

Soil ecosystem services
their value and use in promoting
sustainable farming

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SOIL SERVICE project (FP7)

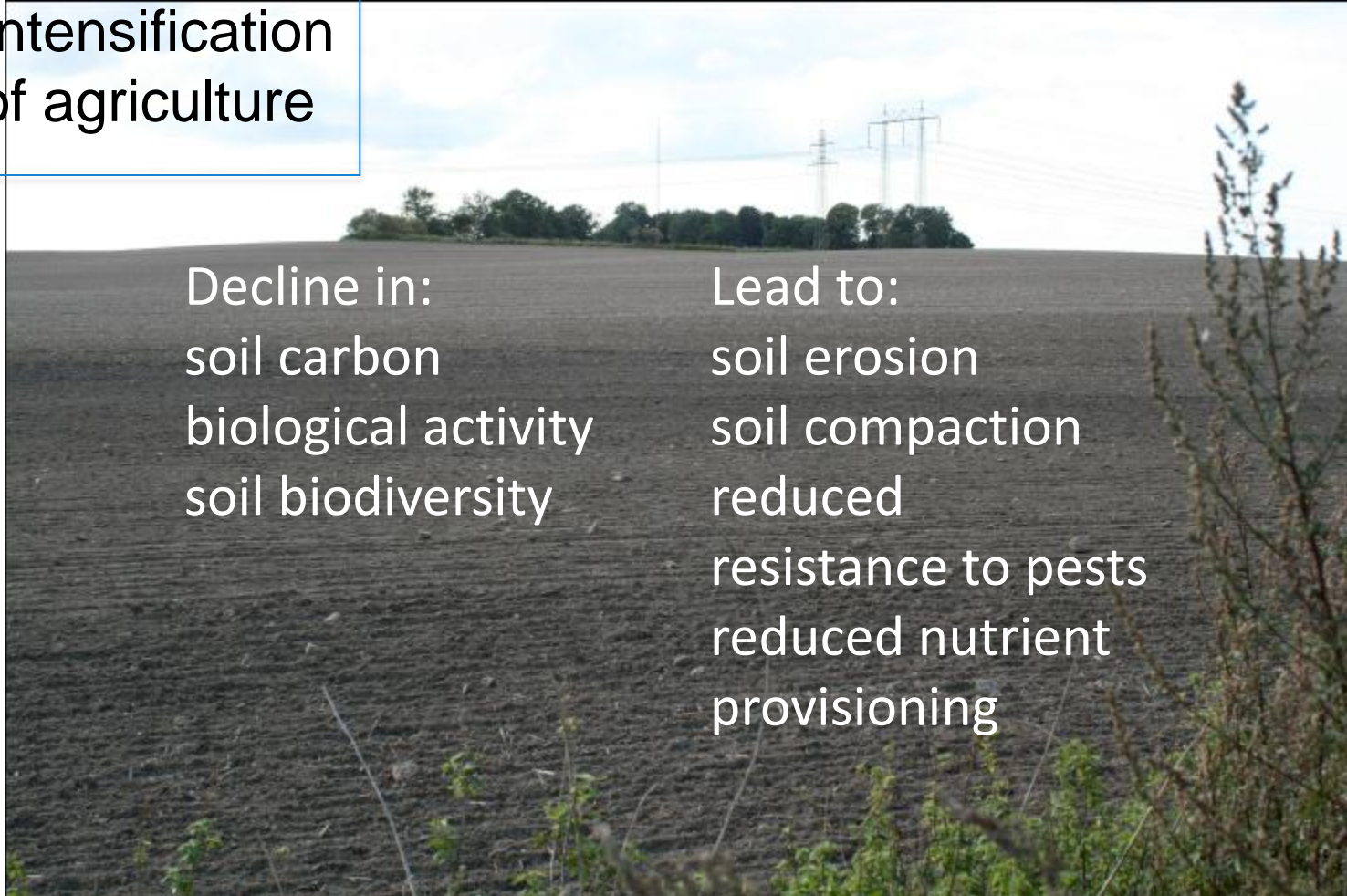


Agriculture and soil threats

