

Solution scenarios and the effect of top-down versus bottom-up measures

– experiences from the Danish Nitrogen Research Alliance



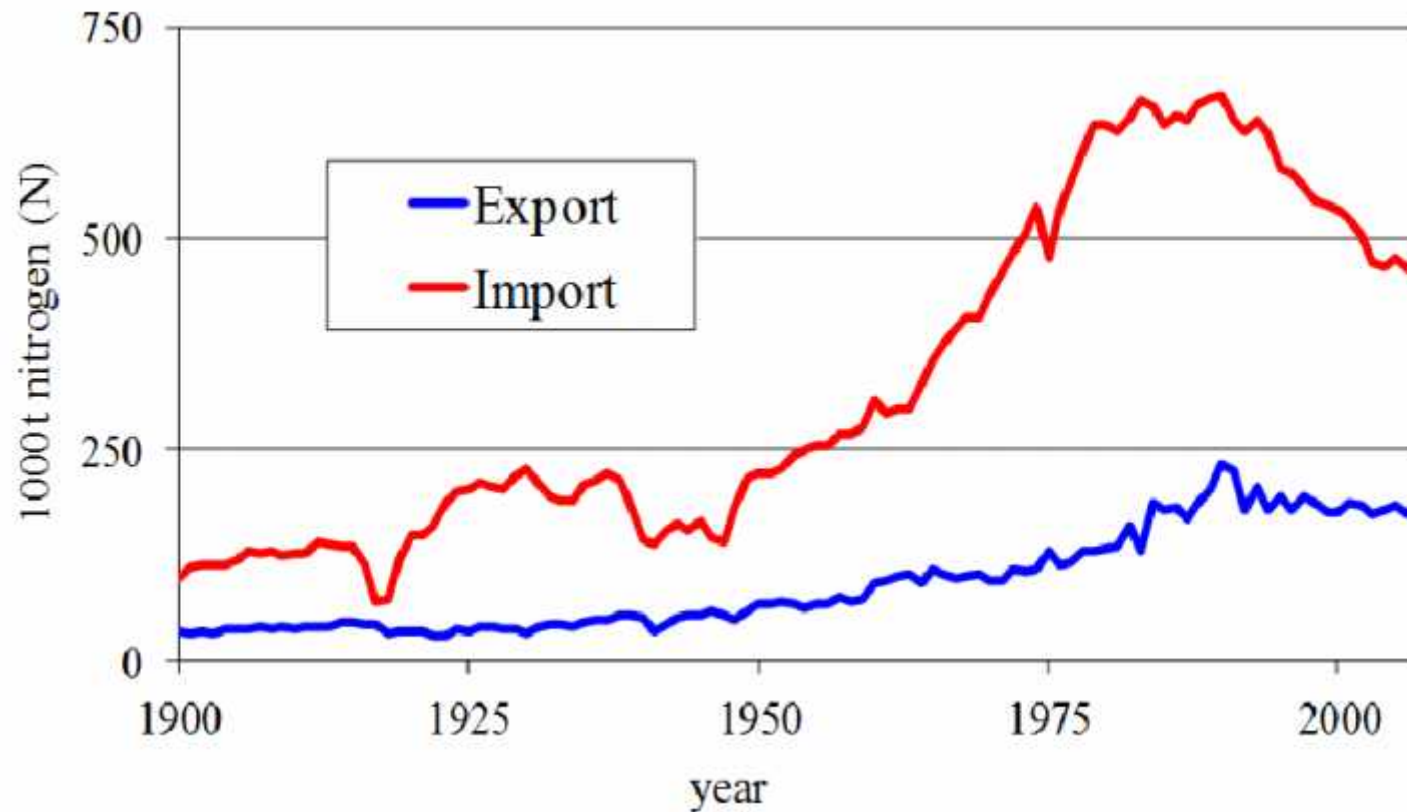
By Tommy Dalgaard et al.

