

A new cost-effective mitigation strategy for drainage filter technologies in Denmark

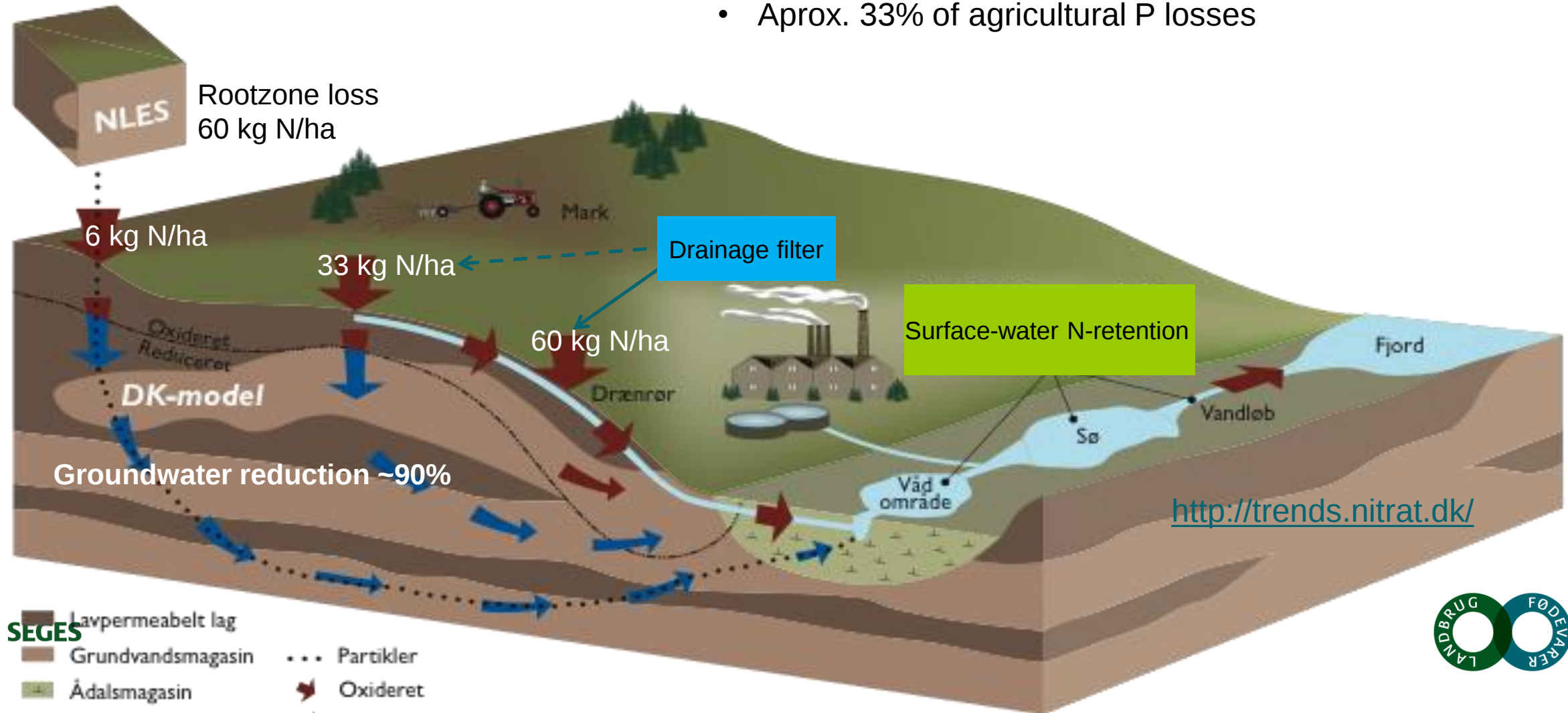
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SEGES, Danish Agriculture & Food Council

(Aarhus University, Dept. Agroecology 2000-2017)

Drainage filters a new targeted mitigation strategy

Drainage losses of nutrients accounts nationally for:

- 50-60% of agricultural N losses -> locally up to 90%
- Aprox. 33% of agricultural P losses



Implementation strategy

Where should we implement targeted drainage measures to ensure a cost-efficient mitigation strategy?



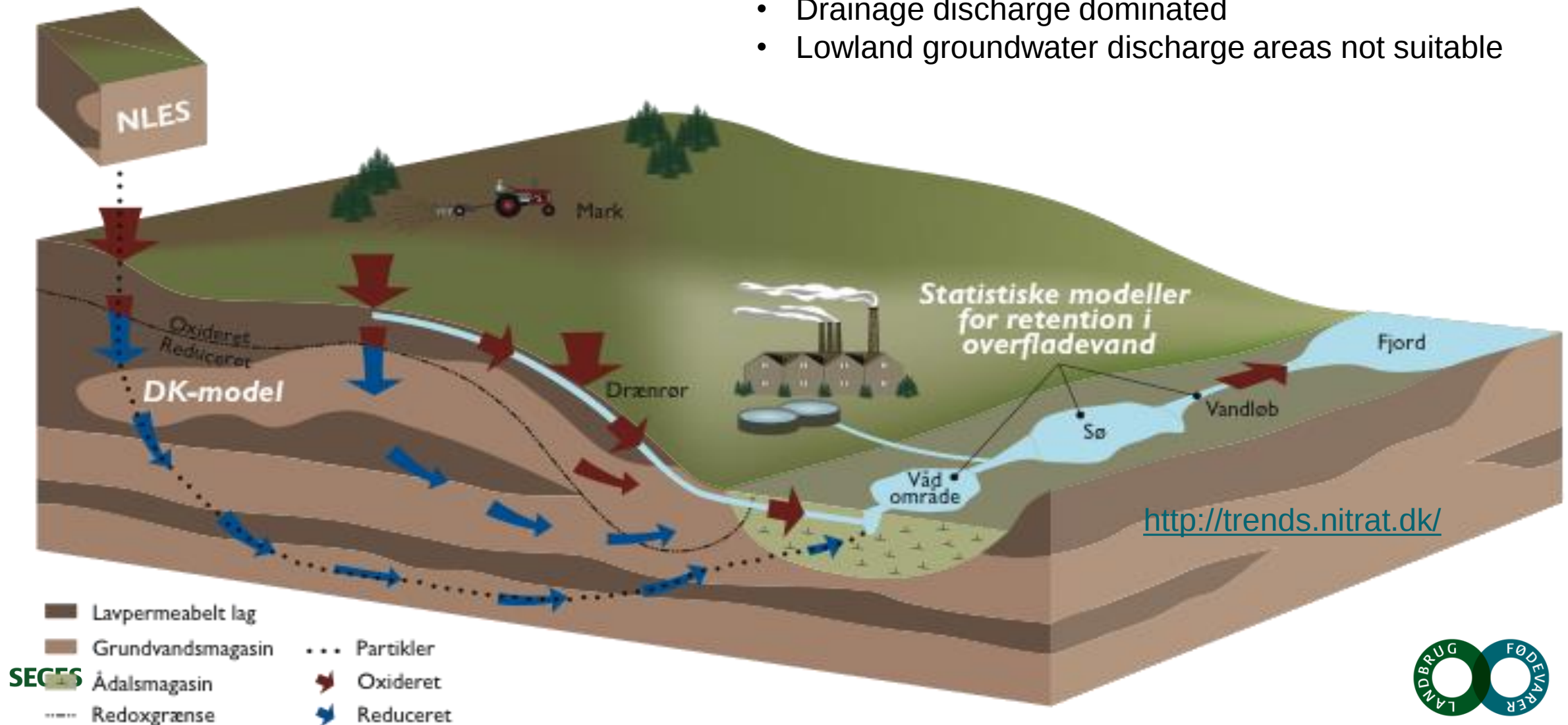
Strategy for implementing targeted drainage measures