Intensification of agriculture

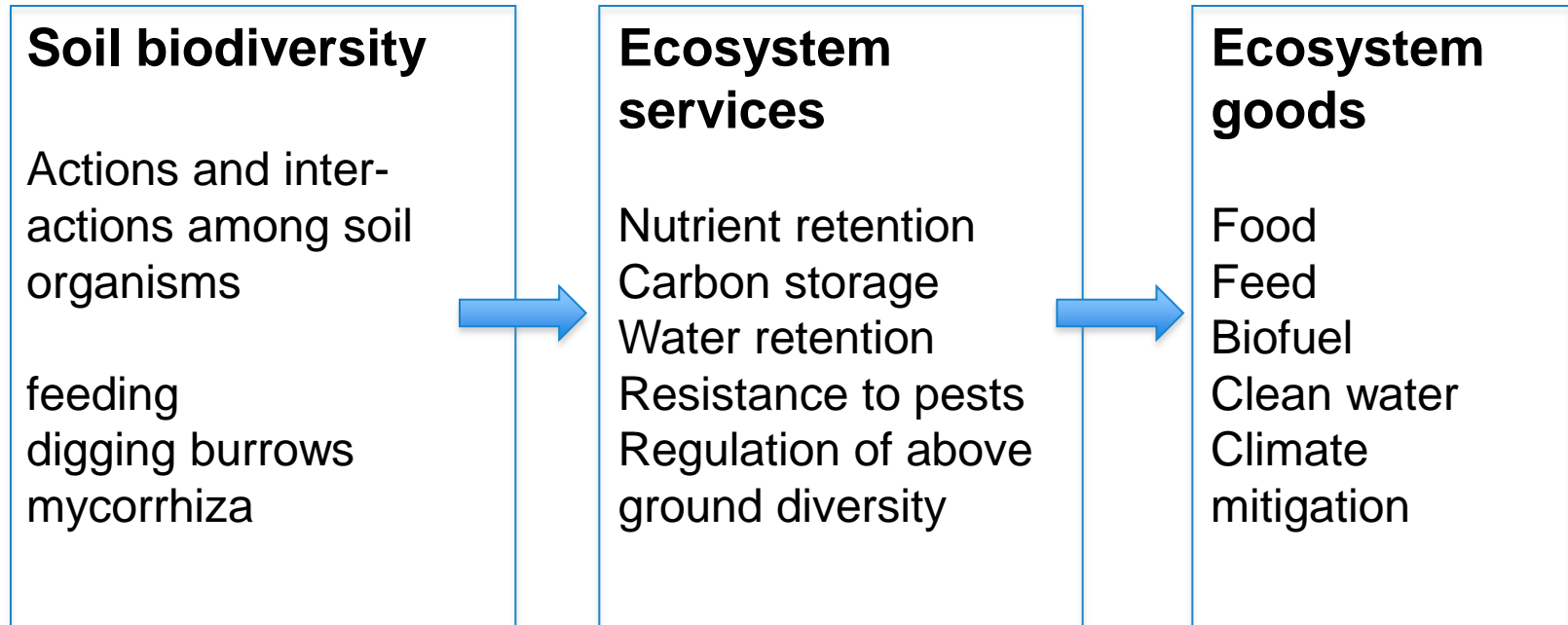
Decline in:
soil carbon
biological activity
soil biodiversity

Lead to:
soil erosion
soil compaction
reduced
resistance to pests
reduced nutrient
provisioning