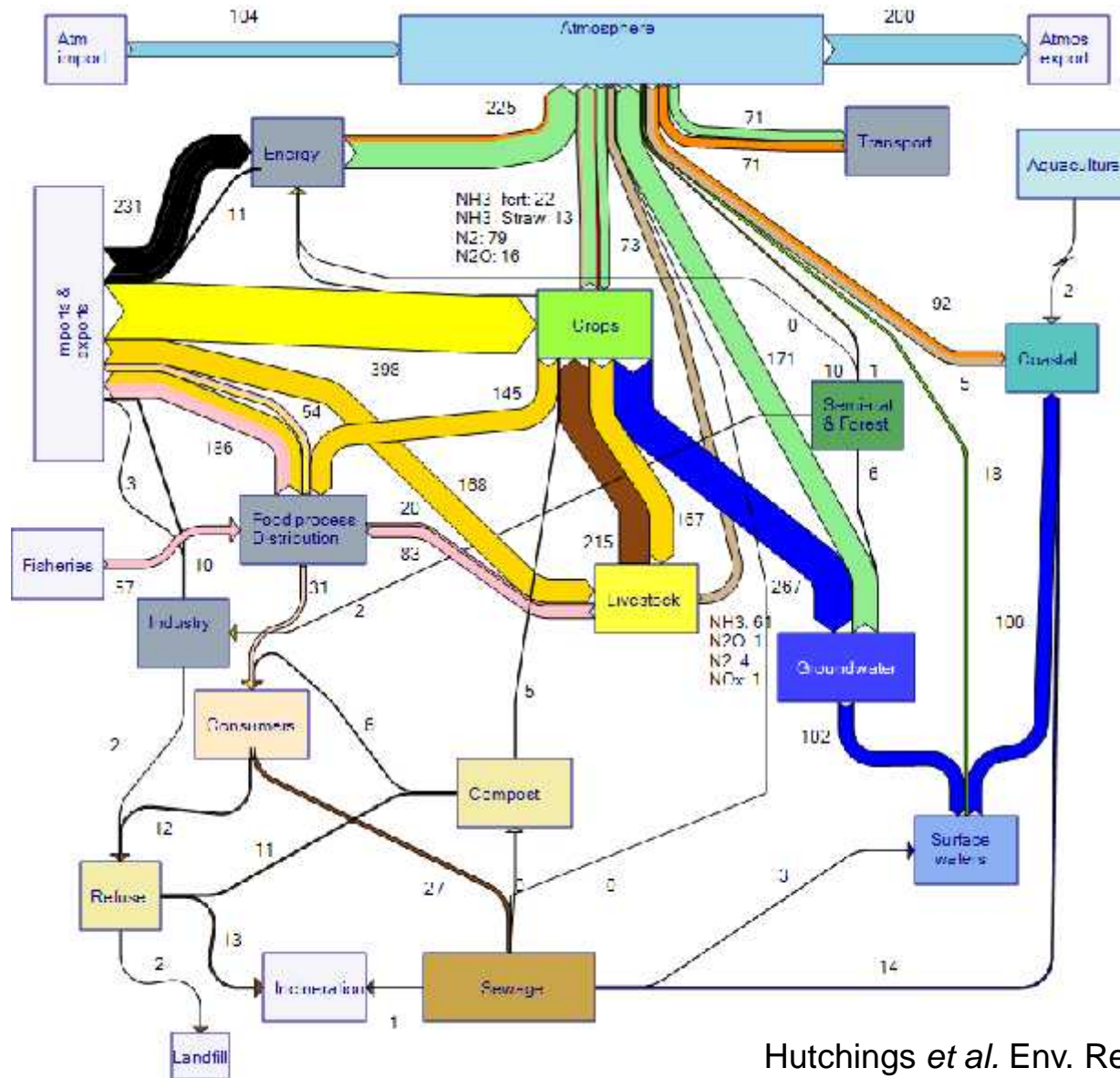
Aarhus University, Dept. of Agroecology. Contact: tommy.dalgaard@agro.au.dk
International Nitrogen Initiative Conference, session 1A: Global Impacts of Reactive Nitrogen.
Melbourne, Australia, December 5-8 2016

Program

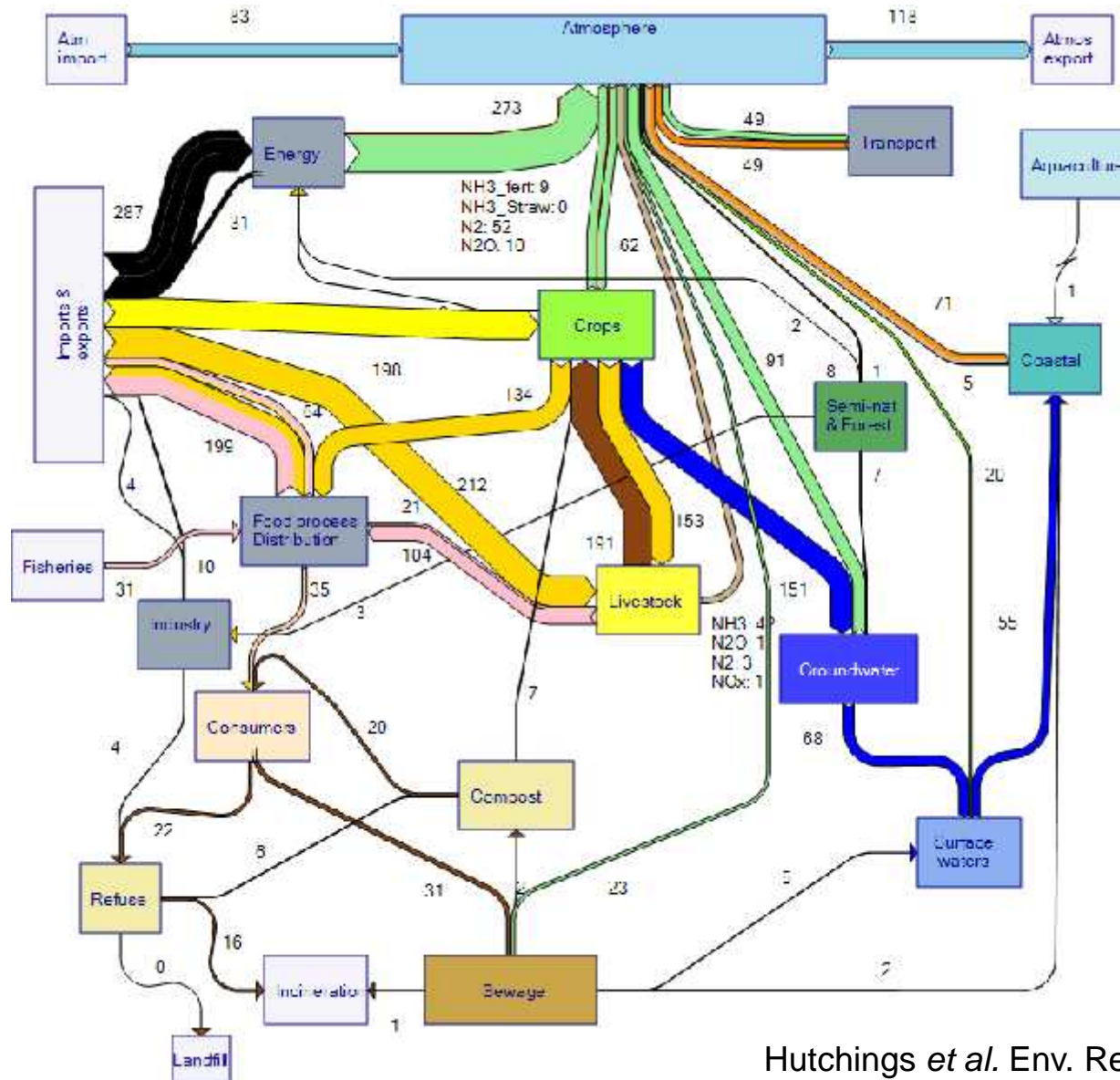
- Current N-balance and flows
- Trends in N efficiency and losses to the environment
- Effects of top-down versus bottom-up measures
- Solution scenarios

