

The implementation of policies for sustainable management of N_r in Denmark

- a succes story with needs for improvements



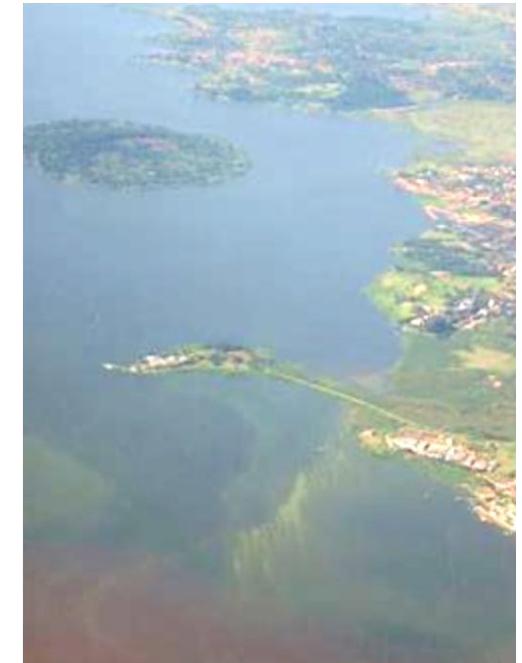
By Tommy Dalgaard¹, Jørgen E. Olesen¹ and Jan K. Schjørring²

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*UN-TFRN-9 Task Force on Reactive Nitrogen Meeting <http://www.clrtap-tfrn.org/tfrn-9>.
Agrícola and Agrónomos Schools, Technical University of Madrid, Spain. Mar 24-26 2014.*

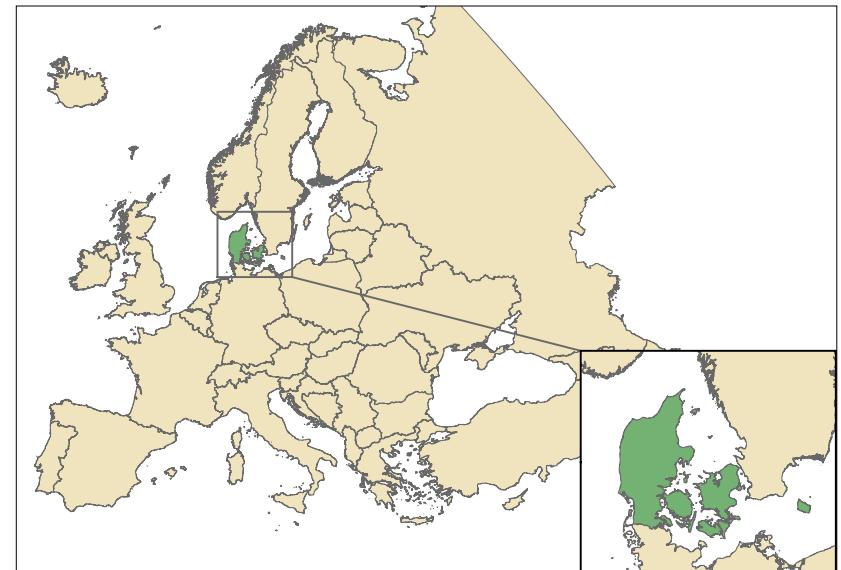
Program

- **Introduction**
- **Development in Danish agriculture; N-utilisation and N-regulation**
- **The Green Growth problem**
- **New policy strategies and research**
- **Conclusion**



Agriculture in Denmark

- 2.6 mio ha agricultural land (62% of total area)
- 5 mio people – 4.5 mio t milk - 24 mio pigs/yr
 - 9 t milk/cow/yr
 - 26 piglets/sow/yr
 - 7.5 t wheat/ha/yr
- 7500 km coastline



Dairy Cows
(1000's)

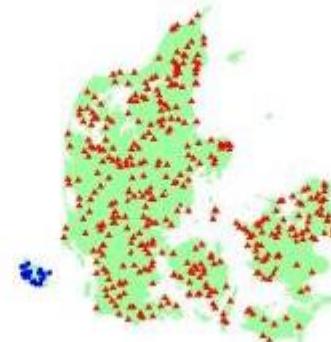
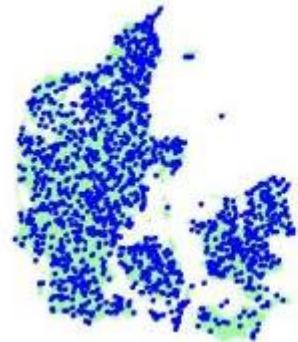
Pigs
(1000's)

Wheat cereals
(1000 ha)

