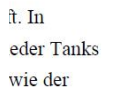


# Nitrate in drinking water: *Outdated issue or unresolved problem?*

Jörg Schullehner

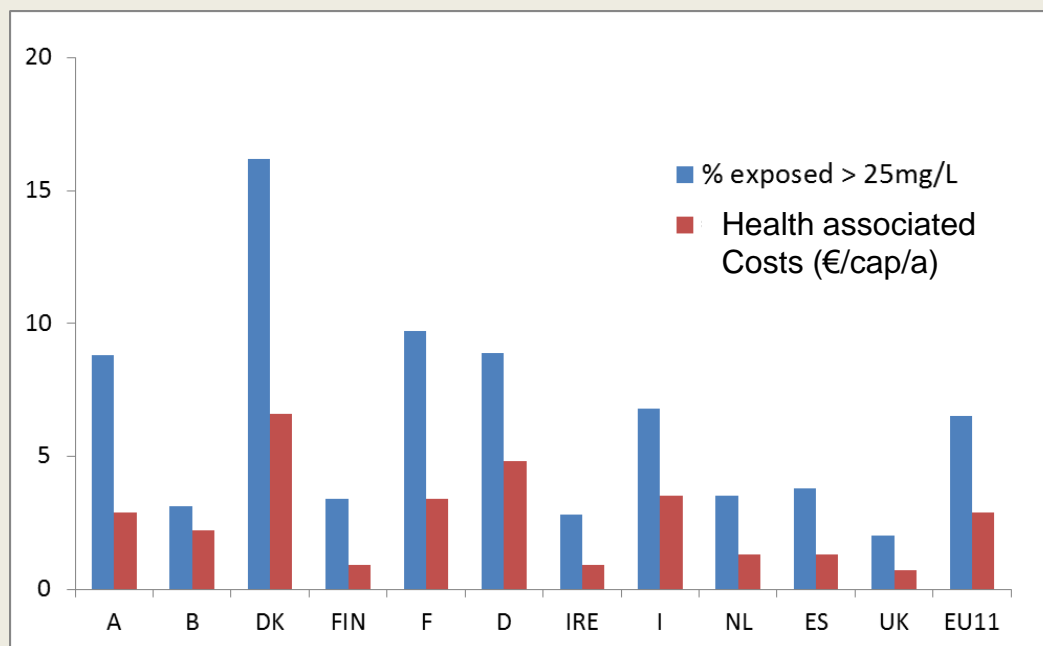
Geological Survey of Denmark and Greenland  
Ministry of Climate and Energy

*1<sup>st</sup> YWPDK conference, Vandcenter Syd  
11<sup>th</sup> March 2015*



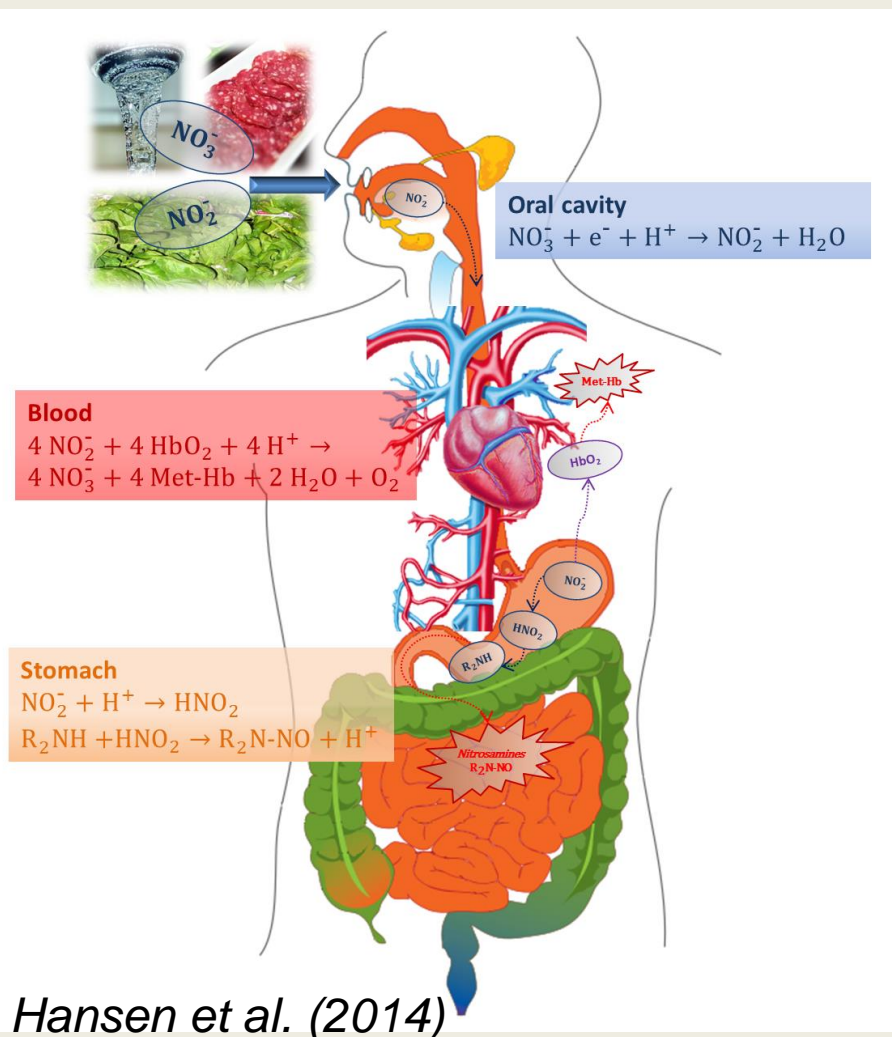
# What's this project about?

