Perspektiver i en mere lokalt differentieret grundvandsbeskyttelse

Miljø-økonomisk vurdering af nitrat-pulsen

EPI WATER

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Nogle resultater

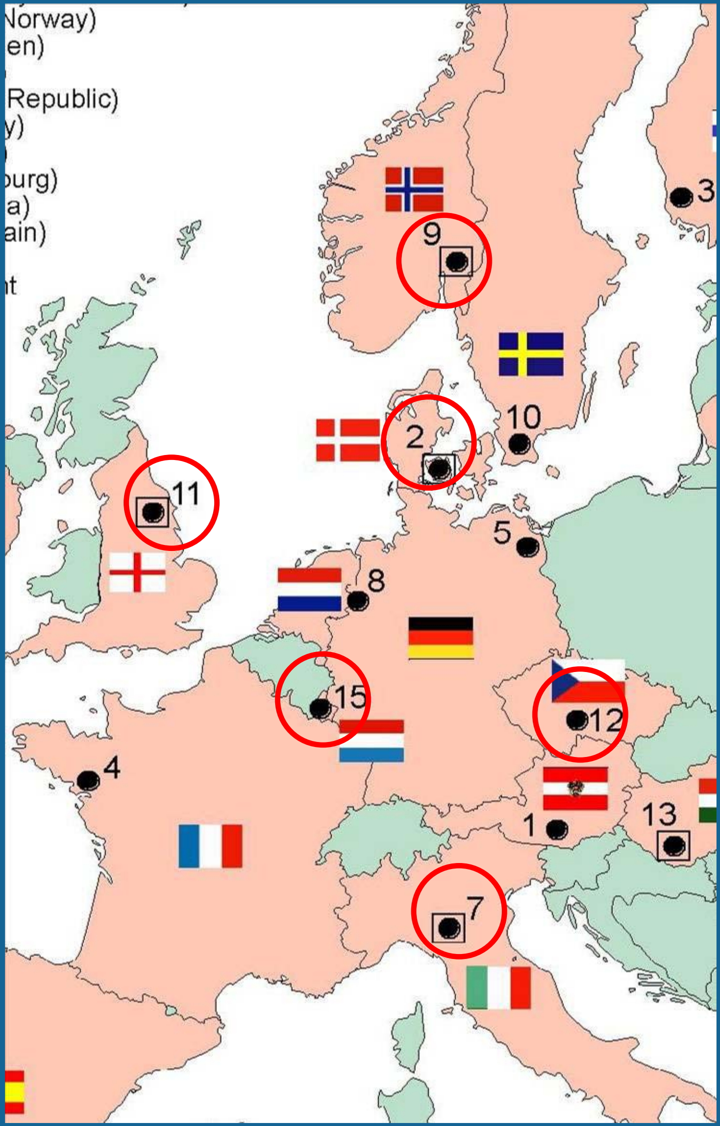
- De eksterne omkostninger ved kvælstof er steds-specifikke; hot spots og robuste arealer

- Forsigtigheds-princippet er nødvendigt eftersom vidensgrundlaget er fragmenteret

