Department of Bioscience
AARHUS UNIVERSITY

Science to address multiple causes of N pollution from source to sea

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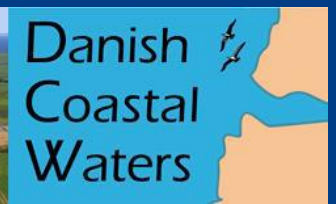
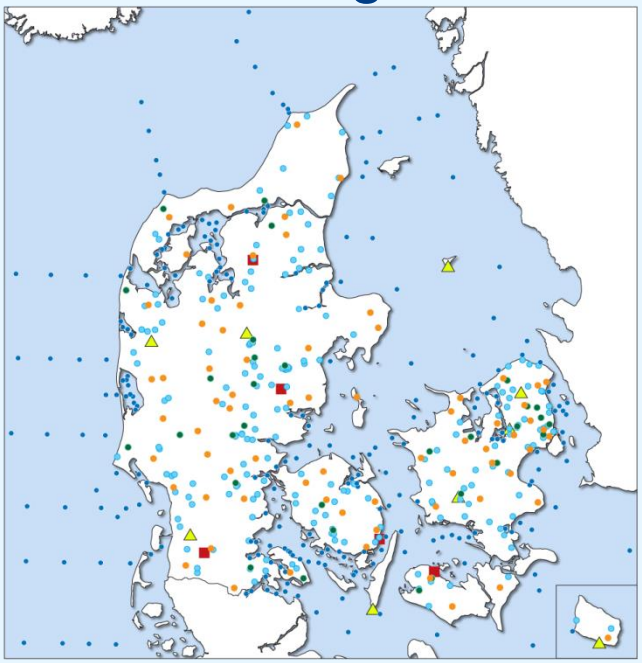
Population: 5,6 milion
Area 43.000 km^2
Agricultural area: 66%

