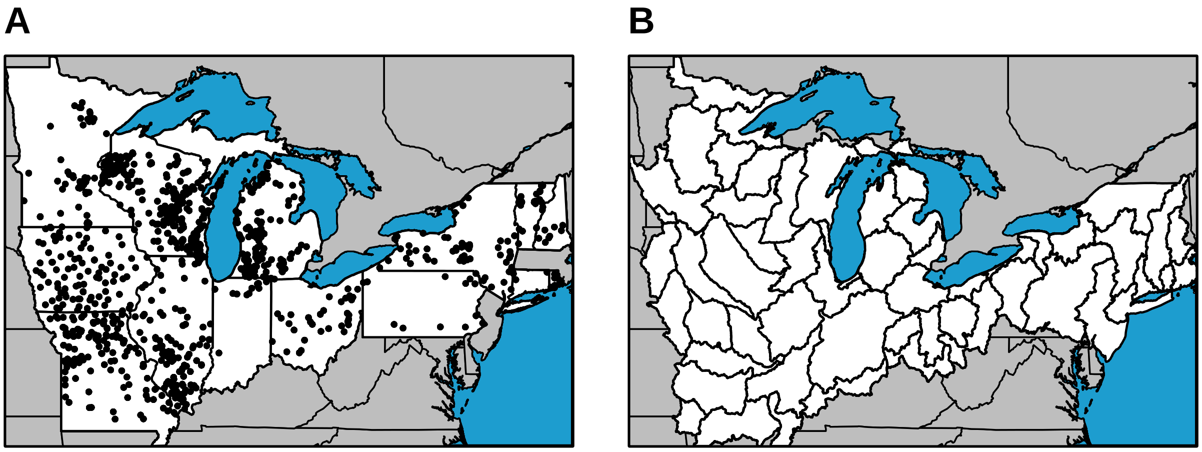

Figure 1: A) Map of lake locations and B) hydrologic (HUC4) regions.

Table 1: Medians followed by first and third quantiles of predictor variables for 928 lakes. Also shown is whether each predictor is defined as an aggregate or granular measure of agriculture.

Variable	Granularity	Median	Q25	Q75
Ag (percent)	Aggregate	42	25	63
Pasture (percent)	Granular	14	7	24
Corn (percent)	-	7	2	17
Soybeans (percent)	-	4	1	14
Buffer Ag (percent)	-	25	11	48
Buffer natural (percent)	-	41	23	59
Fertilizer N (kg/ha)	-	55	32	91
Fertilizer P (kg/ha)	-	10	6	16
Manure N (kg/ha)	-	27	17	45
Manure P (kg/ha)	-	7	5	12
Forest (percent)	Other	25	12	46
Wetlands (percent)	-	3	1	8
N deposition (kg/ha)	-	6	5	7
Precipitation (mm/yr)	-	910	830	1000
Baseflow	-	49	33	62
Wetland potential (percent)	-	15	5	26
Soil organic carbon (g C/m2)	-	4000	2900	5300
Clay (percent)	-	10	5	17
Max depth (m)	-	9	6	14
Watershed-lake ratio	-	15	6	34