- Results from my PhD project  
"Groundwater N-pollution and public health effects - the example of gastrointestinal cancer"



van Grinsven et al. (2010)

# Health effects of nitrate

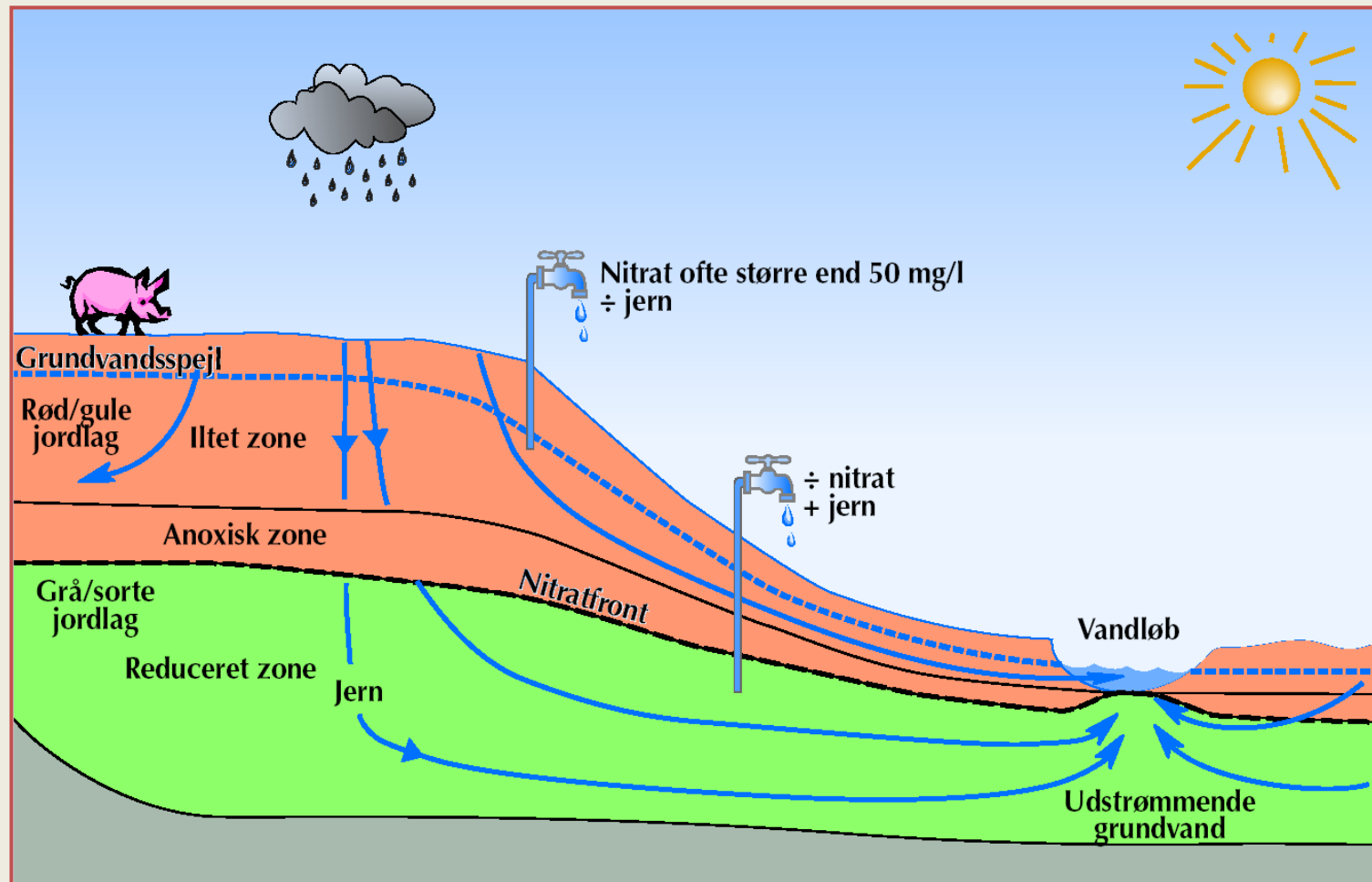


- DW standard 50 mg/L  
→ Acute effects

- Chronic effects from 25 mg/L?

