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Map-based prediction of organic carbon in headwater streams improved by downstream observations from the river outlet

J. Temnerud et al.

Correspondence to: J. Temnerud (johan.temnerud@slu.se)

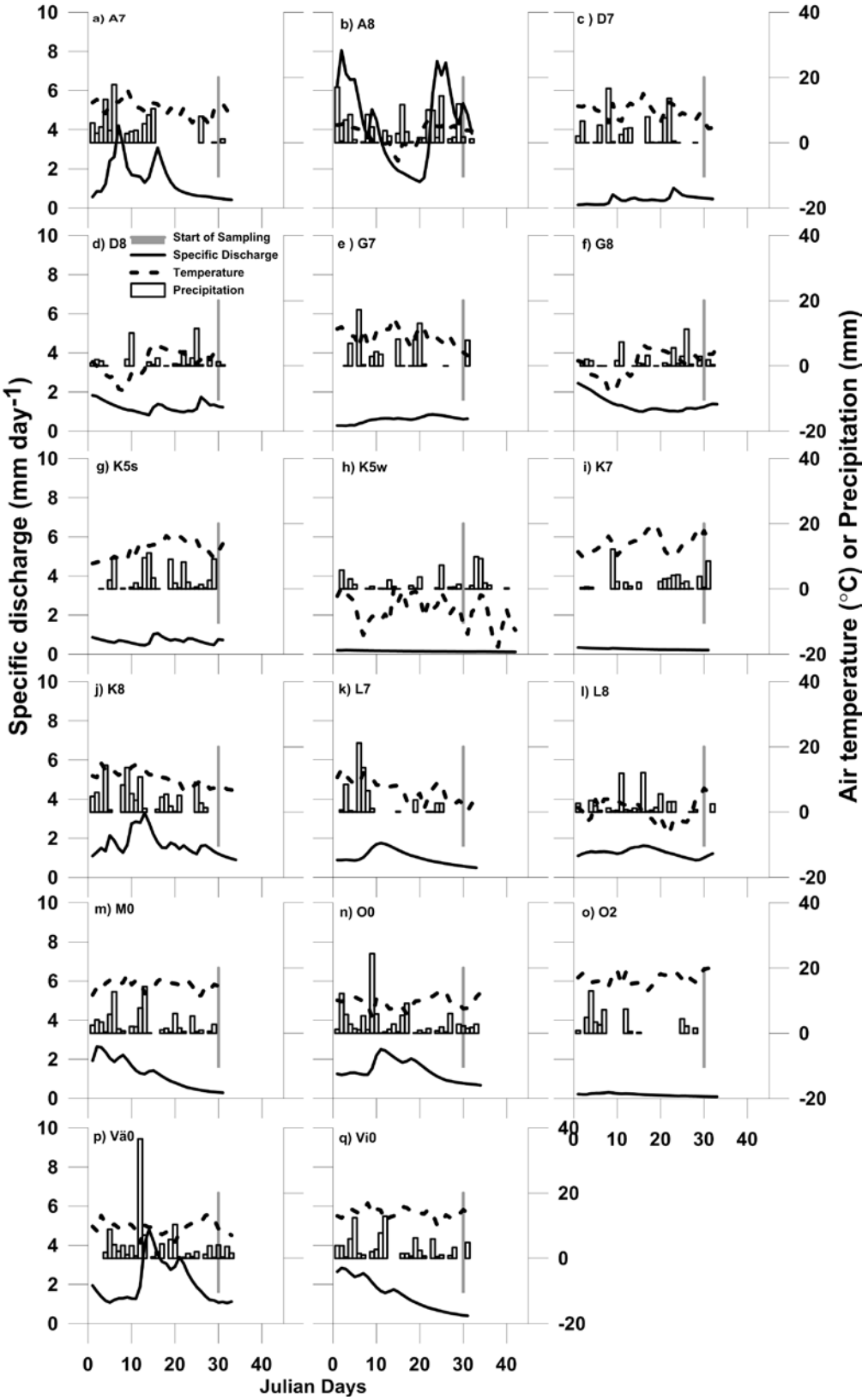

Fig. S1. Modelled daily specific discharge, mean air temperature, and precipitation for each catchment outlet, for the 30 days prior to the respective sampling. Start of sampling is indicated by the grey vertical line. a) is sampling A7, b) is A8, c) is D7, d) is D8, e) is G7, f) is G8, g) is K5s, h) is K5w, i) is K7, j) is K8, k) is L7, l) is L8, m) is M0, n) is O0, o) is O2, p) is Vä0 and q) is Vi0. See the Methods section for more details.

