Bilag 6.3

Kjærgaard, C. 2018. Targeted catchment mitigation planning. Indlæg ved WaterCoG knowledge exchange workshop, Odder, Denmark, d. 12-13. juni 2018

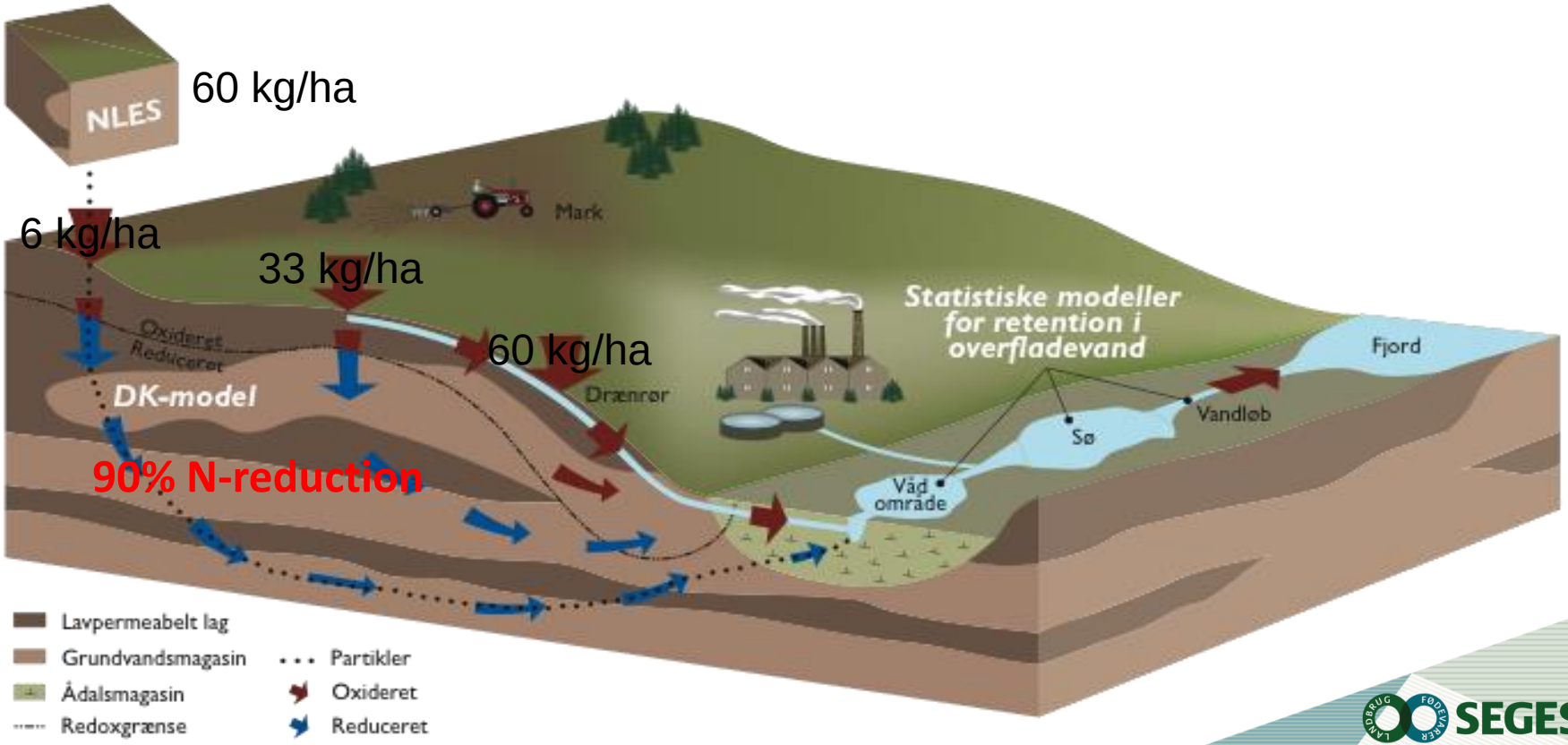
TARGETED CATCHMENT MITIGATION PLANNING

Charlotte Kjærgaard, Chief Scientist Environment, SEGES

WaterCoG konwledge exchange
June 12-13 2018, Odder, DK

SEGES

TARGETED ENVIRONMENTAL MITIGATION



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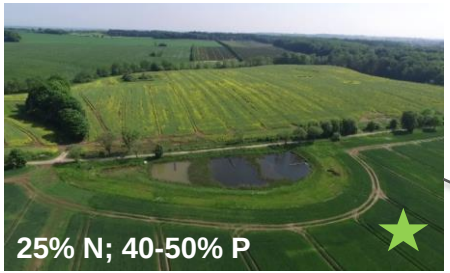
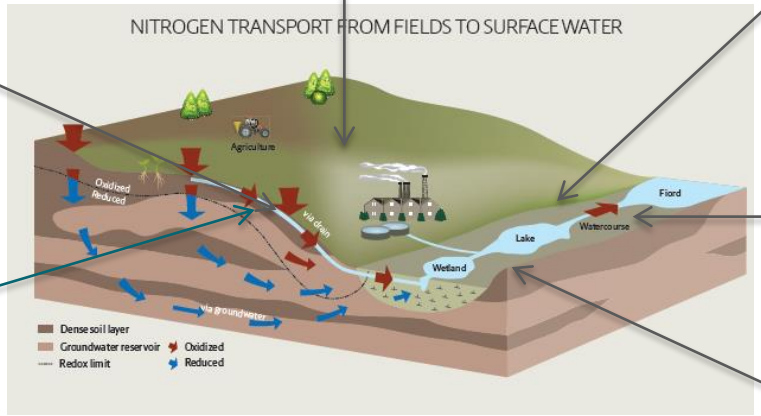
TARGETED MITIGATION MEASURES