Soil is a natural capital





SOIL SERVICE study regions

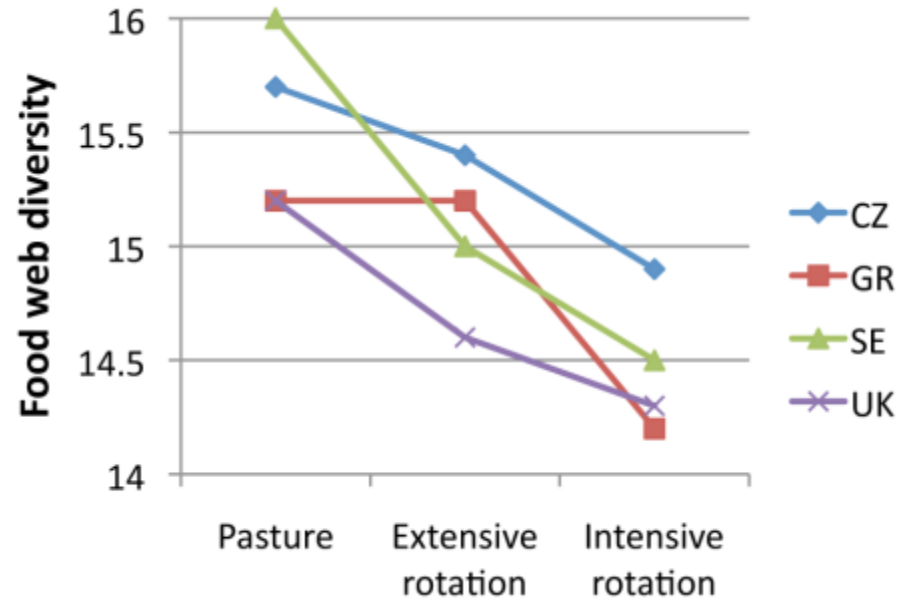
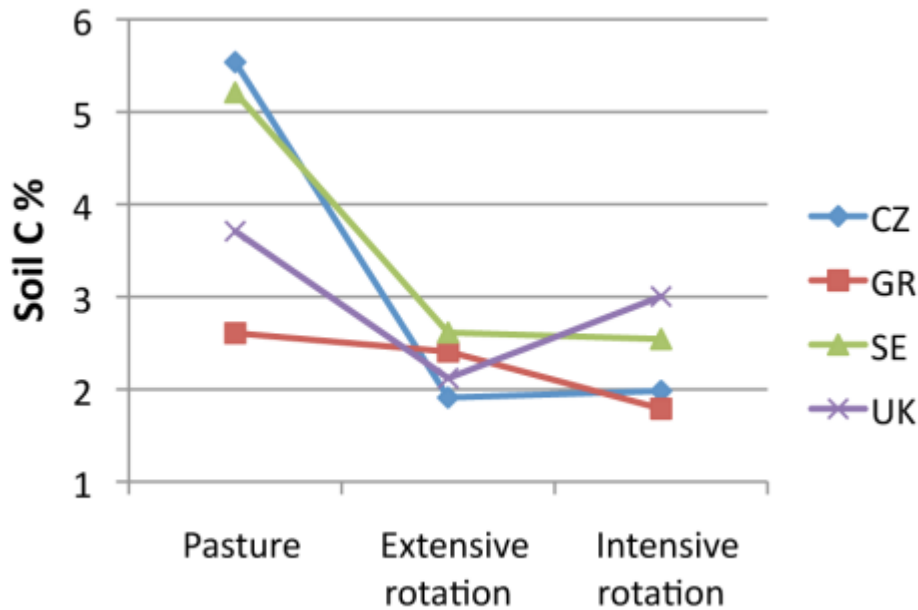


Regions for soil biodiversity and farm economy studies



Soil biodiversity and agriculture

soil biodiversity—correlated to ecosystem services





Soil biodiversity & intensive agriculture

Pastures to crop rotation:

- Reduce species diversity
- Lower food chain length
- Soil carbon: 10 – 0.8 %C
- Soil nitrogen: 0.4 - 0.1%N
- Phosphorous uptake by AM fungi: from 150 to 15 kg/ha
- Reduced soil mixing: from 100 to 5 tons/ha
- Reduction of soil aggregates: more than 50%





Value of the soil ecosystem services

Value to farmers

- Fertile soils
- Water retention
- Less erosion
- Less use of
 - fertilizers
 - pesticides