Table S1. Median values for headwater (HW) catchments, and the value for the entire mesoscale catchment as defined by the outlet (Out). Data includes elevation (Elev) median and interquartile range (IQR) for the catchment, altitude of sampling sites, proportion of land-use (CORINE), tree stand data (kNN), and proportion of soil and surficial geology type. See Table 1 for river names. For CORINE classes a short-name was given, for details see: http://www.eea.europa.eu/publications/COR0-landcover. Index B is *Betula spp*., S is Norway spruce (*Picea abies*), P is Scots pine (*Pinus sylvestris*), and the unit for tree classes is m^3 ha^{-1}. Tree age is the age of the forest stand (years) and Tree height is the average height of the forest. 0.00 is a rounding effect, while no value means that the median value is null.

River	A	A	D	D	G	G	K	K	L	L	M	M	O	O	Vä	Vä	Vi	Vi
Group	HW	Out	HW	Out	HW	Out	HW	Out	HW	Out	HW	Out	HW	Out	HW	Out	HW	Out
Elev median (m a.s.l.)	129	109	244	212	319	269	282	244	245	220	408	375	248	235	406	366	453	411
Elev IQR	18	50	26	60	11	38	35	91	14	37	51	116	15	42	34	96	50	97
Sites altitude	95	88	212	206	294	280	233	198	228	205	385	307	230	223	362	352	381	368
CORINE																		
Agricultural		0.09		0.01		0.00		0.02	0.02	0.06		0.00		0.02		0.00		0.00
Pasture	0.01	0.04		0.00		0.00		0.00	0.01	0.04		0.00		0.01		0.01		0.00
Broad-leaved forest	0.01	0.07		0.02		0.01		0.02	0.00	0.04	0.01	0.02	0.01	0.02	0.03	0.05	0.04	0.04
Coniferous forest	0.68	0.53	0.68	0.62	0.59	0.58	0.71	0.65	0.63	0.59	0.83	0.70	0.49	0.49	0.60	0.56	0.71	0.64
Mixed forest	0.09	0.10	0.09	0.08	0.00	0.06	0.03	0.08	0.04	0.05	0.04	0.04	0.06	0.08	0.11	0.08	0.09	0.08
Clear-felled	0.04	0.06	0.13	0.14	0.16	0.19	0.03	0.13	0.10	0.09	0.04	0.09	0.13	0.16	0.05	0.13	0.04	0.11
Wet mires	0.00	0.02		0.02	0.03	0.04	0.03	0.02		0.01	0.02	0.08	0.03	0.05	0.05	0.09	0.05	0.08
Broad-leaved forest on mires		0.00		0.00		0.00		0.00		0.00		0.00	0.01	0.01		0.01		0.00
Coniferous forest on mires		0.02	0.01	0.03		0.02	0.11	0.05	0.04	0.04		0.03	0.13	0.12	0.03	0.04		0.02
Mixed forest on mires		0.00		0.00		0.00		0.00		0.00	0.00	0.00	0.00	0.01		0.00		0.00
Lake surface		0.07		0.07		0.10		0.01	0.04	0.09		0.03	0.01	0.04		0.01		0.03
kNN data																		
Tree age (year)	42	35	51	44	45	39	59	53	41	38	36	35	45	47	39	42	33	36
Tree height (m)	12	10	13	11	10	9	10	9	12	11	10	9	8	8	7	7	9	8
$Birch^B$ (m3/ha)	17	18	11	12	7	8	13	12	14	14	14	13	13	14	14	13	15	12
$Pine^P$ (m3/ha)	47	39	65	60	62	60	56	50	41	40	22	30	32	29	21	26	22	33
Other Trees (m3/ha)	3	5	2	3	1	2	1	1	4	4	3	3	1	1	2	2	3	2
$Spruce^S$ (m3/ha)	72	59	70	58	39	35	55	32	92	86	56	50	42	40	28	28	42	38
Total Tree (m3/ha)	138	117	158	131	113	103	116	95	152	142	102	94	89	82	66	68	85	84
Soil type																		
Peat		0.01		0.03				0.01		0.01		0.04		0.16		0.05		0.05
Clay		0.12								0.02				0.08				
Coarse		0.00		0.02				0.26										
Glaciofluvial		0.02						0.12		0.03		0.04		0.00		0.01		0.02
Till			0.95	0.82	1.00	1.00	1.00	0.46	0.60	0.57	1.00	0.83	0.86	0.67	1.00	0.91	1.00	0.84
Bare rock	1.00	0.85	0.05	0.13				0.14	0.37	0.34		0.09		0.07		0.02		0.08
Geology																		
Diabase												0.19						0.19
Granite	1.00	0.74	1.00	0.54	1.00	0.99		0.03	0.50	0.49				0.14	1.00	0.58		
Mafic gabbro										0.11								

