

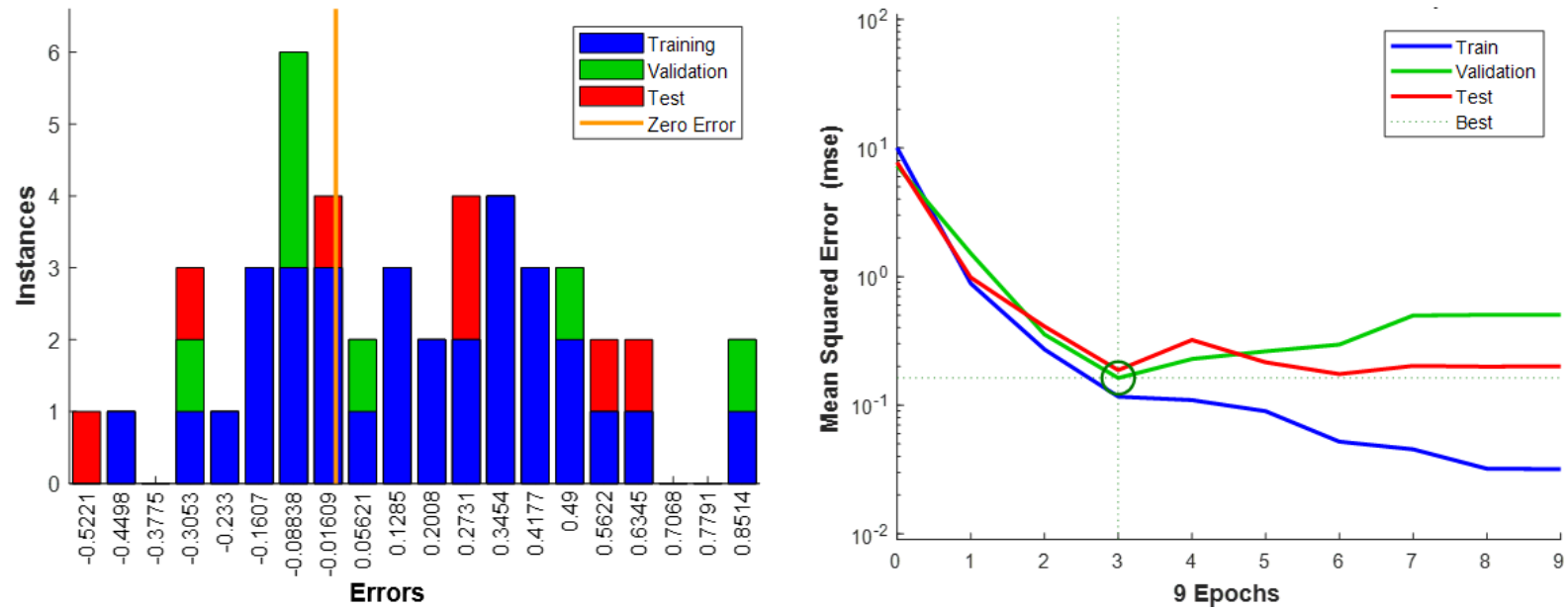


Figure S1. Left: Error histogram with 20 bins; Right: Best validation performance. Instances are the number of *E. coli* observations which lie in a particular bin. Zero error line corresponds to the zero error value on the error axis. Mean squared error is the average squared difference between the predicted and the observed *E. coli* values. Epoch is the number times that the ANN works through the entire training dataset.

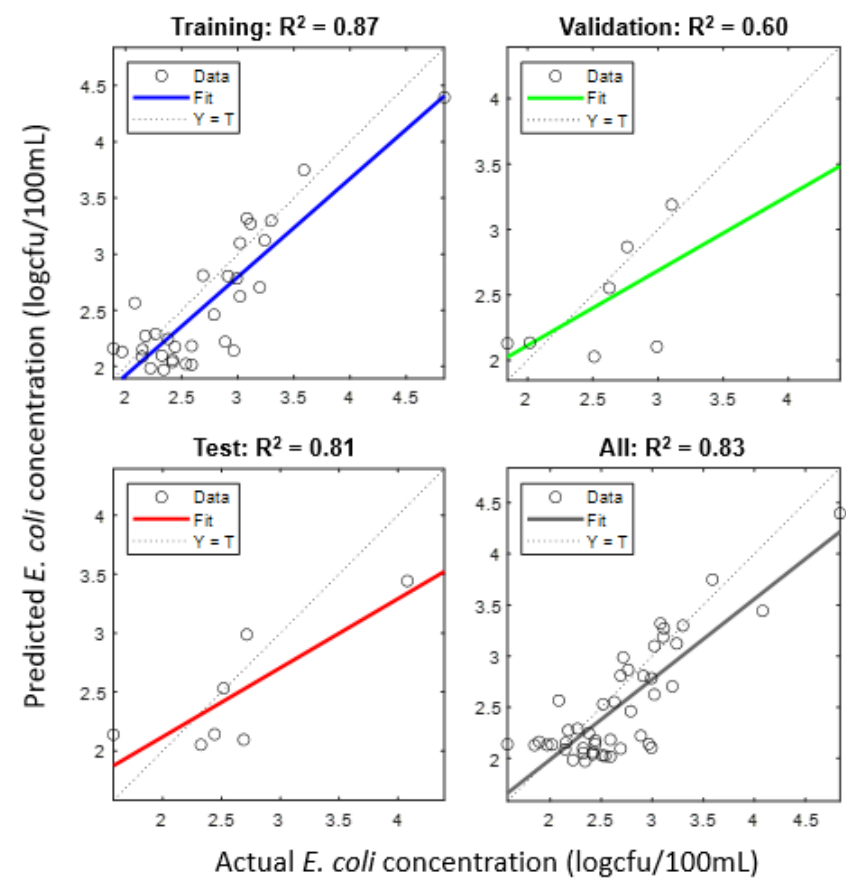


Figure S2. Observed and ANN-simulated *E. coli* concentrations at the gauging station.

