



Long term trends in nitrate in Danish groundwater and drinking water

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The Danish challenge

**Intensive agriculture
and groundwater based
drinking water
production**



**Only simple treatment
Low consumption of
bottle water**

Health effects of nitrate

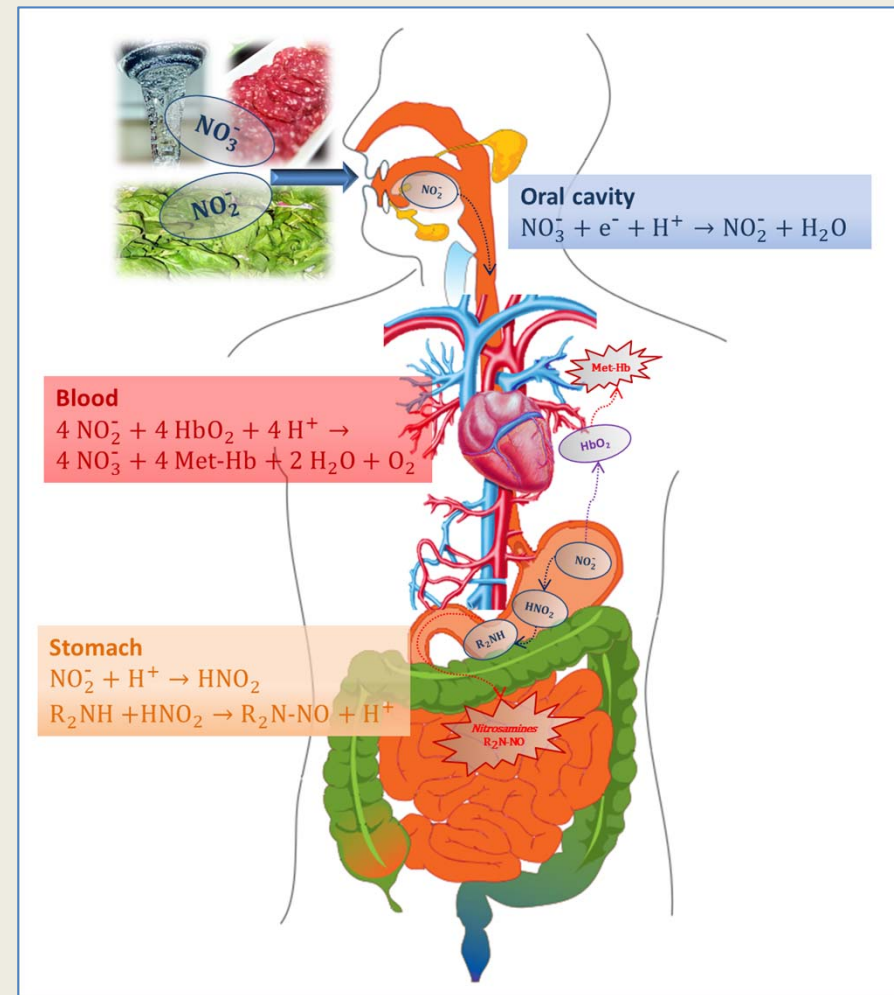
Quality standards

- 50 mg/l: acute effects
"blue baby syndrome"