Gneiss	0.26						1.00	0.80				1.00	0.81	
Acid volcanics		0.44	0.01		0.21	0.37		0.01						
Mafic volcanics				0.06							0.14			
Slate				1.00	0.90				1.00	0.86	0.28			
Limestone		0.02												

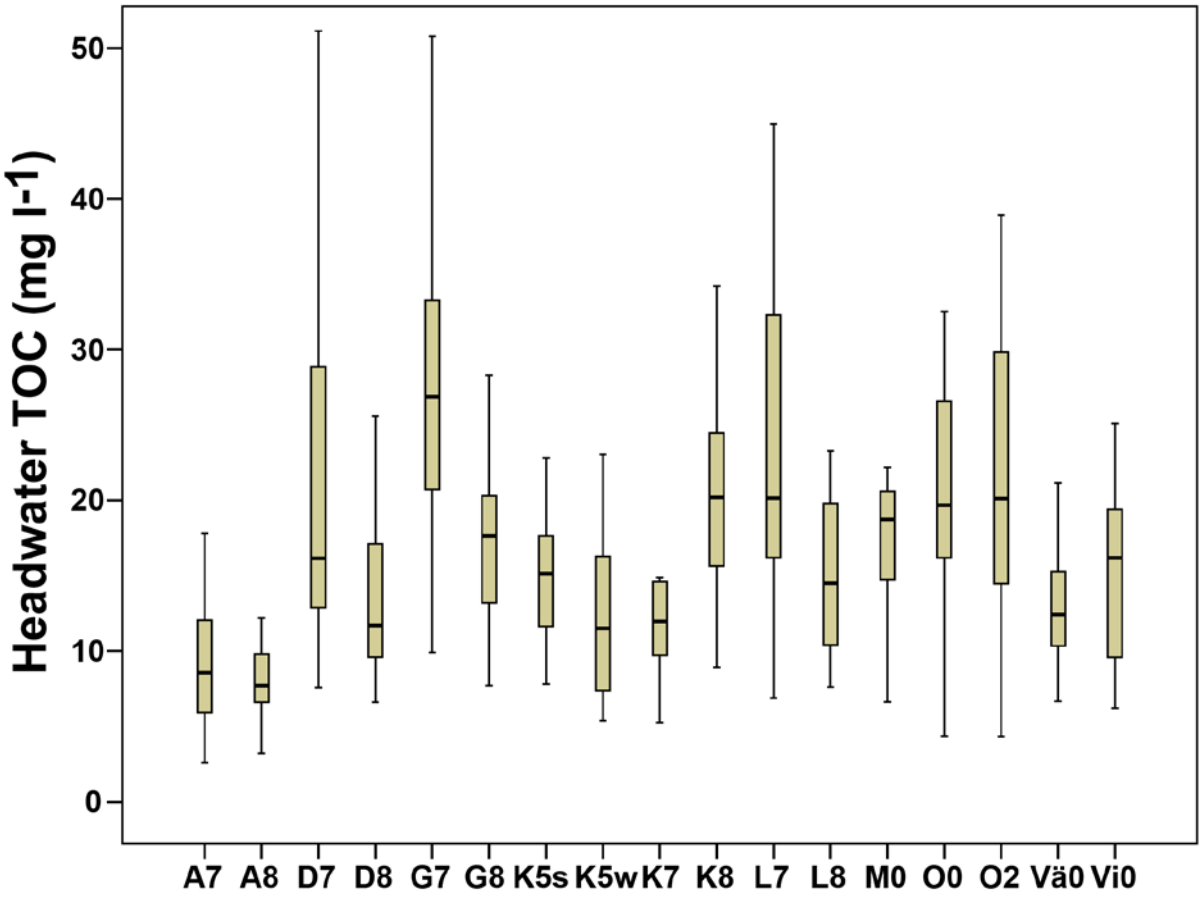

Fig. S2. Box-plot of total organic carbon (TOC) concentrations in headwaters for each survey.