Criteria

1. Reduction requirement (coastal targets)
2. **Suitability of agricultural areas**
3. N-nutrient losses by drainage - quantitative significant
4. Quantitative environmental impact on coastal water (N)

Suitability of agricultural areas

- Drainage discharge dominated
- Lowland groundwater discharge areas not suitable



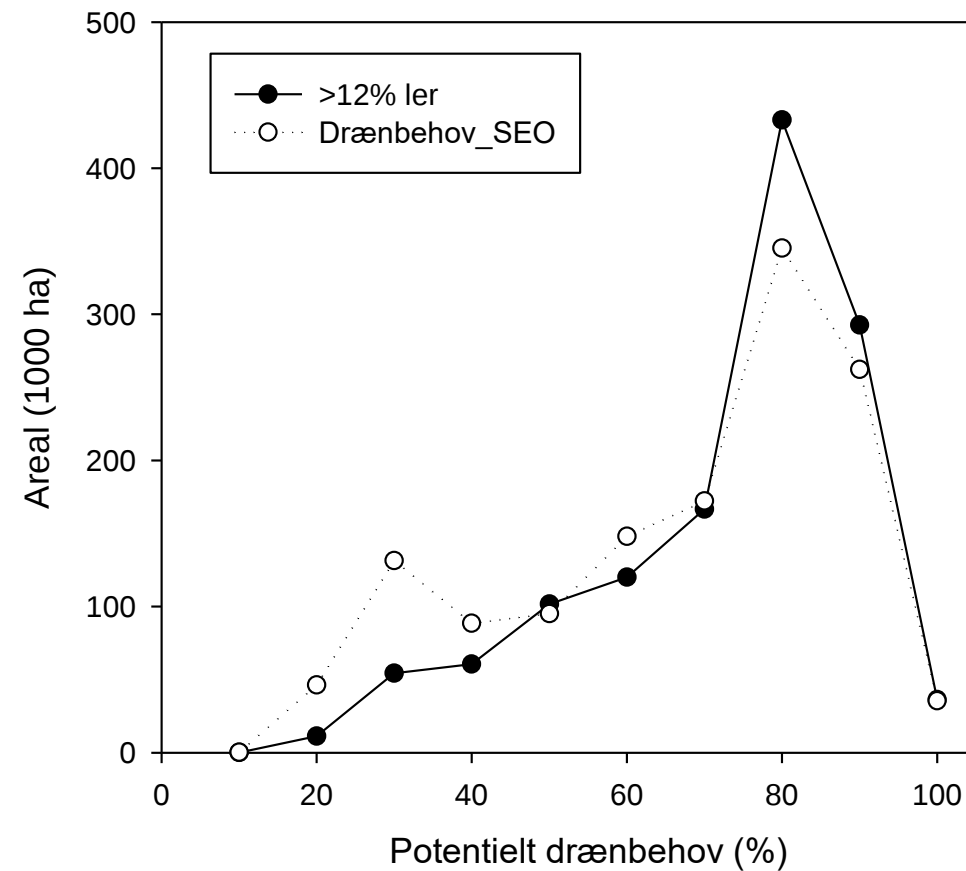
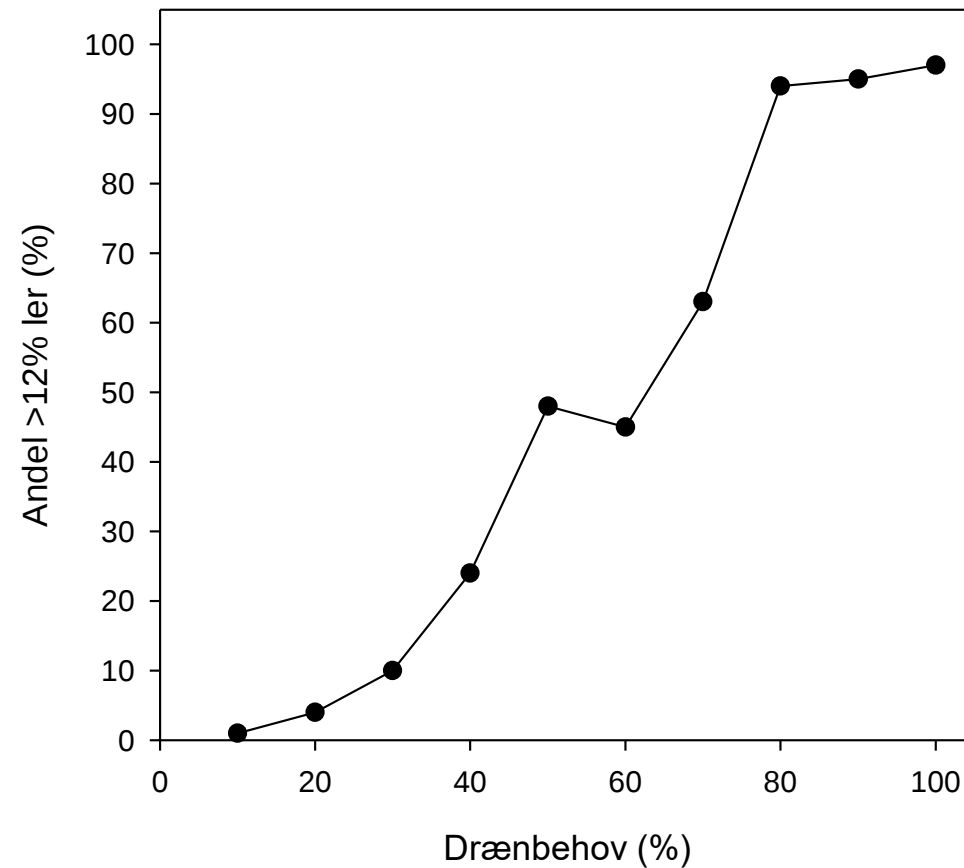
Suitability of agricultural areas

Threshold subsurface clay content -> discriminating between drainage vs groundwater losses

