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SmartSOIL
Sustainable farm Management Aimed at Reducing Threats to SOILs under climate change

STØTTET AF
promilleafgiftsfonden
for landbrug

Organisk stof I jorden

Professor Jørgen E. Olesen

Den Europæiske Landbrugsfond for Udvikling af Landdistrikterne:
Danmark og Europa investerer i landdistrikterne

LDP 2020

Miljø- og Fødevareministeriet
NaturErhvervstyrelsen

Den Europæiske Landbrugsfond
for Udvikling af Landdistrikterne

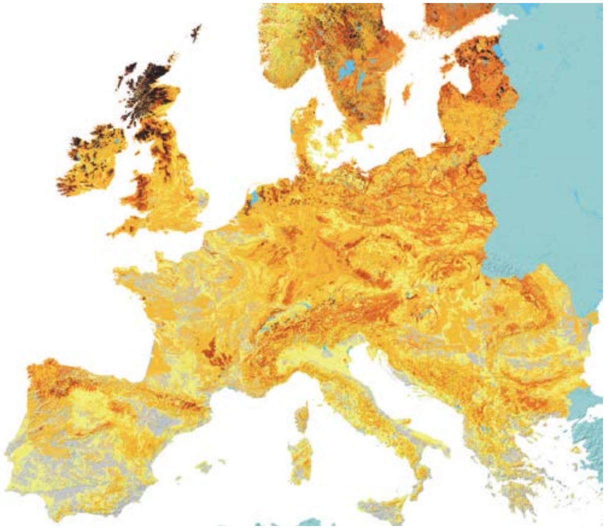
Se EU-Kommissionen, Den Europæiske Landbrugsfond for Udvikling af Landdistrikterne

Problemstillinger

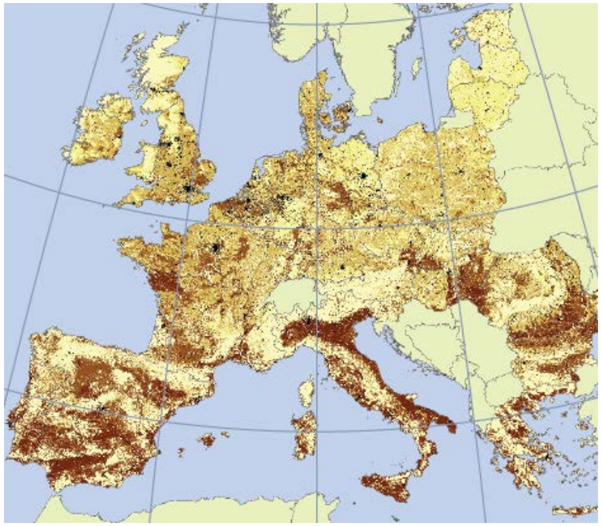
Ændringer i jordens kulstof påvirker klimabelastning (positivt eller negativt)

Jordens kulstof påvirker jordens funktion og produktivitet

Disse problemstillinger indgår ikke tilstrækkeligt i bedriftsmæssig praksis, politikker eller incitamenter for landbruget



Jordens C indhold



Jordens C tabspotentiale

Andre udfordringer

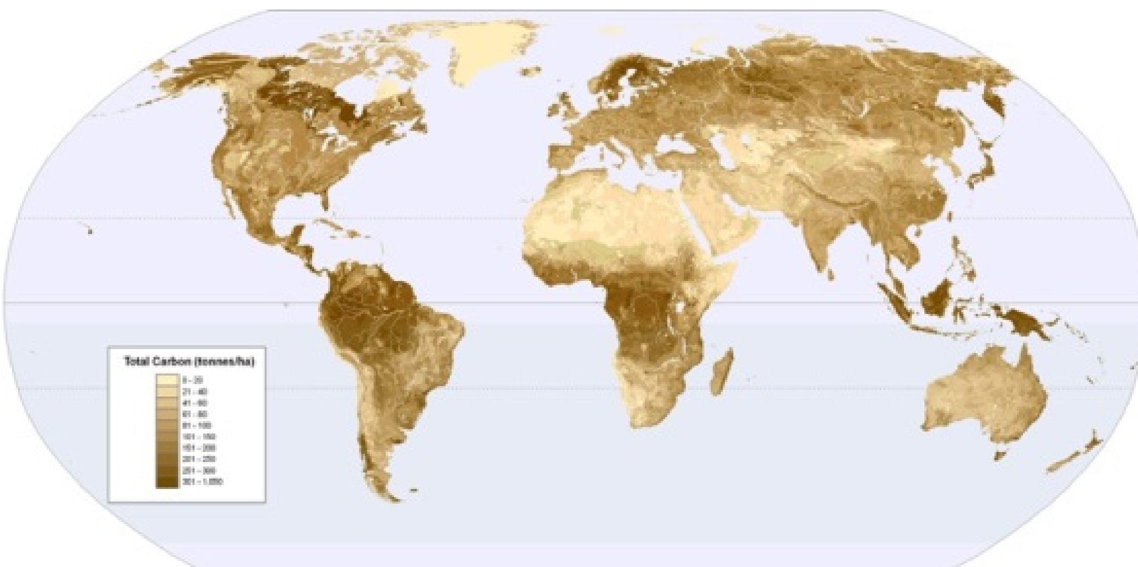
Ufuldstændig videnskabelig forståëlse af betydningen af jordens organiske stof for agroøkosystemets funktion

Ufuldstændig kvantificering af effekt af tiltag til håndtering af jordens C

Manglende forståelse af betydningen af organisk stof blandt landmænd og beslutningstagere

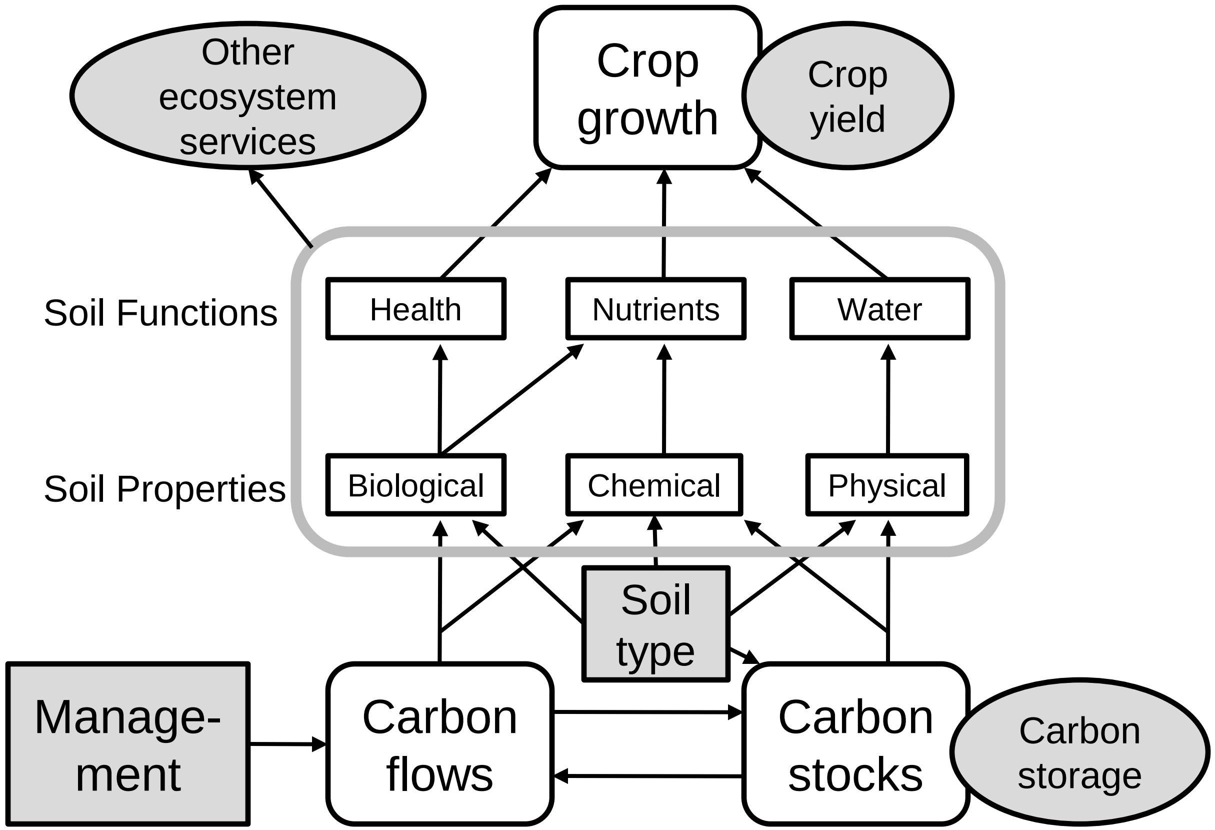
Barrierer for at forbedre organisk stof i jorden

