COMPACT FILTER SYSTEM FOR MITIGATING PHOSPHORUS LOSSES FROM AGRICULTURAL DRAINAGE DISCHARGE

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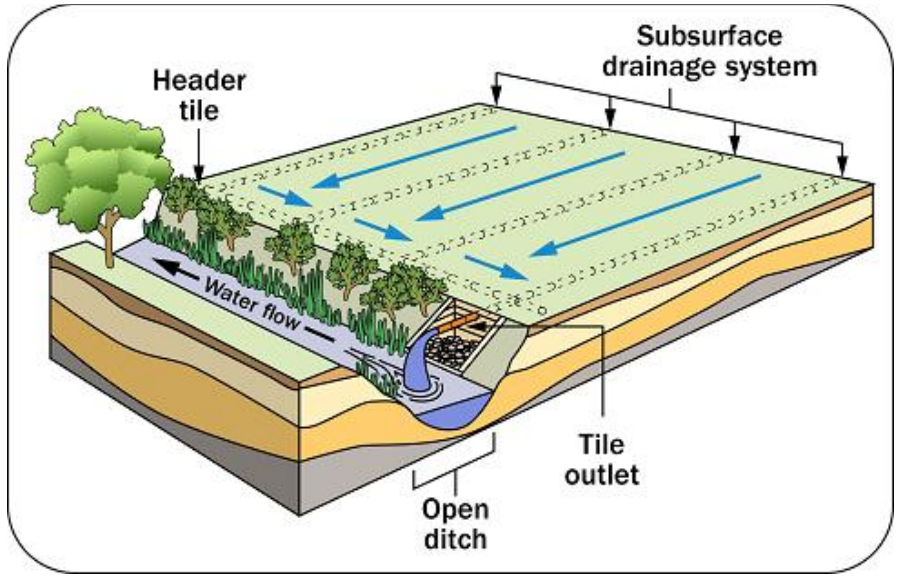
Background

Phosphorus losses from artificially drained agricultural land can locally contribute to surface water eutrophication



