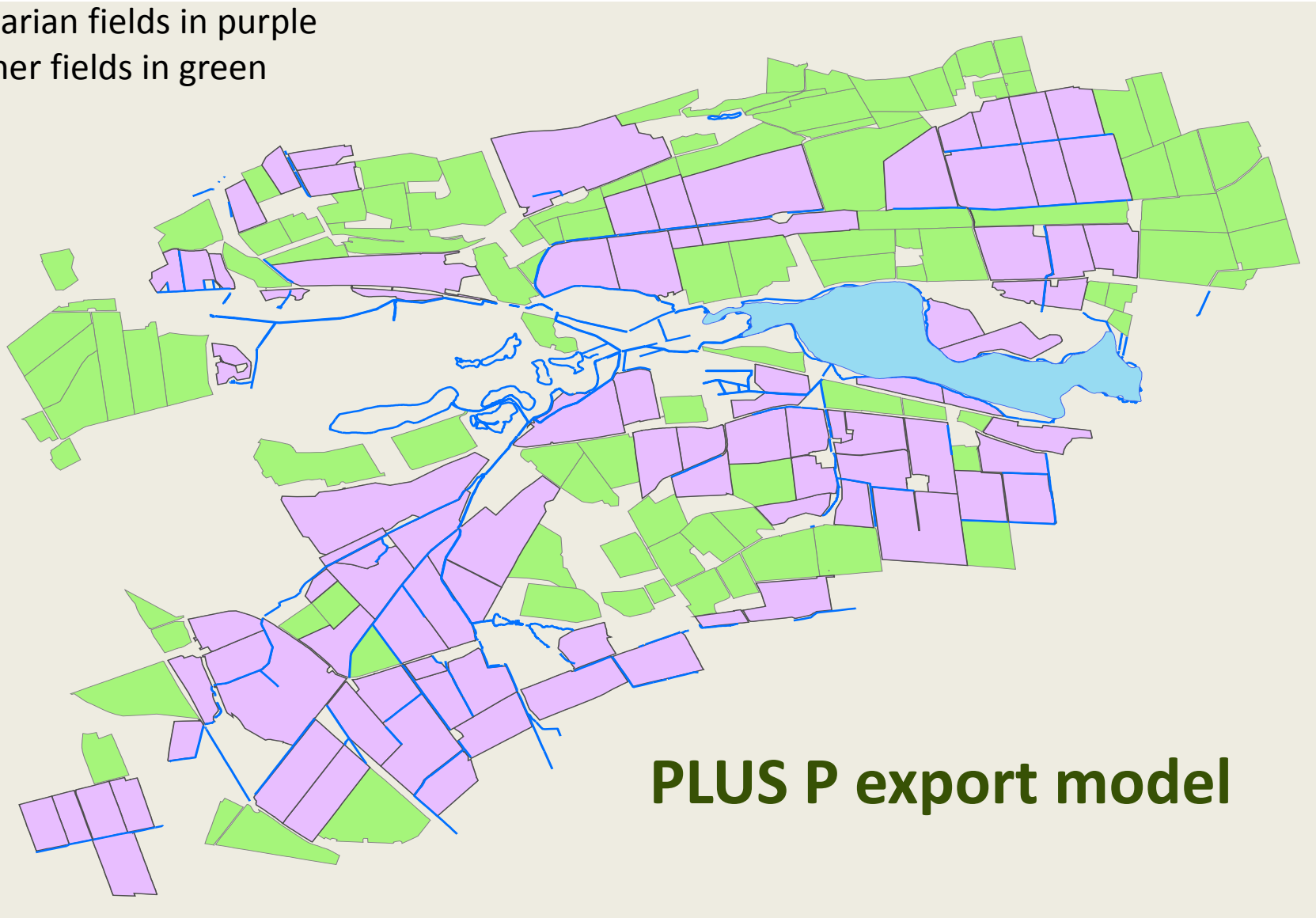
Potential septic tank sites
in Lunan Water catchment