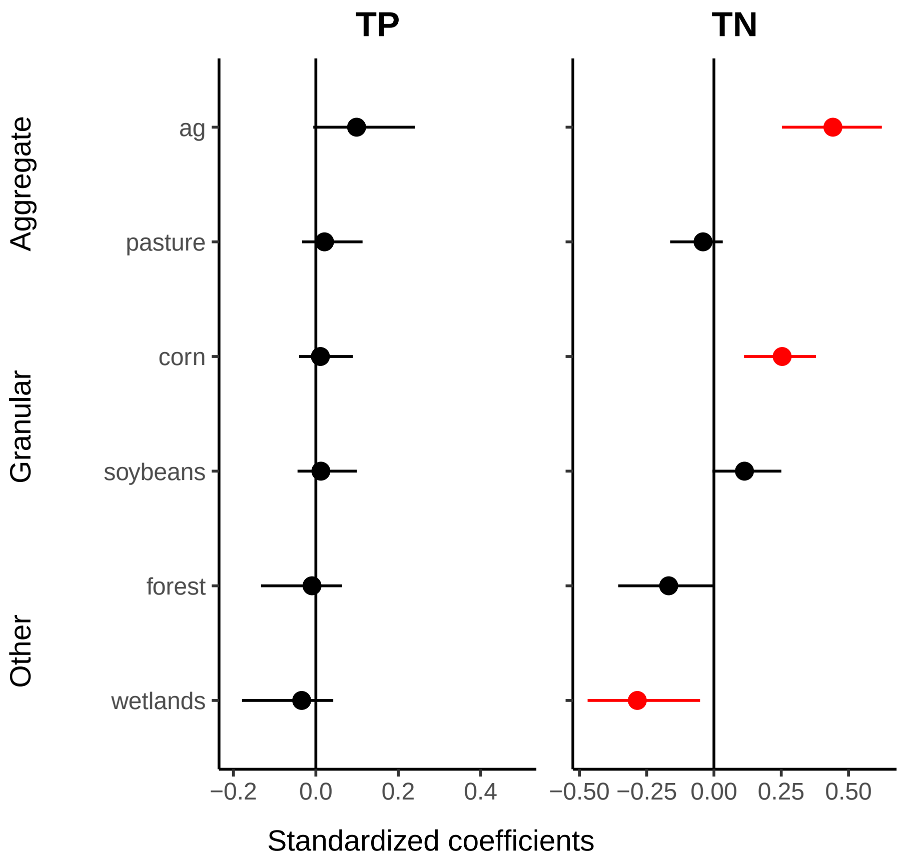

Figure 2: Population level slope estimates (μ_γ) for the effect of watershed land-use cover on lake TP and TN from six candidate models. Values shown are posterior medians (filled circles) and 95% credible intervals (solid lines). Also shown is a comparison to a zero effect (solid vertical line). Values that do not overlap zero are shaded in red. Coefficient estimates are reported relative to standardized predictor variables centered at zero with unit variance.

Table 2: Diagnostics for each model listed by regionally varying coefficient. Table is sorted by decreasing R^2 and expected log predictive density (ELPD). ELPD has a similar interpretation to information criterion measures like AIC. Typically models are considered to be different if they are separated by an AIC value of greater than 2, which is equivalent to an ELPD value of -1.

response	term	R^2	LOO-ELPD
tp	ag	0.63	0.00
tp	wetlands	0.63	-0.41
tp	corn	0.63	-0.59
tp	pasture	0.63	-0.75
tp	forest	0.63	-0.76
tp	soybeans	0.63	-1.43
tn	ag	0.58	0.00
tn	corn	0.58	-2.58
tn	wetlands	0.54	-16.41
tn	soybeans	0.53	-20.88
tn	pasture	0.53	-21.01
tn	forest	0.53	-22.37