*De Roos et al. (2003)*

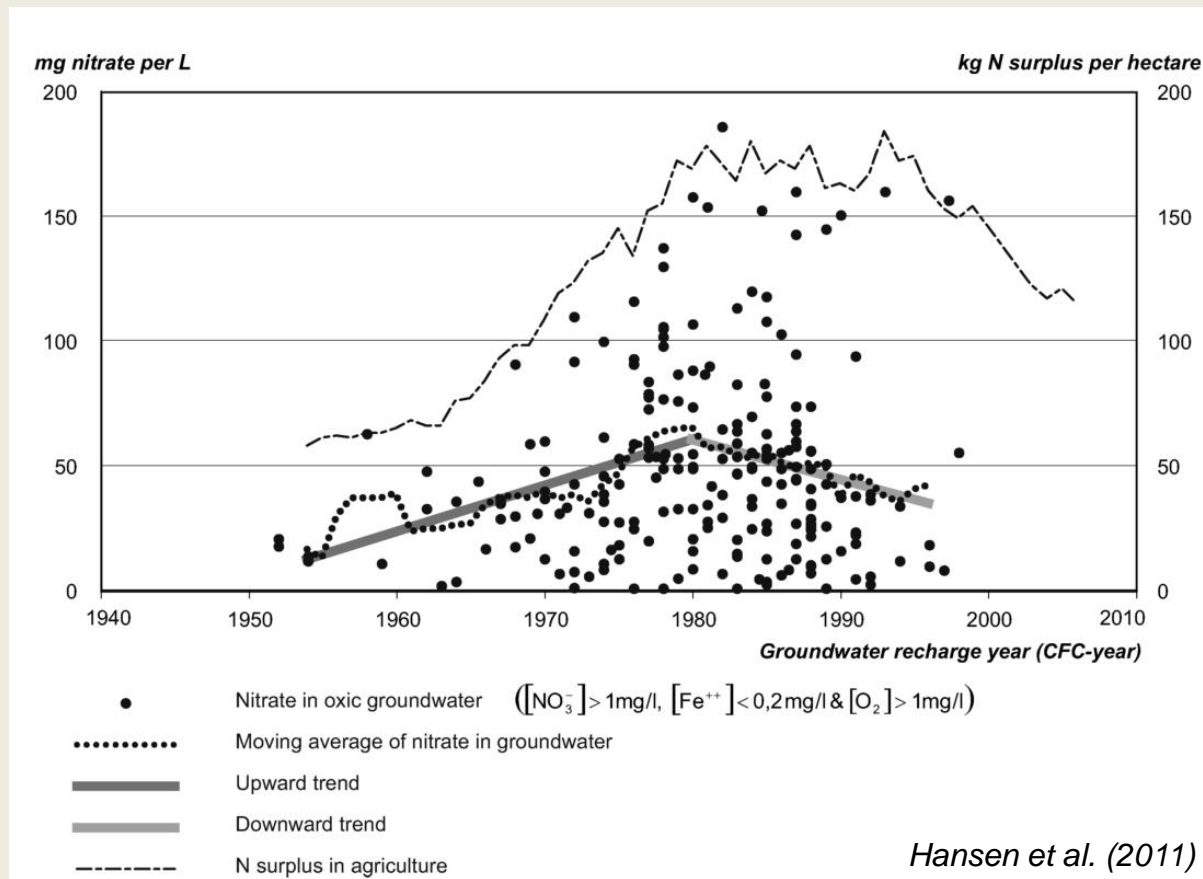
# Where does it come from?