Value to society

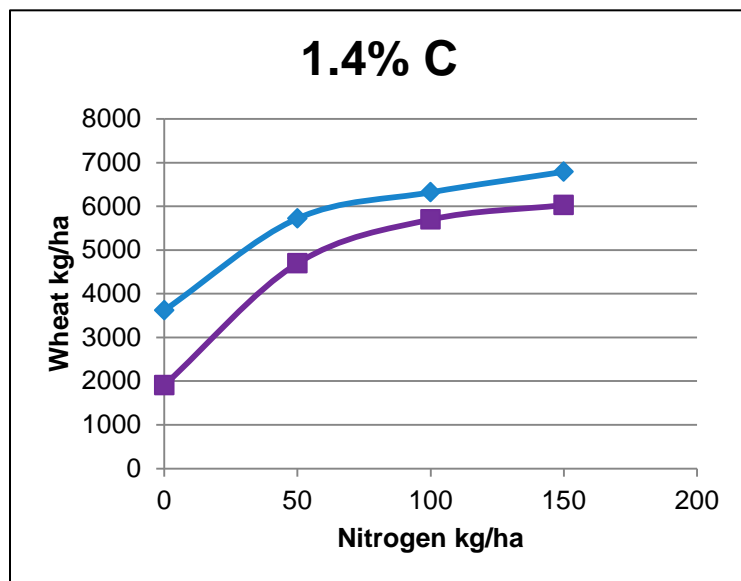
- Reduce eutrofication
- Clean water
- Carbon retention

€?