N balance for Danish agriculture

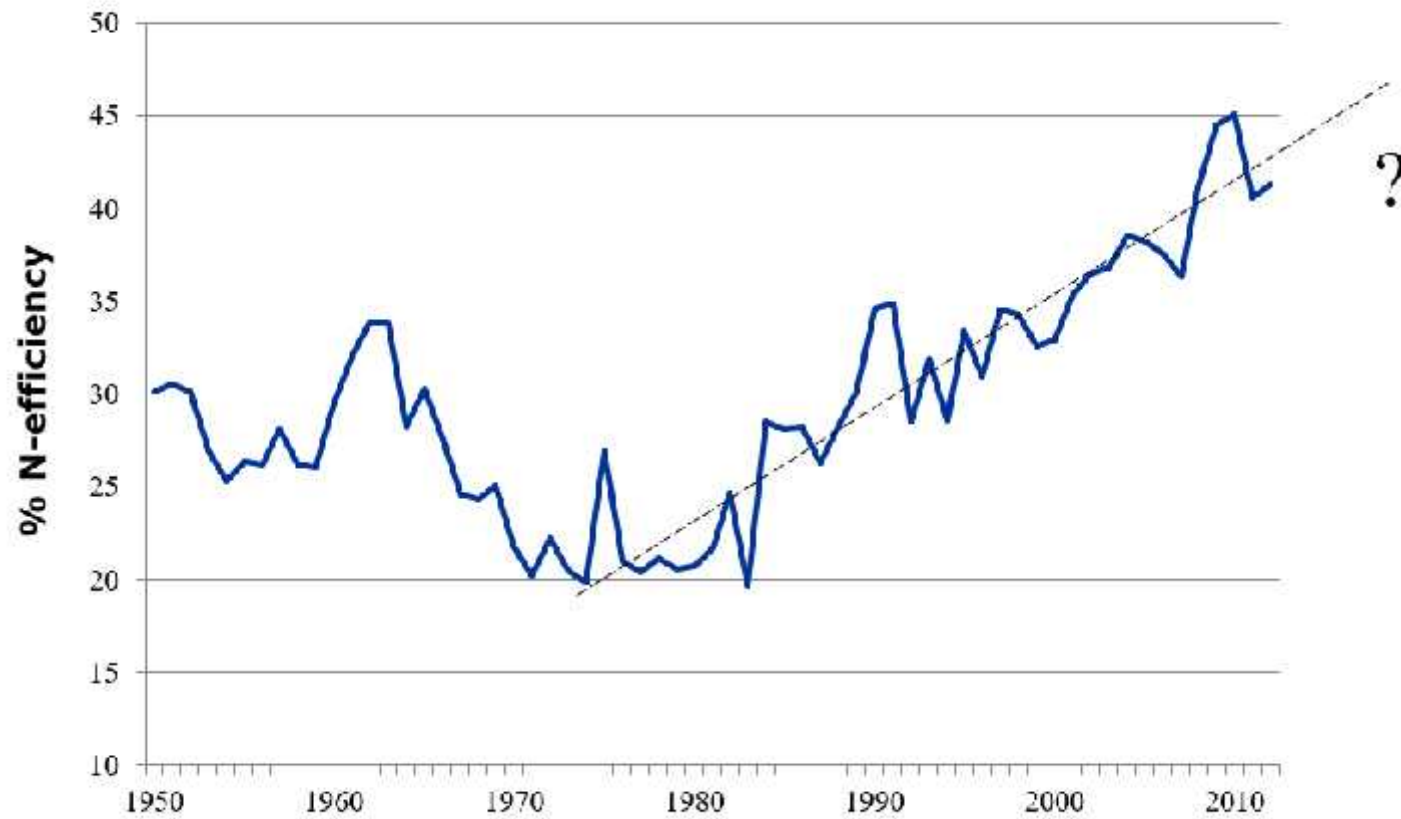




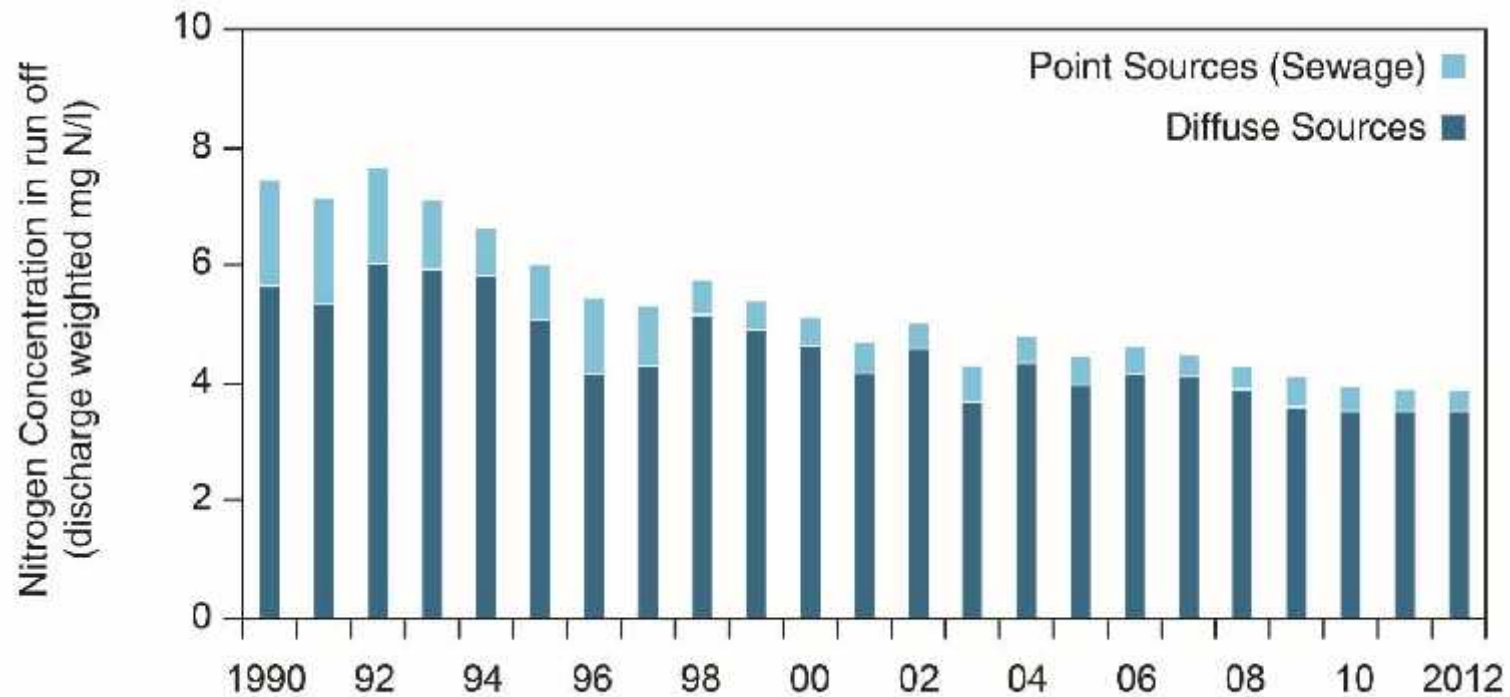
1990