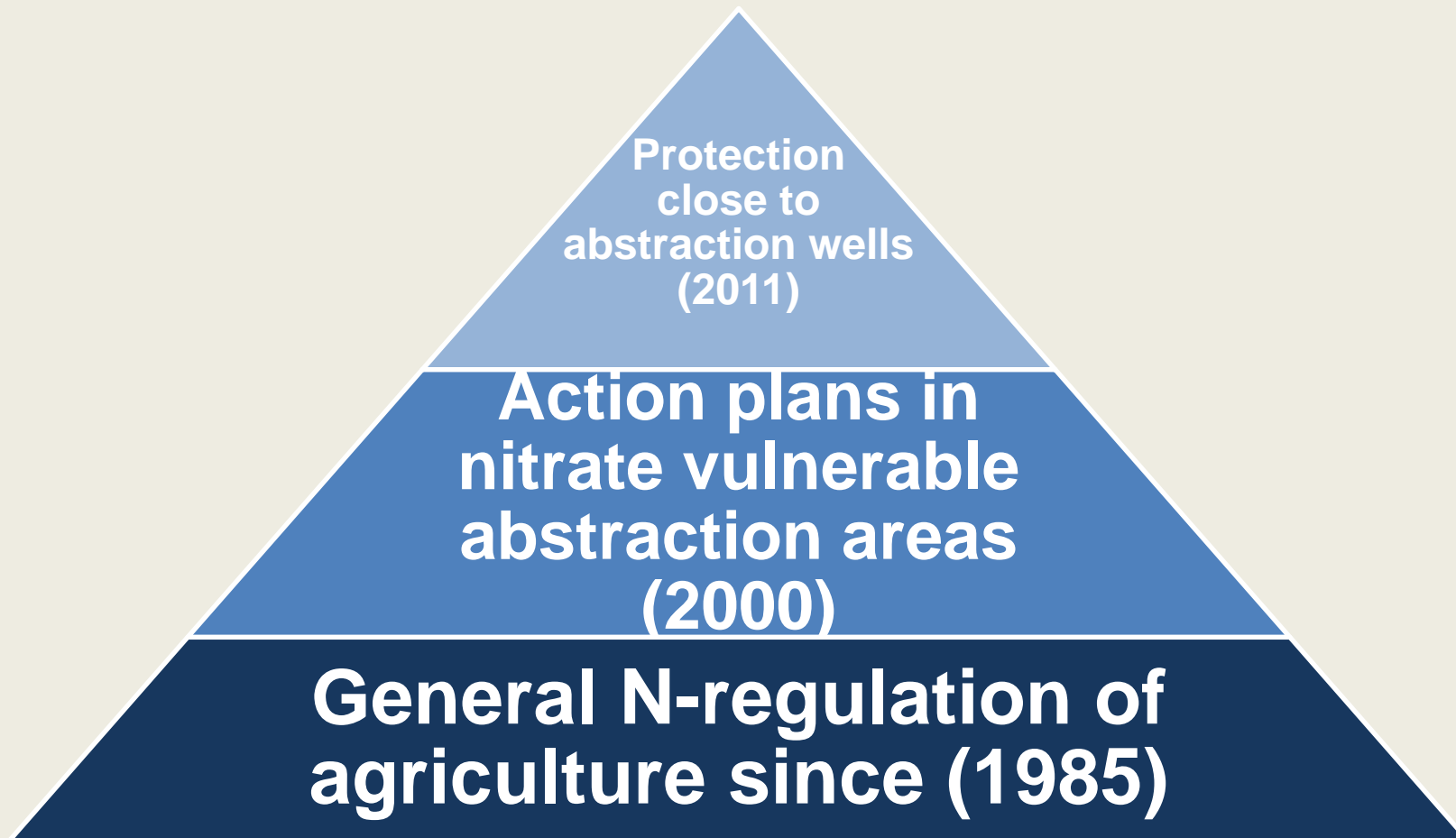
- 25 mg/l: suspicion of chronic effects

e.g. De Roos et al. (2003)



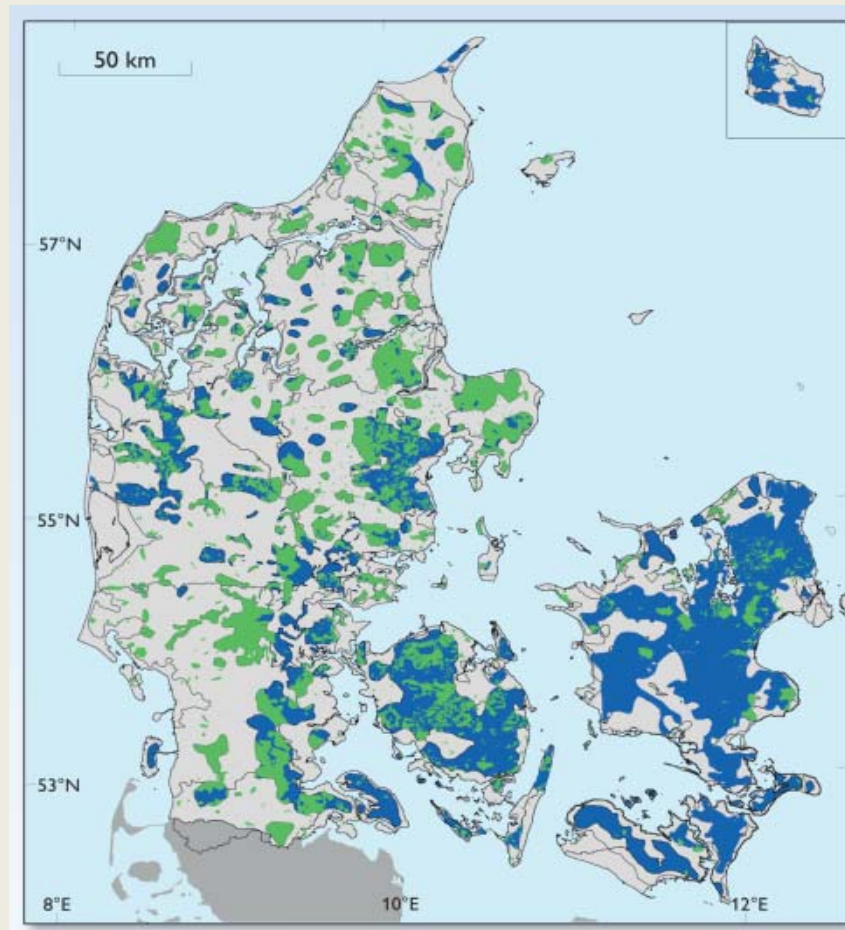
Hansen et al. (2014)

