

Cost of soil degradation in England and Wales: an ecosystems approach

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with

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Acknowledgement: Defra



Overview

- Context
- Objectives
- Approach
- Results
- Implications for policy
- Source Reference
 - Graves, A.R., Morris, J., Deeks, L.K., Rickson, R.J., Kibblewhite, M.G., Harris, J.A, and Farewell, T.S. and I. Truckle. 2015. The Total Costs of Soil Degradation in England and Wales. *Ecological Economics* 119 399–413



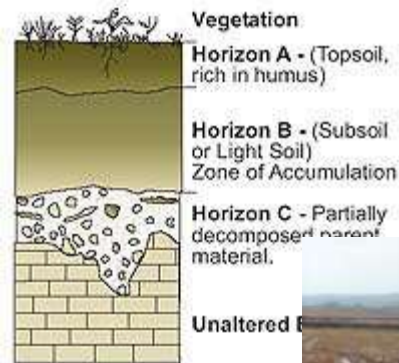
Objectives: Answering questions

- What are the main soil degradation processes and their incidence in England and Wales?
- How does degradation affect soil (ecosystem) services
- What are the likely economic consequences ?
- So what? and what to do?



Soil and soil degradation

- SOIL?
- soil erosion
- compaction
- organic loss
- diffuse contamination
- loss of biota
- soil sealing

