

Innovationscenter
for Økologisk Landbrug

From field to fjord

Nitrogen regulation, field measures and
cropping systems

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Programme

Reduce nitrogen loss to the Limfjord catchment by:

- Increasing nitrogen retention in the landscape
- 🌱 Reducing nitrogen leaching on fields
- 🌱 Introducing regulation: Nitrogen quotas

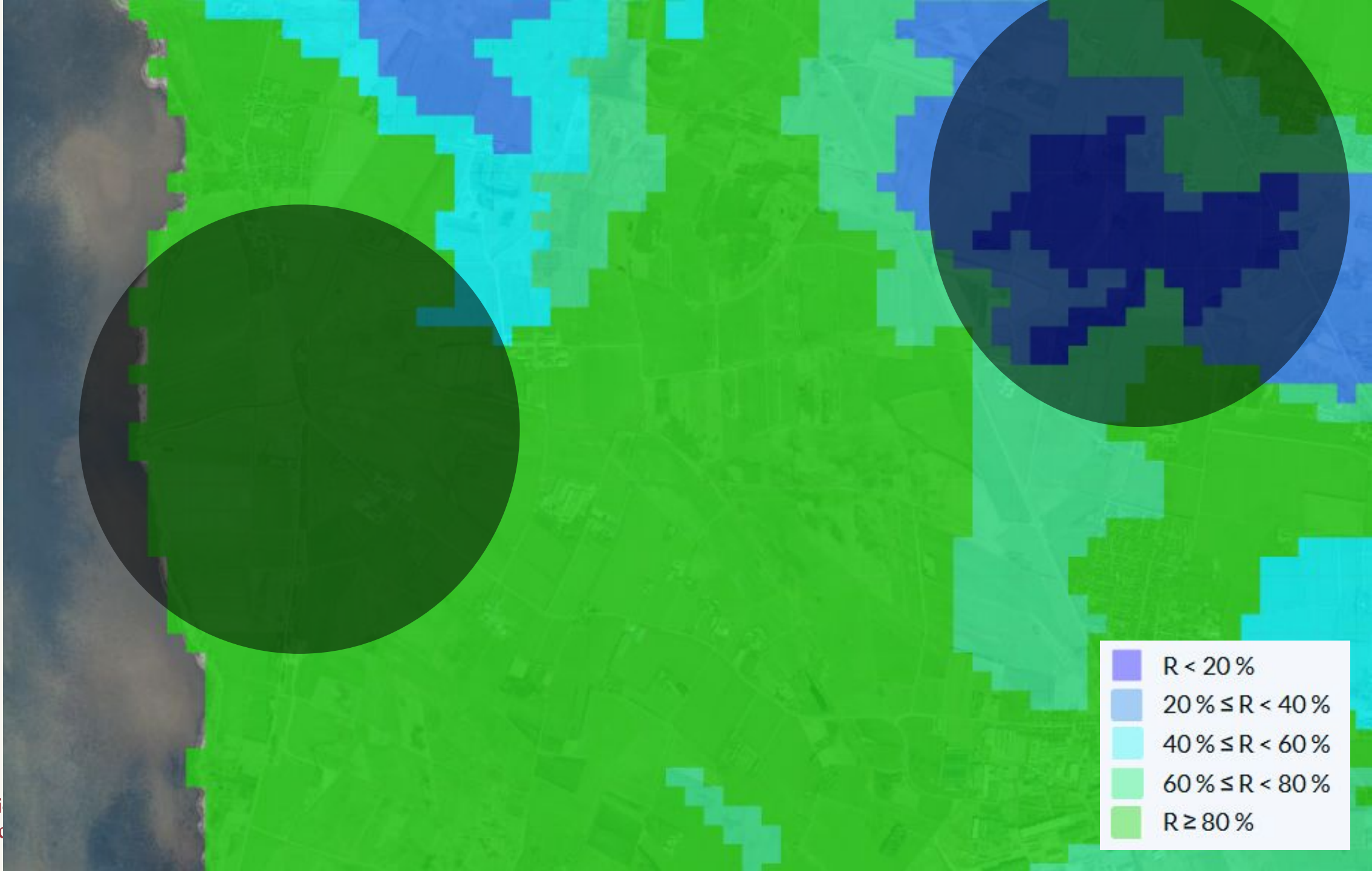


Retention links nitrogen loss from fields to fjord

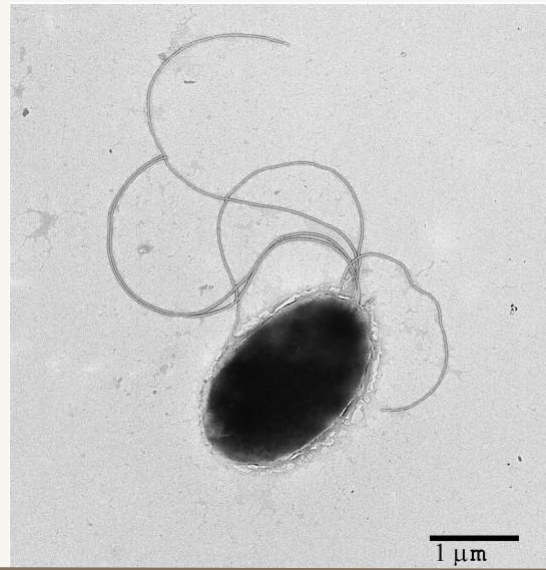
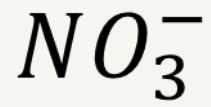




