

Impact of crop management on nutrient losses

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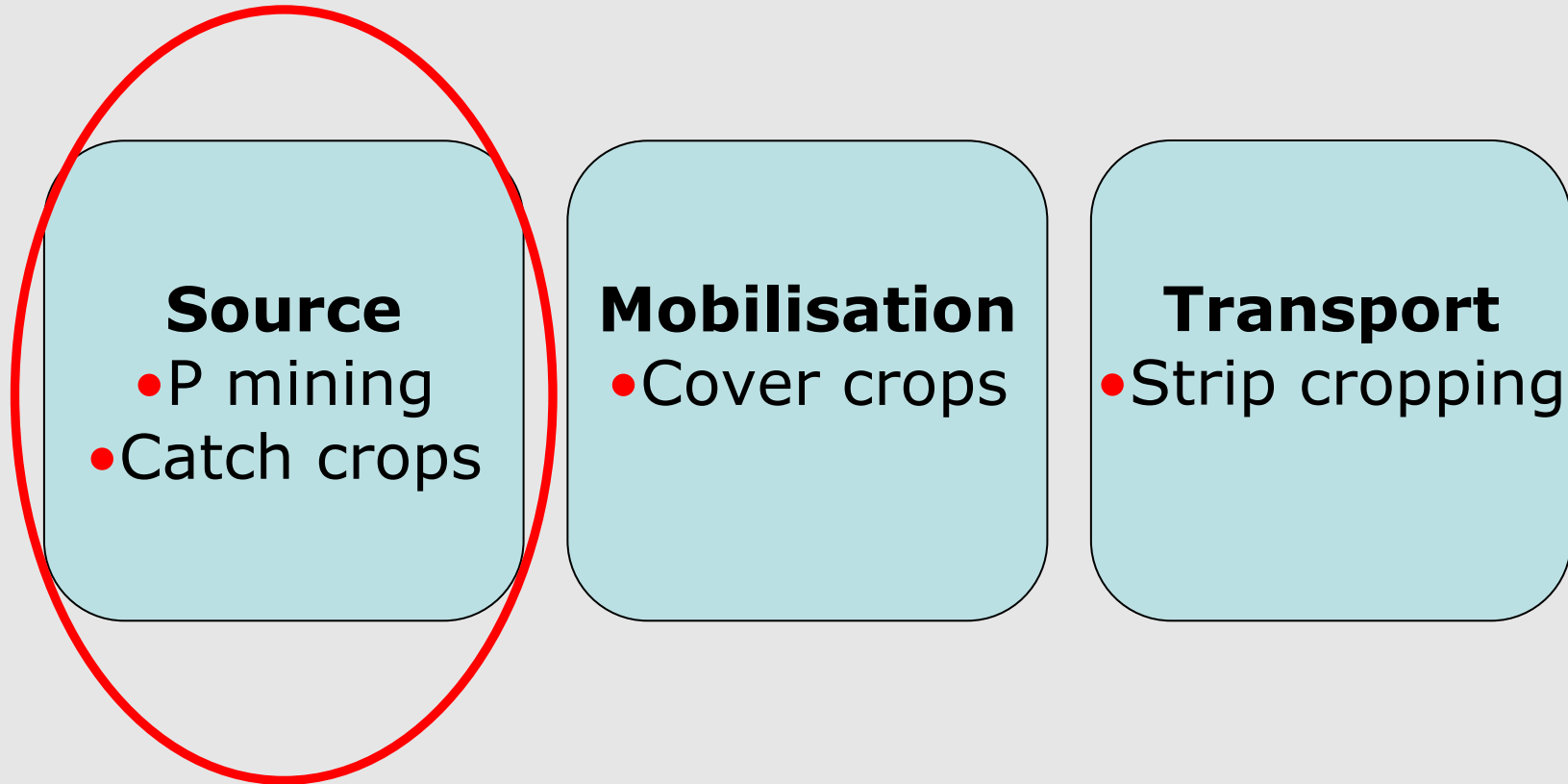