Danish groundwater protection strategy



Nitrate vulnerable abstraction areas

Site-specific groundwater mapping



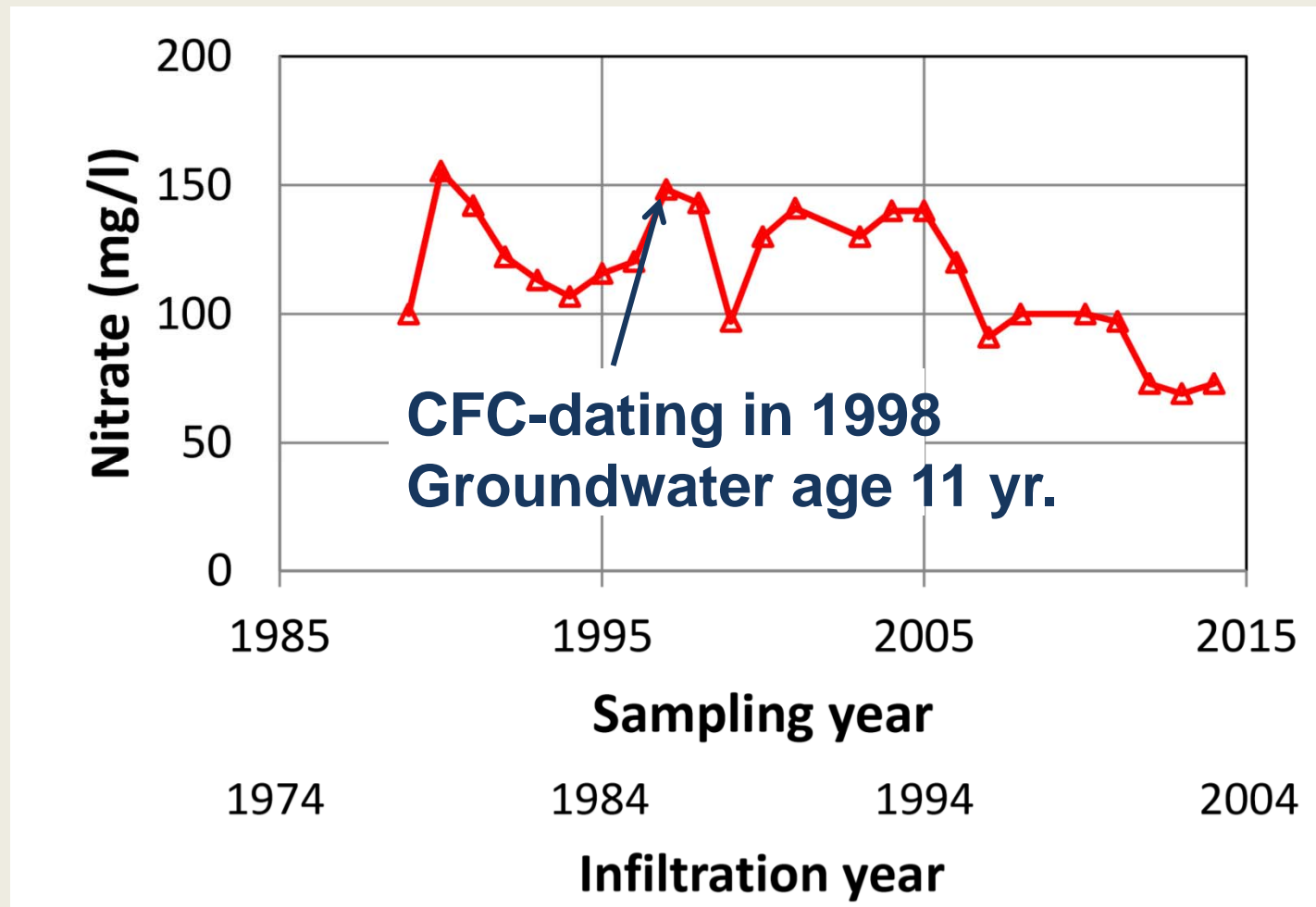
BLUE: Particularly valuable water abstraction areas, 40 % of DK