kt N yr⁻¹



Trends in N efficiency

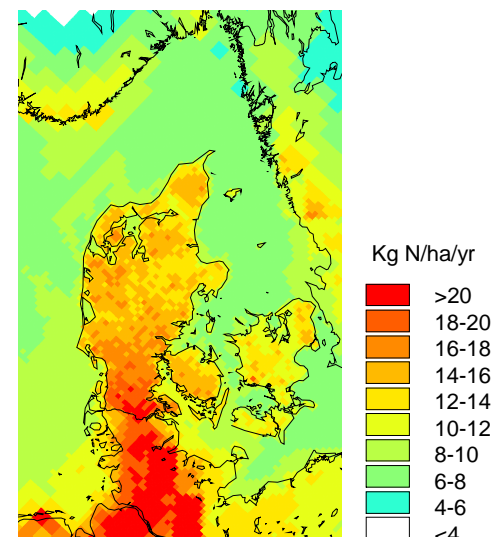
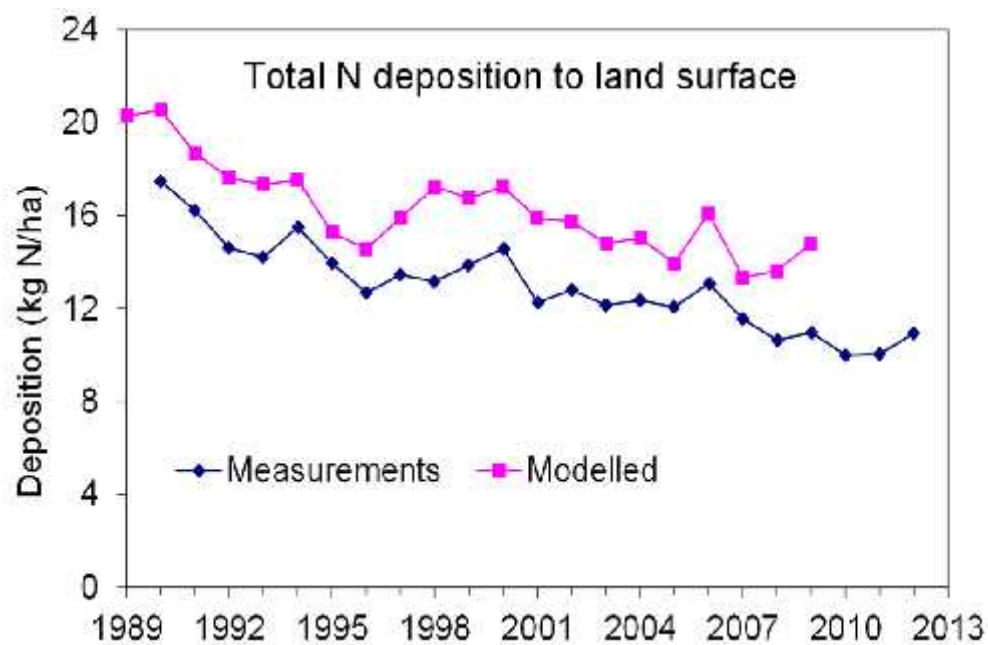


