N-RETENTION & POINT SOURCES – YEAR 1900

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Point Sources – Year 1900

Almost no city/town sewers in 1900

- Rain based street wash off, farm animals in towns (droppings visible on many old photos)
- No waste water treatment in 1900
- Small amounts from "point sources"
- Photos: Odense1905-1920
- & Ribe 1900-1920

Figur 5. Køer i Ribes gader var et almindeligt syn endnu i begyndelsen af 1900-tallet. Postkortet viser et motiv fra Mellemdammen ca. 1900-20. Ironisk nok udgør Mellemdammen i dag en del af byens stregkvarter. Postkortfotografi fra Stender Samlingen ved Syddansk Universitet.

Point Sources

- Pond Fish Farming startet shortly after 1900 but in very few places (large expansion >1950)

- Some industry sewage in 1900 (Dairy plants, butcherries, textile dyeing, others) the first treatment works were installed at B&W shipyard around 1900

LANDSCAPE N-RETENTION

The landscape nitrogen retention has been altered since 1900

- Tile draining - Ground water N-retention SWAT-model
- Larger lakes DKQNP approach
- Small lakes (National nitrogen Model)
- Rivers/streams (National nitrogen Model)
- Wetlands (National nitrogen Model)
- Combined scenario (National nitrogen Model)

- Examples: Odense Å, upstream 450003, Kratholm

TILE DRAINING – GROUNDWATER

Tile draining was less common in 1900, approximately 21% in 1881. Maybe 30% in 1900 primarily in eastern Denmark (Hofmeister (Ed.), 2004)

A proportion of the water that now flows through tile drains would have been infiltrated to ground water in 1900 => thereby it would have been subjected to groundwater N-retention => thereby the GW N-retention in 1900 would have been higher than to day

SWAT model run with and with out tile draining in about 50% of the agricultural area => 33% decrease in river N-load.

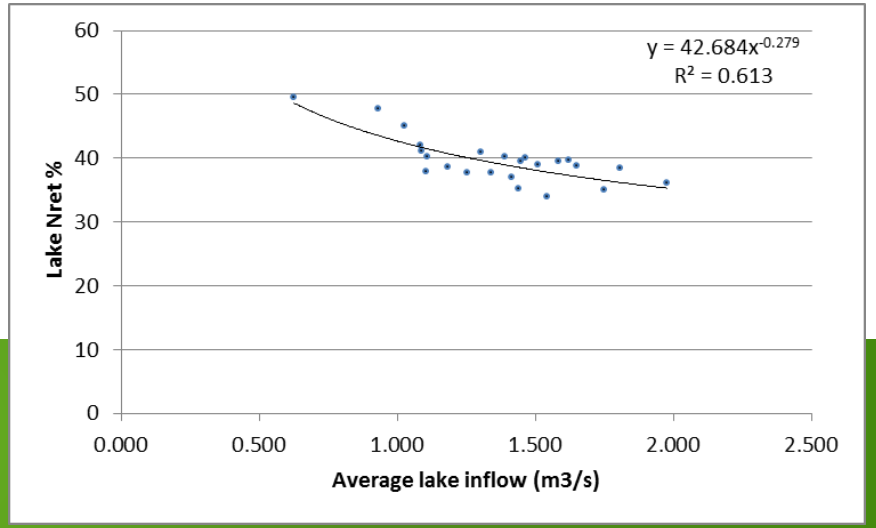
LARGER LAKES

Because the flow was lower around 1900 the lake residence time was higher and therefore the lake N retention % was higher (Jensen et al., 1994, (up dated))

Calculation done for >600 lakes the average lake N retention increases from 39% (mean Q 1990 – 2013) to 42% (mean Q 1895-1905, represented by 2009)

Yielding a 7% increase in N-retention

Jane will tell more about the Y1900 Q-modelling



SMALLER LAKES

- There were more small lakes in 1900. Many small lakes/potholes have been drained or filled. Estimates decrease between xx and xx%

- The area of esisting small lakes in the "nitrogen Model" has been doubled.