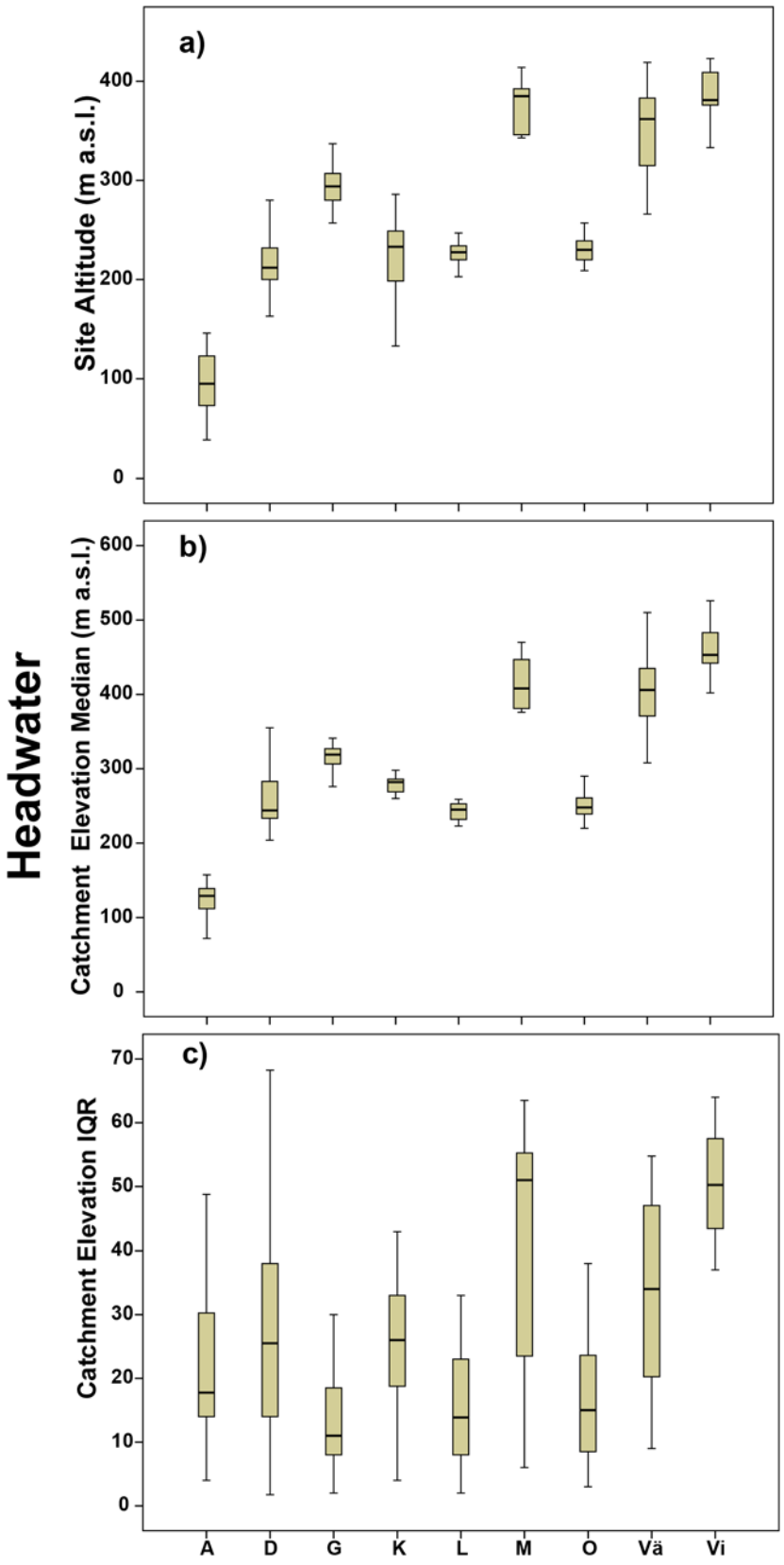

Fig. S3. Box-plot of headwaters site altitude (a) and catchment elevation (m a.s.l.) median (b) and interquartile range (IQR) (c). Please note different scale of the y-axis.