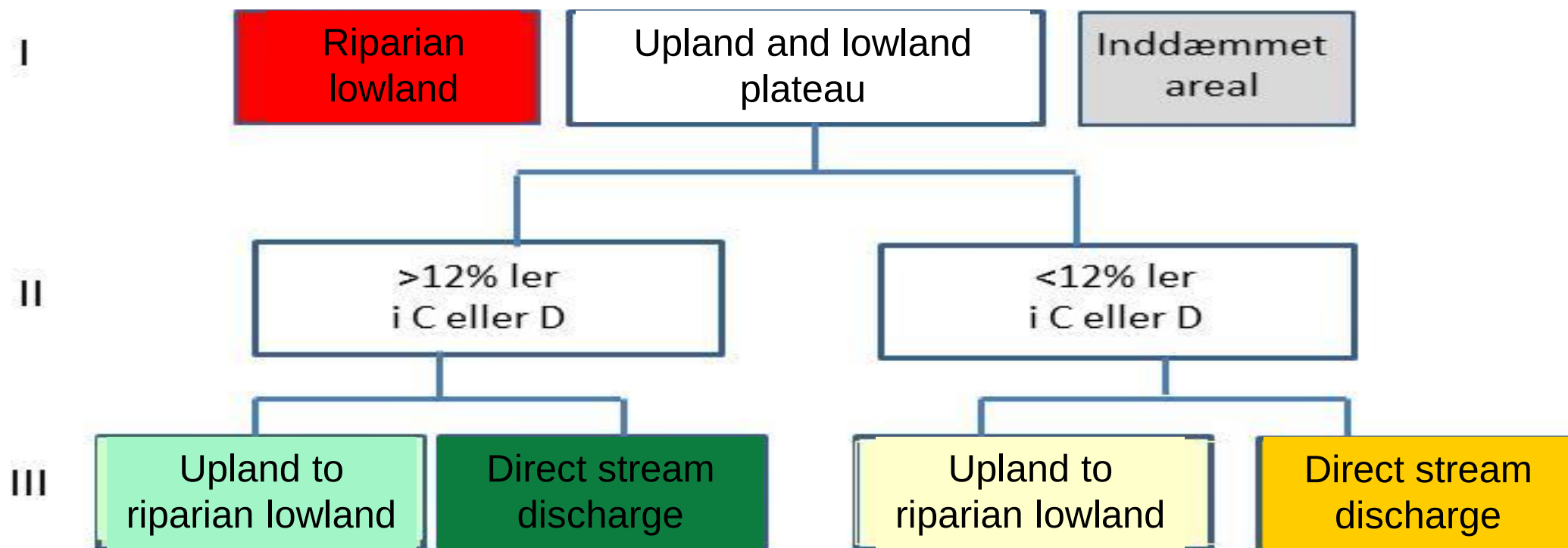


Photo: M. Habekost

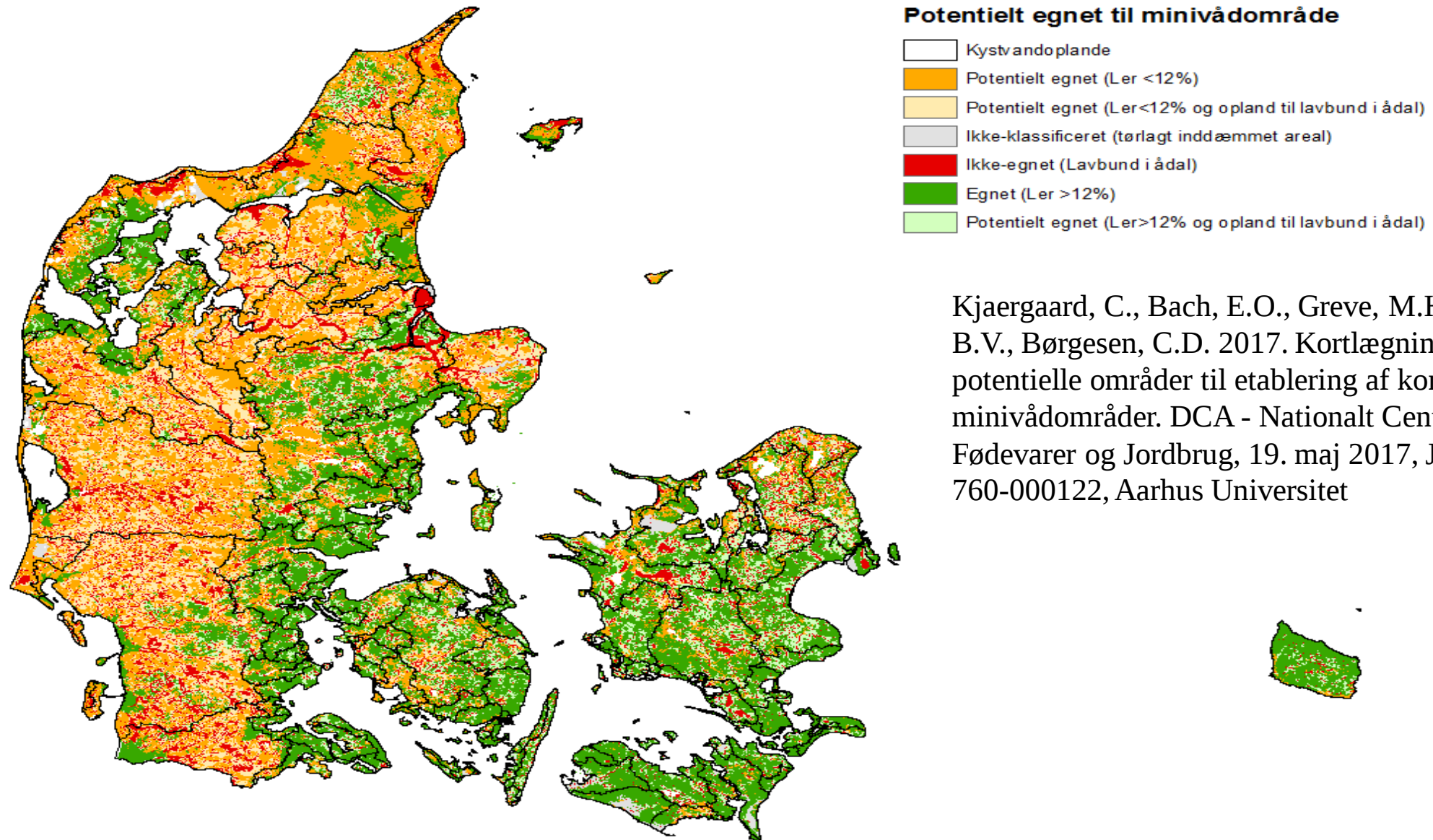
Drainage classes (12% clay threshold)