Scenario	Lake area	N-retention smaller lakes	Total N-retention Surface waters
	Ha	Ton N/yr	Ton N/yr
Baseline	290	14	340 (27%)
Lake N-rate removal decreased	290	7	330 (26%)
Area with smaller lakes doubled	570	21	340 (27%)
Area doubled and Lake N-rate removal decreased	570	11	330 (26%)

N-RETENTION SMALL STREAMS

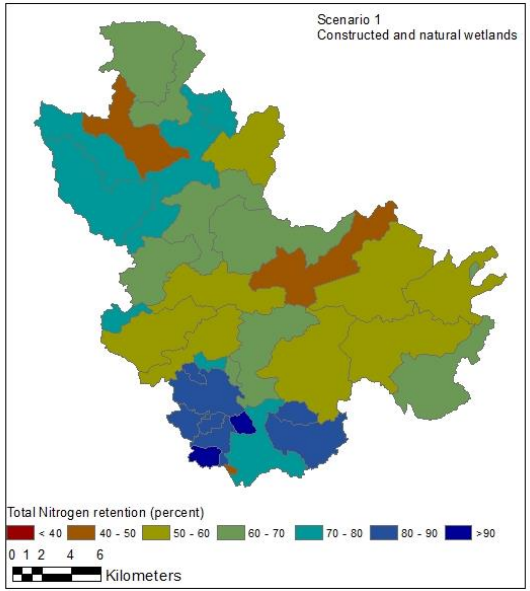
- It is estimated that the total length of small stream and drain ditches would have been larger in 1900. Some have been turned into pipe draining and most piping (rørlægning) of streams have been done since 1900.
- The national nitrogen model have run a scenario with +20% lenght of all small streams (<2m width)

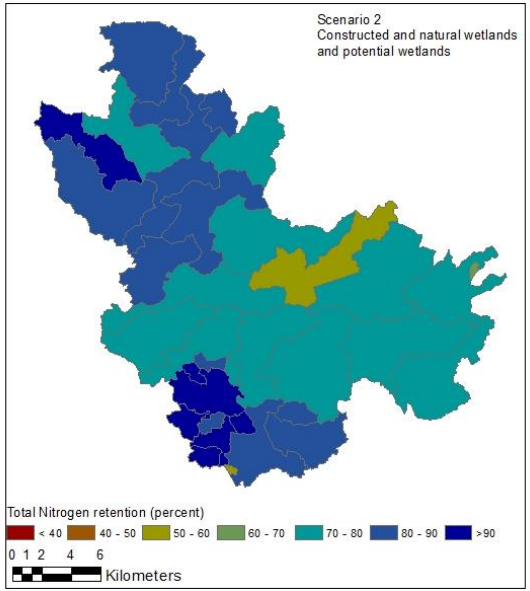
Scenario	Km streams	N-retention in small streams	Total N-retention surface waters
		Ton N/yr	Ton N/yr
Baseline	310	100	340 (27%)
Lenght of smaller streams increased with 20%	370	110	340 (27%)*

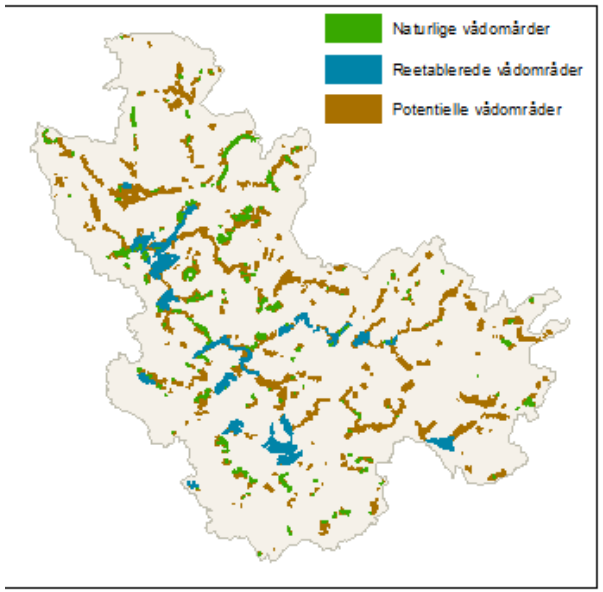
* The increase in N-retention in small streams are resulting in a N-retention decrease in larger streams.