Surface water outflow to the sea

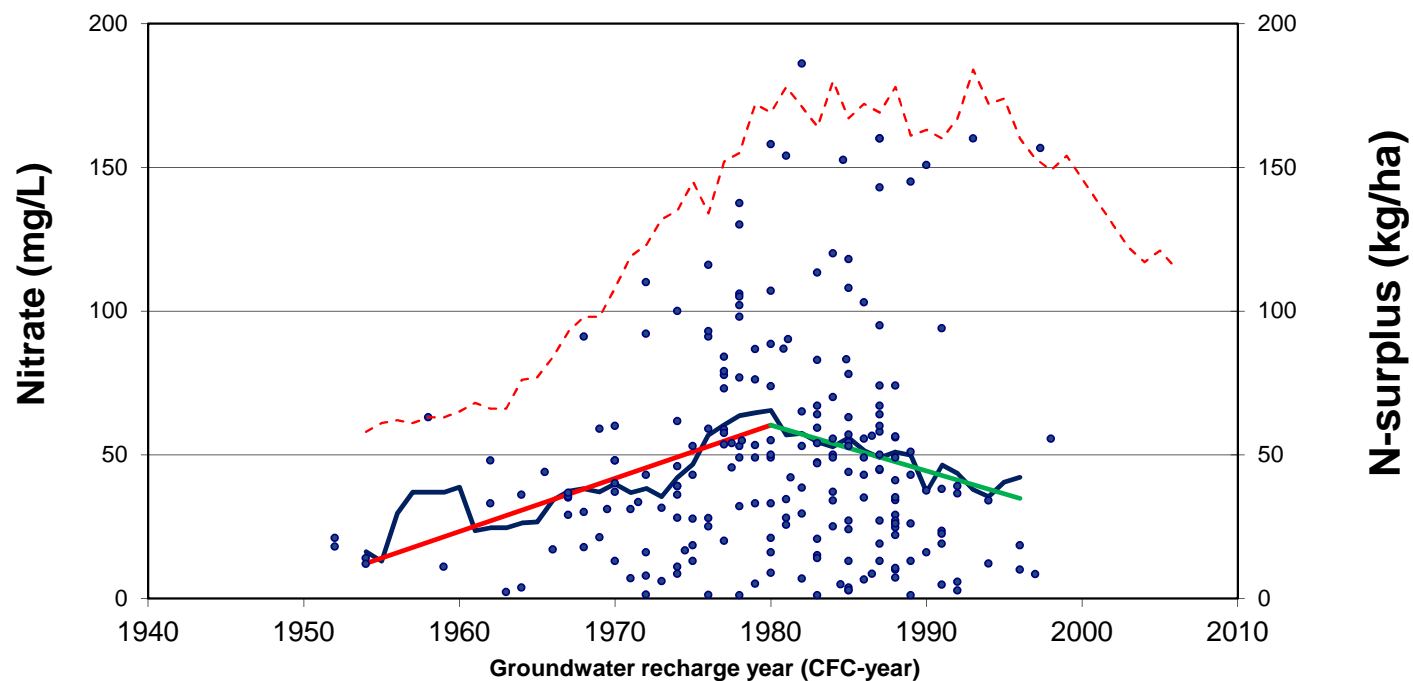


Dalgaard *et al.* Env. Research Letters 9 (2014)

