

Supplementary Table S1: Descriptive statistics for selected properties of FH horizon used in PCA analysis for ten GEOMON headwater catchments. pH in water (pH H₂O) and in KCl; exchangeable acidity – Al+H (meq kg⁻¹); base saturation - BS [%]; total Ca_{tot}, K_{tot}, Mg_{tot} and P_{tot} (total digest) (mg kg⁻¹); available Ca_{avail}, K_{avail}, Mg_{avail} and P_{avail} (Mehlich) (mg kg⁻¹); exchangeable base cations (BaCl₂) of Ca_{ex}, K_{ex}, Mg_{ex} (mg kg⁻¹); and C:N ratio (g g⁻¹).

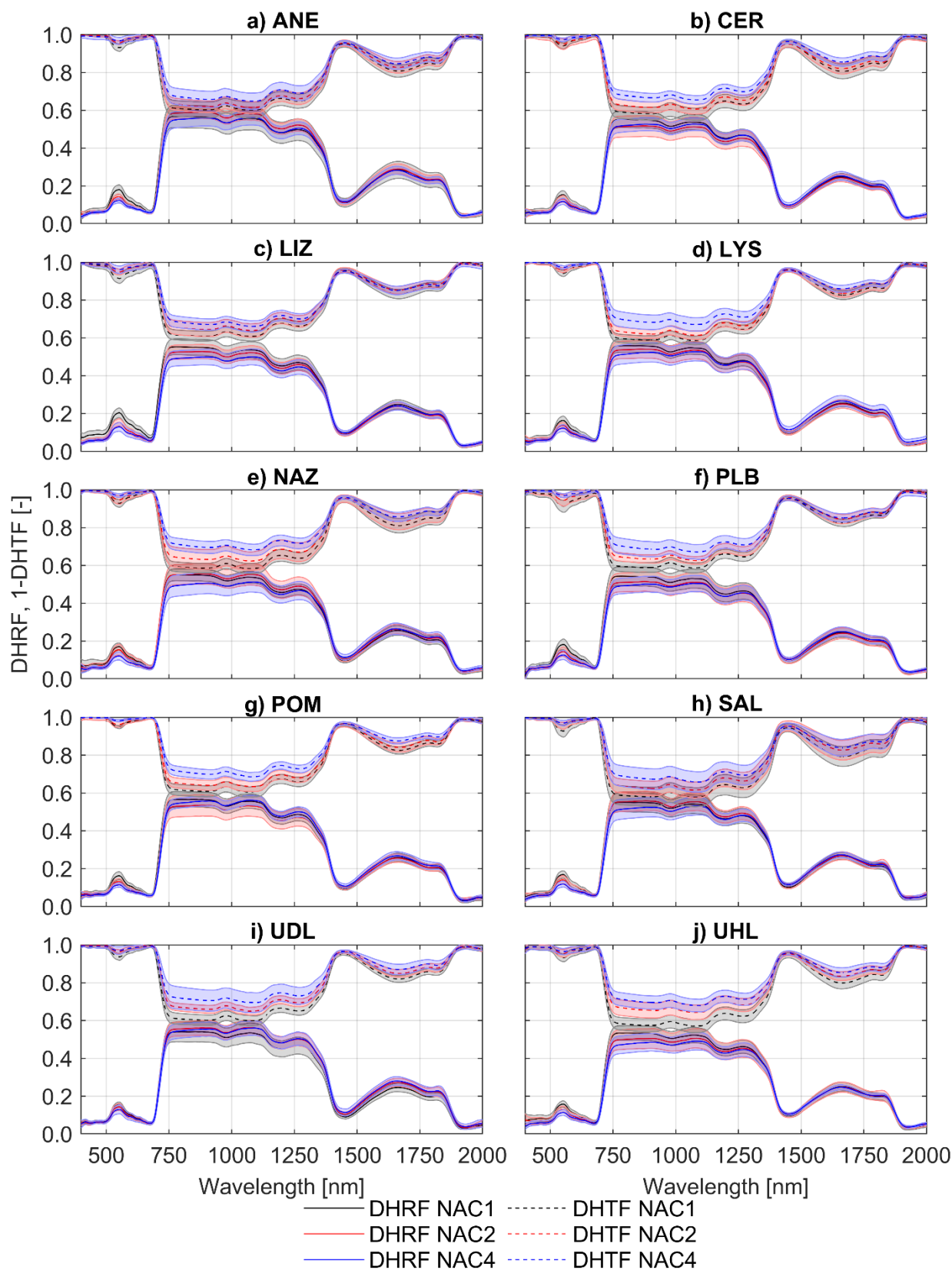
		pH H ₂ O				pH KCl				Exchangeable acidity (Al+H)				Base saturation			
Catchment		<i>Mean</i>	<i>St. dev.</i>	<i>Min</i>	<i>Max</i>	<i>Mean</i>	<i>St. dev.</i>	<i>Min</i>	<i>Max</i>	<i>Mean</i>	<i>St. dev.</i>	<i>Min</i>	<i>Max</i>	<i>Mean</i>	<i>St. dev.</i>	<i>Min</i>	<i>Max</i>
Code																	
ANE		4.15	0.24	3.93	4.41	3.29	0.28	3.09	3.61	15.67	4.16	12.60	20.40	0.87	0.04	0.82	0.91
CER		3.43	0.11	3.31	3.56	2.66	0.14	2.53	2.88	75.40	17.47	47.07	93.33	0.39	0.18	0.21	0.69
LIZ		3.32	0.22	3.08	3.58	2.47	0.22	2.26	2.74	55.06	19.76	39.05	81.34	0.46	0.17	0.26	0.62
LYS		3.37	0.11	3.21	3.48	2.79	0.31	2.47	3.20	90.50	34.81	33.95	125.80	0.29	0.17	0.15	0.58
NAZ		3.71	0.36	3.37	4.15	2.97	0.38	2.61	3.46	51.76	22.71	22.92	80.20	0.61	0.15	0.44	0.79
PLB		3.83	0.43	3.45	4.35	2.95	0.44	2.55	3.44	34.28	11.99	18.54	44.94	0.80	0.13	0.68	0.91
POM		3.60	0.08	3.49	3.67	2.81	0.11	2.71	2.93	53.07	15.54	39.43	75.41	0.60	0.13	0.41	0.70
SAL		3.41	0.14	3.28	3.56	2.56	0.19	2.39	2.76	42.21	9.65	29.49	51.86	0.57	0.15	0.46	0.76
UDL		3.79	0.16	3.65	3.96	3.07	0.08	2.99	3.14	56.44	41.71	25.45	103.86	0.57	0.20	0.35	0.75
UHL		3.36	0.19	3.17	3.52	2.88	0.13	2.69	2.97	144.13	50.38	82.70	206.10	0.12	0.06	0.06	0.20