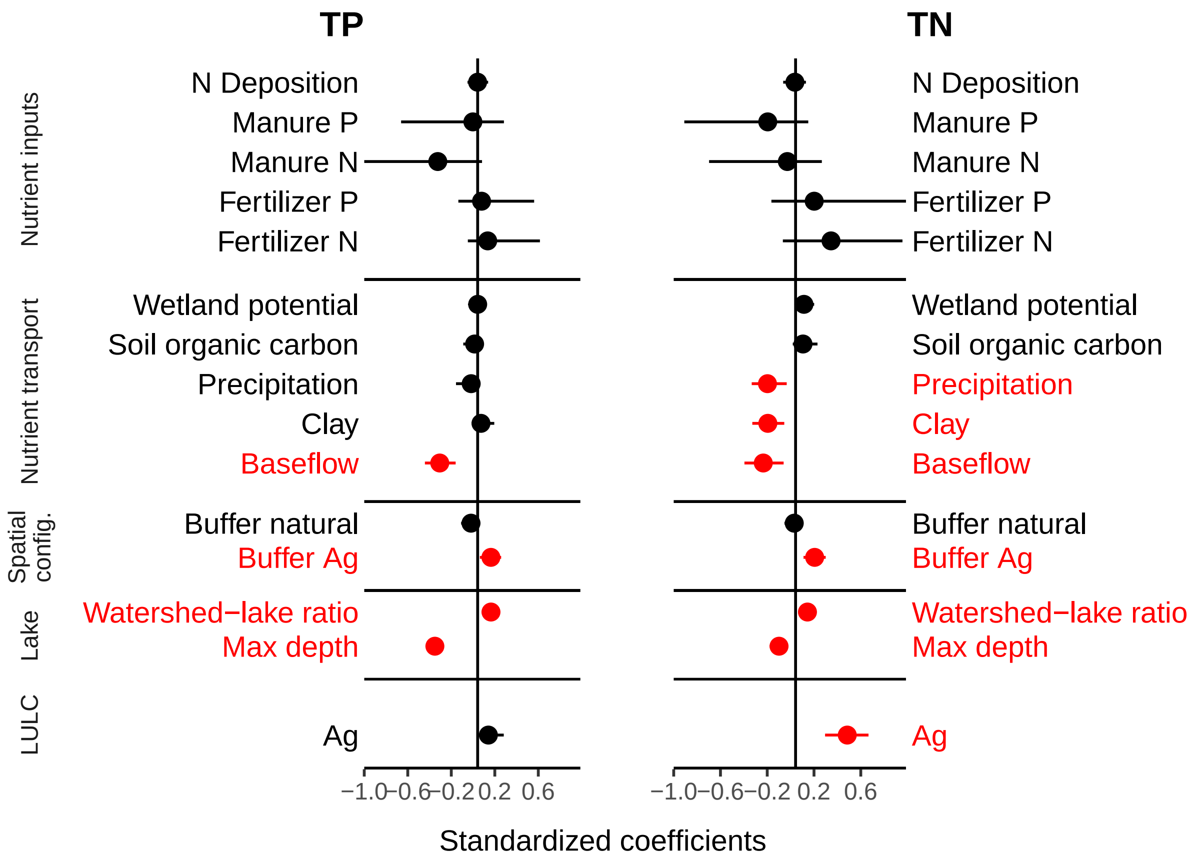

Figure 3: Global (fixed effect) coefficient values (β, for all non-LULC predictors) and population level estimates for the effect of watershed land-use (μ_γ, for LULC) on lake TP and TN for each respective top-ranked model. Note that the values for LULC here are identical to their corresponding values in Figure 2. Values shown are posterior medians (filled circles) and 95% credible intervals (solid lines). Also shown is a comparison to a zero effect (solid vertical line). Values that do not overlap zero are shaded in red. Horizontal bars separate coefficients in distinct predictor categories. Coefficient estimates are reported relative to standardized predictor variables centered at zero with unit variance and correspond with β (and μ_γ for LULC) from Equation 1.