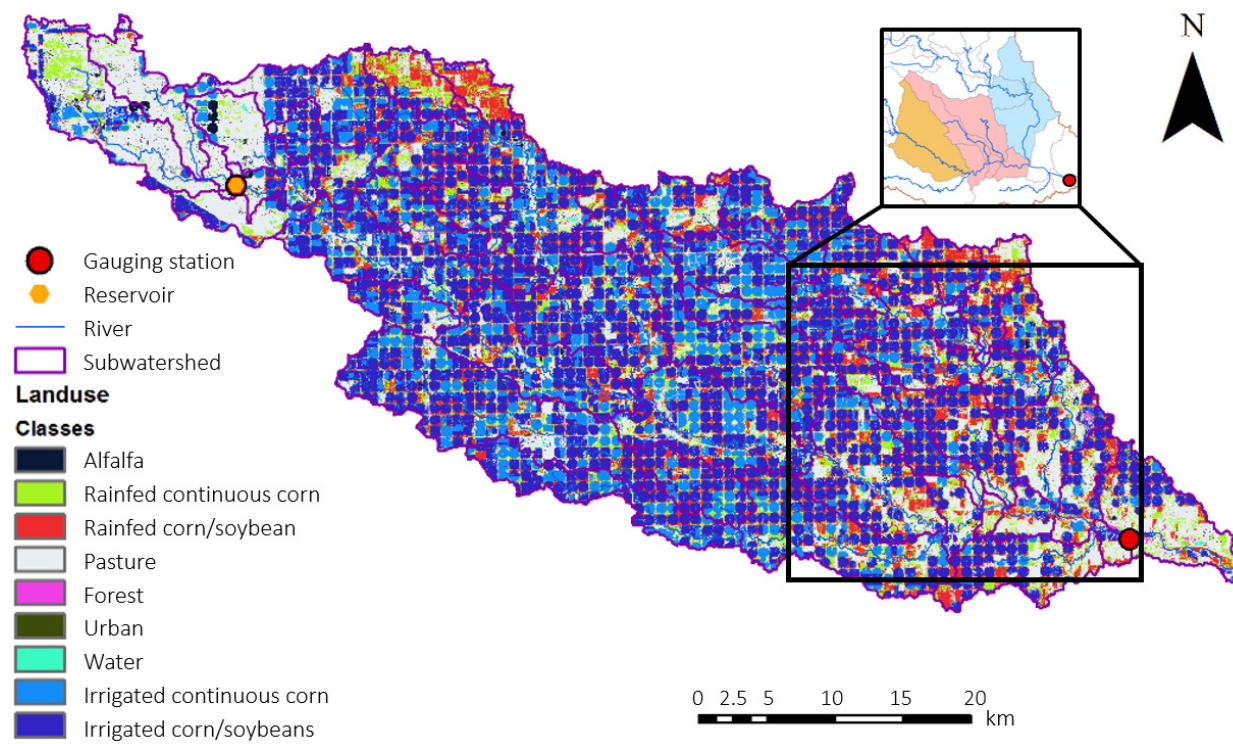


Figure S3. Land use map of BSCW

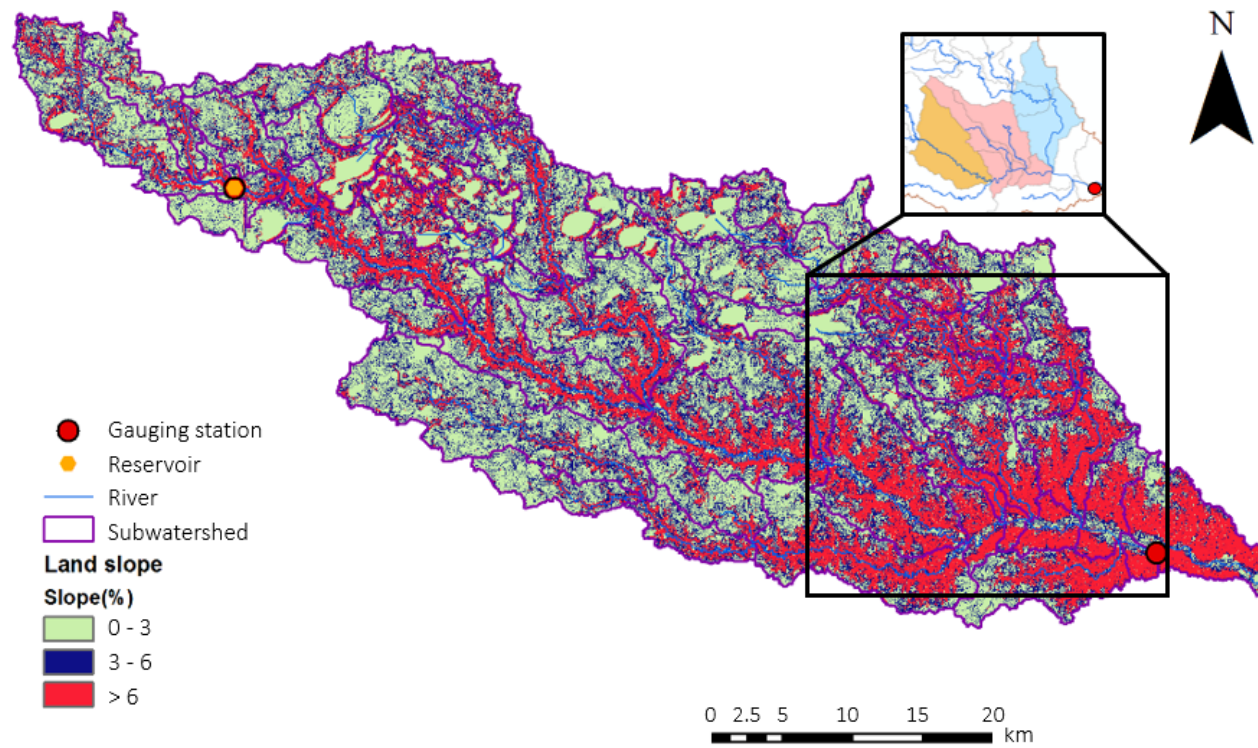


Figure S4. Slope map of BSCW

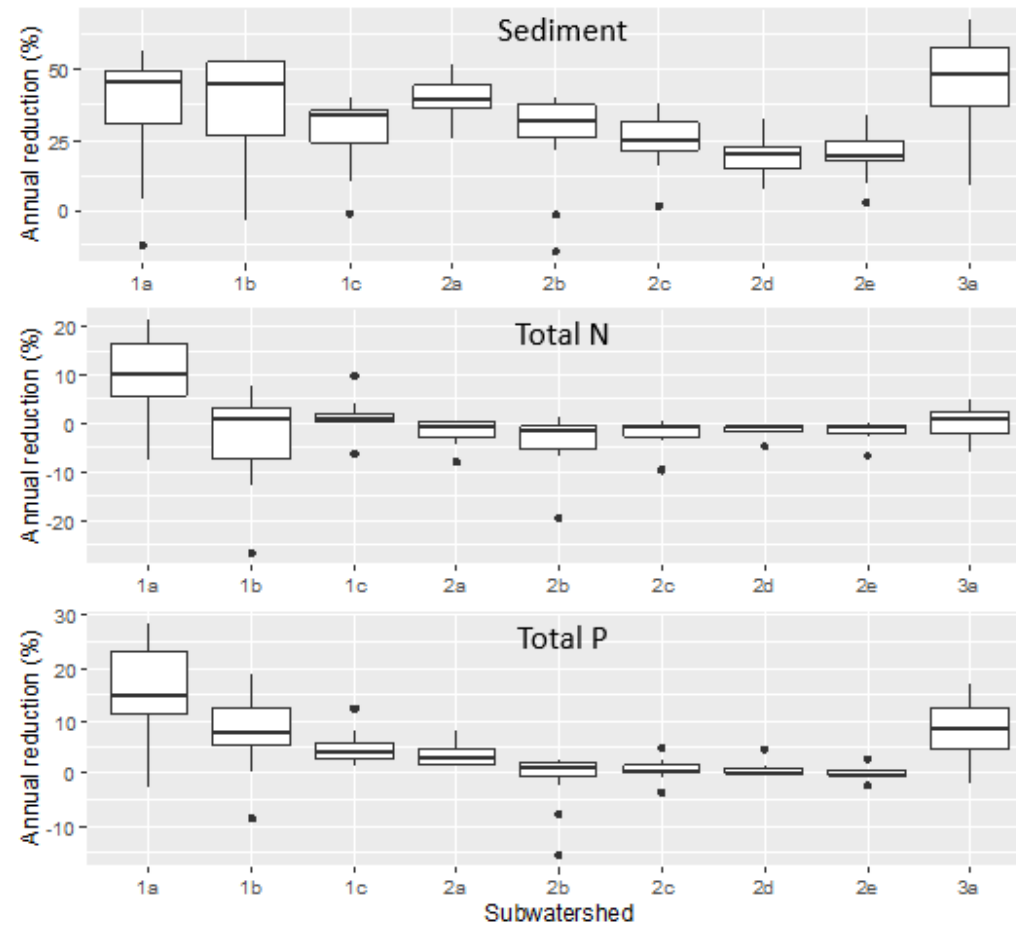


Figure S5. Box plots showing the distributions of annual reductions ($n = 13$) using no-till, with black circles denoting extreme outliers, and thick dashes denoting medians.

