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Supplement of

Trajectories of nitrate input and output in three nested catchments along a land use gradient

Sophie Ehrhardt et al.

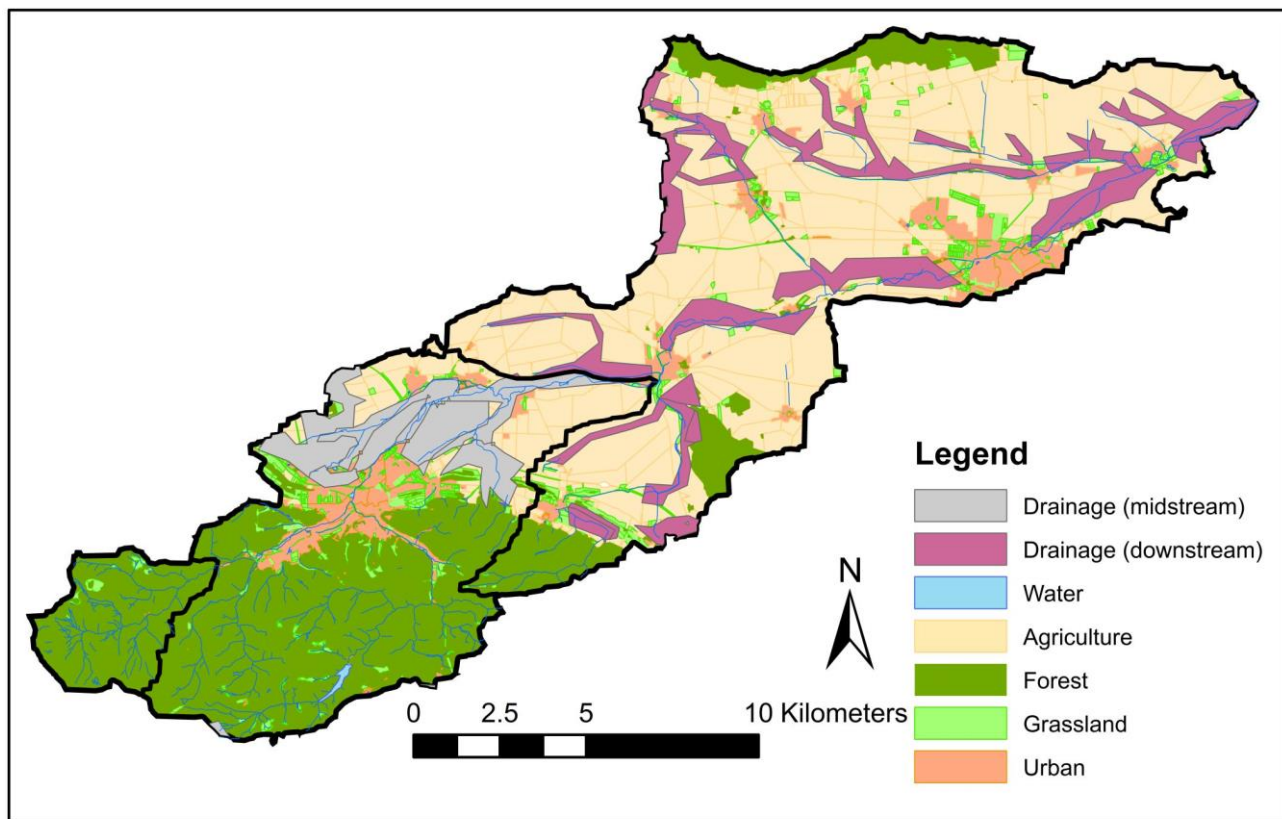
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Supplement

S1 Addition to material and methods

S1.1 Catchment characteristics



5 Figure S1.1: Map of the catchment highlighting the agricultural area that is artificially drained

S1.2 Water quality time series of $\text{NH}_4\text{-N}$ and $\text{NO}_2\text{-N}$