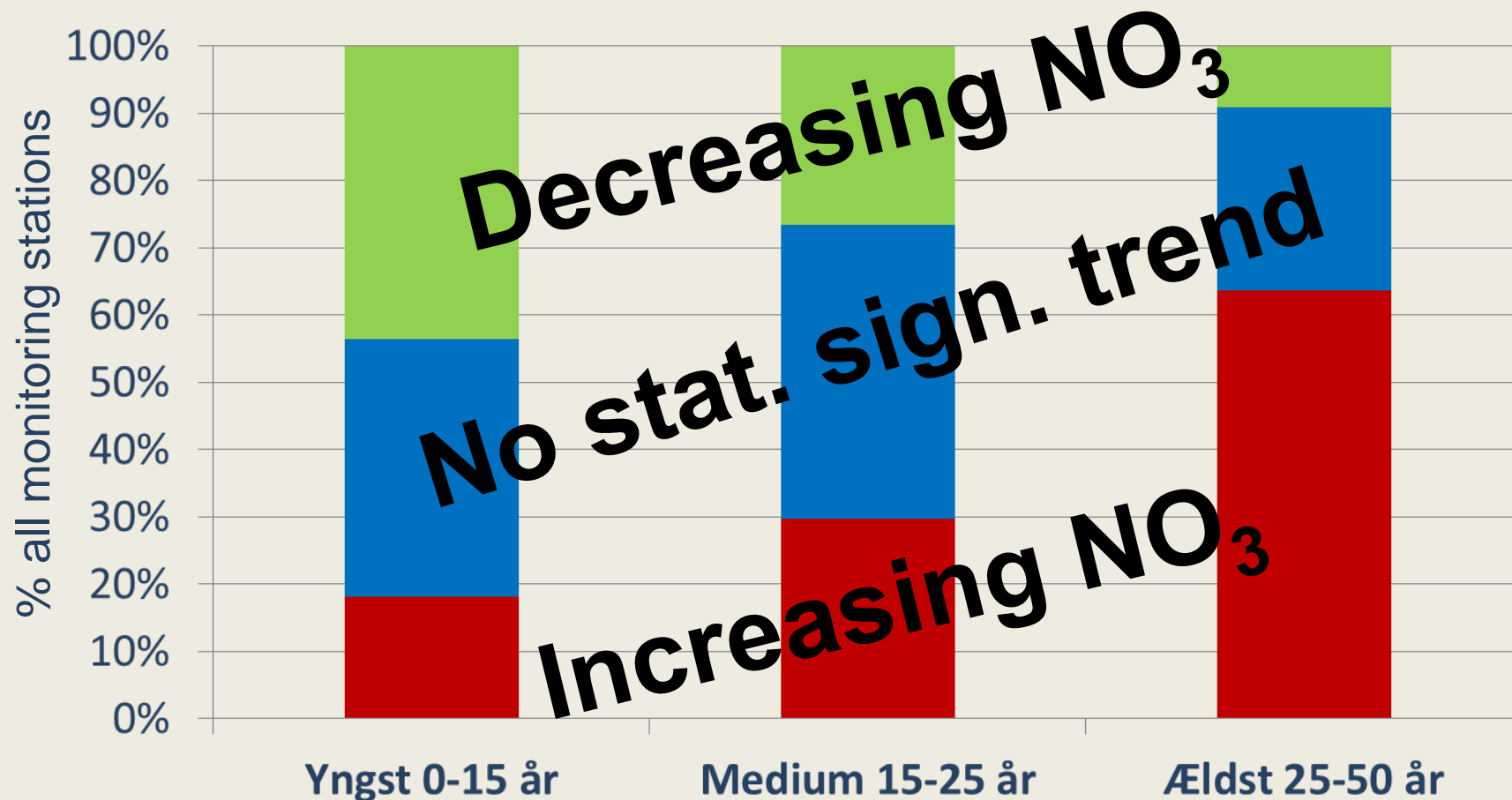
# Legislation

Since 1985 more and more regulation:

- no. of animals
- manure
- catch crops
- max. N-use 15% under economic optimum



# Trends in groundwater



Hansen et al. (2011) 7

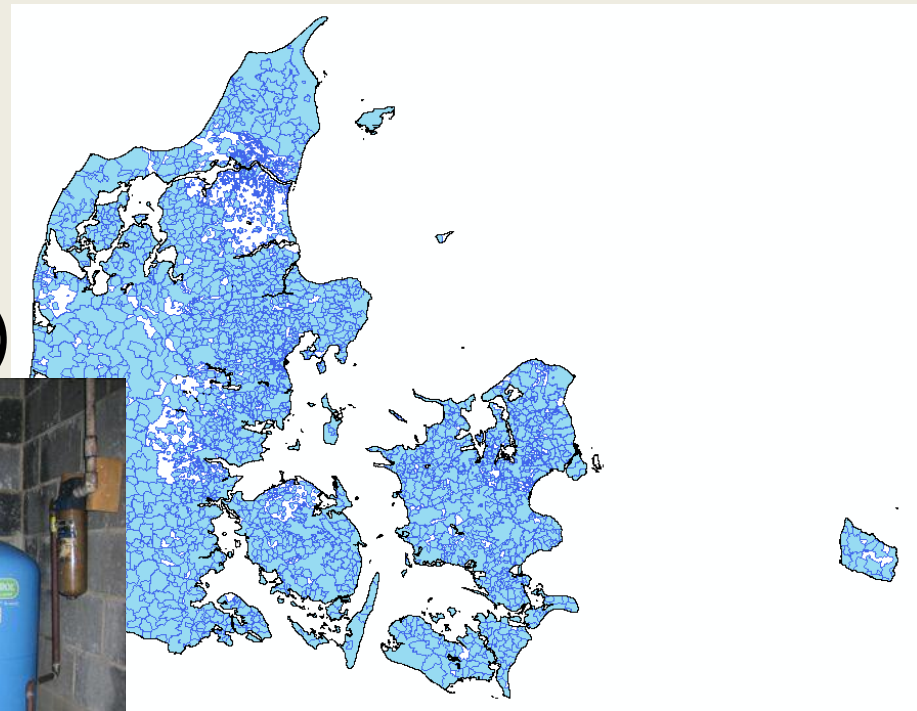
## Aim

- Assigning annual drinking water quality to all DK addresses
- Precise estimation of consumers exposed to nitrate