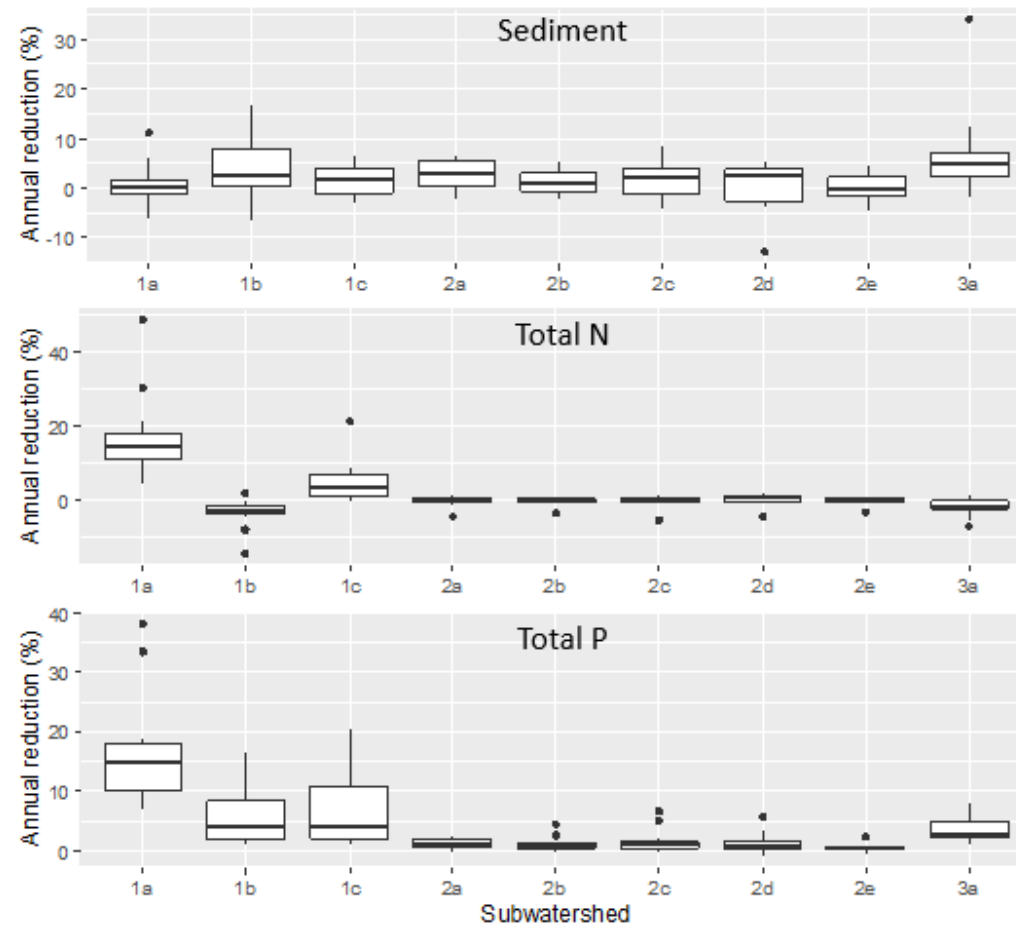


Figure S6. Box plots showing the distributions of annual reductions ($n = 13$) using crop rotation, with black circles denoting extreme outliers, and thick dashes denoting medians.

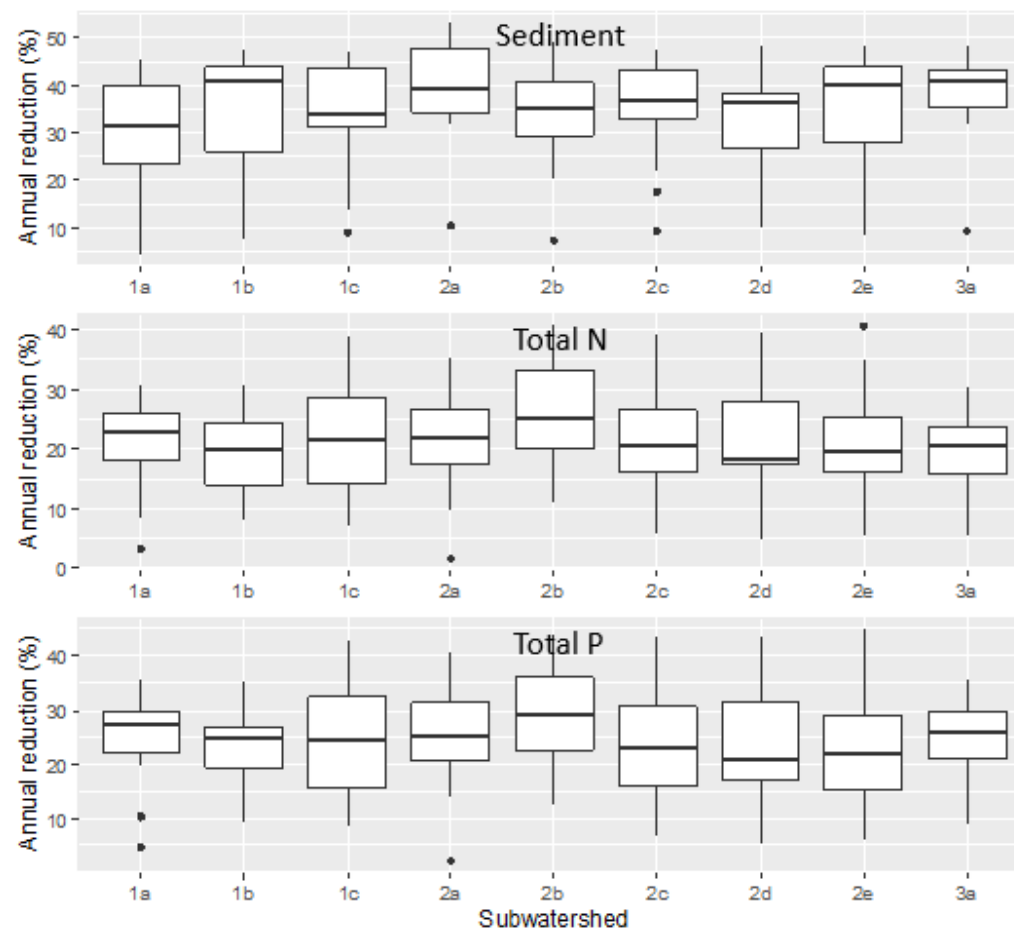


Figure S7. Box plots showing the distributions of annual reductions ($n = 13$) using filter strips, with black circles denoting extreme outliers, and thick dashes denoting medians.