GREEN: Nitrate vulnerable abstraction areas, 15 % of the DK

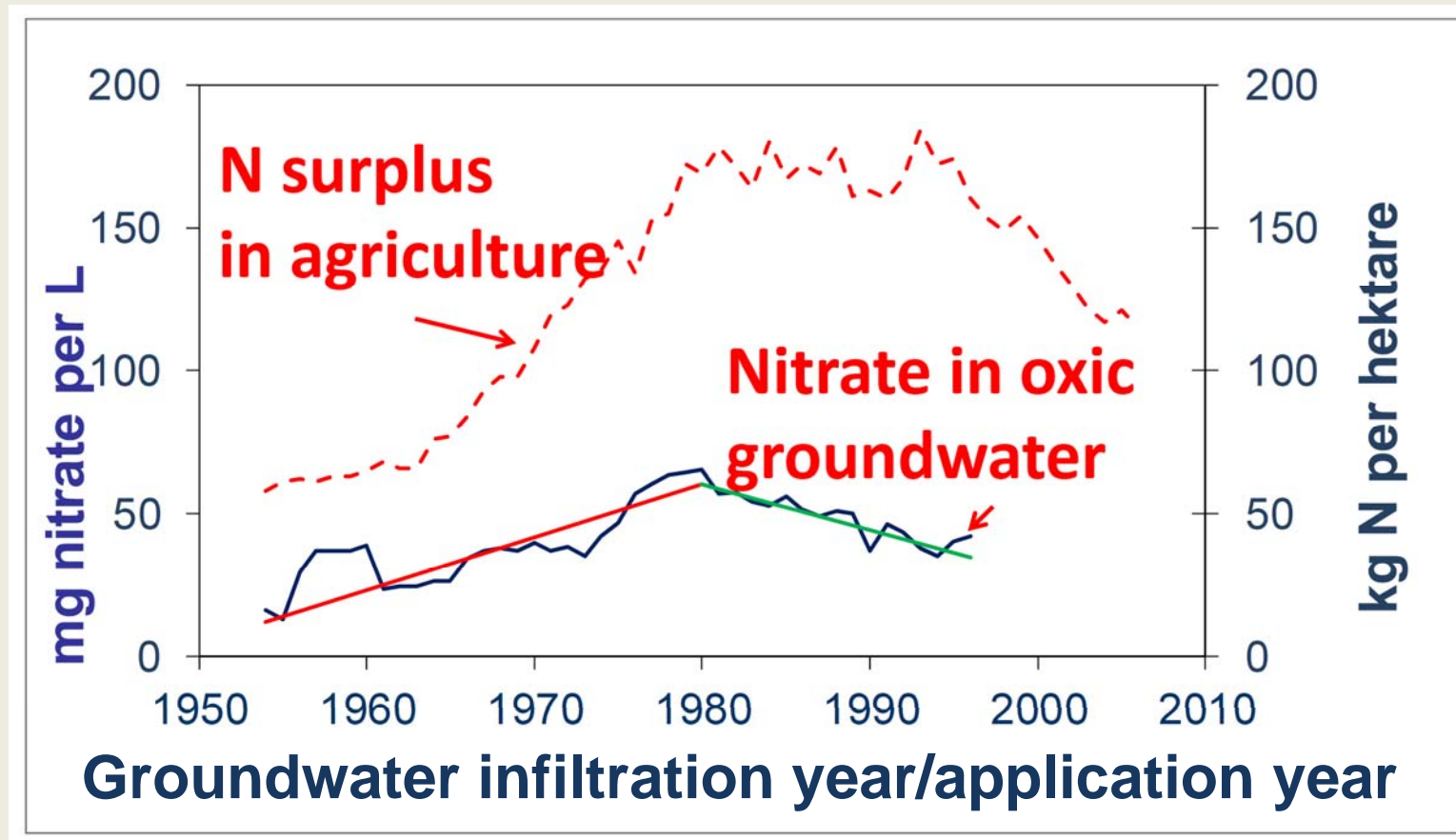
"Miljøportalen" (2015)

From samling year to infiltration year

Example from one monitoring well:

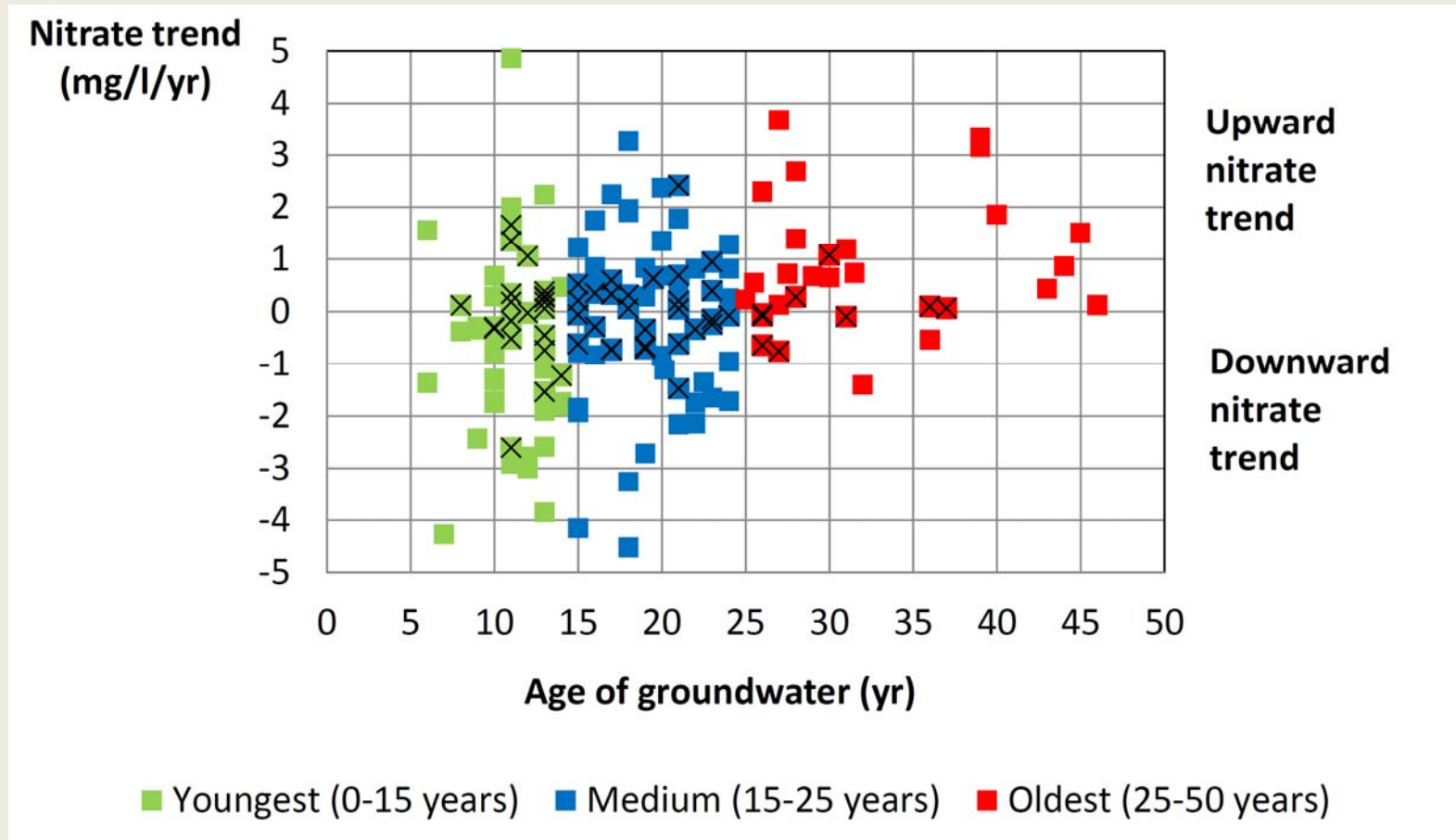


Trend reversal in 1980



ES&T: Hansen et al. (2011)