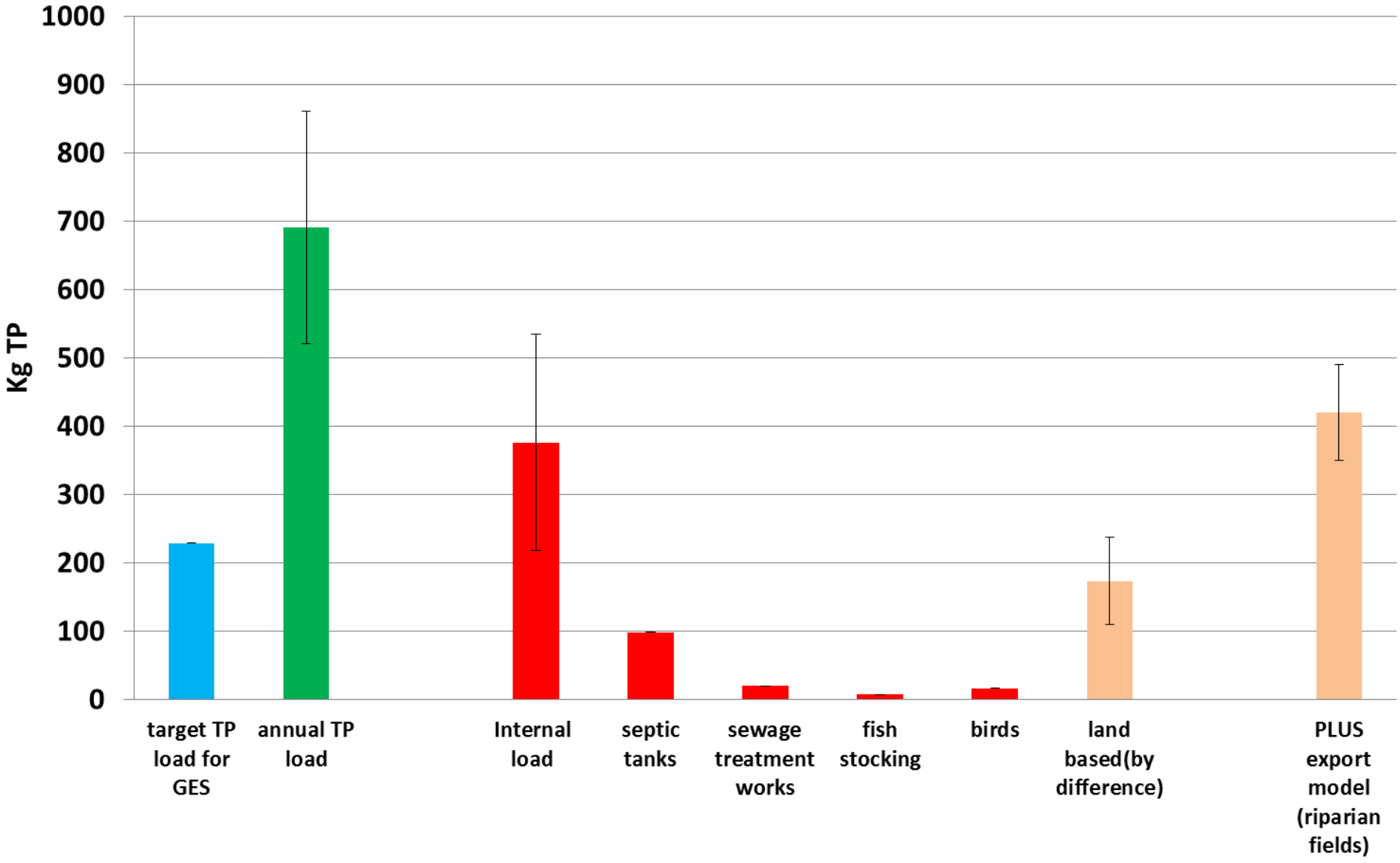
Rescobie catchment: 98 kg P/year assuming 0.3 kg TP/person/day,
4 persons per septic tank
82 septic tanks

