



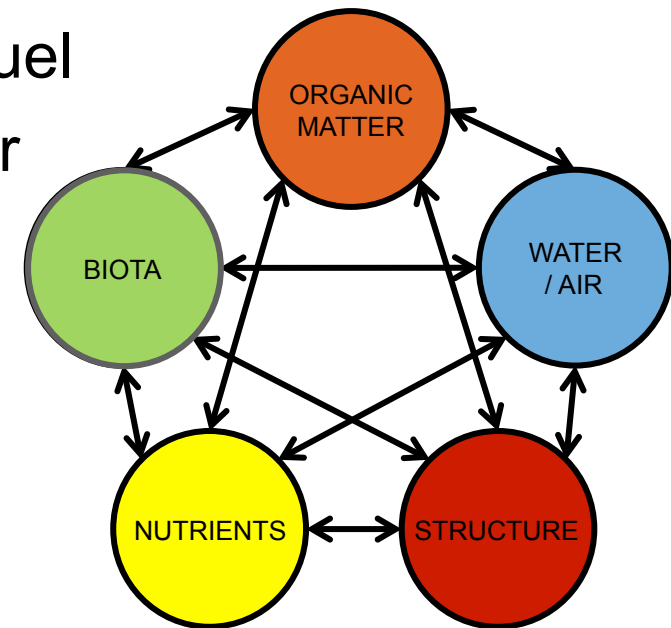
Saving our soils: what science has to offer

- 1. Assessing the state of our soils**
- 2. Maintaining soil health**

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1. Assessing the state of our soils

- Healthy soils deliver multiple ‘ecosystem goods and services’ that underpin sustainable agriculture
 - Production of food, fibre, fodder and fuel
 - Storage of nutrients, carbon and water
 - Protection of habitats and biodiversity
 - Cultural benefits

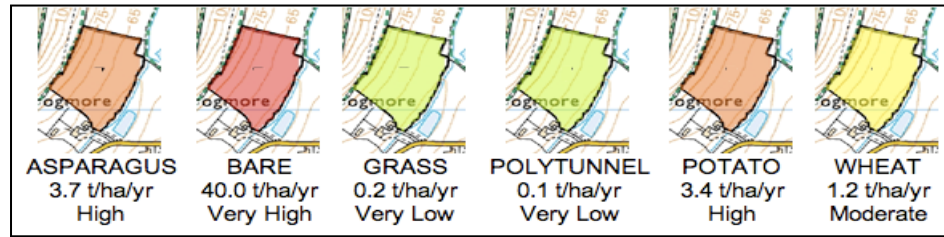
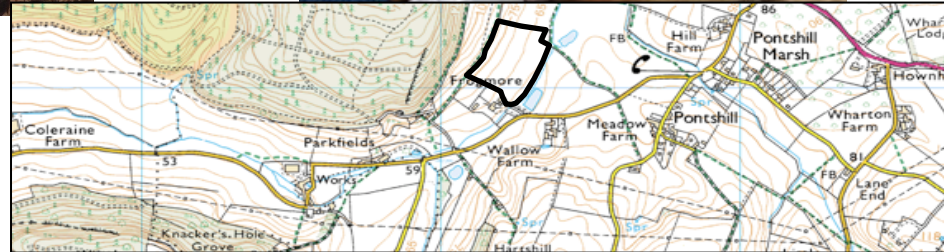
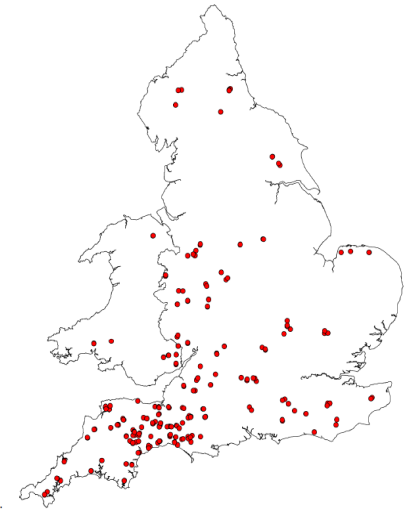
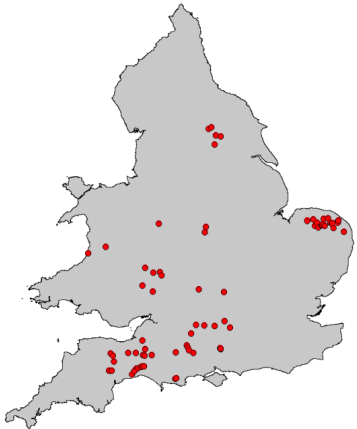


Soil health: the pivotal 5
(after Prof K. Ritz, pers.comm)