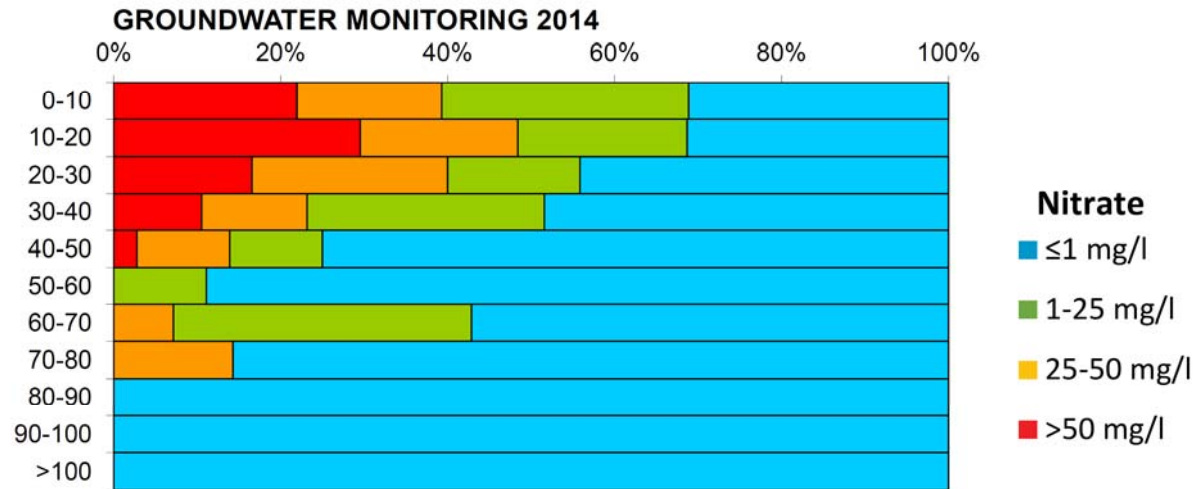
Trend in individual monitoring wells



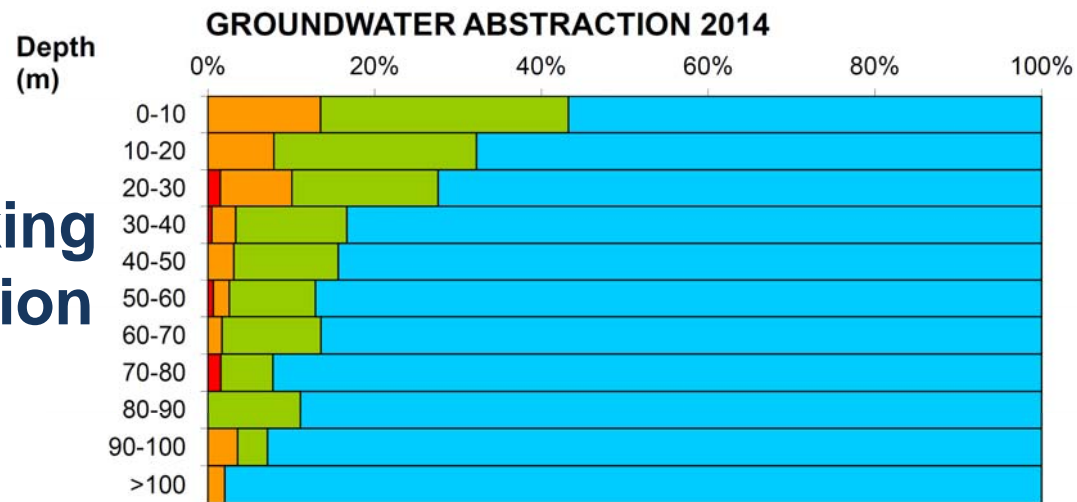
BG: Hansen et al. (2012)