Nationalt suitability map for implementing drainage measures



Nationalt suitability map for implementing drainage measures



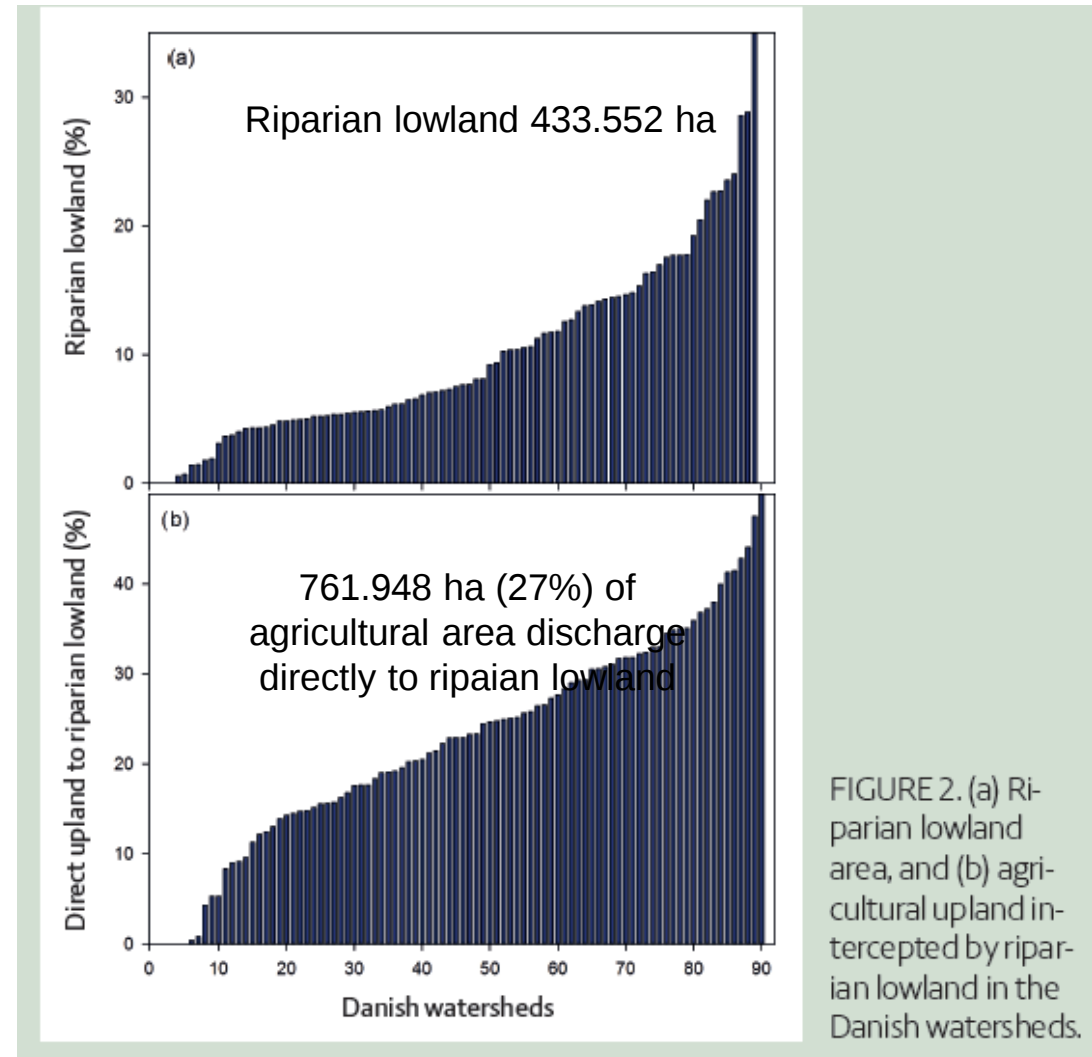
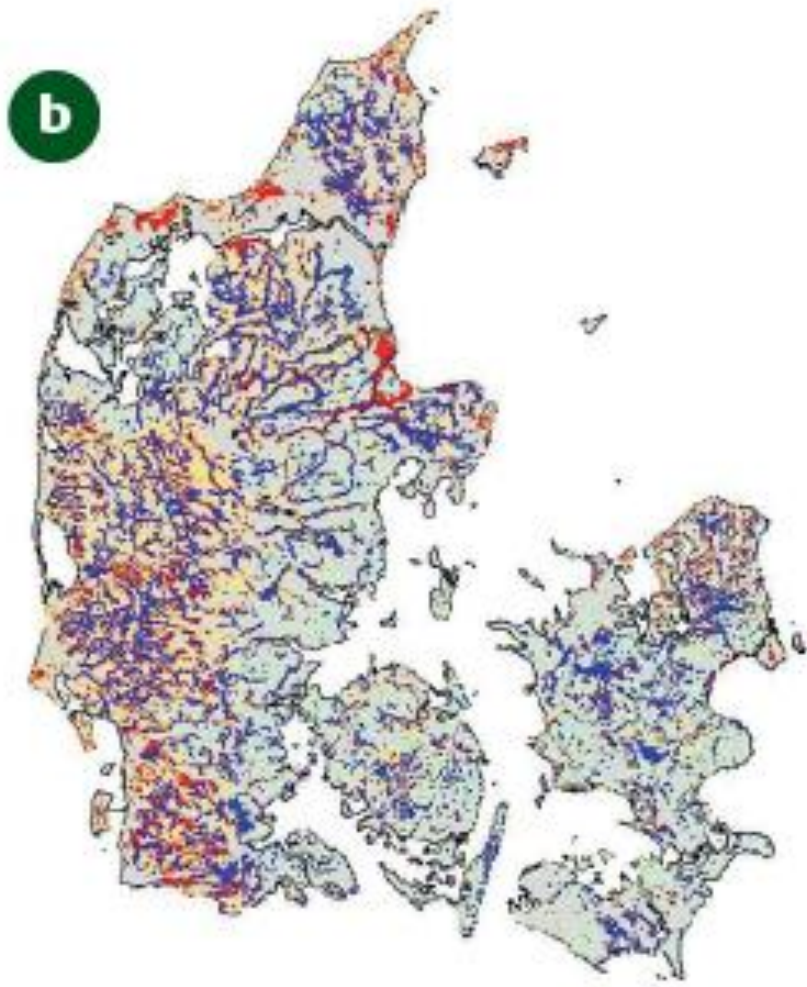
Kjaergaard, C., Bach, E.O., Greve, M.H., Iversen, B.V., Børgesen, C.D. 2017. Kortlægning af potentielle områder til etablering af konstruerede minivådområder. DCA - Nationalt Center for Fødevarer og Jordbrug, 19. maj 2017, J. nr. 2017-760-000122, Aarhus Universitet

Riparian lowland and uplands



Dronefoto: SEGES

Significance of the N-reduction potential using riparian lowland



Nationalt suitability map for implementing drainage measures

2.1 Inputdata

- Ler-procent: Clay (raster 30,4* 30,4 meter) - Institut for Agroøkologi, Aarhus Universitet
- Lavbund: Wetlands (raster 30,4* 30,4 meter) – Institut for Agroøkologi, Aarhus Universitet
- Valley bottom flatness index (raster 30,4* 30,4 meter) – Institut for Agroøkologi, Aarhus Universitet
- Landskabselementer (vektor 1:100.000) – Institut for Agroøkologi, Aarhus Universitet
- Georegioner – Institut for Agro økologi, Aarhus Universitet
- Højdemodel: DHyM/Rain (raster 1,6* 1,6 meter) - hydrologisk højdemodel downloadet fra kortforsyningen i december 2015 <http://kortforsyningen.dk/content/hoejdemodel-nu-med-vand>
- Vand: Vandløb, søer og kystlinje (vektor 1:10.000) GeoDanmark <http://www.geodanmark.dk/> downloadet fra kortforsyningen 7. juli 2016 <http://download.kortforsyningen.dk/content/geodanmark>
- Oplande: Kystvandoplande (vektor) – Naturstyrelsen, Miljø- og Fødevareministeriet
- Retentionskort: (vektor) - Naturstyrelsen, Miljø- og Fødevareministeriet
- Markblok-data: Blokkortet 2015: (vektor 1:10.000) – NaturErhvervstyrelsen, Miljø- og Fødevareministeriet

Kjaergaard, C., Bach, E.O., Greve, M.H., Iversen, B.V., Børgesen, C.D. 2017. Kortlægning af potentielle områder til etablering af konstruerede minivådområder. DCA - Nationalt Center for Fødevarer og Jordbrug, 19. maj 2017, J. nr. 2017-760-000122, Aarhus Universitet

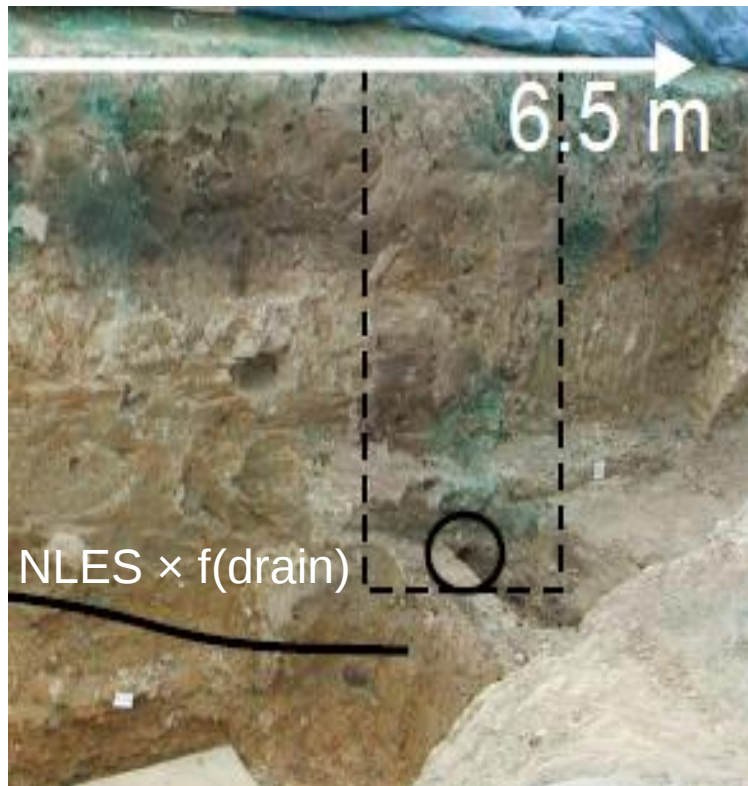
Strategy for implementing targeted drainage measures

