

Agricultural land use and management: Implications for nitrogen leaching losses



1900

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Agriculture Year 1900

- 75 % of DK area used for agriculture:
- 88 % in rotations (65 % of DK area)
- 12 % used extensively (e.g. meadows)



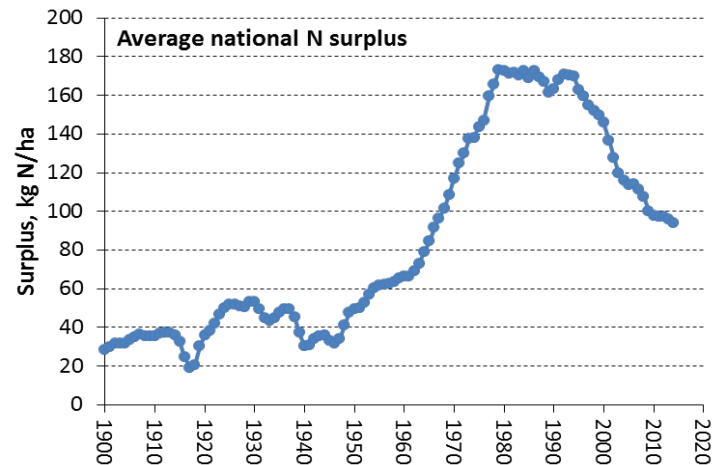
Agriculture Year 1900

Cereals	42 %
Grassland	40 %
Beet roots	6 %
Bare fallow	8 %
Other cash crops	4 %



N leaching year 1900: The basic questions

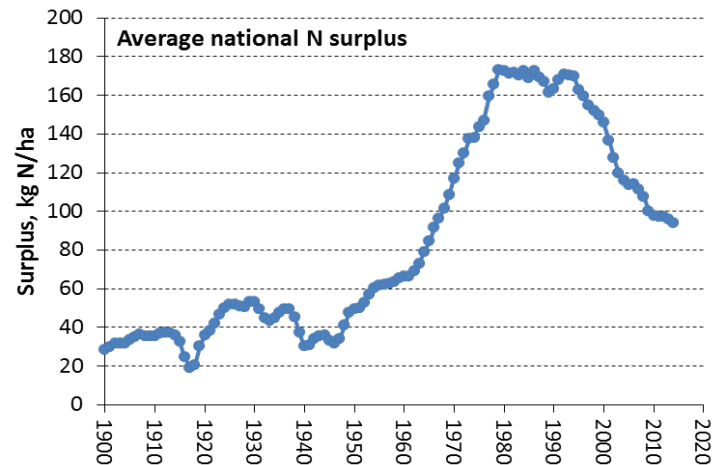
- The source strength? – the source is the soil's root zone
- How to estimate field-scale N losses year 1900?
- Can we derive this loss from national N balances?
- By downscaling field N surplus for current land use?



N leaching year 1900: The basic questions

- The source strength? – the source is the soil's root zone
- How to estimate field-scale N losses year 1900?
- Can we derive this loss from national N balances?
- By downscaling field N surplus for current land use?

- The answer is no!
- Why is that?