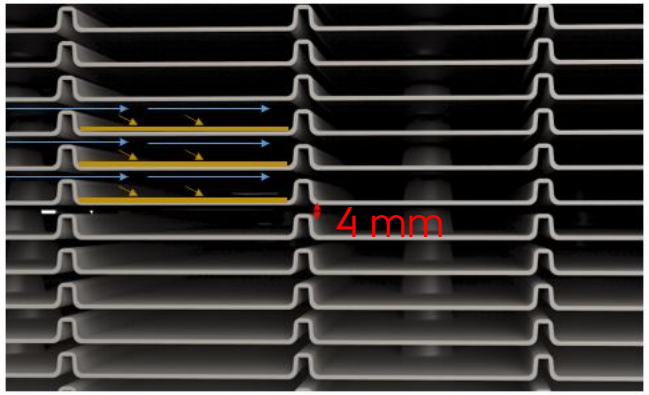
Subsurface drainage systems

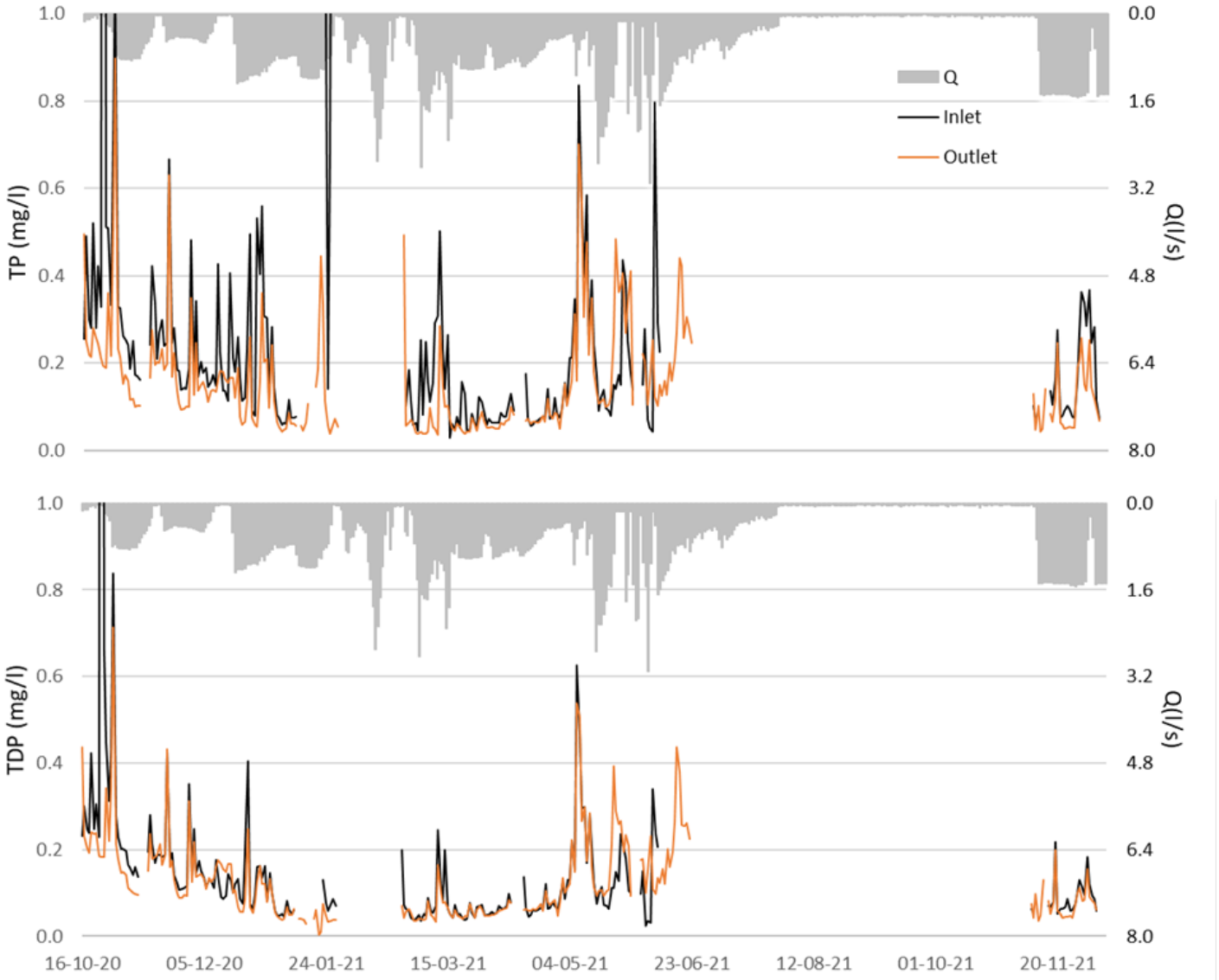
- Transform poorly drained soils into productive croapland
- Accellerate and concentrate water flow spatially

Currently, 50% of the agricultural land in Denmark and MidWest USA are artificially drained (Møller et al. 2018; Song et al. 2021)