# Drinking water structure

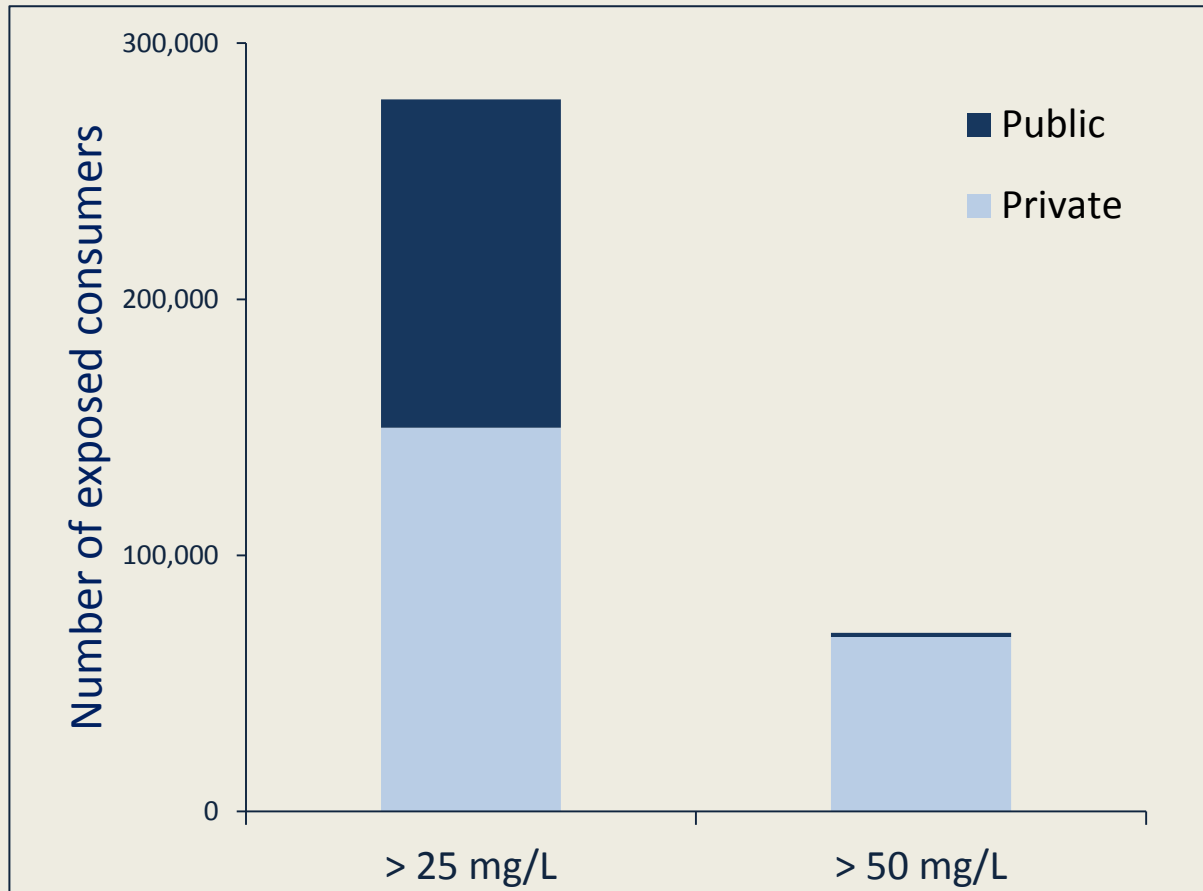
- ~2700 public waterworks (10+ households)
- ~50-70,000 private wells (<10 households)



# Nitrate quality maps

- (video)