The national/farm N balance and surplus: internal N fluxes not included

Input

Inorg. fertilizers

Org. waste

Deposition

N₂ fixation

Seeds

Import of fodder

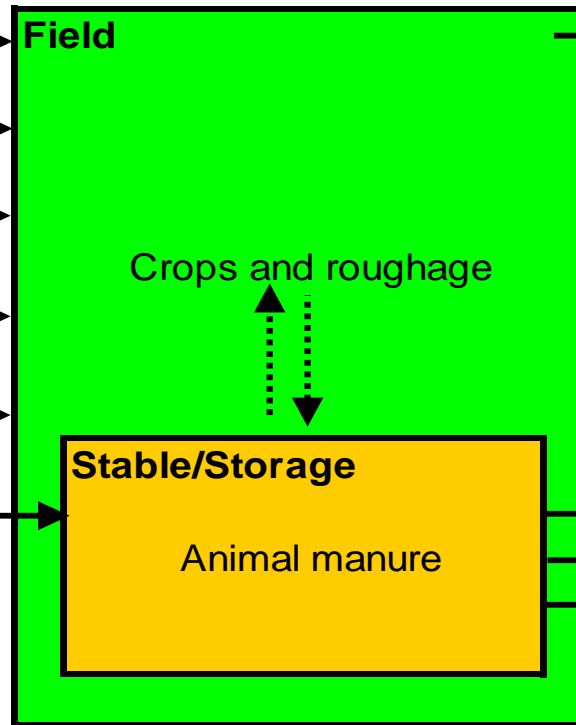
Output

Plant products

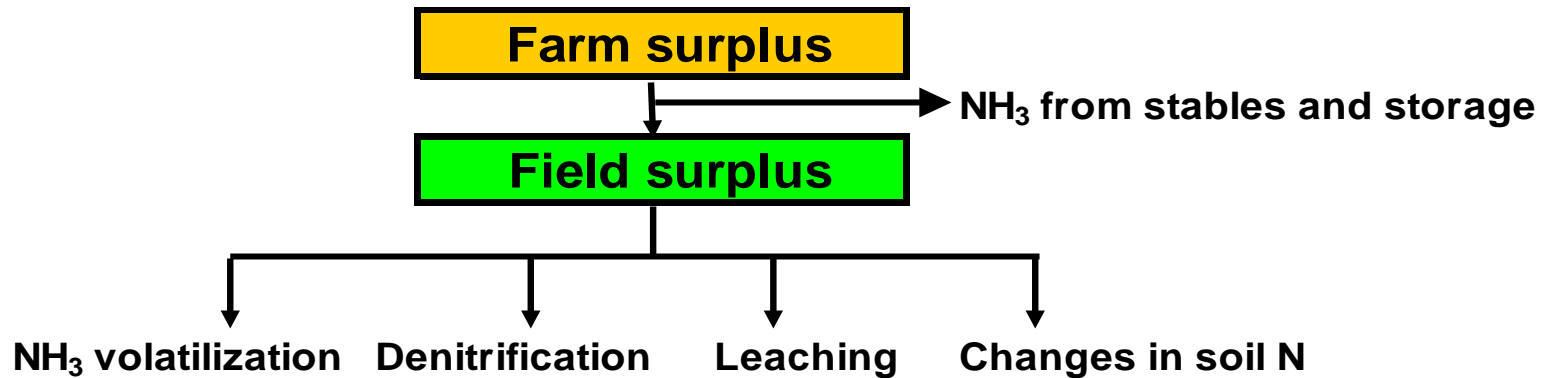
Animal products

Export of living animals

Animals for destruction



The fate of farm-scale N surplus



The animal production system

defines the loss of N from stables and manure storage



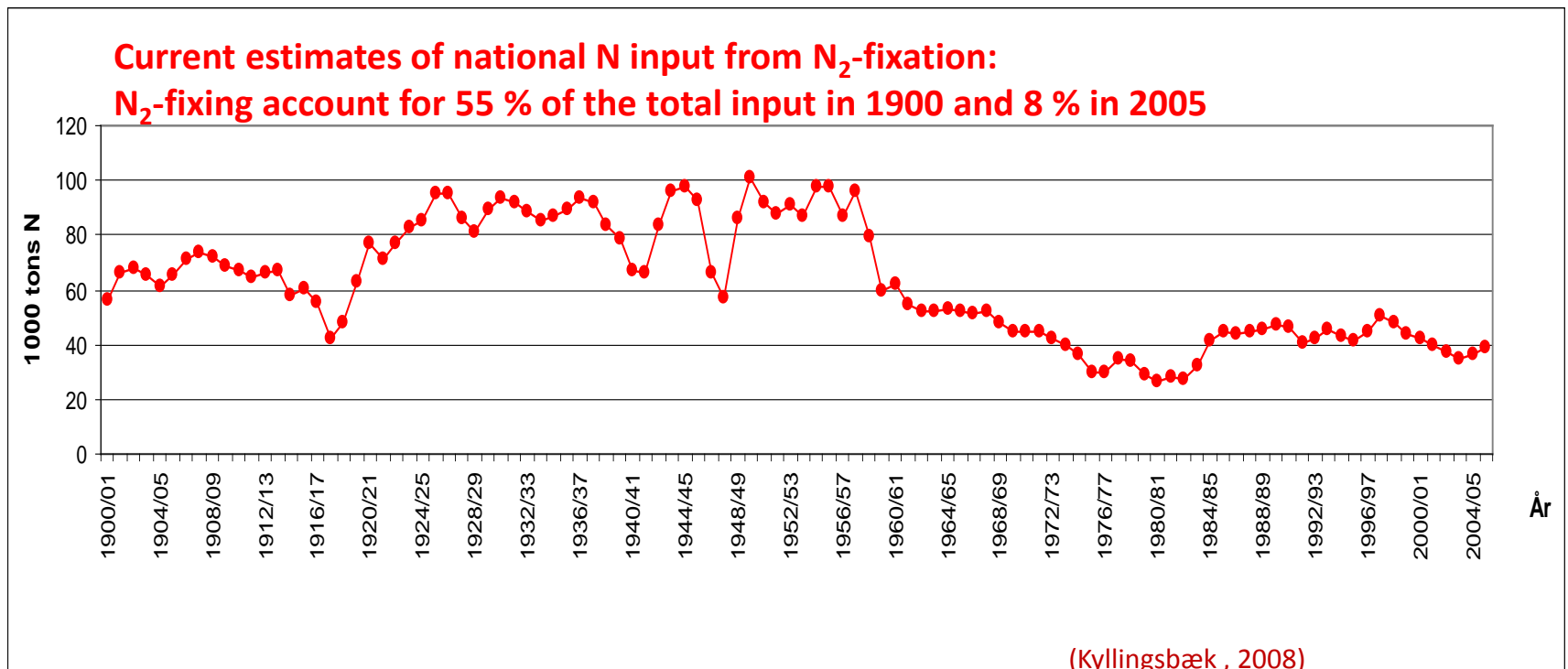
Forsøgsstationen ved Askov 1885.