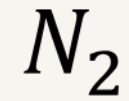
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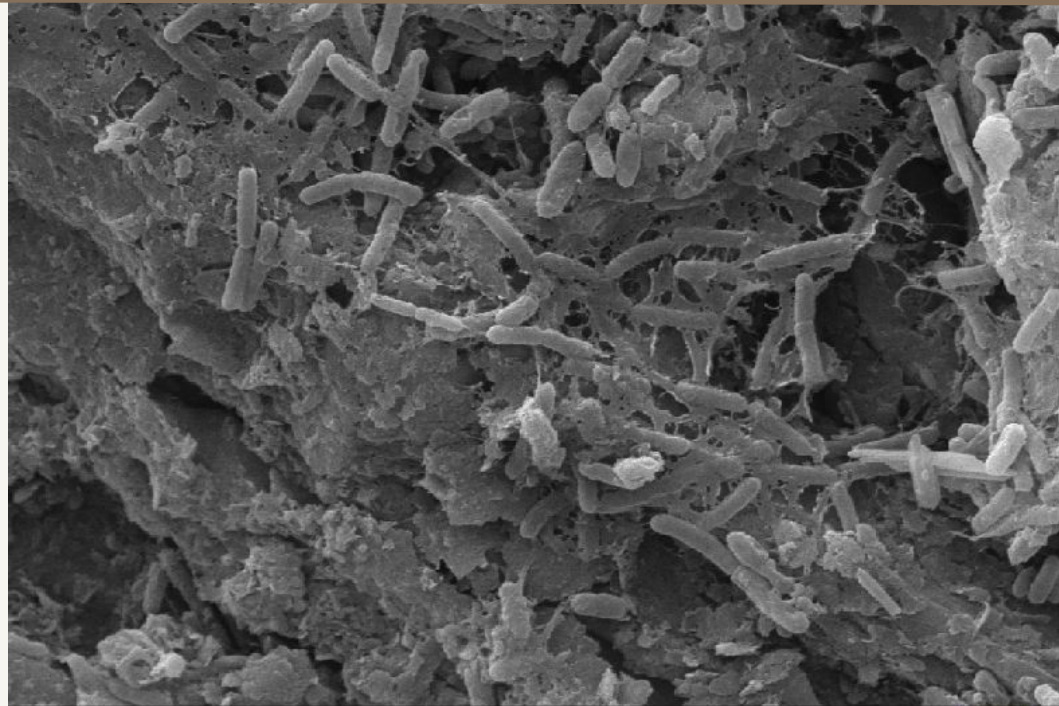
Denitrification



Pseudomonas



Basillus



2 μm

EHT = 20.00 kV

WD = 11.5 mm

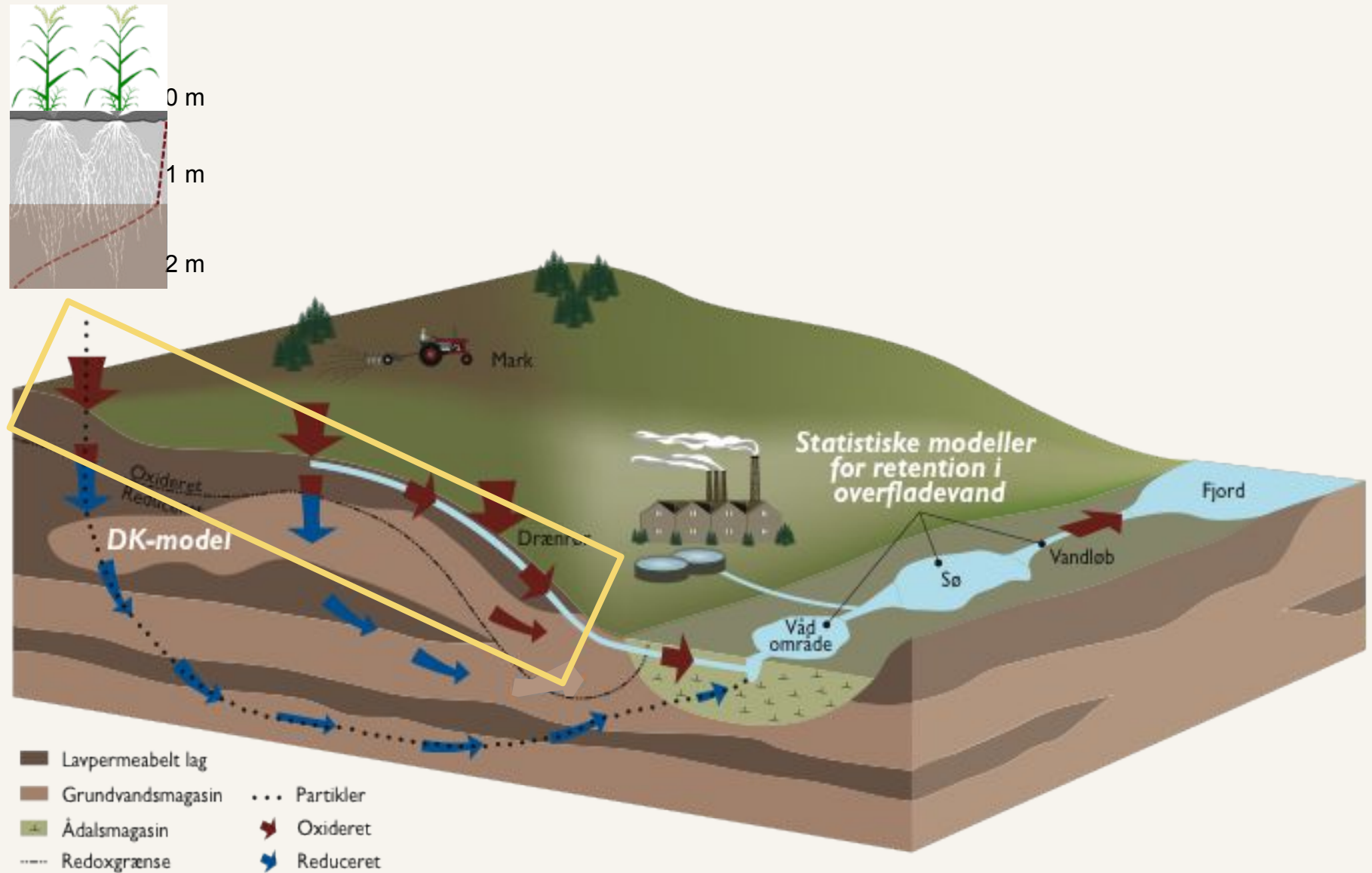
Mag = 10.69 K X



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Altaf, Musheer & Ahmad, Iqbal & Khan, mohd & Grohmann, Elisabeth. (2017). Bacillus Biofilms and Their Role in Plant Health. 10.1002/9781119246329.ch4.

