POTENTIAL SIGNIFICANCE OF RIPARIAN LOWLANDS ON NITROGEN FLUXES FROM AGRICULTURAL DRAINAGE IN DANISH WATERSHEDS

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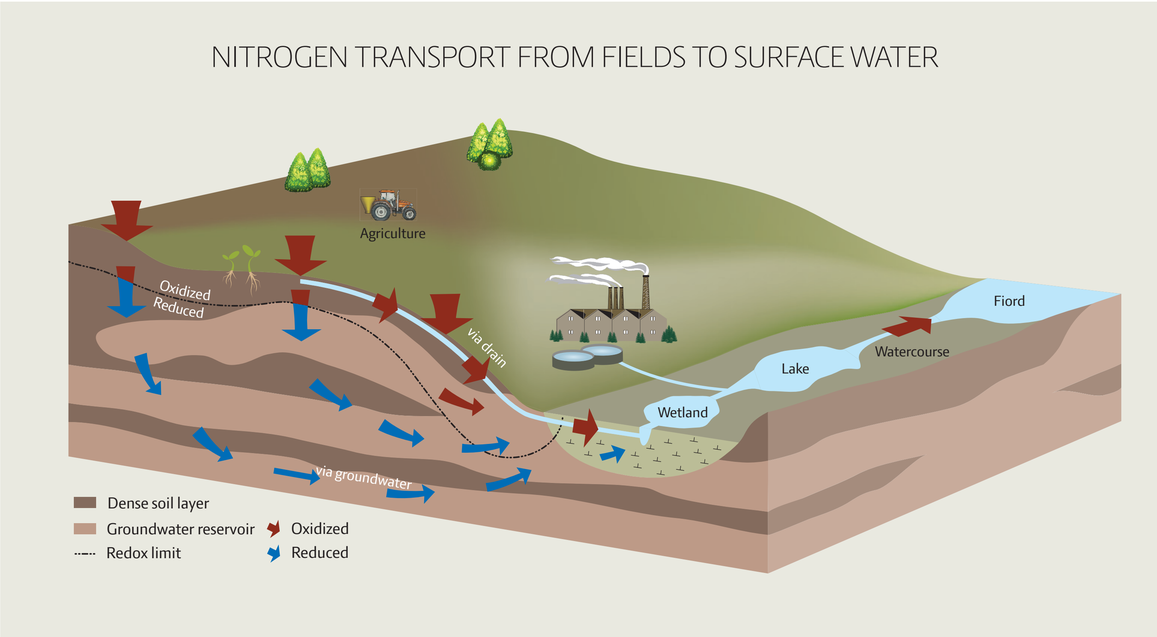
Background

Riparian lowlands intercepting upland fields from surface waters are considered key landscape components regulating nitrogen fluxes at (sub)catchment scale. The potential filter function of riparian lowlands on agricultural drainage depends however on catchment type. Further drainage and cultivation resulting in peat soil degradation, may have weakened the filter function of riparian lowlands.



Catchment analysis

Combining maps of riparian lowlands and potential drained agricultural uplands (Kjaergaard et al., 2017) with maps of lowland carbon content allowed a quantitative analysis of riparian lowland intercepting tile drainage for the 90 Danish watersheds. Further model estimates of N-losses (Kjaergaard & Børgesen, 2017) from upland fields draining to riparian lowlands allowed an estimation of the potential significance of riparian lowlands on N fluxes from agricultural drainage in each watershed.

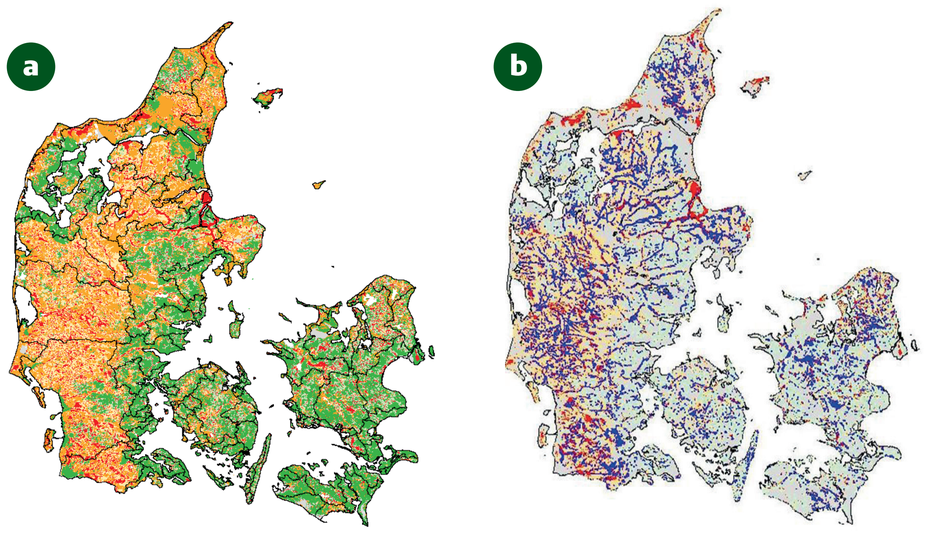


FIGURE 1. (a) Riparian lowlands (red) in clay (green) and sandy (orange) landscapes, (b) Mineral (red) or peat (blue) riparian lowland with adjacent clay (light green) or sandy (yellow) potentially drained uplands.