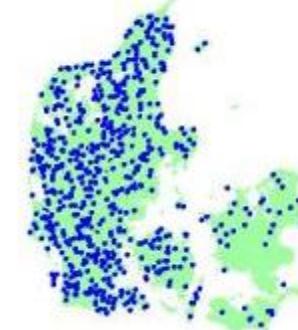
1900



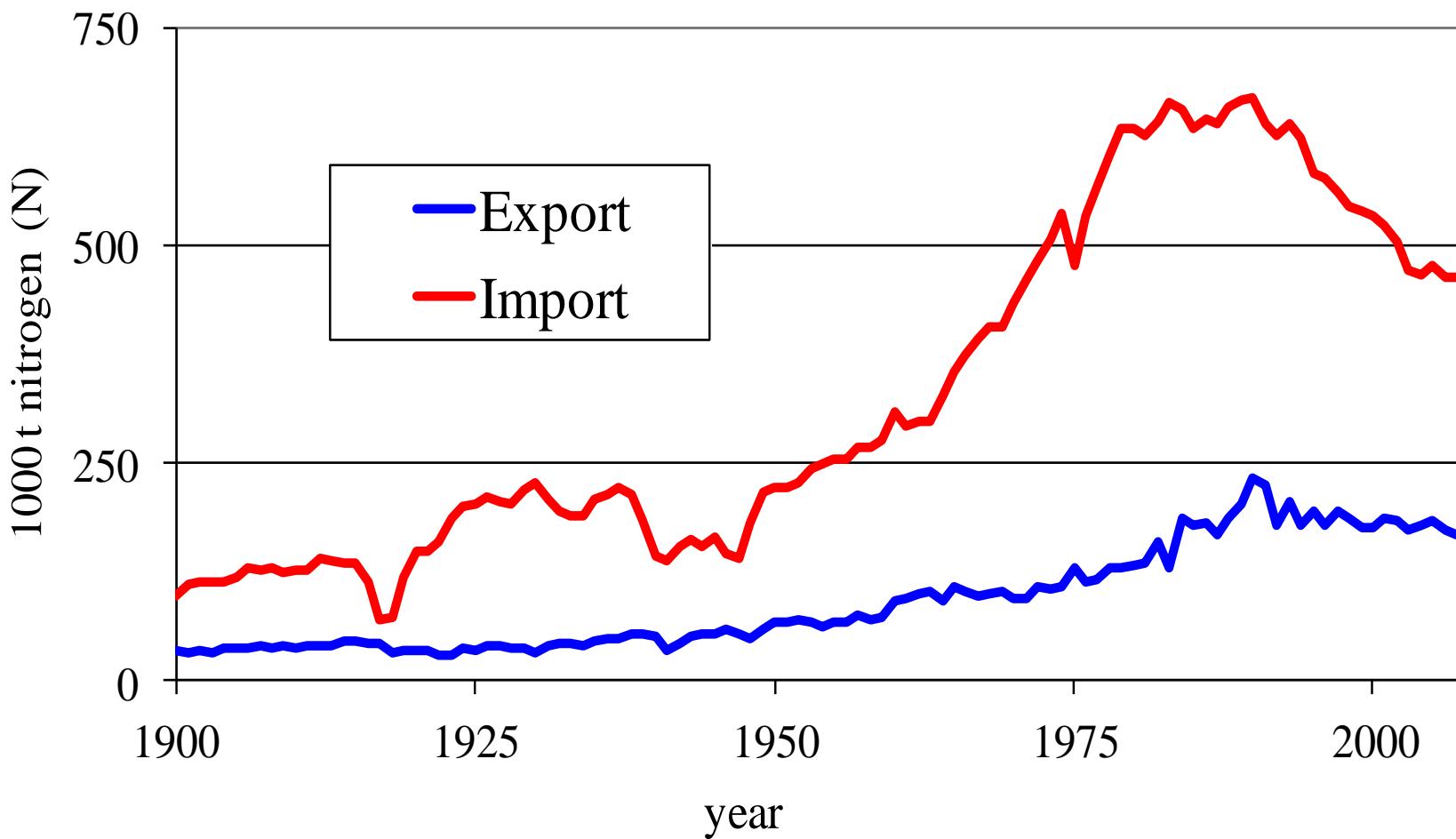
1950



2000

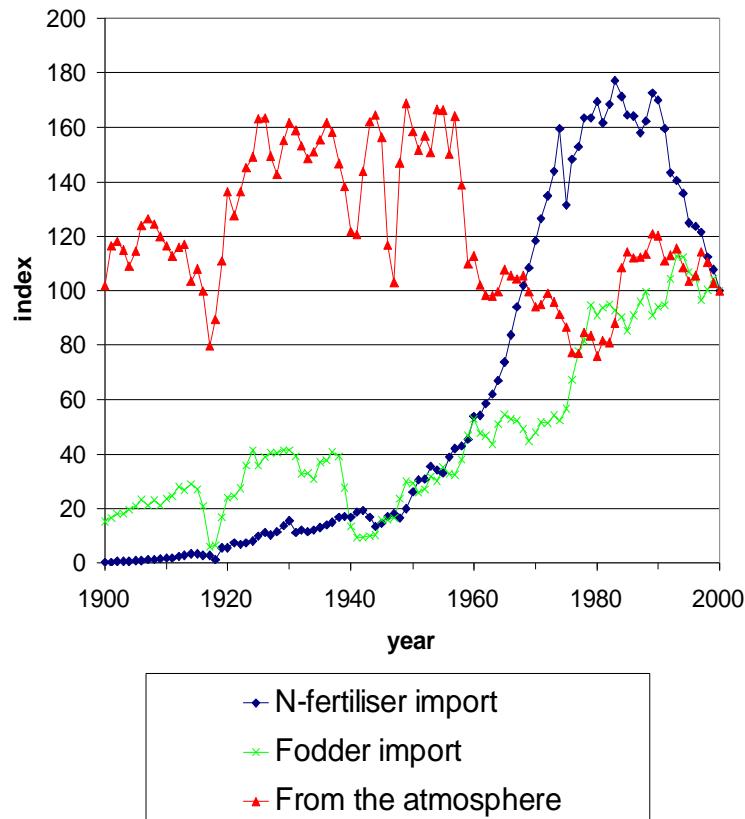


N-efficiency in Danish Agriculture

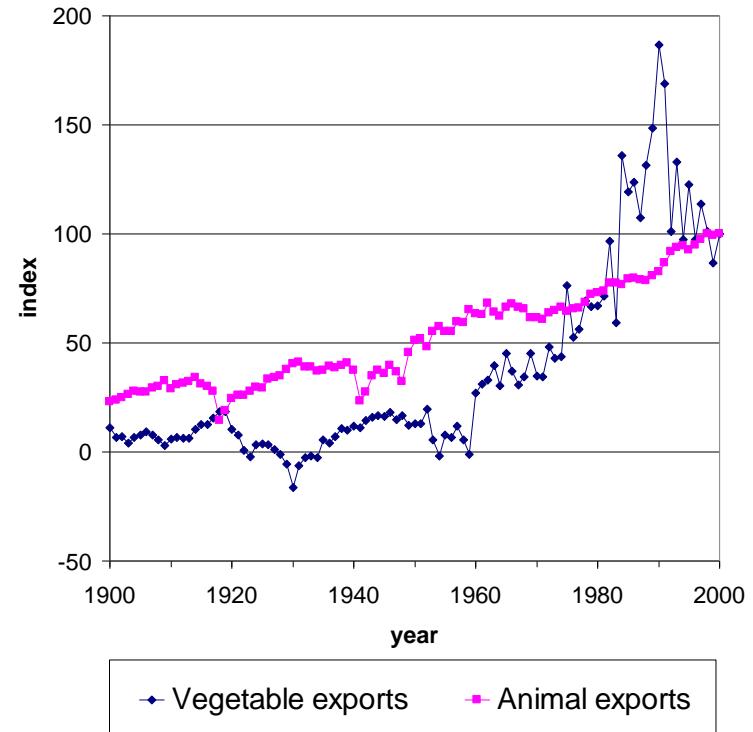


Development phases

N-imports