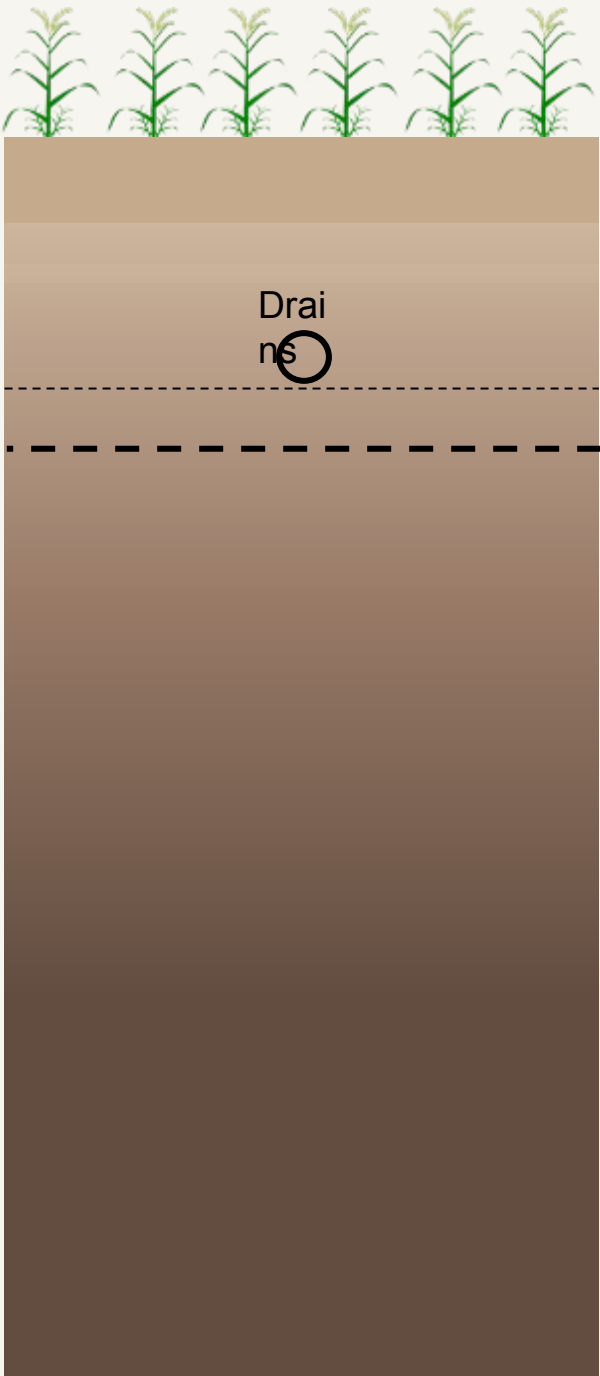
Nitrogen transport and retention

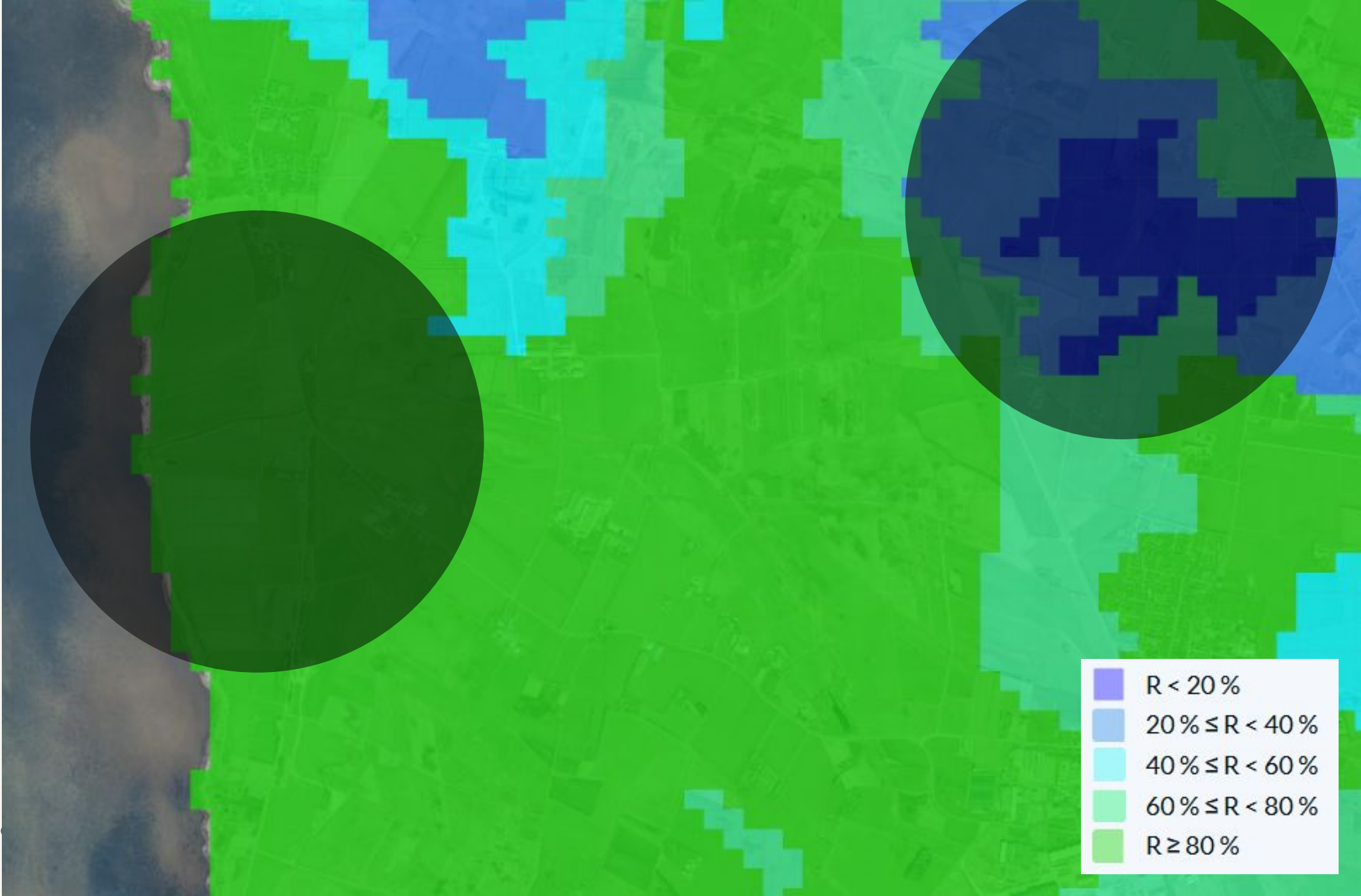


Soil redox conditions

Oxidised
Reducing

Reduced







Field measures must reduce root-zone leaching

-  The root zone is the soil layer where crop roots take up water and nutrients
-  Nitrogen leaving the root zone is lost to the crop
-  From here, it can move towards drains, streams and the fjord



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Mechanisms controlling leaching

- Net nitrogen mineralisation
- Percolation
- Nitrogen uptake by crops and catch crops