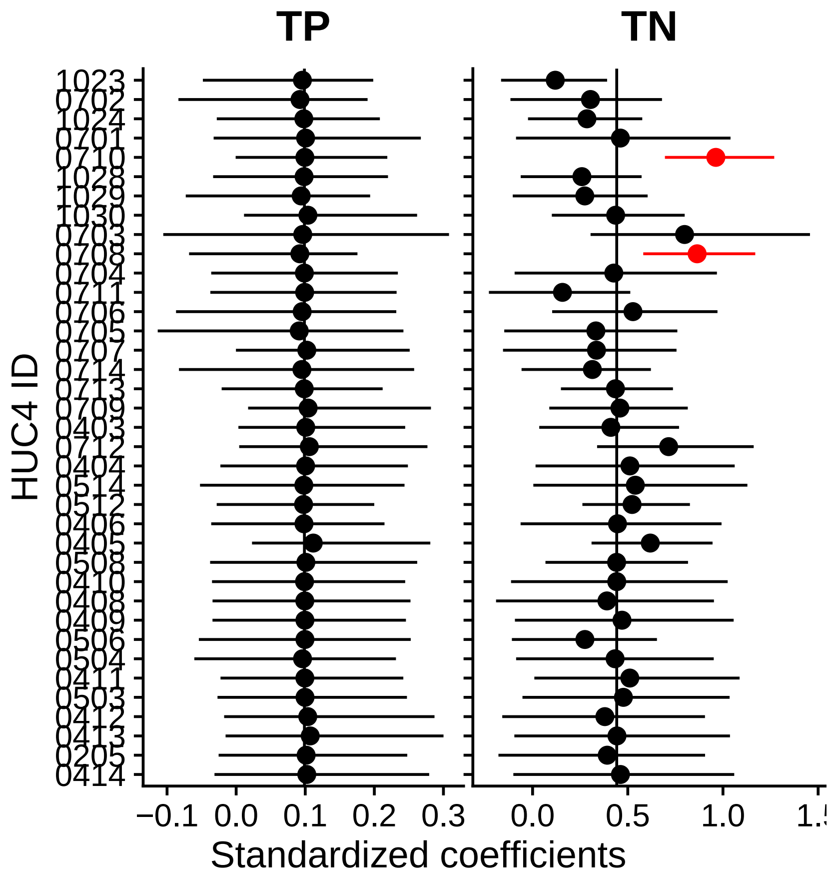

Figure 4: Effect of watershed land-use (γ_j) for individual regions in the top-ranked lake TP and TN models. Values shown are posterior medians (filled circles) and 95% credible intervals (solid lines) for individual hydrologic units (HUC4s) ordered from top to bottom according to longitude (west to east). Also shown is a comparison to a zero effect (solid vertical line. Values that do not overlap the population level effect are shaded in red.

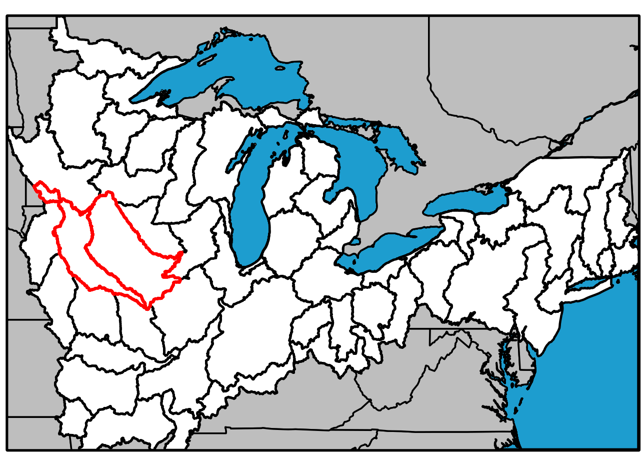

Figure 5: Location of hydrologic regions sensitive to watershed land-use cover corresponding to highlighted credible intervals in Figure 4.

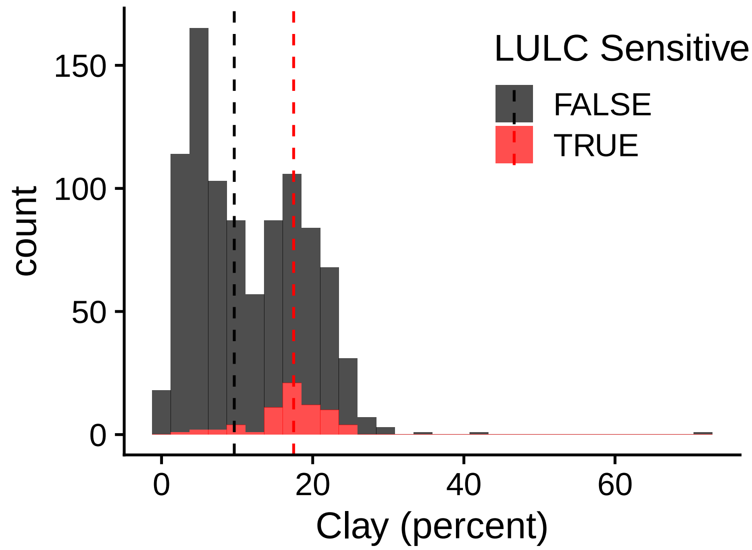

Figure 6: Histograms showing the distribution of soil clay content for watersheds in regions sensitive to watershed land-use (see highlighted credible intervals in Figure 4) relative to watersheds all other regions. Medians for each group are shown as vertical dashed lines.