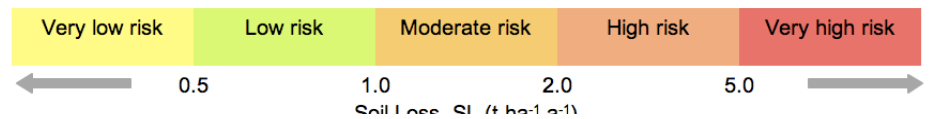
- “Meaningful” Soil Quality Indicators are based on physical, chemical and biological soil properties



1. Assessing the state of our soils: soil degradation



SERAM-DST RISK CLASSIFICATION



Field erosion surveys

Modelled erosion risk classes

1. Assessing the state of our soils: soil erosion

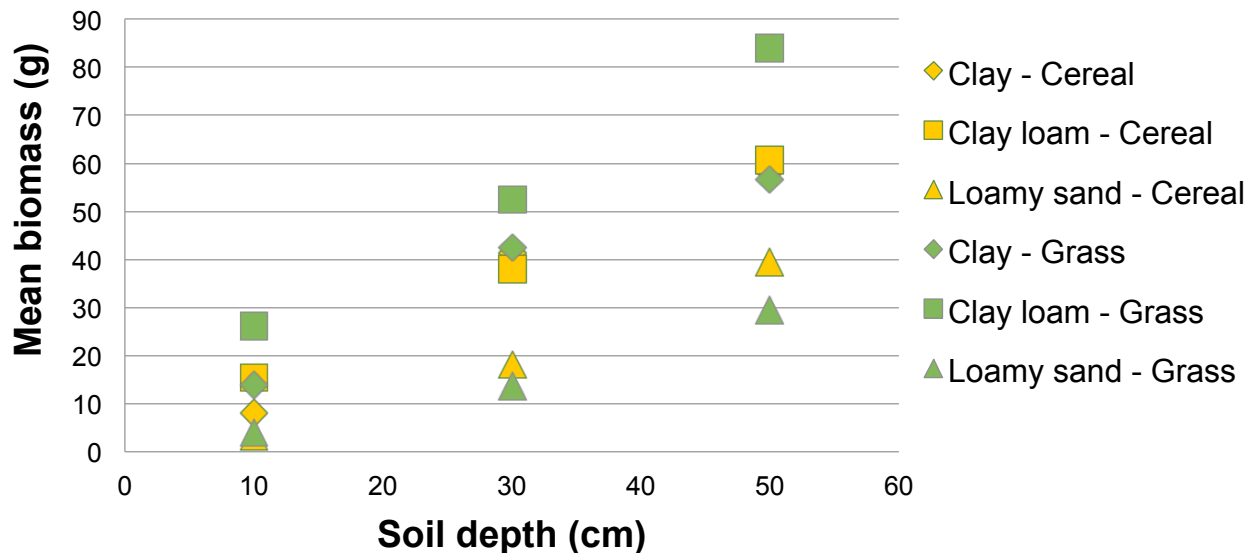


Wind erosion	Tillage erosion	Co-extraction (root crops and farm machinery)	Water erosion
0.1 – 2.0	0.1 – 10.0	0.1 – 5.0	0.1 – 15.0

Comparison of the magnitude of soil loss ($\text{t ha}^{-1} \text{ yr}^{-1}$) for different erosion processes (Owens et al., 2006).

N.B. Rate of soil formation $\approx 1 \text{ t ha}^{-1} \text{ yr}^{-1}$ (Verheijen et al., 2009)

1. Assessing the state of our soils: soil erosion



Total annual costs of soil erosion in England and Wales (2010 prices; Graves et al., 2011)

Agricultural production	Flooding	Water quality	GHG emissions	Cultural services	Total
£30 – 50m	£46 – 80m	£55 – 62m	£8 – 10m	?	~ £165m

2. Finding solutions: maintaining soil health



- **Cultivations and tillage practices**
- **Cover cropping**
- **Soil (organic) amendments**
- **Field engineering**
- **Erosion control products**