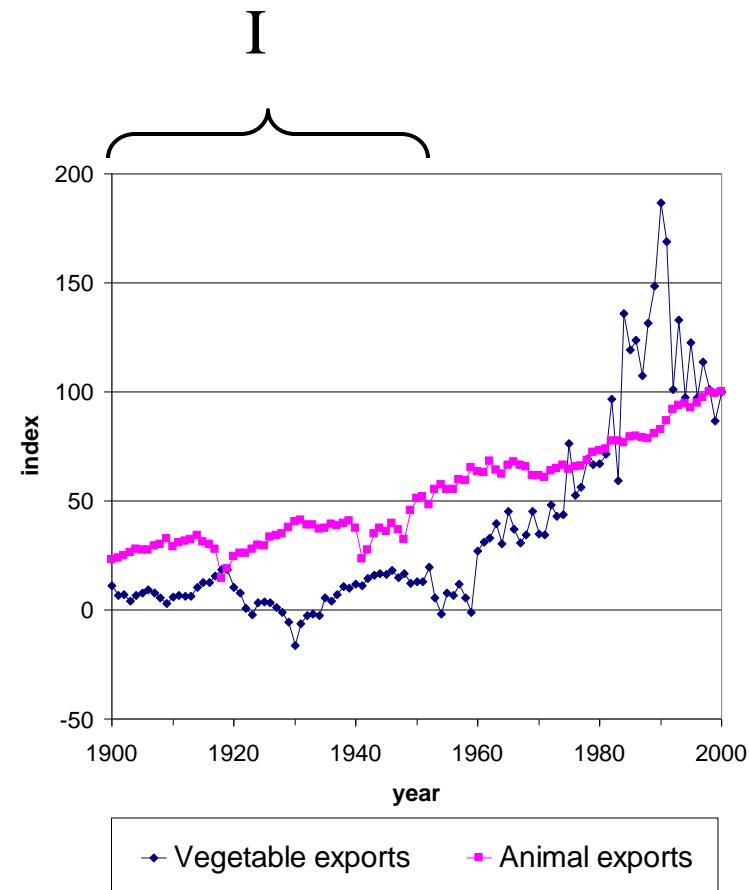
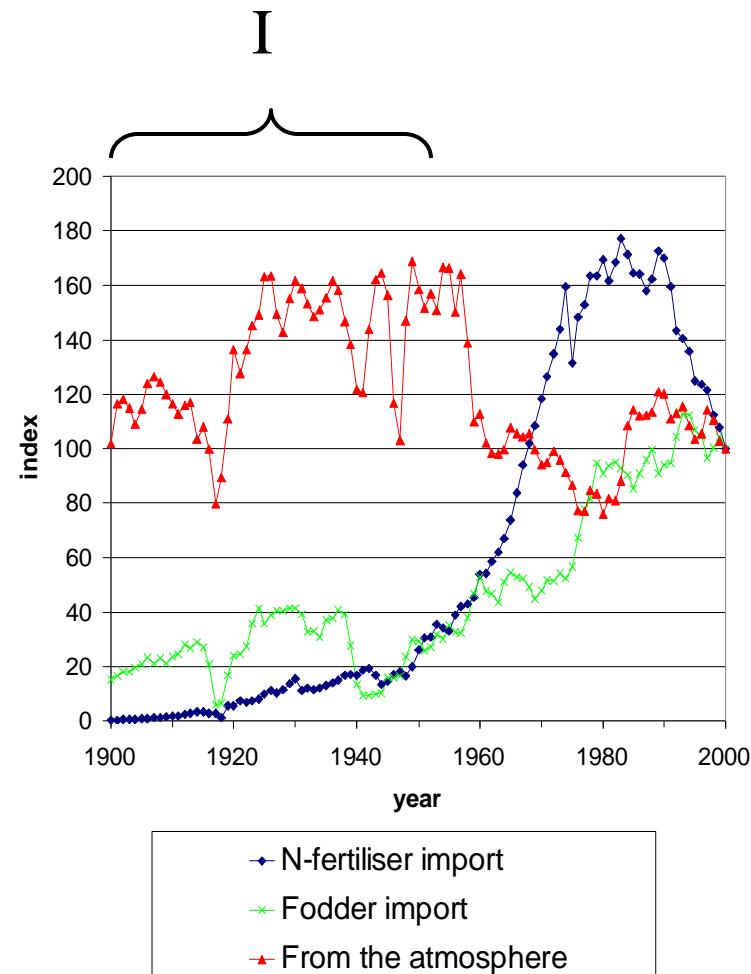


N-exports



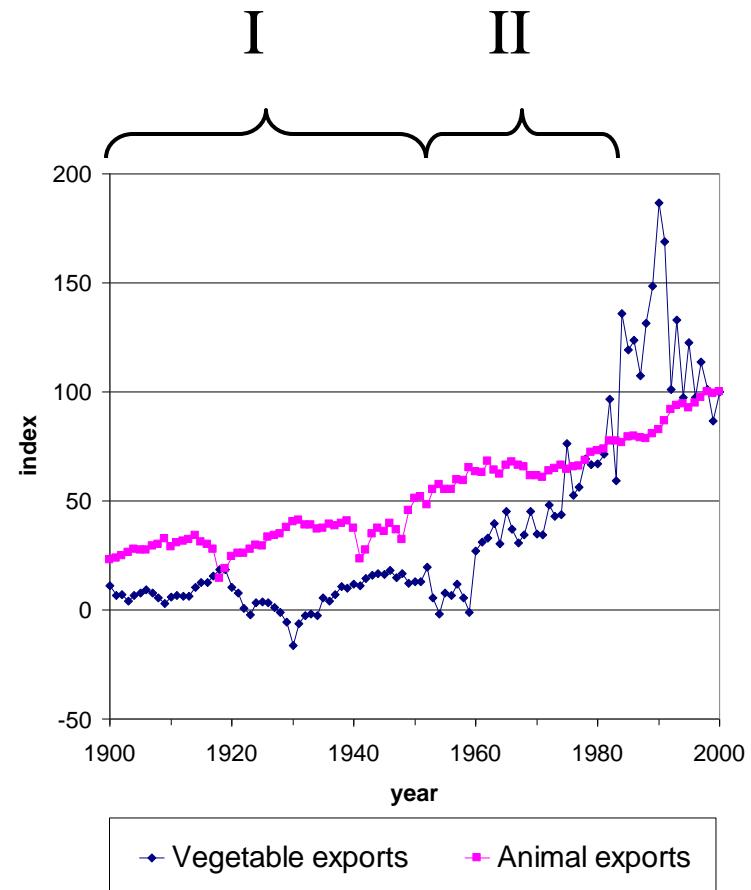
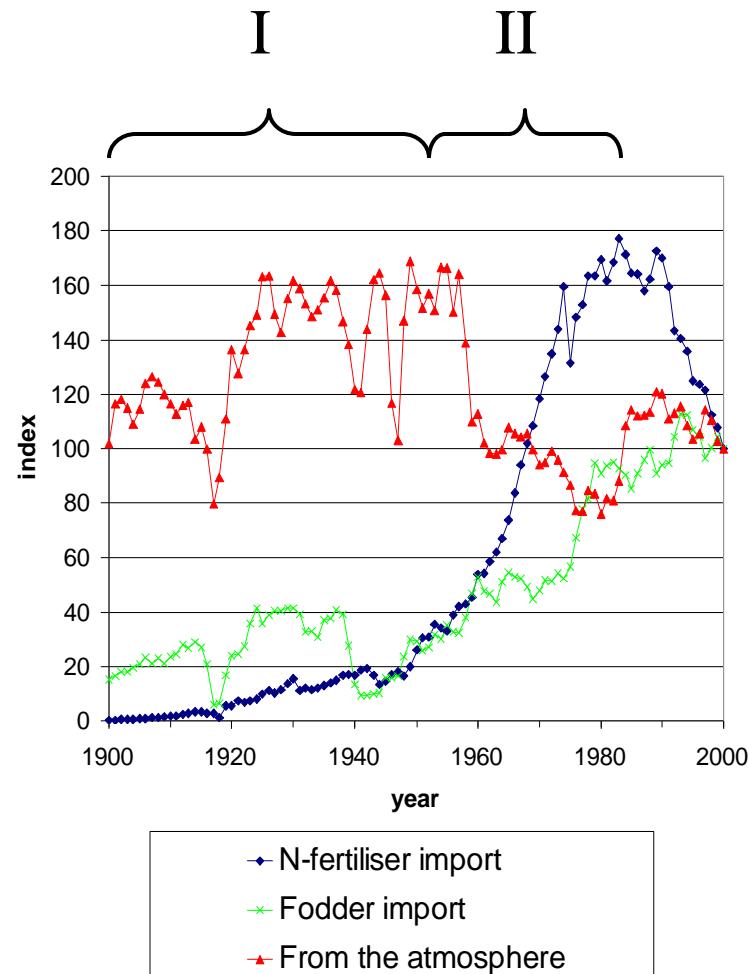
NB: year 2000= index 100

I: Traditional livestock farming (1900-1950)