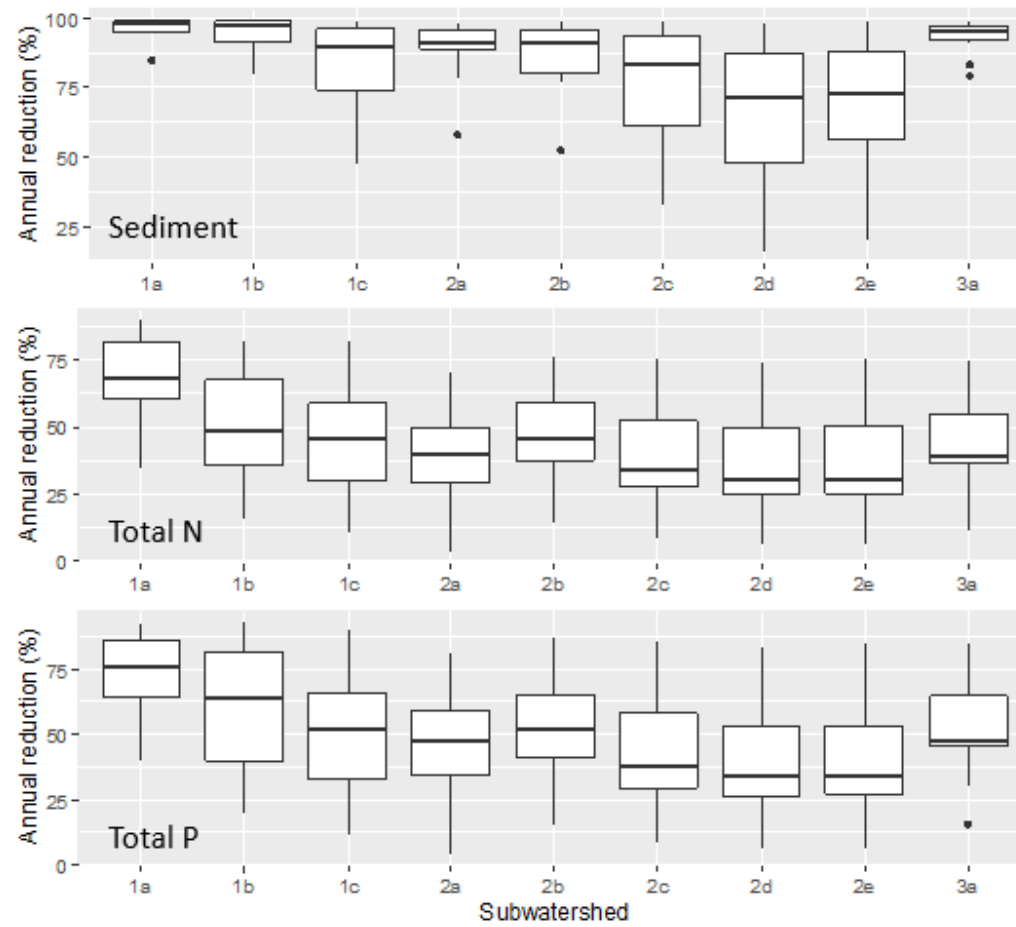


Figure S8. Box plots showing the distributions of annual reductions ($n = 13$) using grassed waterway, with black circles denoting extreme outliers, and thick dashes denoting medians.

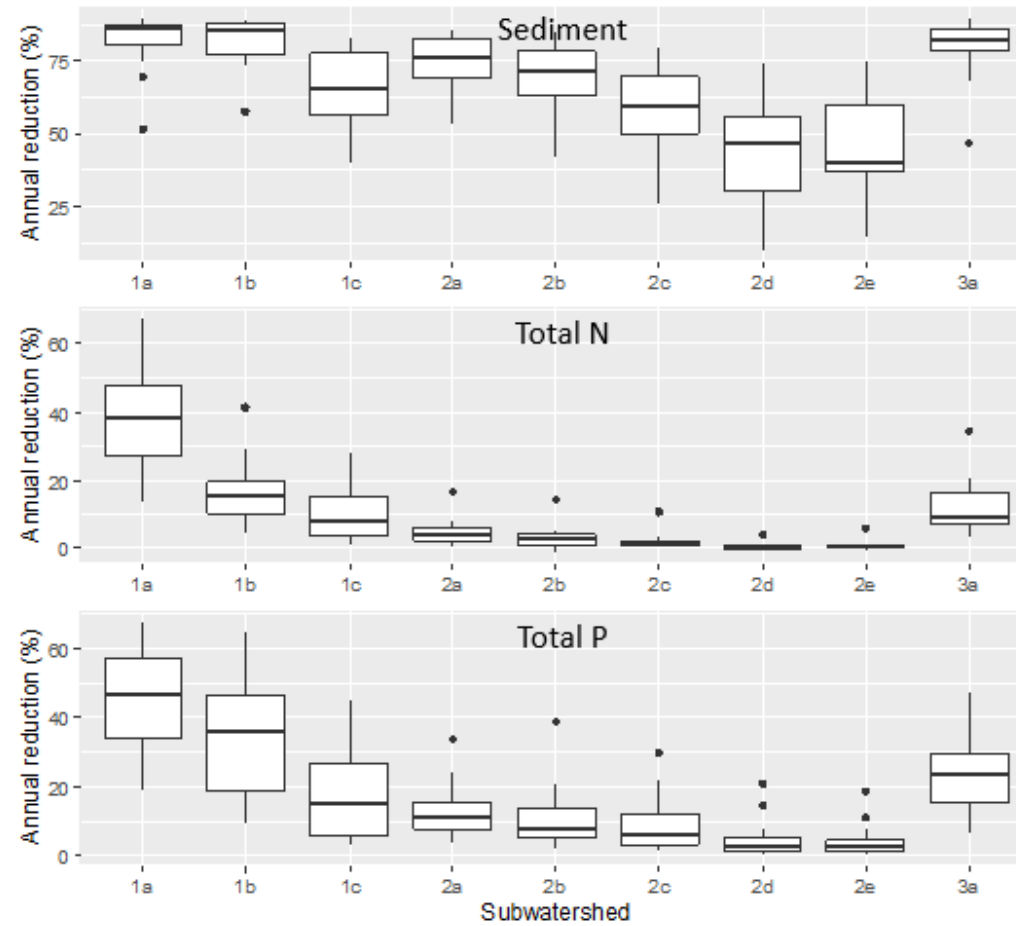


Figure S9. Box plots showing the distributions of annual reductions ($n = 13$) using terrace, with black circles denoting extreme outliers, and thick dashes denoting medians.

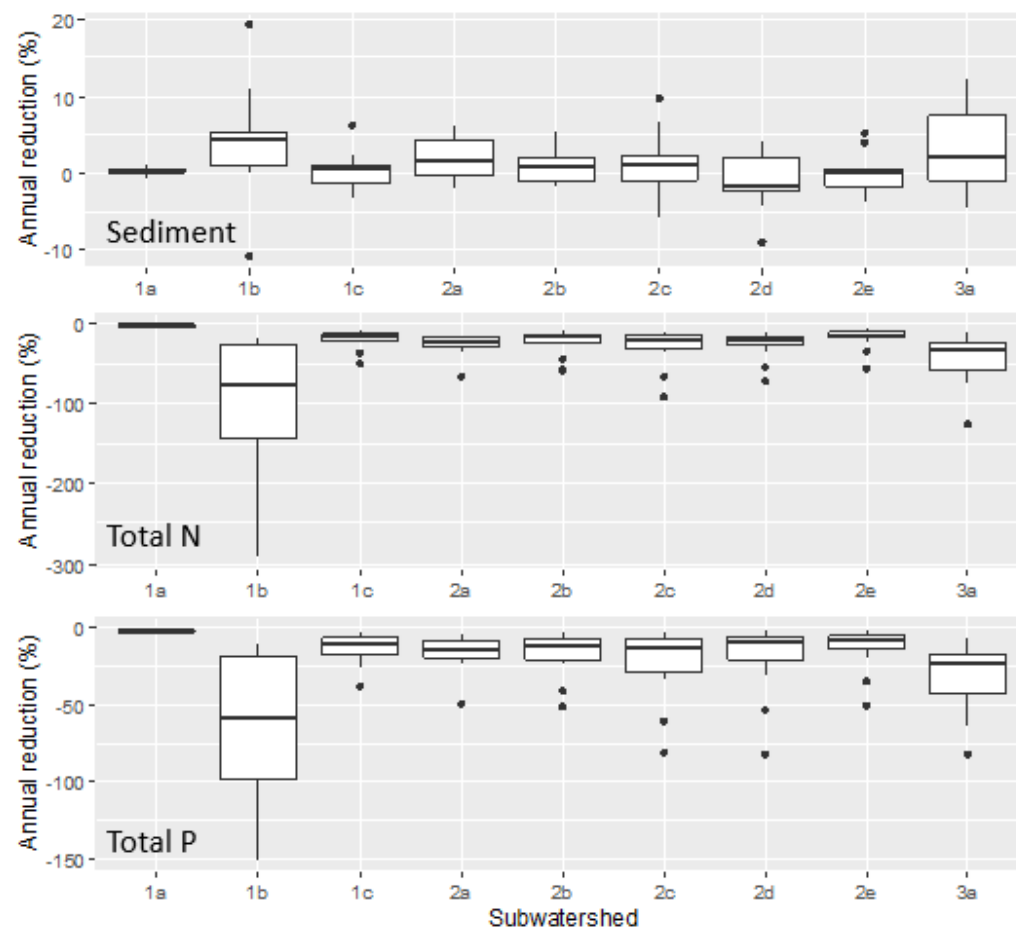


Figure S10. Box plots showing the distributions of annual reductions ($n = 13$) using reduced atrazine rate, with black circles denoting extreme outliers, and thick dashes denoting medians.