FORÅR



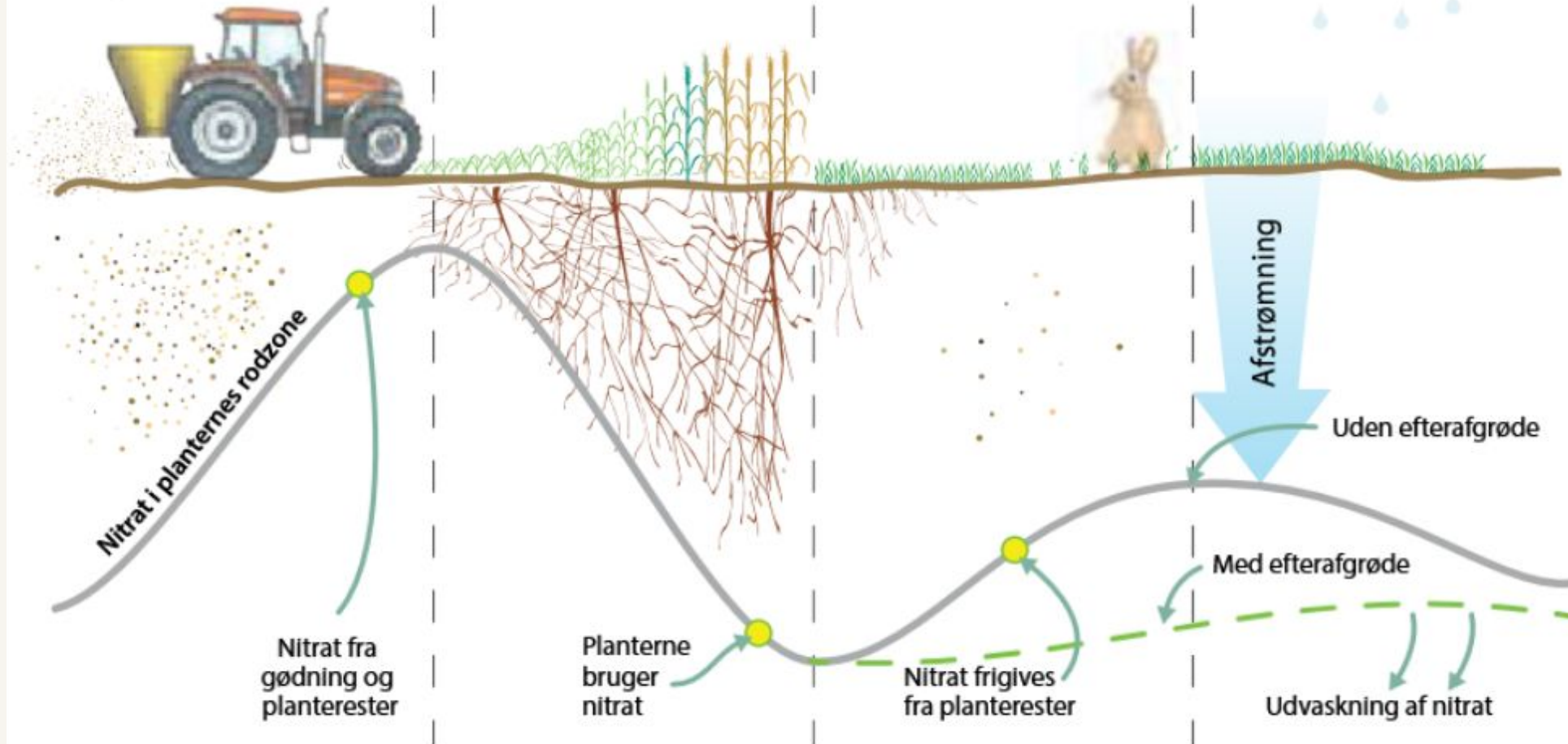
SOMMER



EFTERÅR



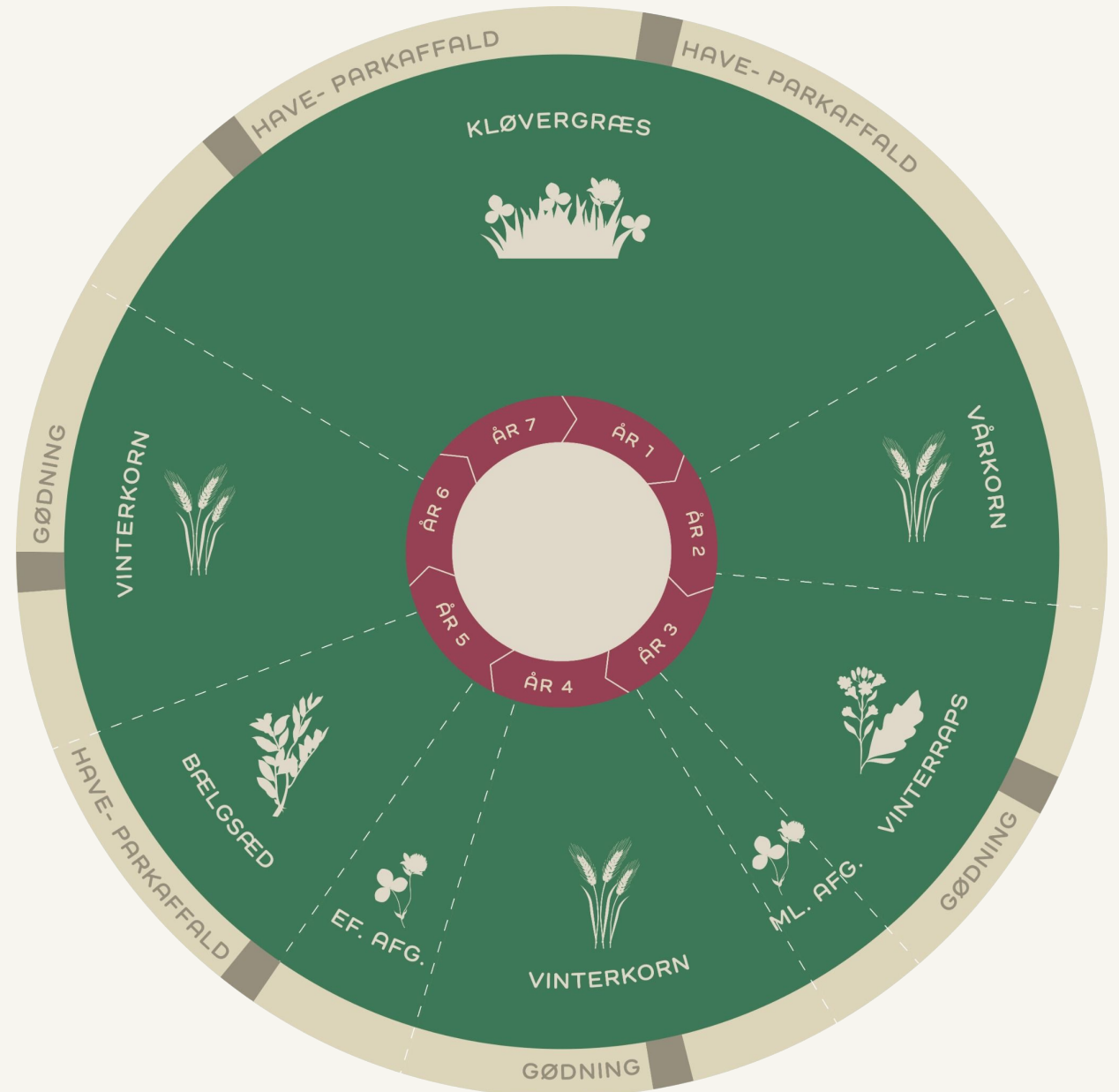
VINTER



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Periods with potential mineralisation, little or no crop growth and rainfall are critical

-  Crop ripening in summer and early autumn
