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Article

Benthic Diatom Communities in Urban Streams and the Role of Riparian Buffers

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Table S1. The list of sampling sites with additional information on their location and diatom sampling date, and data on water quality. FOR = pristine forested reference site (2 FOR sites in case of Frognerelva as FOR1 and FOR2); UBF = unbuffered pair site: FBF = forested buffered pair site: LON = downstream longitudinal matrix site (2 LON sites in case of Frognerelva as LON1 and LON2). Nitrate = nitrite- and nitrate-nitrogen (i.e., oxidized nitrogen, NO_2_N + NO_3_N); TP = total phosphorus.

Site No.	Stream	Site Type	Northing	Easting	Sampling Date	pH [2]	Specific Conductivity (mS/m) [2]	Nitrate (µg/L) [3]	TP (µg/L) [3]
1	Akerselva	FOR	59.9985	10.746472	2 October 2017	6.7	19.3	56.5	47.5
2	Akerselva	UBF	59.949361	10.765083	29 September 2017	7.05	25.9	108.5	6
3	Akerselva	FBF	59.943778	10.767167	29 September 2017	7.07	27	124.5	8.5
4	Akerselva	LON	59.913583	10.758167	29 September 2017	7.07	28.8	148	11
5	Alna	FOR	59.970056	10.87525	2 October 2017	7.25	96	415	28
6	Alna [1]	UBF	59.908083	10.816889	30 September 2017	7.62	396	980	85
7	Alna [1]	FBF	59.907583	10.809139	30 September 2017	7.93	402	990	89
8	Hovinbekken	UBF	59.9465	10.820806	24 September 2017	7.6	190	827.5	11
9	Hovinbekken	FBF	59.945139	10.821194	24 September 2017	7.83	192	830	12
11	Hovinbekken	LON	59.935833	10.816722	24 September 2017	7.9	255	715	27.5
12	Frognerelva	FOR1	59.979139	10.721222	25 September 2017	6.5	23.7	36	7
13	Frognerelva	FOR2	59.950056	10.712611	25 September 2017	7.5	84.7	337	19
14	Frognerelva	UBF	59.942278	10.710778	29 September 2017	7.54	137.3	972.5	92.5
15	Frognerelva	FBF	59.939472	10.712278	29 September 2017	7.6	141.3	860	74
16	Frognerelva	LON1	59.936389	10.709583	25 September 2017	7.9	223	662.5	68.5
17	Frognerelva	LON2	59.922694	10.695861	29 September 2017	7.71	224	610	81.5
18	Gaustadbekken [1]	UBF	59.938833	10.714861	24 September 2017	7.8	539	1195	82
19	Gaustadbekken [1]	FBF	59.937917	10.713111	24 September 2017	7.8	552	1210	109
20	Hoffselva - Skådalsbekken	FOR	59.964861	10.687556	25 September 2017	6.9	41	557	6
21	Hoffselva - Skådalsbekken	UBF	59.95875	10.68925	27 September 2017	7.3	64	757.5	29
22	Hoffselva - Skådalsbekken	FBF	59.953778	10.683583	27 September 2017	6.44	90.1	570	11.5
23	Hoffselva - Skådalsbekken	LON	59.952167	10.6815	25 September 2017	7.5	98.6	567.5	9
24	Hoffselva - Midtstubekken	FOR	59.962194	10.683056	27 September 2017	7.95	401	700	13
25	Hoffselva - Midtstubekken	UBF	59.954861	10.680917	28 September 2017	7.7	378	820	33

26	Hoffselva - Midtstubekken	FBF	59.953722	10.680111	28 September 2017	7.73	367	1065	61
27	Hoffselva - Holmenbekken	LON	59.947889	10.680056	27 September 2017	7.45	214	812.5	28
28	Hoffselva - Makrelbekken [1]	UBF	59.938972	10.67425	28 September 2017	7.67	455	1290	129.5
29	Hoffselva - Makrelbekken [1]	FBF	59.937694	10.673806	28 September 2017	7.9	463	1350	122
30	Hoffselva	LON	59.926	10.677528	29 September 2017	7.77	277	650	81.5
31	Mærradalsbekken	FOR	59.959778	10.646111	4 October 2017	6.67	220	1550	61
32	Mærradalsbekken	UBF	59.942417	10.651611	3 October 2017	7.85	240	1280	65
33	Mærradalsbekken	FBF	59.935389	10.657472	3 October 2017	7.98	243	1450	68.5
34	Mærradalsbekken	LON	59.922	10.664417	3 October 2017	7.97	282	1350	72.5
35	Sandvikselva	UBF	59.922278	10.556222	4 October 2017	6.33	110	725	36
36	Sandvikselva	FBF	59.917861	10.557528	4 October 2017	7.41	114	780	36
37	Sandvikselva	LON	59.901167	10.545528	4 October 2017	7.75	172	885	43.5