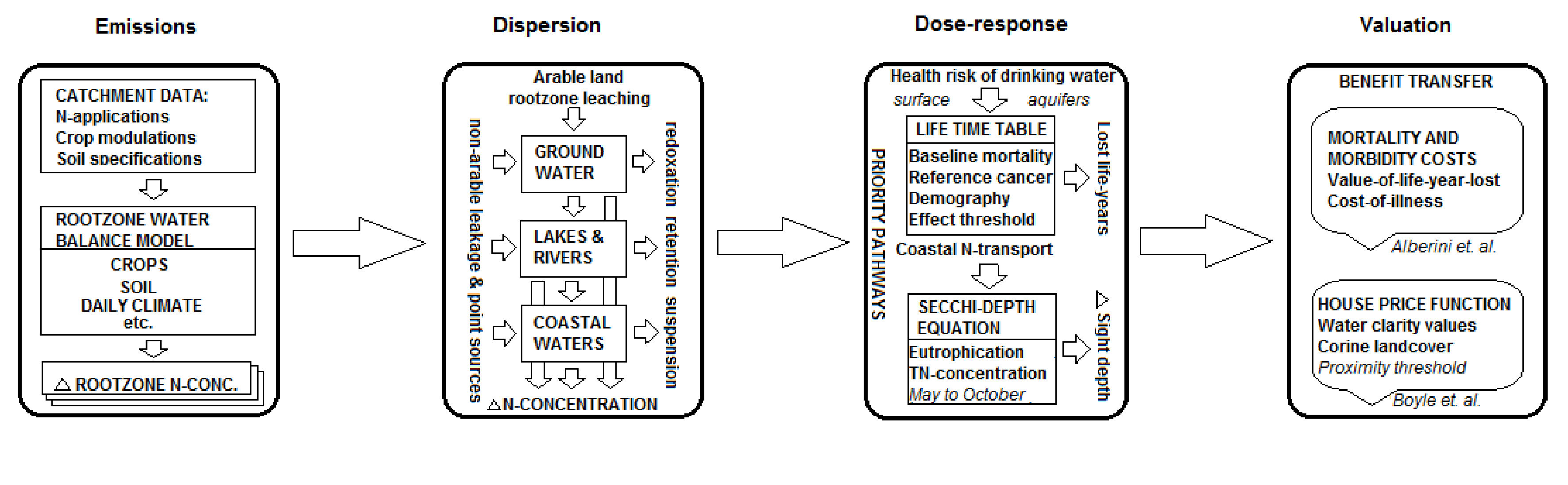
- De eksterne omkostninger er beregnet for EU27 med samme metode som EU anvender for luftforurening

EUROHARP catchments

- Grundvand
  - Odense, Danmark
  - Attert, Luxemborg
  - Enza, Italien
- Overfladevand
  - Ouse, England
  - Zelivka, Tjekkiet
  - Vansjø-Hobøl, Norge