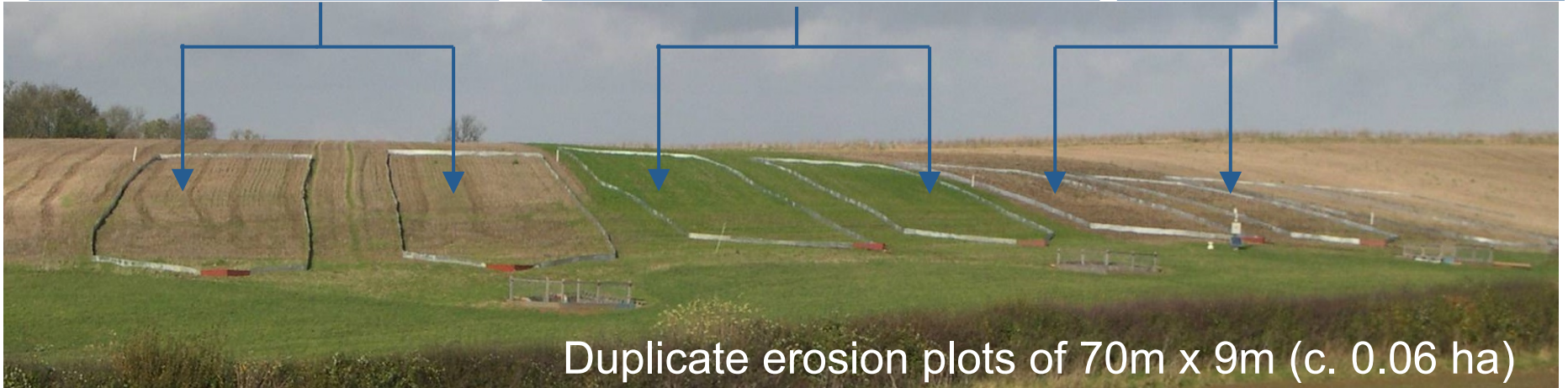


2. Finding solutions: maintaining soil health

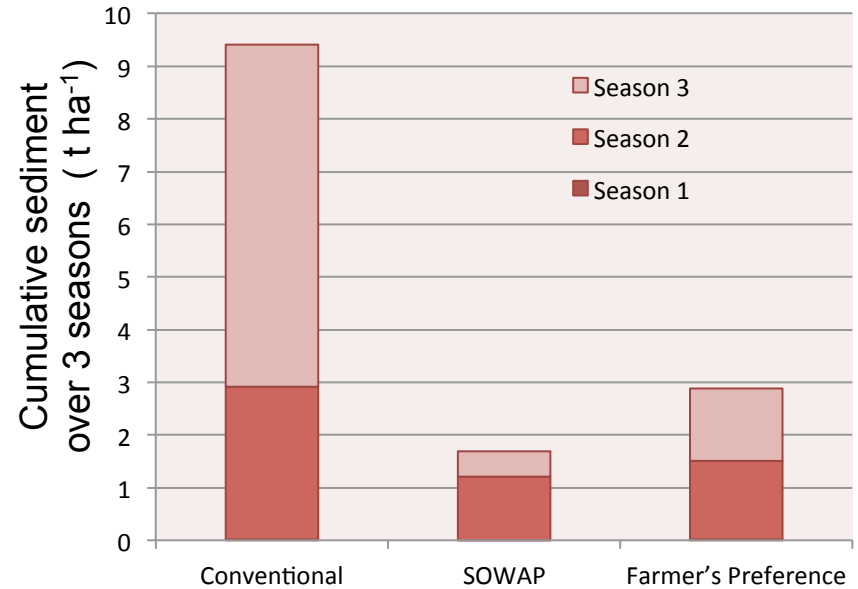
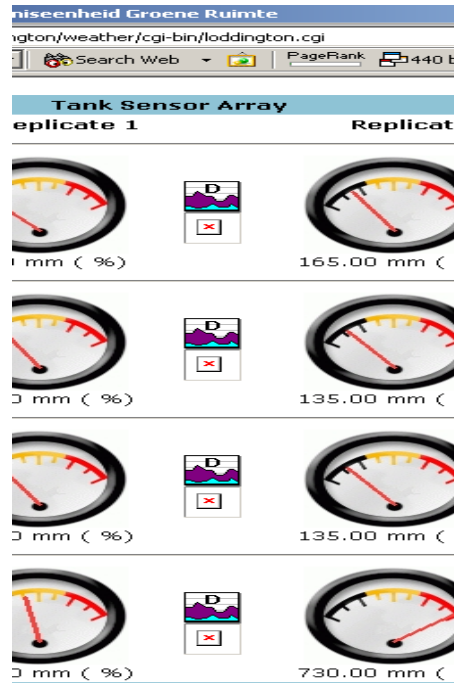
Conventional practice

SOWAP (Minimum tillage)

Farmer's Preference



Duplicate erosion plots of 70m x 9m (c. 0.06 ha)