Distribution of nitrate in groundwater

Groundwater monitoring data



Groundwater used for drinking water production data

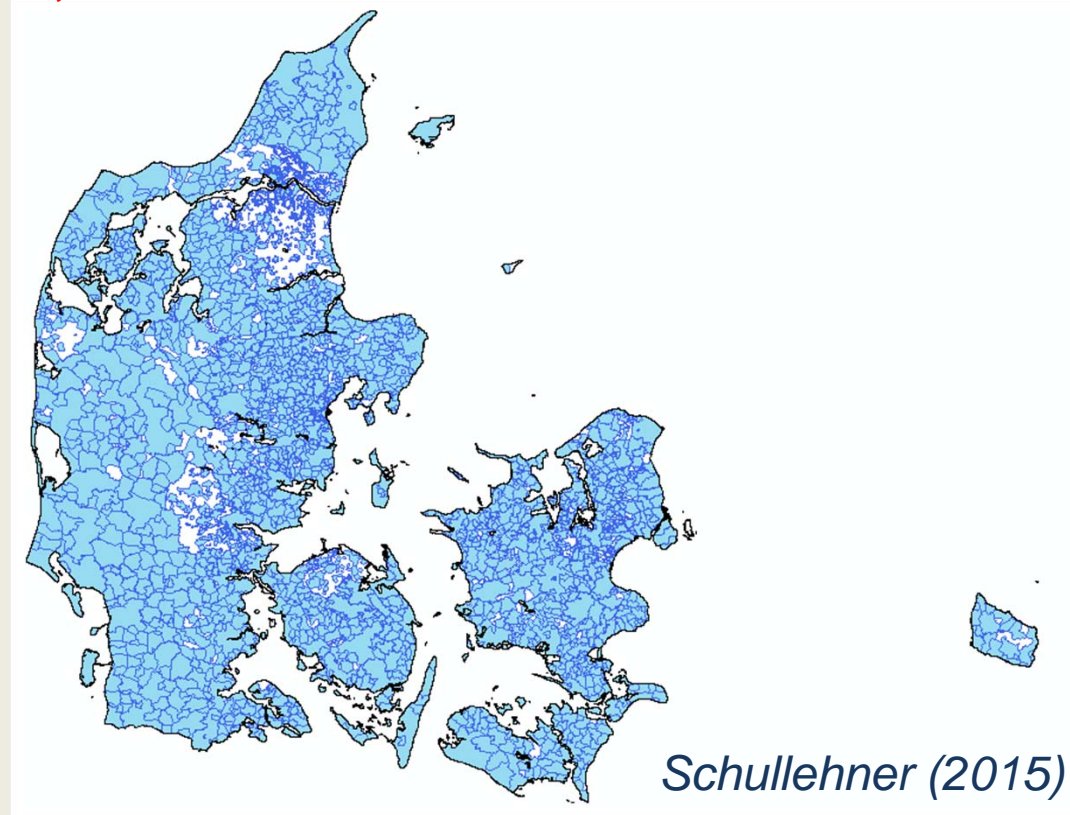


Decentralized drinking water structure in DK

2,700 PUBLIC WATERWORKS



2,700 WATER SUPPLY AREAS

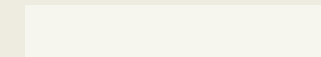


50-70,000 PRIVATE WELLS
7 % of consumers



Nitrate in drinking water

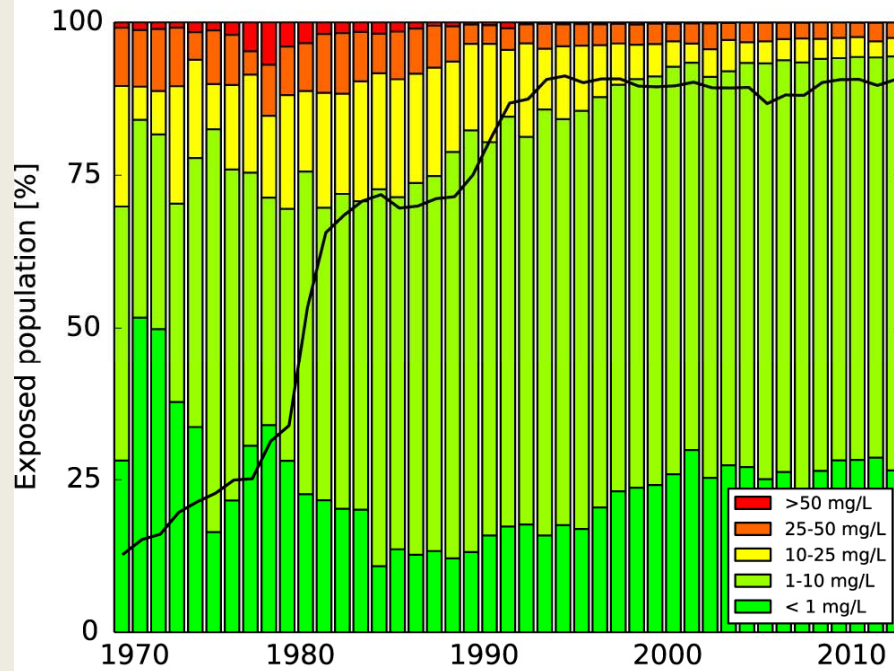
Public water works



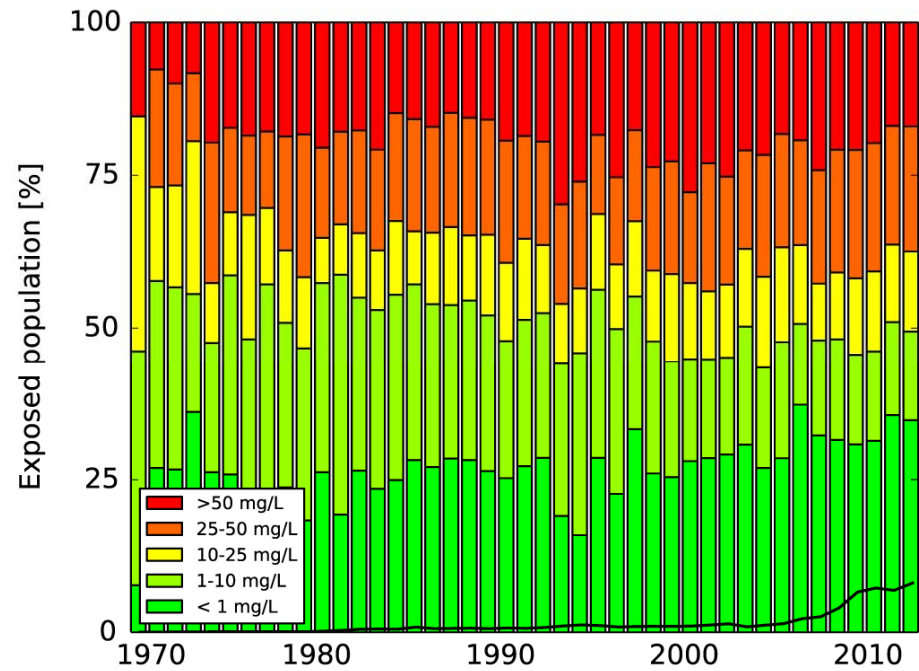
Schullehner & Hansen (2014)