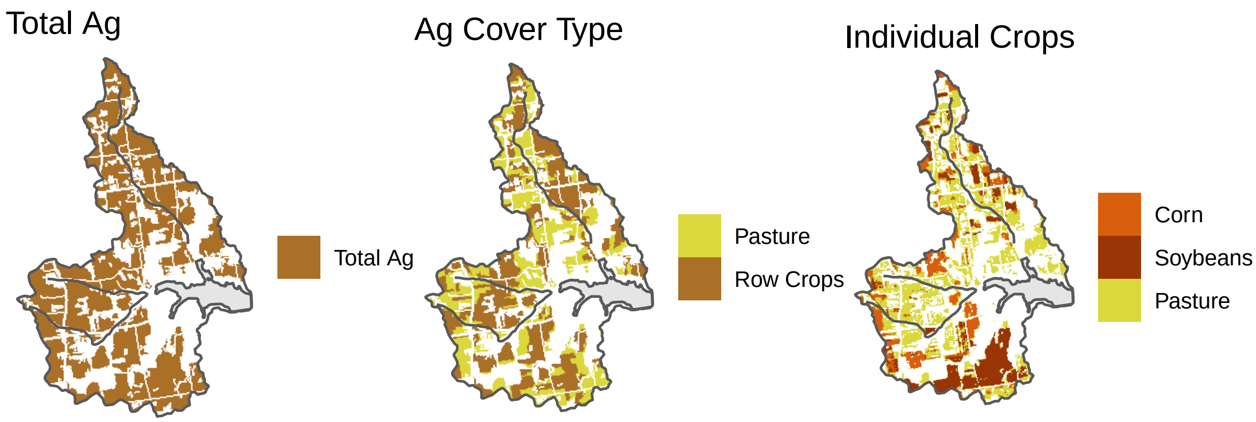

Figure A 1: Example of increasing granularity for total Ag to Ag versus pasture, to pasture versus specific crops. For illustration, only corn, soybeans, and pasture are shown rather than all CDL land-use categories.

Table A 1: Category definitions from the 2010 CDL. See code supplement for listing of variables classified as 'ag'

Category	Description
Corn	Corn
Corn	Sweet corn
Corn	Pop or orn corn
Corn	Non irrigated corn
Forest	Forest
Forest	Deciduous forest
Forest	Evergreen forest
Forest	Mixed forest
Pasture	Grass pasture
Soybeans	Soybeans
Soybeans	Non irrigated soybeans
Wetlands	Wetlands
Wetlands	Woody wetlands
Wetlands	Herbaceous wetlands