Outline

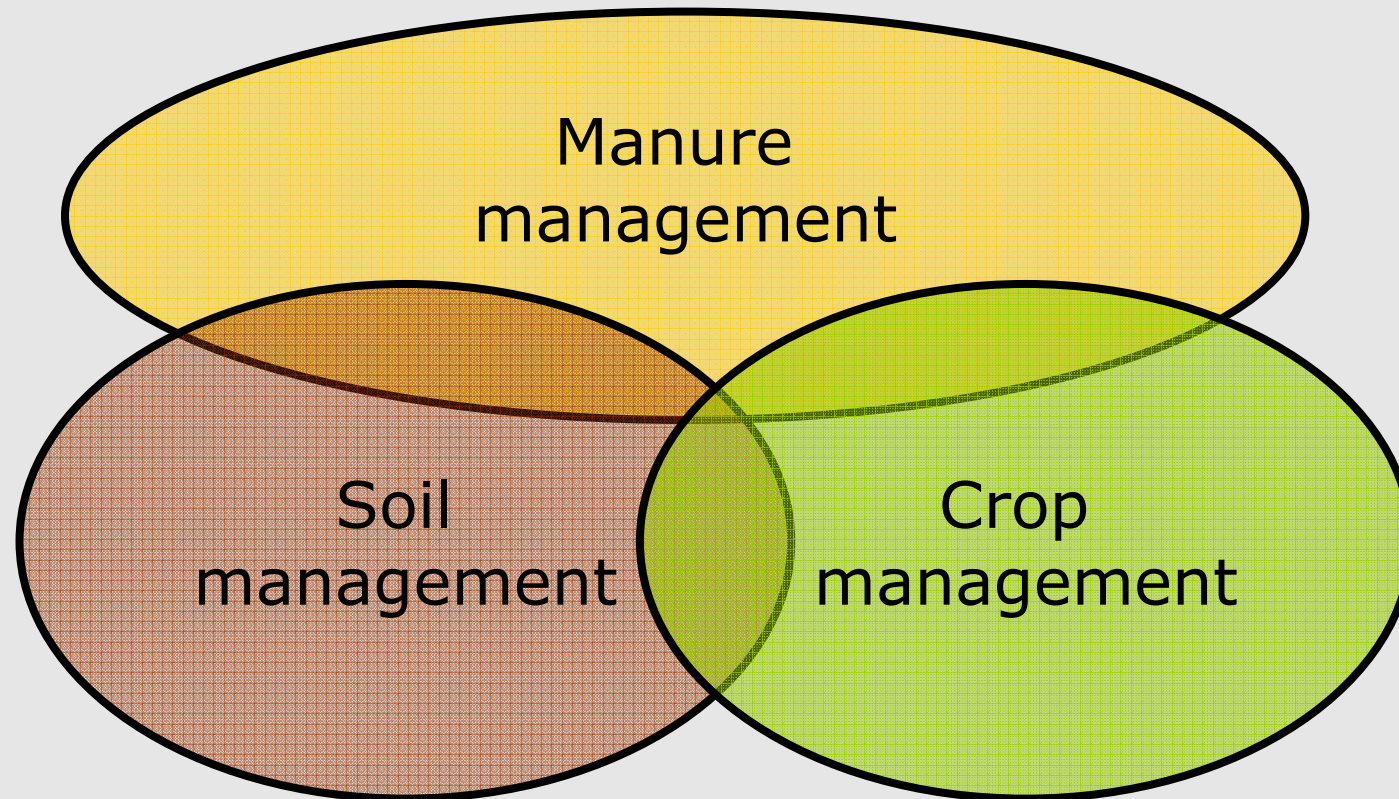
- What characterizes crop management for mitigating N and P losses
- Tightening the nutrient cycles through crop management
 - N leaching
 - P mining
- Outlook



Crop management – Which options – where in the transfer continuum?



Agronomic management practises



Crop management interacts - and may be considered as "second generation mitigation"



N leaching from cultivated land in Denmark

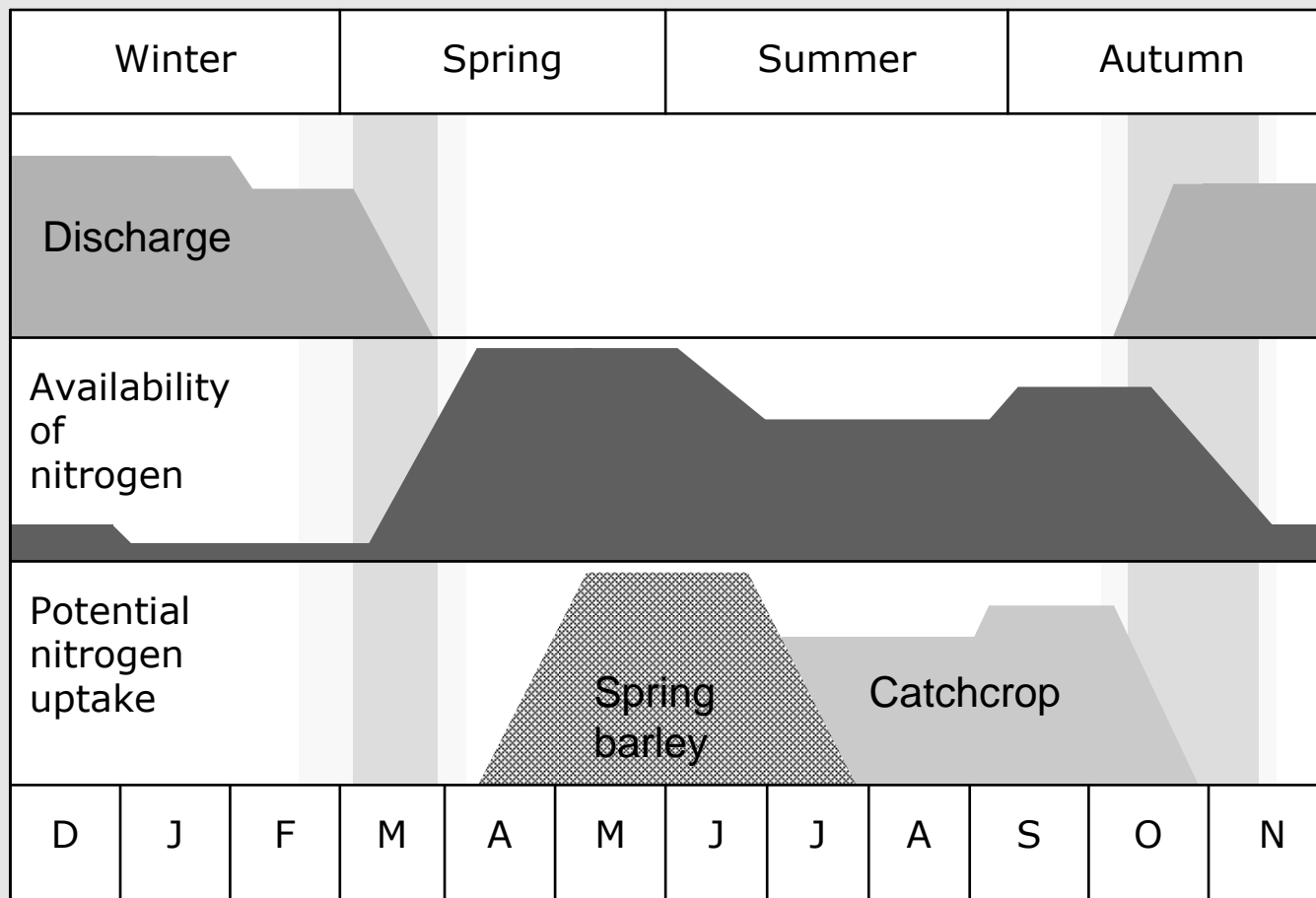
Manure and fertiliser management strategies implemented