Manglende incitamenter for at øge jordens organiske stof



Total kulstof (t/ha) [UNEP-WCMC updated Global Carbon Map]

Kulstof og jordens fuktioner



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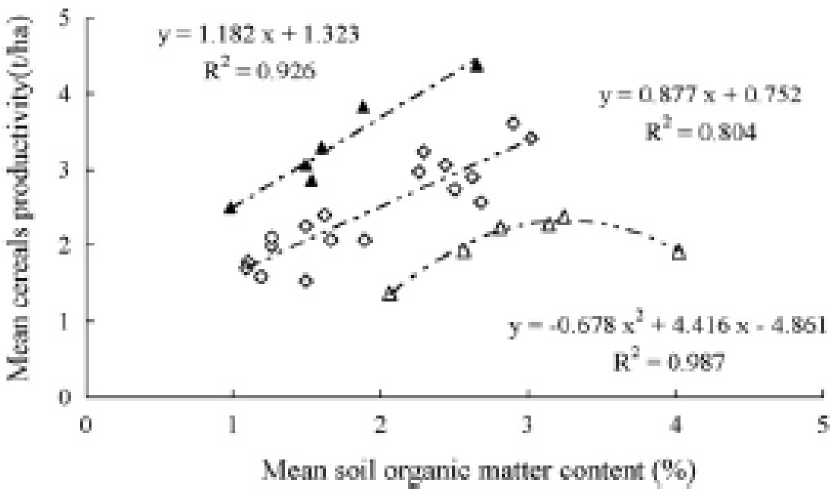
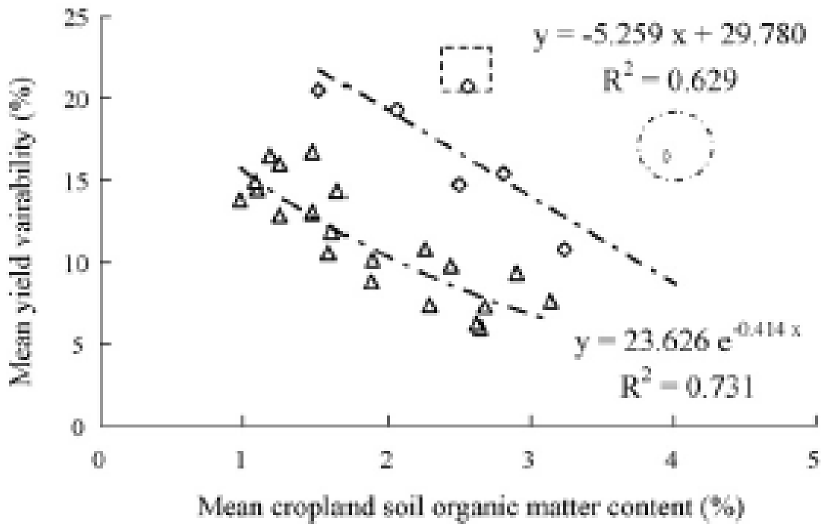
Hvad gør jordens kulstof for os?



Kina: Gns. udbytter mod organisk stof i jord for kinesiske provinser, 1949-1998



Kina: Variation i kornudbytter mod organisk stof i jord

Men hvad er årsager og hvad er effekter?

Pan et al. (2009) AEE 129:344-348

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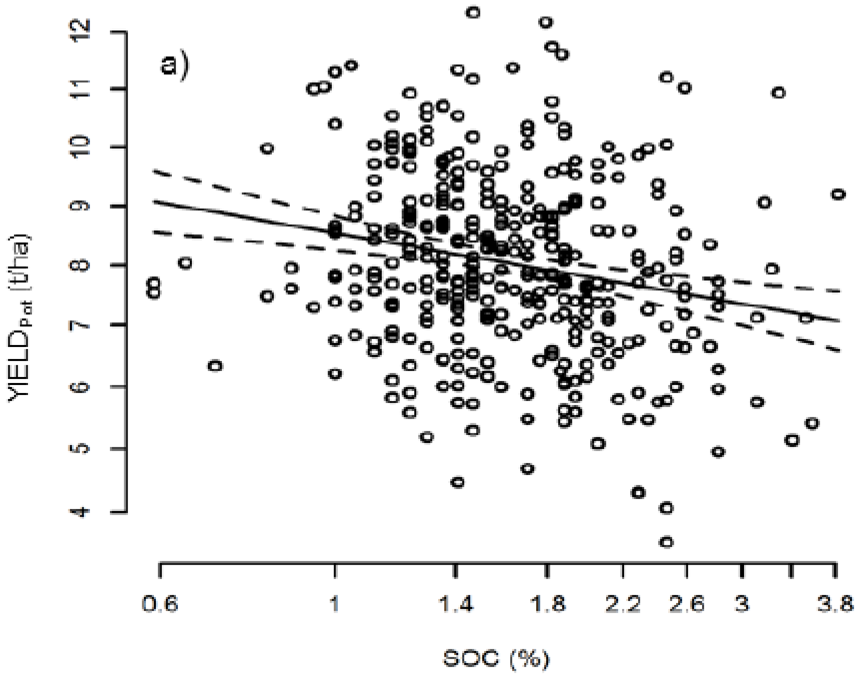
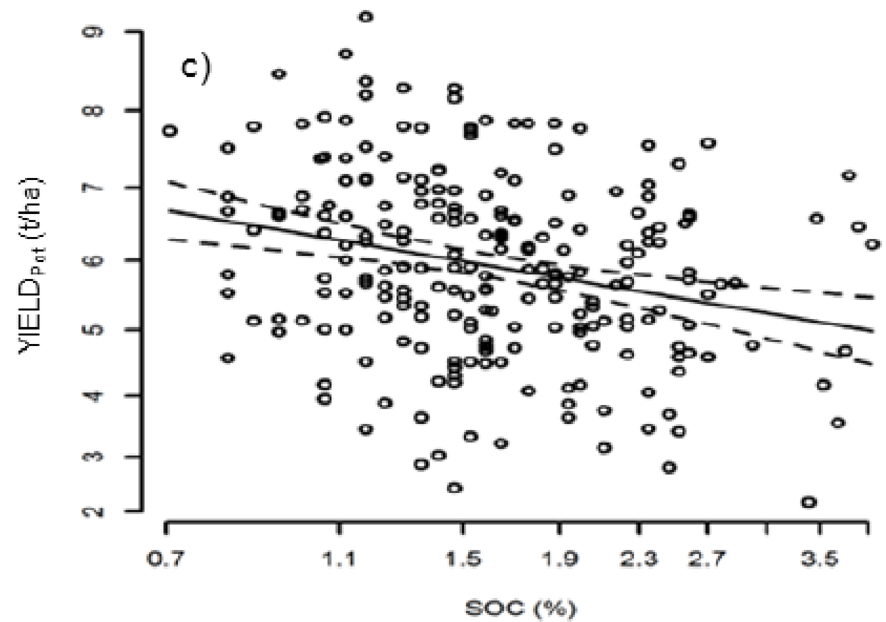
Udbytte ved max N niveau i danske gødningsforsøg

Vinterhvede



Vårbyg



Oelofse al. (2015)