Criteria

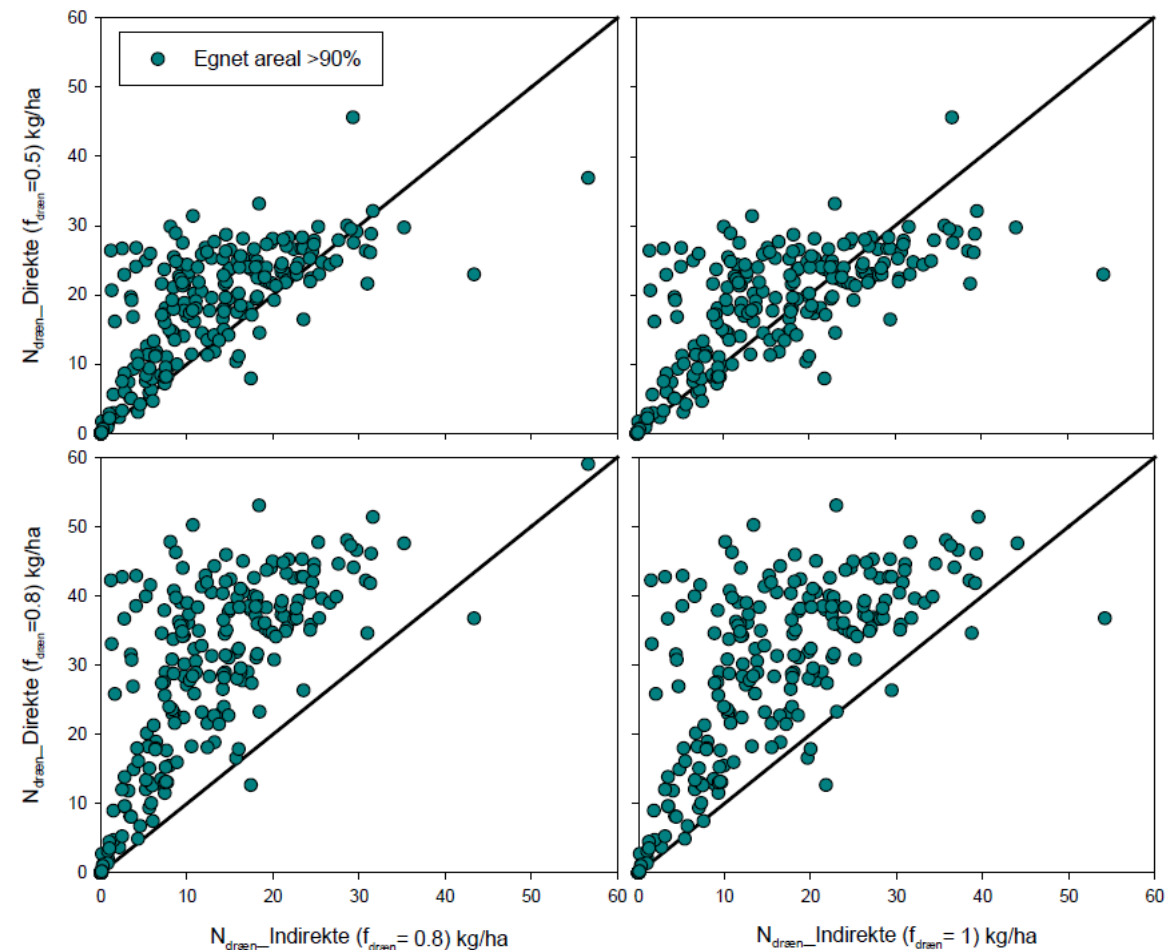
1. Reduction requirement (coastal targets)
2. Suitability of agricultural areas
3. **N-nutrient losses by drainage - quantitative significant**
4. Quantitative environmental impact on coastal water (N)

Strategy for implementing targeted measures

N-losses from rootzone



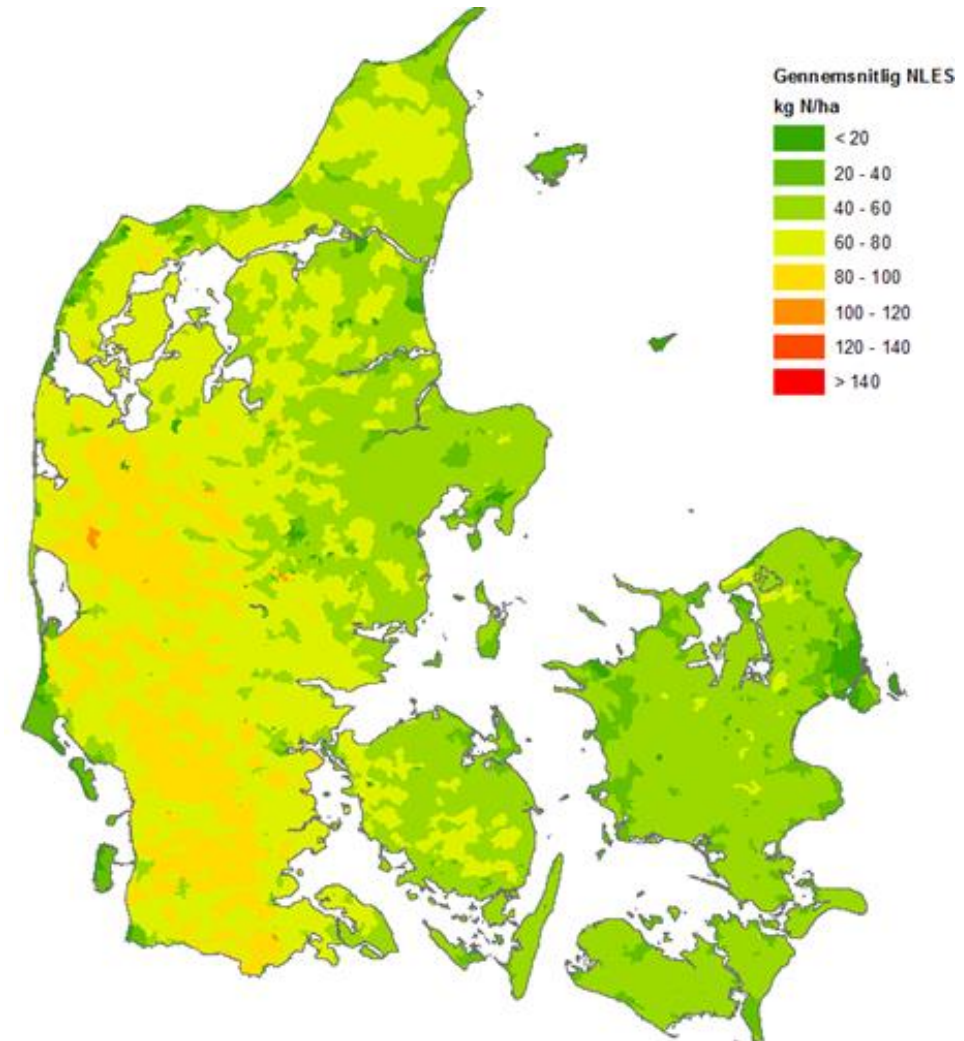
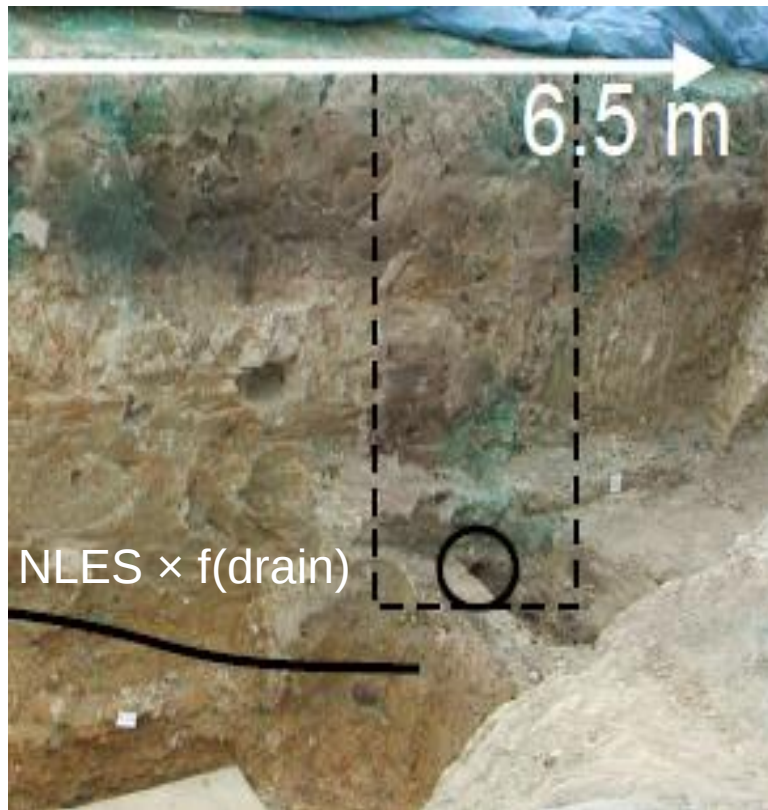
Estimating $f(\text{drain})$