	Kg N ha⁻¹
Average, 1989	109
Average, 2003	61
- Slurry related	4
- Crop related*	45
- Natural	12

* Deep litter and manure deposited during grazing included here



Tightening the N cycle



Using crops to mine soil P

- Mitigation of soils with excessive P contents
- May affect all types of P losses.
 - For erosion and surface runoff only mining of topsoil is required
 - For leaching mining may be needed also at deeper soil layers
- Examples of challenges and possibilities
 - PLEASE modelling on selected Danish soils

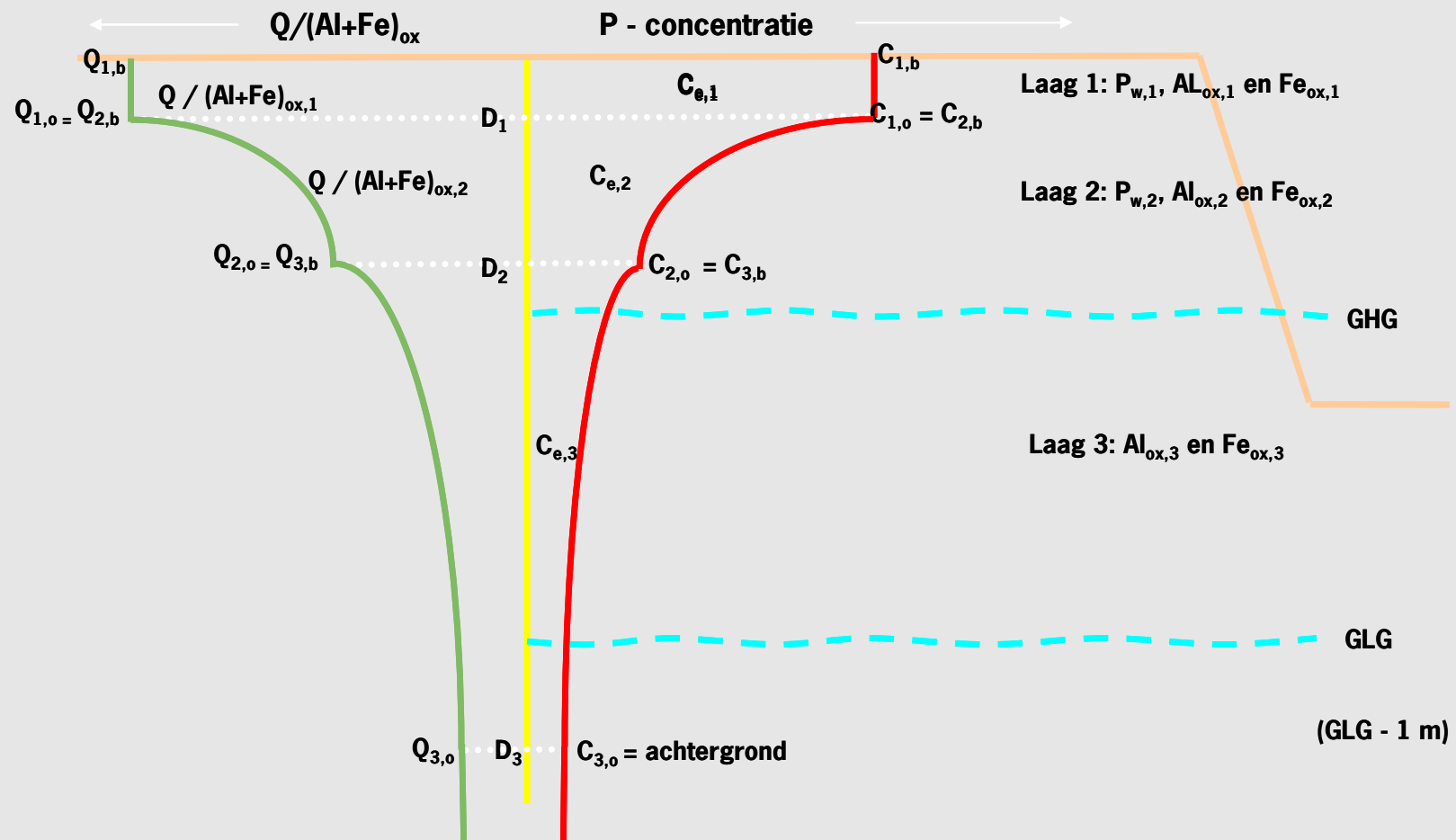


The PLEASE model

- **P LEA**ching from **S**oils to the **E**nvironment
 - Suitable for acid soils susceptible for leaching
- Based on:
 - Kinetics of inorganic P reactions in soil
 - Lateral water flow from soils to surface waters
 - Simple and easily (relatively) available data such as: *Oxalate Fe, Al and P, Pw, mean highest and lowest ground water tables, nett annual precipitation, occurrence of surface runoff, upward and downward seepage*