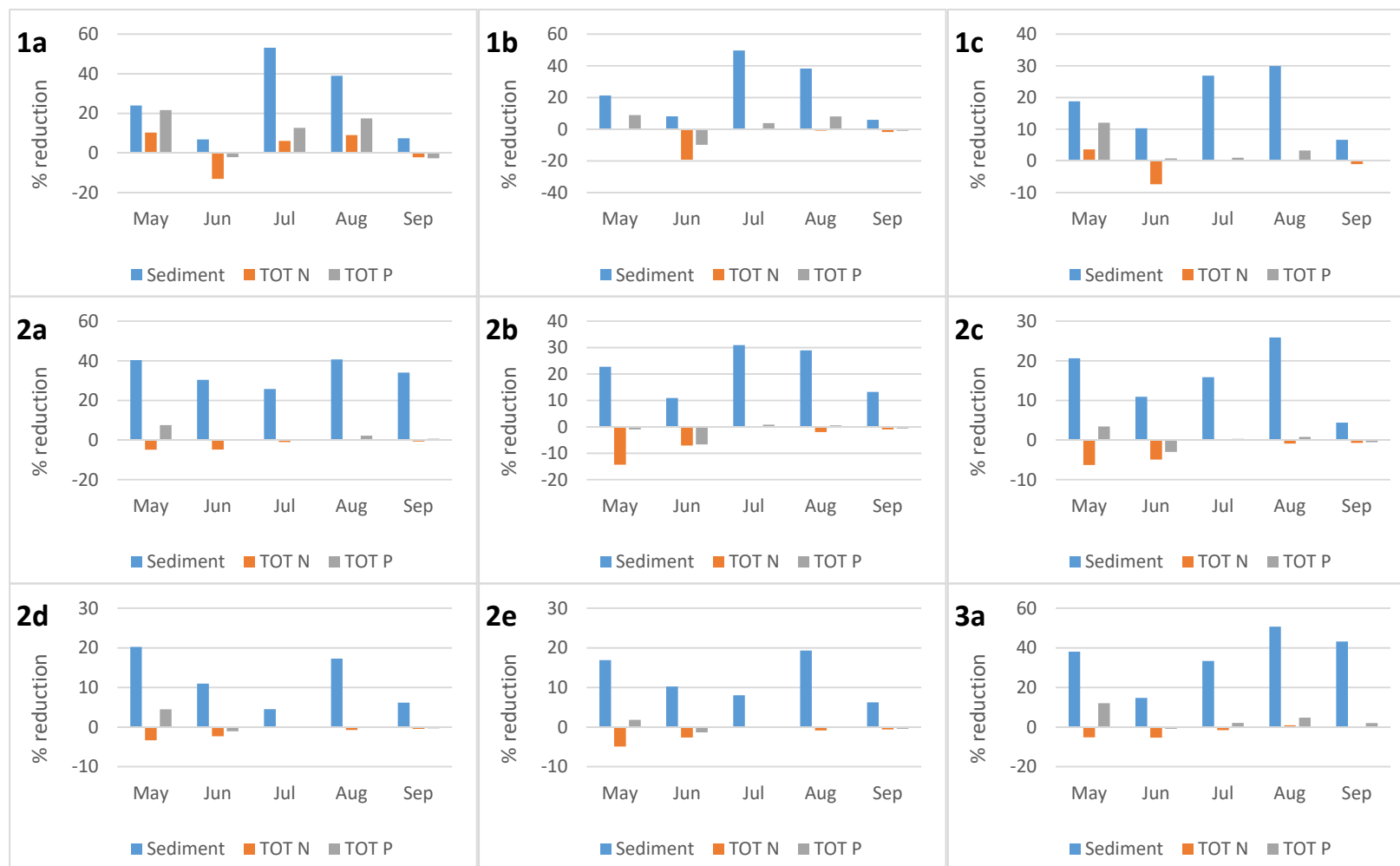


Figure S11. Average monthly (growing season) reduction in loadings using no-till at the target subwatersheds. Negative values indicate an increase.

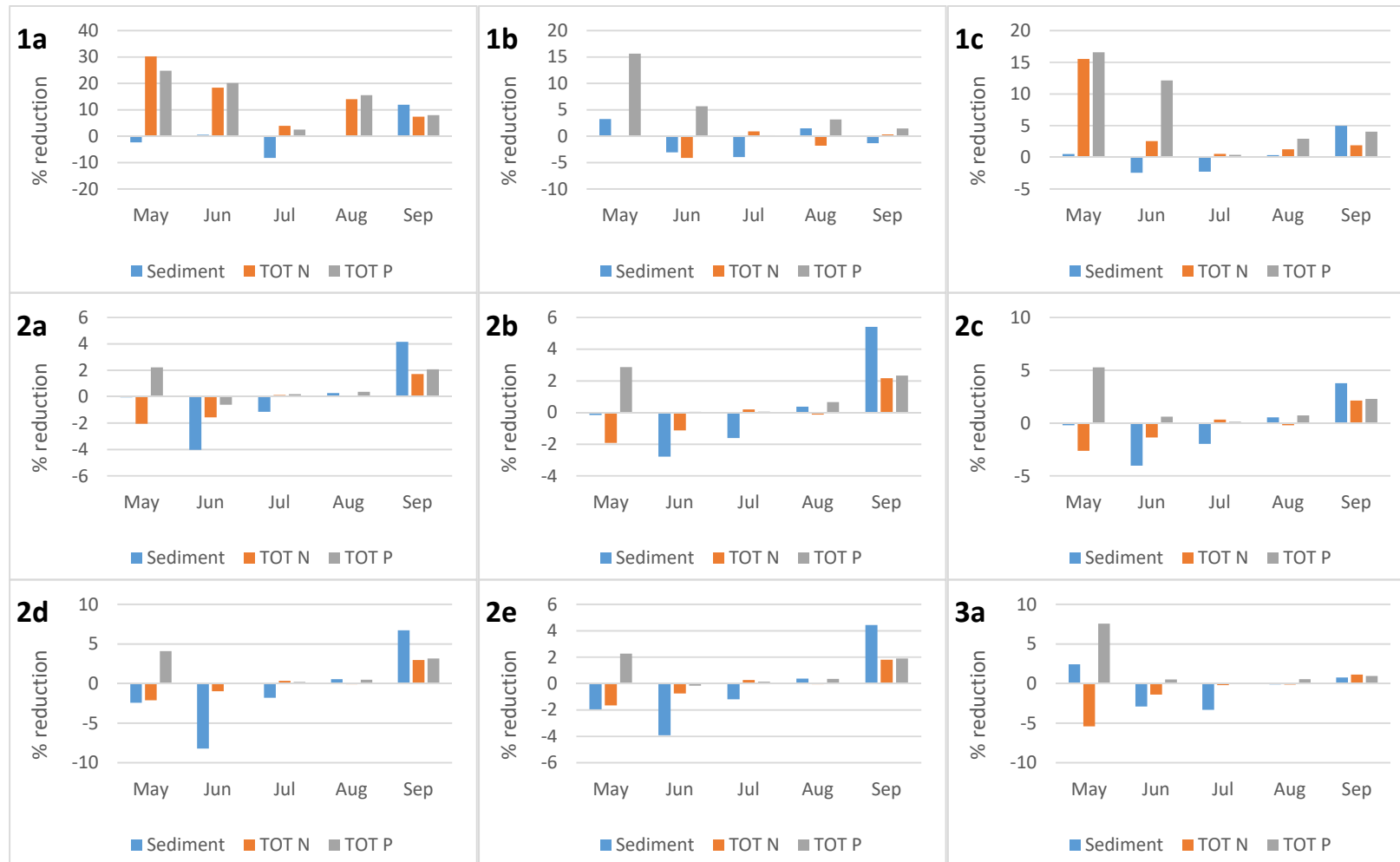


Figure S12. Average monthly (growing season) reduction in loadings using crop rotation at the target subwatersheds. Negative values indicate an increase.