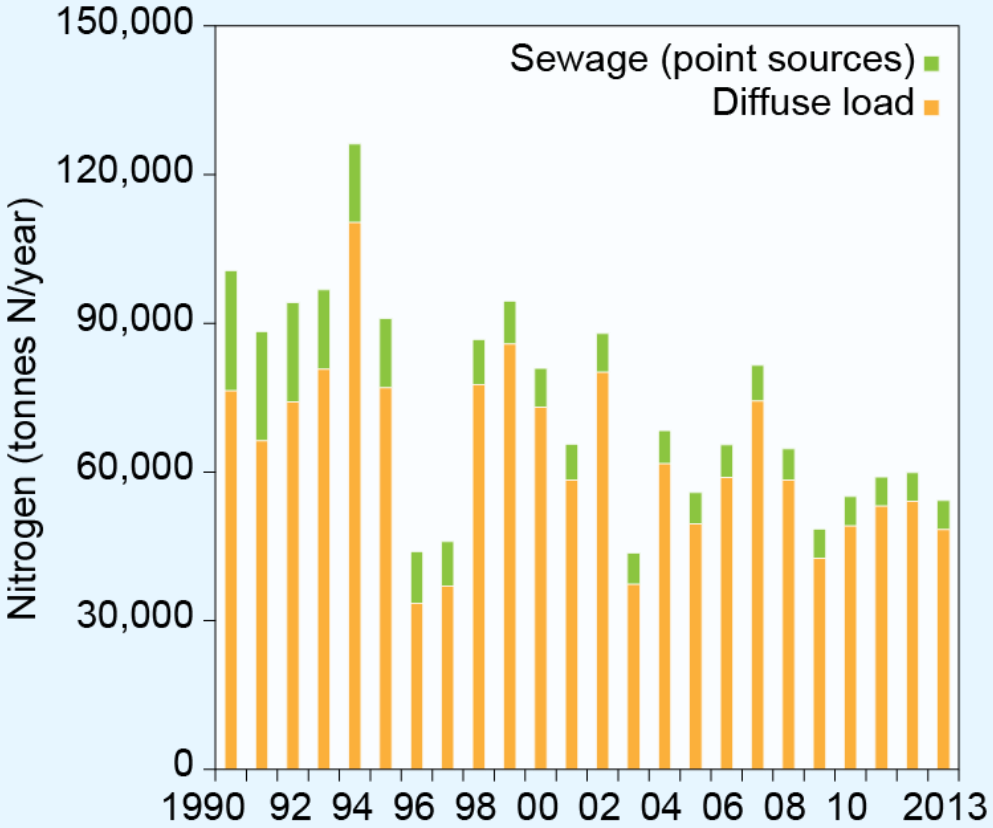


World best in N-management: Land based N emissions to coastal waters in Denmark reduced with *ca.* 50% since 1990.

National rules regulating point source emissions and agricultural N utilization *(Six national Nutrient Action Plans).*

25 Years of Monitoring: The backbone in N management !





Detailed and integrated monitoring in 5 small agricultural catchments (5-15 km^2). Sources, Sinks, Trends, Processes

25 years anniversary

Measuring programme:

- **root zone water, 1 m (32 sites)**
- **drainage water (7 sites)**
- **upper-groundwater 1.5-5 m (100 sites)**
- **streams (5 sites)**

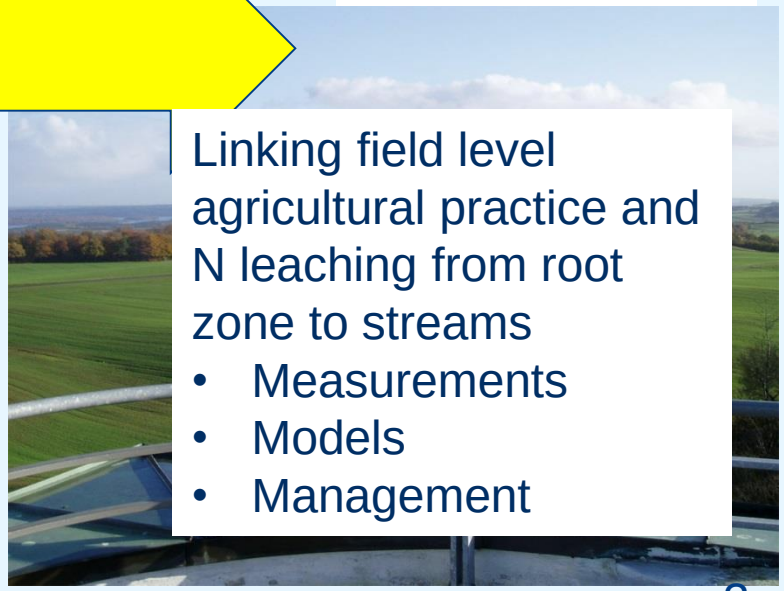
Annual interviews with

farmers

crops

animals

Fertilizers



Linking field level agricultural practice and N leaching from root zone to streams