Constructed P concentration profile

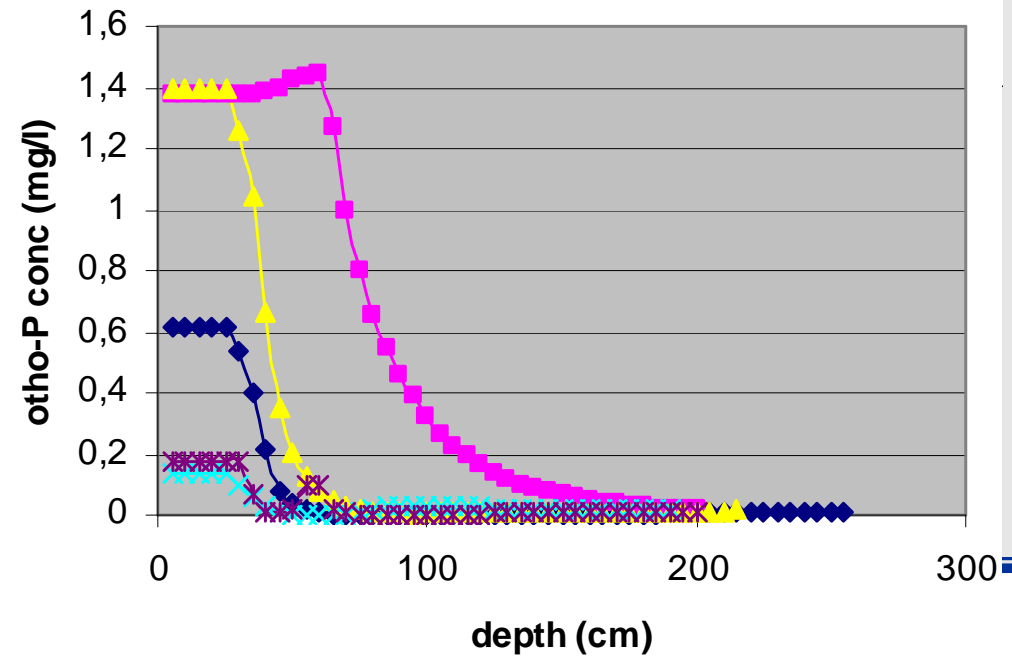
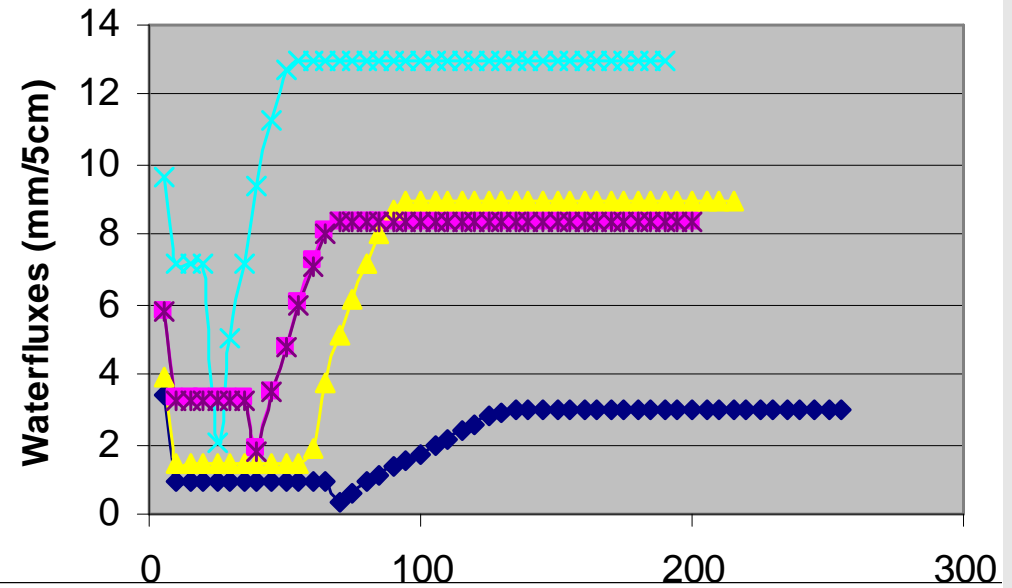


Danish soils (flat, sandy, near stream)