Strategy for implementing targeted measures

N-loss from the rootzone corrected for the drainage fraction

N-losses from rootzone

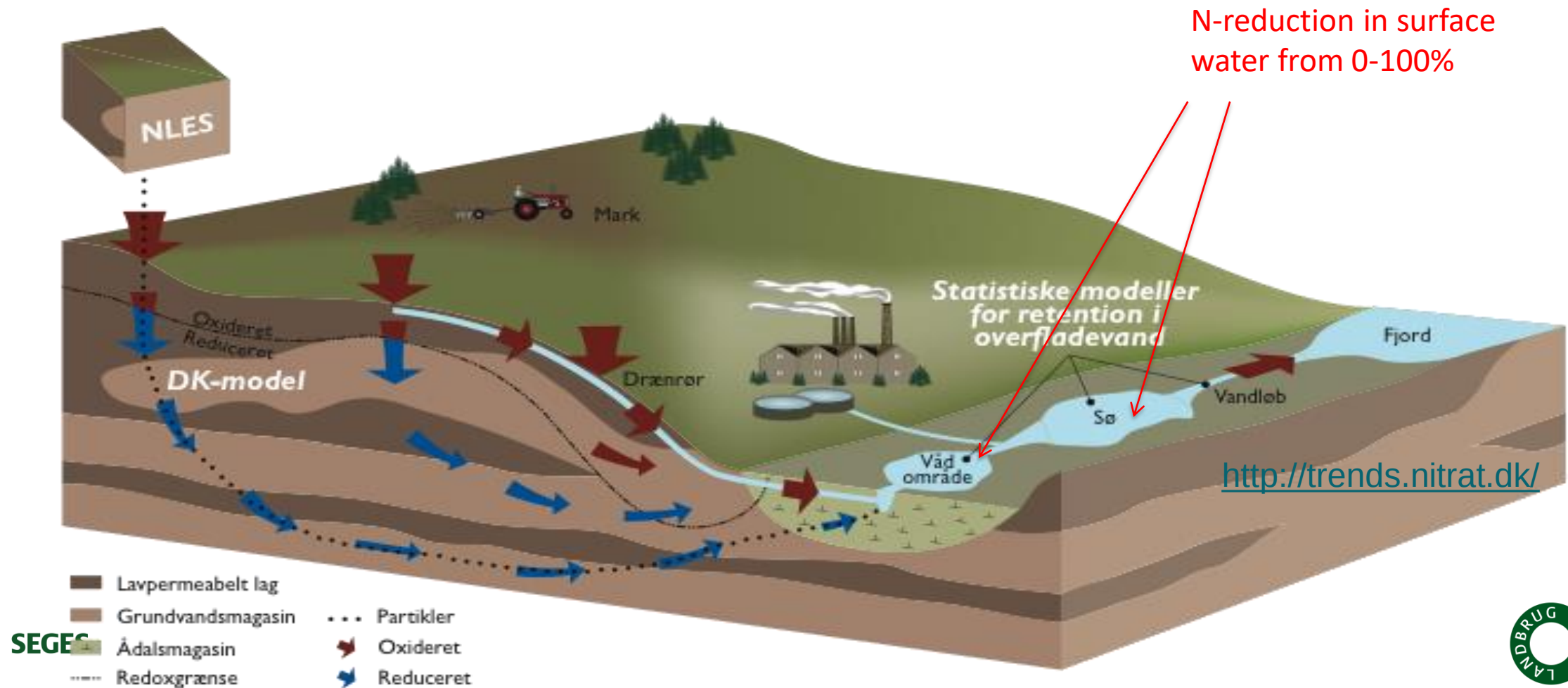


Strategy for implementing targeted drainage measures

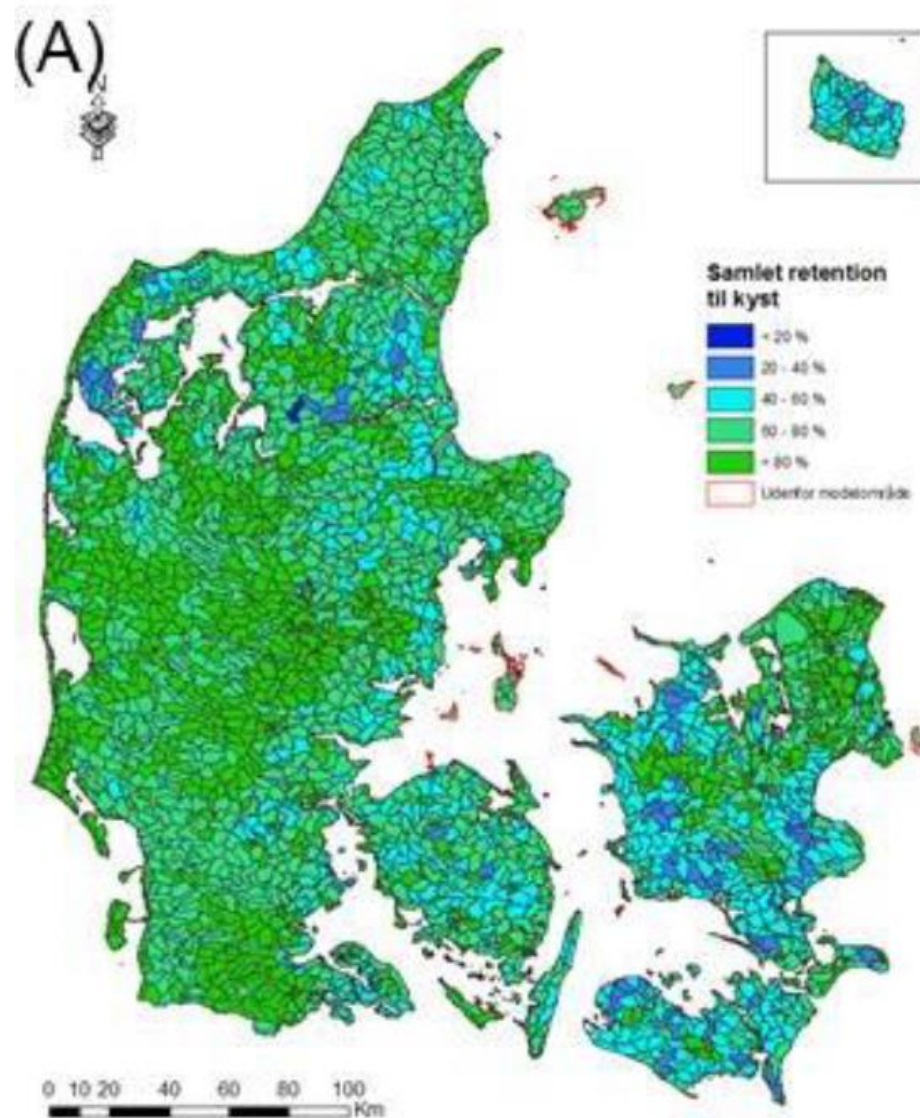
Criteria

1. Reduction requirement (coastal targets)
2. Suitability of agricultural areas
3. N-nutrient losses by drainage - quantitative significant
4. **Quantitative environmental impact on coastal water (N)**