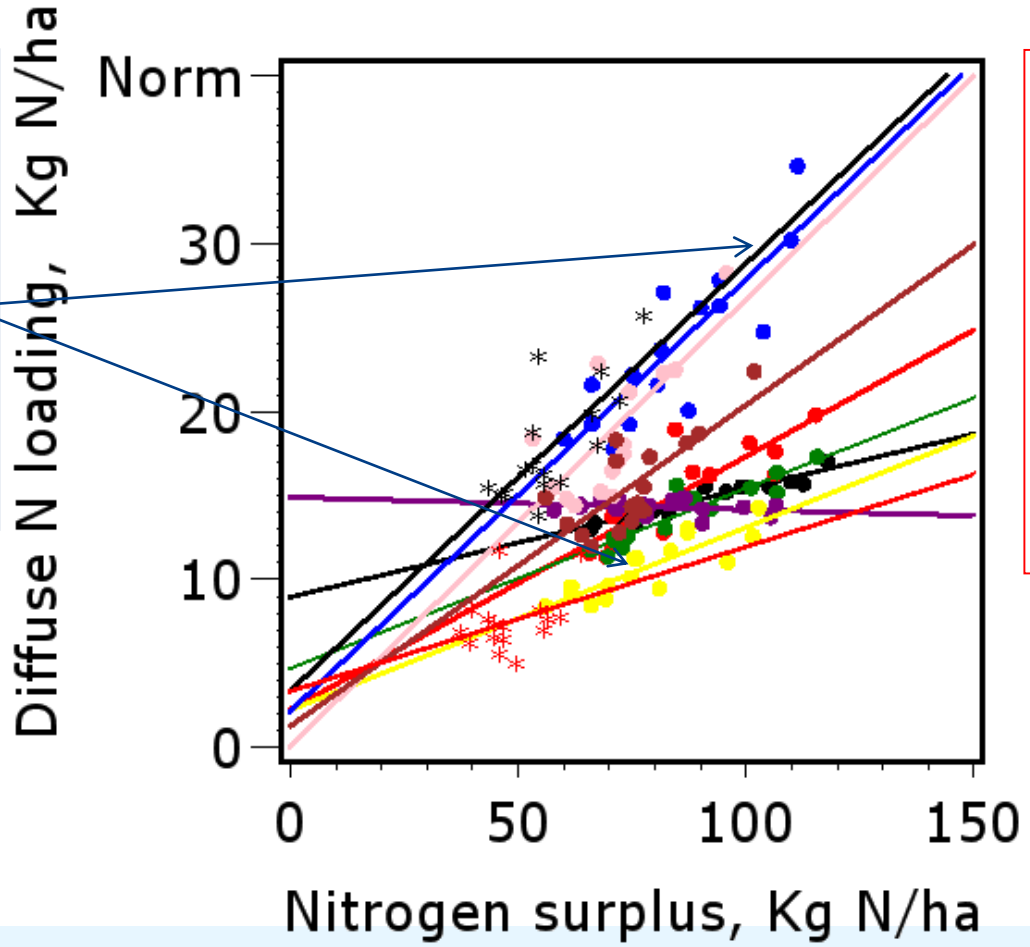
- Measurements
- Models
- Management

Annual N surplus and annual N loading from diffuse sources (normalized) from 10 catchments – 1990-2010

Catchment specific relations:

r^2 = 0.66

(mean for n=9)