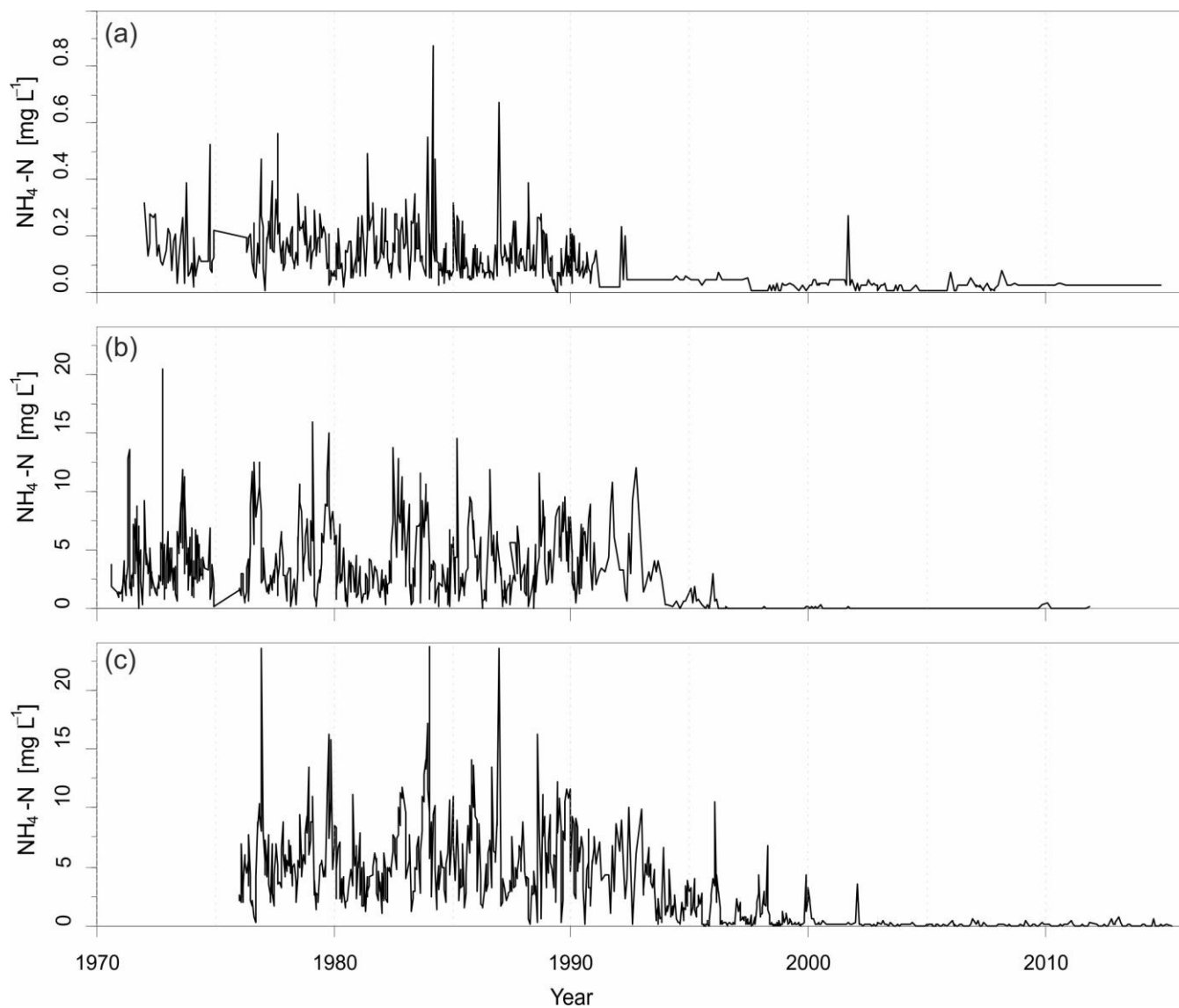


Figure S1.2.1: Time series of $\text{NH}_4\text{-N}$ concentrations. (a) Upstream; (b) Midstream; (c) Downstream.