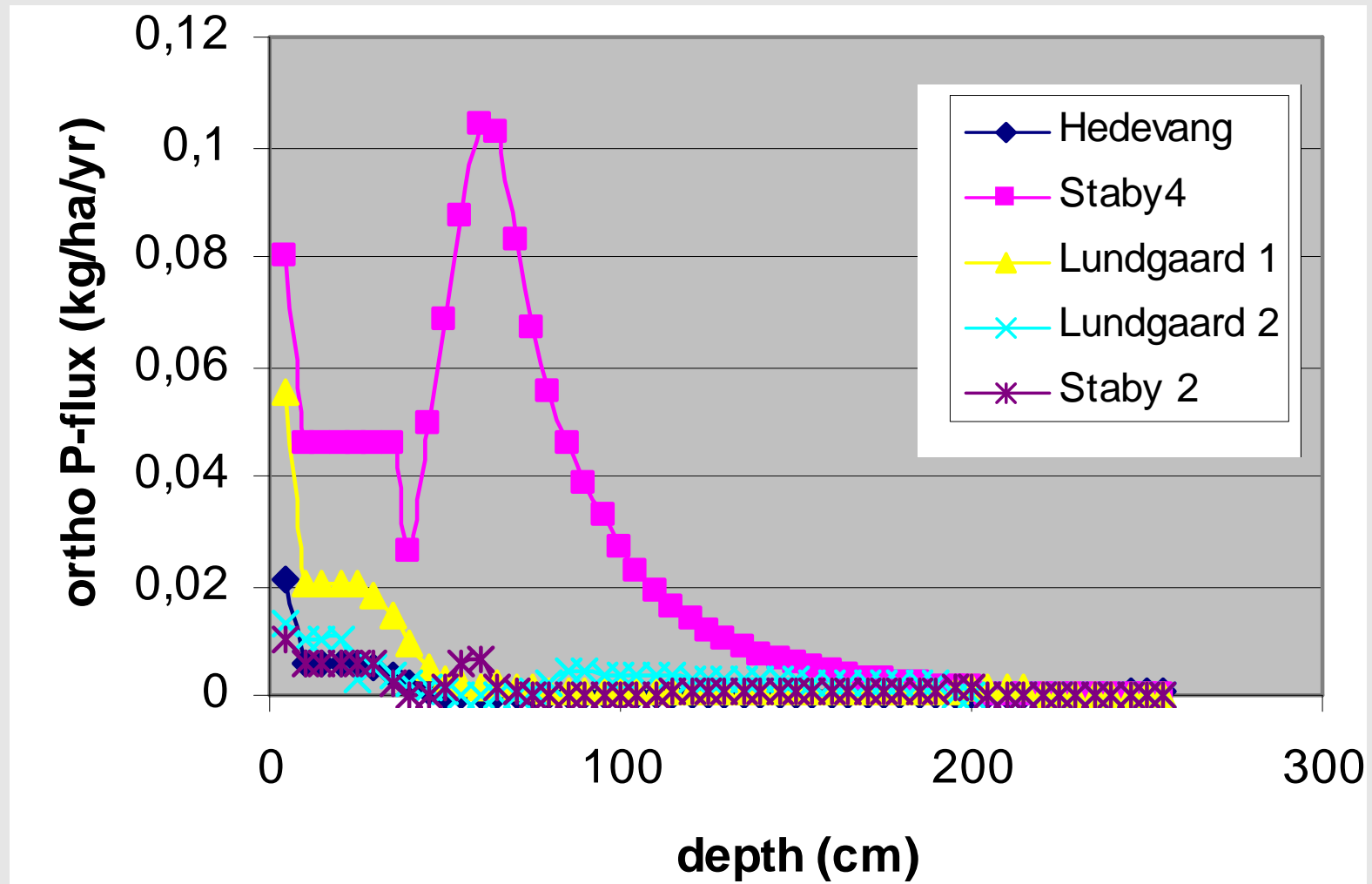
Site	Depth cm	Pw P ₂ O ₅ /l	DPS %	Olsen P mg/kg
Hedevang	0-25	65	49	85
	25-35	56	44	72
Lundgård1	0-25	85	60	70
	25-35	79	56	64
Lundgård2	0-25	34	31	34
	25-35	16	18	14
Staby 2	0-29	22	23	28
	29-39	8	11	11
Staby 4	0-30	102	68	90
	30-60	112	72	86