Udbytter i vårbyg i forhold til N-input

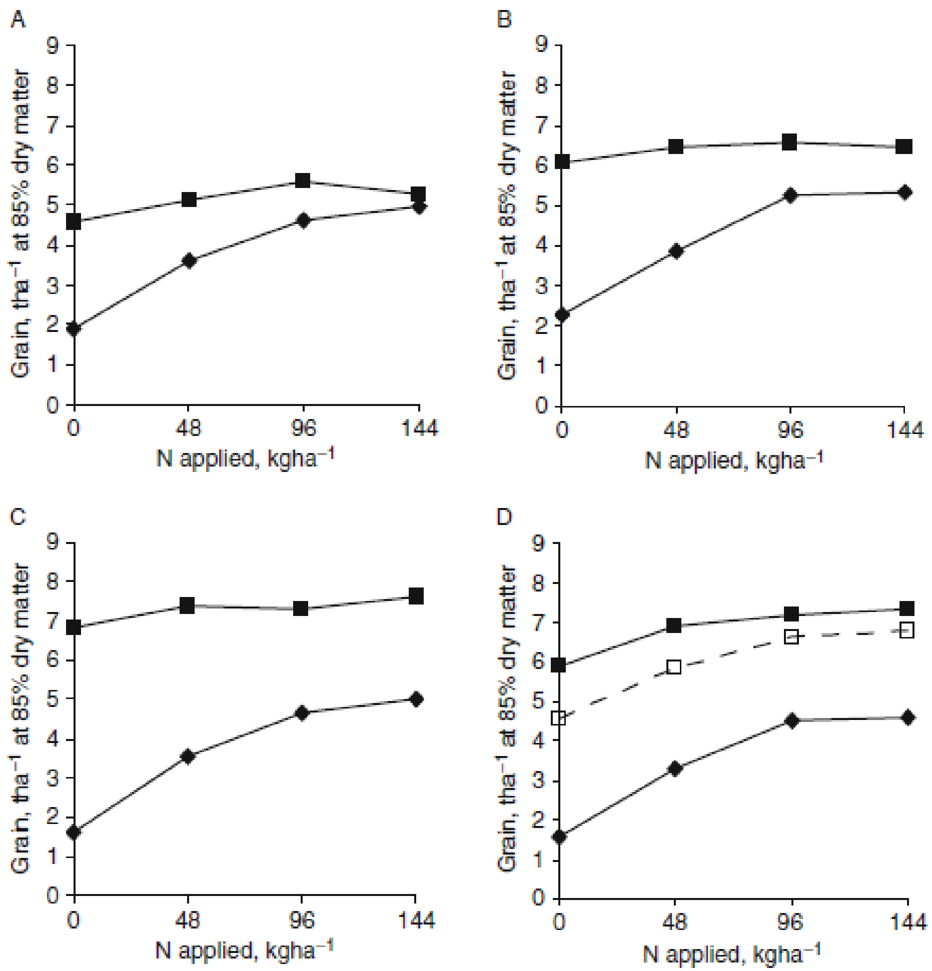


Figure 10 Yields of spring barley grain (t ha^{-1}) Hoosfield Continuous Barley, Rothamsted. Annual treatment 1852–2006: PK fertilizers, ◆; 35 t ha^{-1} FYM, ▪; annual treatment only from 2001 to 2006: 35 t ha^{-1} FYM, □. (A) *cv.* Julia, 1976–1979, (B) *cv.* Triumph, 1988–1991, (C) *cv.* Cooper, 1996–1999, and (D) *cv.* Optic 2004–2007.

Johnston et al. (2009)

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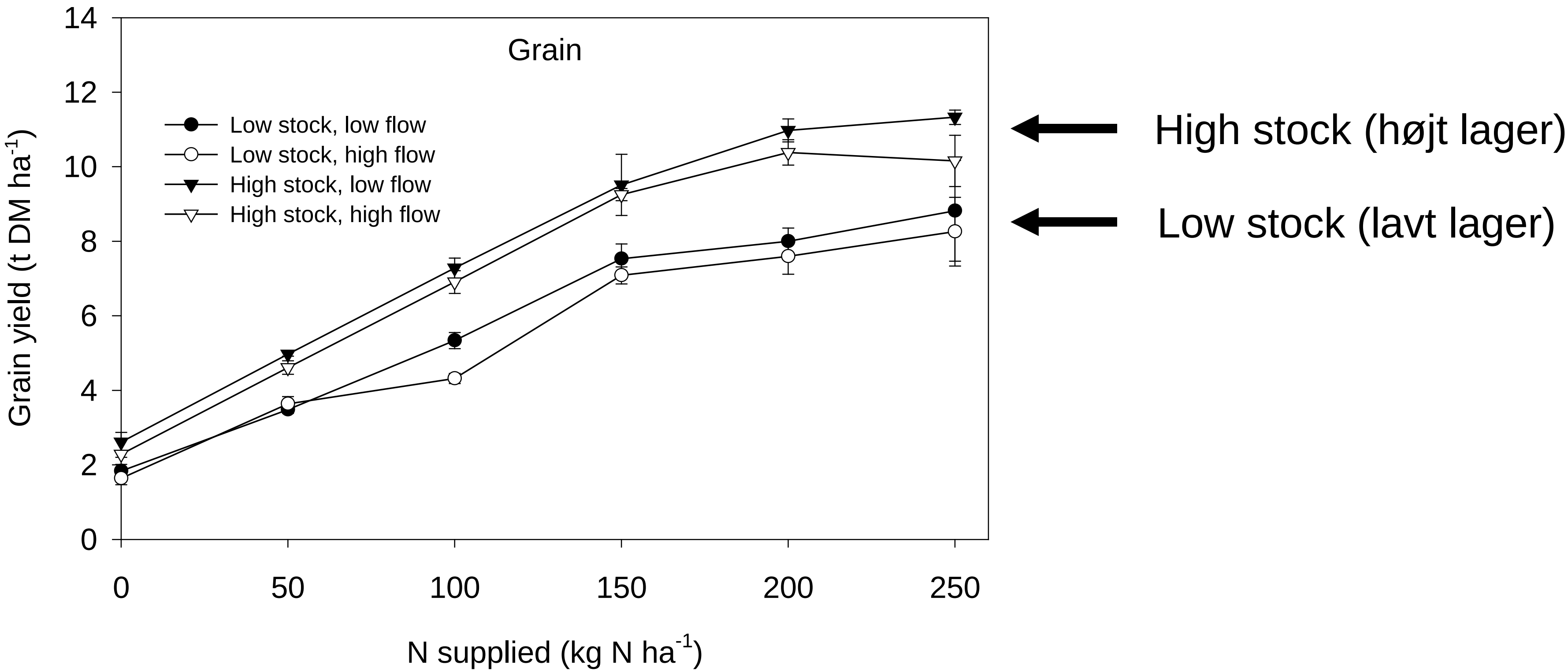
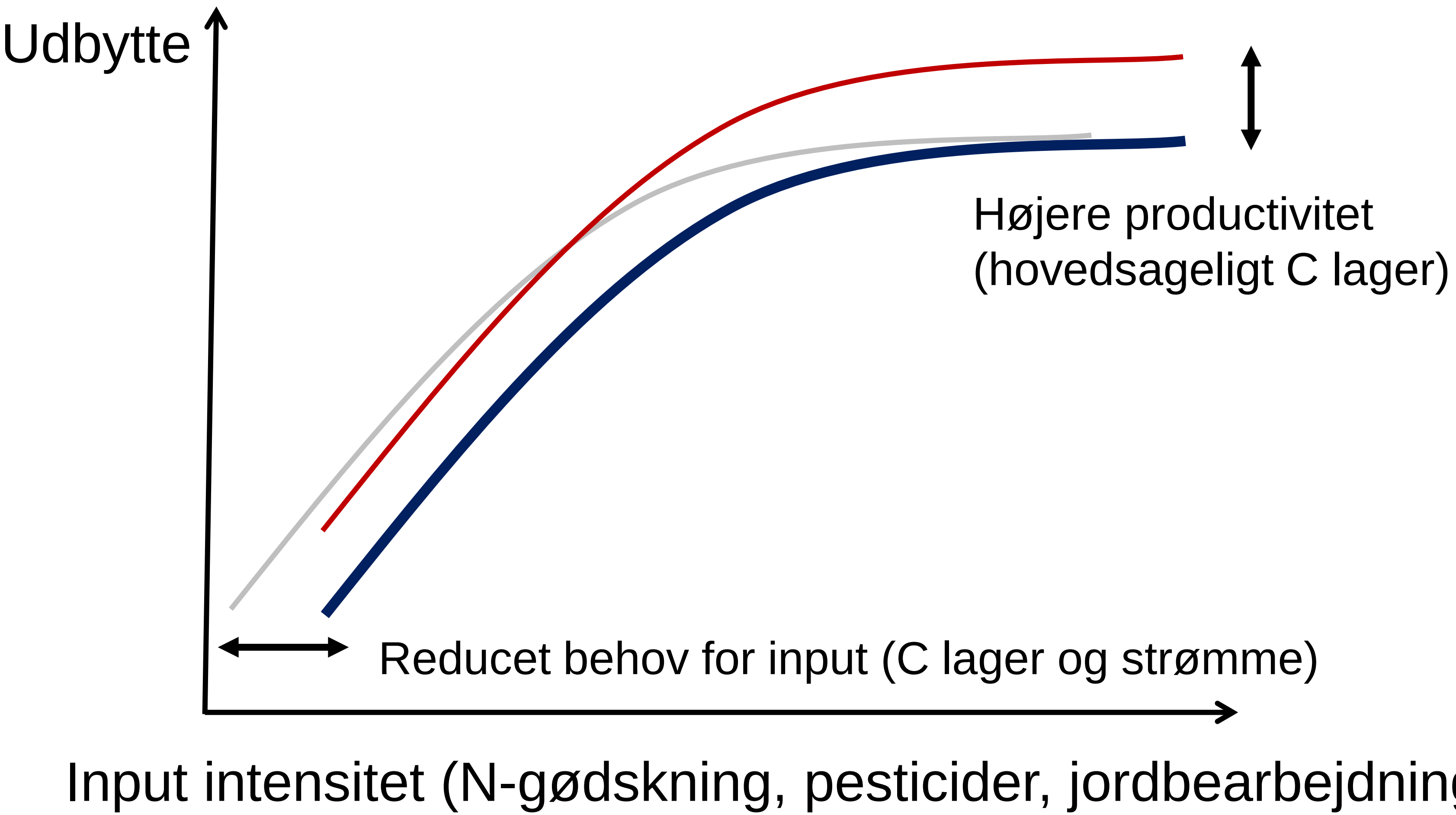
SmartSOIL stock and flow experiment (Askov)