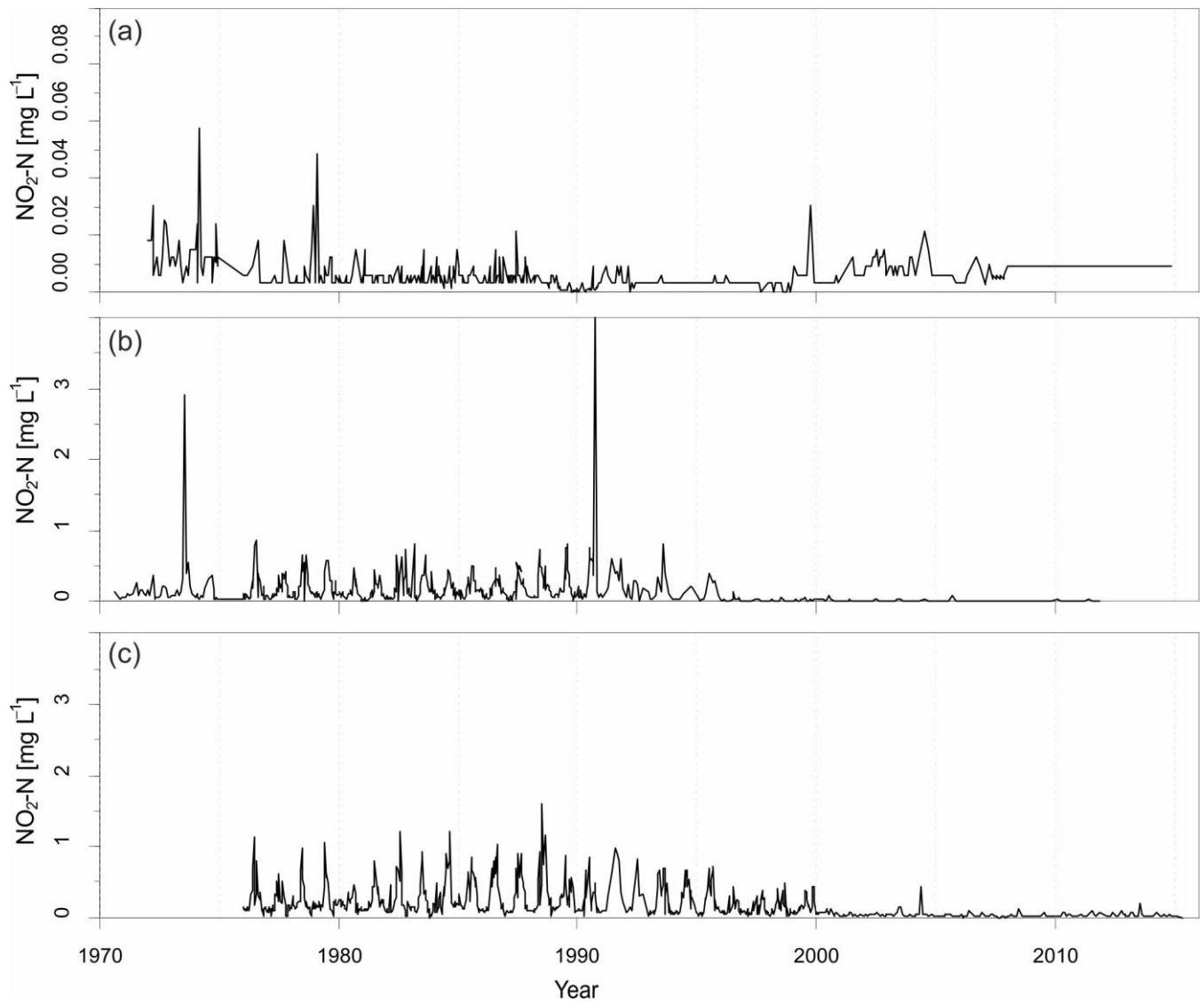


Figure S1.2.2: Time series of NO₂-N concentrations. (a) Upstream; (b) Midstream; (c) Downstream.