[1] Occasional pollution by sewage and/or industrial wastewater of unknown origin and composition was observed.

[2] Actual values were measured in the field during diatom sampling on 24 September–4 October 2017.

[3] Mean values of two measurements: water sampling on 7–15 September 2017 (prior diatom sampling, during a high flow period) and on 31 August–5 August 2018 (during a low flow period).

Table S2. Candidate predictors used in constrained ordination models. OB = Oslo basin; PS = Paired sites.

Model series	Predictor group	Candidate predictors
OB (*n* = 36)	Spatial	PCNM1, PCNM2, PCNM3, PCNM4, PCNM5, PCNM6, PCNM7, PCNM8, PCNM9, PCNM10, PCNM11, PCNM12
	Land use	%Forest, %Arable, %Natural, %Other, %Urban, %Water
	Riparian habitat	%Canopy cover, Tree density, %Conifers, %Managed grasses, %Managed grasses, %Herbs, %Mosses & lichens, %Shrub & small trees, %Rocks, %Bare ground, %Plant litter, %Urban, Log density, Log size, RCI
	Instream habitat	%Shading, Mean substrate size, %Concrete, %Bedrock, %Boulders, %Cobbles & gravel, %Sediment, %Wood, %CPOM, %FPOM, %Algae, %Aquatic mosses, %Macrophytes, Depth, Width, Flow velocity
	Water quality	pH, Specific conductivity, TIN, NH_4, Nitrate, SRP, TP
PS (*n* = 20)	Spatial	PCNM1, PCNM2, PCNM3, PCNM4, PCNM5, PCNM6, PCNM7, PCNM8
	Land use	%Forest, %Arable, %Natural, %Other, %Urban, %Water
	Riparian habitat	%Canopy cover, Tree density, %Conifers, %Managed grasses, %Managed grasses, %Herbs, %Mosses & lichens, %Shrub & small trees, %Rocks, %Bare ground, %Plant litter, %Urban, Log density, Log size, RCI
	Instream habitat	%Shading, Mean substrate size, %Concrete, %Bedrock, %Boulders, %Cobbles & gravel, %Sediment, %Wood, %CPOM, %FPOM, %Algae, %Aquatic mosses, %Macrophytes, Depth, Width, Flow velocity
	Water quality	pH, Specific conductivity, TIN, NH_4, Nitrate, SRP, TP

Table S3. The list of sampling sites with data on selected diatom-based metrics. TDI/100 = Trophic Diatom Index, %PT = % Pollution Tolerant valves, ACID = ACidity Index of Diatoms, FOR = pristine forested reference site (2 FOR sites in case of Frognerelva as FOR1 and FOR2), UBF = unbuffered pair site, FBF = forested buffered pair site, LON = downstream longitudinal matrix site (2 LON sites in case of Frognerelva as LON1 and LON2).