		Total Ca				Total K				Total Mg				Total P			
Catchment		<i>Mean</i>	<i>St. dev.</i>	<i>Min</i>	<i>Max</i>	<i>Mean</i>	<i>St. dev.</i>	<i>Min</i>	<i>Max</i>	<i>Mean</i>	<i>St. dev.</i>	<i>Min</i>	<i>Max</i>	<i>Mean</i>	<i>St. dev.</i>	<i>Min</i>	<i>Max</i>
Code																	
ANE		4943	1930	3350	7090	6410	871	5460	7170	2607	746	1810	3290	915	74	860	999
CER		1263	750	528	2508	7126	2783	4530	11540	1261	715	788	2461	822	160	698	1087
LIZ		1558	783	880	2450	2938	1852	1530	5550	909	622	439	1810	860	55	799	929
LYS		996	455	670	1770	7530	4686	3150	15200	690	258	459	1111	1268	323	842	1619
NAZ		6314	1248	4470	7640	3406	900	2460	4750	4180	1230	3020	6110	859	87	707	921
PLB		4873	1398	3500	6810	2200	398	1640	2490	10978	3063	7470	14930	693	66	632	782
POM		2985	377	2550	3370	3775	1825	2310	6340	2086	1855	960	4845	816	65	768	912
SAL		2095	930	1300	3280	2153	1361	1250	4170	810	334	515	1153	671	85	589	790
UDL		2583	2250	1210	5180	4027	1525	2940	5770	1082	180	876	1205	1459	204	1225	1592
UHL		1176	196	962	1408	5748	1841	3140	7160	1012	64	974	1108	1341	308	1026	1711