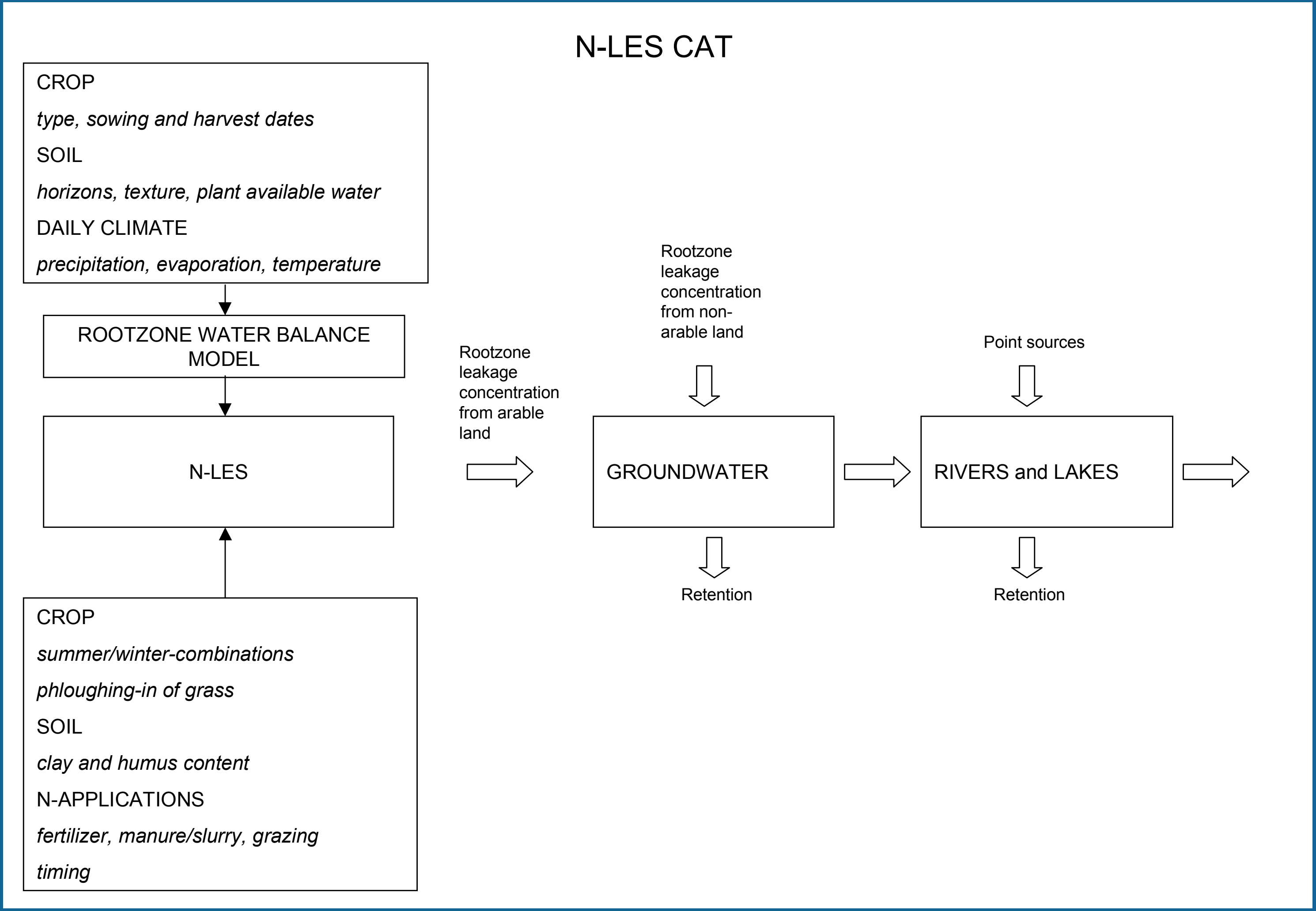
Akvatisk miljø: årsagskæde for kvælstof



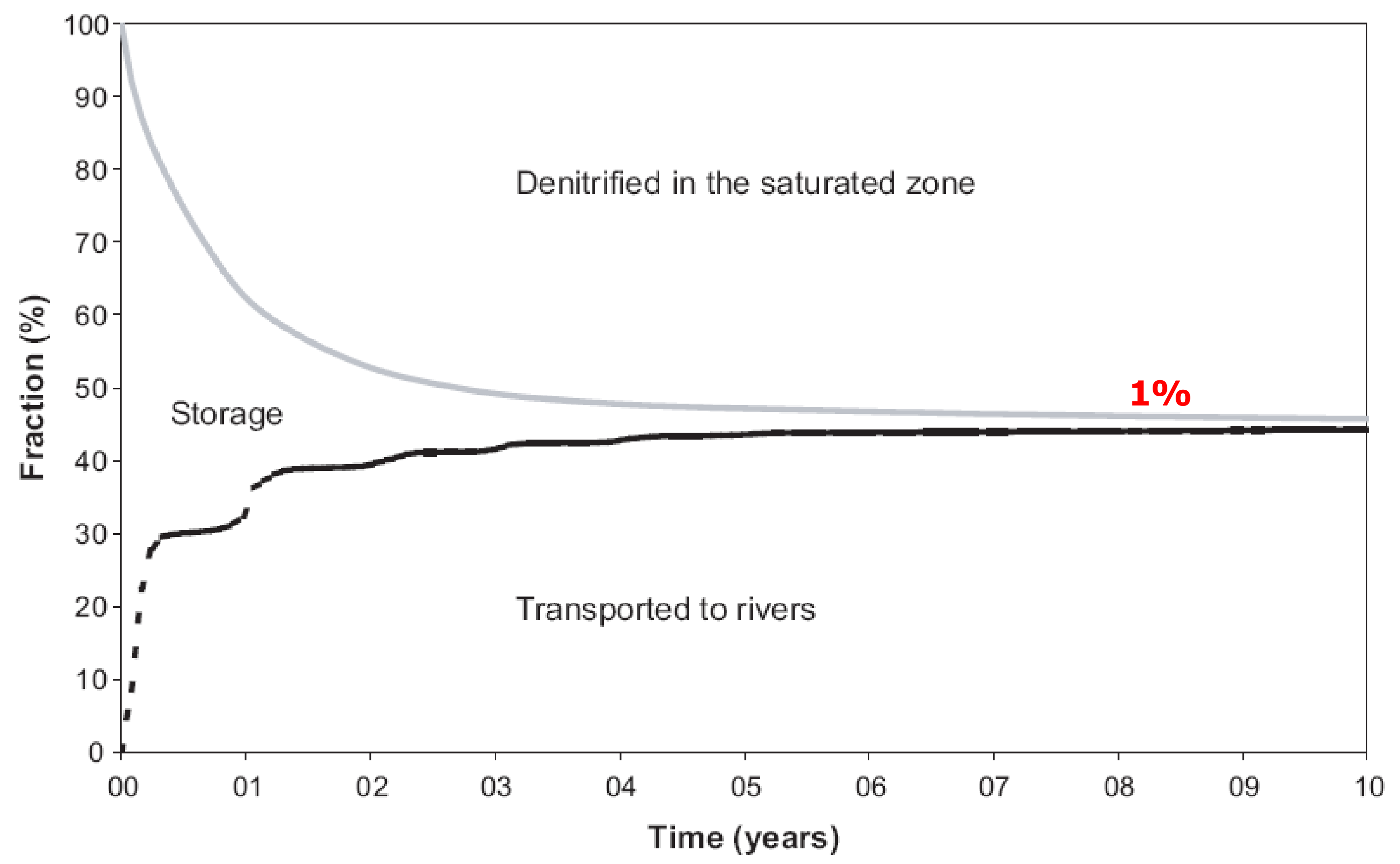
Årsagskæde: grundvand

Nitrogen loss	
Nitrogen loss to root zone	N-LES CAT (EUROHARP)
Nitrate-pulse to groundwater	Odense catchment model Hansen&Refsgaard
Dose-response function chronic nitrate-exposure	Weyer et. al.(2001) Gulis et. al. (2002) (EXIOPOL)
Valuation mortality and morbidity	Alberini et .al. (2003) (NewExt)

Trin 1: Spredning og transport



Trin 2: N-pulsen til grundvand

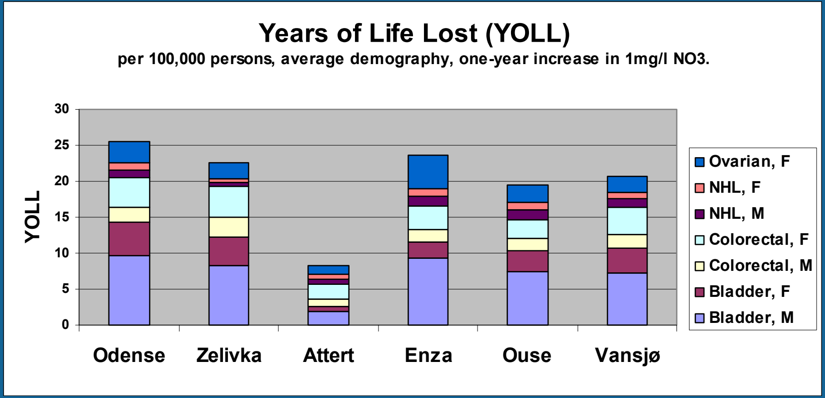


Trin 3: Dosis-respons - mortalitet og morbiditet

- State of the art on Nitrate
  - may inhibit nitrosamines (NOC) that cause increased frequency of cancer in all animal species tested
  - biologically plausible mechanisms to suggest bladder cancer
  - 2/3 of consumed N is detected in bladder within 24 hours
  - according to IARC: 'probably' carcinogenic impact (group IIa)

- Risk quantification on basis of epidemiological literature
  - Iowa health study; large women cohorte (Weyer, 2001)
  - Slovakian nitrate study (Gulis, 2002)
    - Bladder cancer incidence (>55 years) 0.106 / mgNO_3/l
    - Colorectal cancer inc. (>55 years) 0.01 - 0,02 / mgNO_3/l
    - Non-Hodgkins leukemia (>55 years) 0.03 / mgNO_3/l
    - Ovarian cancer (Females >55 years) 0.035 / mgNO_3/l