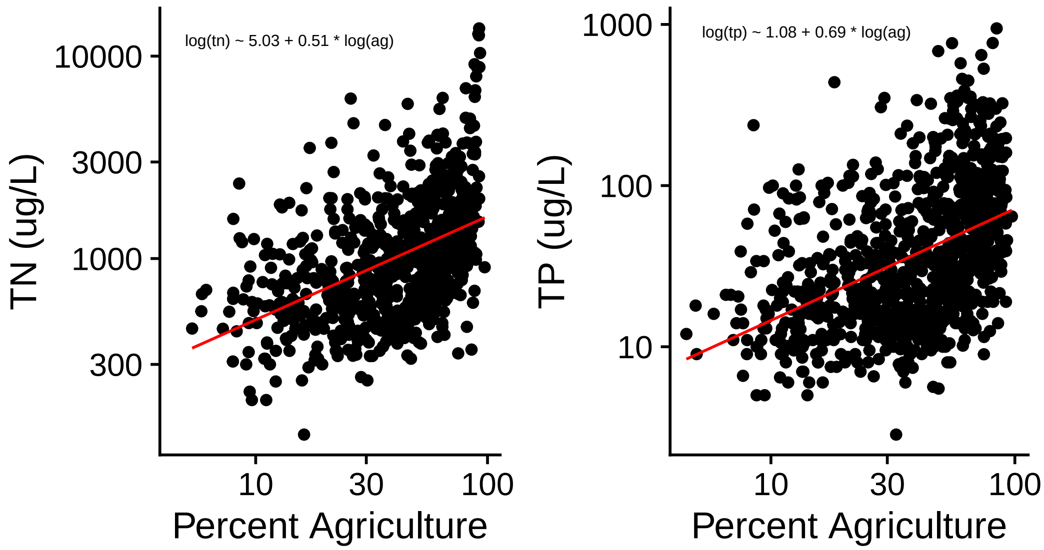

Figure A 2: Lake nutrient concentrations plotted against percent watershed agriculture.

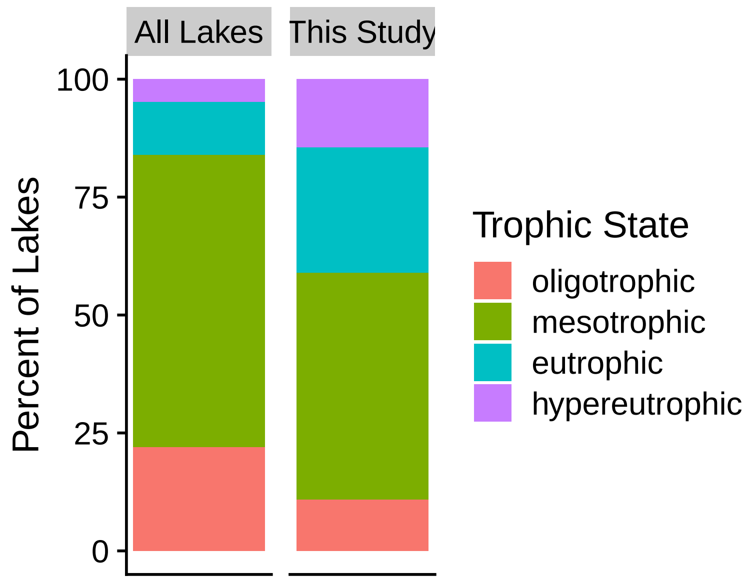

Figure A 3: Lake trophic state in our study lakes versus all lakes from Soranno et al. (2017) located within our study extent. Trophic state based on the chlorophyll critera from Carlson (1996)