Results

The area of riparian lowlands amounting to 346,708 ha (12%) varies from <1 to >25% of the catchment area. From <1 to >40% of the agricultural area is intercepted by riparian lowlands. Carbon content varies from <4 to >40%, p_b from 0.1-1.6 kg m^{-3} and θ_{tot} from 0.5-0.8 m^3 m^{-3}. N-reduction efficiency ranging from 25-80% can potentially reduce agricultural N loads by 5,000-15,000 ton per year.

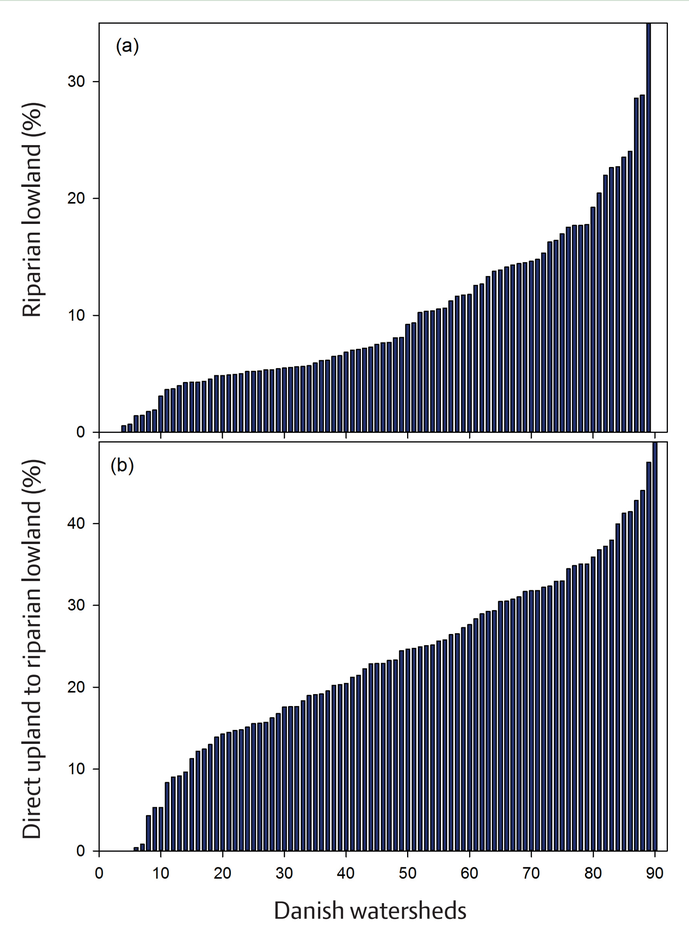


FIGURE 2. (a) Riparian lowland area, and (b) agricultural upland intercepted by riparian lowland in the Danish watersheds.

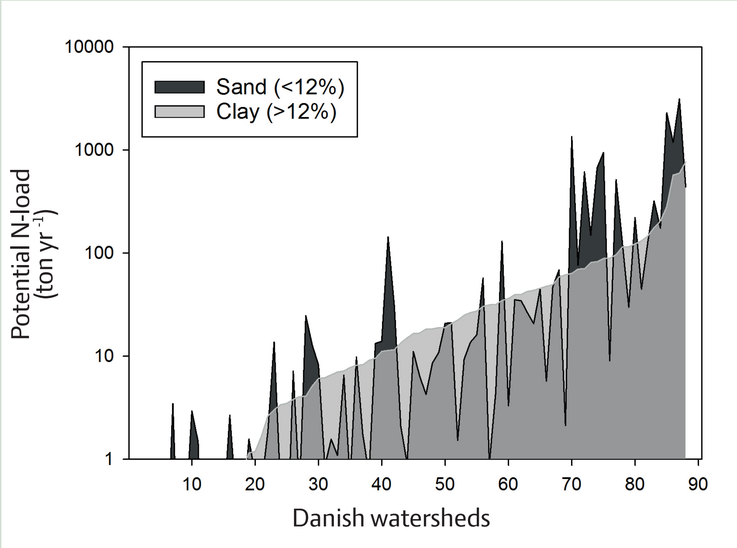


FIGURE 3. Potential N-transport to riparian lowlands for sandy and clay geologies

Potential significance of riparian lowland on N fluxes

Estimated total N-leaching from sandy and clay uplands to riparian lowlands amounts to 18,000 ton per year. Depending on the distribution of drainage to diffuse flow, and the N-reduction efficiency in mineral and peat lowlands, the Danish riparian lowlands can potentially reduce agricultural N-loads by 5,000-15,000 ton per year.

TABLE 1. (ton)	<12% clay	≥12% clay
Total N load (ton yr^{-1})	13,300	4,900
Drain-N load (ton yr^{-1})	3,300	3,100
Diffuse N load (ton yr^{-1})	10,000	1,700
Lowland $N_{red\text{-}min}$	3,300	1,200
Lowland $N_{red\text{-}max}$	10,700	3,900

Innovation Fund Denmark

TReNDS
Transport and Reduction of Nitrate in Danish Landscapes at various Scales

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