Landscape based identification of human disturbance gradients and reference conditions for Michigan streams

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The values and units for total nitrogen loading, total nitrogen yield, total phosphorus loading, and total phosphorus yield in the original Table 1 are

incorrect. The original Table 1 should be replaced with the following table.

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Table 1 Mean and range of human disturbance factors for all stream reaches in Michigan, from which disturbance variables were selected and disturbance thresholds were determined

Disturbance variable	Mean	Range	Threshold	
			Cold	Warm
Variables selected for coldwater dataset:				
Total nitrogen plus (phosphorus×10) yield (kg/km ² /year)	1,400	120–9,824	800	2,000
Variables selected for warmwater dataset:				
Dam density (#/100 km ²)	1	0–278	17.5	4.0
USEPA’s toxic release inventory sites discharging into surface water (#/10,000 km ²)	5	0–7,959	10.0	10.0
Variables selected for coldwater and warmwater dataset:				
Active mining (#/10,000 km ²)	3	0–5,948	0.01	10.0
Network watershed agricultural land use (%)	36	0–100	60	65
Network watershed urban land use (%)	5	0–92	8	8
MDEQ’s permitted point source facilities (#/100 km ²)	6	0–757	10.0	16.0
MDEQ’s permitted point source facilities having direct connection with stream (#/100 km ²)	1	0–759	3.0	6.1
USEPA’s toxic release inventory sites (#/10,000 km ²)	55	0–21,808	10.0	150.0
Population density (#/km ²)	49	0–2,273	50	200
Road crossing (#/km ²)	1	0–16	0.6	0.6
Road density (km/km ²)	2	0–14	2.2	2.5
Total nitrogen plus (phosphorus×10) loading (kg/ year)	13,918	735–49,934	950	6,000
Watershed area treated with manure from barn yards (m/km)	1	0–8	1.3	0.1
Disturbance factors that were not selected:				
Local buffer agricultural land use (%)	25	0–100	30	25
Local buffer urban land use (%)	5	0–100	3.8	6
Local watershed agricultural land use (%)	33	0–100	60	65
Local watershed urban land use (%)	5	0–100	4	6
Network buffer agricultural land use (%)	29	0–100	30	35
Network buffer urban land use (%)	4	0–90	3.8	6
Total nitrogen loading (kg/year)	8,123	501–30,696	6,500	6,500
Total nitrogen yield (kg/km ² /year)	788	86–2,900	430	1,200
Total phosphorus loading (kg/year)	580	23–3,370	320	300
Total phosphorus yield (kg/km ² /year)	61	3–692	25	105
Watershed area treated with fertilizers (%)	20	0–58	9.0	30.0
Watershed area treated with herbicides and insecticides (%)	19	0–62	6.8	30.0
Watershed area treated with manure (%)	2	0–9	3.5	2.8
Covariance variables included in the analysis:				
Watershed size (km ²)	55	0.5–1,598	NA	NA
Gradient (m/km)	5	0–110	NA	NA

The threshold value for each disturbance factor was the level of disturbance beyond which fish variables showed apparent impacts, which was visually determined by plotting each disturbance factor against values of index of biotic integrity and percent intolerant fish individuals

USEPA U.S. Environmental Protection Agency, MDEQ Michigan Department of Environmental Quality