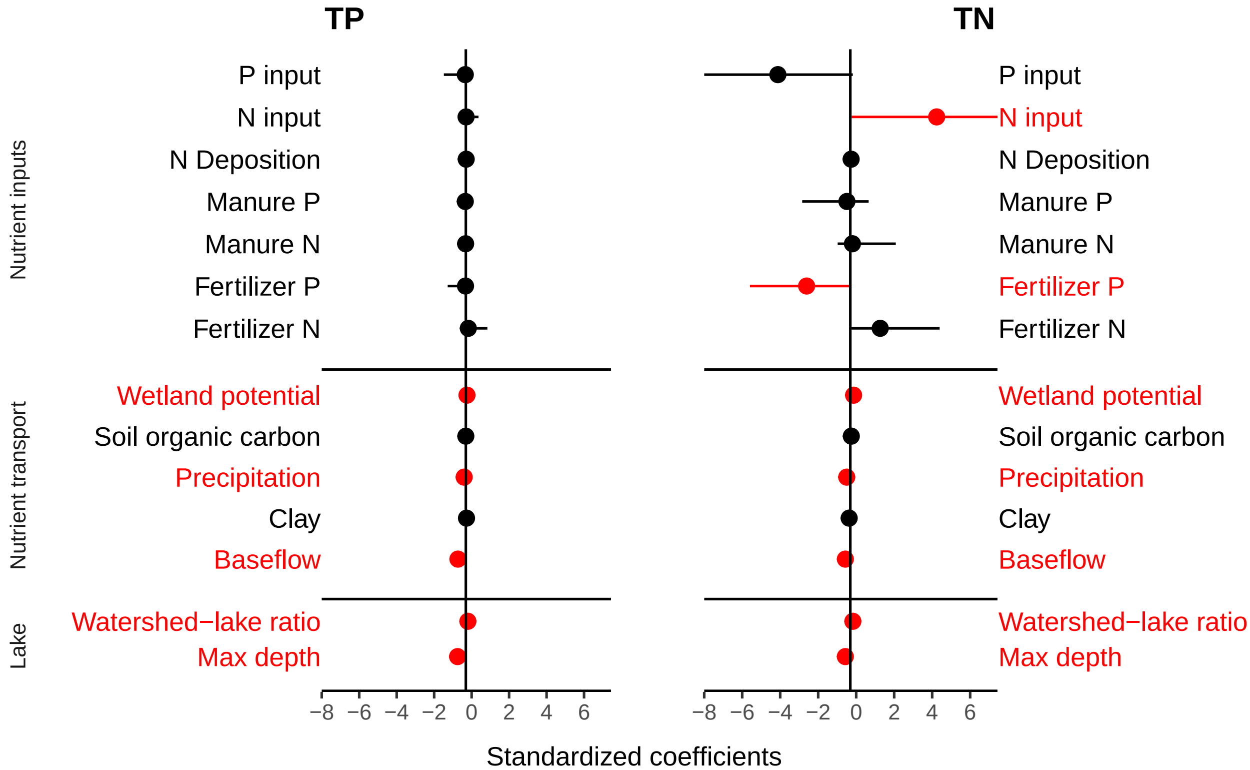

Figure A 4: Global (fixed effect) coefficient values and credible intervals for best-fit lake TP and TN models when land-use predictors are excluded. Values shown are posterior medians (filled circles) and 95% credible intervals (solid lines). Also shown is a comparison to a zero effect (solid vertical line). Values that do not overlap zero are shaded in red. Horizontal bars separate coefficients in distinct predictor categories. Coefficient estimates are reported relative to standardized predictor variables centered at zero with unit variance and correspond with β from Equation 1.