-  Autumn or winter after harvest with little or no winter cover
-  Crops or cropping systems requiring intensive tillage



Managing soil nitrogen pools is crucial

-  Built up substantially by some crops
-  Depleted effectively by others



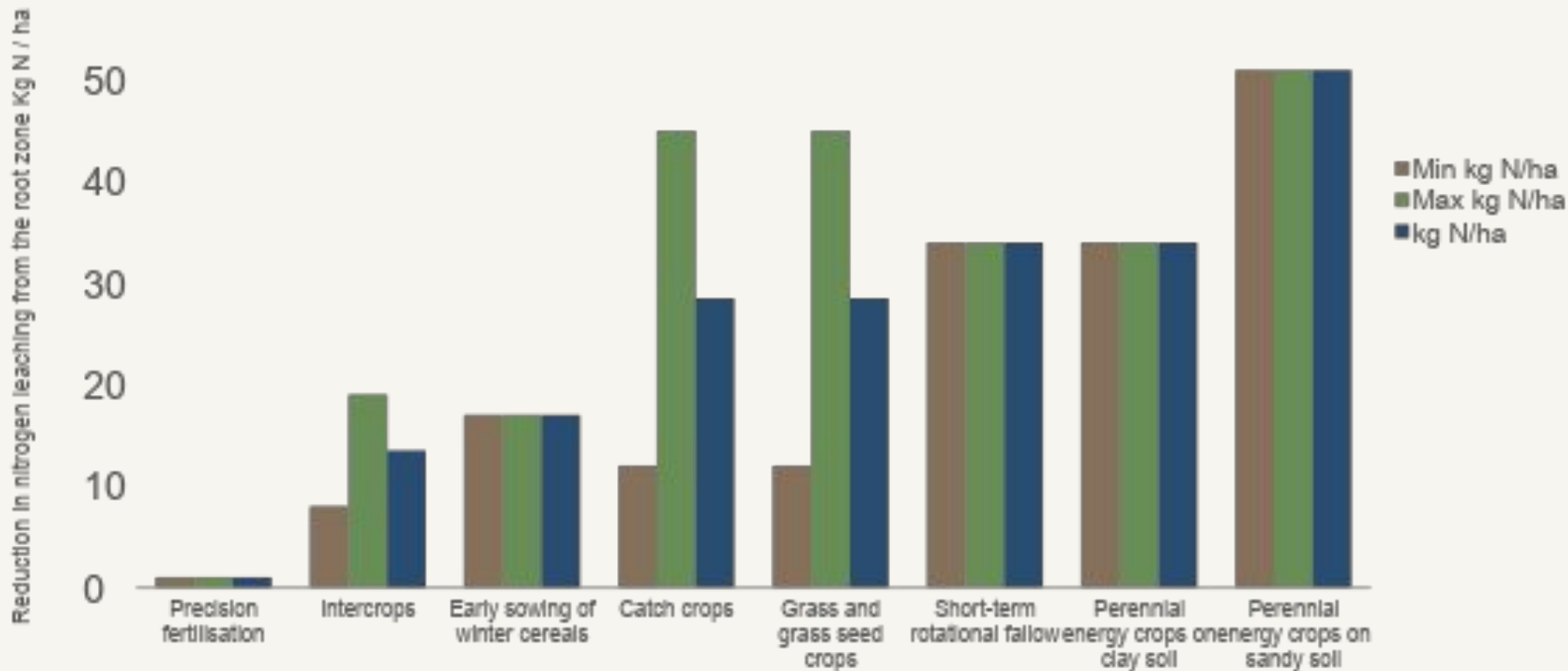
So, the crops themselves are crucial, but their sequence is equally important