Levetids tabel: tabte leveår



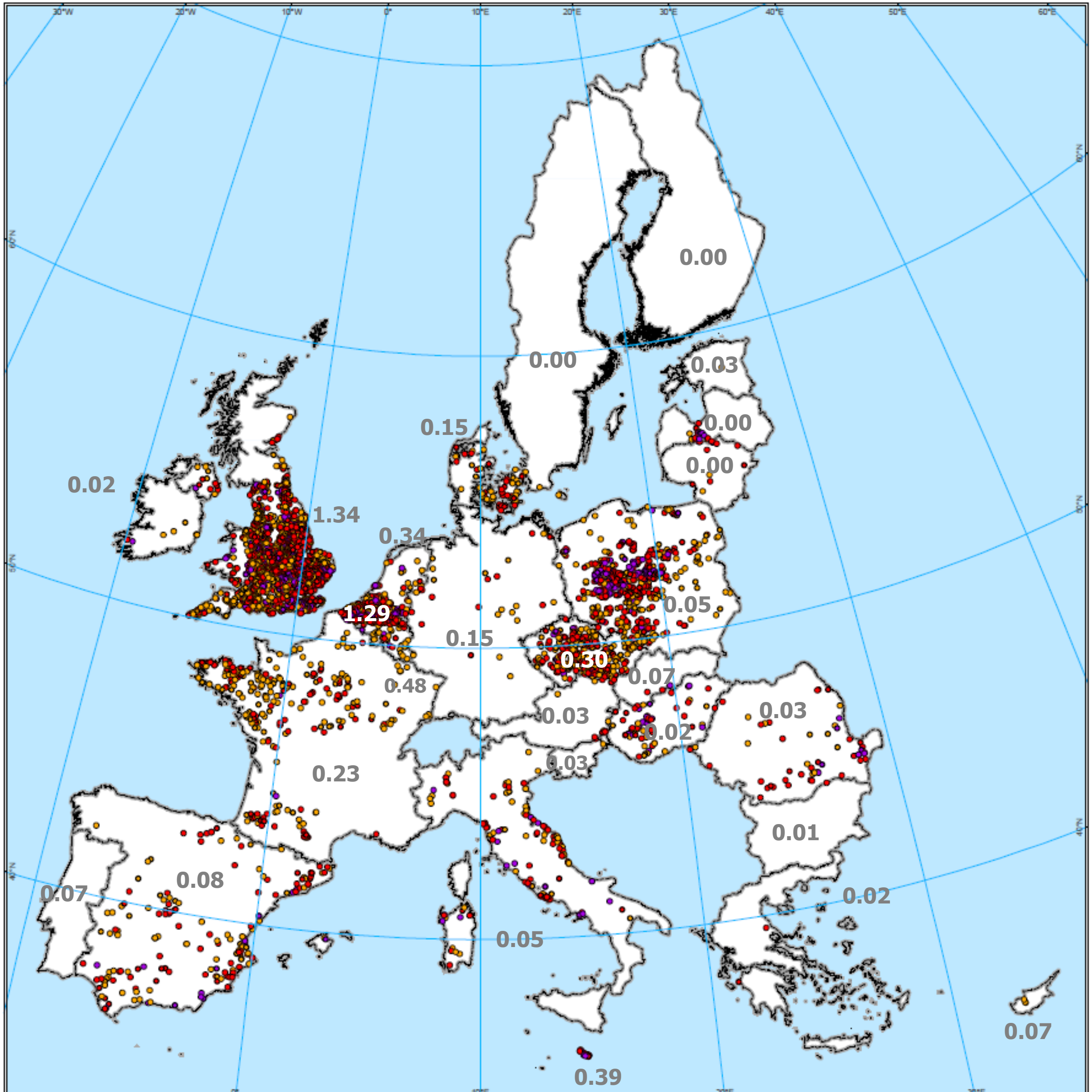
Age Cohort	Death Risk	Population at time t from start									
		0	1	2	3	…	97	98	99	100	
55	0.0068	5511									
56	0.0073	5554	5460								
57	0.0074	5314	5500								
58	0.0082	5119	5261								
…											
97	0.4581	24	15								
98	0.5027	20	14								
99	0.5522	9	10			…					
100	0.6091	6	5								Sum
Life years lived		100,000	96,670								1,588,907

Trin 4: Værdi-sætning

- Mortalitet (risiko reduktion)
  - Kronisk død: 40,000 € per leveår
  - Samme tilgang som i EU; fastlagt af ekspertpanel
- Morbiditet (risiko reduktion)
  - Sundheds-effekter værdisat
  - Opdaterede enhedspriser baseret på cost-of-illness

NITRATES DIRECTIVE EU-27

NITRATE VULNERABLE ZONES
SURFACE WATER



Surface water maximum nitrate concentration
max NO3 mg/l

- 40-50
- 50-100
- >100

with illustrative health-related external costs

€/kgN$_{applied}$

(NUTS1 averages; EXIOPOL)

Sources : DG ENV, Member States reports on Nitrates Directive Implementation
Coordinate Reference System: ETRS89 Lambert Azimutal Equal Area
Cartography : JRC, 01/2008

Extracted from ELISA (European Land Information System for Agriculture and Environment)
http://elisa.jrc.it/website/imsstartv2.html