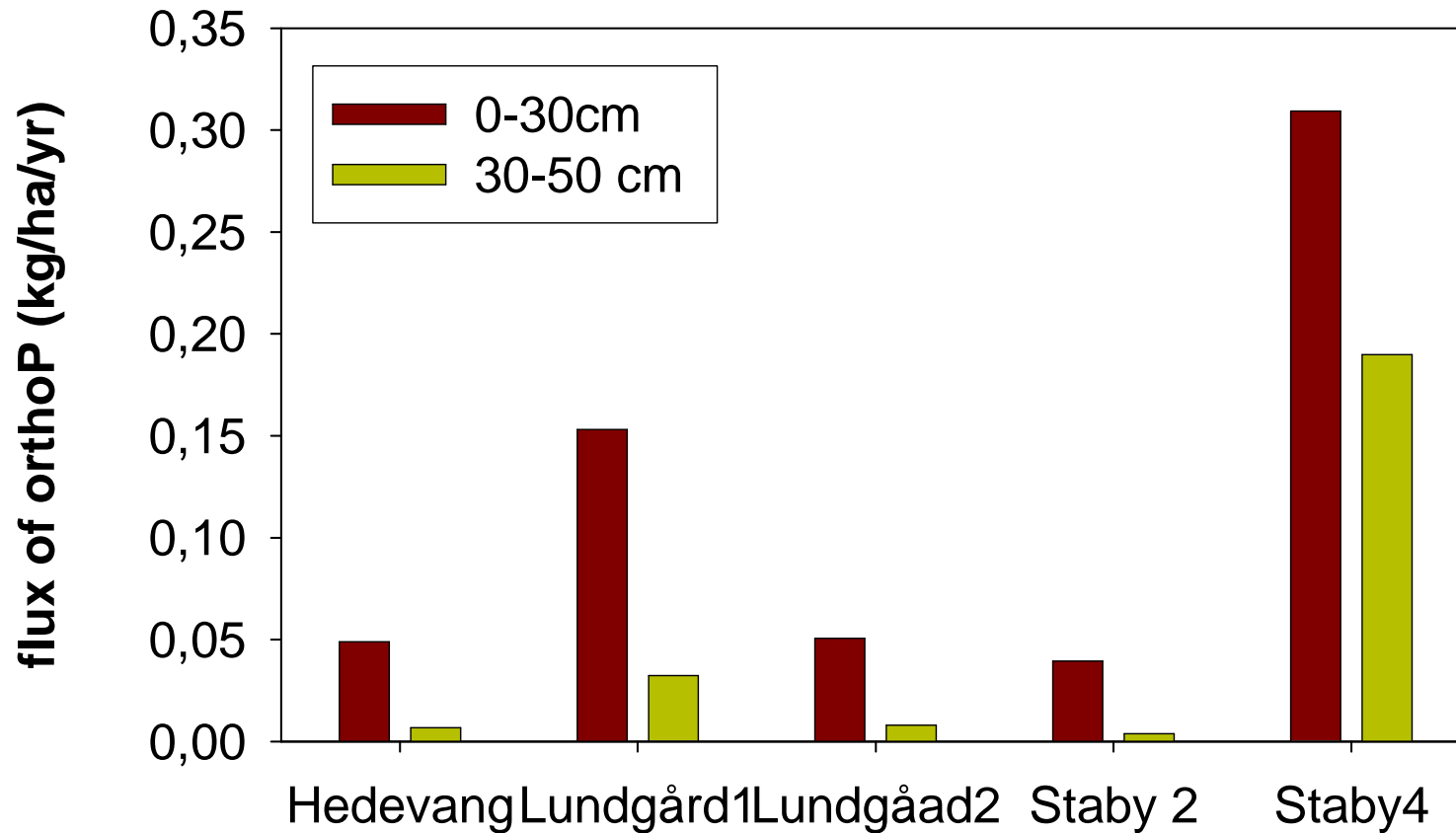
Results of PLEASE



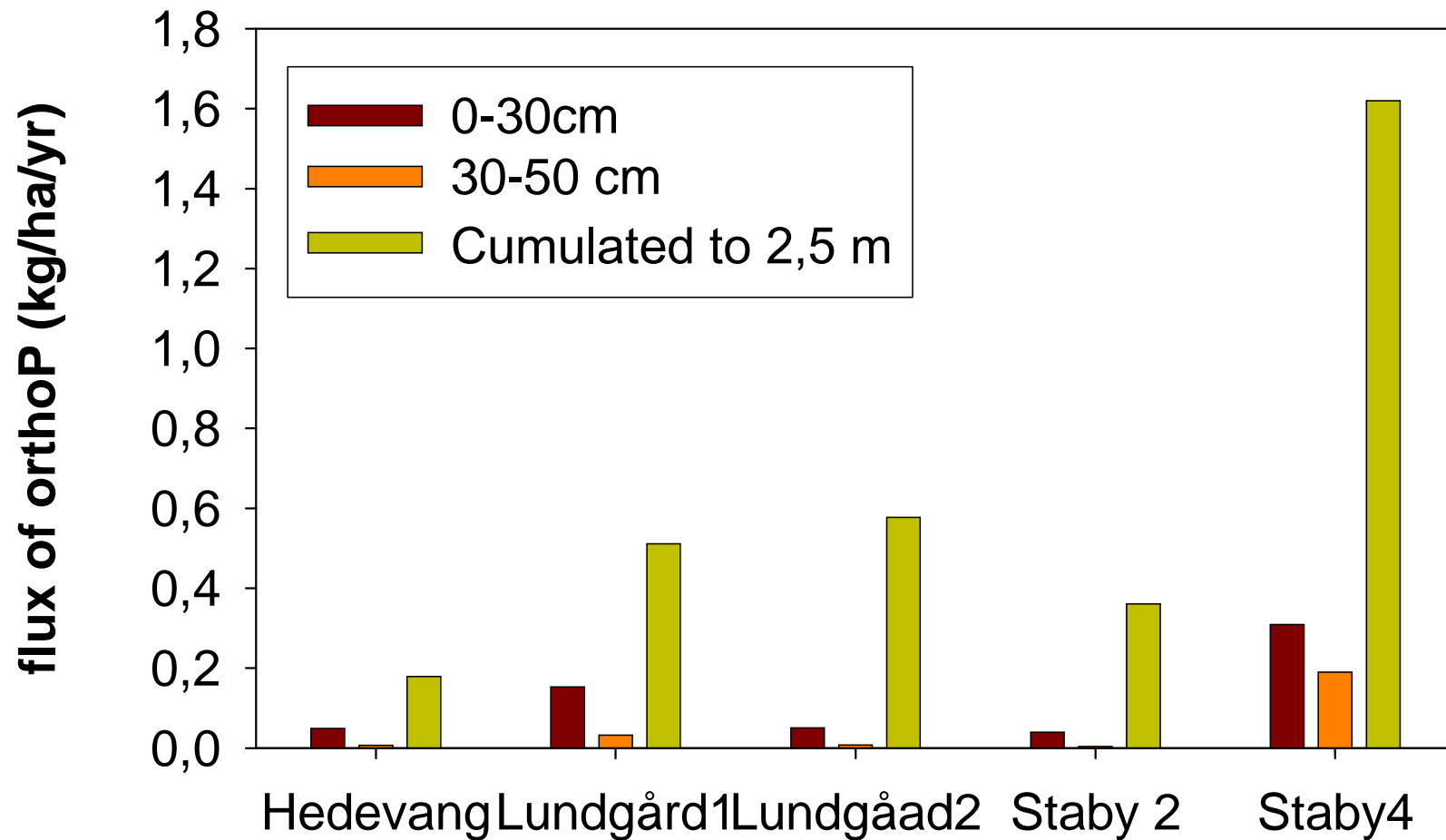
Combining water flux and P conc.