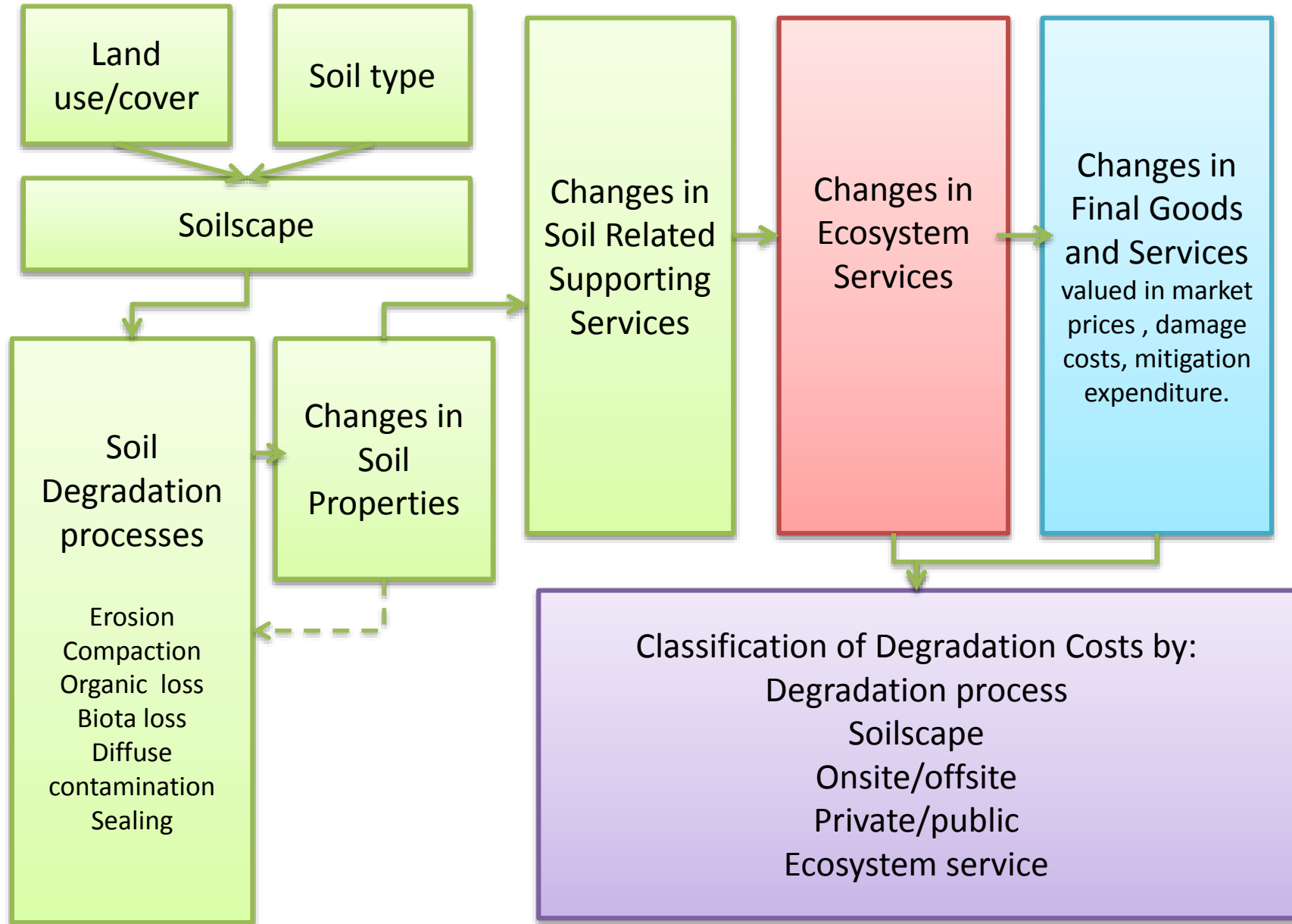


Methods

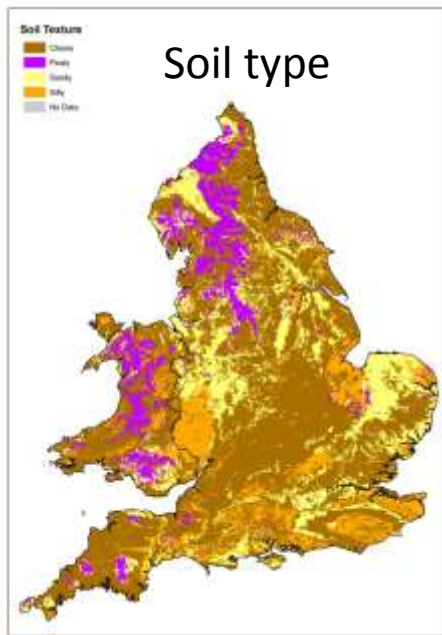
- Assessment
- Data sources
- ‘Soilscapes’
- Degradation probability
- Economic valuation
- Ecosystems framework



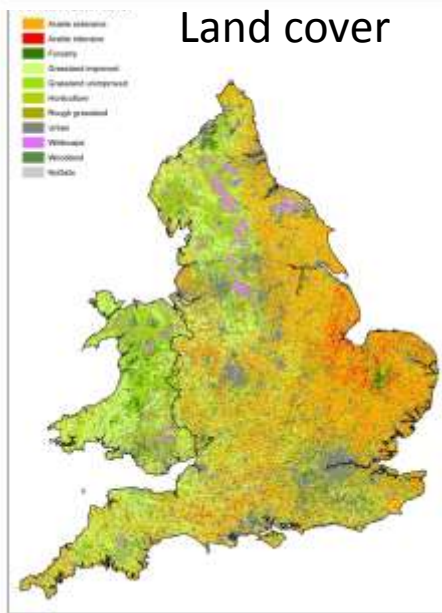
Soil Degradation: An Ecosystems Framework



Soilscapes: soils and land use in E&W



Area (% of total ha)			
Main Soil Types			
Clay	Silt	Sand	Peat
59%	12%	20%	9%



Soilscapes

Land use	Ratio of "actual" to "expected" soilscape areas			
	Clay	Silt	Sand	Peat
Urban	102%	83%	144%	15%
Horticulture	73%	249%	128%	21%
Arable intensive	81%	189%	141%	22%
Arable extensive	113%	110%	98%	12%
Grassland improved	112%	110%	88%	38%
Grassland unimproved	80%	65%	69%	334%
Rough grassland	89%	88%	128%	129%
Forestry	63%	63%	131%	312%
Woodland	102%	115%	110%	48%
Wildscape	39%	49%	70%	609%