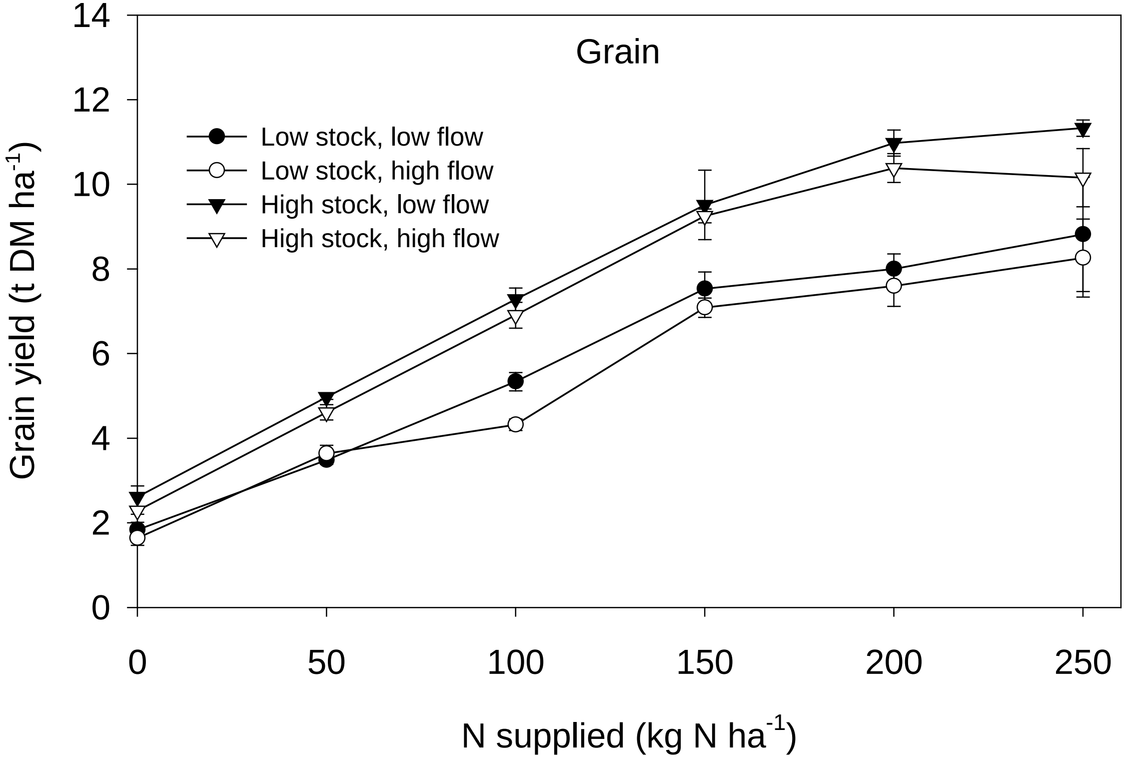


- Højt kulstoflager øgede udbytter af hvede, både ved lav og høj N-forsyning
- Tilførsel af halm (høj kulstofstrøm) reducerede udbyttet (muligvis N immobilisering)

Hvordan påvirker kulstof udbyttet?

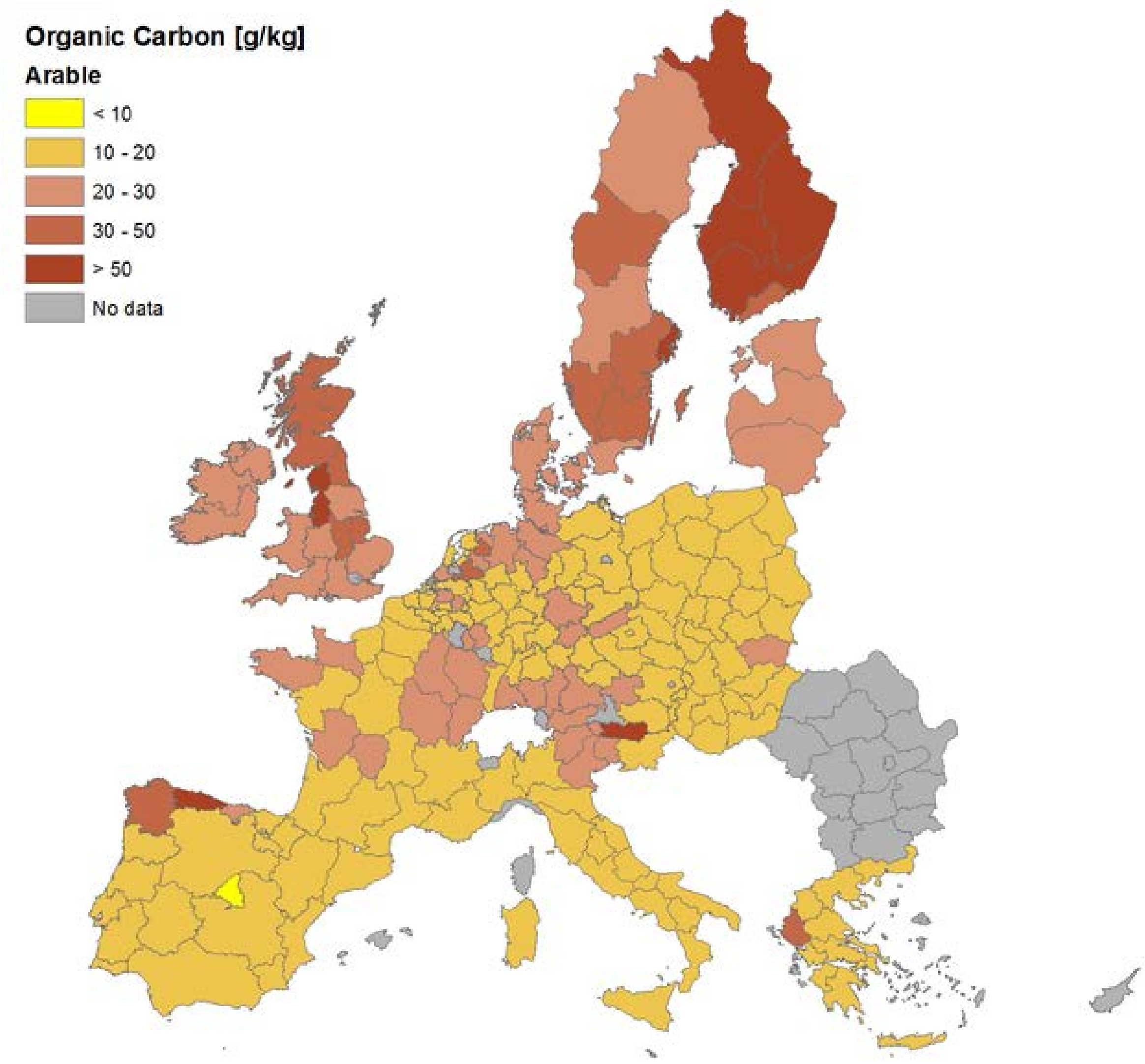


SmartSOIL stock and flow experiment (Askov)