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S.1.2.3 Estimation of NO₃-N contribution from wastewater borne NH₄-N

The assumption that agricultural, diffuse input was the main source of NO₃-N, needed an investigation of the possible amount of NO₃-N stemming from nitrified NH₄-N released by the WWTPs.

We estimated the maximal amount of waste water born NO₃-N from the highest nitrification rates taken from other studies (Webster et al., 2003; Mulholland et al., 2000, Tank et al., 2000). The highest rate was 0.19 g m⁻² d⁻¹ (Tank et al., 2000). Note that we assume that this rate is constant over the year and that NH₄-N was always unlimitedly available.

To calculate the river area, we used the stream length und mean stream width between the two WWTPs and corresponding stations Mid- and Downstream (Table S.1.2.3). This estimation took the relocation of the WWTP Wernigerode in 1995 into account. The estimation of waste water born NO₃-N revealed a maximal contribution of 5.2 % stemming from nitrification over the years. Hence, in-stream nitrification of NH₄-N release from point sources did not contributed significantly to riverine NO₃ loads or concentrations.

Table S.1.2.3: Estimation of NO₃-N contribution by in-stream nitrification of waste water born NH₄-N in the anthropogenically impacted subcatchments

	Midstream before 1995	Midstream after 1995	Downstream
NH ₄ -N uptake (Tank et al. 2000; g m ⁻² d ⁻¹)	0.19		
River area from WWTP to station (m ²)	58456	12431	46092
Nitrified NH ₄ -N (t a ⁻¹)	4.1	0.9	3.2
Years of selected time series	1972–1995	1995–2011	1976–2011
Total uptake over time (t N)		107.0	111.9
Total NO ₃ -N export over time (t)		3697	2146
Total uptake according to export (%)		2.9	5.2