Atmospheric N deposition



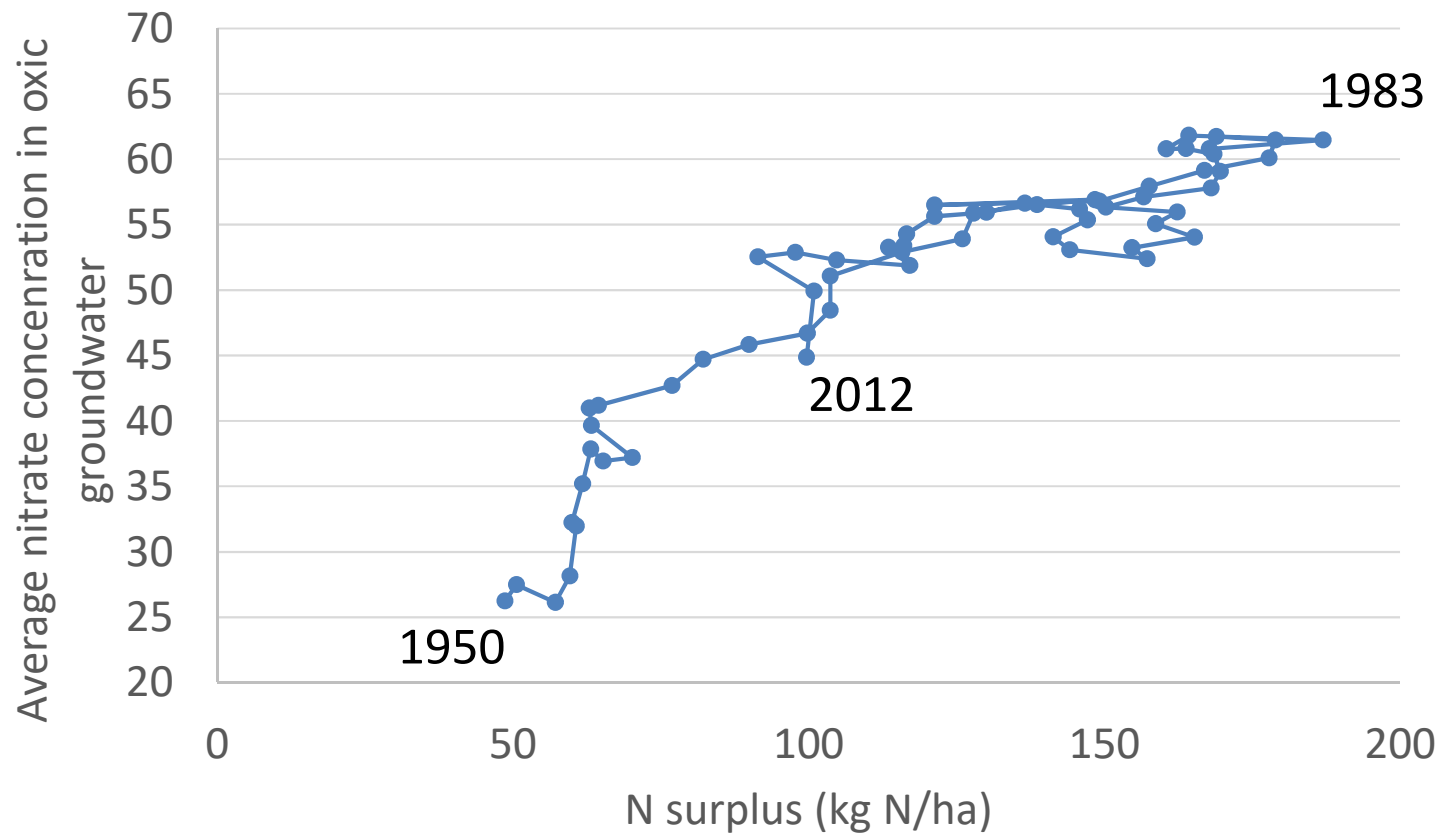
N-surplus and groundwater



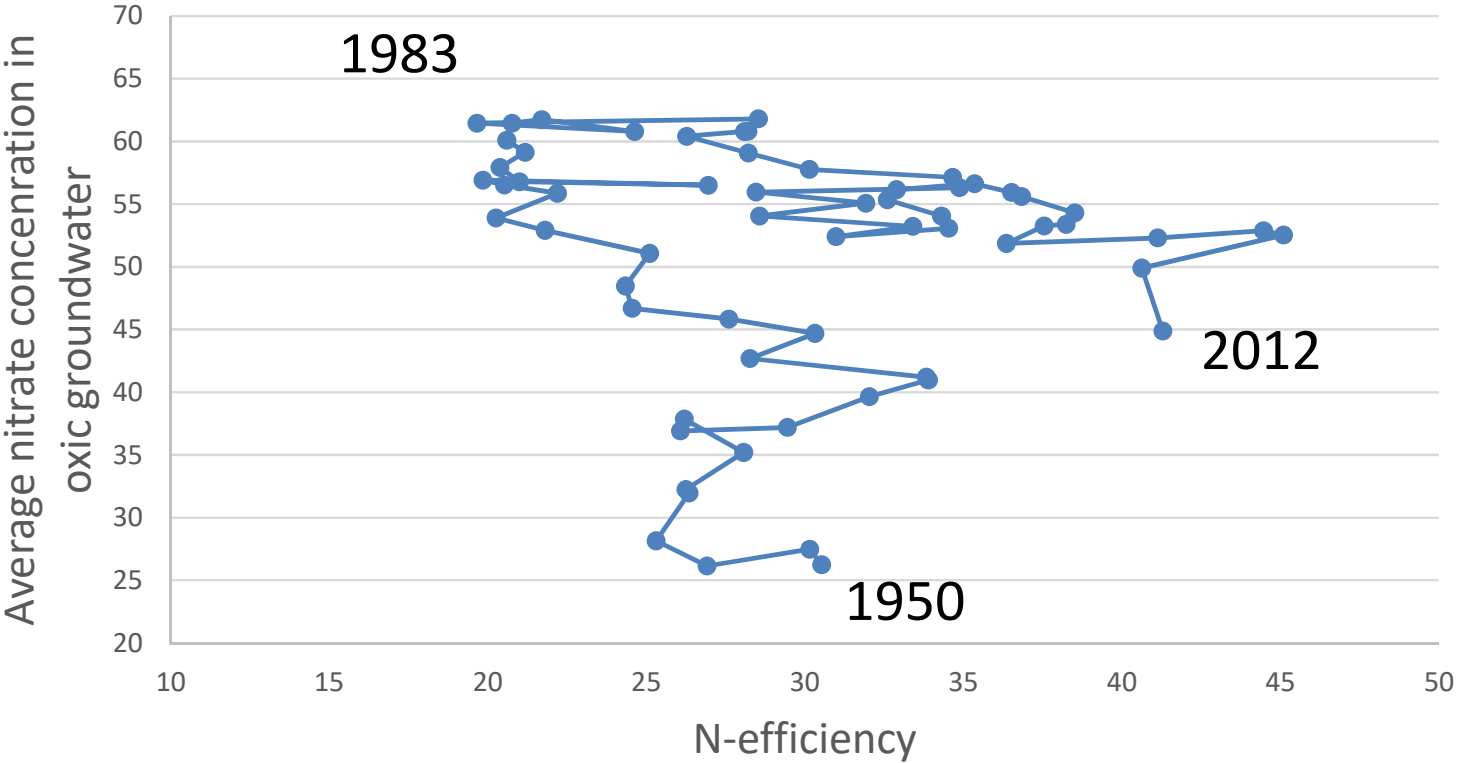
- Nitrate in oxic groundwater (nitrate>1mg/l, iron<0.2 mg/l & oxygen>1mg/l)
- Moving average of nitrate in groundwater
- Upward nitrate trend
- Downward nitrate trend
- - - N surplus in agriculture

Hansen *et al.* Env Sci. Tech. (2011)