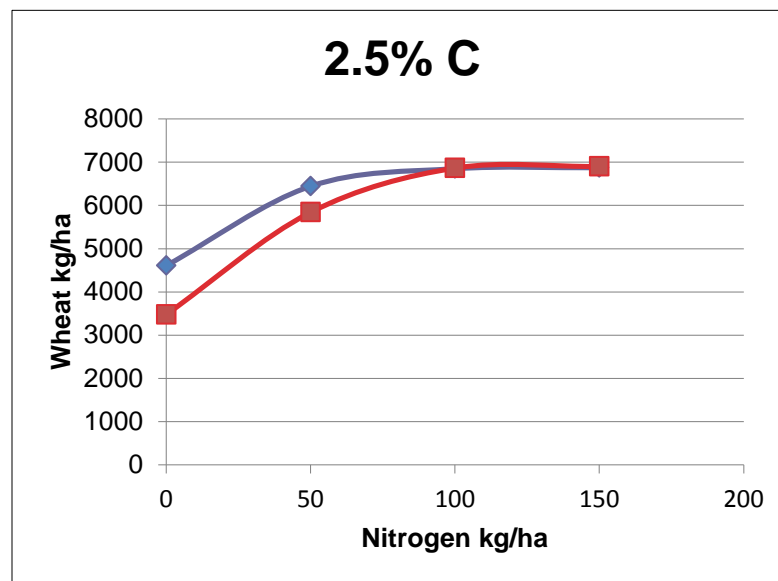


Agricultural production functions

Farm A



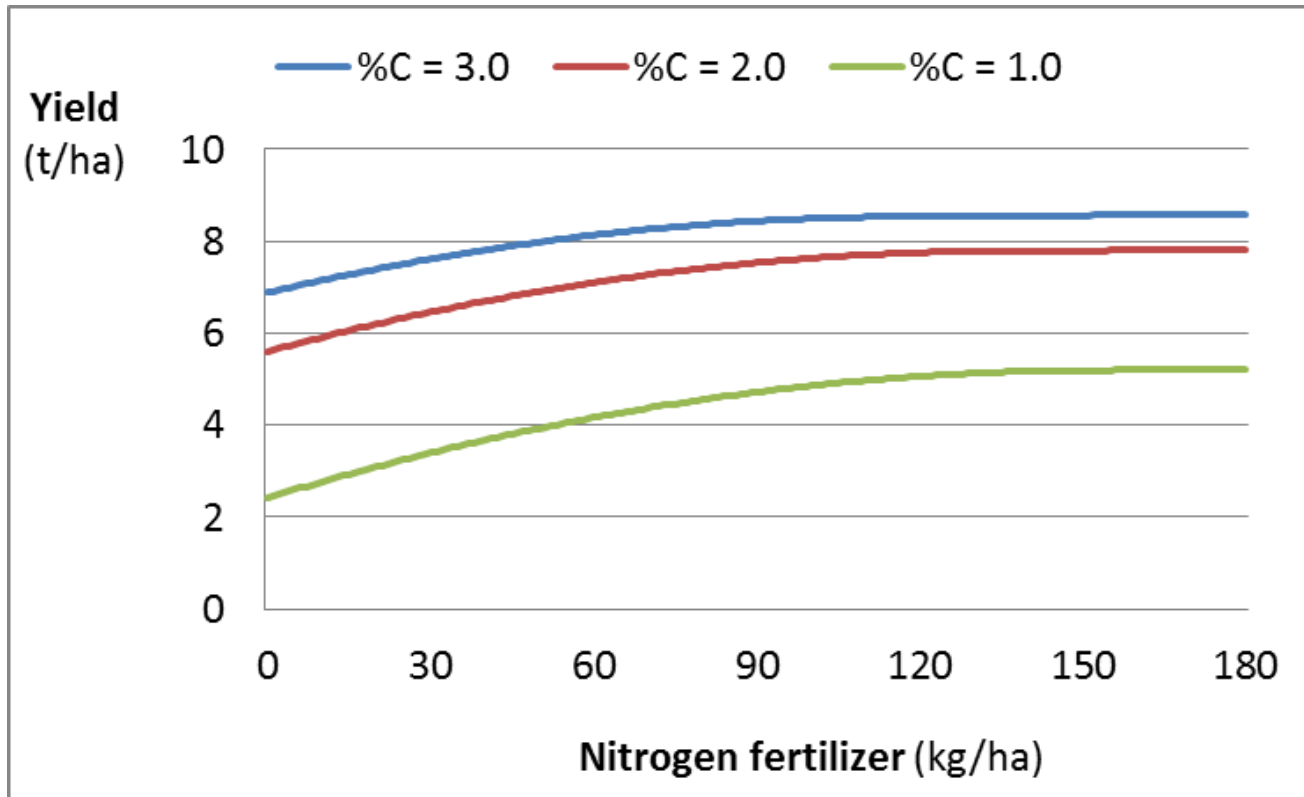
Farm B



0.2 % C between the treatments

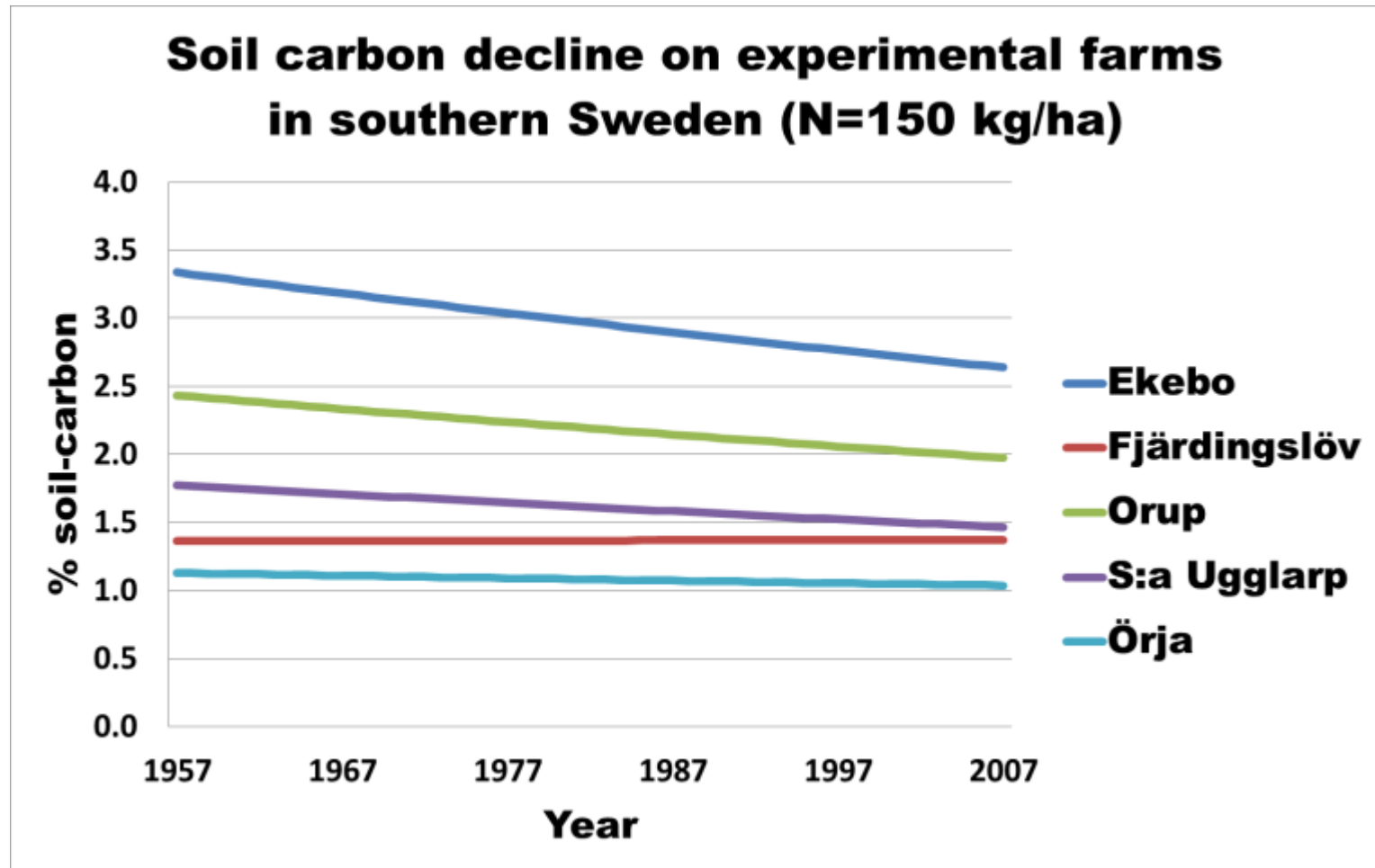


Economic valuation: Carbon a currency for natural capital