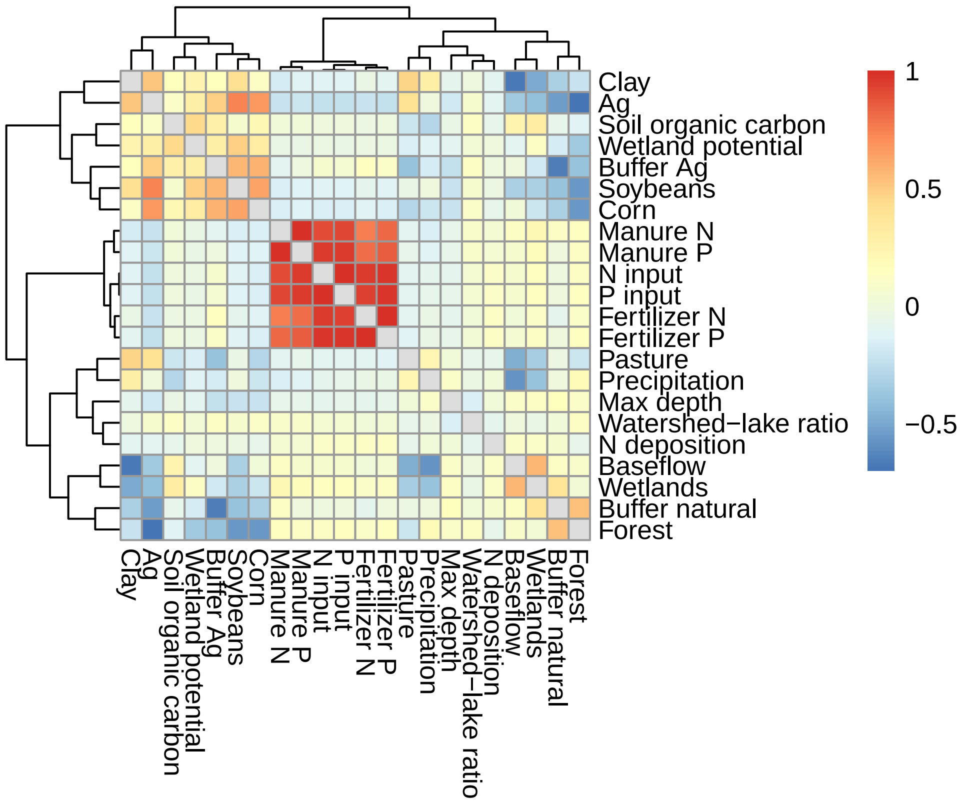

Figure A 5: Heatmap showing Pearson correlation coefficients among predictor variables. Grey cells denote correlation matrix diagonals.

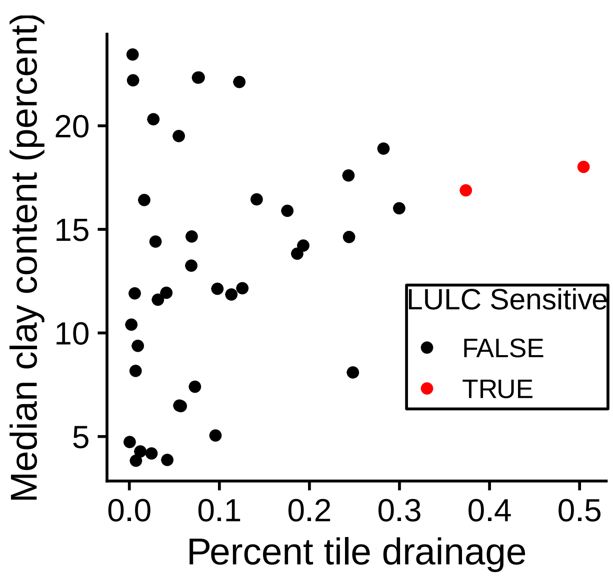

Figure A 6: Scatterplot showing the median clay content of watersheds in our hydrologic regions plotted against percent tile drainage from Nakagaki and Wieczorek (2016). The regions that are highly sensitive to agriculture land-use from Figure 4 are highlighted.

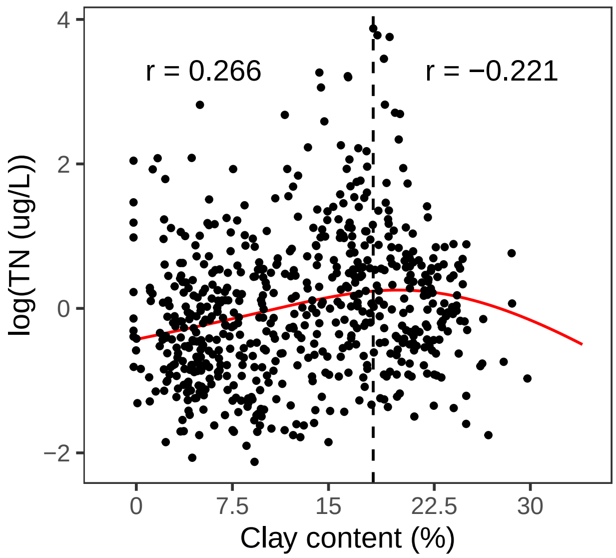

Figure A 7: Scatterplot showing the non-linear relationship between watershed clay content and lake TN concentration. Vertical dashed line shows transition between a positive and a negative correlation (r) between the two variables. Solid red line shows the fit of a generalized additive model from the mgcv R package.