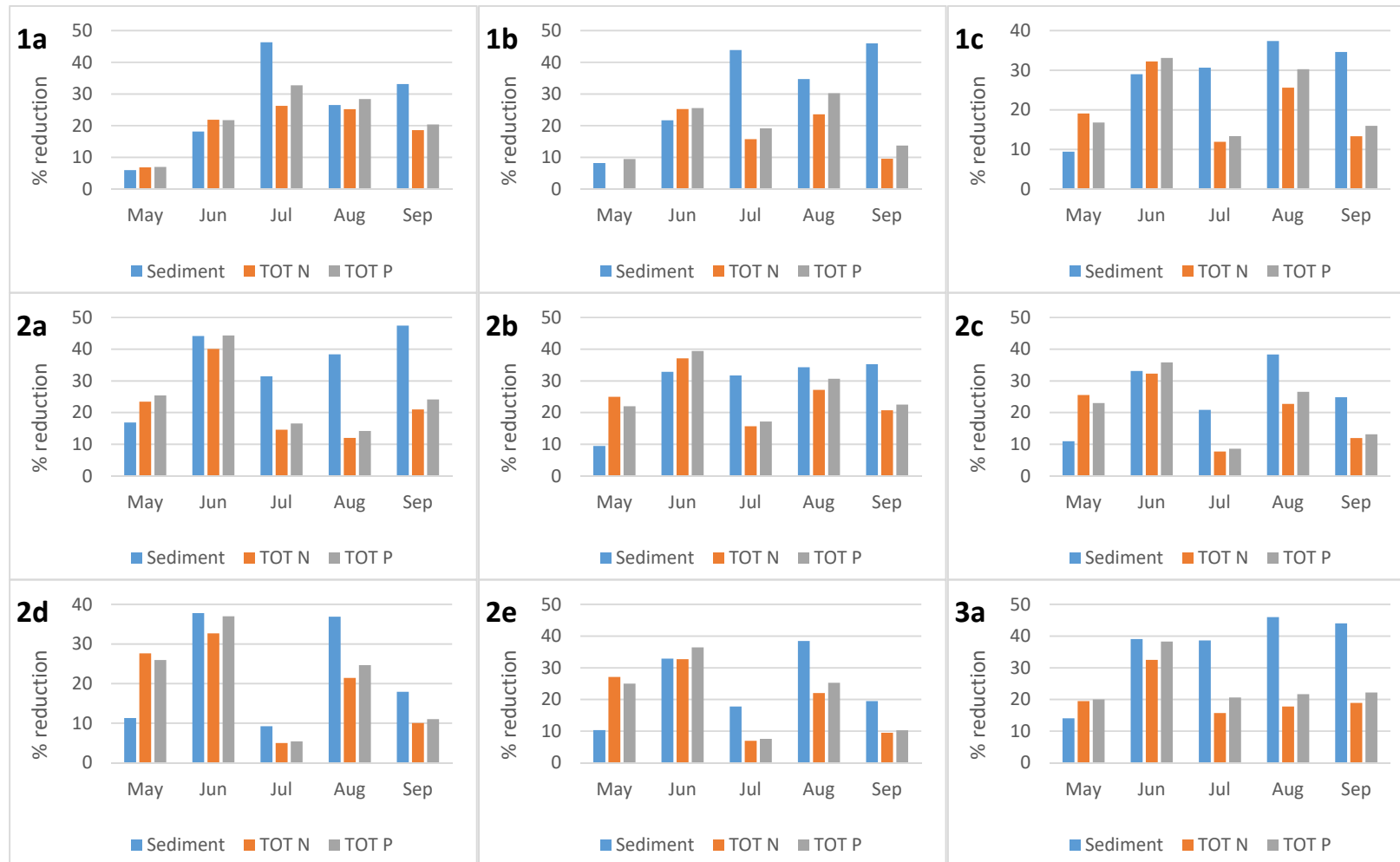


Figure S13. Average monthly (growing season) reduction in loadings using filter strips at the target subwatersheds. Negative values indicate an increase.

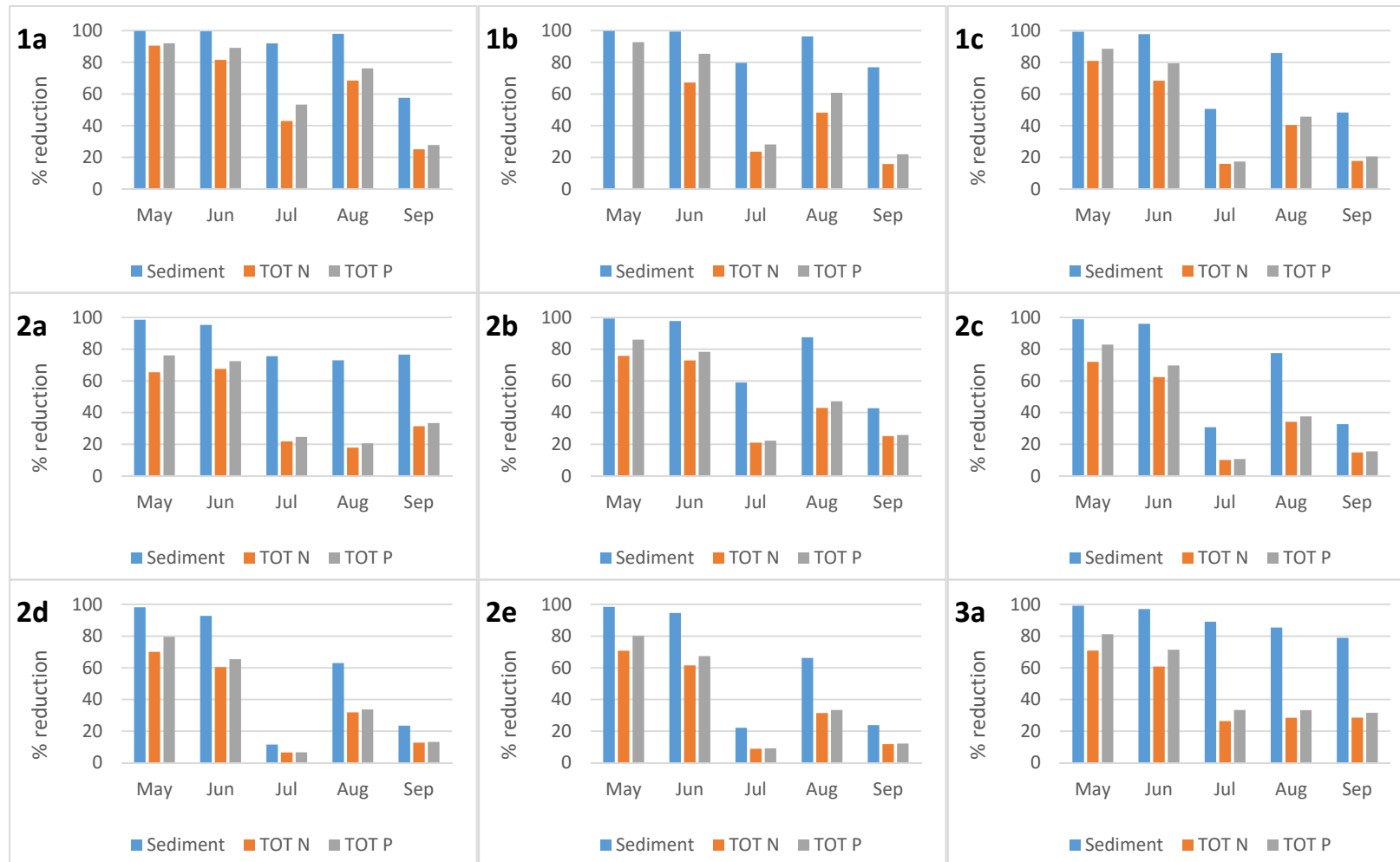


Figure S14. Average monthly (growing season) reduction in loadings using grassed waterway at the target subwatersheds. Negative values indicate an increase.