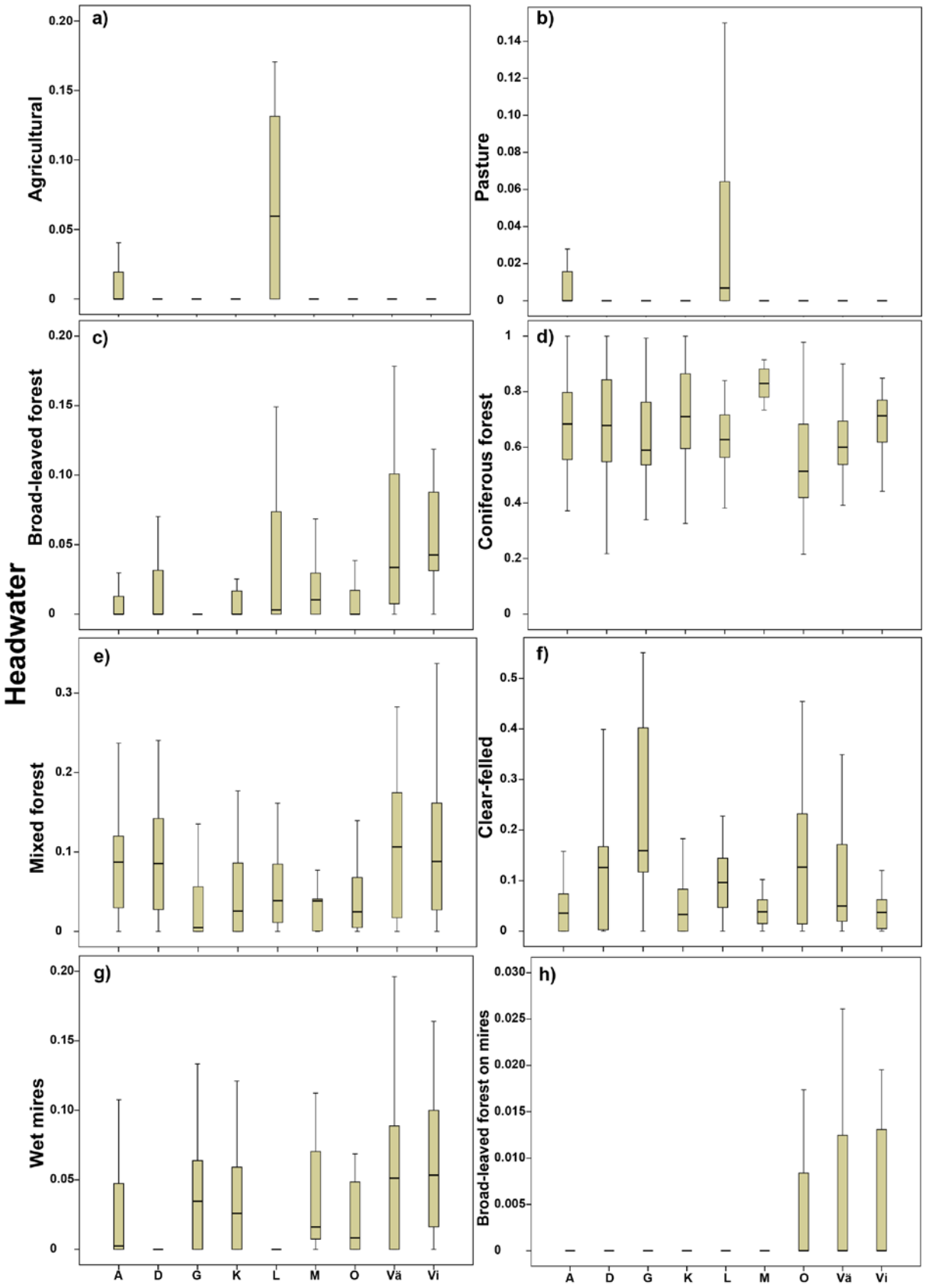

Fig. S4. Box-plot of headwaters catchment proportion in different land-use/land cover: a) Agricultural, b) Pasture, c) Broad-leaved forest, d) Coniferous forest, e) Mixed forest, f)

Clear-felled, g) Wet mires, h) Broad-leaved forest on mires. Please note different scale of the y-axis.