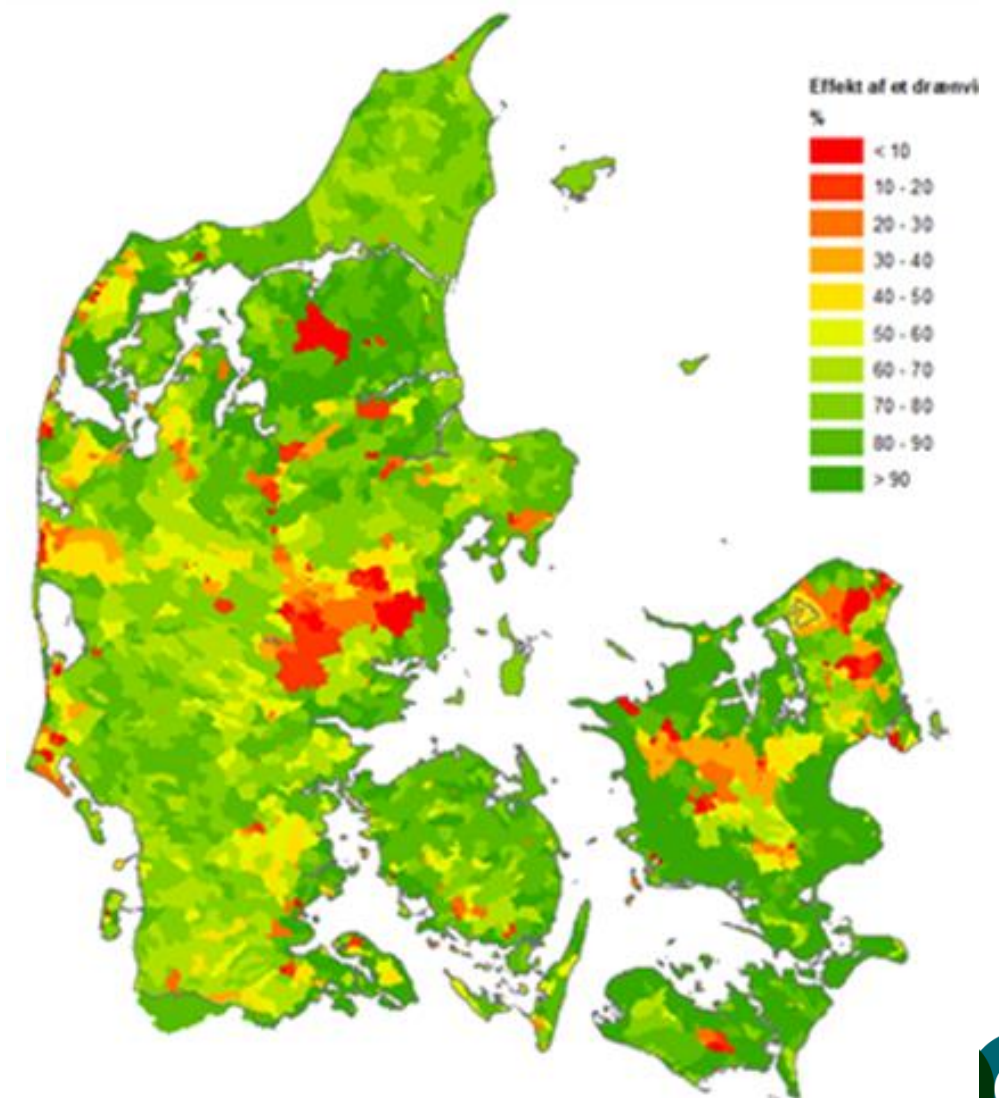
Quantitative impact on coastal water



Quantitative impact on coastal water



Højberg et al., 2019

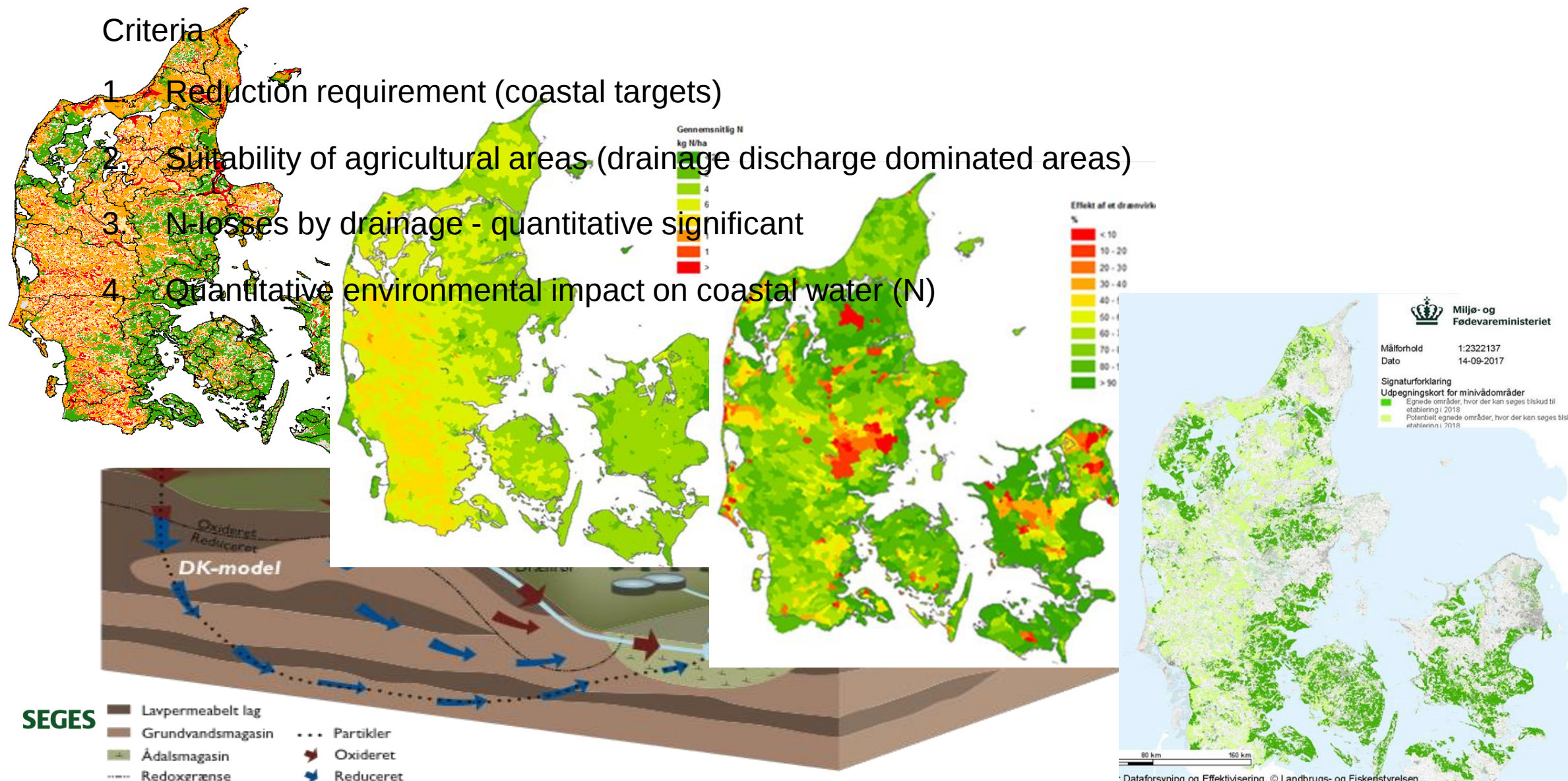


Kjærgaard & Børgesen, 2017

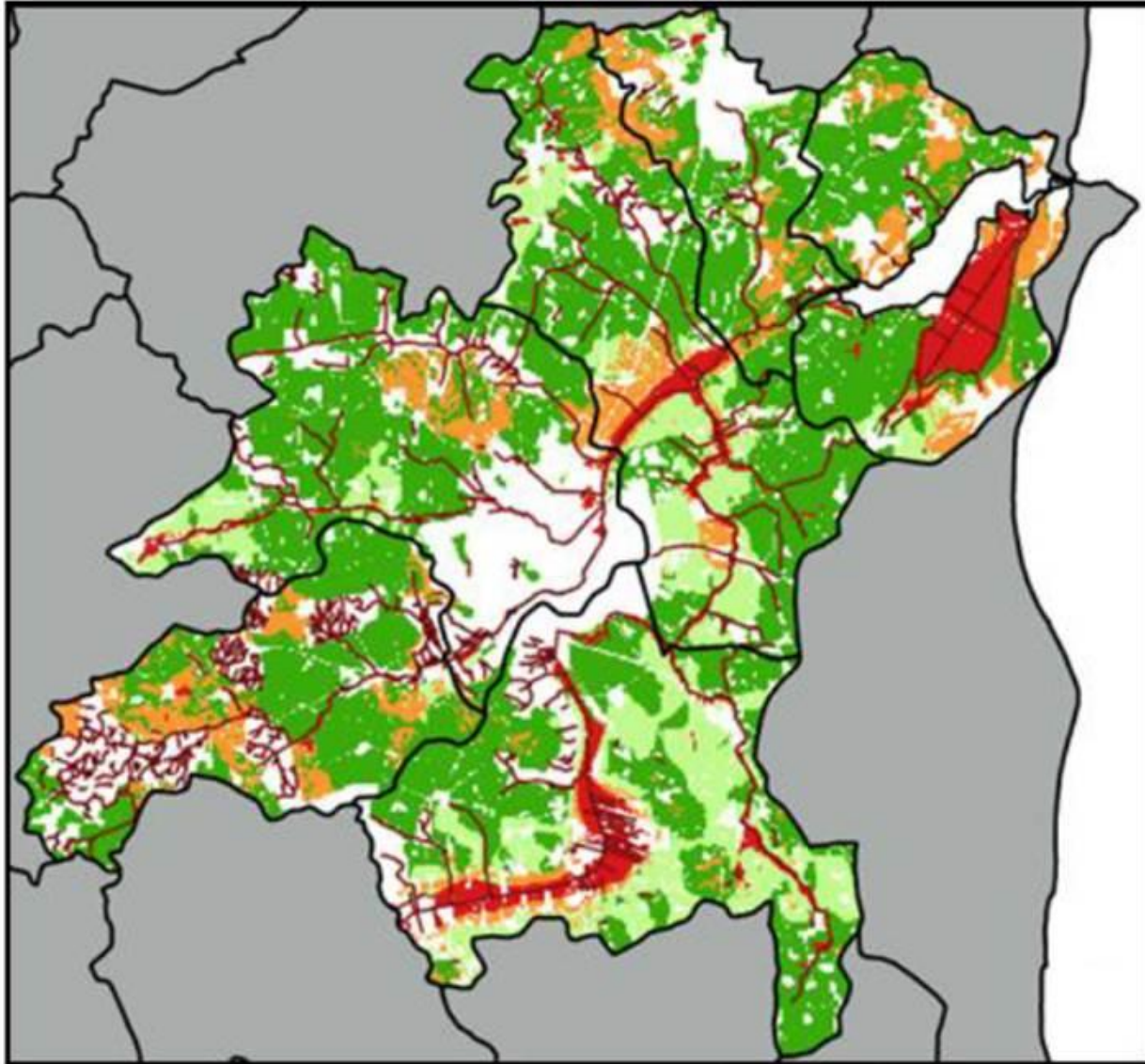
National designation maps for implementing drainage filters

Criteria

1. Reduction requirement (coastal targets)
2. Sustainability of agricultural areas (drainage discharge dominated areas)
3. N-losses by drainage - quantitative significant
4. Quantitative environmental impact on coastal water (N)



Case: Mitigation strategy – Norsminde Fjord catchment