Crop rotation, crop rotation, crop rotation



Effects of area-based measures



Measures

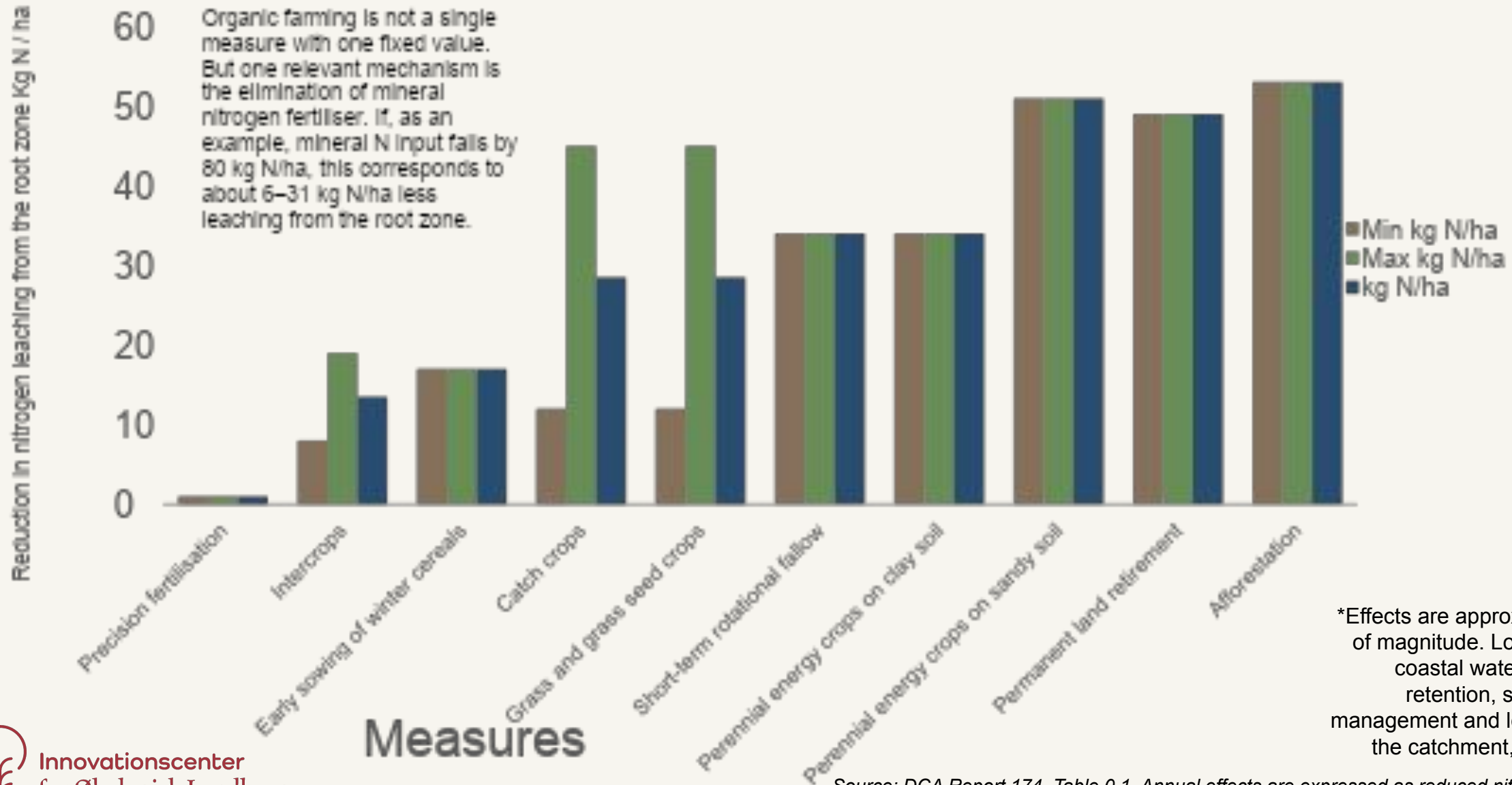
*Effects are approximate orders of magnitude. Local effects on coastal waters depend on retention, soil type, crop, management and location within the catchment, among other factors.

Source: DCA Report 174, Table 0.1. Annual effects are expressed as reduced nitrogen leaching from the root zone and depend on baseline practice, soil type and growing conditions.