Eksterne omkostninger ved kvælstof

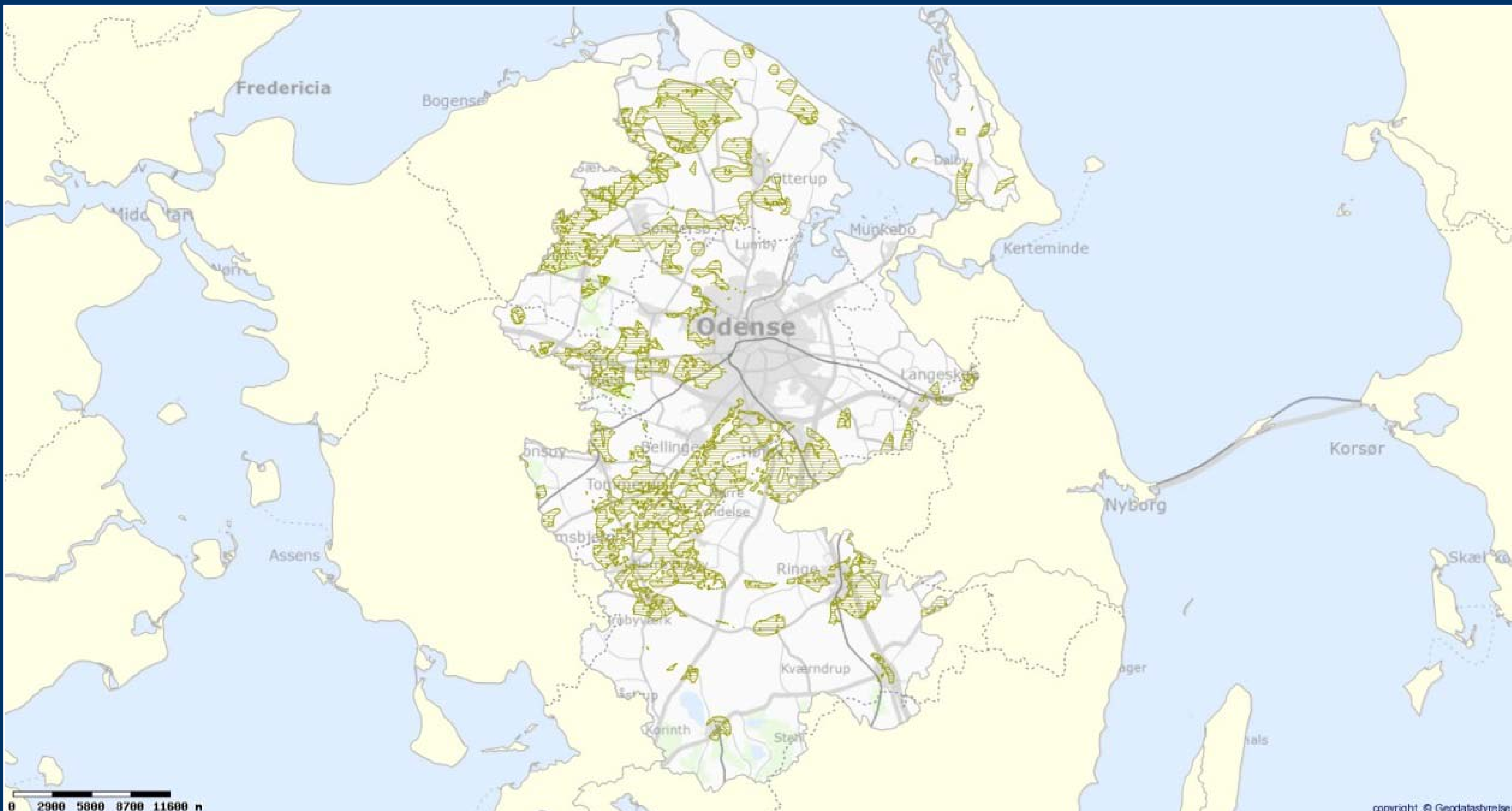
External costs DKK_{2006} pr. kg total-N	N-tilført marken	N-tab rodzone
Sundhed; nitrat i drikkevand		
Kunstgødning, lerjord	1,22	4,19
Husdyrgødning, lerjord	2,21	4,19
Kunstgødning, sandjord	12,20	41,90
Husdyrgødning sandjord	22,07	41,90
Miljø; sigt-dybde		
Kunstgødning	0,18	0,63
Husdyrgødning	0,34	0,63
Klima: N_2O-N		
Kunstgødning	0,84	2,90
Husdyrgødning	1,20	2,30
Sum of external costs		
Kunstgødning, lerjord	**2,24**	**7,72**
Husdyrgødning, lerjord	**3,75**	**7,12**
Kunstgødning, sandjord	**13,22**	**45,43**
Husdyrgødning, sandyjord	**23,61**	**44,83**