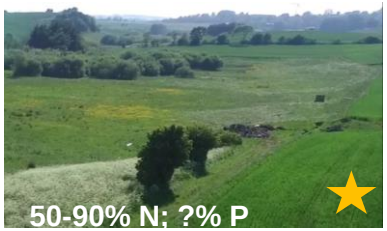
Constructed wetlands



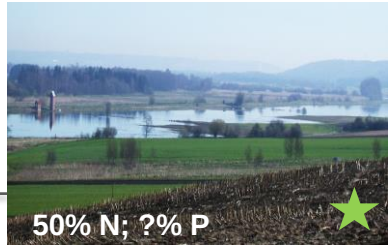
Small local in-field wetlands



Riparian lowlands



Drainage water infiltration



Riparian wetlands

Bufferzone along streams

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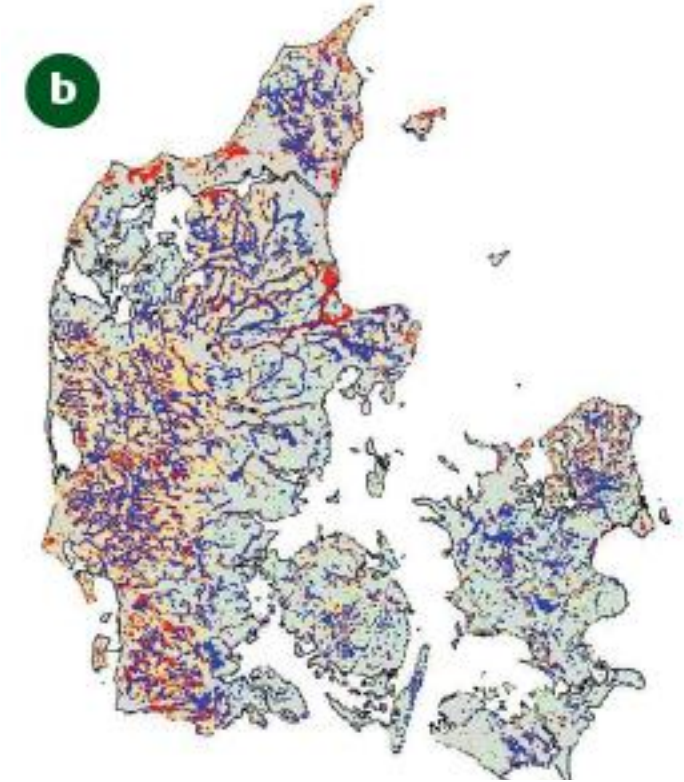
RIPARIAN LOWLAND

- Wetlands (existing mitigation measures)
- Disconnected tile drains and infiltration of drainage water (pt not accected measure)

RIPARIAN LOWLAND



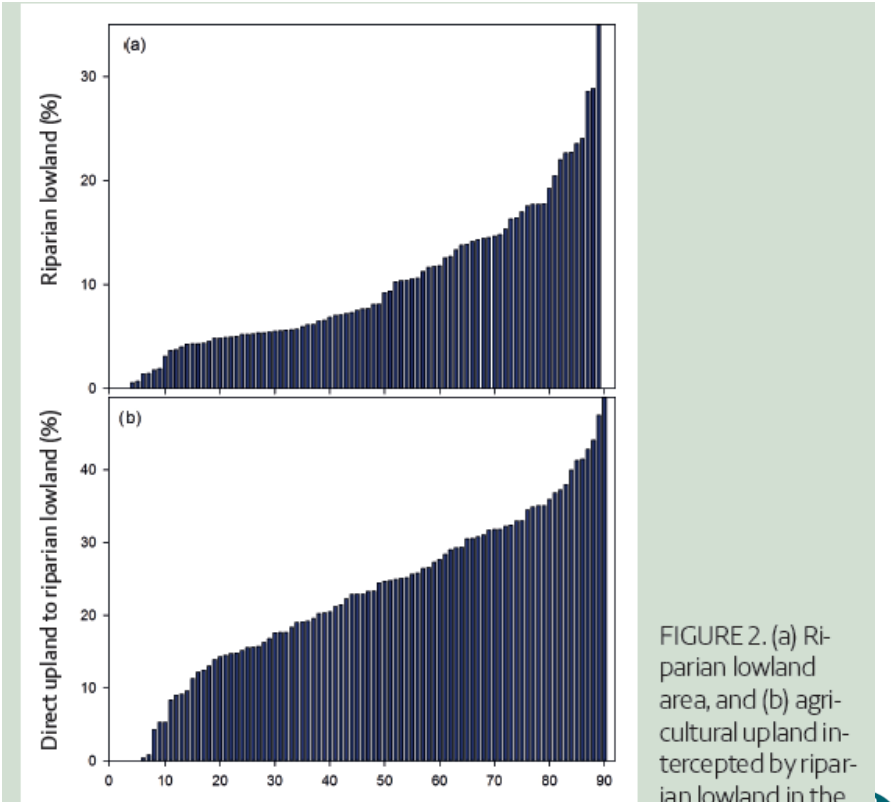
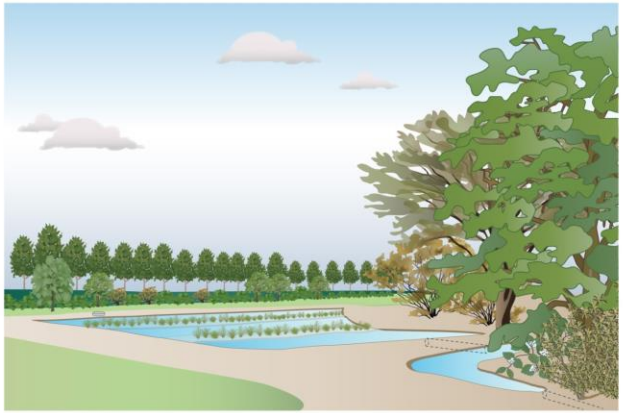
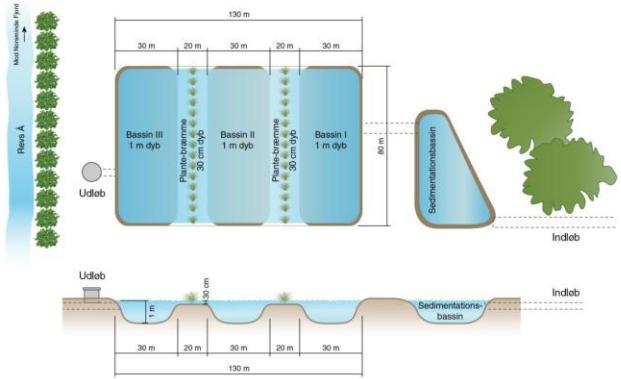


FIGURE 2. (a) Riparian lowland area, and (b) agricultural upland intercepted by riparian lowland in the

Kjærgaard & Hørfarter, 2018. Potential significance of riparian lowlands on nitrogen fluxes from agricultural drainage in Danish watersheds. Presentation BONUS, Gdansk, Polen 14-16, March 2018.