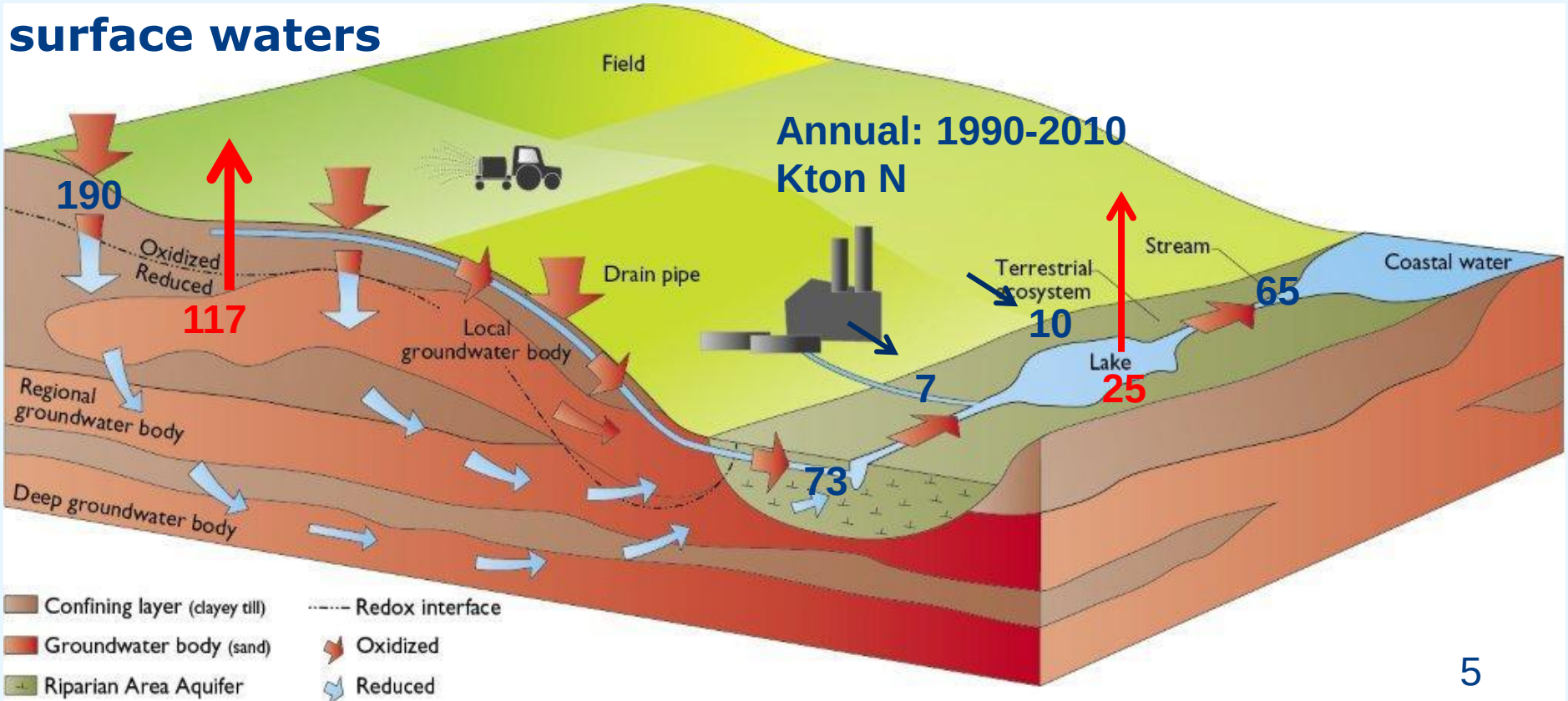
Catchment specific costs of reducing diffuse Nitrogen loading:

24–94 Euro per kg N

Windolf et al., 2012: Env. Sci. Pol. 24

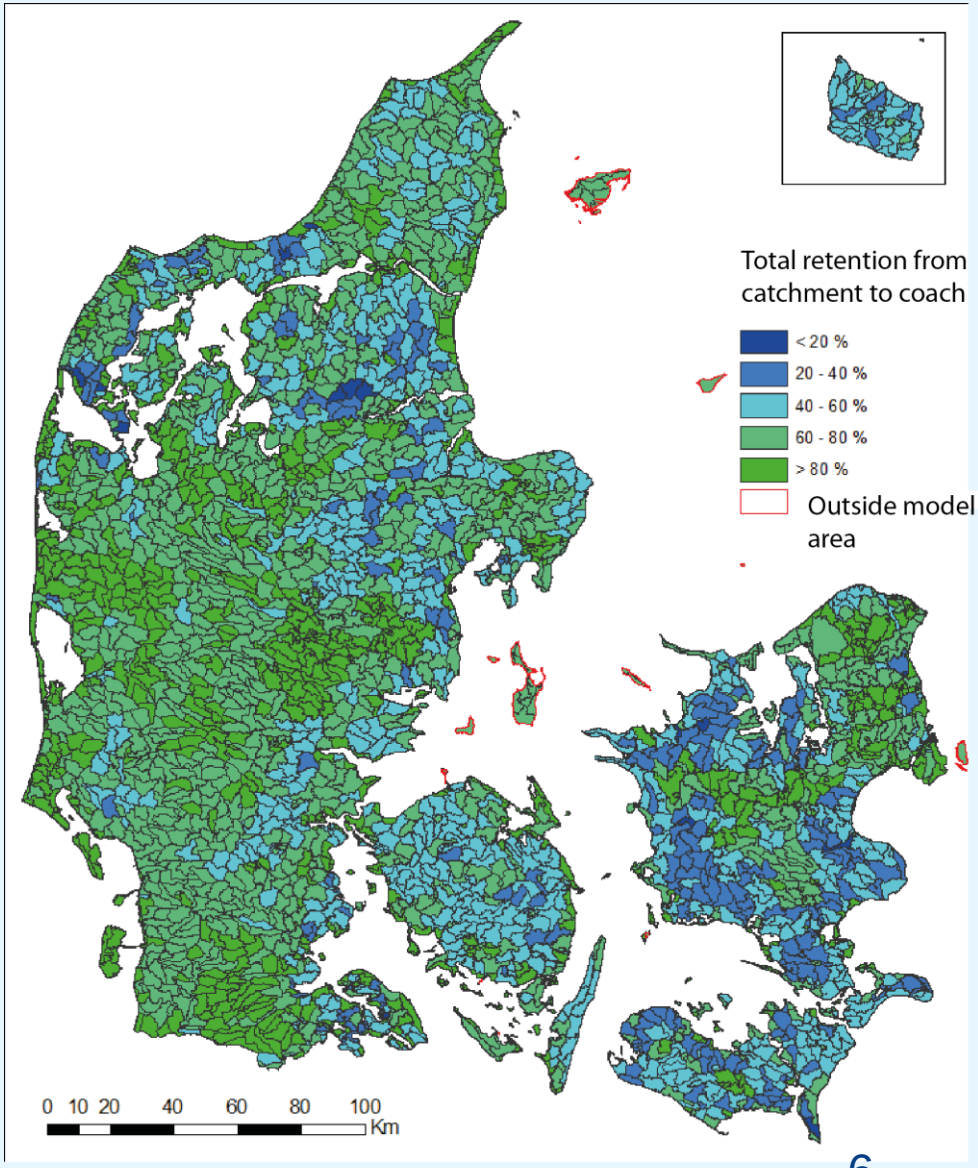
New national consensus model (3D MIKE SHE 0.5x0.5 km with particle tracing coupled with leaching and MIKE11 surface water models) (Developed 2013-15):