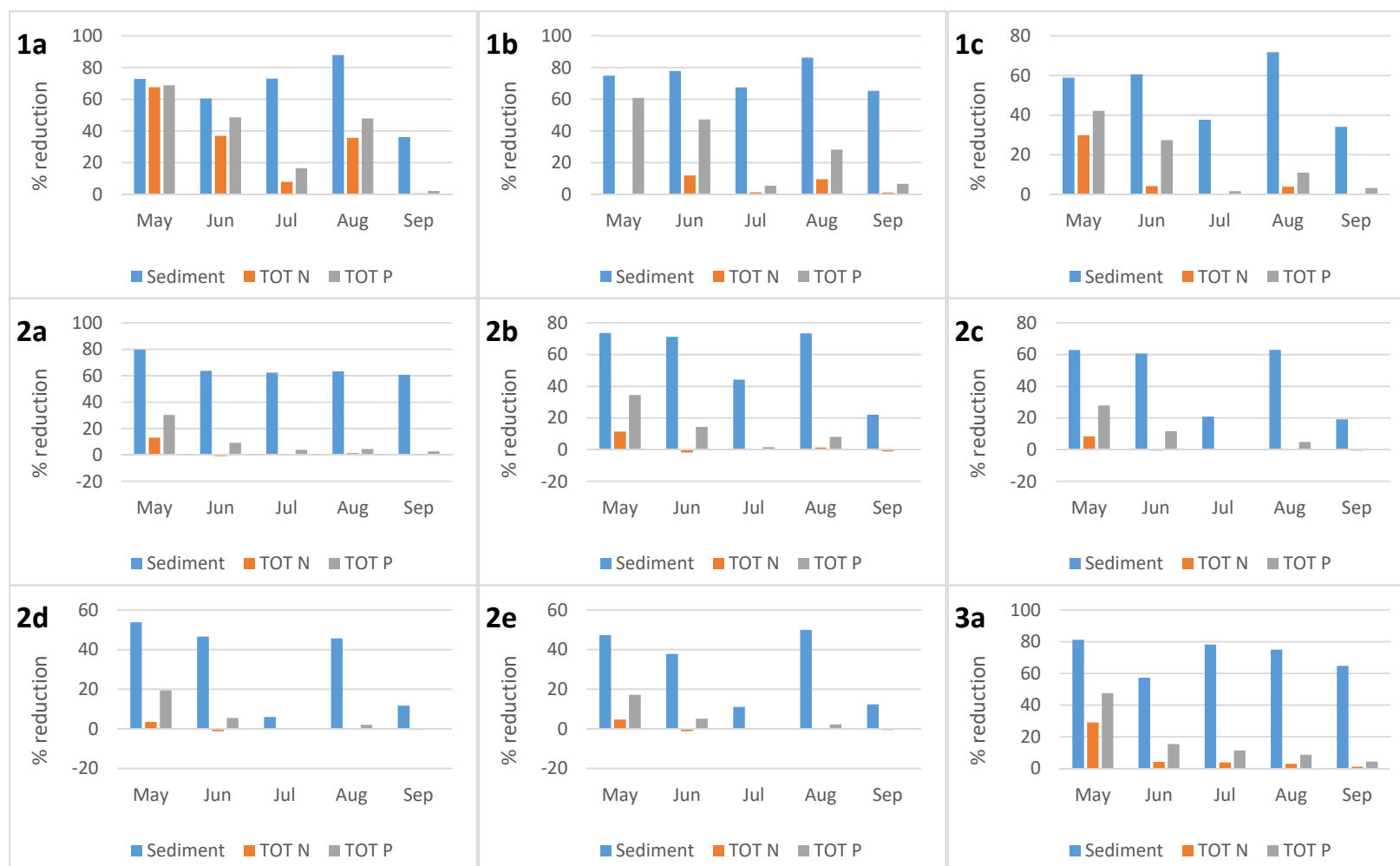


Figure S15. Average monthly (growing season) reduction in loadings using terrace at the target subwatersheds. Negative values indicate an increase.

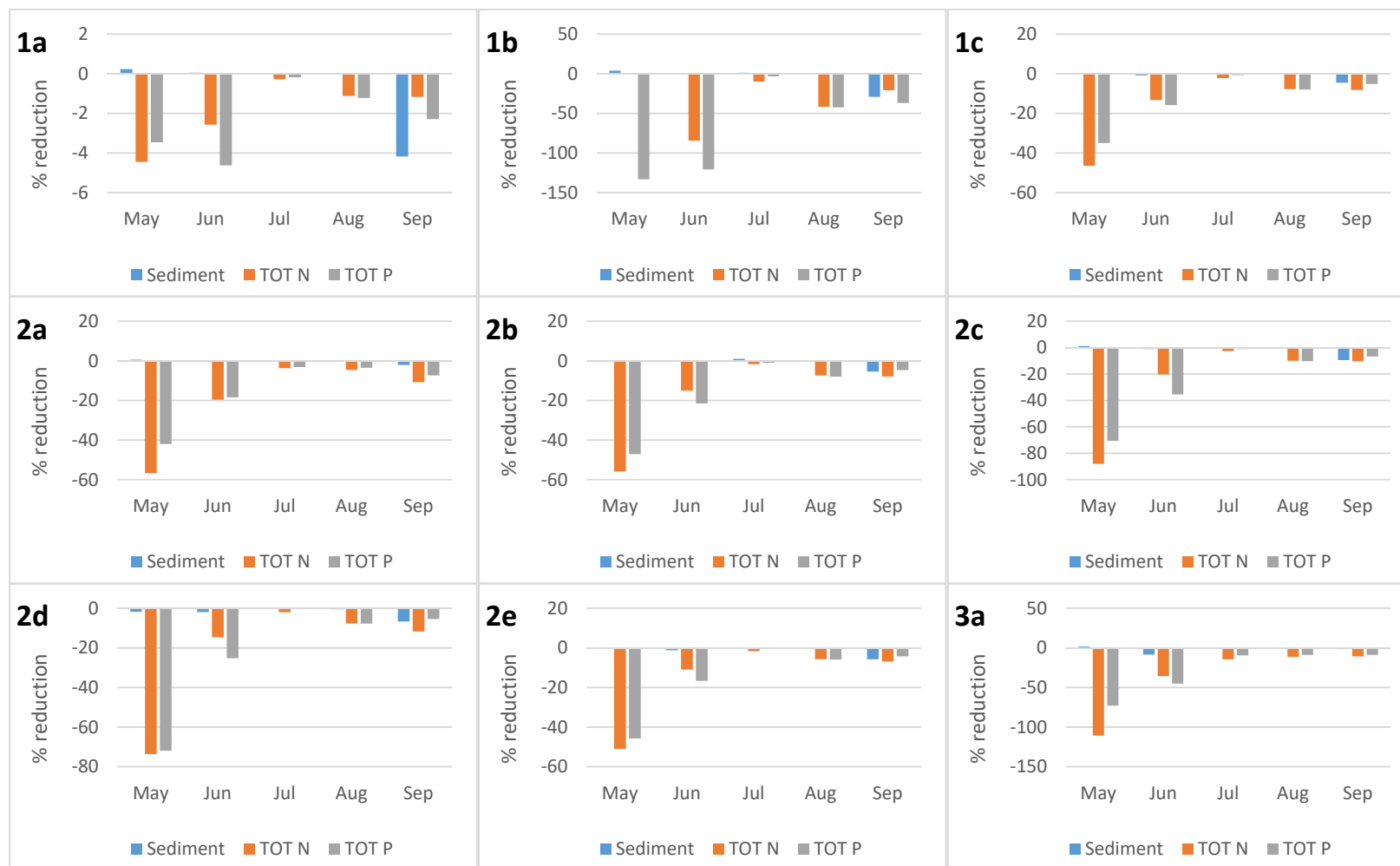


Figure S16. Average monthly (growing season) reduction in loadings using reduced atrazine rate at the target subwatersheds. Negative values indicate an increase.

Table S1. Management operation for land in corn/soybeans rotation and pasture management.