SURFACE-FLOW CONSTRUCTED WETLANDS



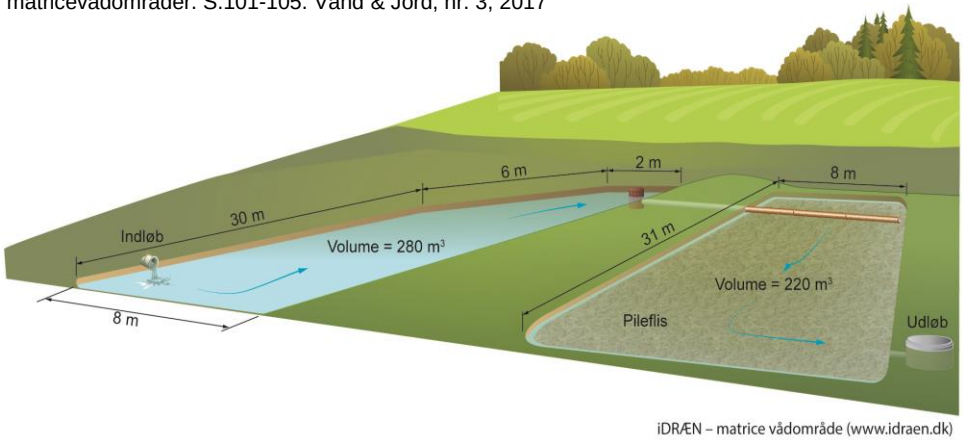


Size: 1% of drained catchment
Yearly N-reduction: 20-30%
Yearly P-reduction: 30-80%
Sediment retention

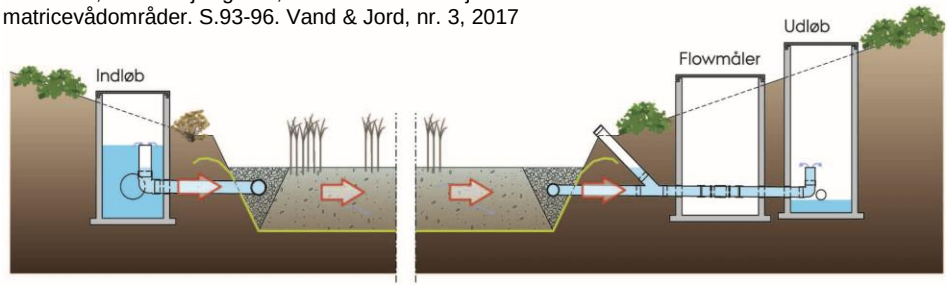
Kjærgaard, C., Hoffmann, C.C., Gertz, F., Iversen, B.V. 2017. Minivådområder – Et nyt kollektivt virkemiddel. S.84-88. Vand & Jord, nr. 3, 2017

SUBSURFACE-FLOW CONSTRUCTED WETLANDS

Hoffmann, C.C. & Kjærgaard, C. 2017. Optimeret kvælstoffjernelse i matricevådområder. S.101-105. Vand & Jord, nr. 3, 2017



Hoffmann, C.C. & Kjærgaard, C. 2017. Kvælstoffjernelse i matricevådområder. S.93-96. Vand & Jord, nr. 3, 2017



Size: 0,2-0,25% of drained catchment
Yearly N-reduction: 50-75%
Yealy P-reduction: N.D.
Sediment reduction