Source apportionment: land to water

- Riparian fields in purple
- Other fields in green



Estimated TP source apportionment for Rescobie Loch

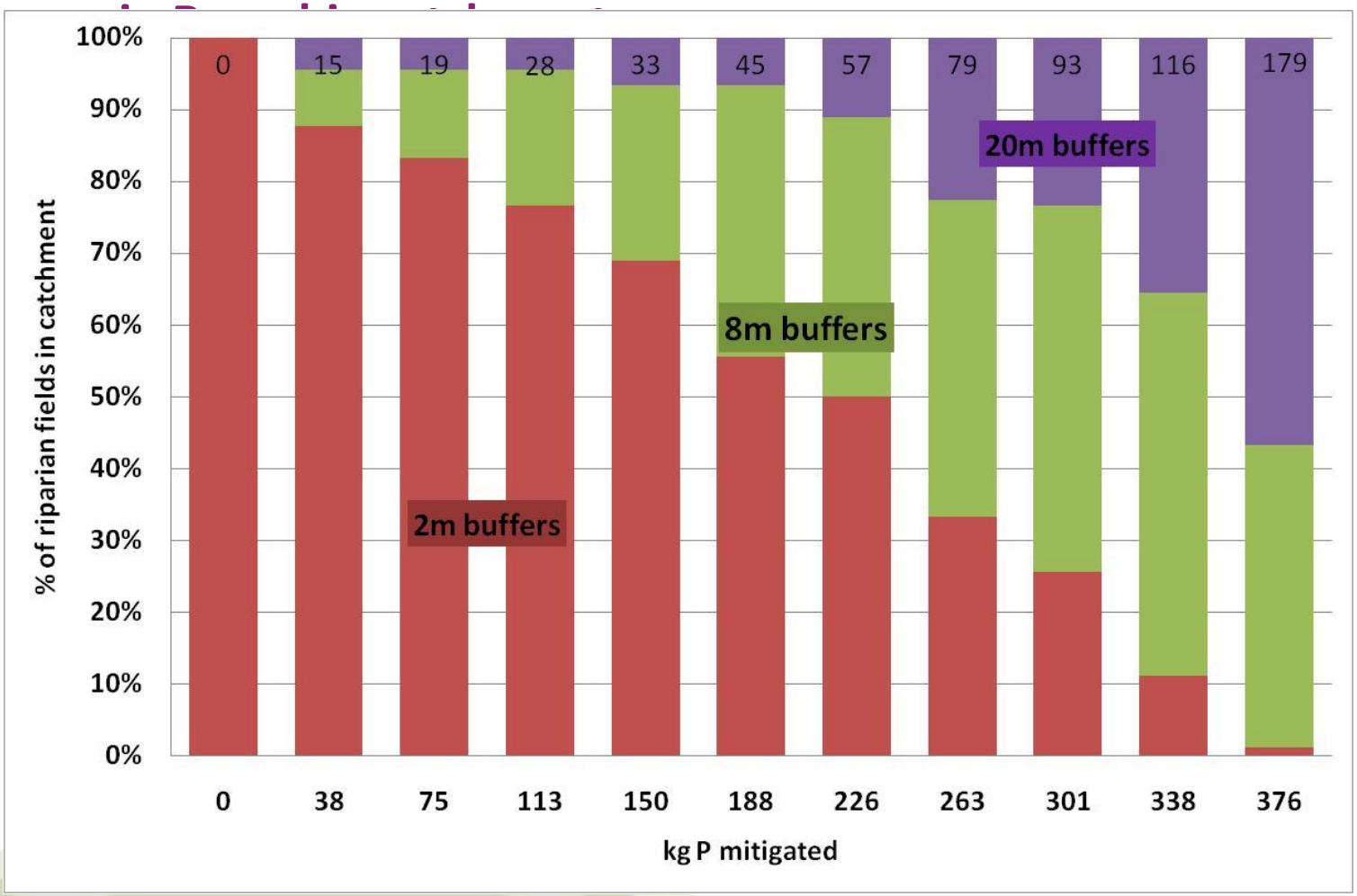