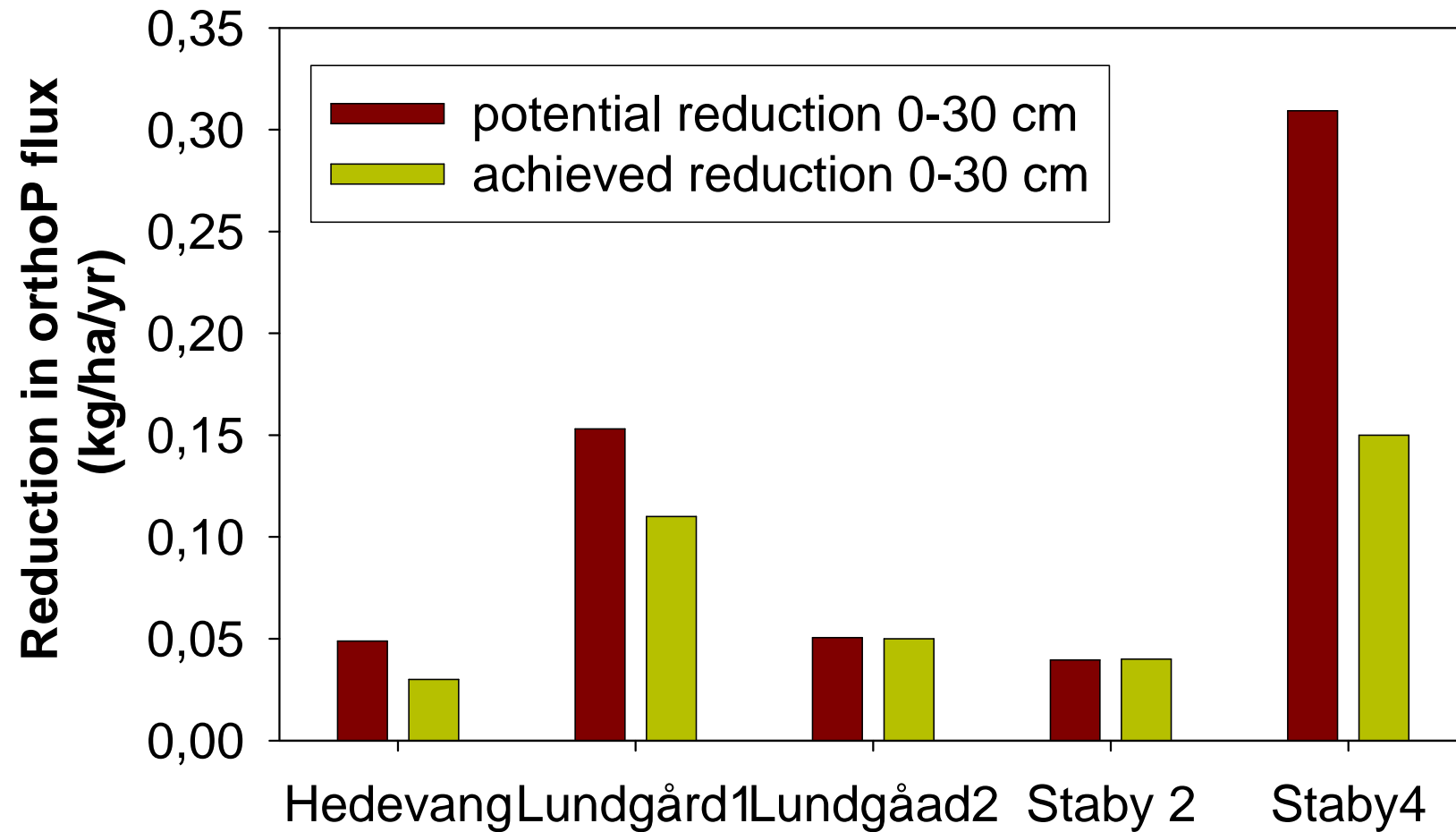
Cumulated fluxes from two upper layers



The two upper layers related to cumulated flux from the whole profile



After 30 years of mining (15 kgP/ha/y)



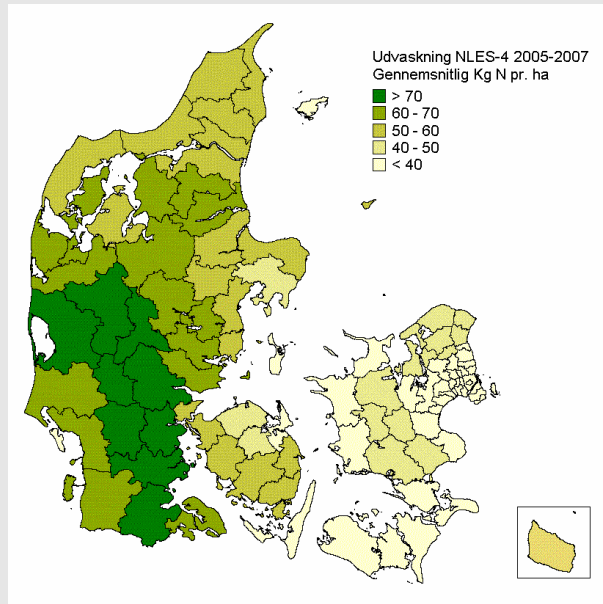
Leaching and P mining on these Danish soils

- Pilot work: we need to check and validate
- Potential reduction in leaching losses from the upper 30 cm was reached after 30 years of mining from two (three) soils
- The potential reduction was modest for most soils, but could be significant for Danish conditions
- Potential for mining to different depths can be evaluated with this model



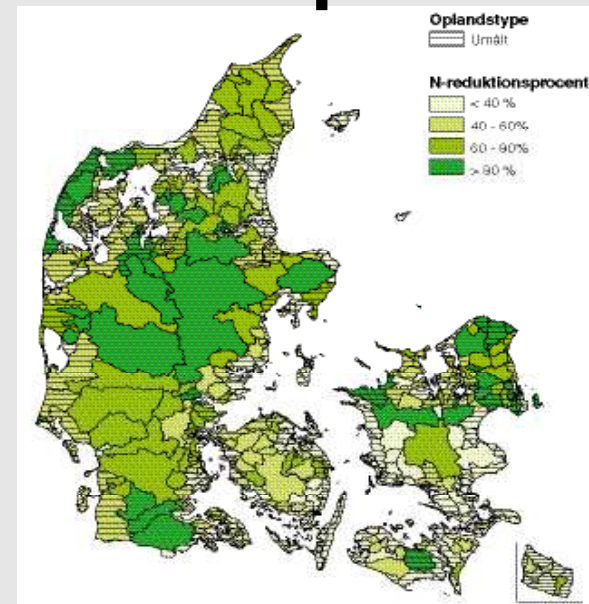
Targeting zones with high risk of N and P losses - new Danish web based tool