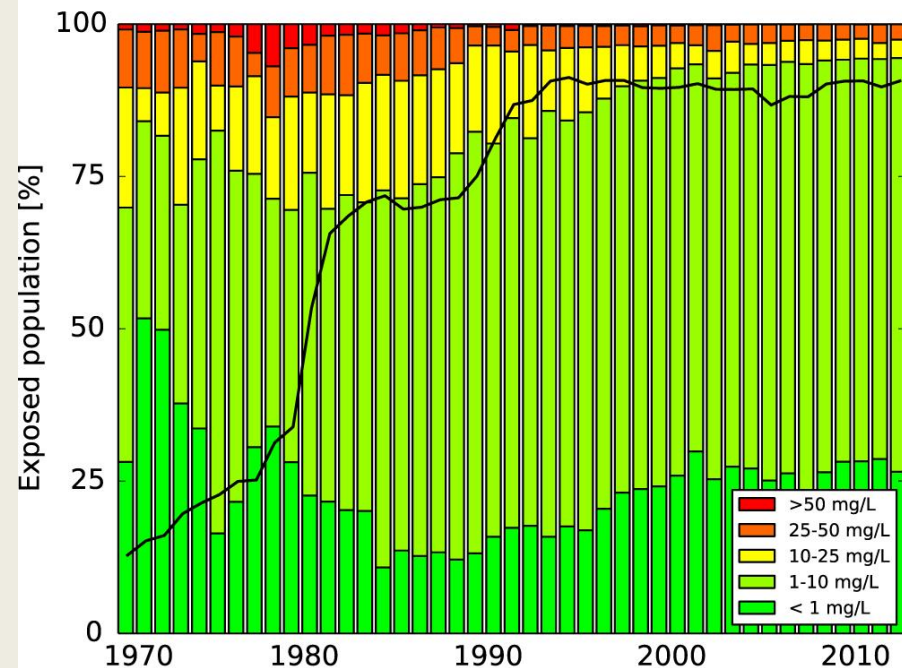
# Exposure Public vs. Private



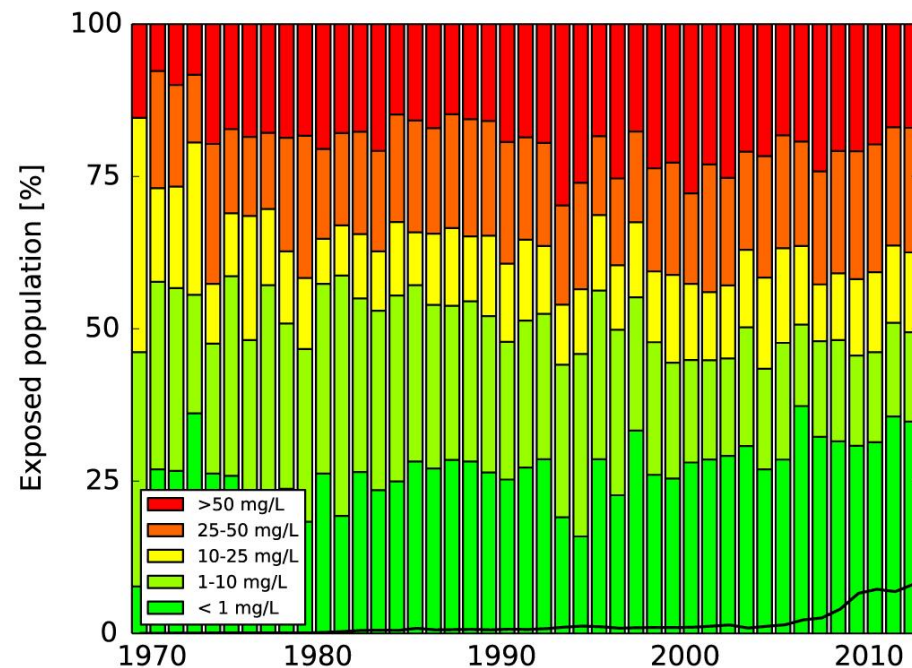
*Schullehner & Hansen (2014)*

# Exposure estimation

Figure 4 from Jörg Schullehner and Birgitte Hansen 2014 Environ. Res. Lett. 9 095001

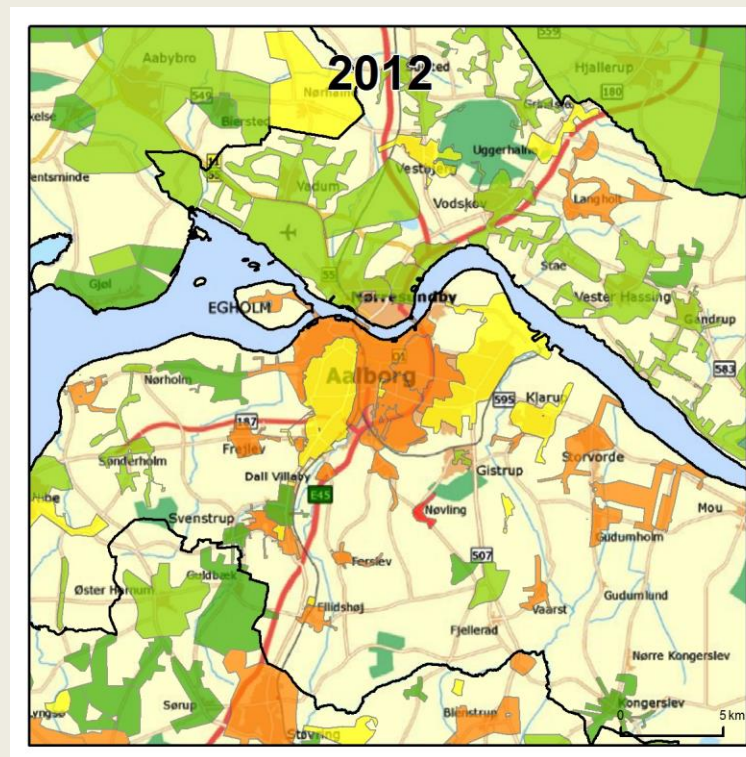
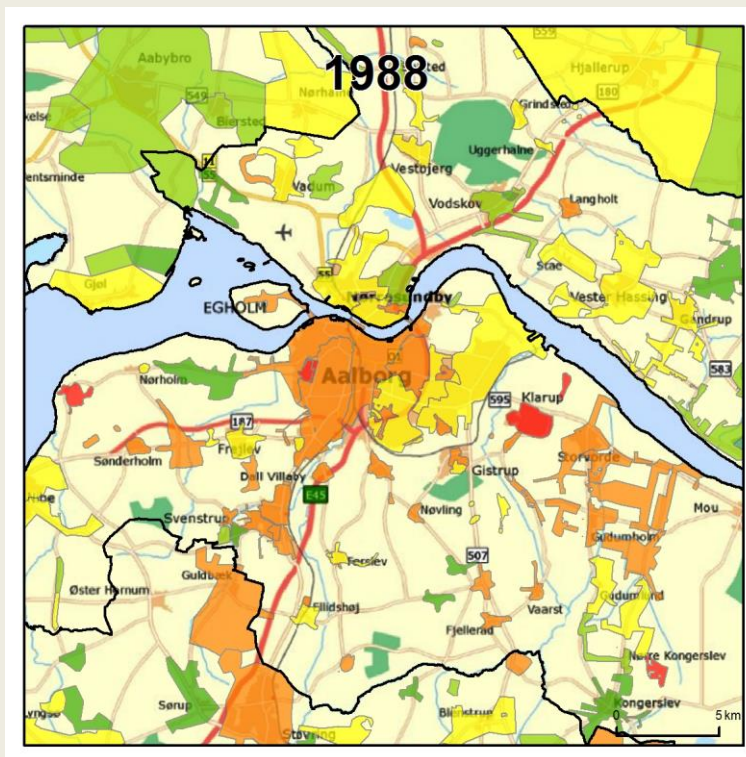