The crop production system

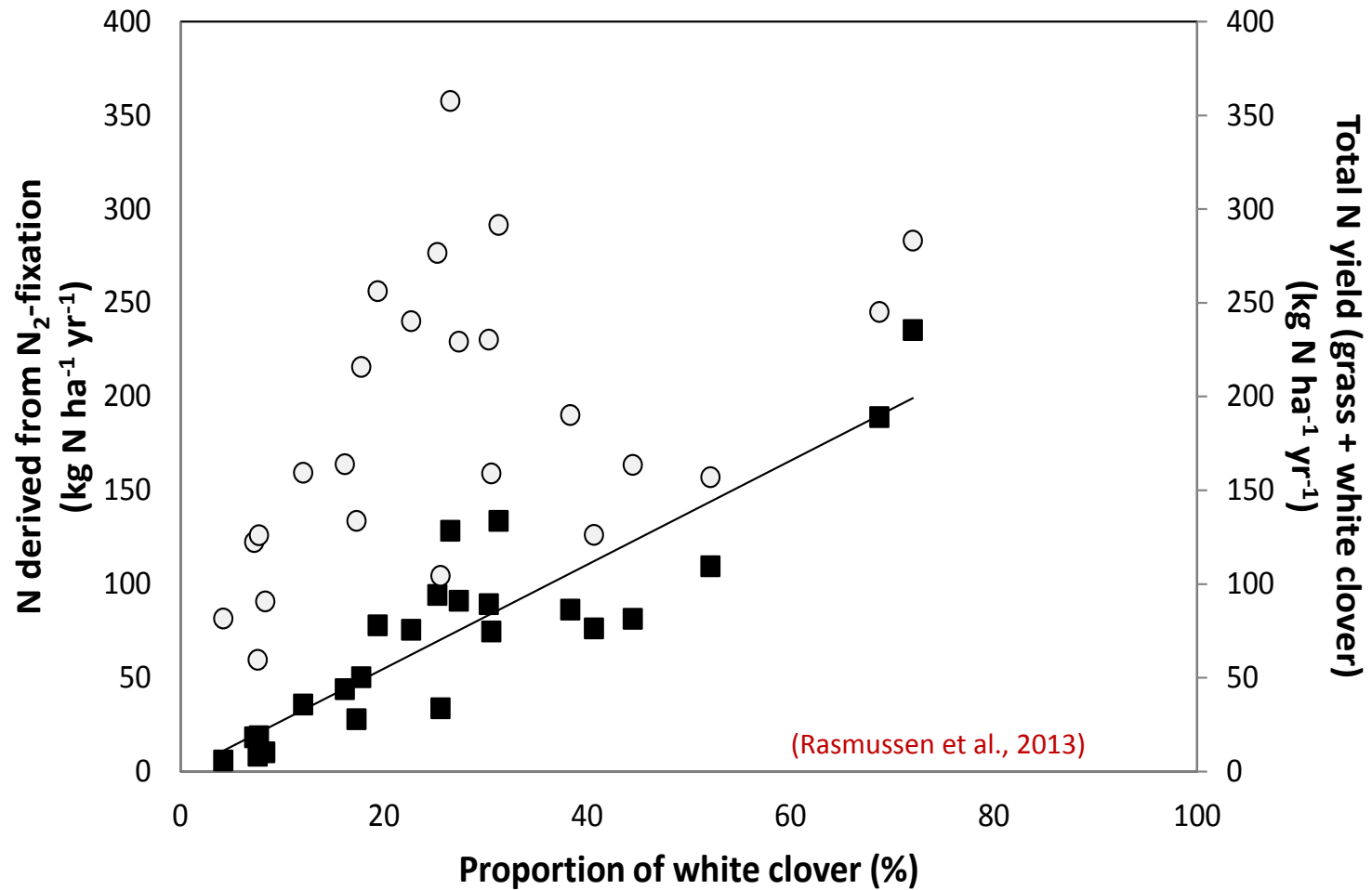
defines the allocation of N surplus to NH_3 volatilization, denitrification, leaching, and soil N storage