N leaching from the root zone



Input: Soil, climate and farming data

N reduction during transport

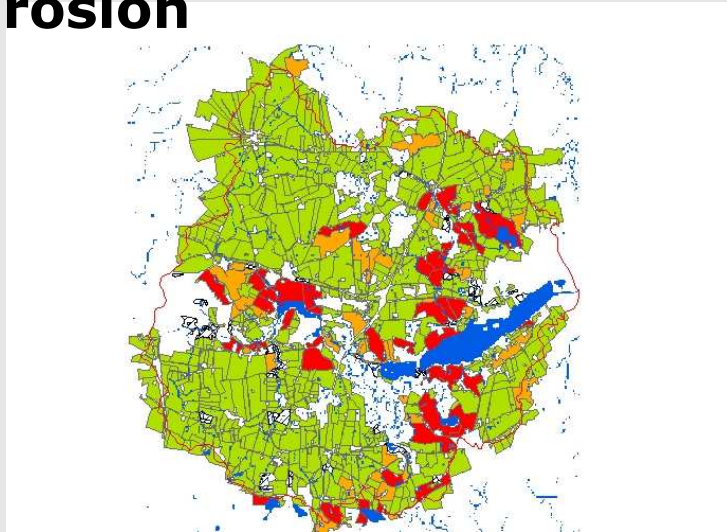


Hydrological modelling

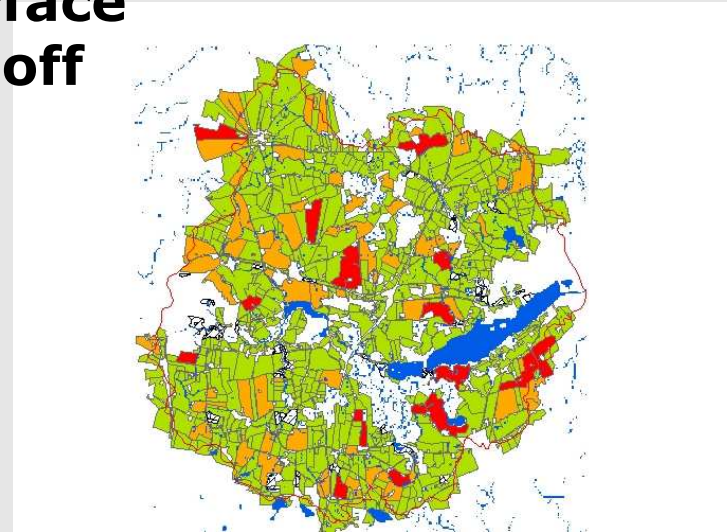


...Areas with high risk of P losses

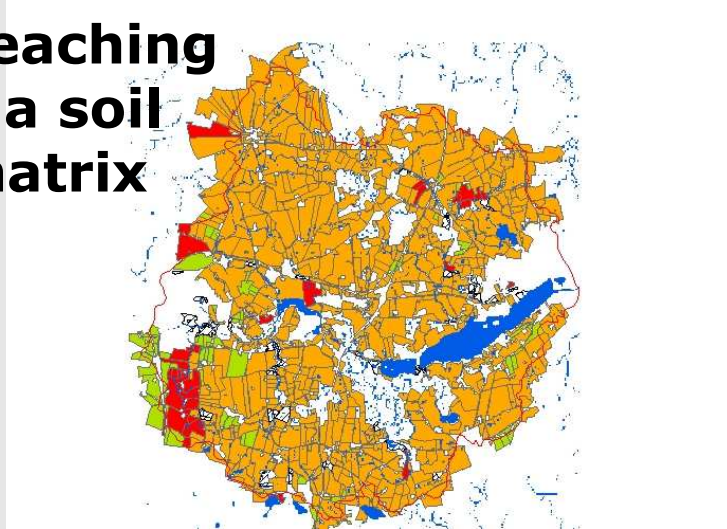
Erosion



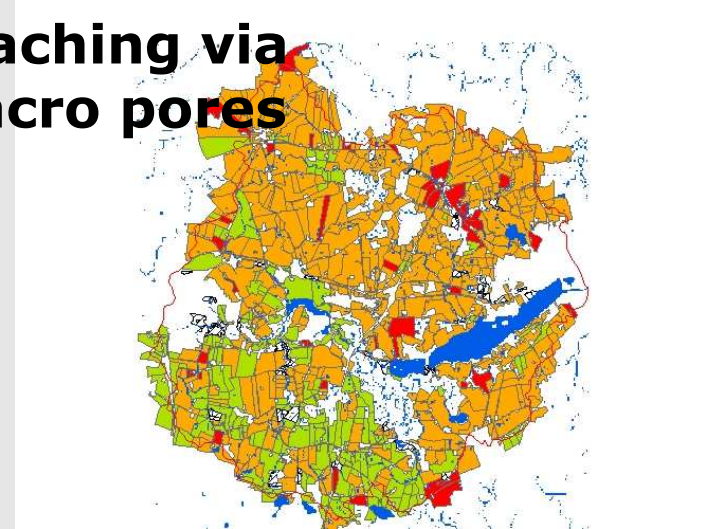
Surface runoff



Leaching via soil matrix



Leaching via macro pores



Outlook

- Managing N and P at various soil depth by choice of crops and crop management
- Climate change may cause more troubles regarding losses but also new possibilities regarding crop management
- Develop new crop types (GMO??)
- Develop cropping systems to optimize nutrient utilisation (e.g. placement of fertiliser, treatment of manures)