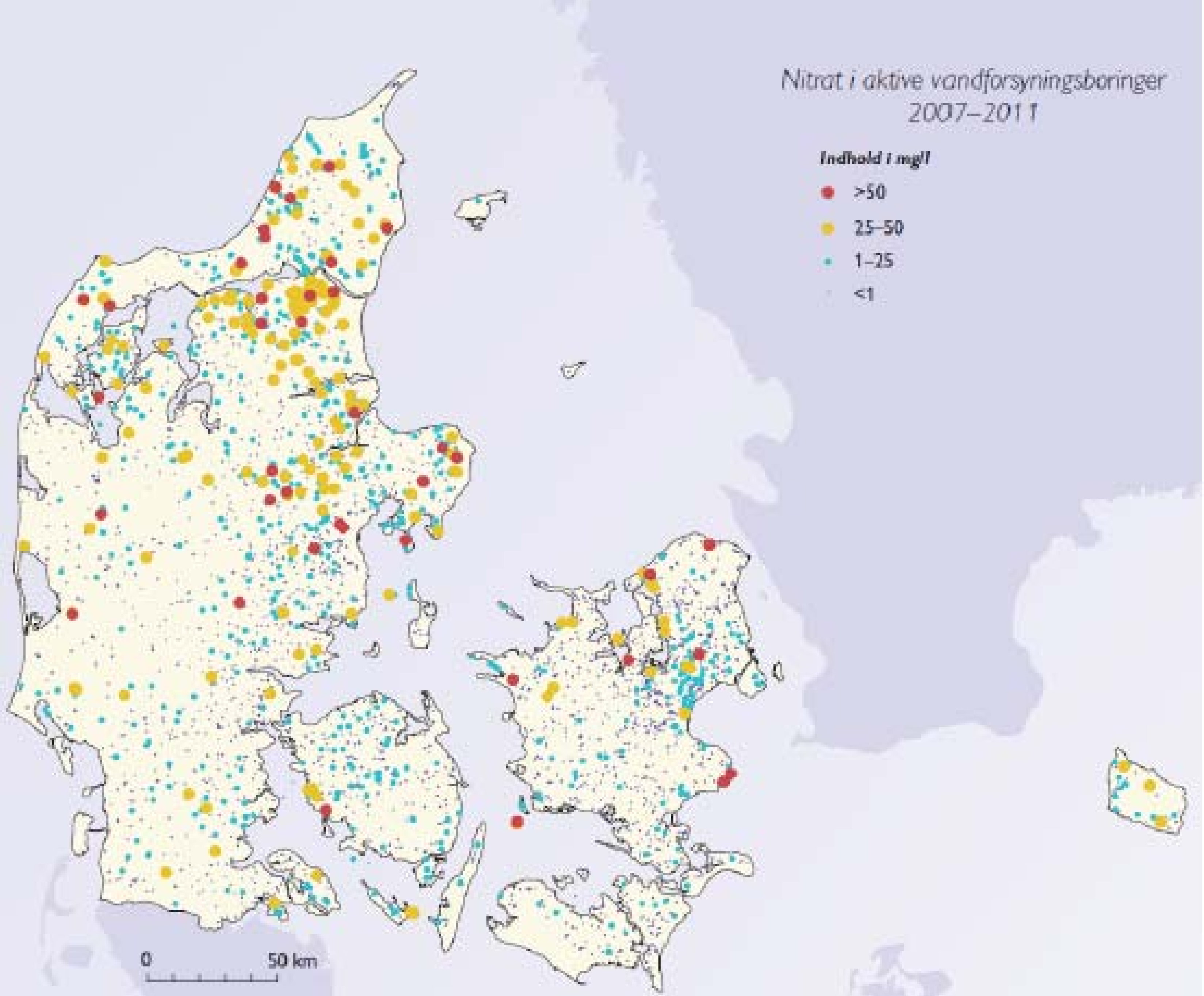
Miljøfordelene ved ‘god’ og ‘høj’ økologisk kvalitet i Odense Fjord