Long term decline of soil-C in Europe





How can we affect Soil C

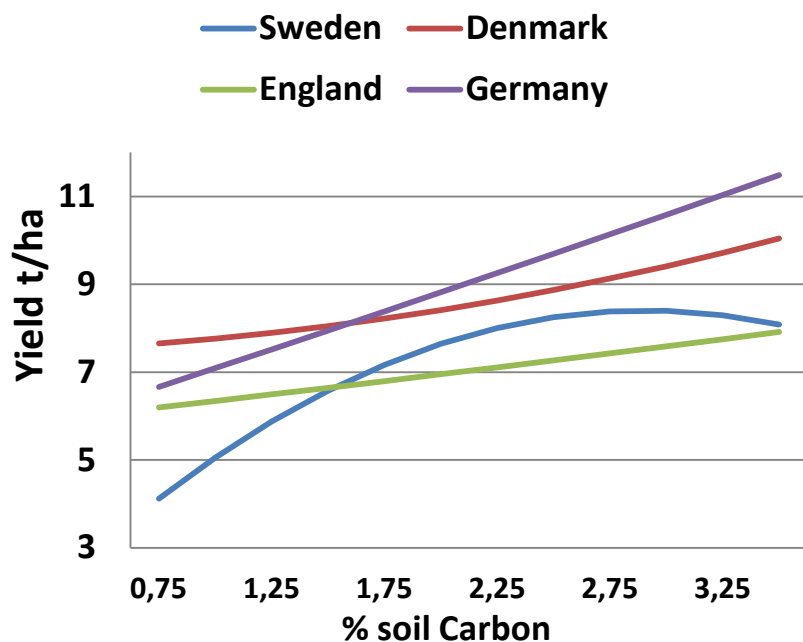
Management	C decline per year	
Intensive cereal production	-1.0%	UK
Inorganic fertilisers	-0.5%	SE
Farm yard manure (5 ton/ha)	-0.2%	SE
Straw addition (3 ton/ha)	-0.2%	DK