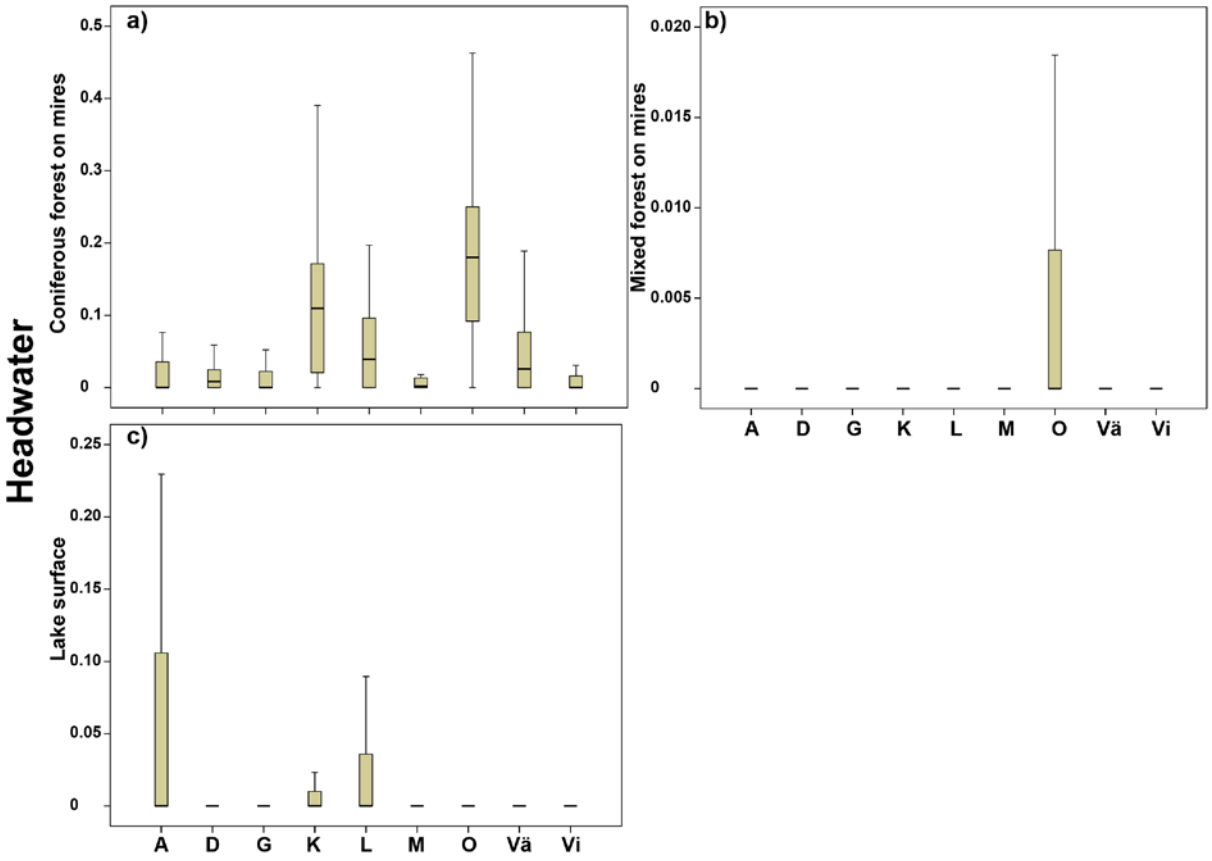

Fig. S5. Box-plot of headwaters proportion of land-use: a) Coniferous forest on mires, b) Mixed forest on mires, c) Lake surface. Please note different scale of the y-axis.