Human exposure estimation in Denmark

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



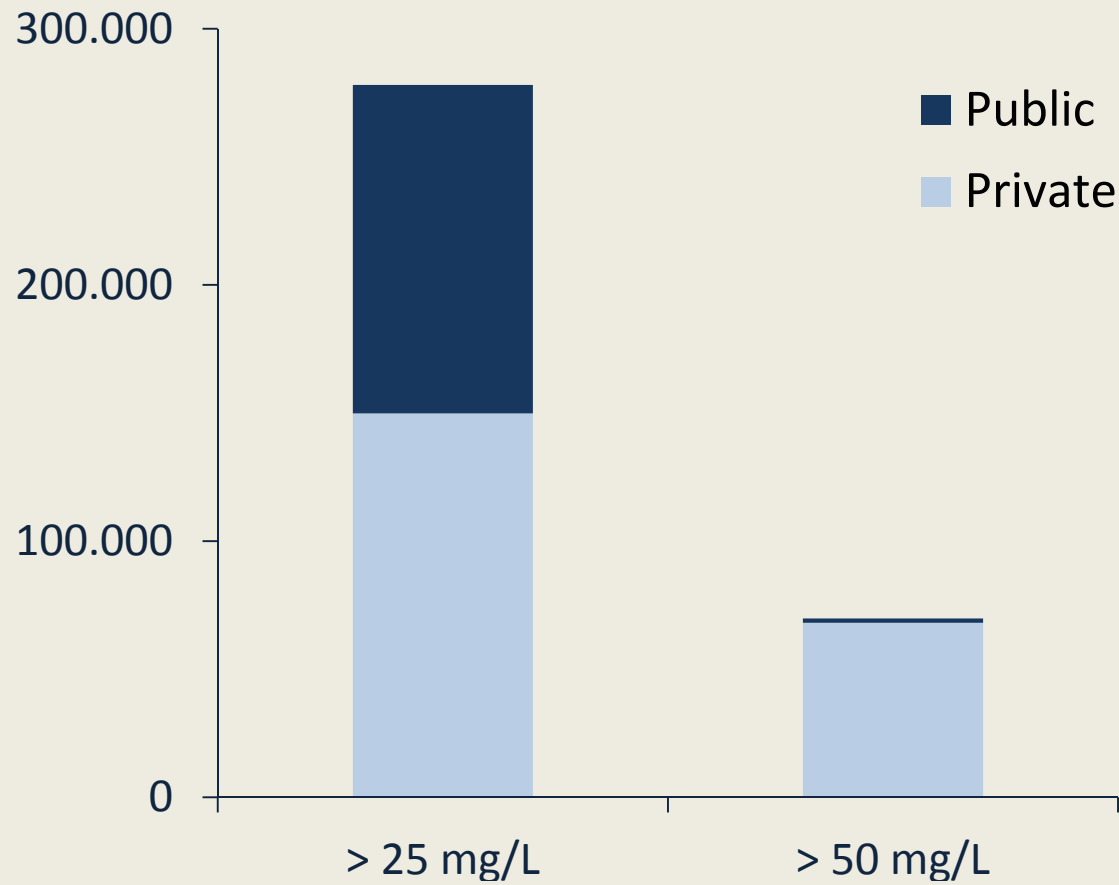
(a) Public



(b) Private

Schullehner & Hansen (2014)

Exposed Danish consumers



Schullehner & Hansen (2014)

Perspectives

- **Strong relation between long-term N surplus and nitrate in oxic groundwater**
- **Tendency to stagnant nitrate concentrations in recent years**
- **Long-term trends in nitrate in drinking water will be related to health outcomes**
- **Focus on agricultural versus climatic impact on long-term nitrate developments in groundwater**

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***THANK YOU FOR YOUR
ATTENTION***