Site Nr.	Stream	Site Type	Species Richness	Shannon Diversity	TDI/100	%PT	IPS	ACID
1	Akerselva	FOR	24	0.70	24.2	0.3	19.6	6.36
2	Akerselva	UBF	33	0.63	37.9	1.3	18.9	7.62
3	Akerselva	FBF	30	0.41	35.8	0.3	19.5	7.87
4	Akerselva	LON	31	0.52	59.8	3.3	18.8	8.42
5	Alna	FOR	38	0.69	55.5	0.5	17.2	6.54
6	Alna [1]	UBF	35	0.73	55.5	0.5	17.2	8.70
7	Alna [1]	FBF	26	0.86	74.6	16.5	12.4	7.79
8	Hovinbekken	UBF	36	0.89	45.3	9	14.7	7.21
9	Hovinbekken	FBF	24	0.85	46.4	5	15	7.83
11	Hovinbekken	LON	32	0.90	54.2	11	15.3	8.81
12	Frognerelva	FOR1	40	0.81	30.3	0	19	5.75
13	Frognerelva	FOR2	37	0.66	55	1.5	18.7	7.52
14	Frognerelva	UBF	41	0.85	58.4	7.5	15.9	7.82
15	Frognerelva	FBF	45	0.86	54.8	9	15.7	8.46
16	Frognerelva	LON1	20	0.77	57	2	14.7	8.06
17	Frognerelva	LON2	34	0.88	62	7.3	15.7	8.87
18	Gaustadbekken [1]	UBF	24	0.80	67.2	11.8	14.4	8.60
19	Gaustadbekken [1]	FBF	19	0.86	65.2	1.5	15	7.91
20	Hoffselva - Skådalsbekken	FOR	27	0.78	30.1	1.8	18.9	6.37
21	Hoffselva - Skådalsbekken	UBF	17	0.78	58.7	10	18.4	9.72
22	Hoffselva - Skådalsbekken	FBF	25	0.75	58	1	18.5	7.47
23	Hoffselva - Skådalsbekken	LON	18	0.82	55.3	7.5	18.9	8.52
24	Hoffselva - Midtstubekken	FOR	17	0.75	53.6	0	17.4	8.60
25	Hoffselva - Midtstubekken	UBF	29	0.80	68.7	13.8	14.7	8.54
26	Hoffselva - Midtstubekken	FBF	26	0.86	57.8	1.5	17.4	8.98

27	Hoffselva - Holmenbekken	LON	16	0.78	61.3	28	17.2	8.47
28	Hoffselva - Makrelbekken [1]	UBF	23	0.75	60.3	7.8	15.2	8.58
29	Hoffselva - Makrelbekken [1]	FBF	16	0.70	55.4	5.8	16.4	8.42
30	Hoffselva	LON	49	0.92	77.7	24	14.6	8.49
31	Mærradalsbekken	FOR	37	0.90	56.9	9.3	14.9	8.51
32	Mærradalsbekken	UBF	28	0.84	62.5	18.3	15	8.47
33	Mærradalsbekken	FBF	40	0.81	64.2	9.3	14.1	7.55
34	Mærradalsbekken	LON	20	0.81	66.3	26.5	14.6	8.48
35	Sandvikselva	UBF	29	0.84	81.9	37.5	14.5	8.53
36	Sandvikselva	FBF	24	0.84	89.5	15.8	14	8.10
37	Sandvikselva	LON	34	0.90	76.6	14	13.2	7.46

[1] Occasional pollution by sewage and/or industrial wastewater of unknown origin and composition was observed.

Table S4. Variables and loadings for Principal Components Analysis (PCA) decomposing catchment land use and water quality variables into a single index of urbanization for all 36 sites in the Oslo basin. PC1 explained 57.0% of the variation among sites, whereas PC2 explained 11.8%.

Group	Parameter	PC1	PC2
Water quality	pH	1.11	0.23
	Conductivity	1.16	0.19
	TIN	1.15	0.37
	NH4	0.85	-0.49
	Nitrate	1.13	0.40
	SRP	1.13	-0.21
	TP	1.00	-0.55
Land use	%Forest	-1.06	0.37
	%Arable	-0.07	-0.27
	%Natural	-0.41	0.39
	%Other	1.04	-0.34
	%Urban	1.14	-0.18
	%Water	-0.73	-0.80
	%Wetland	-0.50	-0.71

Table S5. Species list of taxa that exceed 0,2% relative abundance in the entire study, with mean % abundances at the different site types (FBF = forested buffered pair site; UBF = unbuffered pair site; FOR = pristine forested reference site; LON = downstream longitudinal matrix site). The table is completed by diatom species scores from the partial redundancy analysis model (pRDA) conditioning out confounding influences of spatial location, catchment land uses, instream habitat, and water quality to reveal the true association of diatom community composition with riparian attributes (Figure 4, Main Text) for site pairs. The scores on RDA1 explained 37% of the variation among sites. The biplot value for "% Shrubs and small trees <5cm DBH" on RDA1 was -0.44, and this riparian attribute was more associated with unbuffered sites. In contrast, the biplot value for "% Lichens & mosses" on RDA1 was 0.30, and this riparian attribute was associated with forest buffer sites. Diatom taxa mentioned in the Main Text are highlighted in bold.