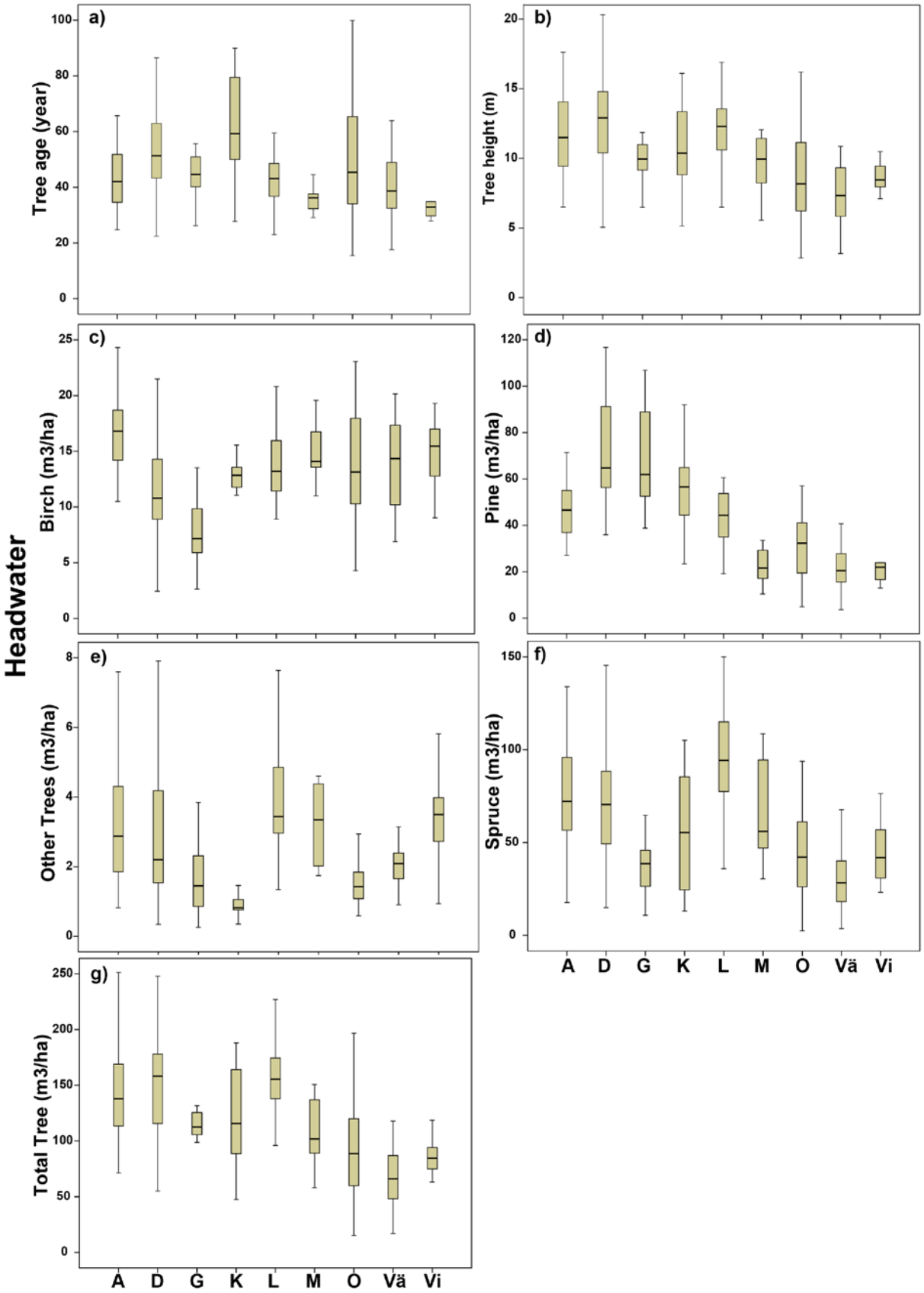

Fig. S6. Box-plot of headwaters proportion of vegetation: a) Tree age (year), b) Tree height (m), c) Birch (m3/ha), d) Pine (m3/ha), e) Other Trees (m3/ha), f) Spruce (m3/ha), g) Total Tree (m3/ha). Please note different scale of the y-axis.

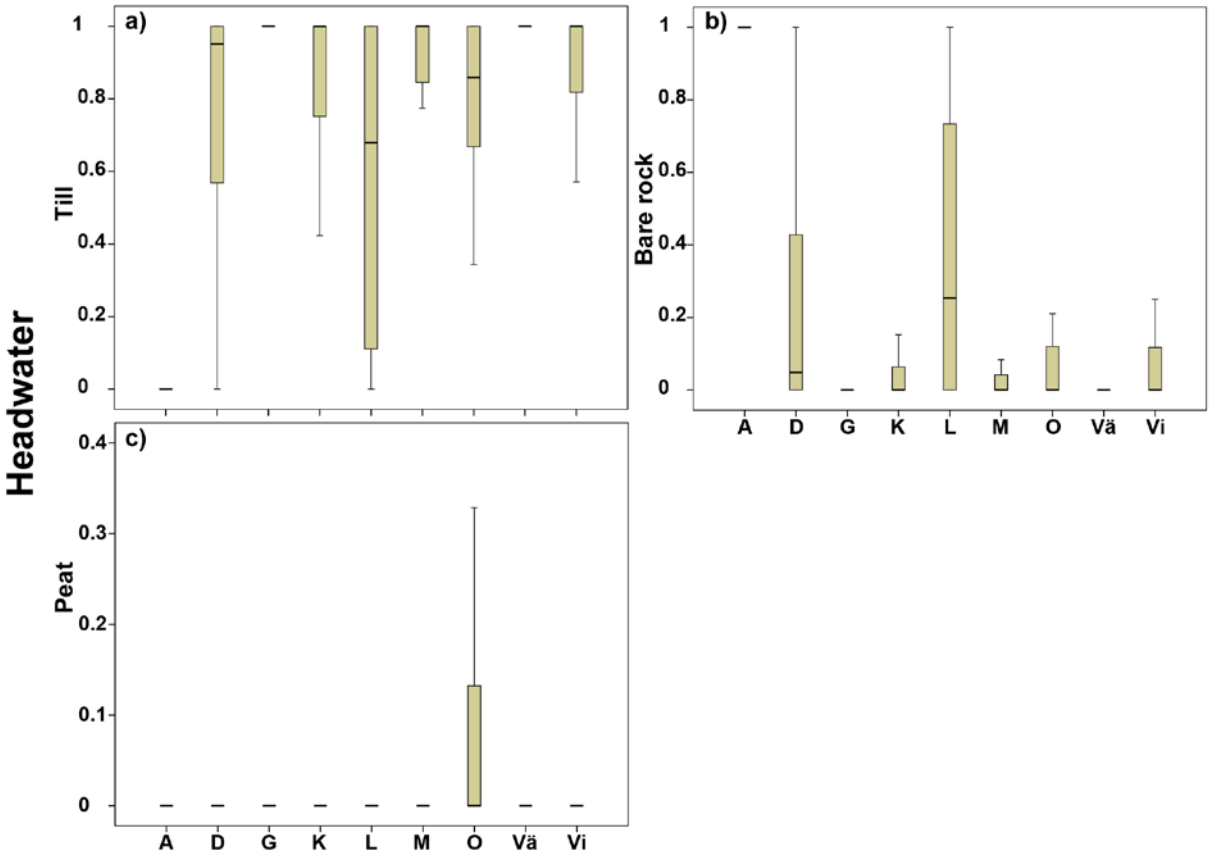

Fig. S7. Box-plot of headwaters proportion of soil type: a) Till, b) Bare rock, c) Peat. Please note different scale of the y-axis.