Current estimates of N₂-fixation do not account for:

- Variations in % clover in grasslands
- Change in cutting frequency and harvest losses when hay is replaced by silage
- Change in field grazing intensity

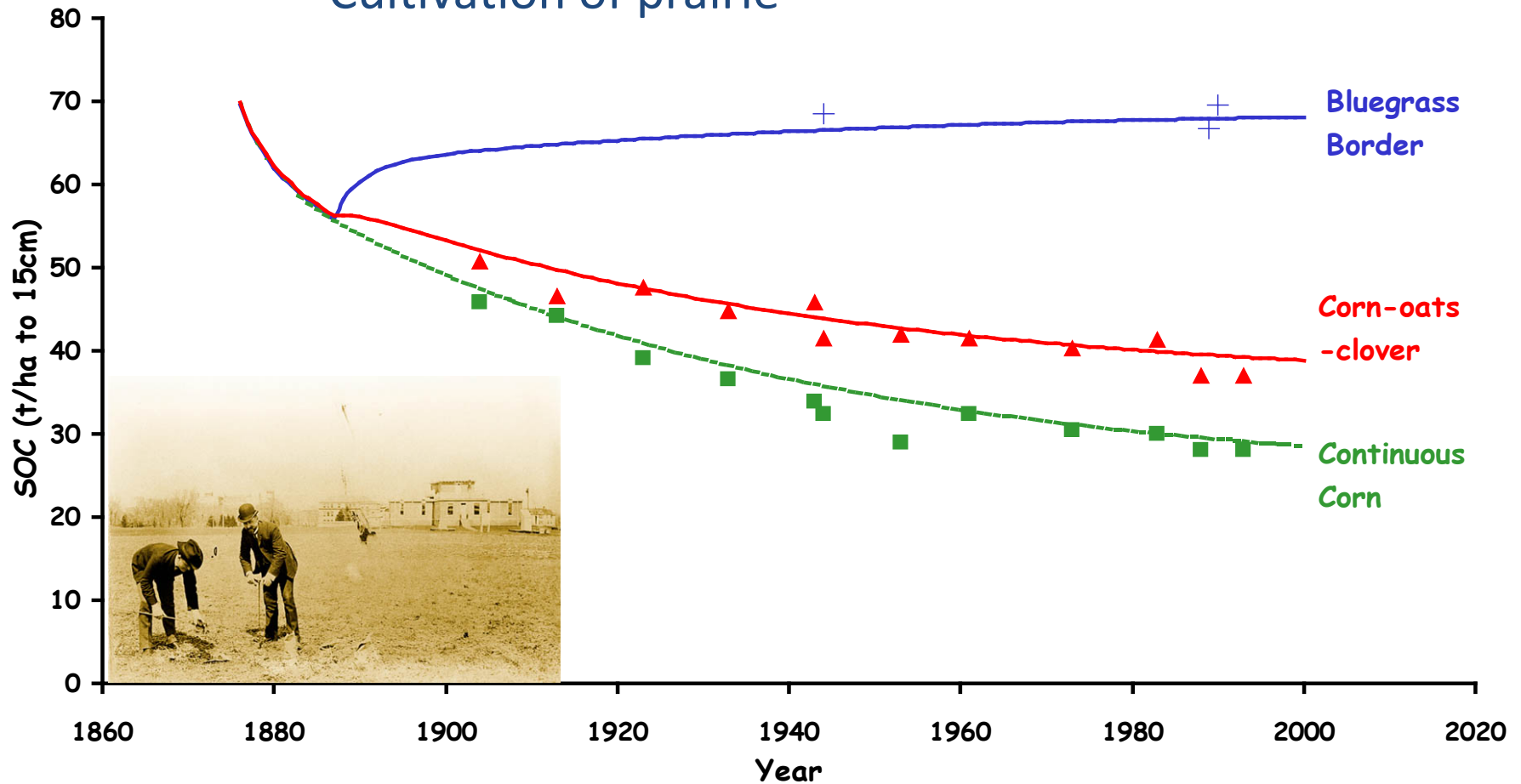


N₂-fixation in grass-clover relates to clover proportion, but not to total harvest