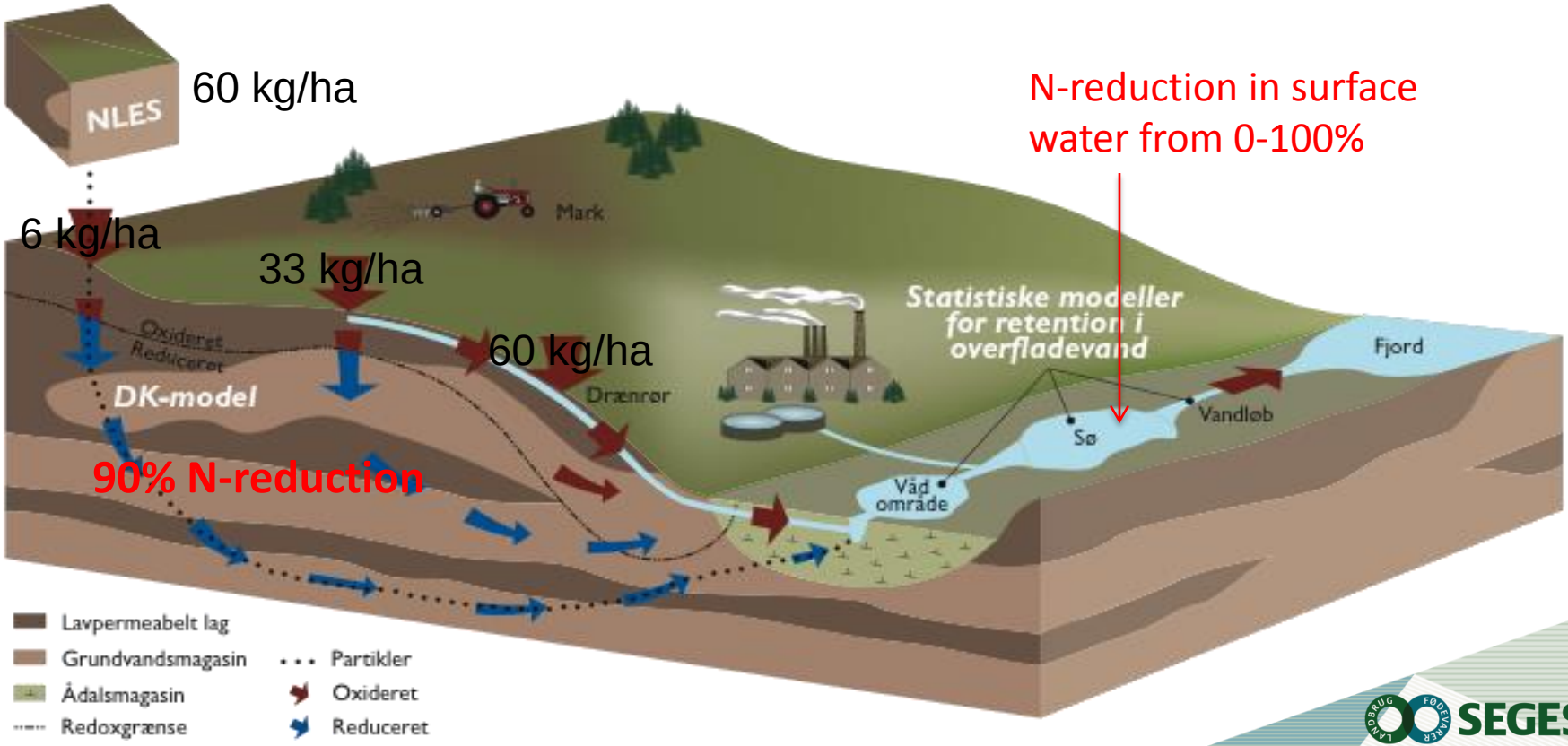
STRATEGY FOR IMPLEMENTING TARGETED MEASURES

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

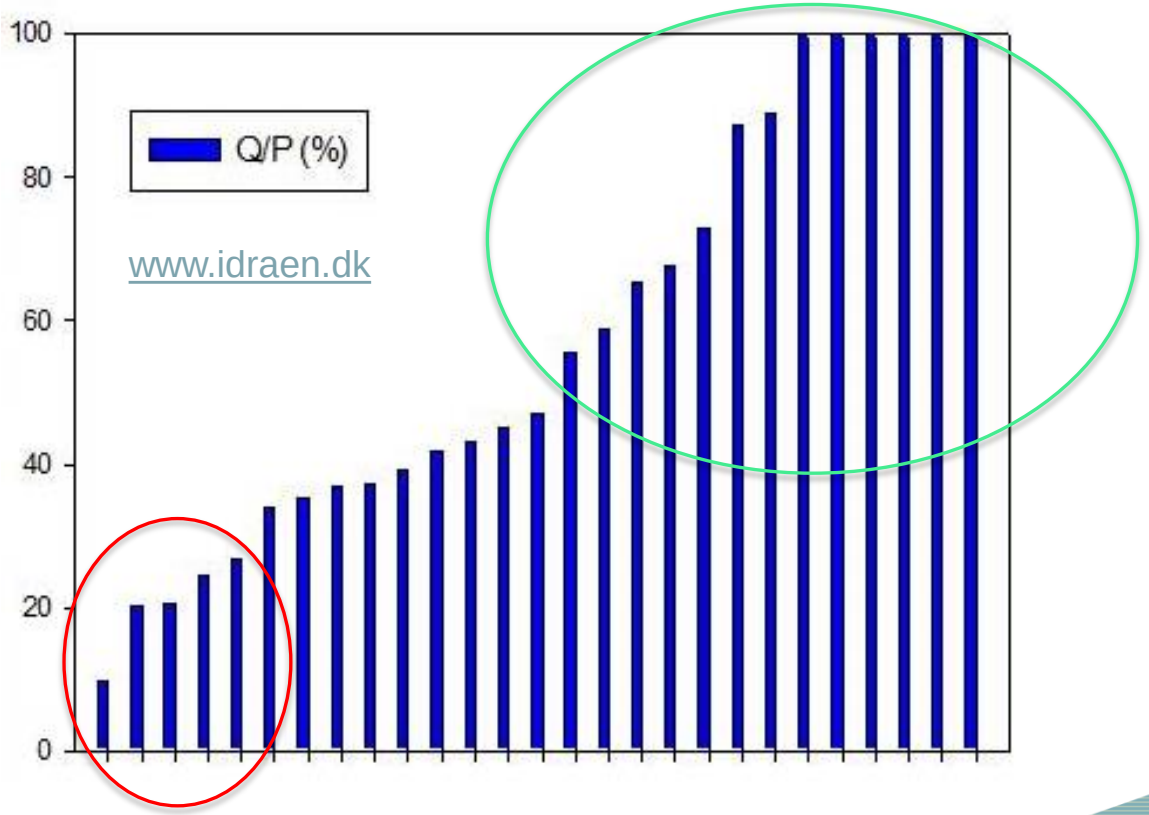
Criteria

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

TARGETED ENVIRONMENTAL MITIGATION



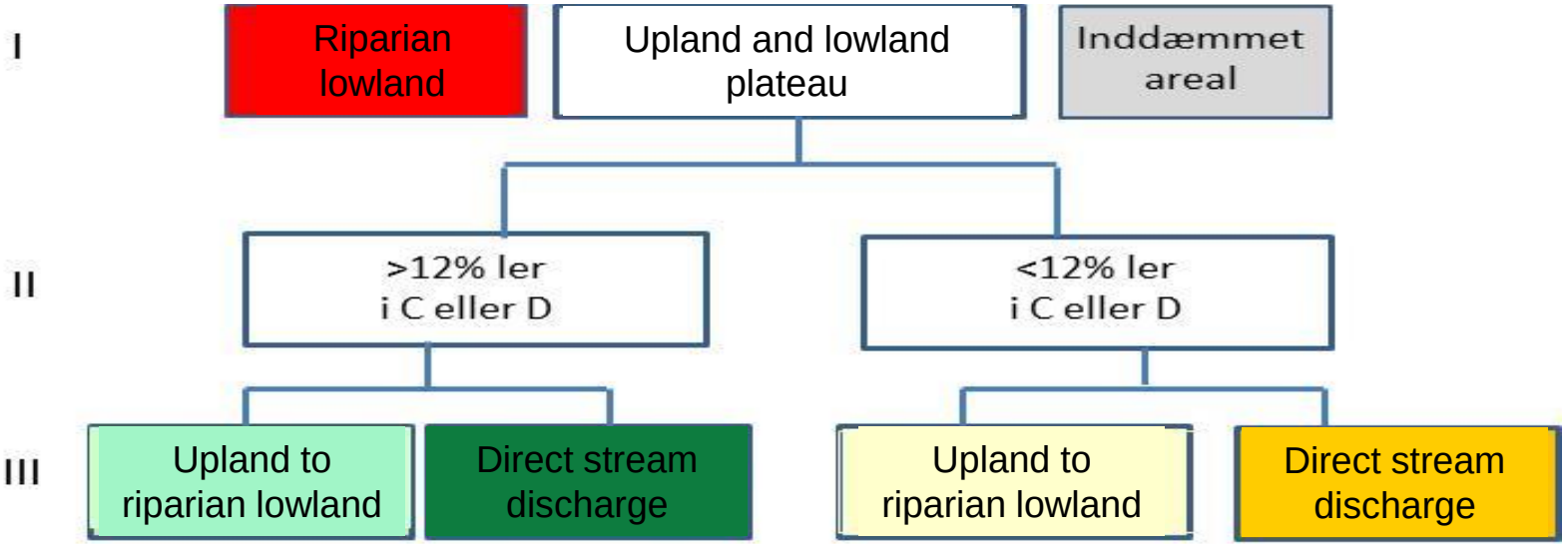
DRAINAGE DISCHARGE PERCENTAGE



Drainage dominated

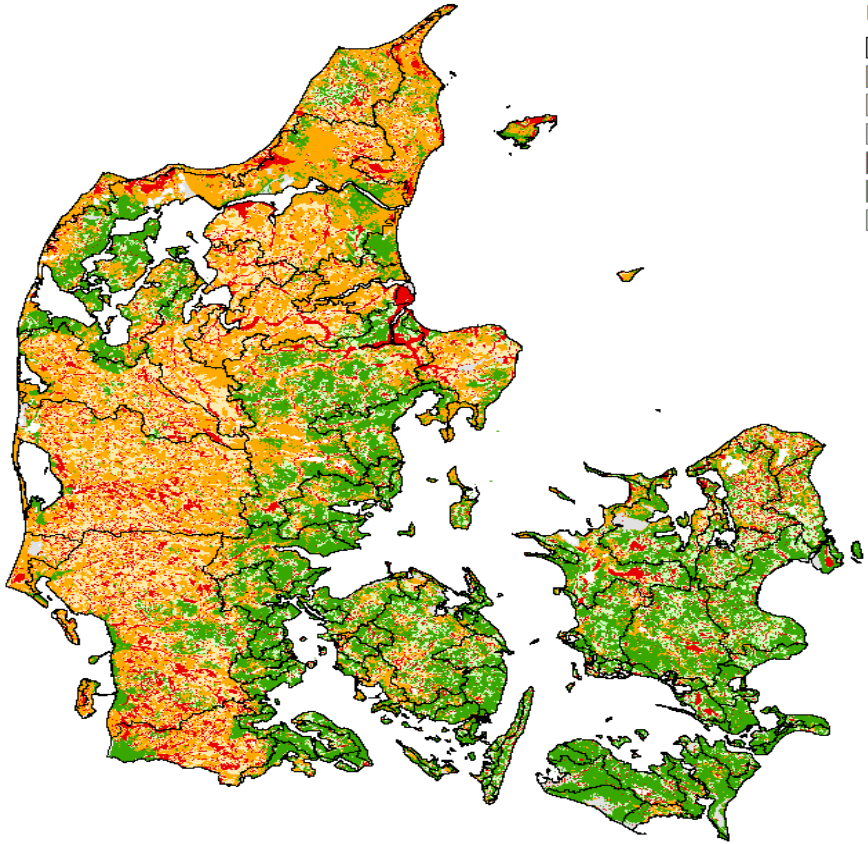
Groundwater dominated

National constructed wetland suitability map



Kjærgaard, C., Bach, E.O., Greve, M.H., Iversen, B.V. 2017. Kortlægning af potentielle områder til etablering af konstruerede minivådområder. DCA – Nationalt Cetner for Fødevarer og Jordbrug, 15 s, 19. Maj, 2017.

National constructed wetland suitability map