		Mean % abundance				pRDA	
Code	**Taxon**	**FBF**	**UBF**	**FOR**	**LON**	**RDA1**	**RDA2**
ADM2	***Achnanthidium minutissimum* (Kützing) Czarnecki - group II (mean width 2,2-2,8 µm)**	**19.2**	**22.2**	**41.3**	**18.2**	**0.282**	**-0.017**
ADM3	***Achnanthidium minutissimum* (Kützing) Czarnecki - group III (mean width >2,8 µm)**	**15.9**	**1.2**	**2.6**	**7.6**	**-0.399**	**0.01**
NGRE	***Navicula gregaria* Donkin, 1861**	**8.1**	**3.6**	**0.8**	**11.4**	**-0.129**	**-0.046**
CPLA	***Cocconeis placentula* Ehrenberg, 1838 - incl.varieties**	**8.1**	**13.6**	**0.9**	**8.1**	**0.014**	**-0.042**
APED	***Amphora pediculus* (Kützing) Grunow ex A.Schmidt, 1875**	**6.1**	**12.7**	**2.7**	**7.7**	**0.044**	**0.023**
NTPT	*Navicula tripunctata* (O.F.Müller) Bory de Saint-Vincent, 1822	3.3	4.2	0.0	2.7	0.004	-0.074
RSIN	***Reimeria sinuata* (Gregory) Kociolek & Stoermer, 1987**	**2.9**	**8.9**	**6.8**	**8.4**	**0.017**	**0.149**
ADDA	*Achnanthidium* cf.*daonense* (Lange-Bertalot) Lange-Bertalot, O.Monnier & L.Ector, 2007	2.8	2.5	2.3	2.6	0.017	0.032
AMPS	***Amphora* sp.**	**2.7**	**6.8**	**2.7**	**2.2**	**0**	**-0.082**
PLFR	*Planothidium frequentissimum* (Lange-Bertalot) Lange-Bertalot, 1999	2.3	3.3	1.3	2.1	-0.003	0.065
PTLA	*Planothidium lanceolatum* (Brébisson ex Kützing) Lange-Bertalot 1999	2.0	2.4	1.5	0.8	0.012	-0.001
GPAR	*Gomphonema parvulum* (Kützing) Kützing, 1849	1.9	0.7	0.1	1.3	0.018	0.01
FGRA	*Fragilaria gracilis* Østrup, 1910	1.7	1.0	2.6	2.0	0.036	-0.006
FCAPsl	*Fragilaria capucina* s.lat.	1.7	1.1	1.0	0.9	-0.007	0
GCLF	*Gomphonema* cf.*calcifugum* Lange-Bertalot & E.Reichardt, 1999	1.7	1.0	1.1	2.6	0.001	0.024
CLCT	*Caloneis lancettula* (Schulz) Lange-Bertalot & Witkowski, 1996	1.6	1.1	0.1	3.1	-0.049	-0.061
NLAN	*Navicula lanceolata* Ehrenberg, 1838	1.5	0.8	0.0	2.1	-0.061	0.015
ENLB	*Encyonema lange-bertalotii* Krammer, 1997	1.4	0.2	0.0	0.1	-0.018	-0.004
EOMI	*Eolimna minima* (Grunow) Lange-Bertalot & W.Schiller, 1997	1.4	1.3	1.0	1.3	0.007	-0.007