N-RETENTION WETLANDS

- The "national nitrogen model" was run with existing near river wetlands (AIS) and with existing + potential near river wetlands around year 1880 (map from Fynen county)



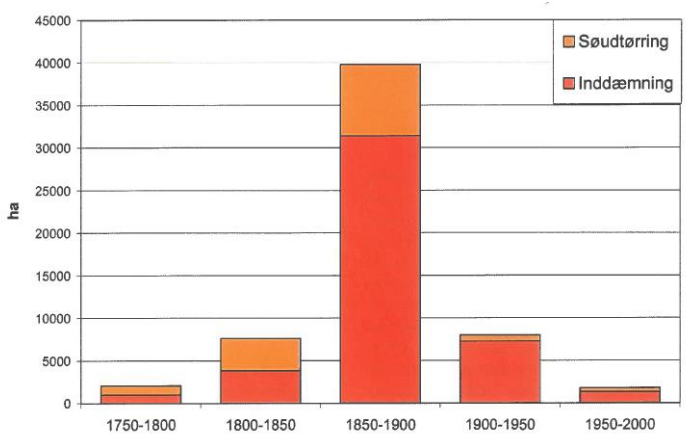




N-RETENTION WETLANDS II

- The increased wetland area is found to influence the total N-retention substantially.
- The scenario is based on modern day river N-concentrations
- The effect of potential wetlands is probably over estimated

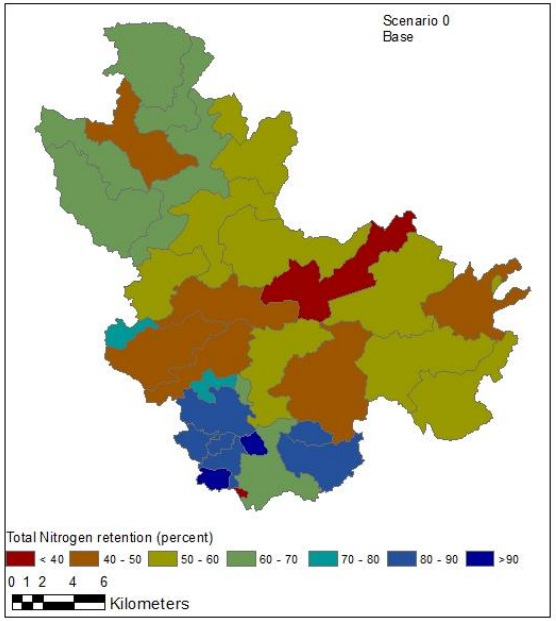
(Hofmeister (Ed.), 2004)

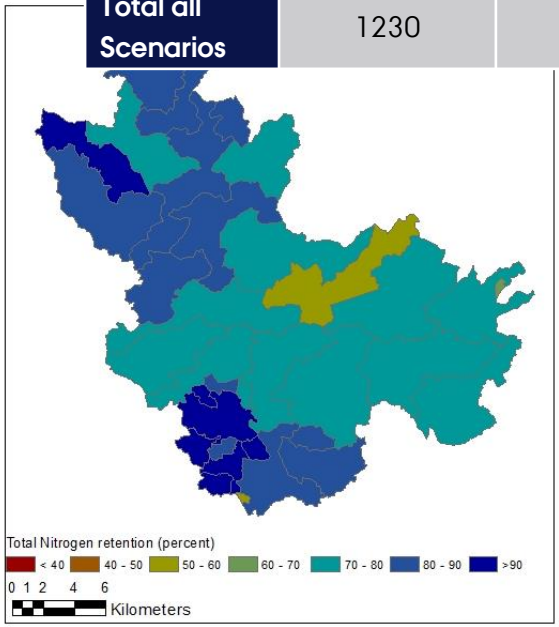


Scenario	Total wetland area	Total N-retention wetlands	N-retention rate wetlands	Total N retention Surface waters
	ha	Ton N/yr	Kg N/ha/yr	ton N/yr
Baseline	1410	230	160	450 (36%)
All wetlands 1880	3770	610	160	800 (63%)

N-RETENTION GENERAL

Scenario	N-emission to surface waters	N-retention lakes	N-retention wetlands	N-retention streams	N-export from catchment
	Ton N/yr				
Baseline	1260	60	90	200	910
Total all Scenarios	1230	30	600	160	440





CONCLUSIONS

- No major point source emissions from towns and cities around year 1900, however, smaller local outlets from factories and maybe diffuse urban storm outlets - all major cities situated along the coastline at that time.
- The landscape around year 1900 provided a much higher N removal/retention:
- A lower amount of tile drainage in fields was model estimated to yield ca. a 30% increase in N retention in groundwater at present days N concentrations and loadings.
- Regaining year 1880 wetlands along the stream corridor was model simulated to yield more than a doubling of present day N retention in surface waters at present day N concentrations and loadings.