Kjærgaard, C., Bach, E.O., Greve, M.H., Iversen, B.V. 2017. Kortlægning af potentielle områder til etablering af konstruerede minivådområder. DCA – Nationalt Cetner for Fødevarer og Jordbrug, 15 s, 19. Maj, 2017.

Catchment analysis Norsminde Fjord

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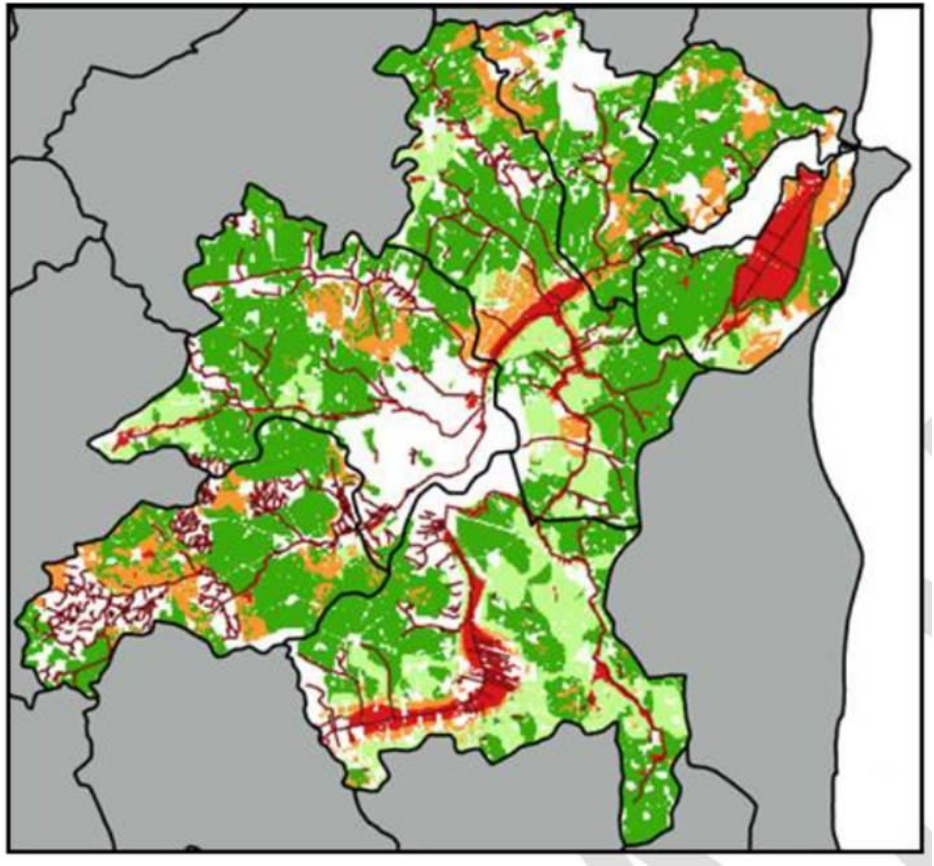


Areas suitable for riparian wetlands or constructed wetlands

Sub-catchments	Suitable constructed wetlands (%)	Upland 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)

Constructed wetlands

Riparian wetlands

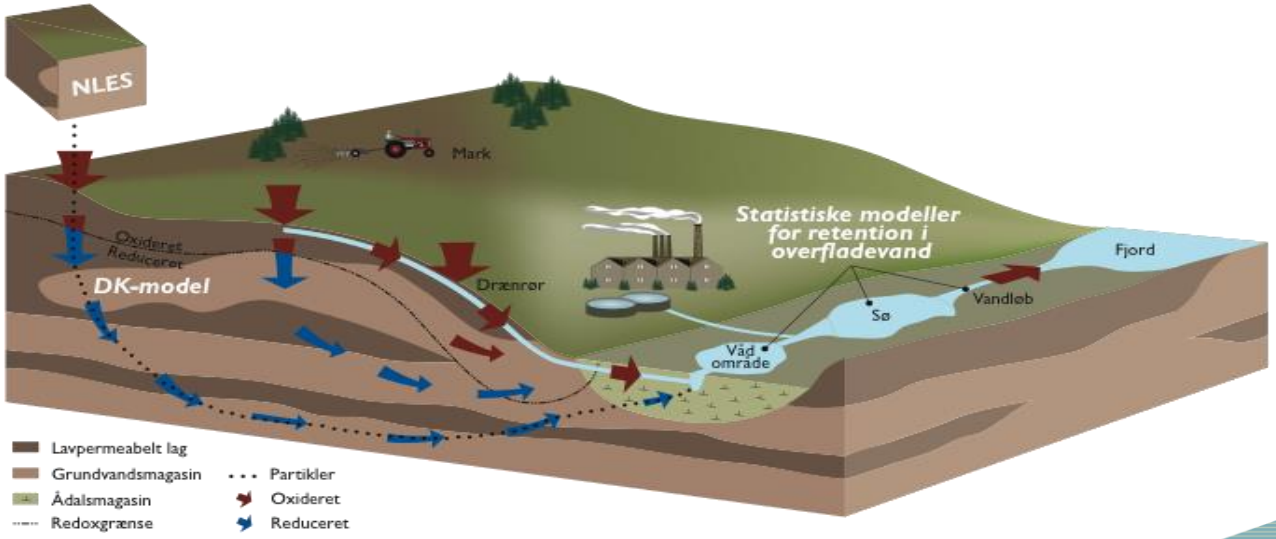
Kjærgaard, C., Hoffmann, C.C., Iversen, B.V. 2017. Filtre i landskabet øger retentionen. S.106-110. Vand & Jord, nr. 3, 2017