(a) Public



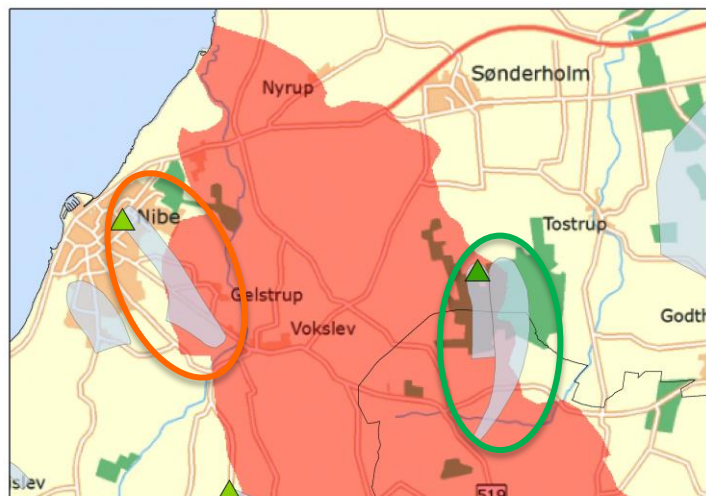
(b) Private

# Aalborg

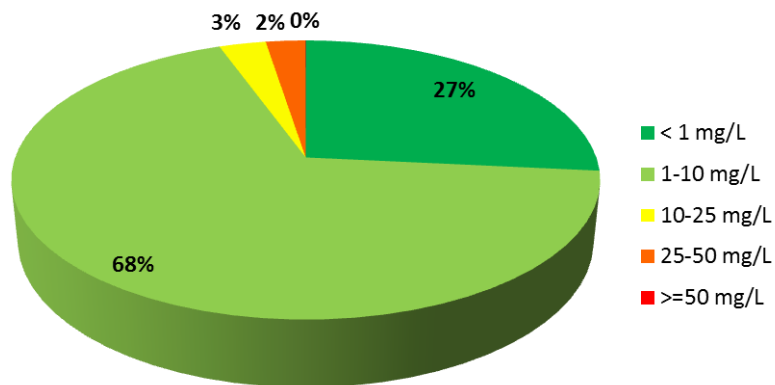




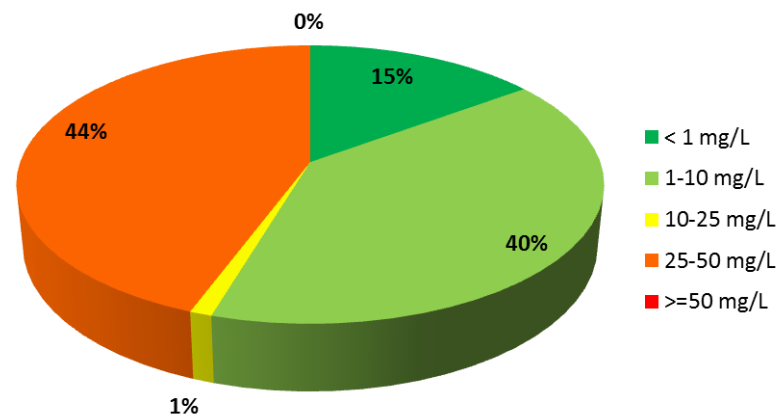
# Example: Nibe



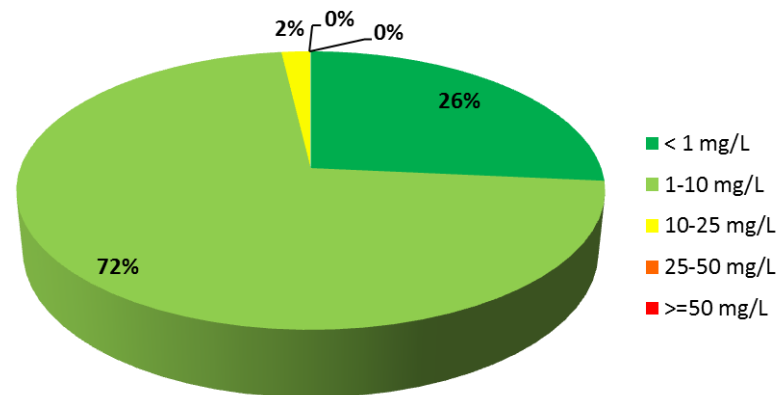
DK 2012



Aalborg SV 2004-2011



Aalborg SV 2012-2013



## Focus: private well users

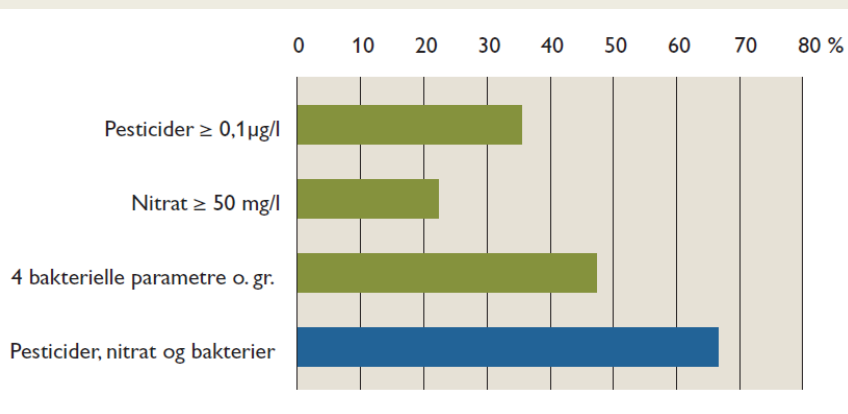
- How many users? 120,000? 400,000?