Mitigation options: measures for control of soil erosion

Farmer focus group

Post-harvest cultivation

Cost:effectiveness of buffer strips

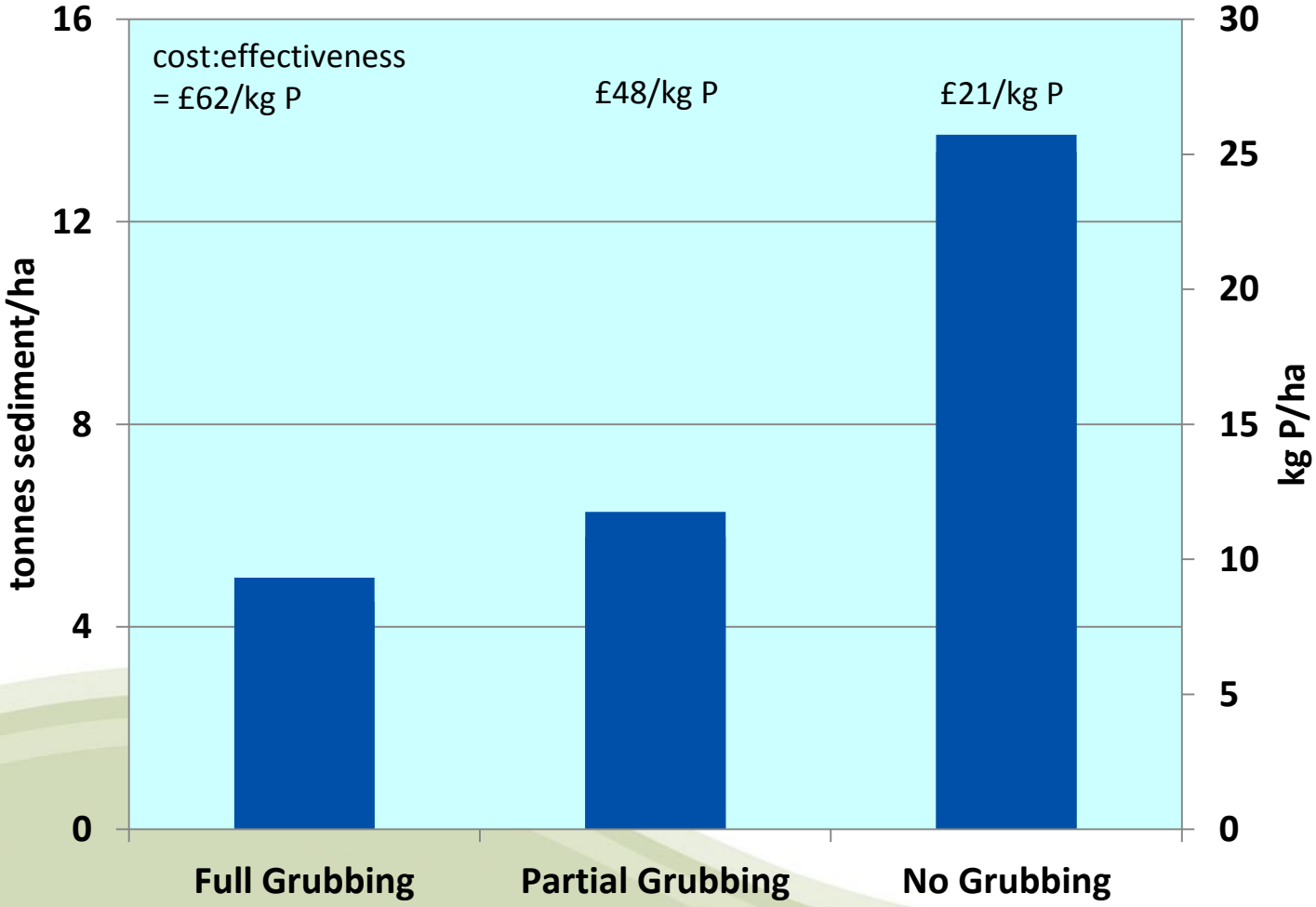


Marginal cost (£/kg P)