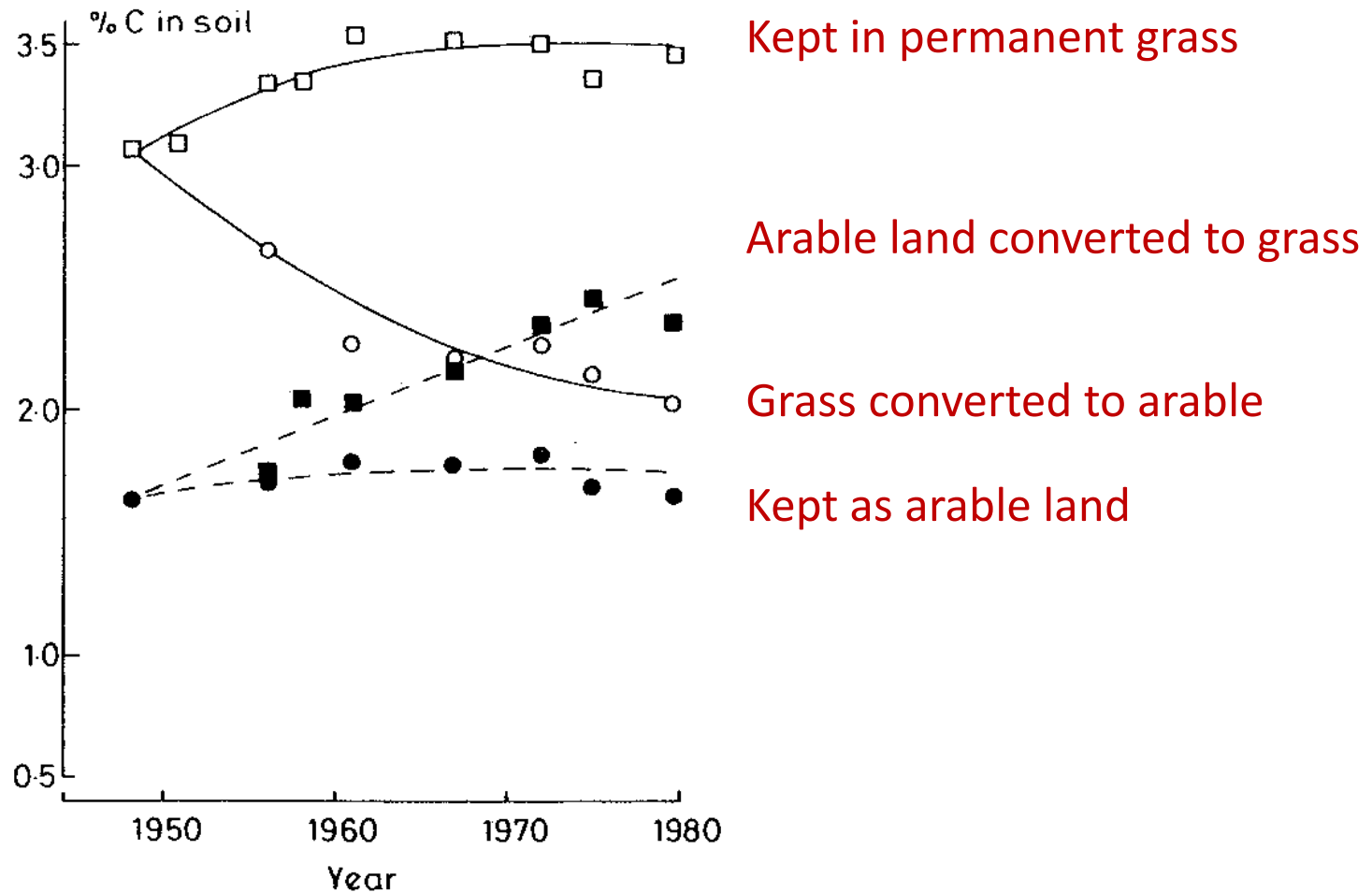


Large and long-lasting loss of soil organic matter follows cultivation

Cultivation of prairie

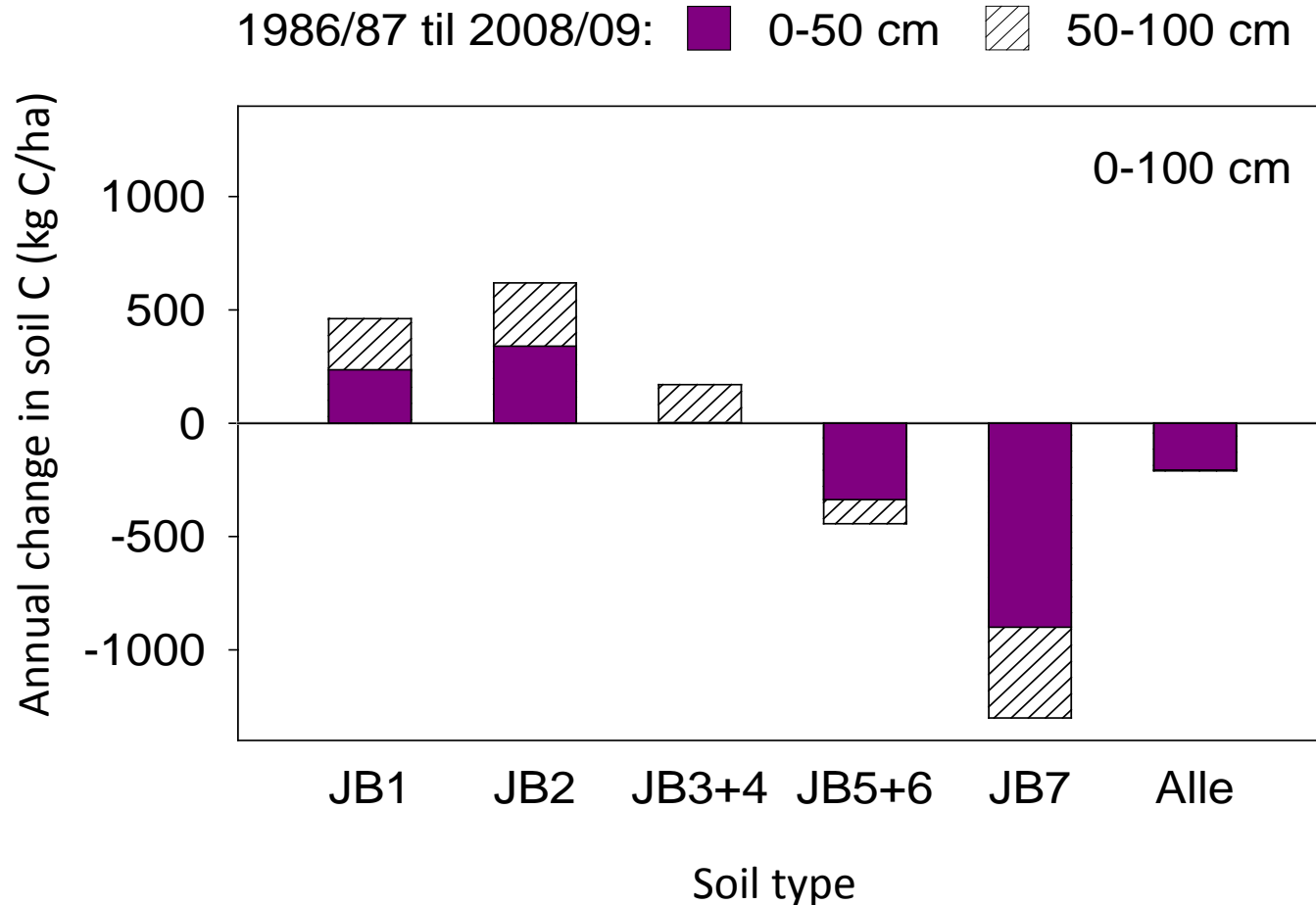


Land use change impacts soil organic matter levels



National Square Grid Net: Current changes in soil organic matter storage

(Taghizadeh-Toosi et al., 2014)



Agriculture Year 1900 - To do list!

Establish reliable estimates of N leaching from the soil's root zone as affected by:

- Historic increase in arable land (+ 15 %; 1861-1900) and in drained area (+ 650.000 ha; 1860-1900)
- Fixation of atmospheric N₂ in grass-clover crops
- The fate of N in animal manures during storage and following autumn application
- Area under tillage-intensive bare fallow (8 % in 1900)

**Thank you for your
attention!**

2016