Probability of Soil Degradation in E&W*

Erosion



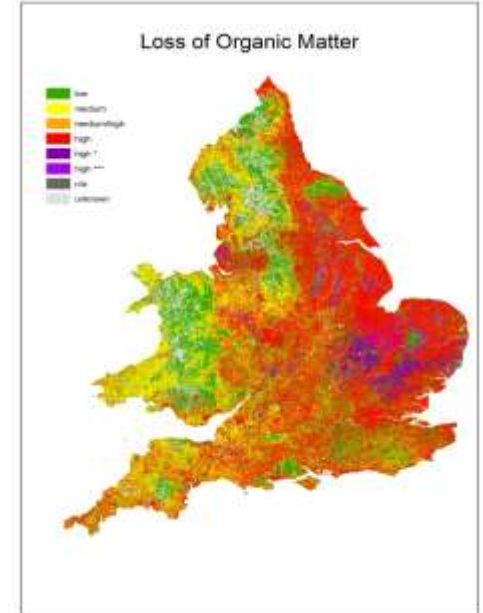
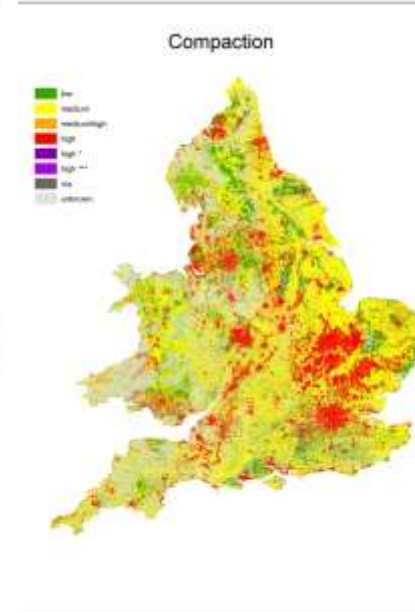
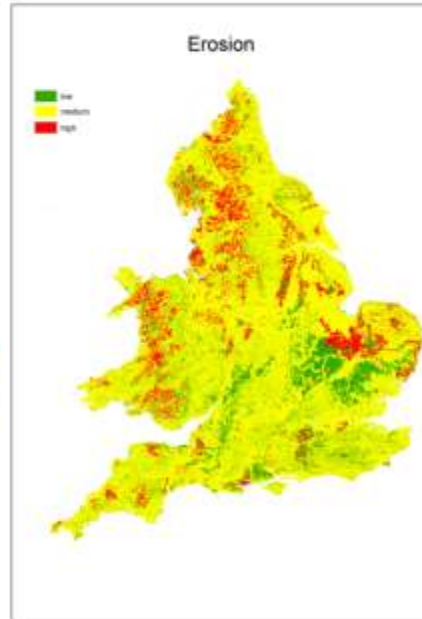
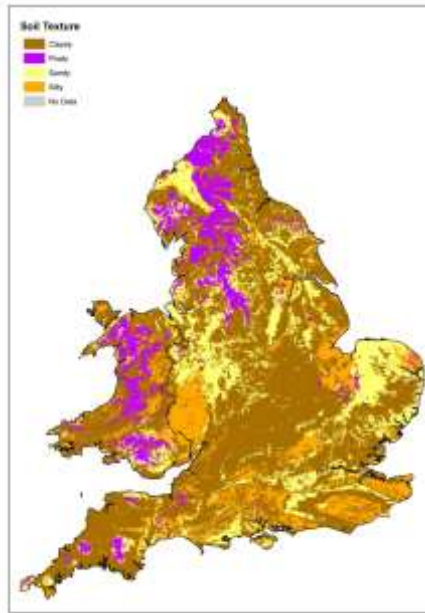
Compaction



Land use	Soilscapes			
	Clay	Silt	Sand	Peat
Urban	L	H	H	n/a
Horticulture	L	H	H	H
Arable intensive	L	H	H	H
Arable extensive	L	M	H	H
Grassland improved	L	M	M	H
Grassland unimproved	L	M	M	H
Rough grassland	L	M	M	H
Forestry	L	L	L	M
Woodland	L	L	L	M
Wildscape	L	L	L	M