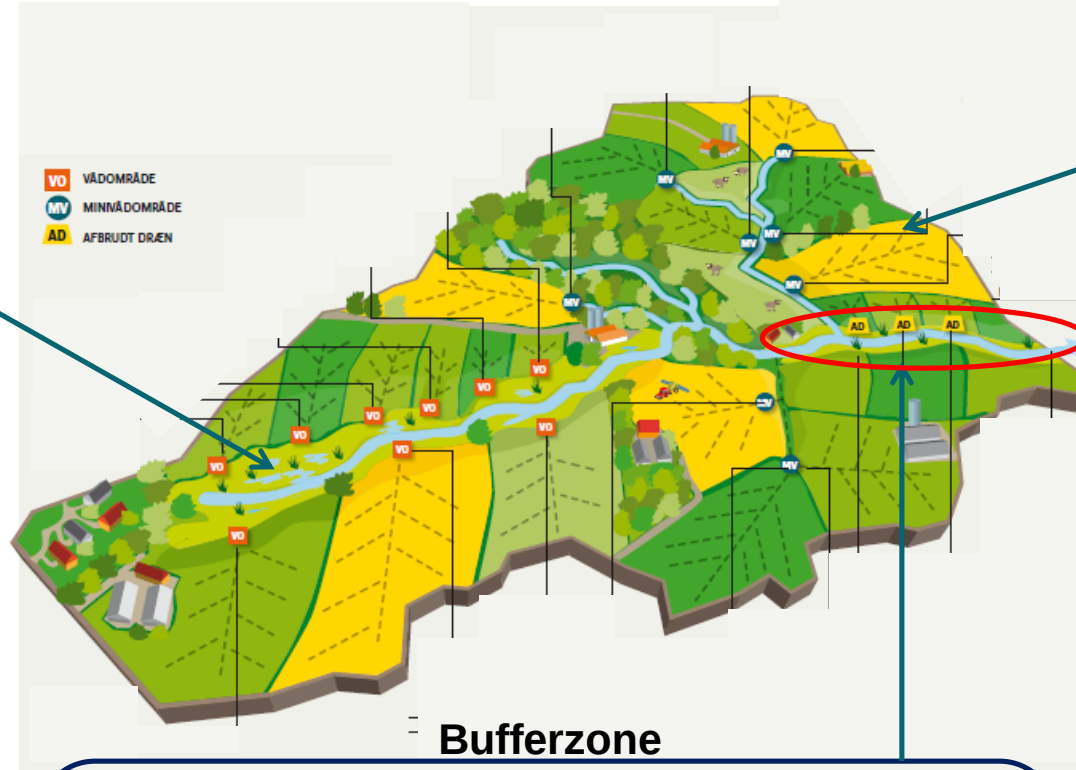
Catchment (10.100 ha) including six ID15 subcatchments (1500 ha units)

ID15 subcatchment	Suitable for CWS (%)	Upland drained to riparian lowland (%)	Riparian lowland (%)
43600028	61	4,4	16
43600041	50	33	11
43600042	75	11	2,5
43600043	61	22	6,2
43600051	73	1,1	0,9
43602599	72	5,4	1,1
Total	4.815 (63)	1.224 (16)	541 (7)

Kjærgaard, C., Hoffmann, C.C., Iversen, B.V. 2017. Filtre i landskabet øger retentionen. I: Filtre i landskabet, Vand & Jord, nr. 3, s. 106-110

Visions for the targeted nutrient mitigation – restore landscape filters

Riparian lowland



Constructed wetlands

