

Table SM2. Environmental variable descriptions (mean, standard deviation and transformation applied) and relationships with assemblage richness across all 80 sites

Variable (code - description)	Transformation	Mean \pm Std	Pearson correlations	
			Macroinvertebrate Richness	Fish Richness
<i>Geophysical landscape</i>				
↯ Dren_area - drainage area (km ²)	Log(x)	27.97 \pm 38.15	0.138	0.325***
● Dren_den - drainage density (km/km ²)	Log(x)	1.42 \pm 0.81	0.358***	0.056
Altitude - site altitude (m)	Log(x)	771.96 \pm 125.87	-0.171	-0.083
● Elev_range- range basin elevation (m)	Log(x)	162.3 \pm 77.74	0.323***	0.391****
Elev_mean - average basin elevation (m)	Log(x)	849.50 \pm 133.31	-0.104	-0.024
Elev_std - std. dev. basin elevation	Log(x)	35.36 \pm 17.03	0.278**	0.299***
↯ Slope_range - range basin slope (%)	Log(x)	24.29 \pm 12.18	0.320***	0.363***
Slope_mean - average basin slope (%)	Log(x)	7.72 \pm 3.08	0.240*	0.130
Slope_std - std. dev. basin slope	Log(x)	4.16 \pm 1.86	0.209*	0.190*
● Rainfall - total annual rainfall (mm/m2)	Log(x)	1425.84 \pm 183.77	-0.307***	-0.237**
↯ Thalweg_slope - slope of thalweg (%)	Log(x)	3.1 \pm 1.9	0.286*	0.259**
<i>Geology (rock type)</i>				
%_Schist (Metamorphic)	$\sqrt{(\arcsin(x))}$	31.81 \pm 53.15	-0.137	0.093
● %_Phyllite (Metamorphic)	$\sqrt{(\arcsin(x))}$	14.42 \pm 38.82	0.330***	0.065
↯ %_Sandstone (Sedimentary)	$\sqrt{(\arcsin(x))}$	12.61 \pm 34.39	-0.372***	-0.302***
%_Arkose (Sedimentary)	$\sqrt{(\arcsin(x))}$	10.51 \pm 27.19	0.126	0.071
%_Mudstone (Sedimentary)	$\sqrt{(\arcsin(x))}$	35.96 \pm 50.07	0.046	-0.046
%_Conglomerate (Sedimentary)	$\sqrt{(\arcsin(x))}$	14.26 \pm 27.40	0.059	0.178
<i>Land use and cover</i>				
%_Woodland - pct. of woodland savanna	$\sqrt{(\arcsin(x))}$	15.63 \pm 10.70	0.135	0.005
↯ %_Parkland - pct. of parkland savanna	$\sqrt{(\arcsin(x))}$	13.64 \pm 21.67	0.487****	0.200*
%_Grassy_woody - pct. of grassy-woody sav.	$\sqrt{(\arcsin(x))}$	10.63 \pm 12.10	0.102	-0.002
● %_Wetland - pct. of wetland	$\sqrt{(\arcsin(x))}$	0.95 \pm 2.45	-0.333***	0.006
%_Eucaliptus - pct. of eucaliptus forest	$\sqrt{(\arcsin(x))}$	1.85 \pm 4.37	0.021	0.191*
%_Pasture - pct. of pasture use	$\sqrt{(\arcsin(x))}$	28.64 \pm 21.80	0.030	0.098
%_Agriculture - pct. of agriculture use	$\sqrt{(\arcsin(x))}$	24.78 \pm 30.42	-0.294***	-0.129
● %_Natural - pct. of natural land cover	$\sqrt{(\arcsin(x))}$	39.90 \pm 23.23	0.499****	0.118
↯ City_dist - distance to cities (km)	Log(x)	16234.4 \pm 9571.20	0.292***	0.176
Highway_dist - distance to paved highways (km)	Log(x)	6034.93 \pm 4834.25	0.246*	0.087
Road_density - density of roads in catchment (km/km ²)	Log(x)	0.15 \pm 0.10	-0.169	-0.124
House_prox - distance to homes	Log(x)	6.89 \pm 15.6	-0.364***	-0.149
↯ House_density - density of homes in the basin (houses/km ²)	Log(x)	0.85 \pm 0.79	-0.154	0.098
<i>Site habitat (morphology)</i>				
↯ Reachlen - length of sample reach (m)		167.3 \pm 46.65	0.107	0.323***
Xdepth - mean thalweg depth (cm)		38.13 \pm 16.62	-0.048	0.064
Xwidth - mean wetted width (m)		3.11 \pm 2.01	0.310***	0.287**
● Xbkf_w - mean bankfull width (m)		5.85 \pm 2.89	0.399****	0.271**
Xbkf_h - mean bankfull height (m)		0.85 \pm 0.30	0.079	-0.051
Xwxd - mean width x mean depth (m ²)		1.27 \pm 1.20	0.205*	0.272**
Xwd_rat - mean width/depth ratio (m/m)		8.98 \pm 6.23	0.273**	0.182
Xbk_a - mean bank angle (degrees)		47.64 \pm 18.92	-0.190	-0.020
Xslope - water surface gradient over reach (%)		11.63 \pm 8.610	-0.132	-0.006
Sinu - channel sinuosity		1.41 \pm 0.48	-0.003	0.066