MCIR	*Meridion circulare var. circulare* (Greville) C.Agardh, 1831	1.2	0.9	0.2	0.4	-0.01	0.011
NDIS	*Nitzschia dissipata* (Kützing) Rabenhorst, 1860	1.0	1.0	1.1	0.6	-0.039	0.014
SSEM	*Sellaphora* cf.*seminulum* (Grunow) D.G.Mann, 1989	0.9	0.4	0.0	0.1	0.035	-0.034
ENMI	***Encyonema minutum* (Hilse) D.G.Mann, 1990**	**0.7**	**0.5**	**0.4**	**1.8**	**-0.032**	**-0.012**
ESLE	*Encyonema silesiacum* (Bleisch) D.G.Mann, 1990	0.7	0.4	0.1	0.7	-0.017	0.014
DMES	*Diatoma mesodon* (Ehrenberg) Kützing, 1844	0.7	0.2	0.2	1.2	0.053	-0.023
TDEB	*Tryblionella debilis* Arnott ex O'Meara, 1873	0.6	0.5	0.0	0.8	0.011	-0.009
RABB	*Rhoicosphenia abbreviata* (C.Agardh) Lange-Bertalot, 1980	0.5	0.3	0.2	0.3	-0.019	-0.006
TFLO	*Tabellaria flocculosa* (Roth) Kützing, 1844	0.5	0.3	3.4	0.1	-0.01	0.008
NNOT	*Navicula notha* Wallace, 1960	0.4	0.1	0.0	0.1	-0.003	-0.003
ALBL	*Adlafia langebertalotii* O.Monnier & Ector, 2012	0.3	0.5	0.9	0.0	-0.005	0.009
GMIC	*Gomphonema micropus* Kützing, 1844	0.3	0.1	0.2	0.2	-0.034	-0.031
KALA	*Karayevia laterostrata* (Hustedt) Round & Bukhtiyarova, 1996	0.3	0.6	0.0	0.1	-0.005	0.026
AUDI	*Aulacoseira distans* (Ehrenberg) Simonsen 1979	0.2	0.1	0.4	0.0	-0.011	-0.006
EUNS	*Eunotia* spp.	0.2	0.4	2.9	0.1	0.017	0.017
GEXL	*Gomphonema exilissimum* (Grunow) Lange-Bertalot & E.Reichardt, 1996	0.2	0.3	0.7	0.2	0	0.015
NIAR	*Nitzschia* cf.*archibaldii* Lange-Bertalot, 1980	0.2	0.1	0.0	0.1	-0.02	-0.009
SUMI	*Surirella minuta* Brébisson, 1849	0.2	0.1	0.0	0.3	-0.012	0
FCPL	*Fragilaria capitellata* (Grunow) J.B.Petersen, 1946	0.2	0.0	0.0	1.4	-0.02	0.024
EMIN	*Eunotia minor* (Kützing) Grunow, 1881	0.2	0.0	0.2	0.0	-0.022	-0.007
FARC	*Fragilaria arcus var. arcus* (Ehrenberg) Cleve, 1898	0.2	0.1	0.0	0.6	-0.006	-0.005
NLIN	*Nitzschia linearis* W.Smith, 1853	0.2	0.3	0.0	0.0	-0.007	0
ADCA	*Achnanthidium caledonicum* (Lange-Bertalot) Lange-Bertalot, 1999	0.2	0.0	0.4	0.1	0.015	0
MVAR	***Melosira varians* C.Agardh, 1827**	**0.2**	**0.0**	**0.0**	**0.4**	**0.005**	**-0.007**
SJOU	*Sellaphora joubaudii* (H.Germain) M.Aboal, 2003	0.1	0.0	0.1	0.1	-0.009	0.008
CYLS	*Cyclotella* sp.	0.1	0.0	0.9	0.1	-0.018	-0.003
EULA	*Eucocconeis laevis* (Østrup) Lange-Bertalot, 1999	0.1	0.1	0.4	0.0	-0.015	-0.005
NPAL	*Nitzschia palea* (Kützing) W.Smith, 1856	0.1	0.1	0.1	0.1	-0.024	0
ADLB	*Achnanthidium lauenburgianum* (Hustedt) Monnier, Lange-Bertalot & Ector, 2007	0.1	0.4	0.0	0.0	0.008	0.02