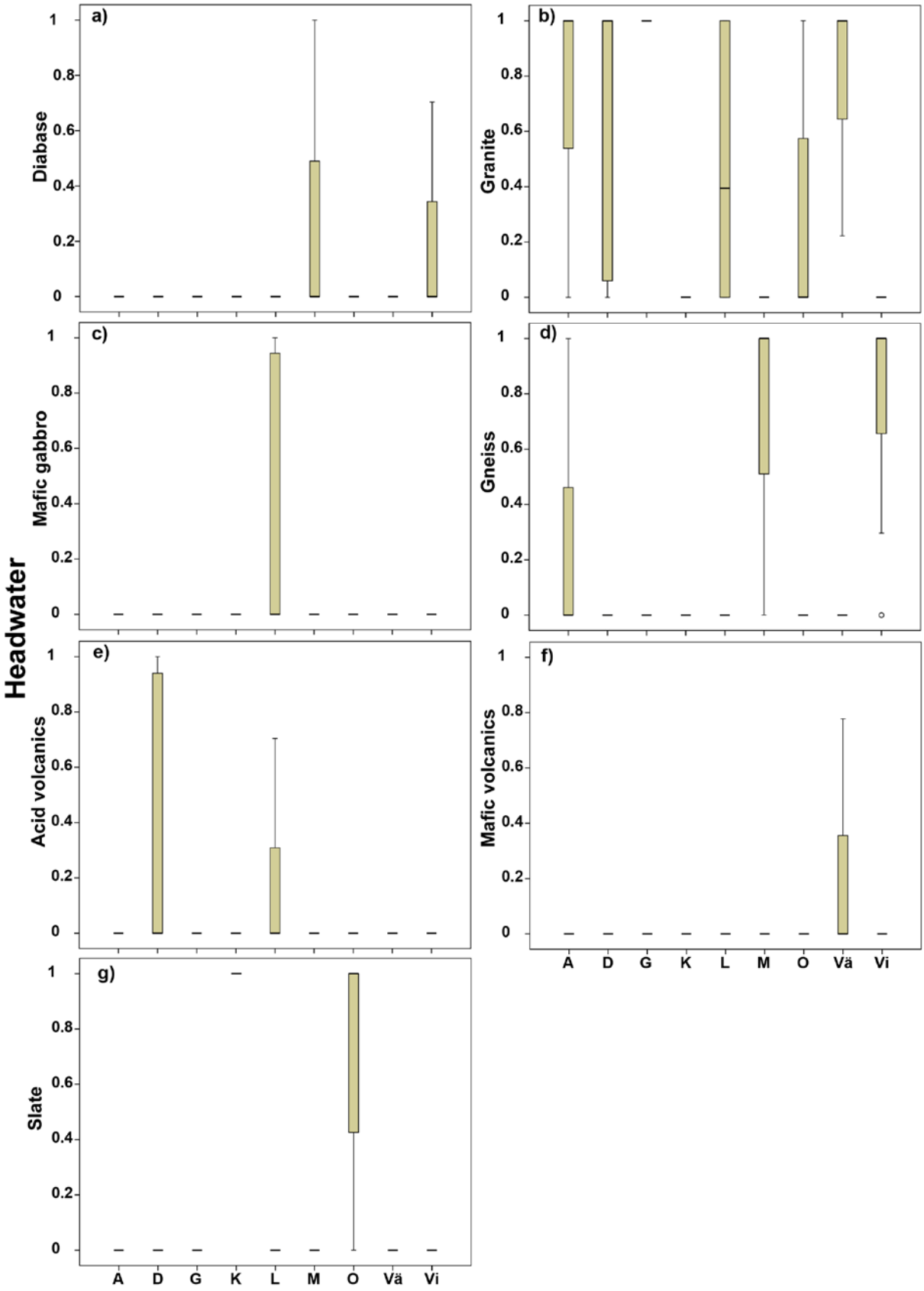

Fig. S8. Box-plot of headwaters proportion of bedrock parent material: a) Diabase, b) Granite, c) Mafic gabbro, d) Gneiss, e) Acid volcanics, f) Mafic volcanics, g) Slate.