SEGES

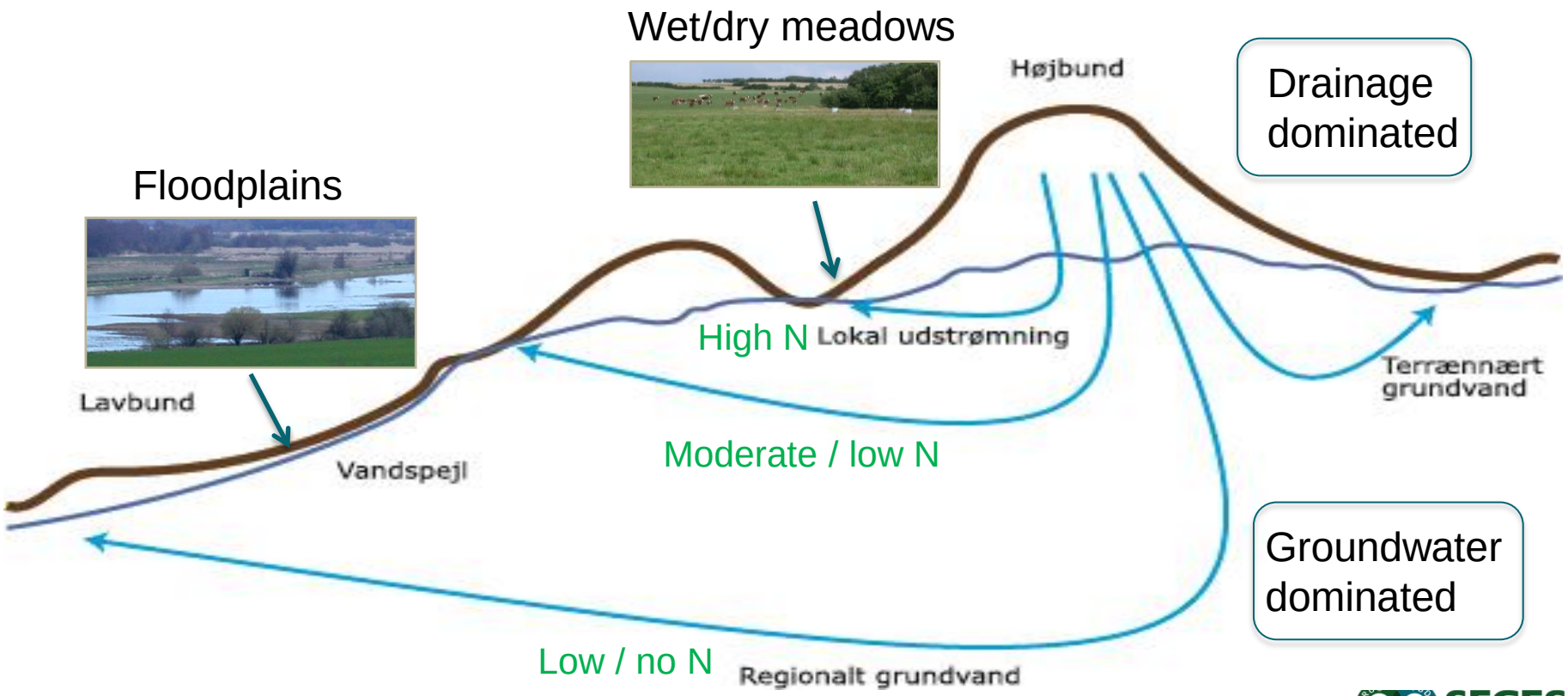
STRATEGY FOR IMPLEMENTING TARGETED MEASURES

Criteria

1. Suitability of agricultural areas (drainage discharge dominated areas)
2. **Nutrient losses by drainage - quantitative significant**
3. **Quantitative environmental impact on coastal water (N)**