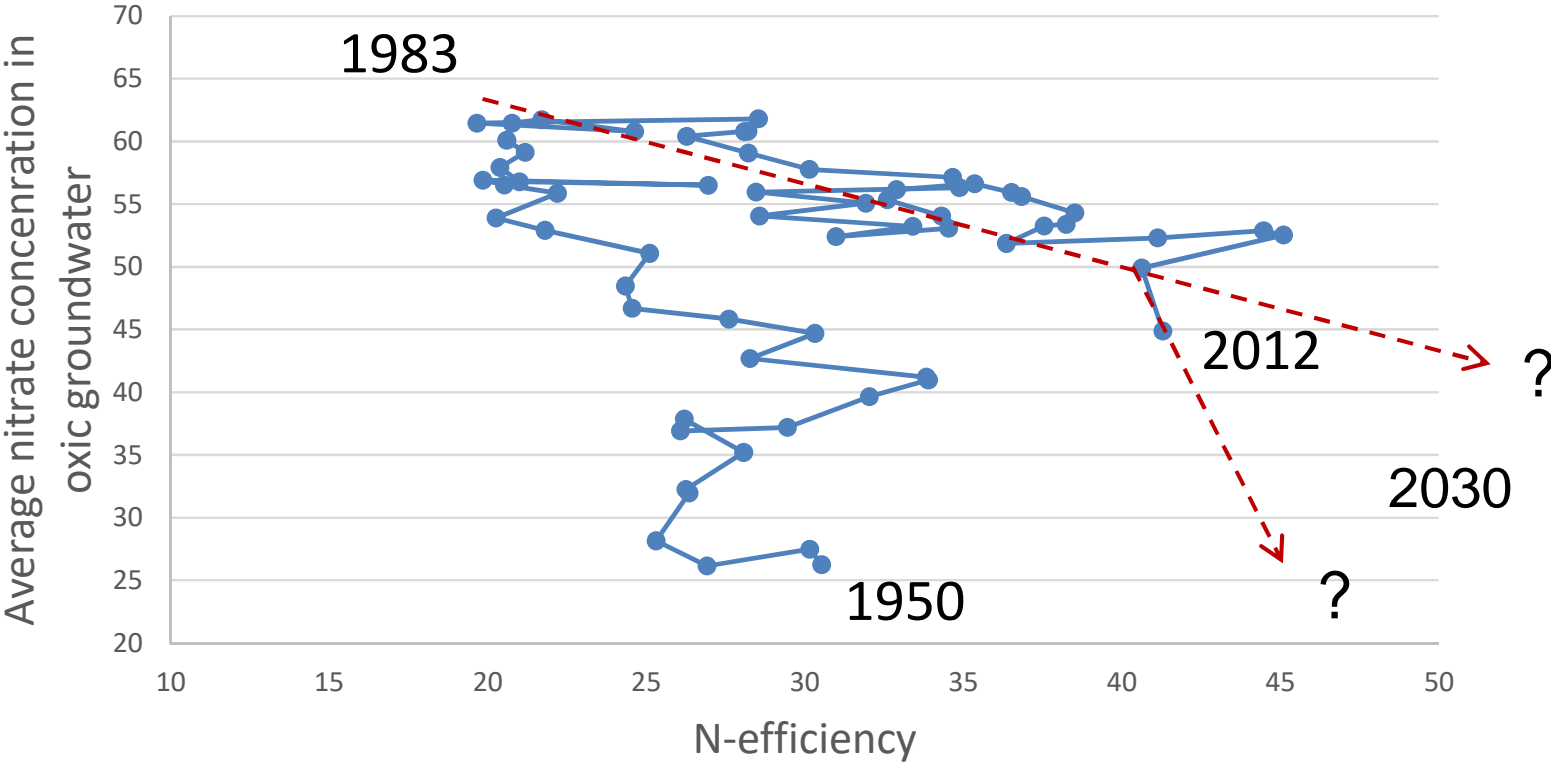
Correlation with N surplus



Correlation with N efficiency?