2. Finding solutions: maintaining soil health



Control Treatment: Two Pass



Claydon Hybrid



Sumo DTS



Mzuri Pro-Til 3



Vaderstad Seed Hawk



Vaderstad Rapid A

Results: How tillage affects soil quality

	Penetration resistance MPa	Organic carbon (%)	Microbial biomass carbon ($\mu\text{g C g soil}^{-1}$)	Earthworms / m^2
1	0.50 c	2.710 b	339.1 b	75.0 c
2	0.60 bc	2.789 ab	321.8 b	118.8 b
3	0.70 ab	2.829 ab	380.2 ab	137.5 b
4	0.61 abc	2.714 b	379.8 ab	103.1 bc
5	0.76 a	2.985 a	443.8 a	187.5 a





2. Finding solutions: maintaining soil health

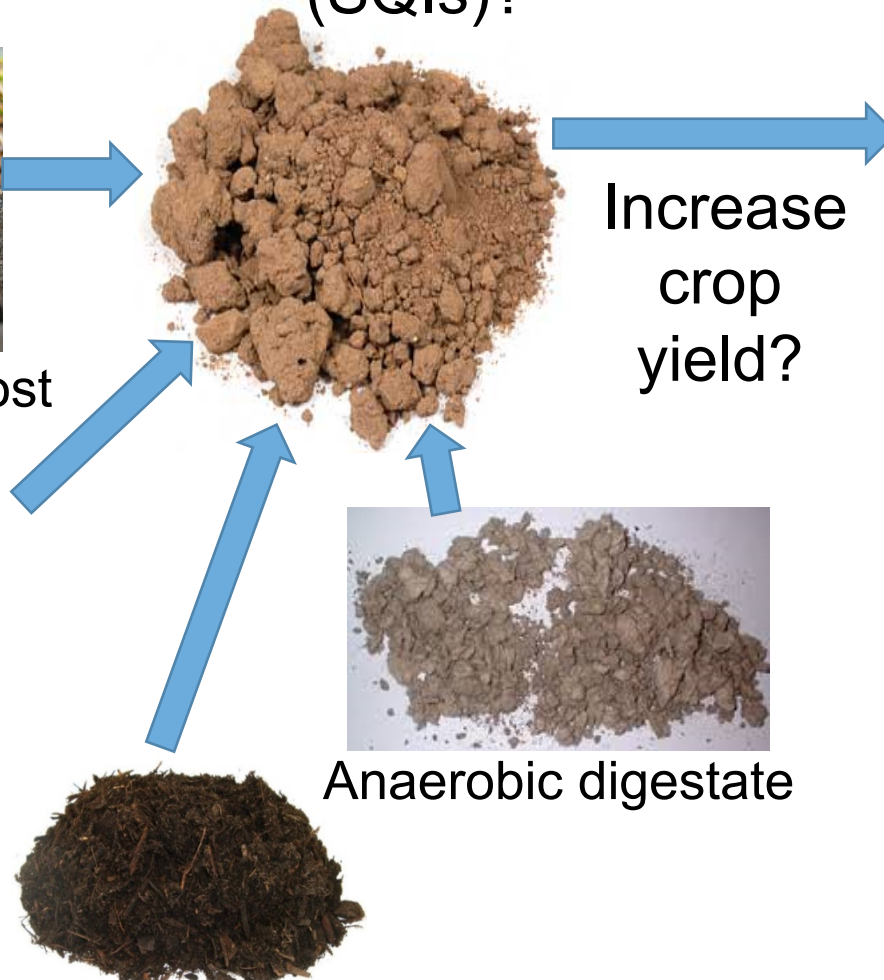
Improve Soil Quality Indicators (SQIs)?



Mushroom compost



Poultry manure



PAS 100 green waste compost

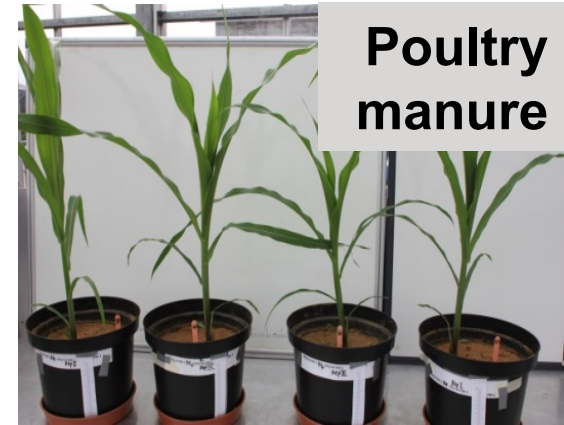


Anaerobic digestate

Increase crop yield?



Control



Poultry manure



Mushroom compost



Saving our soils: what science has to offer

Assessing the state of our soils

Healthy soils deliver multiple ecosystem goods and services, but can be irreversibly degraded

Maintaining soil health

Soil management can improve soil productivity and control degradation processes

Cost effectiveness of practices will be site specific and must fit into current farming practices



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