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Effects of area-based measures



Field measures rarely work in isolation

➤ Their effect depends on their role in the whole crop rotation and farm management.

➤ Example: Cattle farm on irrigated sandy soil

Cattle farm on irrigated sandy soil in southwest Jutland

Rotations

Grass–clover	Grass–clover	Grass–clover	Grass–clover	
Grass–clover	Grass–clover	Grass–clover	Grass–clover	
Maize + CC	Grass–clover	Grass–clover	Maize + CC	
S. oats + stubble till.	Green crop + lt. ryegr.	Grass–clover	Maize + CC	
Faba beans + CC	S. oats + CC	Green crop + lt. ryegr.	Maize + CC	
S. barley + cl. und.	Maize + CC	S. oats + IC	Maize + CC	
	Pea silage + cl. und.	W. rye + CC	S. barley + cl. und.	
		Pea silage + cl. und.		
Applied Kg N / ha	140 total N	140 total N	140 total N	170 total N + 53 mineral N
Leaching Kg N / ha	67 79%	46 54%	44 52%	85 100%

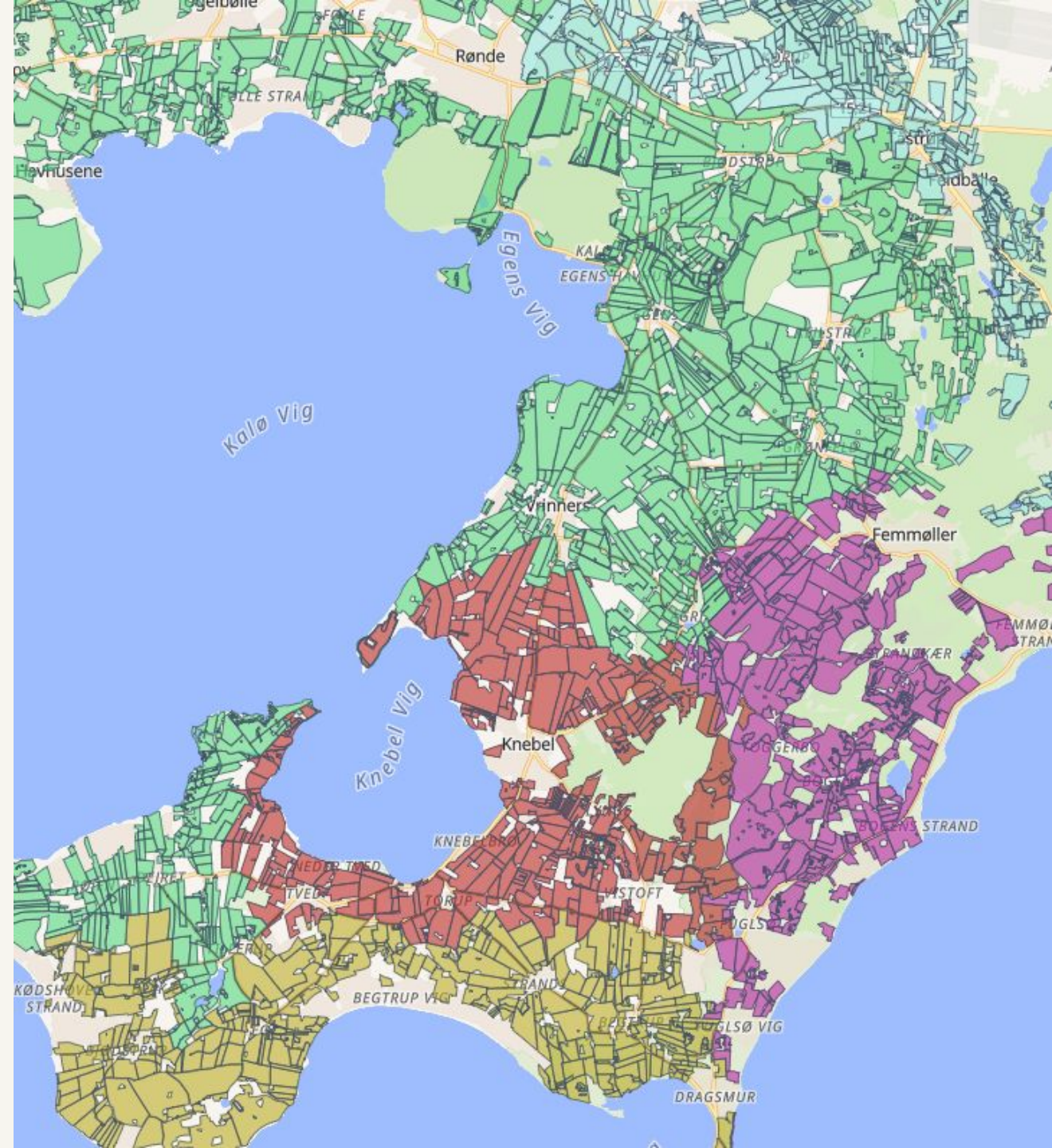
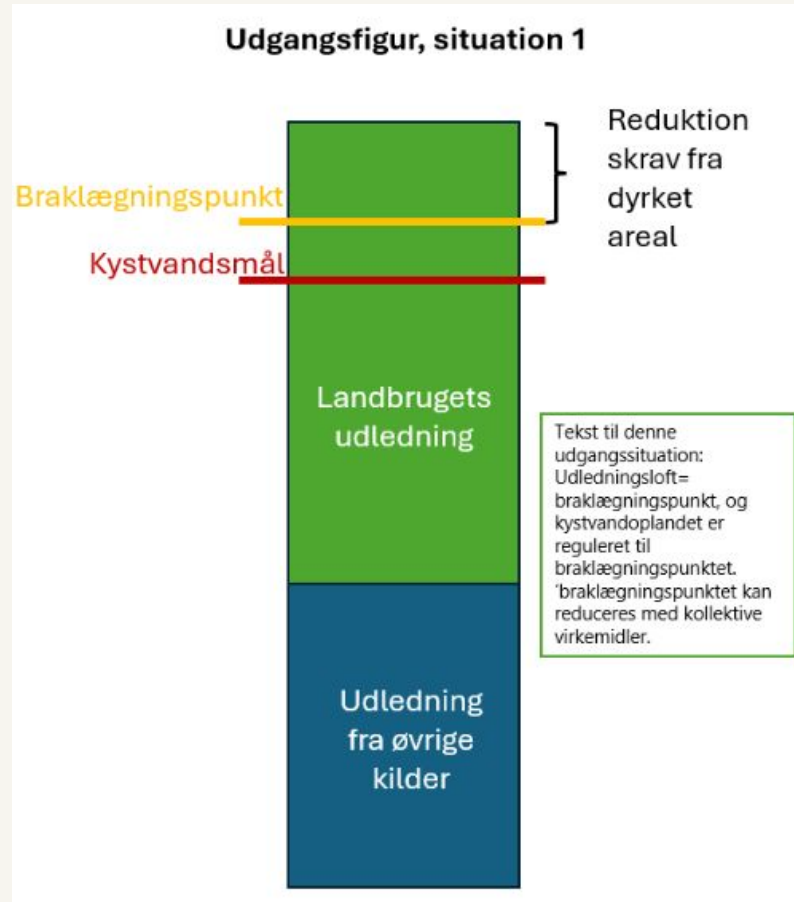
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Quotas are allocated by catchment