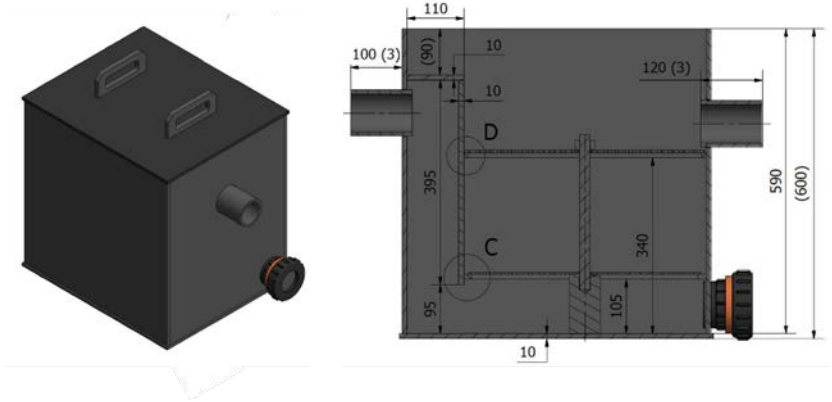
System design

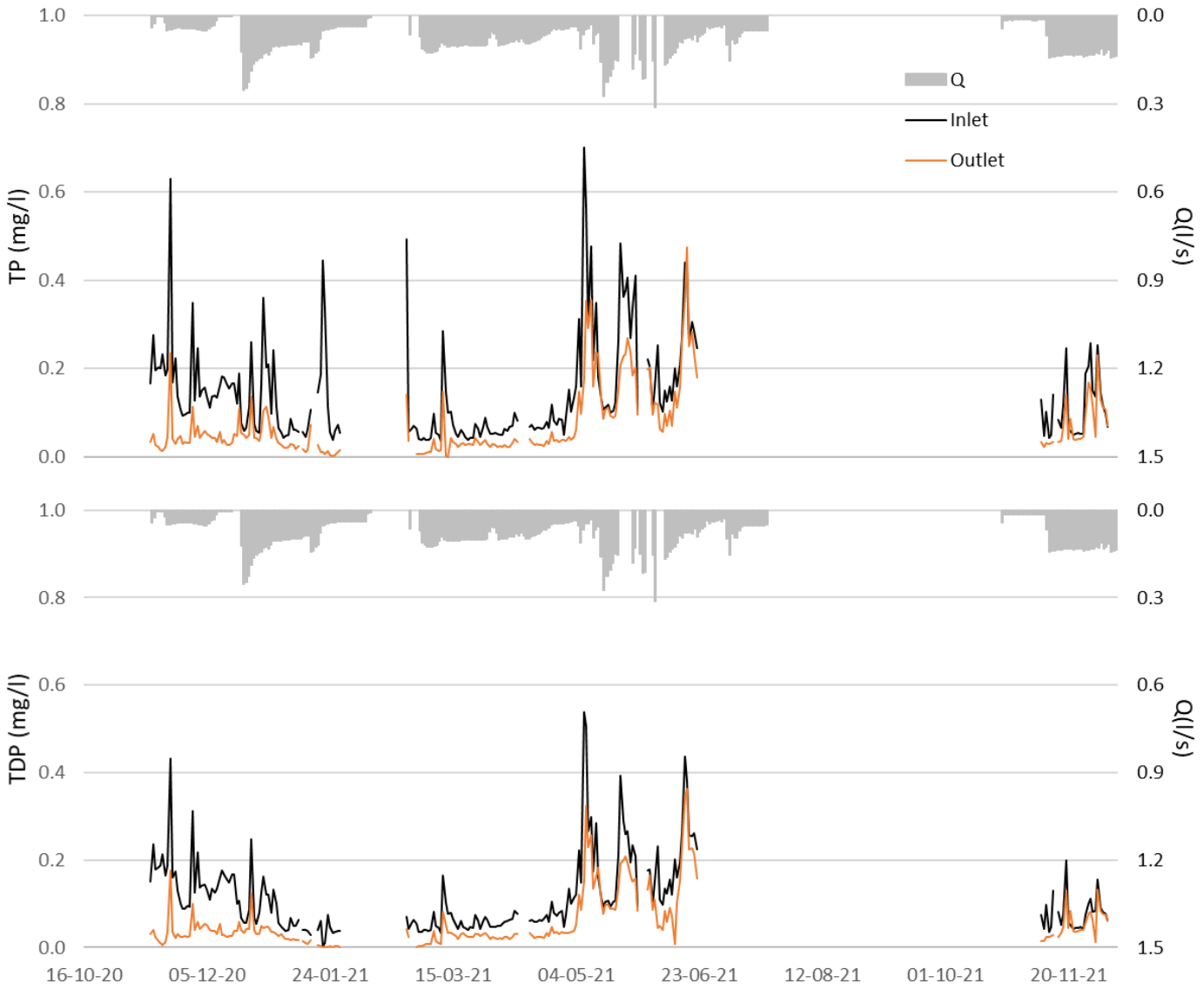
Sediment filter





Reactive filter





Results sediment filter

Month	Q (m^3)	TP Removal (%)	TDP Removal (%)	PP Removal (%)	SS Removal (%)
okt-20	613	30	23	56	73
nov-20	1299	31	16	75	79
dec-20	1798	28	2	75	76
jan-21	2133	48	20	75	66
feb-21	1825	35	16	67	49
mar-21	3245	31	10	69	72
apr-21	1904	13	2	60	72
maj-21	2842	6	-7	42	63
jun-21	2398	-73	-155	45	75
nov-21	2646	27	14	45	64
dec-21	3529	5	-7	2	53