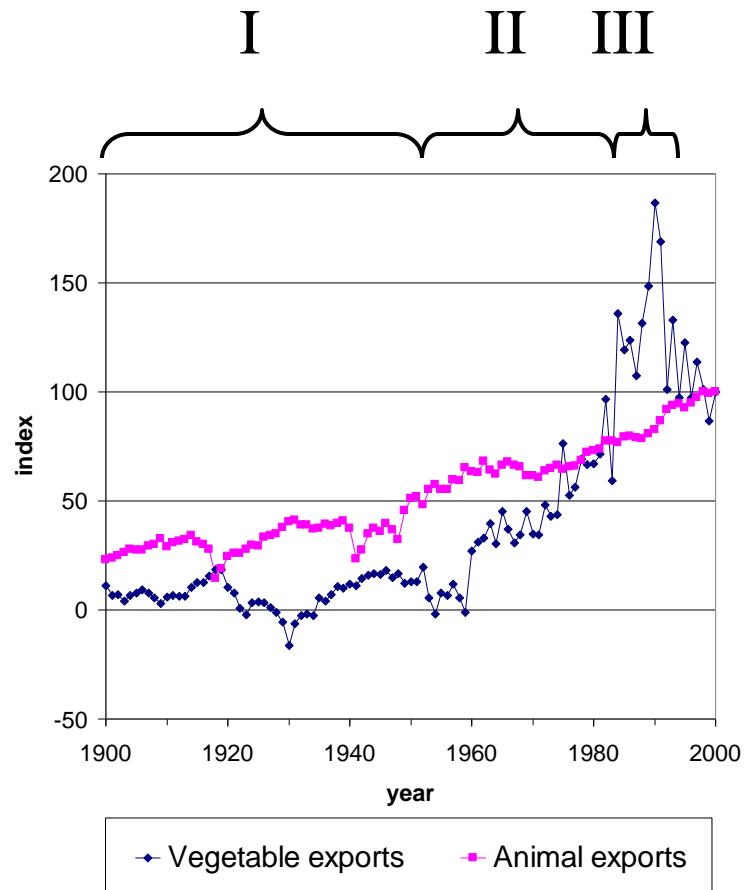
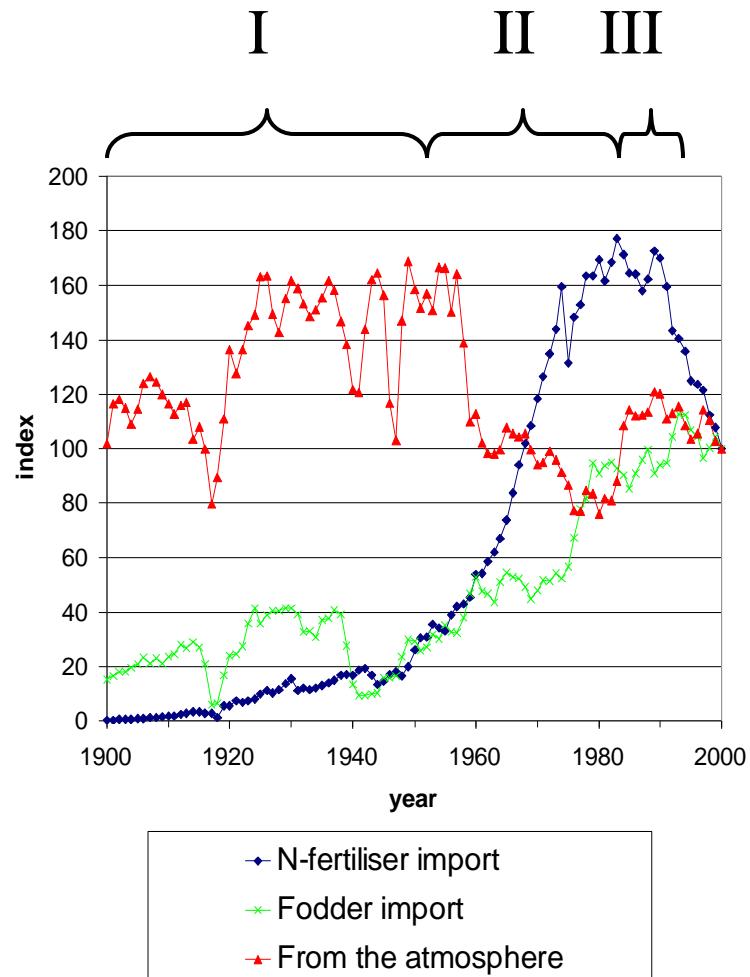
NB: year 2000= index 100

II: The green revolution (1950-1983)



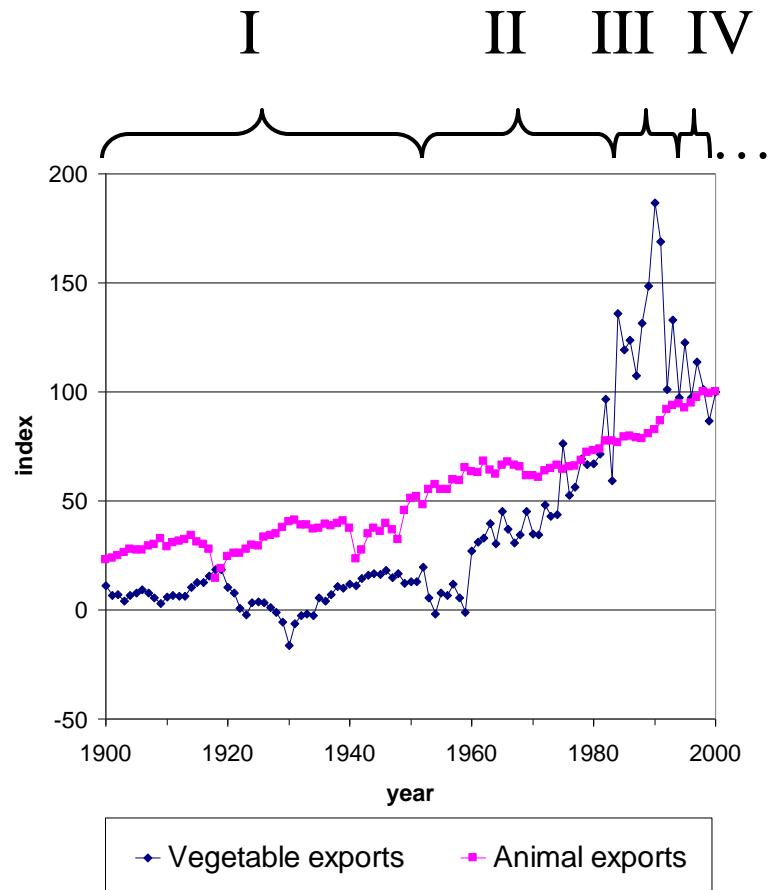
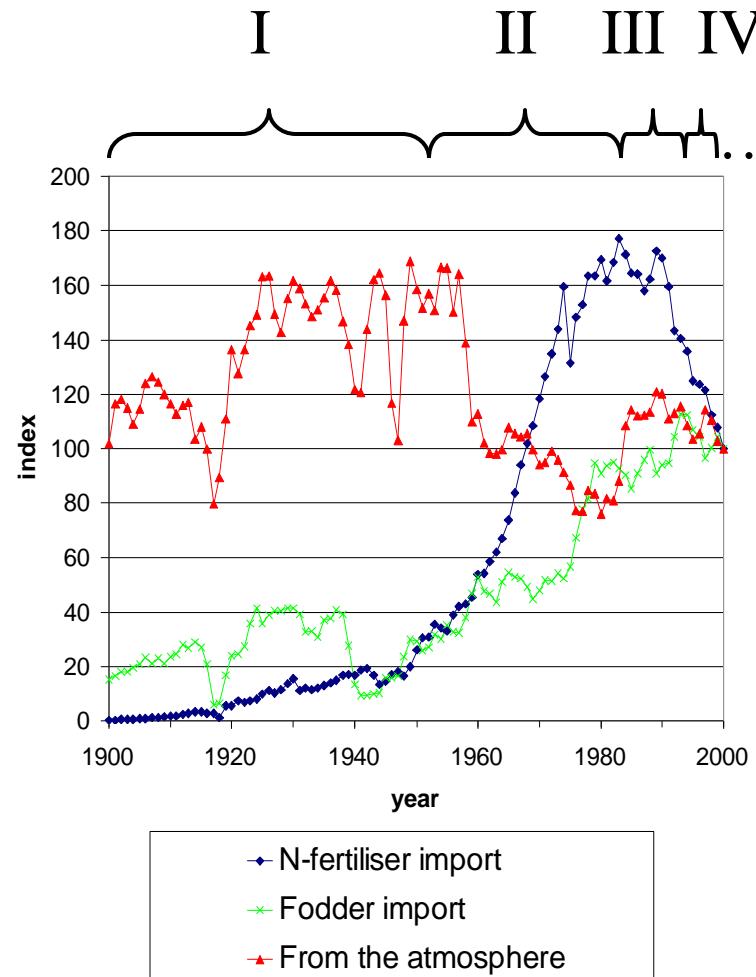
NB: year 2000= index 100