Land use	Soil types			
	Clay	Silt	Sand	Peat
Urban	H	H	H	H
Horticulture	H	H	M	H
Arable intensive	H	H	M	H
Arable extensive	H	M	M	M
Grassland improved	H	H	L	H
Grassland unimproved	M	M	M	M
Rough grassland	M	M	M	M
Forestry	H	M	L	H
Woodland	L	L	L	L
Wildscape	L	L	L	L

Probability of soil degradation in England and Wales



Economic valuation

- Stocks and flows
- On site: off site (market failure)
- Private/Public
- Damage costs
- Defensive/mitigation expenditure
- Market and Accounting prices
- Quantifiable Expected Annual Costs



Estimates of soil degradation *Cranfield* UNIVERSITY

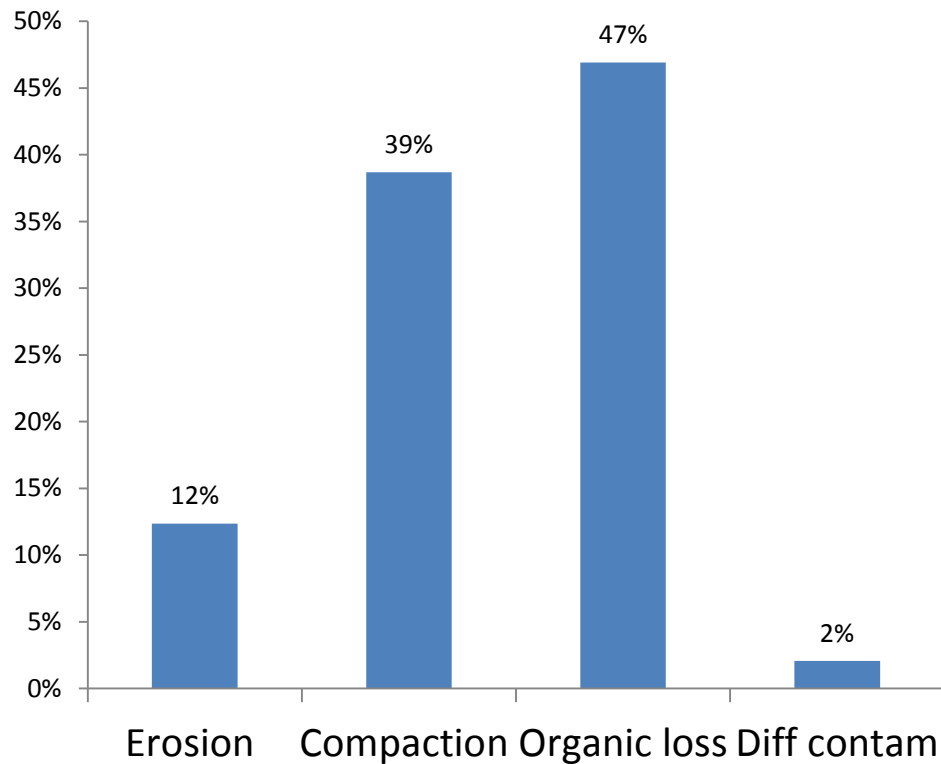
England and Wales, £'000/year 2009 prices

	Provisioning agric prod	Regulating				Cultural	Total 'central'	Total range
		Flooding	Water quality	GHG	Other			
Erosion	30-50	50-80	25-40	5-10	U	U	150	110-180
Compaction	180-220	120-200	5-10	75-110	U	U	470	350-540
Organic content loss	U	U	U	360-700	U	U	570	360-700
Diffuse Contam.	U	U	U	U	20-30	U	25	20-30
Soil biota loss	U	U	U	U	U	U	U	U
Sealing	U	U	U	U	U	U	U	U
Total central	244	238	37	671	25	U	1,215	
Total range	210-270	170-280	30-50	440-820	20-30	U		870-1,450