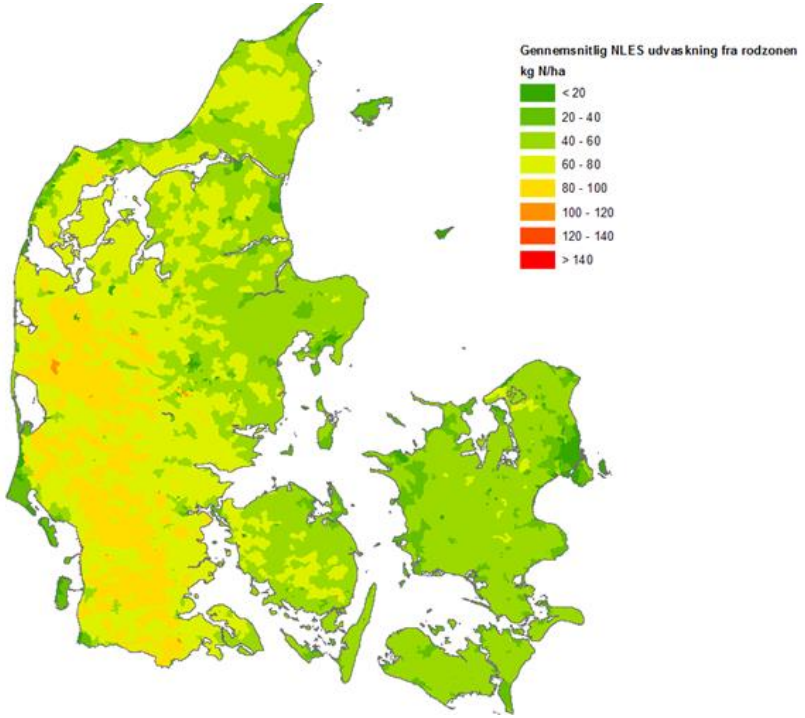


CATCHMENT ANALYSIS – WETLAND SUITABILITY

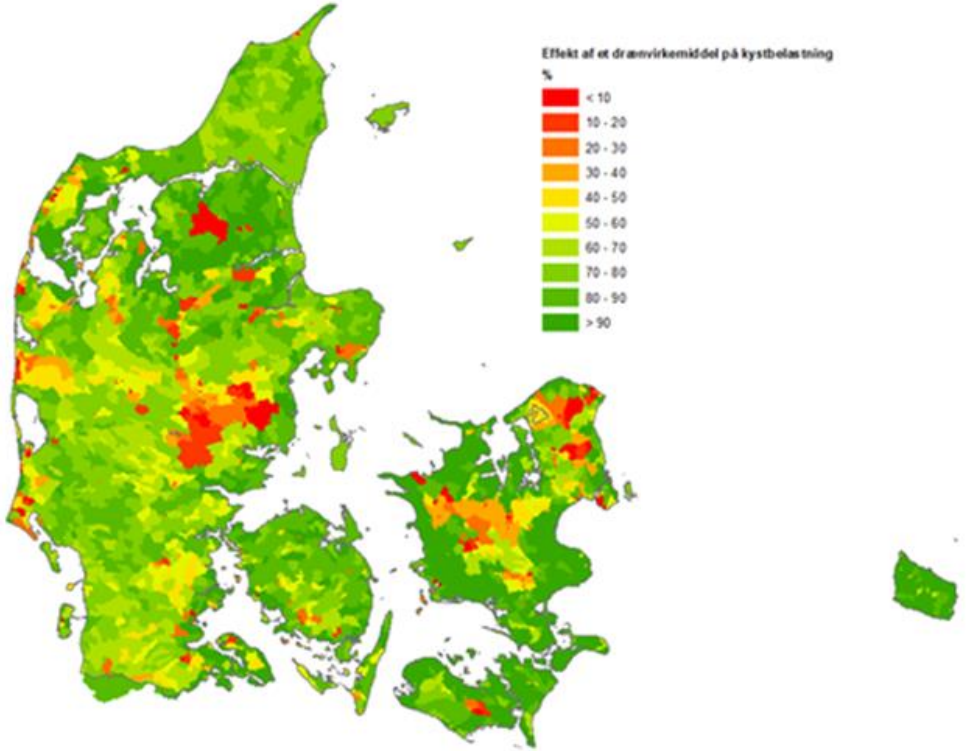


MITIGATION MEASURE IMPACT AT COAST

N-losses from rootzone

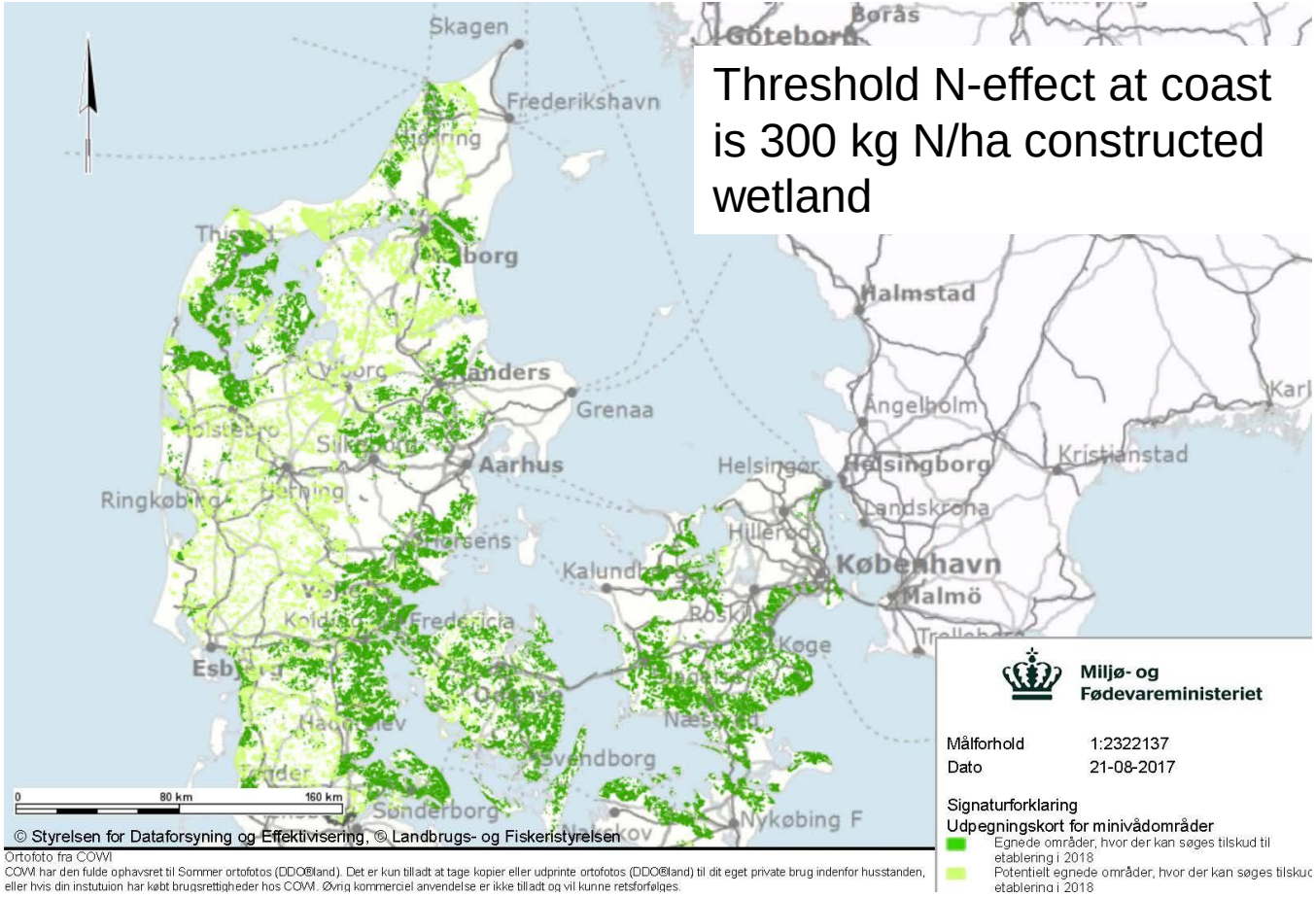


Effect of drainage measure at coast



Kjærgaard, C., Børgesen, C.D. 2017. Udarbejdelse af minivådområdeeffekt (kg N pr ha minivådområde) på ID15-oplandsniveau. DCA – Nationalt Cetner for Fødevarer og Jordbrug, 16 s, Nr. 2017-760-00042, 7. april 2017.