III: Limits to growth (1984-1993)



NB: year 2000= index 100

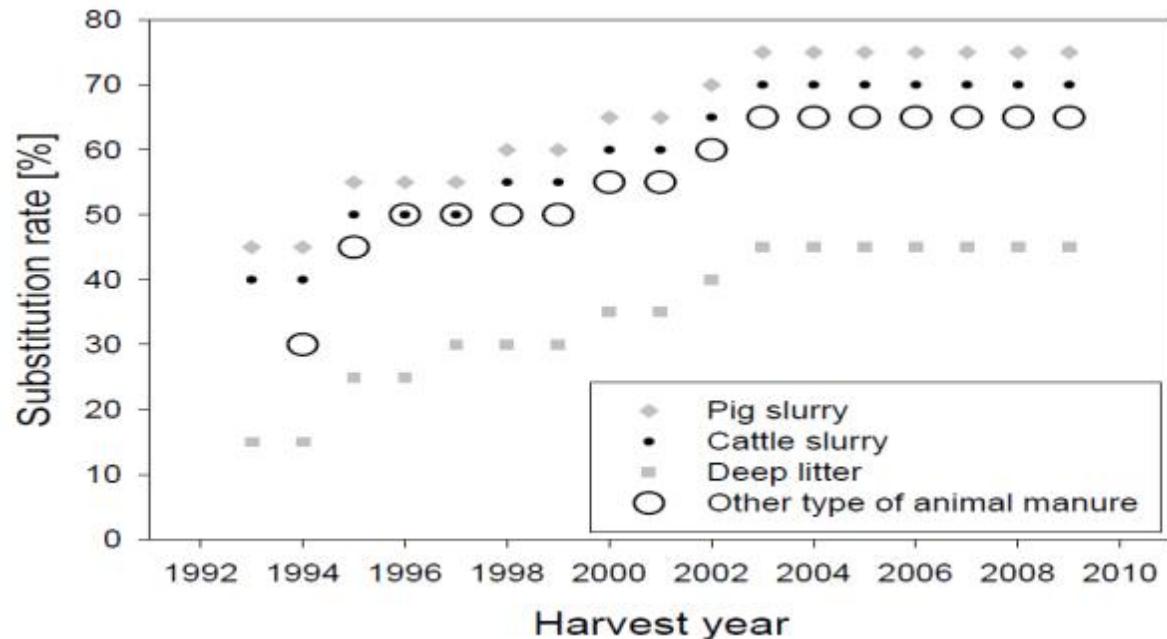
IV: Globalisation and sustainable development? (1994-?)



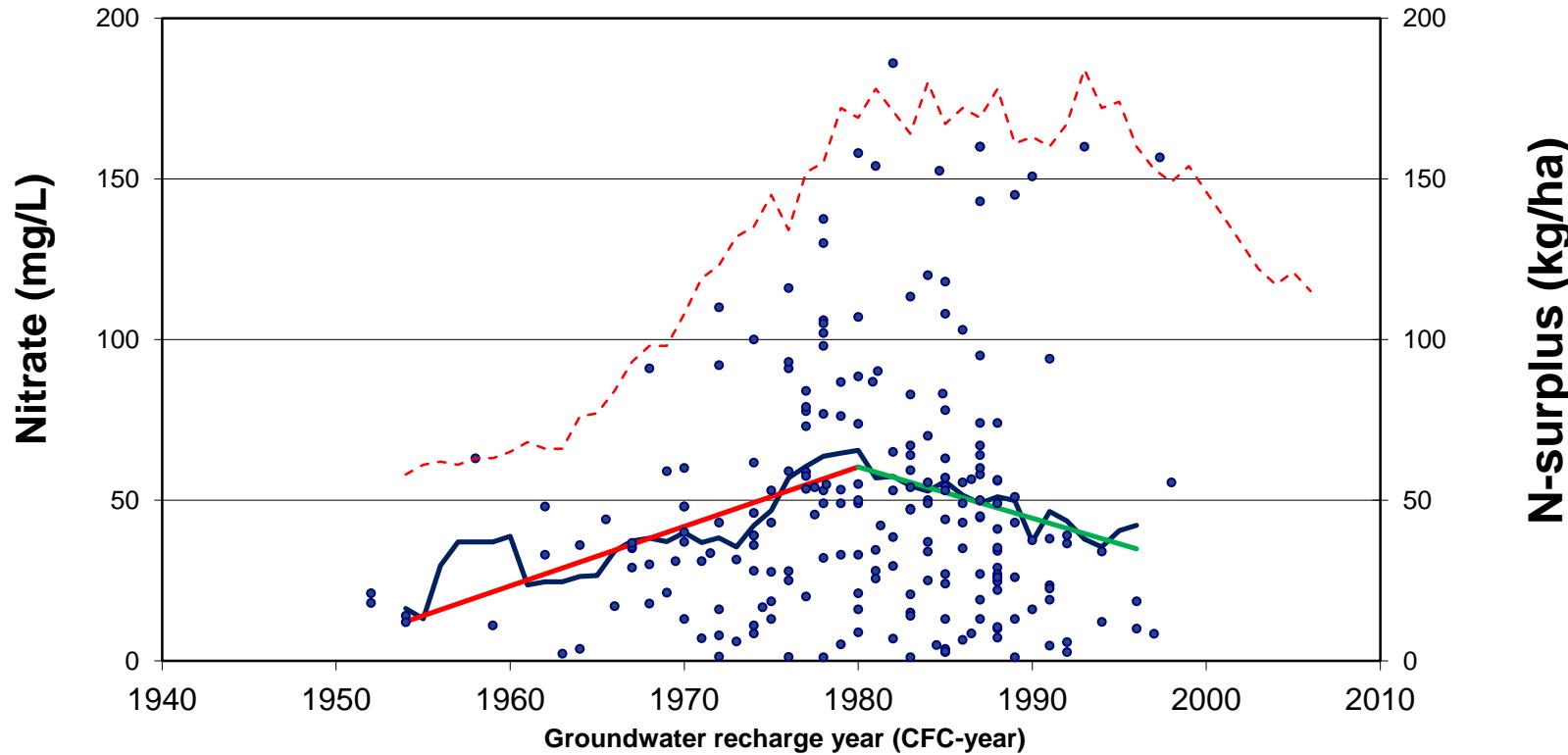
NB: year 2000= index 100

Action plans

- The 1985 Action Plan
- AP-I for the Aquatic Environment (1987)
- Action Plan for Sustainable Agriculture (1991)
- AP-II for the Aquatic Environment (1998, 2000)
- Ammonia Action Plan (2001)
- AP-III for the Aquatic Environment (2004)
- Green Growth
(2009)
- EU Water-
Framework
Directive
implementation
(2010+)