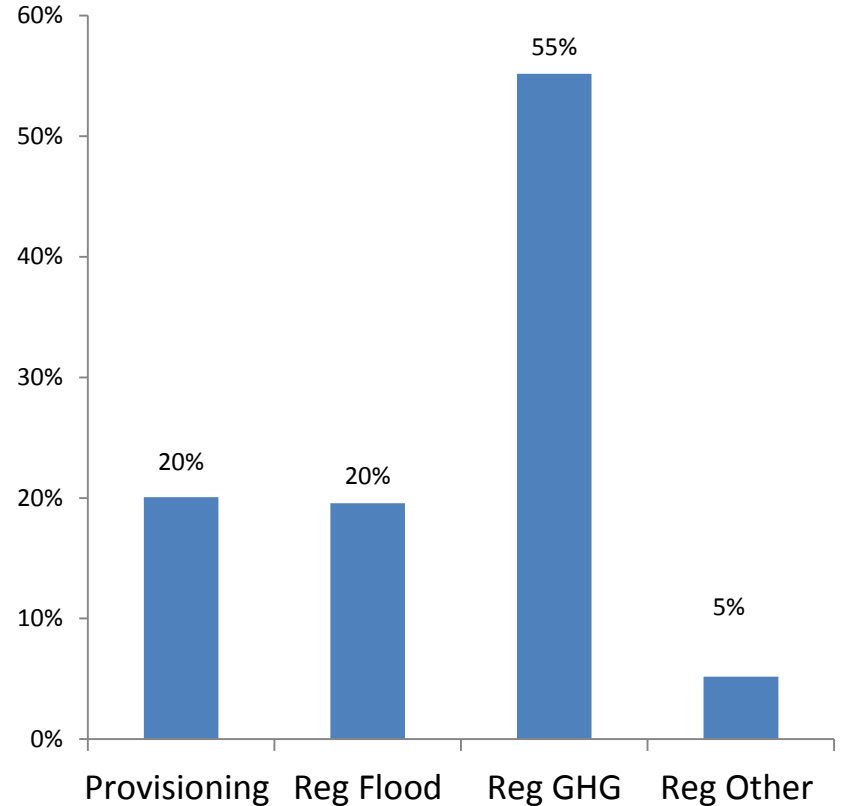
U :Estimates not available for national scale

Distribution of estimated £₂₀₀₉1.2 bn quantified economic costs of soil degradation in E&W