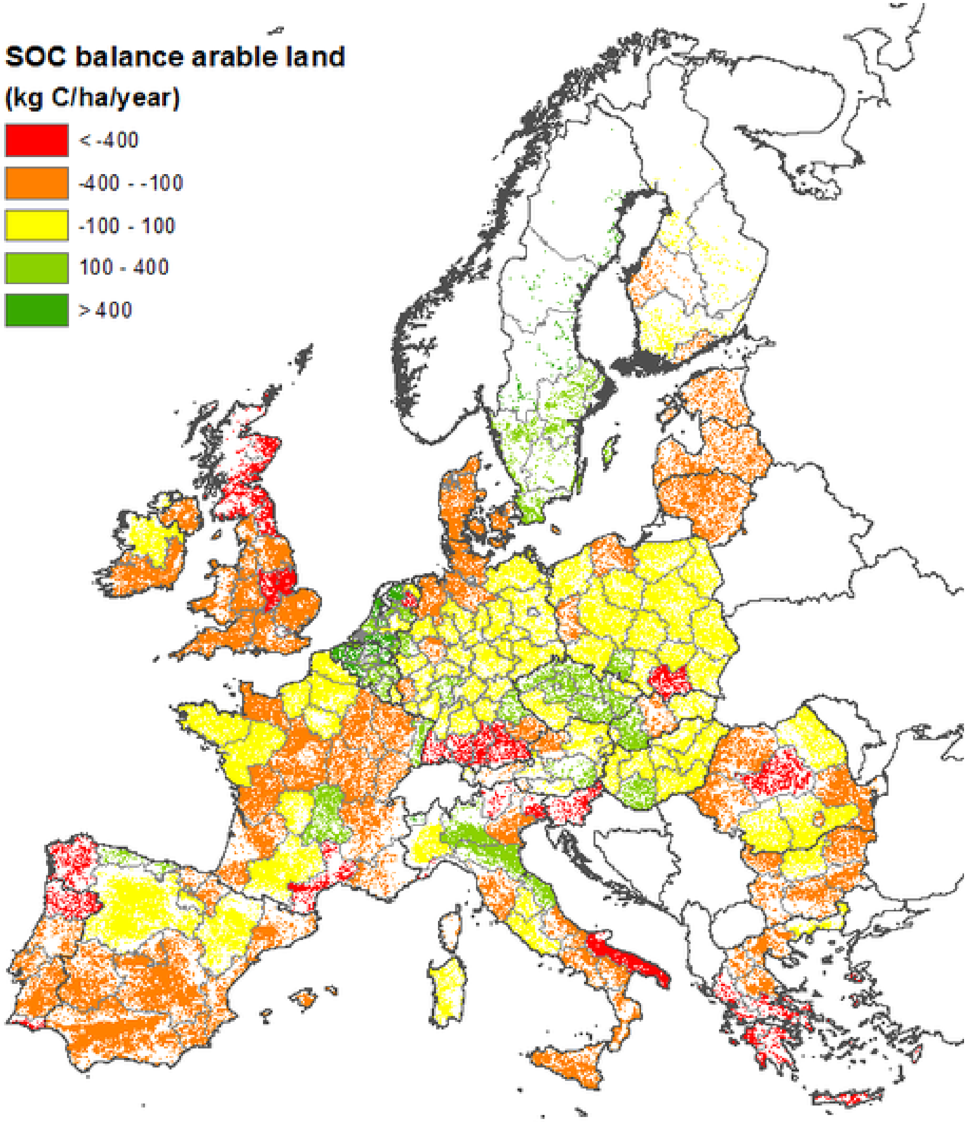


- Plots in long-term experiments with low and high stock were used
- Sub-treatments with low and high flow (straw) was imposed
- Increasing rates of mineral N was applied in miniplots.
- Data from N^{15} fertiliser labelling not yet available

Kulstof i jord i omdrift



Kulstofbalance på jord i omdrift



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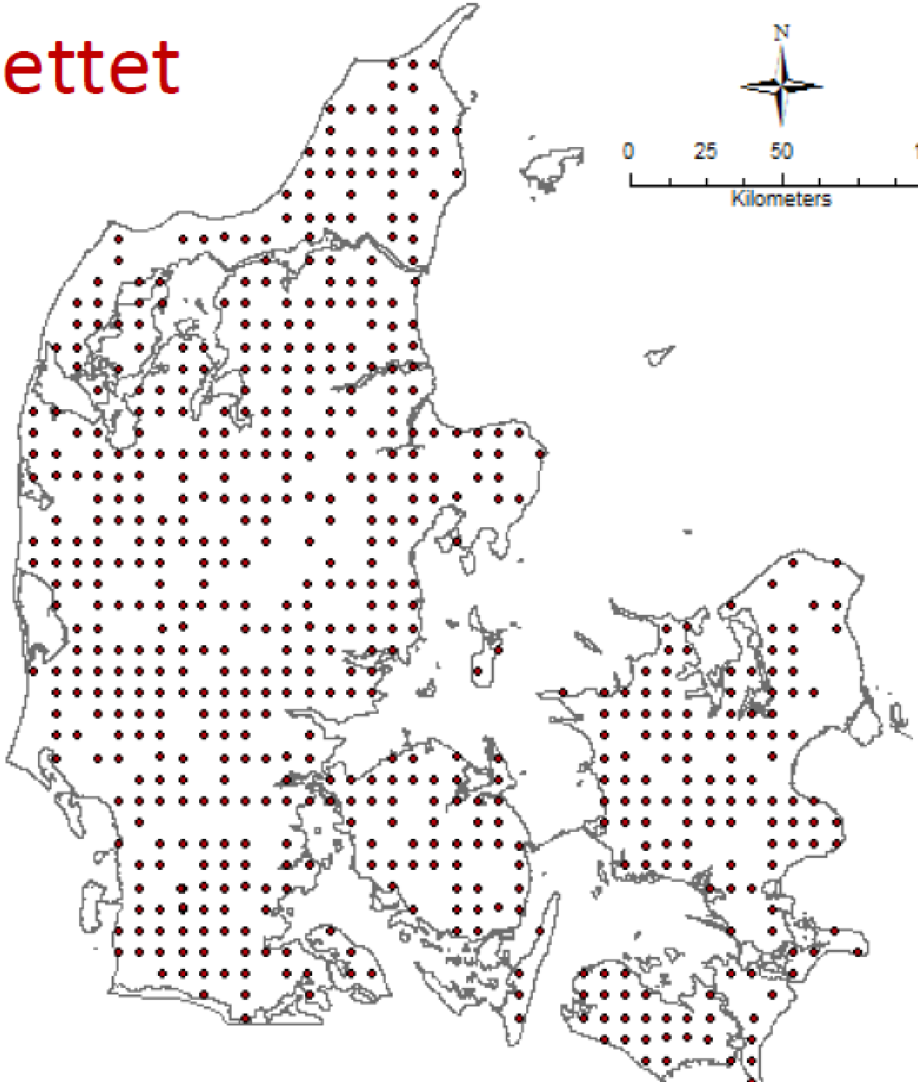
Monitering af kulstof i jord i Danmark