All sources and N reduction/retention in groundwater and surface waters

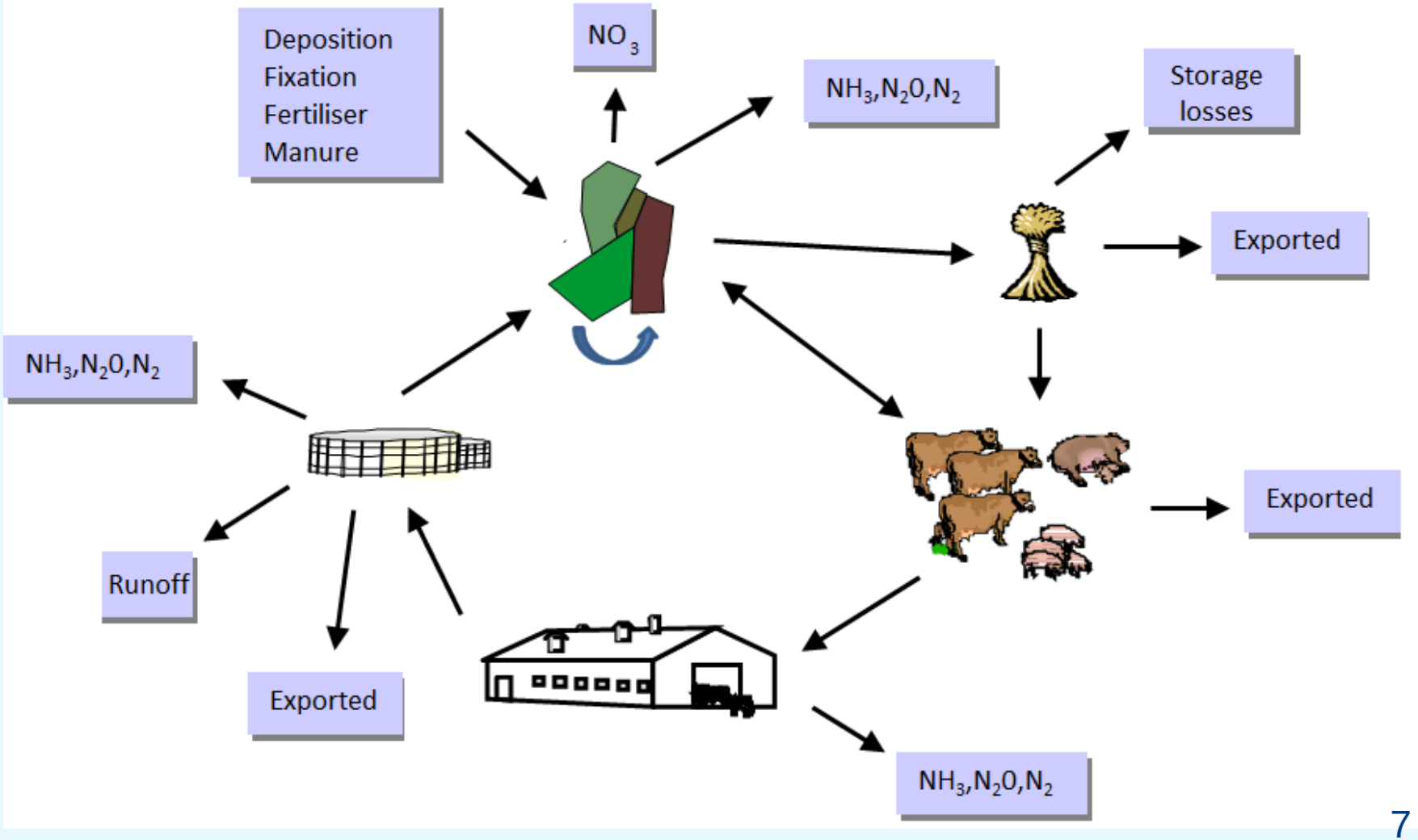


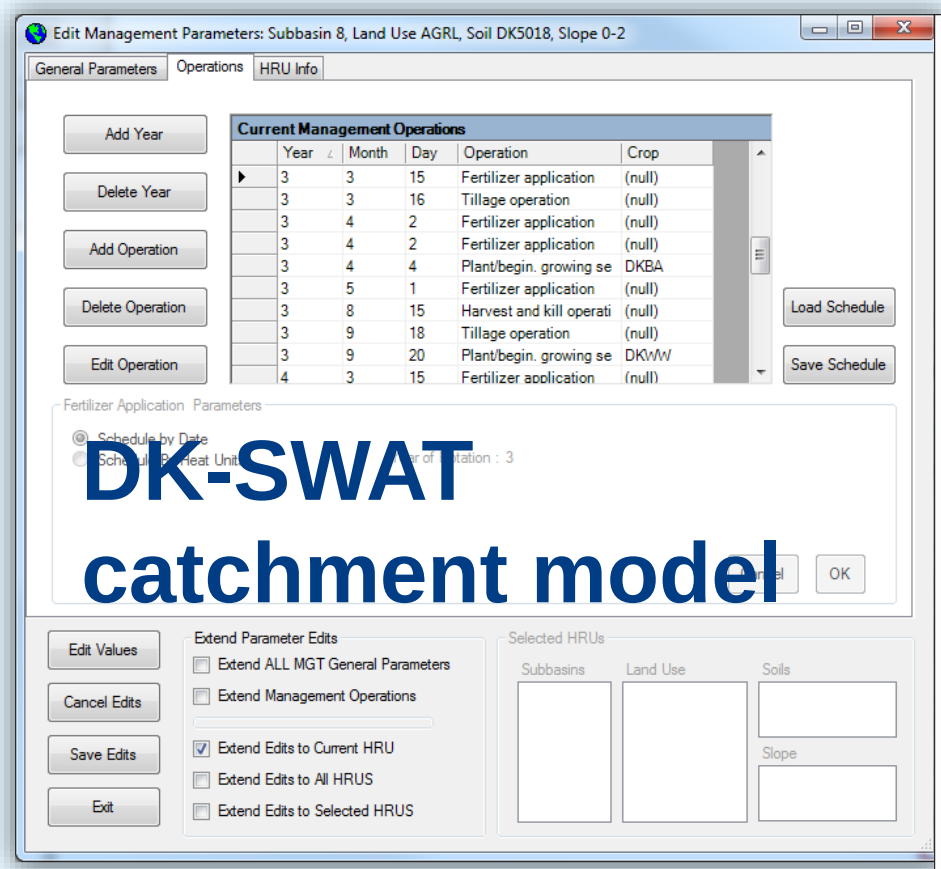
- **Focus in Denmark is now towards targeted regulations, according to local N retention (reduction) conditions.**