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S2 Addition to results

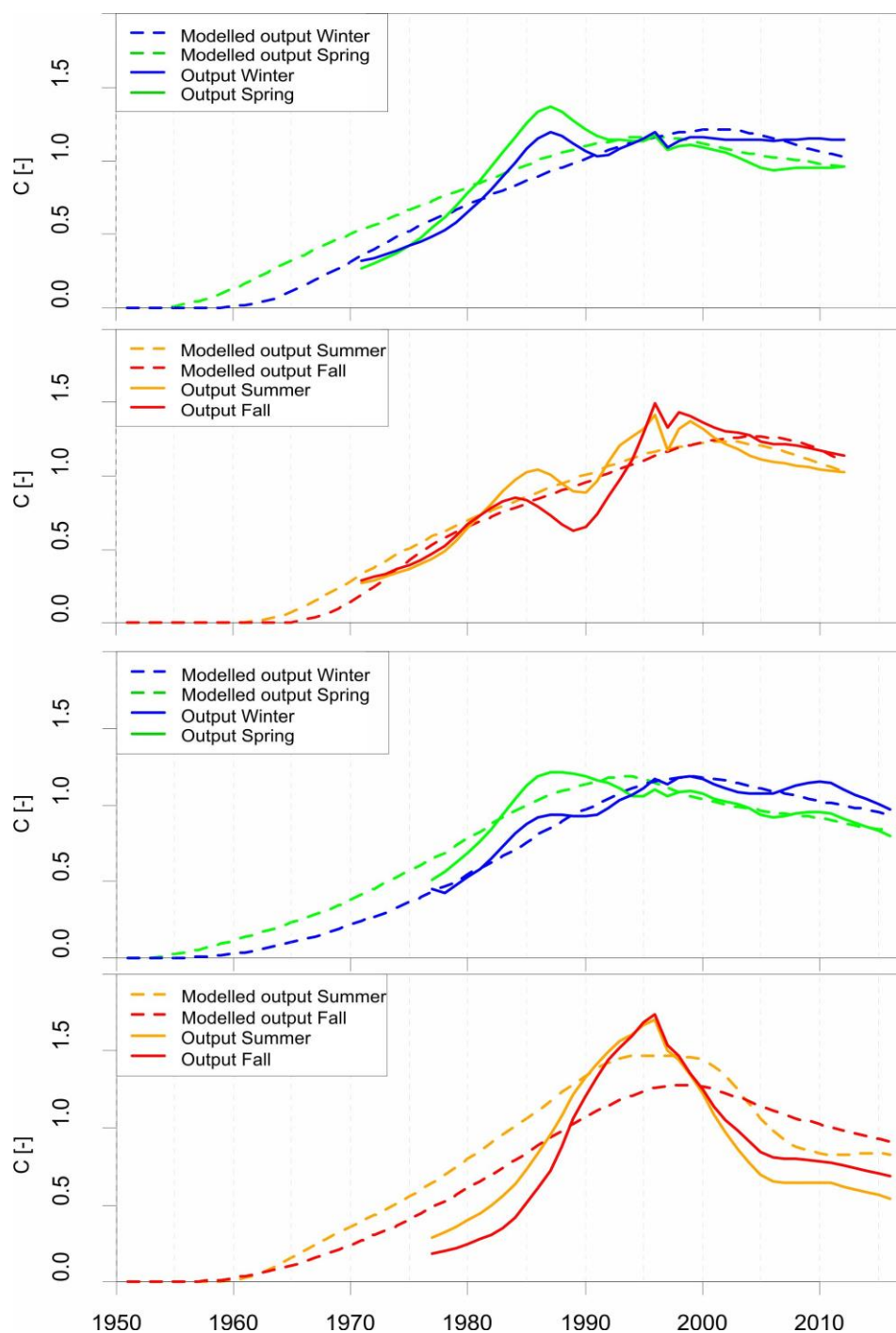


Figure S2.1: Modelled N-output concentrations derived from the N-input convolved with the log-normal travel time distributions (dashed lines) and the scaled observed flow-normalized seasonal $\text{NO}_3\text{-N}$ concentrations (solid lines) over time.

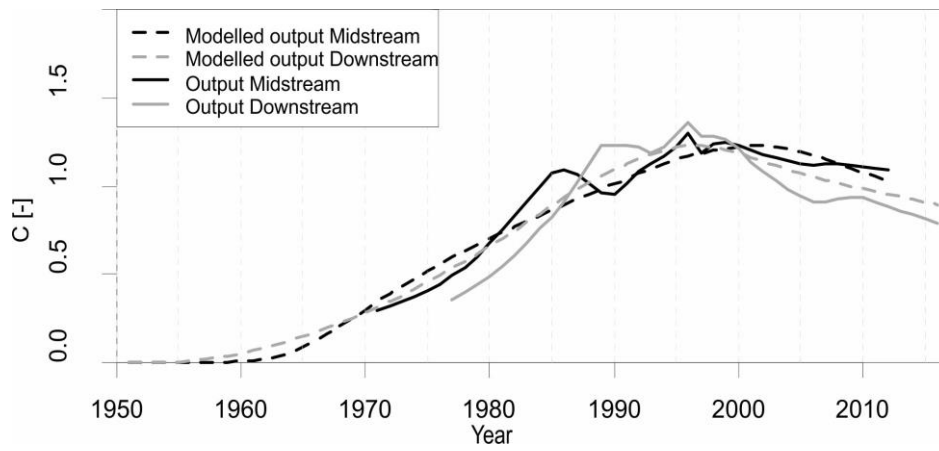


Figure S2.2: Modelled N-output concentrations derived from the N-input convolved with the log-normal travel time distributions (dashed lines) and the scaled observed flow-normalized annual $\text{NO}_3\text{-N}$ concentrations (solid lines) over time.