Quota allocation: VISA and/or FLAT

75% VISA and 25% FLAT was chosen

Udledningsloft 75 kg N
Fordeling med
VISA



Udledning
60 kg



Udledning
30 kg

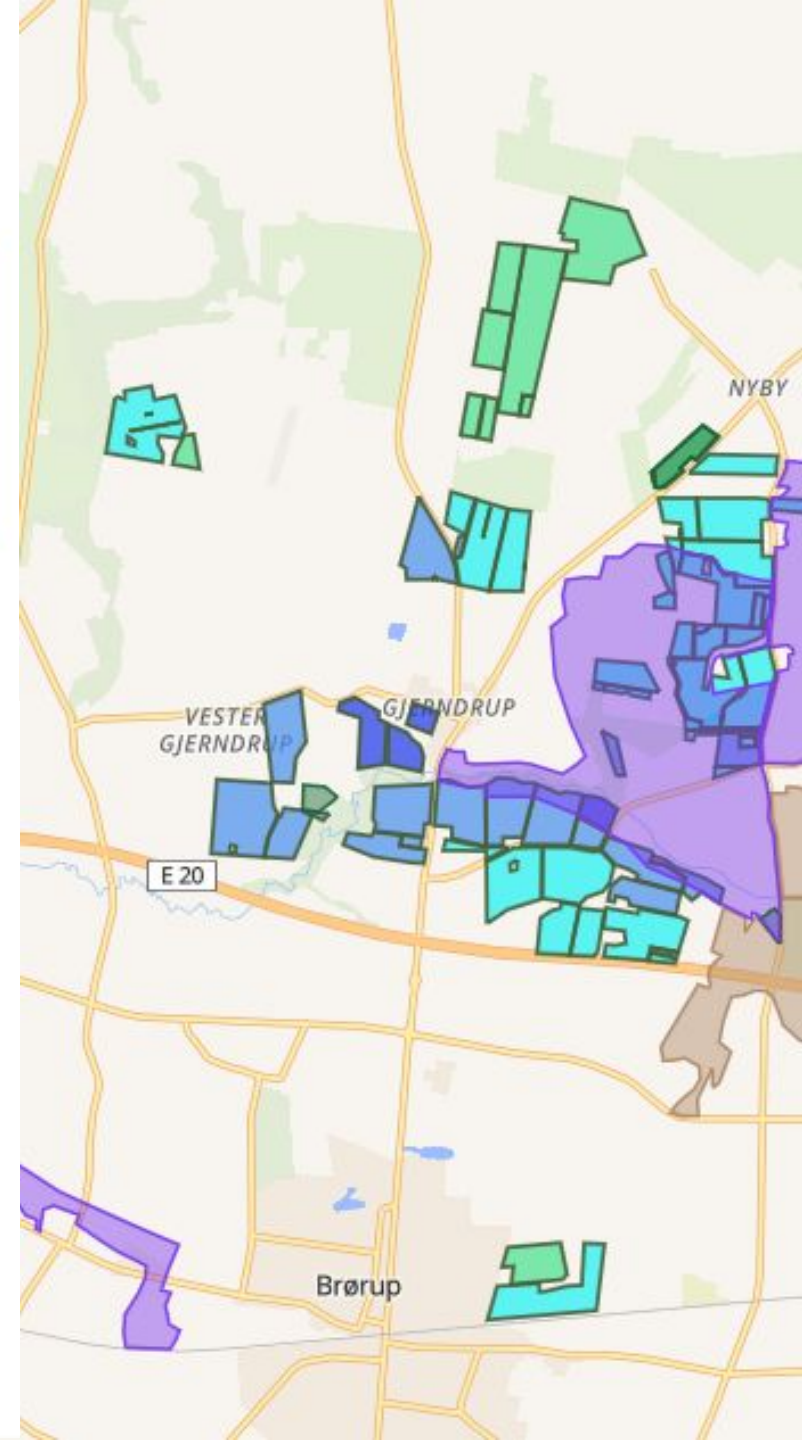
Udledningsloft 75 kg N
Fordeling med
FLAD



Udledning
60 kg



Udledning
30 kg



Three take-home messages

-  Retention can be changed and field location is crucial for nitrogen loss
-  Field measures work, with effects varying by crop rotation, soil type and management
-  Regulation on fields yield quotas and they are subject to political compromises.