Management	C increase per year	
Cover crops	0.2%	FR
Straw addition (12 ton/ha)	0.3%	DK
Farm yard manure (35 ton/ha)	0.4%	UK
Sewage sludge	0.9%	SE
Miscanthus grass (bioenergy)	?	

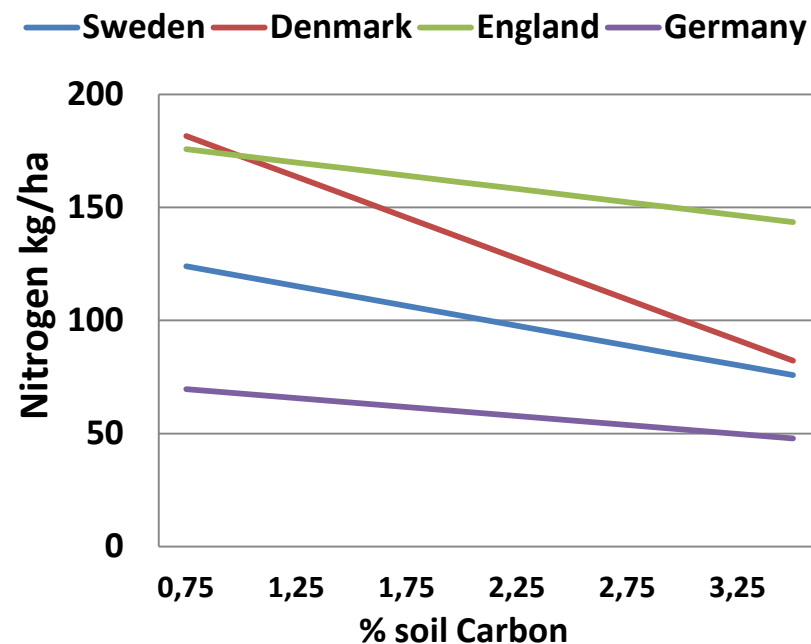


Optimal use of soil C

Optimal yield

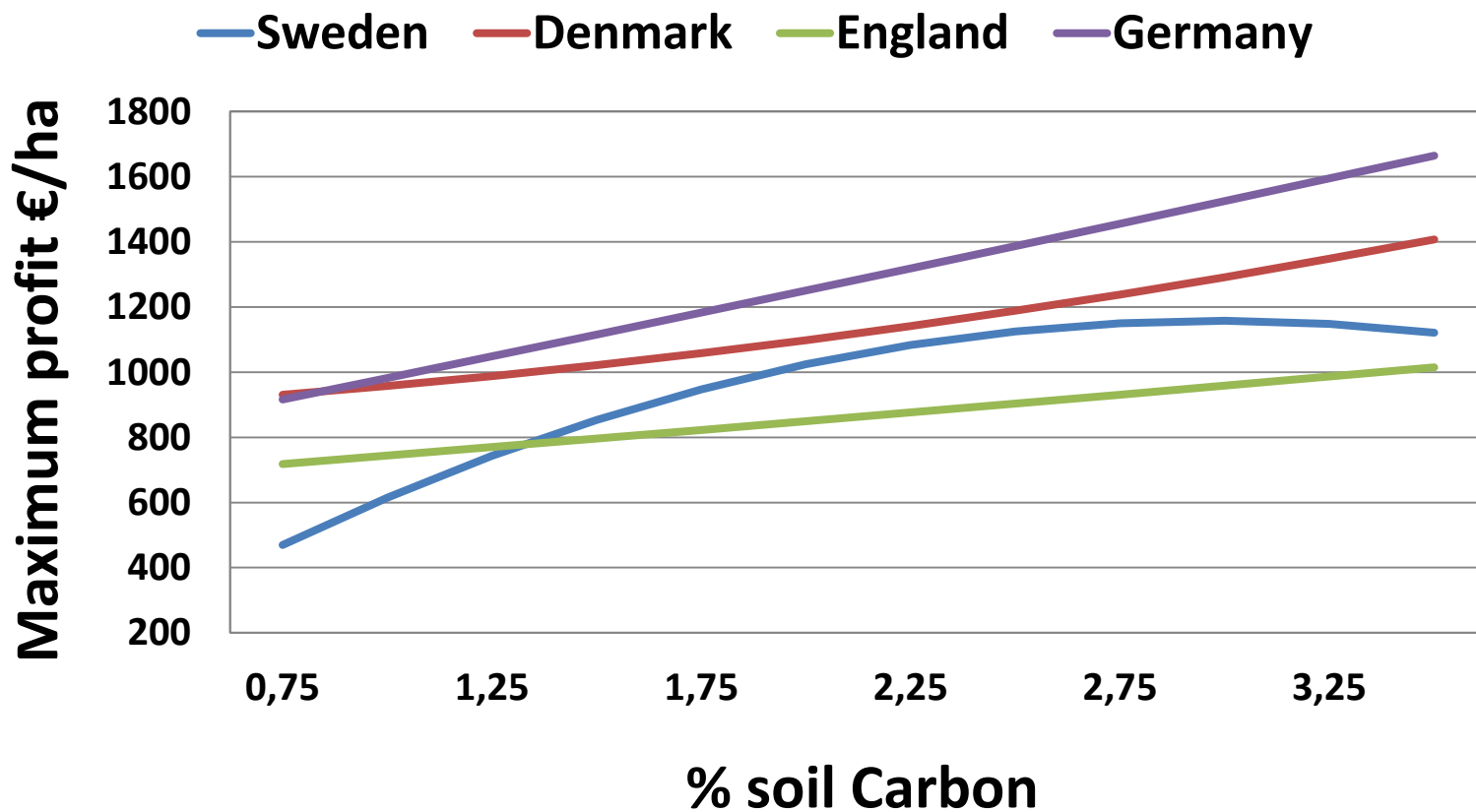


Optimal fertiliser use





Carbon a natural capital





Scenarios for predicting the future

Scenario	World Market	Regional Enterprise	Global Sustainability	Local Stewardship
Yield increase	High	Medium	Medium	Low
Crop Price	Low	Low	Low	Medium
Energy price	Low	Medium	Medium	High
Global pop	Low	High	Low	Medium

Adopted from the ACCELERATES project
(Abildtrup, et al. 2006)



Farm profits and C change in 2035

No change in C	2010	WM	RE	GS	LS
Yield (kg/ha)	7 907	13 673	10 858	10 824	8 295
Total revenues (€/ha)	1 832	2 364	2 223	2 591	2 233
Farmers profit (€/ha)	813	1 321	1 084	1 160	783
C change - 0.5 %/yr		WM	RE	GS	LS
Yield (kg/ha)		13 144	10 438	10 406	7 974
Total revenues (€/ha)		2 057	1 935	2 255	1 944
Farmers profit (€/ha)		974	742	753	416
C change +0.5 %/yr		WM	RE	GS	LS
Yield (kg/ha)		13 953	11 081	11 046	8 464
Total revenues (€/ha)		2 709	2 548	2 970	2 560
Farmers profit (€/ha)		1 703	1 457	1 603	1 179



Soil a natural capital

- Promoting soil C means increasing soil biodiversity and soil ecosystem services
➔ sustainable agriculture
- Processes are long term and farmers economy will be affected in the future
➔ long term investments



SOIL SERVICE project



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