N balance and N-leaching

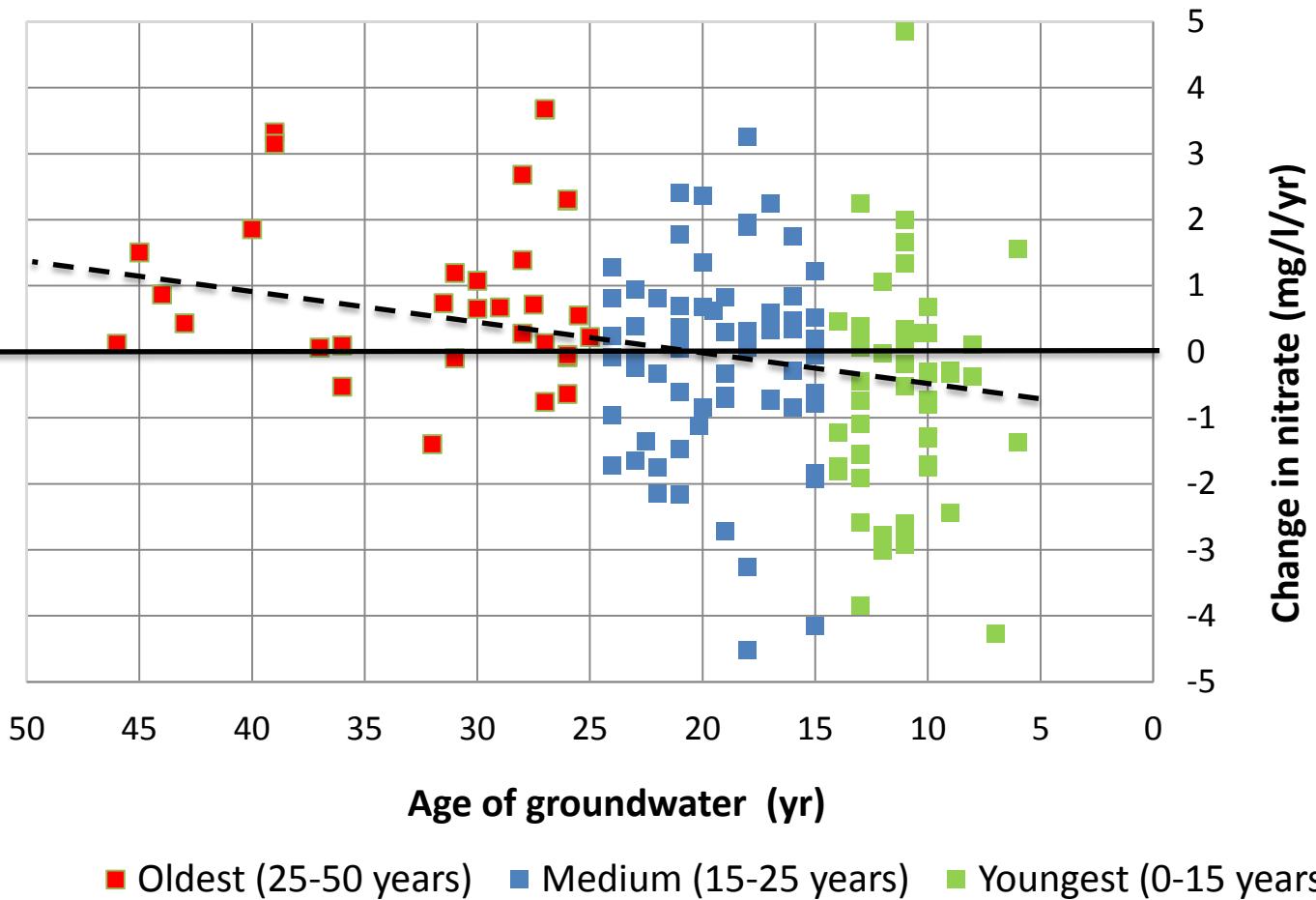


- Nitrate in oxic groundwater (nitrate > 1 mg/l, iron < 0.2 mg/l & oxygen > 1 mg/l)
- Moving average of nitrate in groundwater
- Upward nitrate trend
- Downward nitrate trend
- - - N surplus in agriculture