Kvadratnettet



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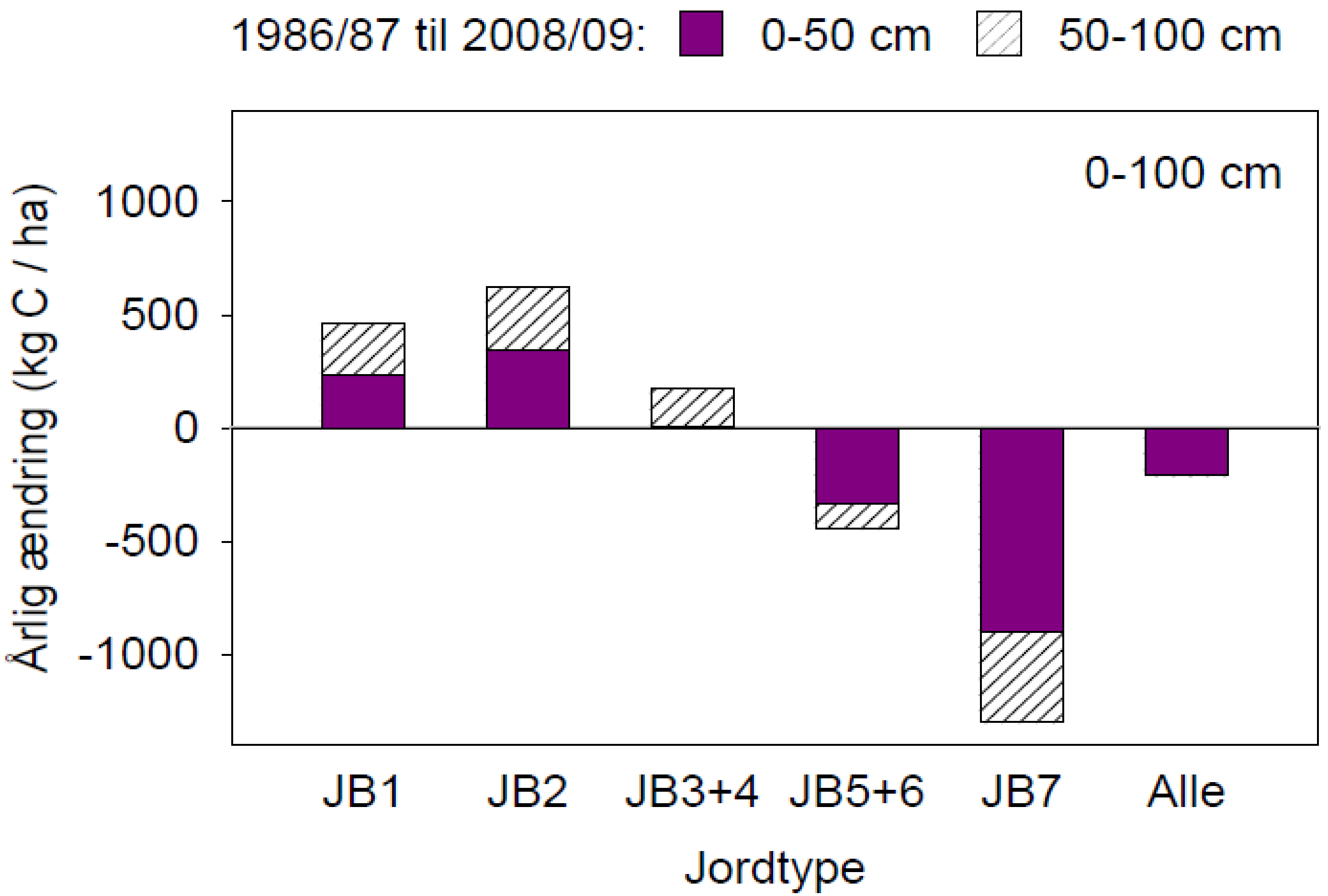
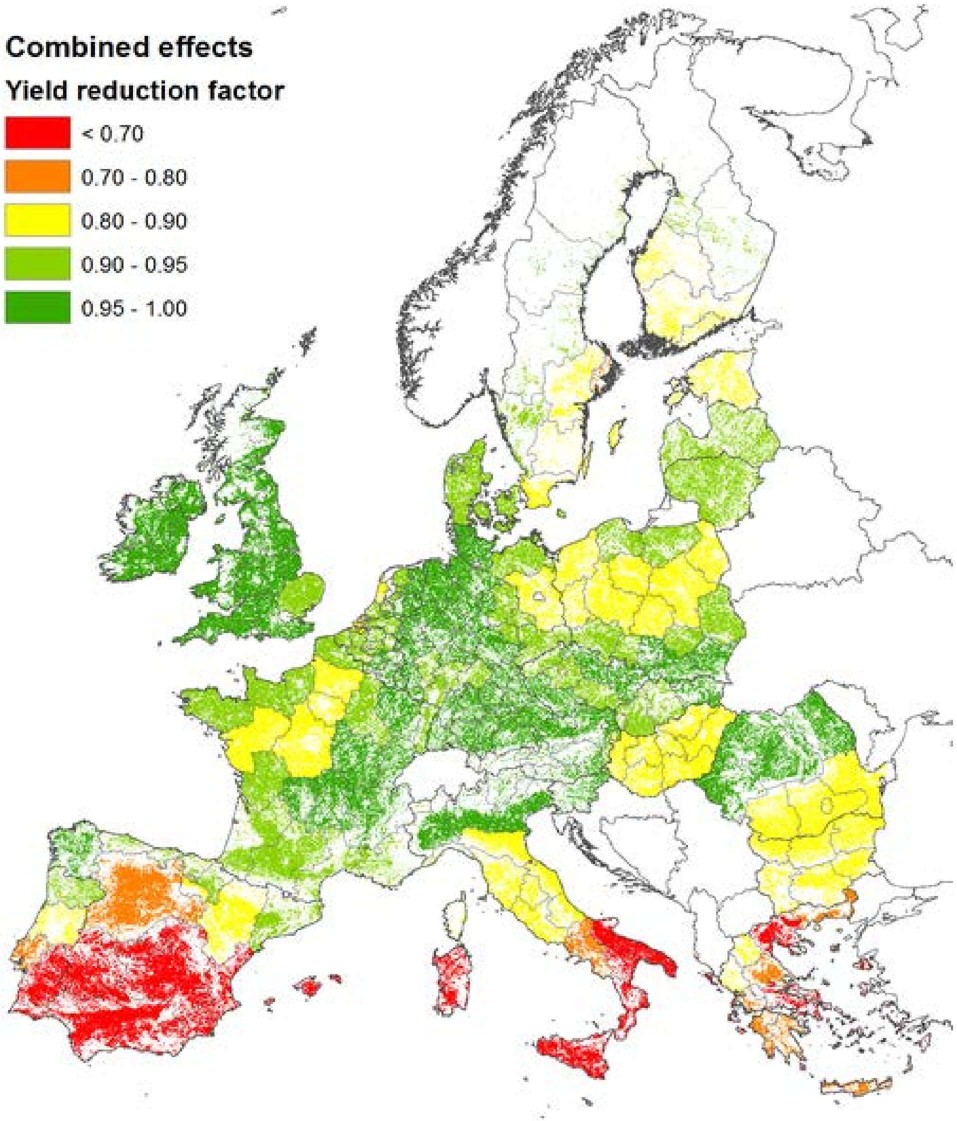
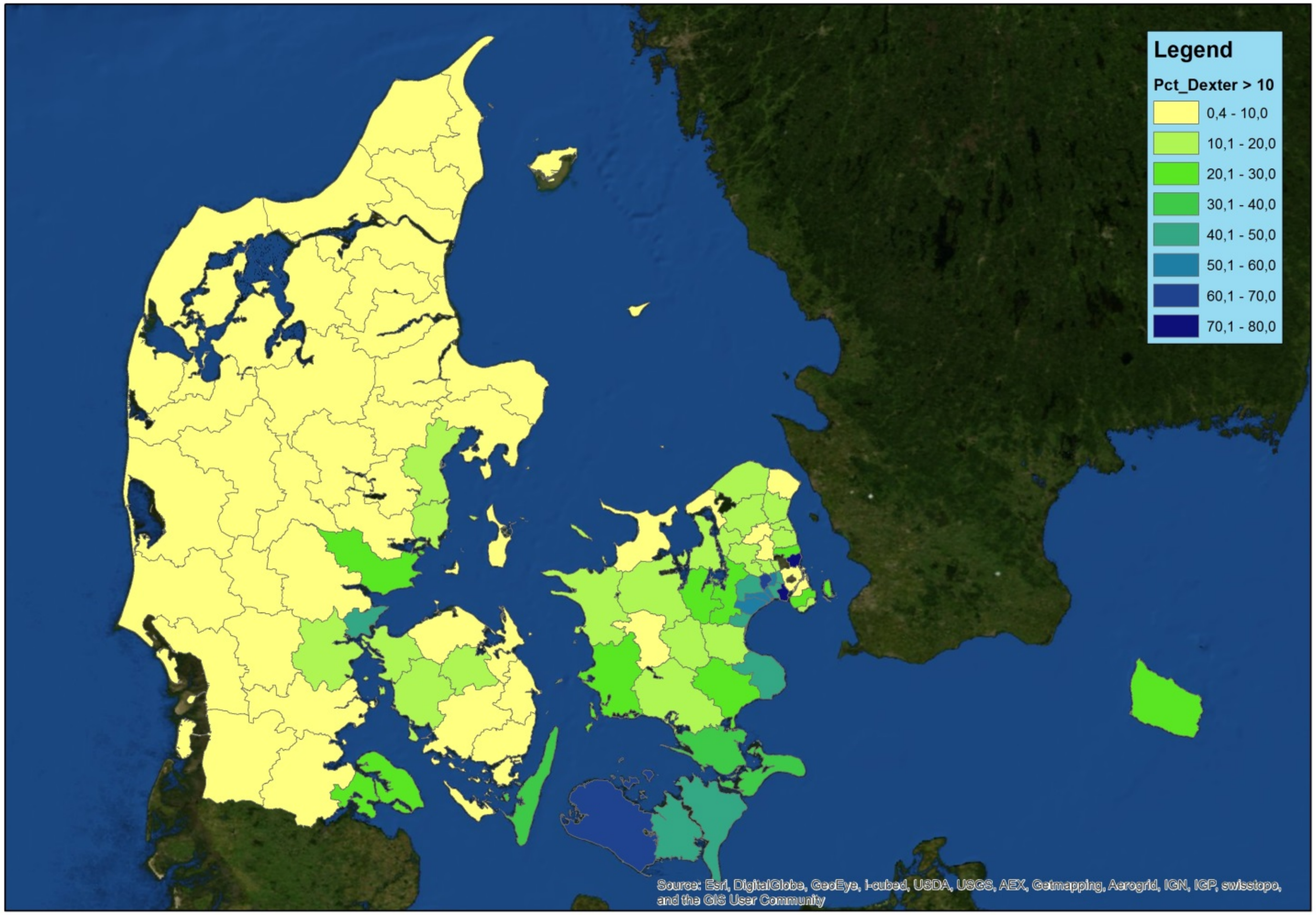
Ændring af jordkulstof på grundlag af Kvadratnettet