Crop	Date	Management Operation	Rate
Corn	15-Apr	Fertilizer application (82-0-0* anhydrous ammonia)	78.5 kg/ha
	24-Apr	Tillage (Field cultivator)	
	1-May	Plant corn	
	3-May	Pesticide application (Atrazine)	1.1 kg/ha
	4-June	Pesticide application (Atrazine)	0.6 kg/ha
	9-Sept	Harvest and kill	
Soybeans	1-May	Plant soybeans	
	30-Sept	Harvest and kill	
	25-Oct	Fertilizer application (11-52-0*)	168.1 kg/ha
	31-Oct	Tillage (Tandem disk)	

Note: * Fertilizer content in percent N-P-K.

Table S2. SWAT parameters and their final values used in calibration for the Big Sandy Creek Watershed, Nebraska SWAT model

Parameter type	Parameter	File type	Description	Model range	Big Sandy Creek
Flow	CN2	mgt	Initial SCS runoff curve number for moisture condition II	-0.2 to 0.2	0.014
Flow	ESCO	hru	Soil evaporation compensation factor	0 to 1	0.886
Flow	EPCO	hru	Plant uptake compensation factor	0 to 1	0.741
Flow	ALPHA_BF	gw	Baseflow alpha factor (days)	0 to 1	0.153
Flow	GW_DELAY	gw	Groundwater delay (days)	0 to 500	178.757
Flow	GWQMN	gw	Threshold depth of water in the shallow aquifer required for return flow to occur (mm)	0 to 5000	4870.673
Flow	REVAPMN	gw	Threshold depth of water in the shallow aquifer for "revap" to occur (mm)	0 to 500	261.9
Flow	RCHRG_DP	gw	Deep aquifer percolation fraction	0 to 1	0.118
Flow	GW_REVAP	gw	Groundwater "revap" coefficient	0.02 to 0.2	0.0808
Flow	CH_K2	rte	Effective hydraulic conductivity (mm/hr)	-0.01 to 500	9.688
Flow	ALPHA_BNK	rte	Baseflow alpha factor for bank storage (days)	0 to 1	0.363
Flow	CH_N2	rte	Manning's n value for main channel	-0.01 to 0.3	0.051
Flow	SOL_AWC	sol	Available water capacity of the soil layer	0 to 1	0.35
Sediment	LAT_SED	hru	Sediment concentration in lateral flow and groundwater flow (mg/l)	0 to 5000	2775
Sediment	CH_COV	rte	Channel cover factor	-0.001 to 1	0.213
Sediment	CH_EROD	rte	Channel erodibility factor	0 to 1	0.55
Sediment	USLE_K	sol	USLE equation soil erodibility (K) factor	0 to 0.65	0.284
Sediment	PRF	bsn	Peak rate adjustment factor for sediment routing in the main channel	0 to 2	1.458
Sediment	SPCON	bsn	Linear parameter for calculating the maximum amount of sediment that can be re-entrained during channel sediment routing	0.0001 to 0.01	0.009299
Sediment	SPEXP	bsn	Exponent parameter for calculating sediment re-entrained in channel sediment routing	1 to 1.5	1.027
Total N/P	RSDCO	bsn	Residue decomposition coefficient	0.02 to 0.1	0.076
Total N	SHALLST_N	gw	Initial concentration of nitrate in shallow aquifer (mg N/l)	0 to 1000	949.286
Total N	RCN	bsn	Concentration of nitrogen in rainfall (mg N/l)	0 to 15	7.682
Total N	CMN	bsn	Rate factor for humus mineralization of active organic nitrogen	0.001 to 0.003	0.001391

Total N	NPERCO	bsn	Nitrogen percolation coefficient	0 to 1	0.092
Total N	CDN	bsn	Denitrification exponential rate coefficient	0 to 3	0.458
Total N	SDNCO	bsn	Denitrification threshold water content	0 to 1	0.941
Total N	N_UPDIS	bsn	Nitrogen uptake distribution parameter	0 to 100	84.929
Total N	ANION_EXCL_BSN	bsn	Fraction of porosity from which anions are excluded	0.01 to 1	0.343
Total N	CH_ONCO_BSN	bsn	Channel organic nitrogen concentration in basin (ppm)	0 to 100	80.050
Total N	SOL_NO3	chm	Soil NO3 (mg/kg)	0 to 1	17.45
Total N	SOL_ORGN	chm	Soil organic N (mg/kg)	0 to 100	67.15
Total N	HLIFE_NGW	gw	Half-life of nitrate in the shallow aquifer (days)	0 to 200	6.9
Total N	LAT_ORGN	gw	Organic N in the base flow (mg/L)	0 to 200	50.550
Total N	ERORGN	hru	Organic N enrichment ratio	0 to 5	1.725
Total P	PPERCO	bsn	Phosphorus percolation coefficient	10 to 17.5	16.591
Total P	PHOSKD	bsn	Phosphorus soil partitioning coefficient	100 to 200	142.702
Total P	PSP	bsn	Phosphorus sorption coefficient	0.01 to 0.7	0.1201
Total P	P_UPDIS	bsn	Phosphorus uptake distribution parameter	0 to 100	16.699
Total P	CH_OPCO_BSN	bsn	Channel organic phosphorus concentration in basin (ppm)	0 to 100	69.792
Total P	SOL_ORGP	chm	Soil organic P (mg/kg)	0 to 100	39.14
Total P	GWSOLP	gw	Concentration of soluble phosphorus in groundwater contribution to streamflow from subbasin (mg P/l)	0 to 1000	497.5
Total P	LAT_ORGP	gw	Organic P in the base flow (mg/L)	0 to 200	5.792
Total P	ERORGP	hru	Organic P enrichment ratio	0 to 5	0.263
Atrazine	SKOC	pest	Soil adsorption coefficient normalized for soil organic carbon	1 to 999999999	3.985
Atrazine	WOF	pest	Wash off fraction	0 to 1	0.305
Atrazine	HLIFE_F	pest	Degradation half-life of the chemical on the foliage	0 to 10000	25.032
Atrazine	HLIFE_S	pest	Degradation half-life of the chemical on the soil	0 to 100000	125.5
Atrazine	AP_EF	pest	Application efficiency	0 to 1	0.933
Atrazine	WSOL	pest	Solubility of the chemical in water	0 to 11000000	26.325
<i>E. coli</i>	PERCOP	bsn	Pesticide percolation coefficient	0 to 1	0.607
<i>E. coli</i>	BACTKDQ	bsn	Bacteria partition coefficient	0 to 500	300.5
<i>E. coli</i>	THBACT	bsn	Temperature adjustment factor for bacteria die-off/growth	0 to 10	0.888
<i>E. coli</i>	WDL PQ	bsn	Die-off factor for less persistent bacteria in soil solution (1/day)	0 to 1	0.023

<i>E. coli</i>	WDLPS	bsn	Die-off factor for less persistent bacteria adsorbed to soil particles. (1/day)	0 to 1	0.065
<i>E. coli</i>	WDLPF	bsn	Less persistent bacteria die-off factor on foliage	0 to 1	0.403
<i>E. coli</i>	BACTMX	bsn	Bacteria percolation coefficient (10 m ³ /Mg)	7 to 20	18.401
<i>E. coli</i>	WOF_LP	bsn	wash-off fraction for less persistent bacteria on foliage	0 to 1	0.851
<i>E. coli</i>	BACTMINLP	bsn	Minimum daily bacteria loss for less persistent bacteria (# cfu/m ²)	0 to 1	0.917
<i>E. coli</i>	WDLPRCH	bsn	Die-off factor for less persistent bacteria in streams (moving water) at 20 C (1/day)	0 to 1	0.427
<i>E. coli</i>	WDLPRES	bsn	Die-off factor for less persistent bacteria in water bodies (still water) at 20 C (1/day)	0 to 1	0.073
<i>E. coli</i>	BACTKDDB	fert	Bacteria partition coefficient	0 to 1	0.987
<i>E. coli</i>	BACT_SWF	bsn	Fraction of manure applied to land areas that has active colony forming units	0 to 1	0.273