NATIONAL PRIORITY MAP CONSTRUCTED WETLANDS



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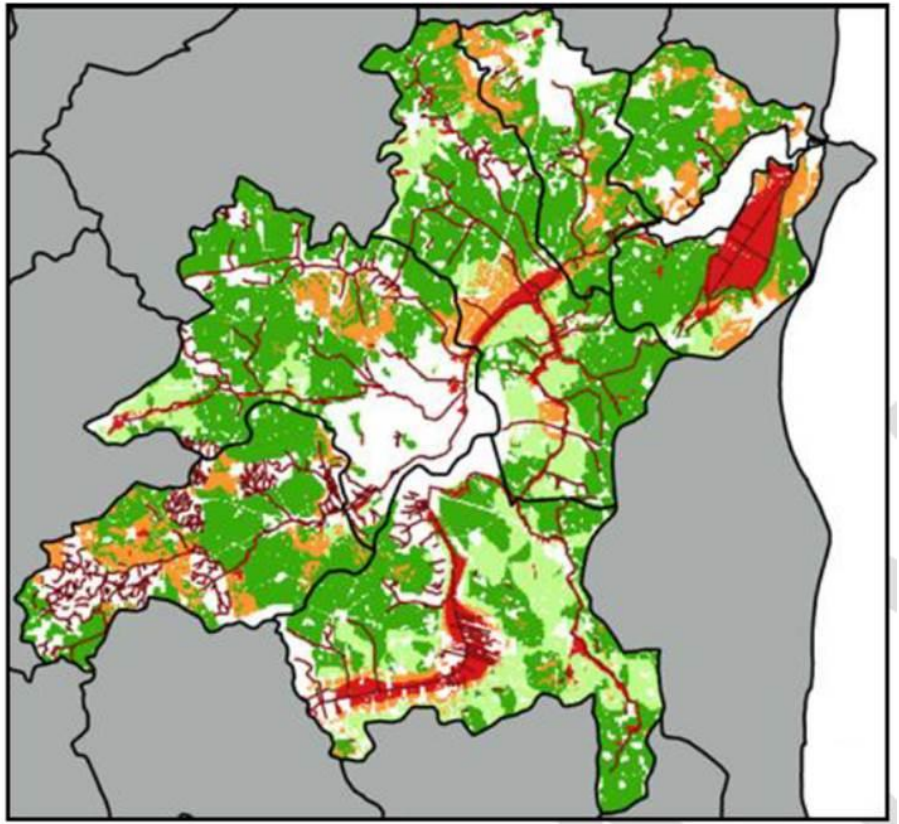
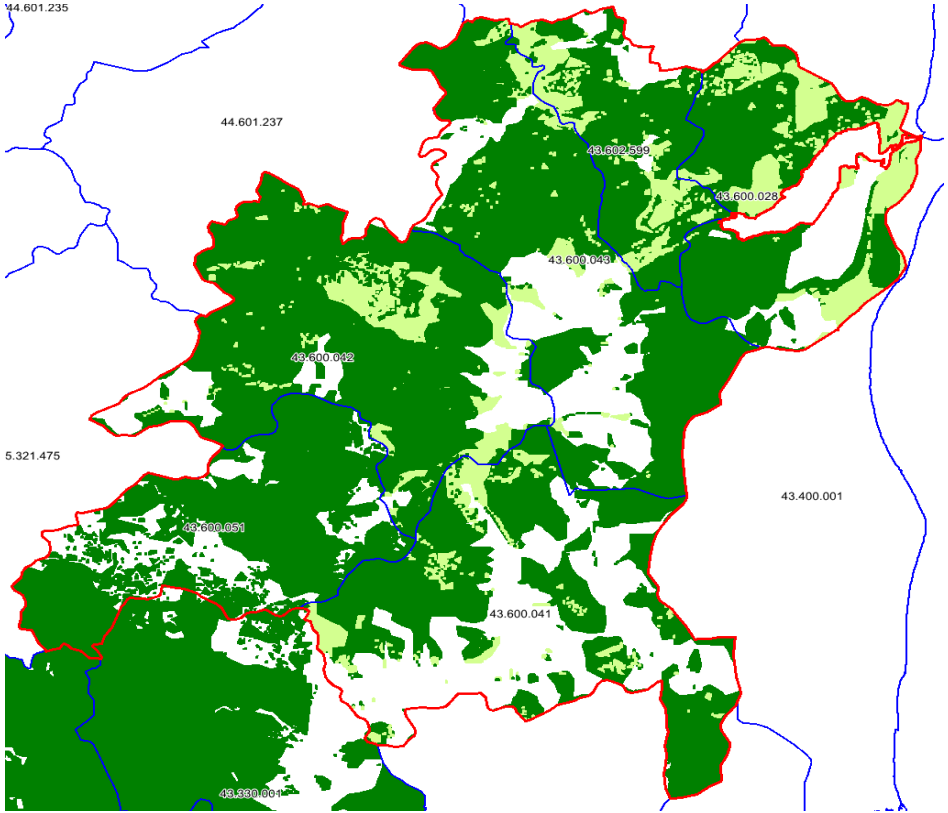
Targeted mitigation planning Norsminde





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

WETLANDS AS TARGETED DRAINAGE MEASURES

Mitigation measure	Position in landscape	Area required (%)	N-red. eff (%)	P-ret. eff (%)
Riparian wetlands	Riparian lowland	10*	50-100	Risk eval.
Surface-flow constructed wetlands	Upland	1	20-30	30-80
Subsurface-flow constructed wetlands	Upland	0,2-0,25**	50-70	N.A.

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

Mitigation potential Norsminde Fjord

Scenario	Measure	Area	Drainage catchment	Yearly N-effect	Area norm N-effect	Mitigation potential	
		ha	ha	Ton N/yr	Kg N/ha	Ton N/yr	Ton P/yr
0	Baseline					173	4,7
1	Riparian wetlands	122	1.224	18-35	148-287	+	Risk eval.
2	Surface-flow CW	48	4.815	51	1.063	69-86 (40-50%)	1.9-2.4 (43-54%)
3	Subsurface-flow CW	12	4.815	95	7.917	113-130 (67-75%)	N.D.

Correcting N-loads to coast for surface-water N-reduction

- Current N-load: 23 kg N/ha/yr
- Scenario 2: 12-14 kg N/ha/yr
- Scenario 3: 6-8 kg N/ha/yr

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


Constructed wetlands are cost-efficient measures for reducing agricultural drainage losses
Foto: Charlotte Kjærgaard