Udbytteeffekt af lavt kulstof (SmartSOIL modellen)



Procentdel af arealet med kritisk lavt kulstofindhold i forhold til jordstruktur



Baseret på Dexter index: ler / kulstof

Kulstoflagring og klimaforandringer

- Meget stor udveksling af CO_2 mellem atmosfæren og jordens pulje af organiske stof

- 2/3 af det danske areal dyrkes
- 150 tons C/ha i den øverste meter
- 2,6 mio. ha dyrket jord = 1400 mio. t CO_2
- 70 mio. tons CO_2-ækv. udledes årligt fra DK
- 21 % mindre udledning = 15 mio. t CO_2-ækv.

- Altså: den nationale forpligtigelse modsvarer en årlig relativ stigning i jordens kulstoflager på 1 %

Hvordan kan jordens kulstofindhold øges?

- Vi kan øge tilførslen af kulstof til jorden:
  - nedmulde afgrøderester
  - tilføre husdyrgødning
  - flerårige græsmarker

- Vi kan nedsætte omsætnings-hastigheden af jordens kulstoflager
  - reduceret intensitet i jordbearbejdningen
  - *øget vandmætning (nedsat luftskifte) ?*
  - *nedsat omsættelighed – delvis forkulning ?*

Kulstoflagring: Resultater af markforsøg

- Ved årlig nedmuldning af planterester tilbageholdes 10-20 % af det tilførte kulstof

- Ved årlig tilførsel af husdyrgødning tilbageholdes 30 - 40 % af det tilførte kulstof

- set over en periode på 10-30 år

Kulstoflagring: Resultater af markforsøg

• Rod, stub, bladtab mv.	300 kg C/ha/år
• Halmnedmuldning (5 t TS/ha)	300 kg C/ha/år
• Gylle (30 t/ha, 5 %TS)	200 kg C/ha/år
• Efterafgrøde (rajgræs, udlagt forår)	400 kg C/ha/år
• Vedvarende græsmark (slæt)	1100 kg C/ha/år

- set over en periode på 10-30 år

Kulstoflagring: Resultater af Kvadratnettet

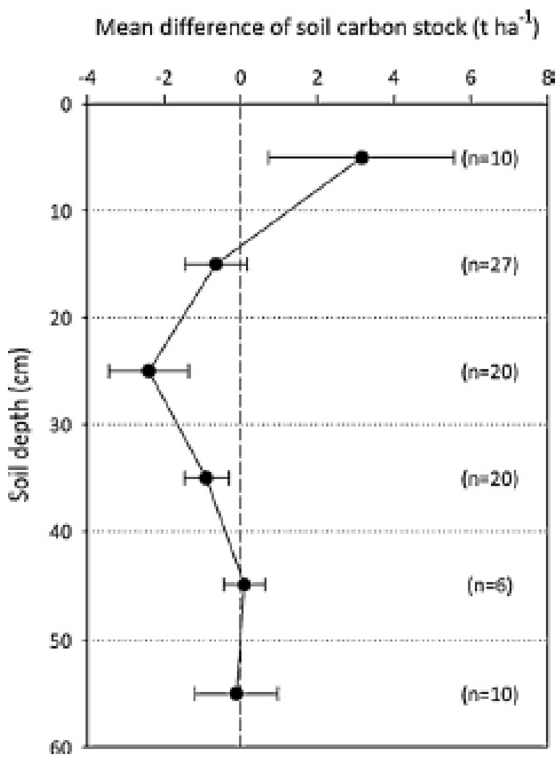
- For 0-25 cm:
  - Græsmark 950 kg C/ha/år
  - Vintersæd + halmnedmuldning 400 kg C/ha/år
  - Kvæggødning 200 kg C/ha/år
- For 25-50 cm:
  - Græsmark 580 kg C/ha/år

Kornafgrøder under økologisk dyrkning har mere rodbiomasse end konventionel dyrkning

	Produktionssystem	Art	Rod tørstof g m^{-2}
Kornafgrøder	Økologisk	Hvede	243 ± 41
		Byg	193 ± 40
		Korn	218 ± 47
	Konventionel	Hvede	147 ± 24
		Byg	129 ± 19
		Korn	143 ± 24
Efterafgrøder og ukrudt		Efterafgrøder	119 ± 45
		Ukrudt	35 ± 36

- men mindre i halm og stub

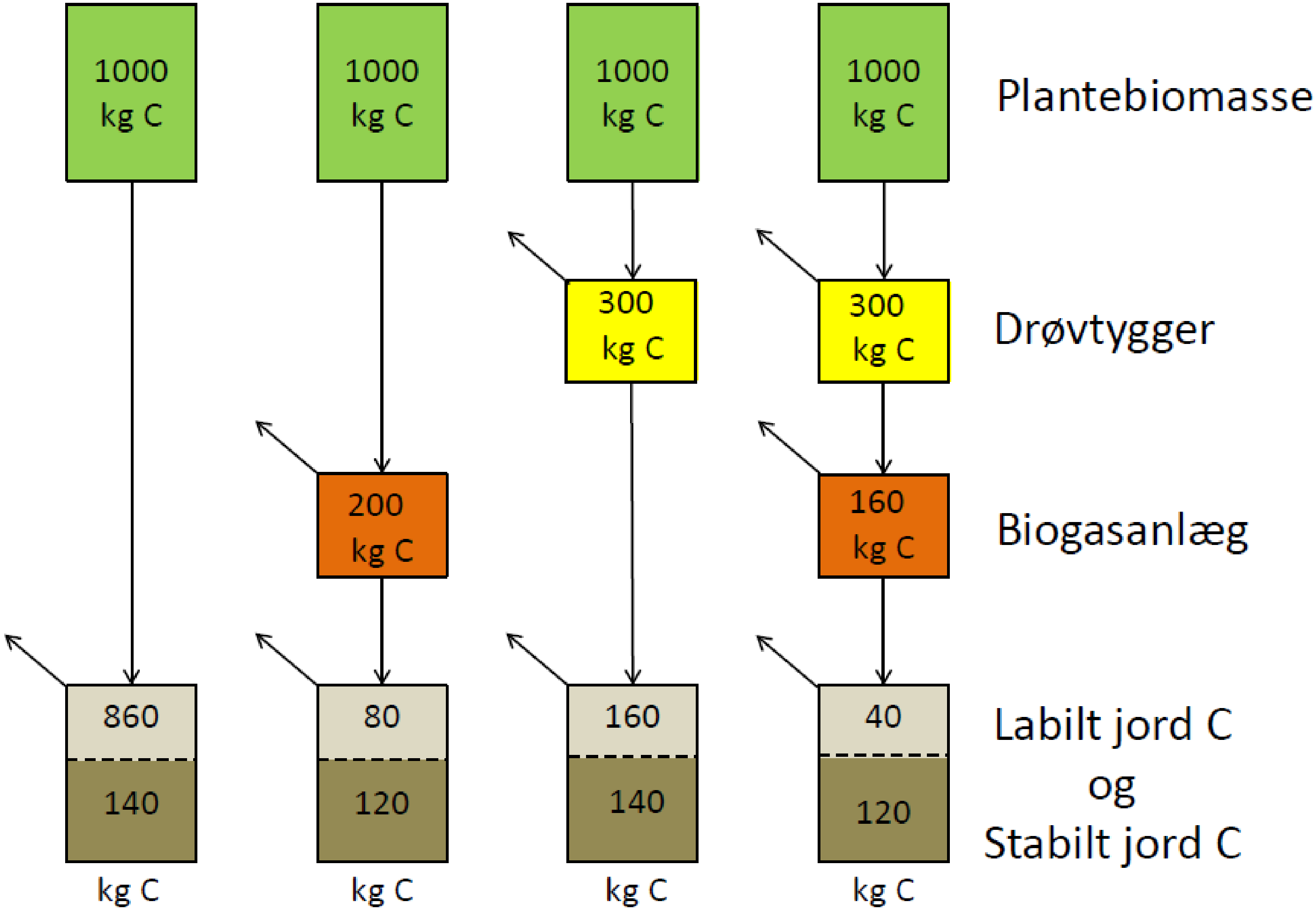
Jordbearbejdning påvirker kun i ringe omfang jordens samlede kulstoflager



Review: 69 paired tillage experiments.
Mean difference of carbon contents
of soils under conventional tillage
and no-tillage.
(Luo et al. 2010)

Ændring fra pløjning til direkte såning øgede ikke det samlede kulstoflager men øgede den andel der ligger tæt på jordoverfladen.