by degradation process



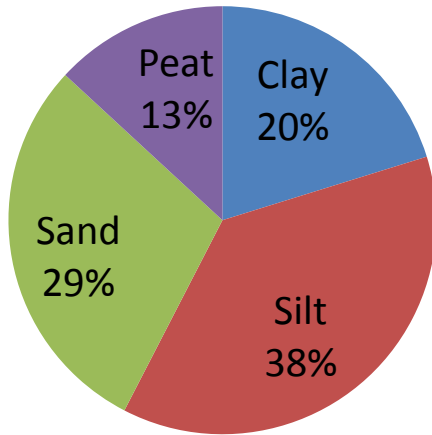
by ecosystem service



Distribution by soil type

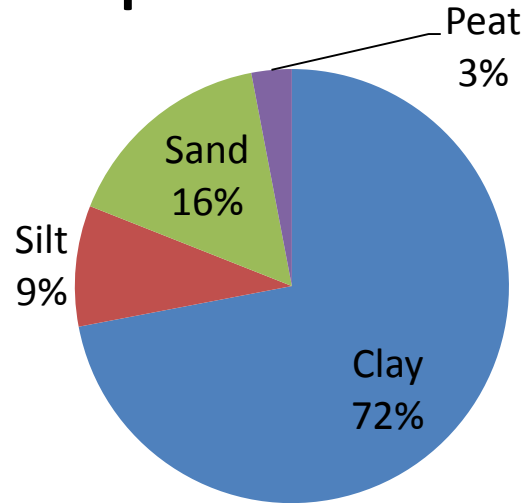
Total Cost: £1.2 bn /year

Erosion



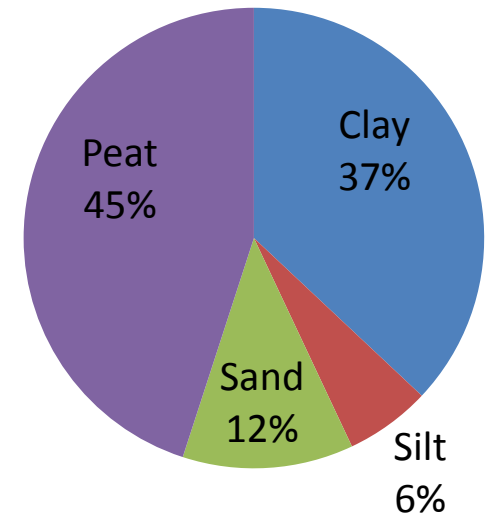
Total: £150M
On site: 27%
Off site: 73%

Compaction



Total: £470 M
On site: 43%
Off site: 57%

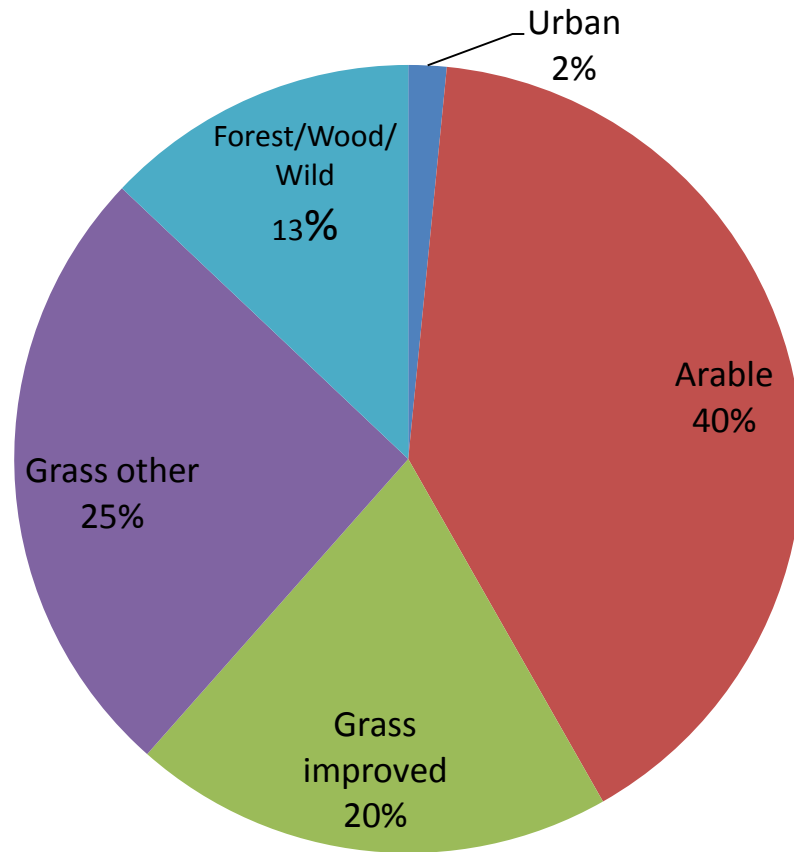
Organic loss



Total: £570M
On site: 1%
Off site: 99%

Distribution by land cover

Total Cost: £1.2 bn /year



Issues and challenges

- Key challenges: biophysical relations, valuation, dynamics
- Soilscaapes and ecosystems: implications for science
- ‘Units’ of soil service
- Stocks, flows and thresholds
- Spatial, scale and temporal variation
- Joint /overlapping effects
- Efficacy of measures/levers



Policy Implications

- Rural space:
 - avoid erosion and compaction on intensively farmed soils
 - maintain soil organic content
 - protecting soil carbon embraces most aspects of soil quality
- Urban context : reduced sealing for flood control
- Large Off Site/External Costs indicate failure of soil governance and justification for policy interventions
- Soils and Policy Domains