BINT	*Brachysira intermedia* (Østrup) Lange-Bertalot, 1994	0.1	0.1	1.1	0.0	0.001	0.013
CPED	*Cocconeis pediculus* Ehrenberg, 1838	0.1	0.0	0.0	0.3	-0.014	0.008
DPER	***Humidophila perpusilla* (Grunow) Lowe, Kociolek, Johansen, Van de Vijver, Lange-Bertalot & Kopalová, 2014**	**0.1**	**0.5**	**0.9**	**0.0**	**0.026**	**-0.001**
ENVE	*Encyonema* cf.*ventricosum* (C.Agardh) Grunow, 1875	0.1	0.1	0.1	0.2	0.001	0.013
EIMP	*Eunotia implicata* Nörpel, Lange-Bertalot & Alles, 1991	0.1	0.1	0.2	0.0	-0.005	0.006
FTEN	*Fragilaria tenera* (W.Smith) Lange-Bertalot, 1980	0.1	0.1	0.1	0.1	0.003	-0.003
UNID	Pennales sp.	0.1	0.2	0.0	0.1		
ADKR	*Achnanthidium kranzii* (Lange-Bertalot) Round & Bukhtiyarova, 1996	0.0	0.0	0.4	0.0	0.001	-0.001
ADKG	*Achnanthidium kriegeri* (Krasske) P.B.Ham., D.Anton. & Siver in Antoniades et al., 2008	0.0	0.0	3.4	0.0	0.018	0.002
ESUM	*Encyonopsis subminuta* Krammer & E.Reichardt, 1997	0.0	0.0	0.5	0.0	-0.003	0
NSTS	*Nitzschia* cf.*soratensis* E.A.Morales & M.L.Vis, 2007	0.0	0.0	0.0	0.4	-0.001	0.001
ADSO	*Achnanthidium subatomoides* (Hustedt) O. Monnier, H. Lange-Bertalot & L. Ector, 2007	0.0	0.0	0.2	0.0	0.005	-0.002
BNEO	*Brachysira neoexilis* Lange-Bertalot, 1994	0.0	0.2	2.7	0.1	0.017	0.01
DBRE	*Diadesmis* cf.*brekkaensis* (J.B.Petersen) D.G.Mann, 1990	0.0	0.1	0.3	0.0	0.012	-0.024
DVUL	*Diatoma vulgaris* Bory de Saint-Vincent, 1824	0.0	0.0	0.0	0.3		
EAMB	*Eunotia ambivalens* Lange-Bertalot & Tagliaventi, 2011	0.0	0.0	0.3	0.0		
EBLU	*Eunotia bilunaris* (Ehrenberg) Schaarschmidt, 1880	0.0	0.0	0.3	0.0		
EEXI	*Eunotia exigua var. exigua* (Brébisson ex Kützing) Rabenhorst, 1864	0.0	0.0	0.7	0.0		
ETEN	*Eunotia tenella* (Grunow) Hustedt, 1913	0.0	0.1	0.7	0.0	0.001	0.008
FSBH	*Fallacia subhamulata* (Grunow) D.G.Mann, 1990	0.0	0.0	0.0	0.5		
FRAS	*Fragilaria* sp.	0.0	0.1	0.5	0.0	0.001	-0.004
FRSP	*Frustulia* sp.	0.0	0.0	0.6	0.0		
GOMS	***Gomphonema* spp.**	**0.0**	**0.5**	**1.4**	**0.1**	**0.043**	**-0.006**
NFON	*Nitzschia fonticola* (Grunow) Grunow, 1881	0.0	0.0	0.0	0.4	0.004	0.001
ENSP	*Encyonema* spp.	0.0	0.0	0.2	0.1		

Table S6. Mean values for riparian and stream variables the different site types (FBF = forested buffered pair site; UBF = unbuffered pair site; FOR = pristine forested reference site; LON = downstream longitudinal matrix site). Results from mixed models testing the difference between site pairs (UBF, FBF) are also shown.