Biogas mindsker kun kulstoflagringen minimalt

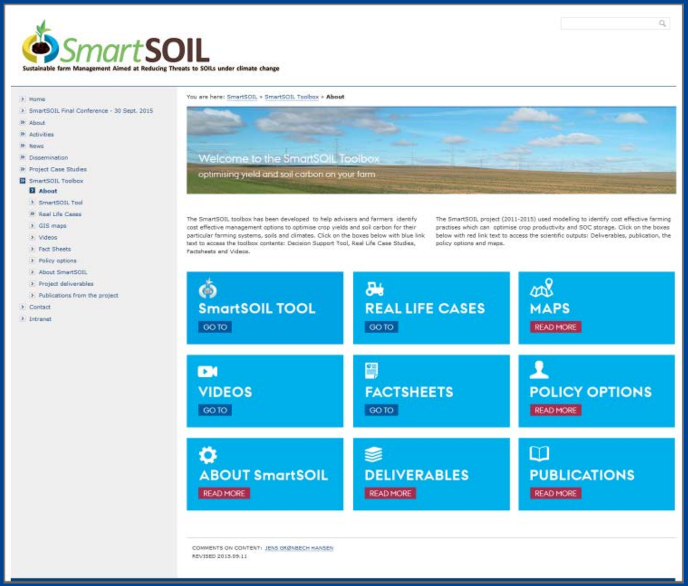


(Thomsen et al., 2013)

Betragtninger om udbytteeffekter af kulstof

- Kvælstof følger kulstof
- Udbytter påvirkes betydeligt af N-strømme
- C/N forholdet i afgrøderester påvirker N-strømme
- Afgrødens vandforsyning spiller en stor rolle under tørre klimaforhold
- Vandforsyning påvirkes af vandhøst, retention I jorden og af beskyttelse mod fordampning (C lager og strømme)
- Jordens C lager påvirker jordstruktur og afgrødeetablering
- Jordens C strømme påvirker biologien i jorden og dermed plantesundhed

The SmartSOIL Tool and Toolbox



http://smartsoil.eu/

TATION

The Toolbox - Factsheets

Crop Rotation

Read it here

Residue management

Read it here

Manure & compost

Read it here

Cover & Catch crops

Read it here

Conservation Agriculture

Read it here

The Toolbox – Real Life Case Studies

HUNGARY

Real Life Case, László Lévai, Kompolt, Hungary

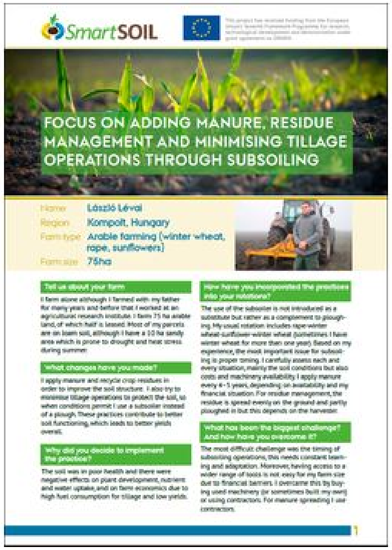
Focus on adding manure, residue management and minimising tillage operations through subsoiling

Location of farm in Hungary

László Lévai who runs a 75ha arable farm in Kompolt

In Hungary SmartSOIL partner Andras Molnar spoke to László Lévai who runs a 75ha arable (winter wheat, rape, sunflowers) farm in Kompolt. The soil is loam with some sandy areas prone to drought and heat stress during summer. He applies manure and recycles crop residues in order to improve the soil structure. He also tries to minimise tillage operations to protect the soil, so when conditions he uses a subsoiler instead of a plough. These practices contribute to better soil functioning, which leads to better yields overall. For more details see below

RLC - Hungary



- Click here for English version
- Click here for Hungarian version

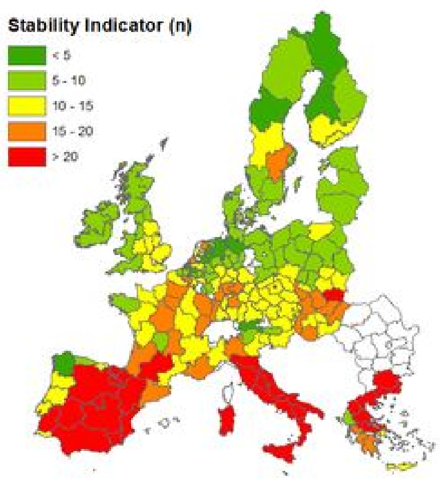
Video - Demonstrating on farm SmartSOIL practices in Hungary

This video demonstrates SmartSOIL practices on a farm in northern Hungary. We take a look at how László, a farmer in Kompolt, engages in smart soil practices to improve his soil. He uses both reduced tillage and residue management to keep his soil healthy. Watch to find out more.

Case studies: Hungary, Denmark, Poland, Scotland, Italy and Spain

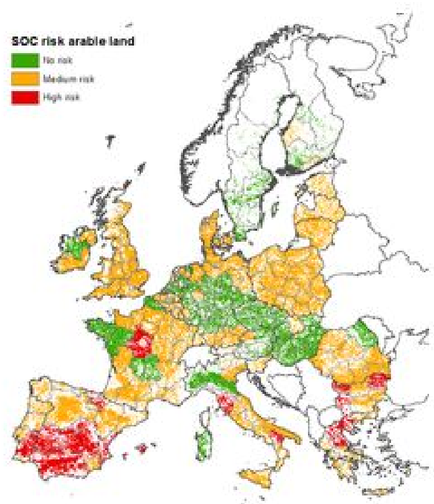
The Toolbox – Soil risk maps

Soil risk maps



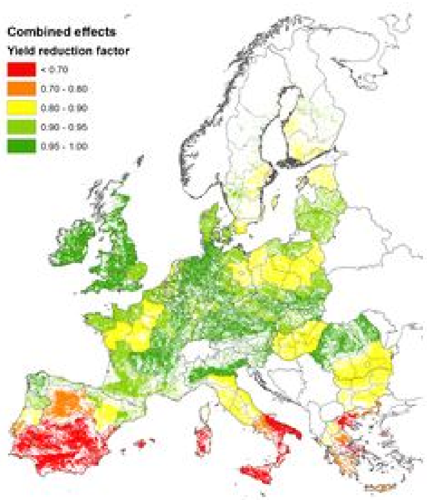
Click on the map to enlarge

Soil potential stability map (Figure 4 from D2.4)



Click on the map to enlarge

SOC risk map



Click on the map to enlarge

Yield reducing factors

The Toolbox – Farmer videos

SmartSOIL partners own videos

SmartSOIL practices in Hungary

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SmartSOIL practices in Italy

This video explores the farming practices of Andrea and Nunzio De Angeli. They run a 300ha mixed farm producing apples, peaches, potatoes and maize in Tuscany with both sandy and heavier clay soils, which are managed differently. Using the SmartSOIL practices of cover crops and no-till seeding within their rotations, Andrea and Nunzio aim to improve their soil organic matter. Check out the video for more details.

Links to relevant videos from other sources

Visualising carbon - no mean feat!

This animated film demonstrates the need to protect the long term carbon stored in soils and vegetation as well as reduce carbon emissions. It quite neatly gives you a sense of the quantities of carbon in our atmosphere and soils. Read more...

3 min.

Carbon Accounting for farmers

Farming Futures has created this short film to explain the benefits of using carbon calculators on your farm. Henry Aubrey Fletcher, CLA president and dairy farmer, takes us through his journey using the CLA CALM Calculator and how it helped him identify areas for improvement and efficiency savings on his farm. Read more...

5 min.

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SmartSOIL partnere

www.smartsoil.eu

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