In Jupiter	with samples	without samples	total
Private wells (#)	22,337	25,026	47,363
Private wells (%)	47	53	100

- What's the law?
  - Owner's responsibility
  - Municipality is authority – in theory

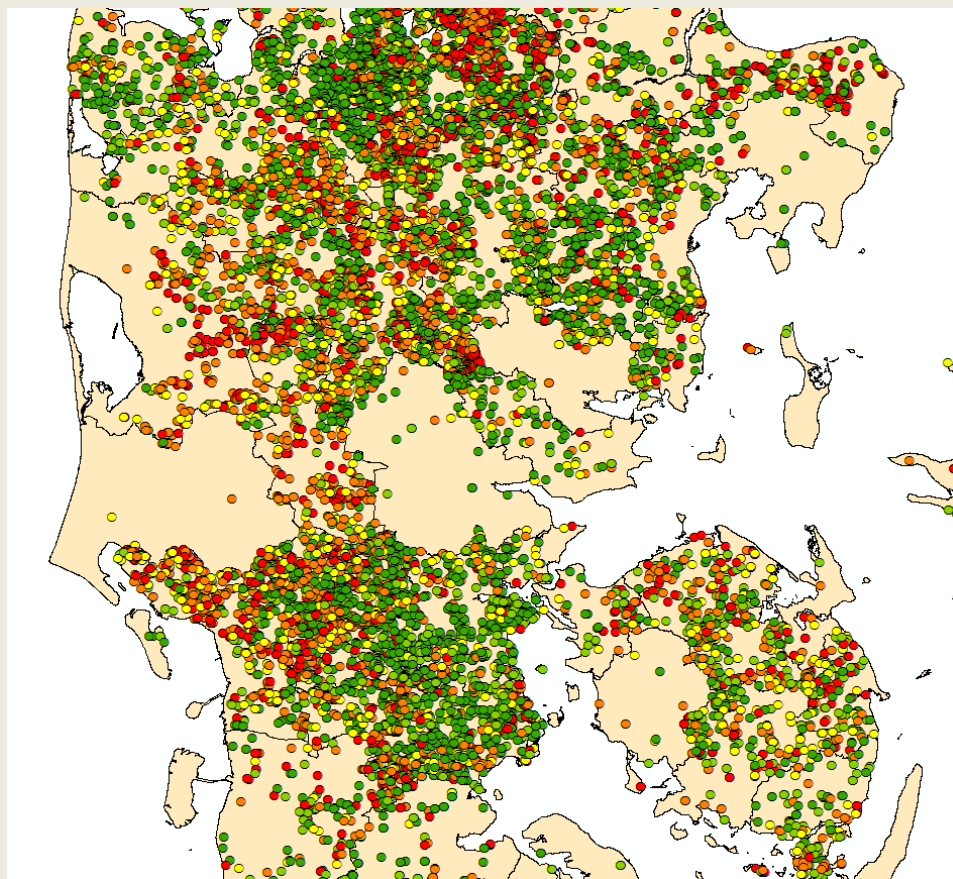
# Focus: private well users

- What happens?
  - inform users
  - few municipalities: focus areas



Violations of the drinking water standard for the 628 analyzed private wells

Brüsch, W., Stockmarr, J., von Platen-Hallermund, F., & Rosenberg, P. (2004). *Pesticidforurenet vand i små vandforsyninger*.





# Conclusions

- On a national level: improvement
  - Mainly due to structural changes
- Some areas will not be able to comply with nitrate standard (intensive agriculture and low geological protection)
- DK drinking water supply infrastructure requires local measures
- Private well users
  - Exposed to worst water quality
  - Littlest data/monitoring

# Thank you!



Schullehner, J. & Hansen, B. (2014). Nitrate exposure from drinking water in Denmark over the last 35 years. *Environmental Research Letters*, 9(9), 095001.

Hansen, B, Thorling, L, Dalgaard, T, Erlandsen, M. (2011). Trend Reversal of Nitrate in Danish Groundwater – a Reflection of Agricultural Practices and Nitrogen Surpluses since 1950. *Environmental Science & Technology*, 45(1), 228-234.

Jensen, O. M. (1982). Nitrate in Drinking Water and Cancer in Northern Jutland, Denmark, with Special Reference to Stomach Cancer. *Ecotoxicology and Environmental Safety*, 6(1973), 258–267.

van Grinsven, H. J. M., Rabl, A., & de Kok, T. M. (2010). Estimation of incidence and social cost of colon cancer due to nitrate in drinking water in the EU: a tentative cost-benefit assessment. *Environmental health*, 9(1), 58.

Brüsch, W., Stockmarr, J., von Platen-Hallermund, F., & Rosenberg, P. (2004). *Pesticidforurennet vand i små vandforsyninger*.