TAX ON MINERAL FERTILISER	GOD SCP20 Ton N (not) applied	HØJ SCP 40 Ton N (not) applied	External costs € per kg N-fertilizer	GOD SCP20 Benefits Million € /year	HØJ SCP40 Benefits Million € /year
Drinking water -Loamy soils -Sandy soils	4687 960	7257 1486	0.16 1.64	0.8 1.6	1.2 2.4
Greenhouse gas N_2O	5646	8743	0.11	0.6	1.0
Ammonia	5646	8743	0.22	1.2	1.9
Eutrophication -House price impact -Swimmers’ WTP	5646	8743	>0.02 0.02-0.25	>0.2 0.4	>0.3 0.8
Sum			2.18-2.41	**4.8**	**7.6**

Grund og drikkevandet betaler for fjorden!

Nitratfølsomme områder Odense Fjord




Nitrat i aktive vandforsyningsboringer
2007–2011
Indhold i mg/l
>50
25–50
1–25
<1
0
50 km

Perspektiver for mere differentieret indsats ?

- Afgift eller pant på kvælstof mere effektivt end areal-regulering
- Kvælstof-reduktion har størst økonomisk værdi hvor grund- og drikkevandsinteresser
- Kombination af generelle styringsmidler med lokale tiltag må nytænkes

References

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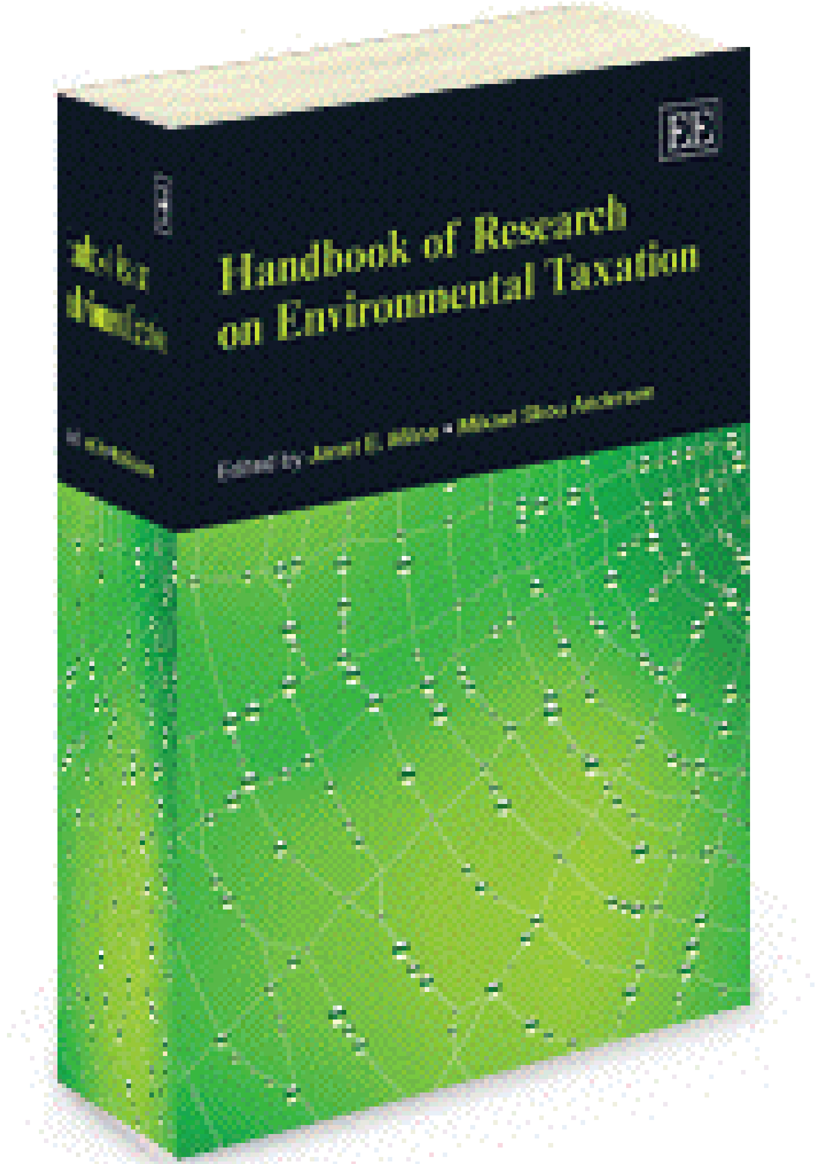
Handbook of Research
on Environmental Taxation