Results reactive filter

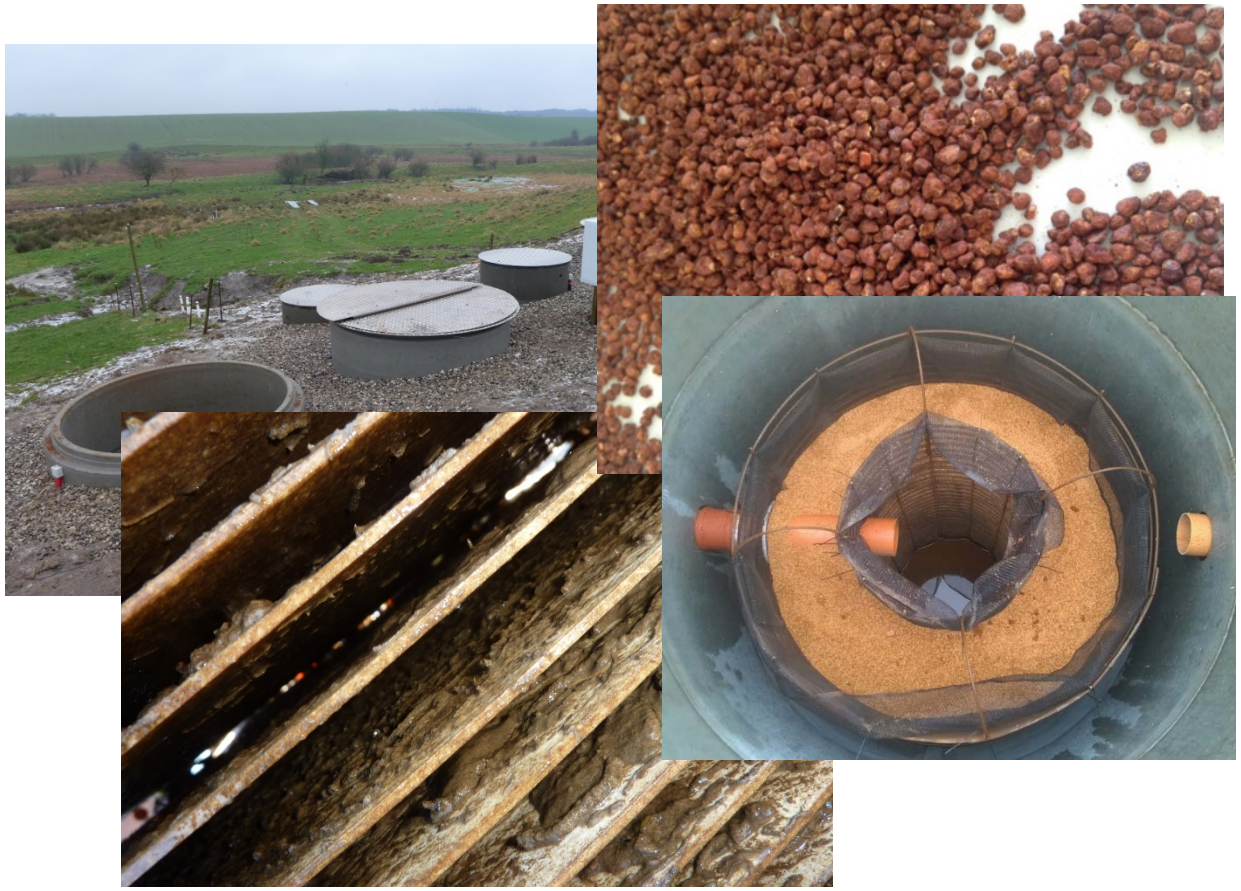
Month	Q (m^3)	TP Removal (%)	TDP Removal (%)	PP Removal (%)
nov-20	59	76	79	14
dec-20	225	58	61	18
jan-21	214	72	72	79
feb-21	27	82	68	72
mar-21	272	58	58	68
apr-21	190	55	57	28
maj-21	284	30	29	15
jun-21	209	23	33	-140
nov-21	254	35	33	35
dec-21	404	12	23	-57

Conclusions and perspectives

- Compact filter systems have shown good potential for removing particulate-bound and dissolved P
- Both sediment and spent filter material can potentially be recycled on agricultural fields as soil amendment
- Technically challenging to develop a filter system with large hydraulic capacity and high P removal efficiencies
- Problems with upscaling were observed in DK systems primarily in connection with particulate-bound P

- Improved sedimentation (physical and/or chemical) and overall P removal efficiency
- Study of P transformations under varying redox conditions and drainage flow characteristics

Thank you



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Recent projects:

NuReDrain (https://northsearegion.eu/nuredrain/) - Filter systems for nutrient removal from agricultural waters

FosLav (https://projekter.au.dk/foslav/) - Compact filter systems for phosphorus in drainage water from high and low soil