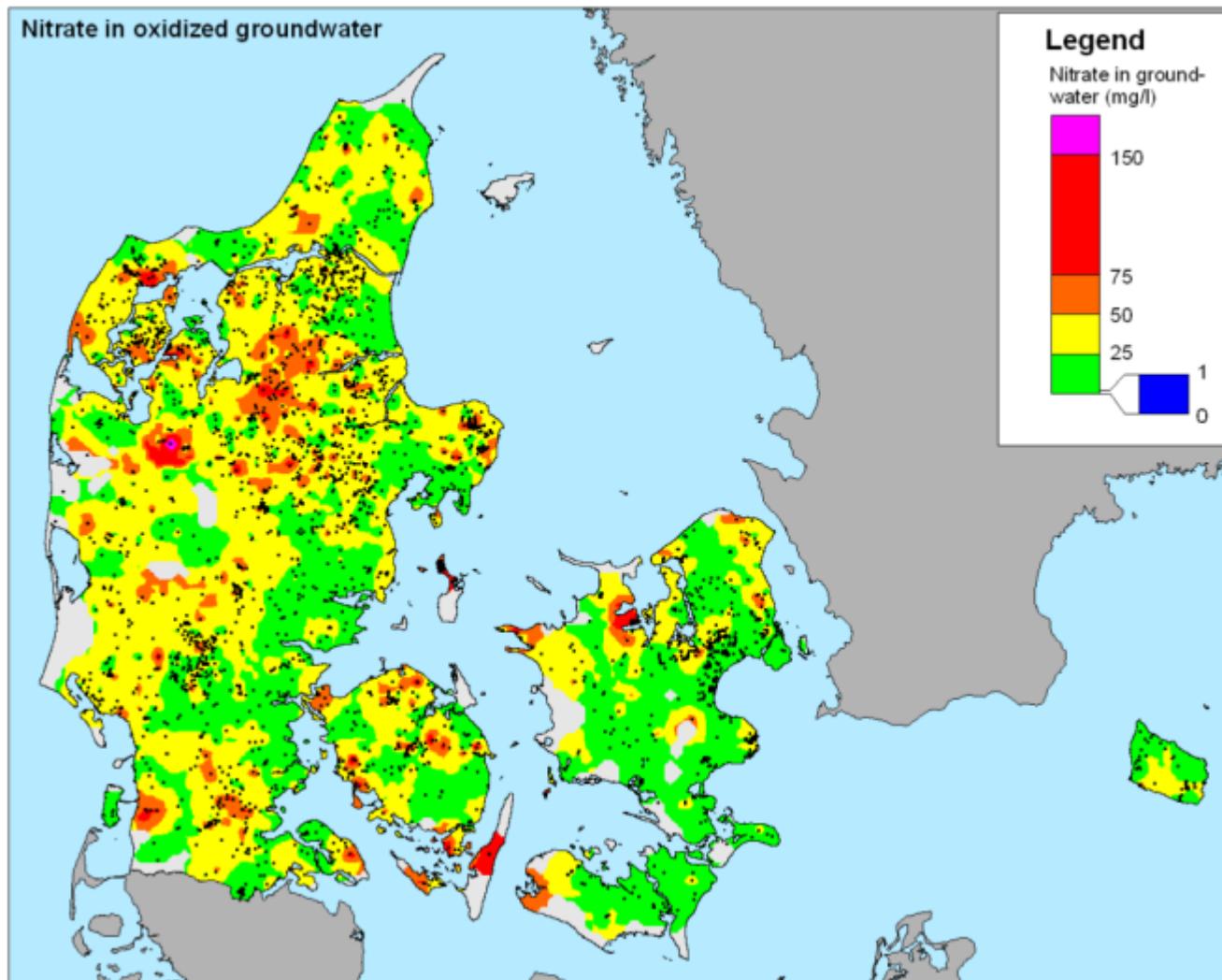
3 age groups of nitrate trends

Upward
nitrate
trend

Down-
ward
nitrate
trend



Call for further local actions



Hansen *et al.*
BiogeoSciences 9
(2012)

Development in measures

		Command and Control	Marked-Based Instruments	Information and Voluntary Action
1985	Max stock density, Min. Slurry capacity and ban on winter spreading for spring crops. Mandatory slurry tank floating barriers. No runoff from silage clamps and manure heaps.	X		
1987	Mandatory fertilizer and crop rotation plans, Min. proportion of area with winter crops. Mandatory manure application within 12 hours	X		
1991	Statutory norms for manure N utilization. Max N applied to crops equaling economic optimum.	X	(X)	
1998	Max N applied 10% below economic optimum, 6% obligatory catch crops. Subsidies to more organic farming, wetlands, extensification and afforestation. Promotion of low excretion livestock feeding.	X	X	
2001	Tightened ammonia restriction (e.g. broadcasting banned), and special restrictions near sensitive nature areas. Subsidies to promote better manure handling and animal housing (BAT).	X		X
2004		(localized)	X	X
2008	Buffer zones around streams, lakes and NH ₄ sensitive habitats. Tax on mineral P in feed. Max N applied ≈15% below economic optimum.	localized	X	
2010+	Optimized feed practice promotion.			X

.... ?

Conclusions

- General N regulation has successfully halved N-leaching, reduced N-surplus from 170 to 130 kg N/ha/yr and increased N-efficiency from $\approx 30\%$ to 43% over the last 25 years
- More local regulation with stakeholder involvement and a better balance between environmental and socio-economic benefits are now called for
- The challenge is to integrate both C&C, MBI's and I&V's with modes for local action