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<i>Site habitat (substrate)</i>				
Xembed - mean embeddedness (%)		61.23 \pm 22.43	-0.297***	0.003
Pct_bdrk - percentage of bedrock (> 4000 mm)		0.06 \pm 0.11	0.176	-0.022
Pct_bl - pct. of boulders (250 to 4000 mm)		0.06 \pm 0.09	0.062	-0.079
Pct_cb - pct. of cobble (64 to 250 mm)		0.07 \pm 0.10	0.155	-0.110
Pct_gc - pct. of coarse gravel (16 to 64 mm)		0.05 \pm 0.09	-0.045	-0.077
Pct_gf - pct. of fine gravel (2 to 16 mm)		0.12 \pm 0.14	0.006	-0.056
Pct_sa - pct. of sand (0.6 to 2 mm)		0.17 \pm 0.19	-0.114	0.011
Pct_fn - pct. of fines (< 0.06 mm)		0.38 \pm 0.34	-0.048	0.1124
Pct_wd - pct. of wood		0.01 \pm 0.02	-0.002	-0.030
LSubDmm - Log ₁₀ estimated geometric mean substrate diameter (mm)		-0.22 \pm 1.279	0.150	-0.128
Lrbs - Log ₁₀ relative bed stability (dimensionless: m/m)		-2.98 \pm 1.307	0.182	-0.096
<i>Site habitat (flow)</i>				
↯ Pct_gl - percentage of glides		0.48 \pm 0.28	-0.097	0.298***
Pct_fast - percentage of rapids and riffles		0.19 \pm 0.17	-0.079	0.04
Pct_pool - percentage of pools		0.34 \pm 0.35	0.1161	-0.260**
Q - instantaneous discharge (m ³ /s)		0.07 \pm 0.11	0.085	0.078
<i>Site habitat (canopy)</i>				
● Xcdenmid - mean mid-channel canopy density (%)		75.04 \pm 23.18	0.100	-0.257**
Xcl - mean canopy cover > 0.3m DBH		7.32 \pm 9.20	-0.067	-0.016
Xcs - mean canopy cover <= 0.3m DBH		16.14 \pm 11.75	0.000	0.035
Xmw - mean woody mid-layer cover		21.56 \pm 11.60	-0.087	-0.127
Xmh - mean herbaceous mid-layer cover		12.07 \pm 10.22	0.011	0.036
Xgw - mean woody ground-layer cover		12.4 \pm 7.78	-0.037	-0.050
↯ Xgh - mean herbaceous ground-layer cover		28.94 \pm 20.60	-0.022	0.309**
Xc - mean riparian veg canopy cover		23.46 \pm 19.00	-0.032	0.013
Xm - mean riparian veg mid-layer cover		33.63 \pm 16.91	-0.052	-0.065
Xg - mean riparian veg ground cover		41.35 \pm 21.69	-0.034	0.275**
Xpcan - present riparian canopy (fraction of reach)		0.86 \pm 0.22	0.211*	-0.082
Xpmid - present riparian mid-layer (fraction of reach)		0.96 \pm 0.10	0.168	-0.045
Xpgveg - present riparian ground-layer (fraction of reach)		0.99 \pm 0.03	0.031	-0.024
<i>Site habitat (fishcover)</i>				
Xfc_alg - prop. areal cover filamentous algae		2.55 \pm 7.21	0.081	0.056
↯ Xfc_aqm - prop. areal cover aquatic macrophyte		2.35 \pm 6.89	0.030	0.256**
Xfc_lwd - prop. areal cover large woody debris		2.77 \pm 5.44	0.065	-0.039
Xfc_brs - prop. areal cover brush		9.49 \pm 13.0	0.151	-0.134
● Xfc_ucb - prop. areal cover undercut banks		4.36 \pm 5.36	-0.206*	-0.111
Xfc_rck - prop. areal cover boulders		13.51 \pm 20.11	0.269**	0.025
Xfc_hum - prop. areal cover anthropogenic		1.28 \pm 8.95	-0.175	-0.081
● Xfc_nat - prop. areal cover natural fish		41.2 \pm 26.0	0.219*	-0.023
<i>Site habitat (human presence)</i>				
w1_hall - riparian human disturbance (all types)		1.15 \pm 0.85	-0.195*	-0.001
w1_hnoag - riparian human disturbance (non-agricultural type)		0.47 \pm 0.62	-0.242**	0.064
w1_hag - riparian human disturbance (agricultural type)		0.67 \pm 0.51	-0.014	0.080

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<i>Site habitat (water physical and chemical)</i>				
Temp - temperature (°C)	Log(x)	18.8 \pm 2.35	-0.099	0.121
pH - potential of hydrogen		7.29 \pm 0.61	0.128	0.172
Cond - electrical conductivity (μ S/cm)	Log(x)	49.66 \pm 71.17	0.085	0.078
TDS - total dissolved solids (mg/L)	Log(x)	28.16 \pm 28.14	0.217*	0.129
Alk - alkalinity (mequiv./L)	Log(x)	430.24 \pm 650.91	0.219	0.098
Turb - turbidity (NTU)	Log(x)	7.89 \pm 12.6	-0.259**	0.076
DO - dissolved oxygen (mg/L)	Log(x)	7.57 \pm 2.17	0.180	0.160
Nitrogen - total nitrogen (mg/L)	Log(x)	0.15 \pm 0.70	0.019	-0.080
● \neg Phosphorus - total phosphorus (mg/L)	Log(x)	0.04 \pm 0.11	-0.319***	-0.224**

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