- **A map of N retention (reduction) in DK has been developed in 2015 utilizing the national concensus N-model (scale: 1500**

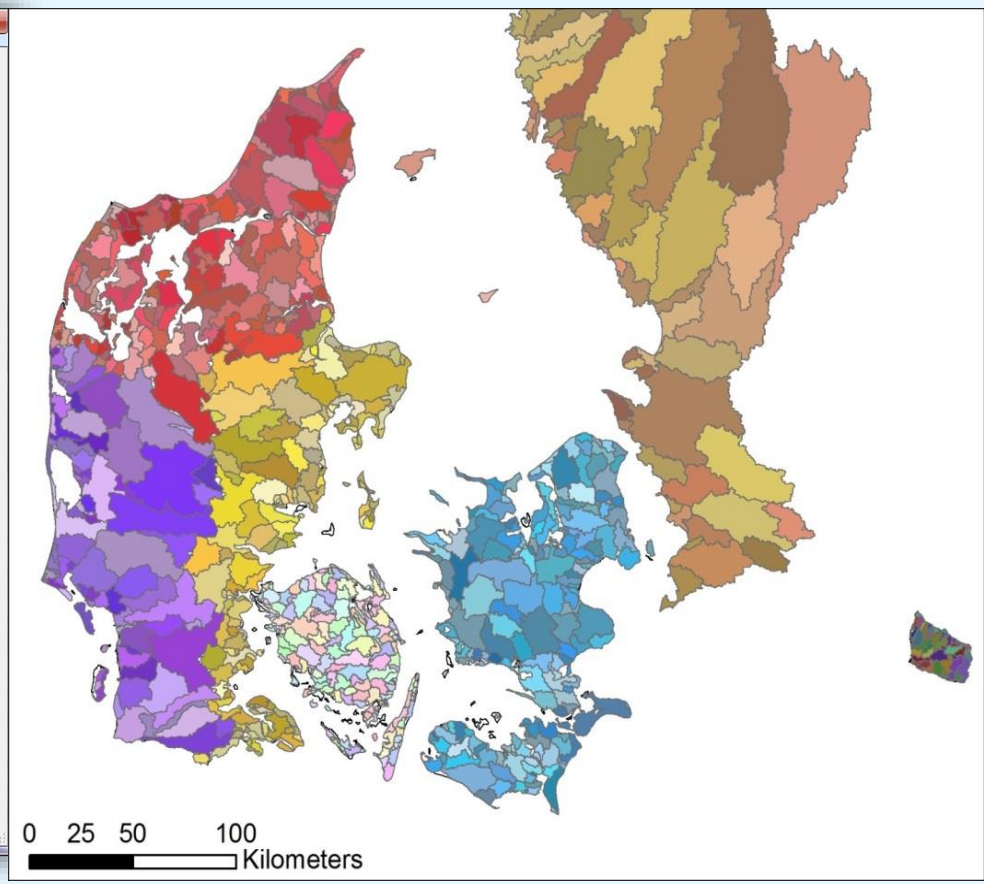


FarmAC – Farm C and N model – can describe consequences of mitigation for arable farming systems