Solution Scenarios



Top-down AND bottom-up measures needed

The 'Catchment Process' – catchment officers across DK



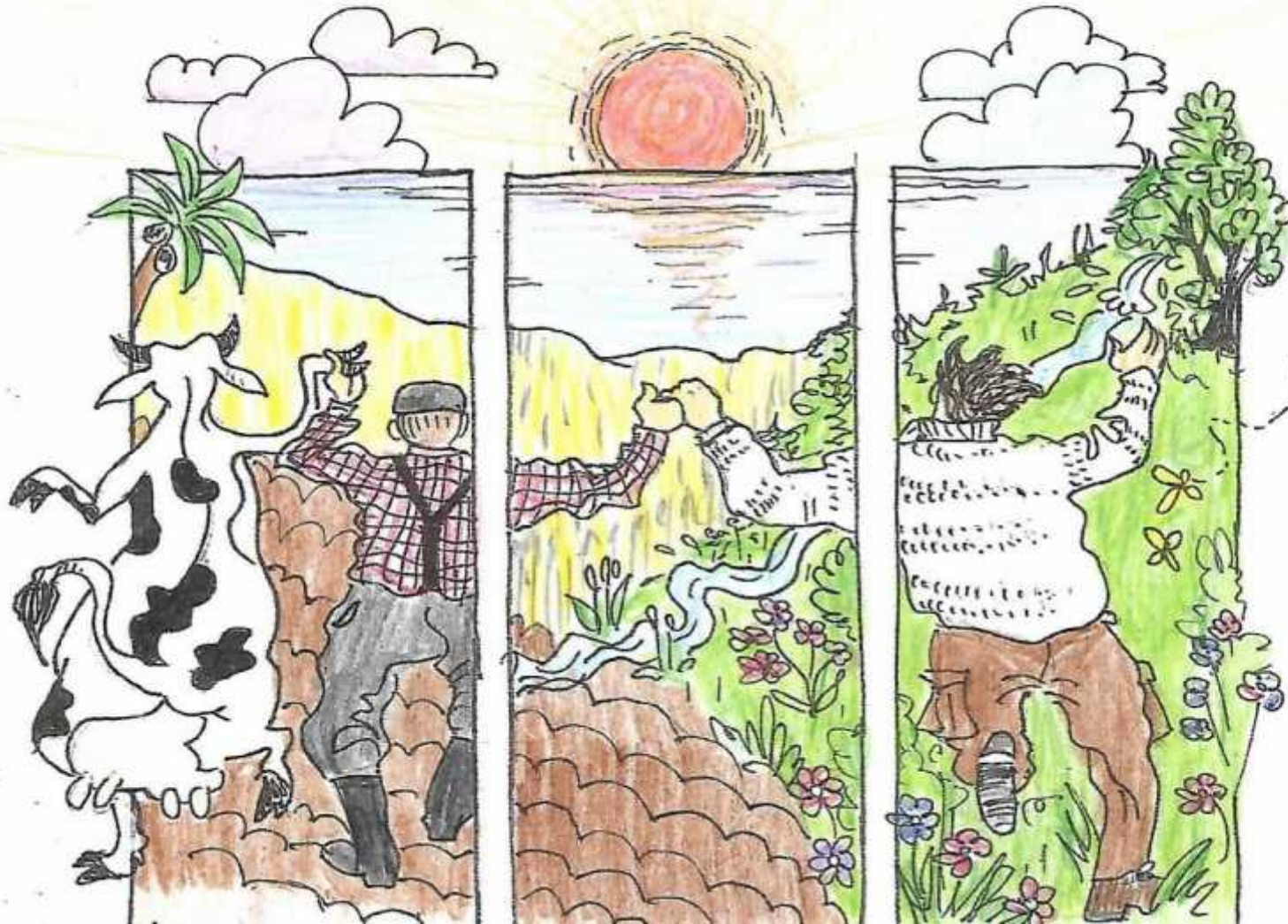
 20 / NaturErhvervstyrelsen



- Coordination of action programmes
- Constructed wetlands
- Targeted catch crops
- In dialogue with farmers, agricultural organizations and municipalities etc.

Source: The Danish AgriFish Agency

Solution scenarios



DNMARK solution scenarios

- **New production chains with more efficient use and recycling of N**
 - This scenario focuses on reducing losses through more efficient crop uptake of N (perennial crops, cover crops), efficient use of N in livestock production, technologies for reducing losses through the production (e.g. within crop and livestock production systems), technologies for capturing and recycling N for fertilisation.
- **Geographically differentiated N-measures based on landscape planning and management**
 - N flows and emissions have substantially different effects depending on the location of the emissions relative to vulnerable ecosystems, depending on N retention (uptake and reduction) during the low path. Measures here focus on optimising N retention through local planning.
- **Changed consumption patterns driving land use change and reducing N use**
 - Changes in consumption patterns can involve changes in organic food consumption (e.g. extensive grassland farming), less meat consumption (less livestock), new demands and productions through bioenergy crops, biorefineries etc. that lead to more perennial cropping for food, feed and bioenergy.

Next year June 25-30 in Aarhus!

Sustainable N Conference and TFRN-meeting



AARHUS-2017
EUROPEAN CAPITAL
OF CULTURE

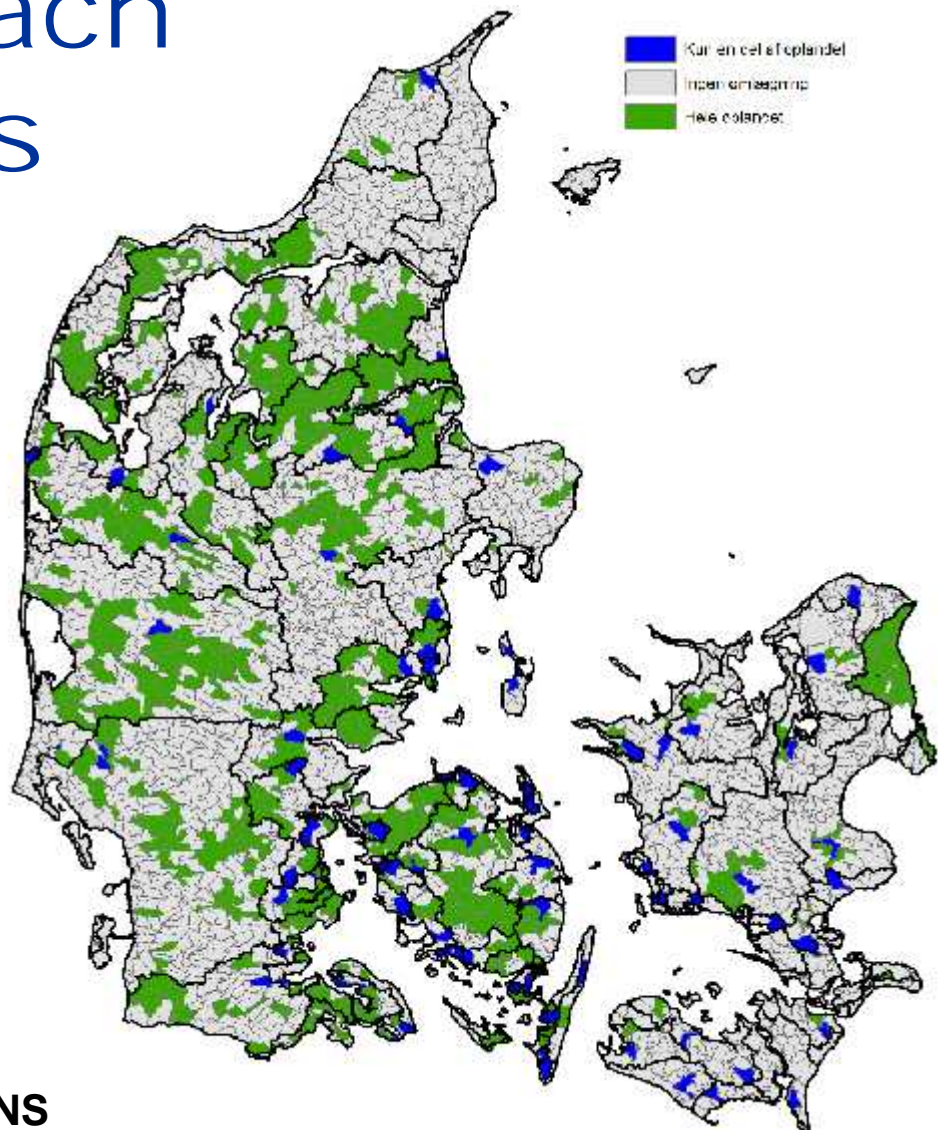
dNmark
research alliance
www.dNmark.org

sustainableNconference.dnmark.org

Set-aside to reach EU-WFD targets

National average: 47%

Optimally placed (ID15): 30%



PRELIMINARY CALCULATIONS