Predictor group	Attribute	LON	FOR	UBF	FBF	X^2	*P*-value
Riparian	Shading (% canopy cover)	36.03	61.38	41.29	78.31	15.84	**<0.001**
	Tree density (trees/m^2)	0.08	0.13	0.08	0.19	29.24	**<0.001**
	% Conifers	0	18.67	0.34	1.07	0.25	0.618
	% Small tress & shrubs	11.09	17.25	13.93	10.33	0.02	0.895
	% Herb	18.09	20.3	14.27	12.58	0	0.95
	% Unmanaged grasses	10.77	1.47	5.85	0.47	7.57	**0.006**
	% Managed grasses	16.11	0	14.12	0.92	5.5	**0.019**
	% Mosses & lichens	0.57	11.87	2.76	10.07	3.11	0.078
	% Plant litter	11.98	34.49	18.69	32.22	5.12	**0.024**
	% Rocks	3.15	10.71	8.87	10.76	0.9	0.342
	% Bare ground	9	8.05	5.6	17.23	9.48	**0.002**
	Number of logs	1.4	4.71	1.6	4.3	9.22	**0.002**
	Mean log length (m)	0.89	4.77	1.49	5.47	9.48	**0.002**
	Mean log circ. (m)	0.25	0.38	0.19	0.3	1.75	0.186
Instream	Shading (% canopy cover)	37.54	46.38	34.8	71.86	17.91	**<0.001**
	Mean width (m)	4.49	3.59	4.41	3.61	0	0.96
	Mean depth (cm)	24.85	16.96	24.71	16.9	5.34	**0.021**
	Mean flow velocity (m/s)	0.19	0.26	0.22	0.29	0.61	0.436
	% Filamentous algae	10.5	1.57	21.6	1.1	6.69	**0.01**
	% Aquatic mosses	3.25	6.43	6.85	10.4	2.76	0.097
	% Submerged macrophytes	0.15	0	0.2	0	0.11	0.738
	% Emergent macrophytes	0.05	0	0	0	-	-
	% Large wood	0.4	0.29	0.65	1.3	1.11	0.292
	% CPOM	0.4	2.93	1	1	0	0.971
	% FPOM	5	0.79	5.7	6.35	0.12	0.73
	% Concrete	0	0	4	0	0	1
	% Bedrock	0	7.57	3.5	0.55	0.9	0.344
	% Boulder	12.6	16.21	12.6	19.5	0.76	0.384
	% Cobbles & gravel	70.2	65.14	63.5	62.5	1.33	0.248
	% Fine sediment	8.7	5.71	8.8	9.2	0.41	0.522
	Mean substrate size (cm)	9.11	45.25	30.23	19.51	0.39	0.532
Water chemistry	pH	7.88	7.38	7.84	7.87	8.23	**0.004**
	Conductivity (mS$_{25°C}$/cm)	221	114	223	178	0.02	0.89
	TIN (µg/L)	966	536	959	753	0.02	0.884
	Nitrate (µg/L)	923	522	896	711	0.36	0.55
	NH_4 (µg/L)	42.8	14.1	63.6	41.6	0.6	0.438
	TP (µg/L)	59.2	25.9	56.9	47	0.04	0.85
	SRP (µg/L)	38.8	12.9	38.1	31.6	0.17	0.681

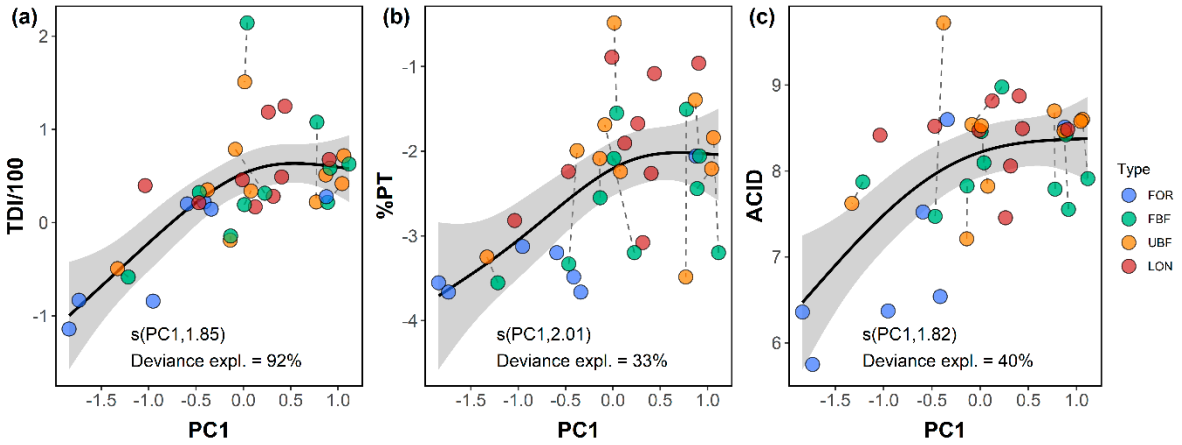

Figure S1. Standard diatom indices responded to catchment urbanization (PC1): (a) the Trophic Diatom Index (TDI/100) [logit-transformed], % Pollution Tolerant valves (%PT) [logit-transformed], and (c) the ACidity Index of Diatoms (ACID) all indicating changes in environmental quality with increasing urban land cover and changes in water chemistry. Site types are indicated by different colors; dashed lines indicate site pairs.