DK-SWAT catchment model



New **targeted management** of agricultural production:

Needs for new mitigation Measures – **current research on several technologies**

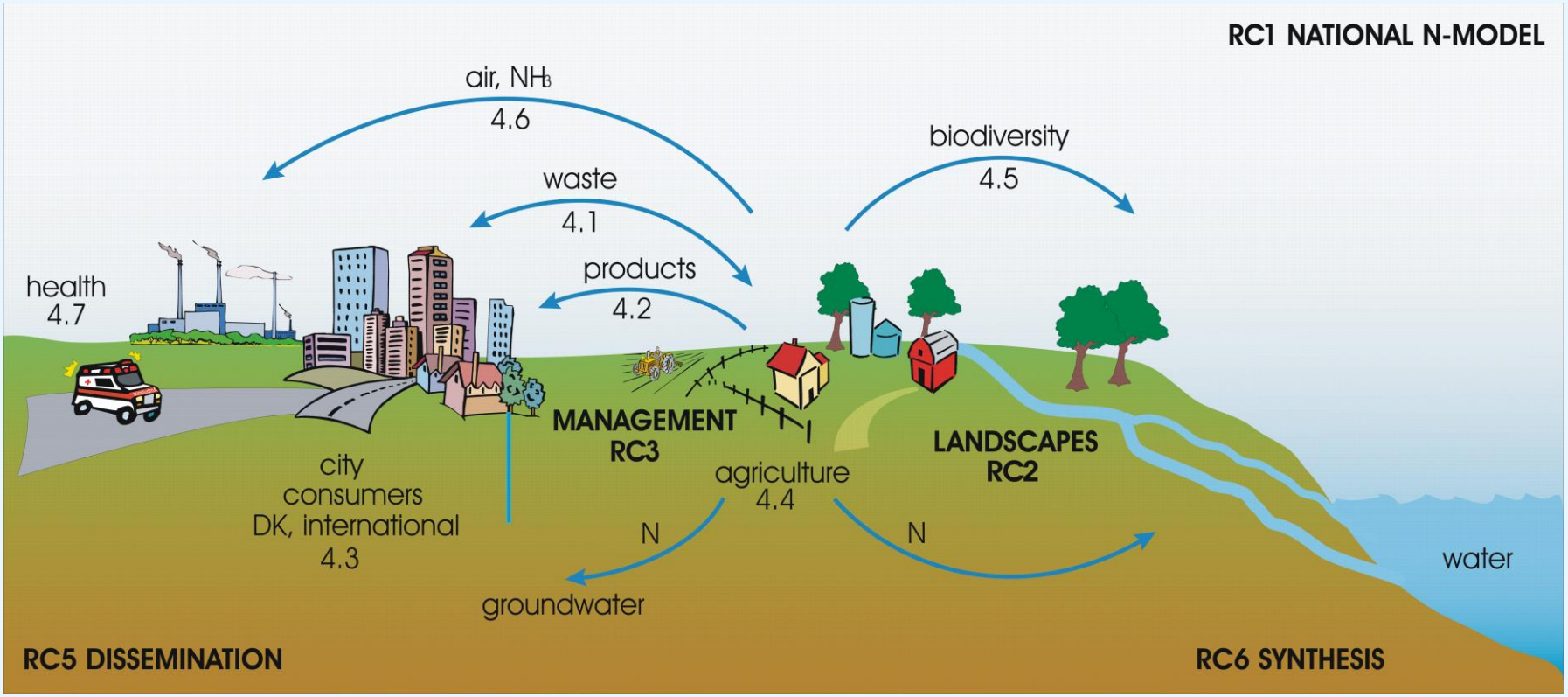
Recommendations from the Policy-Science Working Group on
Reducing nutrient emissions from Agriculture in NW European Catchments
to DG Environment, DG Agriculture and DG Research

BUFFERtech

A national research alliance: Studying the components of Danish nitrogen landscapes

dNmark research alliance

Research components:



Thank you for your attention

www.dNmark.org