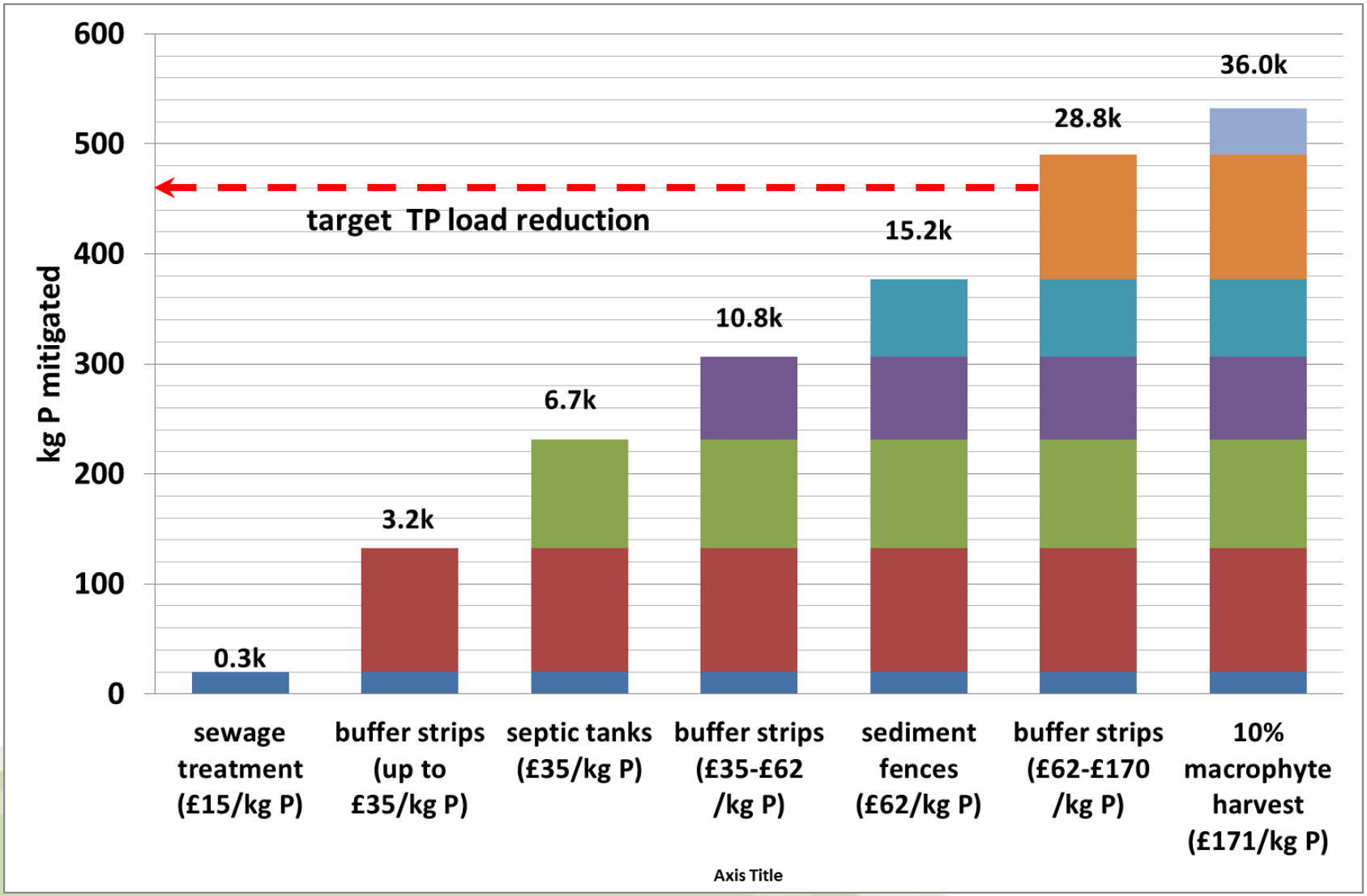
Detention bunds – Loch Leven and Lunan Water catchments

2010 filter fence trial

Cost:effectiveness of sediment fences on plots with 10% slope in aftermath of potatoes as a function of post:harvest cultivations



P mitigation cost:effectiveness analysis for Rescobie Loch



Potential for sediment fence mitigation of P in Rescobie Loch catchment

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	riparian connectivity index			
	0		1	
slope risk class	% of area	P load (kg)	% of area	P load (kg)
1	1.6%	56	1.6%	61
2	1.3%	149	0.5%	73
total	2.9%	205	2.1%	134

Conclusions

- Macrophyte removal is unlikely to be justifiable on grounds of P mitigation potential on its own
- Need to consider and quantify other benefits and costs
  - Other nutrients removal
  - Recreational benefits
  - Flood mitigation benefits
  - Added value eg. as feed or compost