Available Ca					Available K				Available Mg				Available P				
Catchment																	
Code	Mean	St. dev.	Min	Max	Mean	St. dev.	Min	Max	Mean	St. dev.	Min	Max	Mean	St. dev.	Min	Max	
ANE	2122	634	1464	2728	523	75	451	601	312	18	300	333	66	14	57	81	
CER	684	534	176	1579	348	92	256	461	130	79	59	259	31	9	20	41	
LIZ	716	464	257	1118	425	65	356	488	256	77	179	345	44	3	42	47	
LYS	466	412	139	1148	379	133	274	607	92	25	69	131	47	13	26	61	
NAZ	1683	672	899	2554	401	109	260	543	340	98	293	516	31	13	11	47	
PLB	1067	560	695	1886	257	91	151	337	1493	991	610	2850	31	12	20	45	
POM	1424	468	736	1723	355	93	236	457	317	106	225	420	30	21	4	53	
SAL	1385	751	745	2374	488	35	442	526	262	65	182	339	43	8	35	50	
UDL	779	364	517	1195	499	123	371	616	358	224	189	612	57	46	22	109	
UHL	155	112	71	313	275	52	226	349	69	15	51	86	26	9	14	35	

Exchangeable Ca					Exchangeable K				Exchangeable Mg				C:N ratio			
Catchment																
Code	Mean	St. dev.	Min	Max	Mean	St. dev.	Min	Max	Mean	St. dev.	Min	Max	Mean	St. dev.	Min	Max
ANE	1608	343	1255	1939	307	68	245	380	232	25	215	260	25.2	2.0	23.0	26.7
CER	703	505	220	1525	265	71	173	351	113	65	54	214	20.6	2.2	17.6	23.4
LIZ	511	276	208	755	268	54	195	323	165	38	127	216	25.6	2.4	22.0	27.1
LYS	361	233	137	713	269	92	181	417	73	16	59	100	23.2	2.8	19.2	26.9
NAZ	1053	382	727	1587	216	50	169	286	232	96	140	391	23.7	1.6	21.9	26.1
PLB	978	358	565	1419	177	29	140	202	1433	1160	664	3120	26.1	0.9	25.0	27.1
POM	1073	275	669	1263	212	44	169	257	227	72	160	296	23.7	0.6	23.3	24.5
SAL	825	456	430	1367	259	45	200	301	163	60	83	223	30.2	2.4	28.2	33.1
UDL	723	92	668	830	301	37	274	343	245	85	170	338	19.6	0.4	19.2	20.0
UHL	181	176	38	424	214	68	137	293	56	16	40	76	22.1	2.3	20.1	24.7

Supplementary Figure S1: Needle optical properties for ten GEOMON sites for current (NAC1), previous-year (NAC2) and older (NAC4) needles. Directional-Hemispherical Reflectance Factor (DHRF); Directional-Hemispherical Transmittance Factor (DHTF). Solid line - average 9-15 trees per site, shaded area – standard deviation.



Supplementary Figure S2: Weather conditions for the period of needle sampling 2nd-23rd August 2017. a) Mean daily temperature, b) Mean daily relative humidity, c) Daily mean precipitation. Black diamonds with catchments codes indicate the days of needle sampling at GEOMON catchments.