The dNmark.org research alliance



dNmark
research alliance

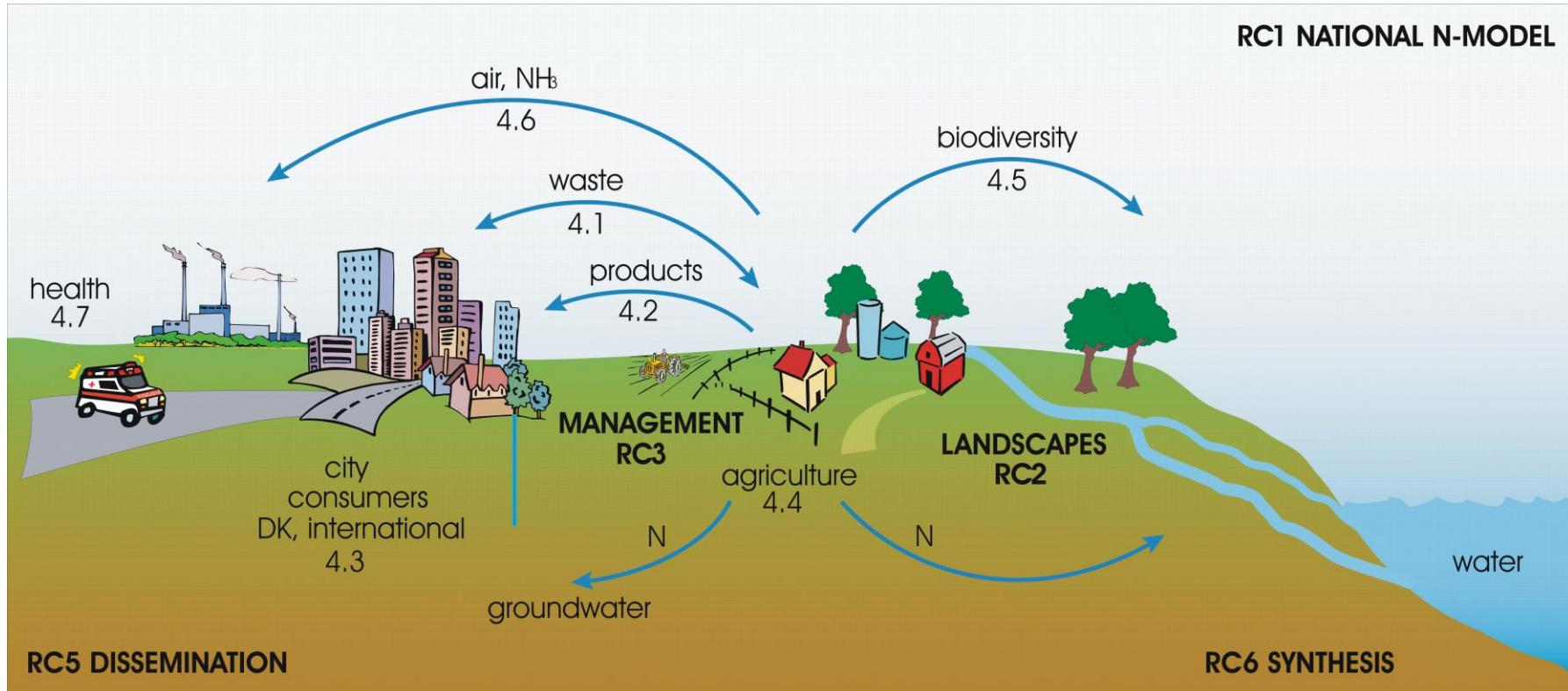
Innovative solutions for a

SUSTAINABLE MANAGEMENT
OF NITROGEN IN AGRICULTURE

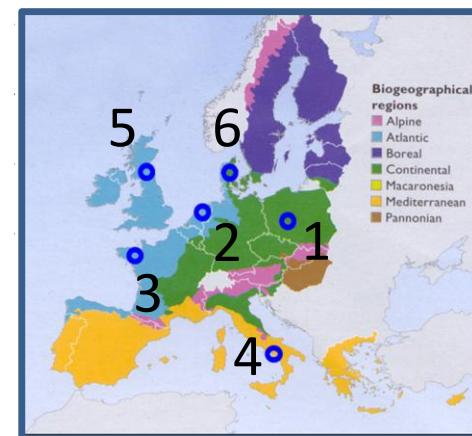
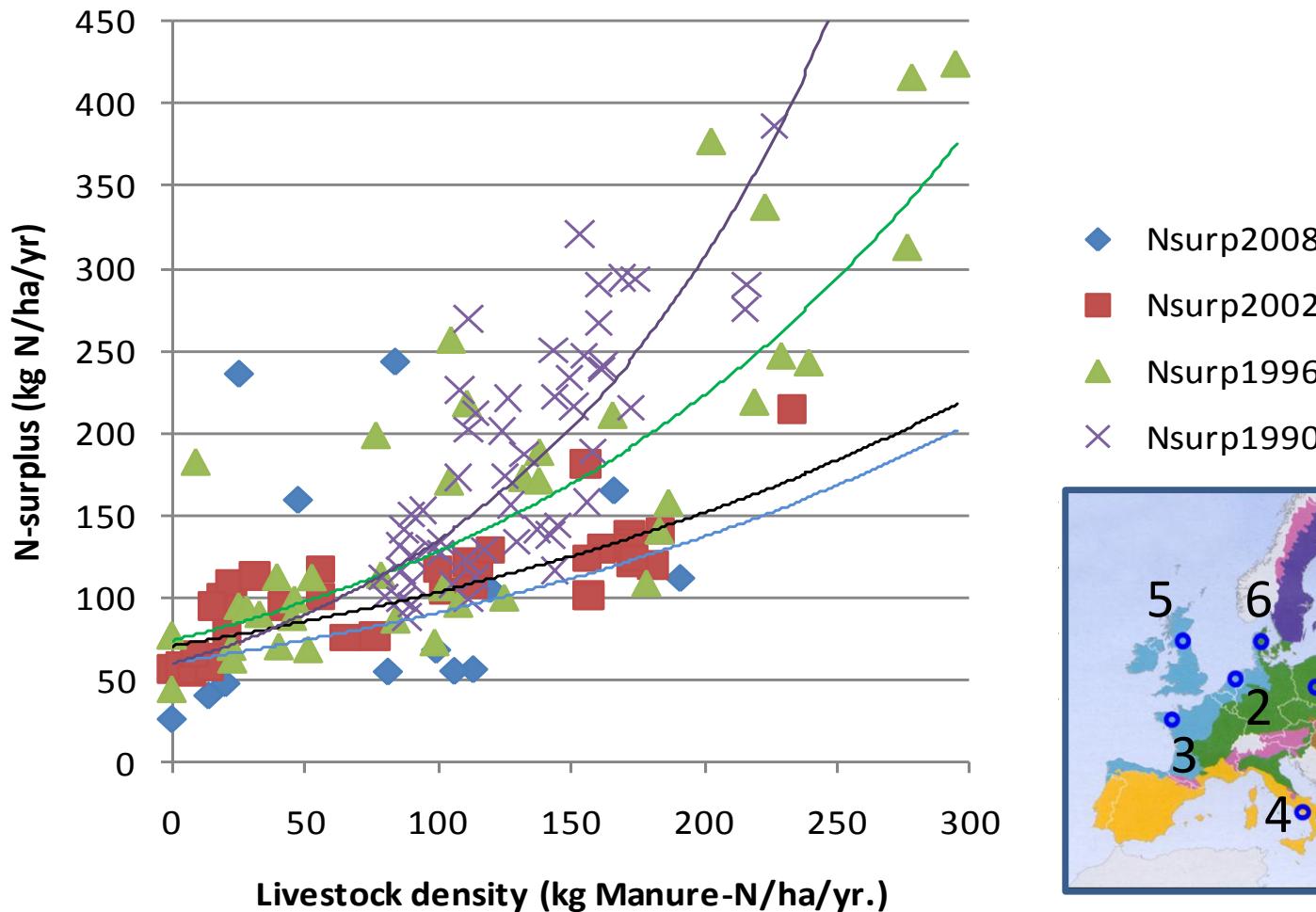


Studying all components of Danish nitrogen landscapes

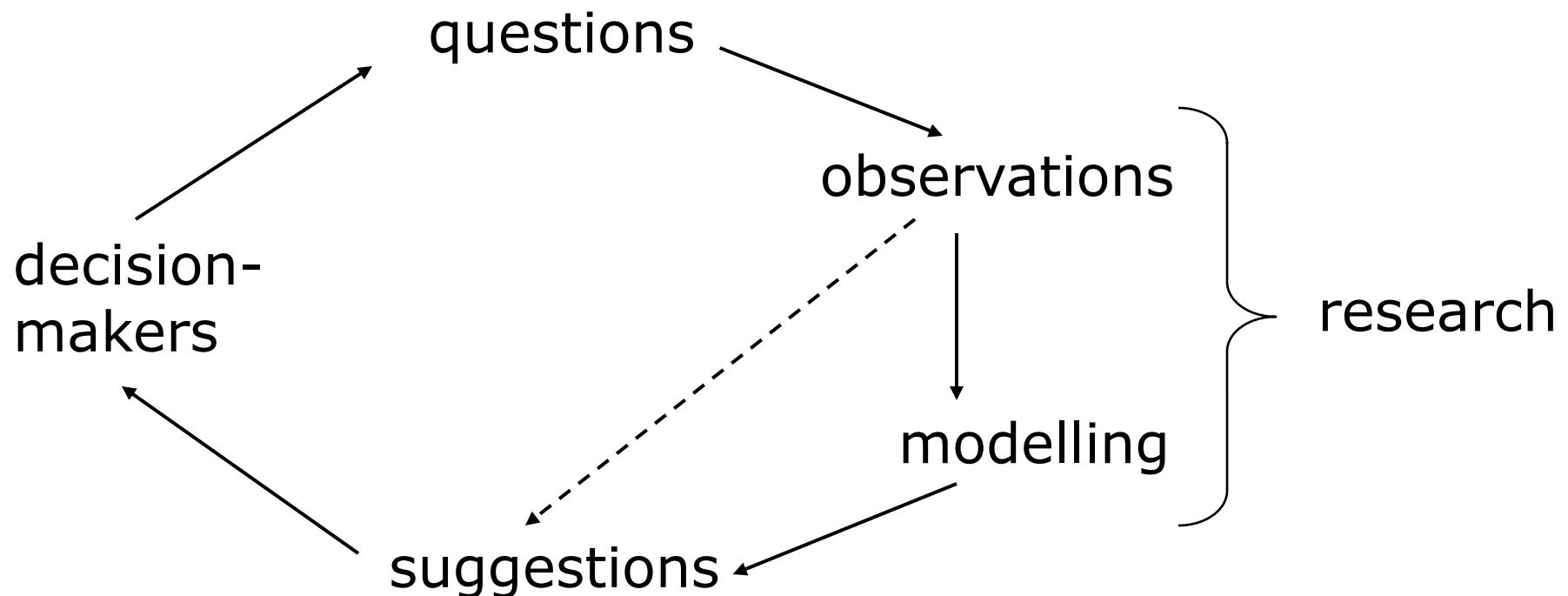
Research components:



Example: The Danish NitroEurope landscape



The cycle of applied research



Adapted from Bierkens (2000)

It is all about a balanced approach!

