SUPPLEMENTARY INFORMATION

Table S1. Physico-geographical parameters of the studied Lena River tributaries.

Watershed				Area,	Average annual temp, °C				Average annual precipitation, mm			
ID	Name, km	Lat	Long	Km²	Mean	STD	Min	Max	Mean	STD	Min	Max
1	Orlinga (208)	56.031	105.881	3650	-5.81	0.24	-6.3	-5.1	409	5	396	421
2	Nizhnaya Kytyma (228)	56.145	105.680	985	-4.68	0.34	-5.1	-3.9	392	4	381	398
3	Tayura (416)	56.997	106.545	5726	-5.34	0.22	-6.0	-5.0	395	5	387	406
4	Bolshaya Tira (529)	57.270	107.222	5127	-5.47	0.21	-5.8	-4.7	390	3	380	396
5	Kirenga (579)	57.761	108.087	46669	-5.62	1.01	-8.7	-4.3	398	12	377	437
6	Chaika (1025)	59.011	111.476	2524	-5.65	0.05	-5.8	-5.5	402	4	394	413
7	Chuya (1110)	59.265	112.458	18332	-6.84	0.62	-8.4	-5.5	426	10	400	446
8	Vitim (1132)	59.443	112.637	234219	-7.5	1.75	-12.3	-2.3	417	27	342	465
9	Yukte (1265)	60.126	113.966	564	-7.17	0.17	-7.5	-6.8	414	3	409	419
10	Kenek (1312)	60.423	114.301	1050	-6.84	0.07	-7.0	-6.7	400	2	395	404
11	Nuya (1331)	60.547	116.319	38207	-7.45	0.38	-8.3	-6.3	389	18	339	417
12	Bolshoi Patom (1670)	60.031	117.263	26816	-8.6	0.69	-10.0	-6.9	427	29	352	463
13	Biryuk (1712)	60.268	119.619	9819	-7.22	0.14	-7.5	-6.7	322	7	307	338
14	Olekma (1750)	60.343	120.696	209378	-7.73	1.26	-12.3	-5.7	426	48	334	575
15	Markha (1948)	60.606	123.255	8823	-8.37	0.38	-9.0	-7.6	342	11	319	375
16	Tuolba (2008)	60.600	124.257	15880	-7.49	0.38	-8.4	-6.2	406	15	378	444
17	Sinyaa (2118)	61.142	126.854	30875	-9.08	0.22	-9.8	-8.5	324	10	306	354
18	Buotama (2170)	61.245	128.770	12539	-8.85	0.43	-9.5	-7.4	382	26	317	435
19	Aldan (2381)	63.406	129.714	717203	-10.5	3.06	-20.8	-6.0	445	98	273	671
20	Tumara (2635)	63.465	129.593	14051	-15.9	2.29	-19.1	-11.0	325	21	277	356
	Sub total			1402436								
	Lena above Aldan			1661606	-8.76	2.95	-21	-2.1	418	77	267	671
	Lena below Aldan			825793	-11.6	2.96	-22	-6.3	311	29	197	400
	The drainage area of the Lena			2487399	-9.7	3.24	-22	-2.1	383	83	197	671

Table S1, continued. Landscape parameters of the studied Lena River tributaries.

Name	Dark Needleleaf Forest	Light Needleleaf Forest	Broadleaf Forest	Deciduous Needleleaf Forest	Mixed Forest	Needleleaf Shrubs	Humid Grassland	Riparian Vegetation	Tundra	Bare Soil and Rock	Water Bodies	Peatlands and bogs	Recent Burns	Other	Total
Orlinga (208)	2134	248	13	349	298	61	436	0	0	59	0	5	45	0	3649
Nizhnaya Kytyma (228)	299	25	14	125	485	0	34	0	0	4	0	0	0	0	985
Tayura (416)	1816	876	91	482	1664	1	581	0	0	11	0	3	201	0	5727
Bolshaya Tira (529)	1743	448	79	510	1880	0	378	0	0	19	0	1	68	0	5127
Kirenga (579)	10079	4426	703	12435	8544	2134	2741	0	2735	1874	17	509	453	18	46668
Chaika (1025)	311	264	134	897	872	1	36	0	0	2	0	3	2	0	2523
Chuya (1110)	3239	1730	186	6450	1649	2302	1053	0	1062	384	5	149	124	0	18333
Vitim (1132)	5013	5139	3488	123475	2490	14057	27683	0	27998	15081	724	3039	6013	21	234220
Yukte (1265)	88	165	83	111	104	5	0	0	0	2	0	5	0	0	564
Kenek (1312)	34	465	13	327	181	4	0	0	0	20	0	0	7	0	1050
Nuya (1331)	1262	5486	1403	25392	3286	117	0	0	0	773	8	269	207	0	38205
Bolshoi Patom (1670)	888	1321	791	9400	1533	3904	88	2	7077	994	10	695	110	0	26815
Biryuk (1712)	24	1144	303	7693	228	30	0	11	0	325	6	41	13	0	9818
Olekma (1750)	1683	4210	2644	131753	5587	17392	12791	21	20510	8556	213	2219	1797	0	209377
Markha (1948)	6	130	288	8071	104	2	0	1	0	121	3	94	0	0	8821
Tuolba (2008)	46	439	509	13373	563	89	0	9	0	805	0	24	23	0	15880
Sinyaa (2118)	10	1325	569	26616	44	25	0	3	0	1451	6	767	59	0	30875
Buotama (2170)	14	303	194	11160	110	20	0	29	0	627	0	45	38	0	12539
Aldan (2381)	3159	25741	3608	441249	15283	88410	4518	3403	63705	46906	1915	12115	7136	56	717202
Tumara (2635)	3	47	13	6155	6	1659	0	42	3970	1399	1	646	110	0	14051

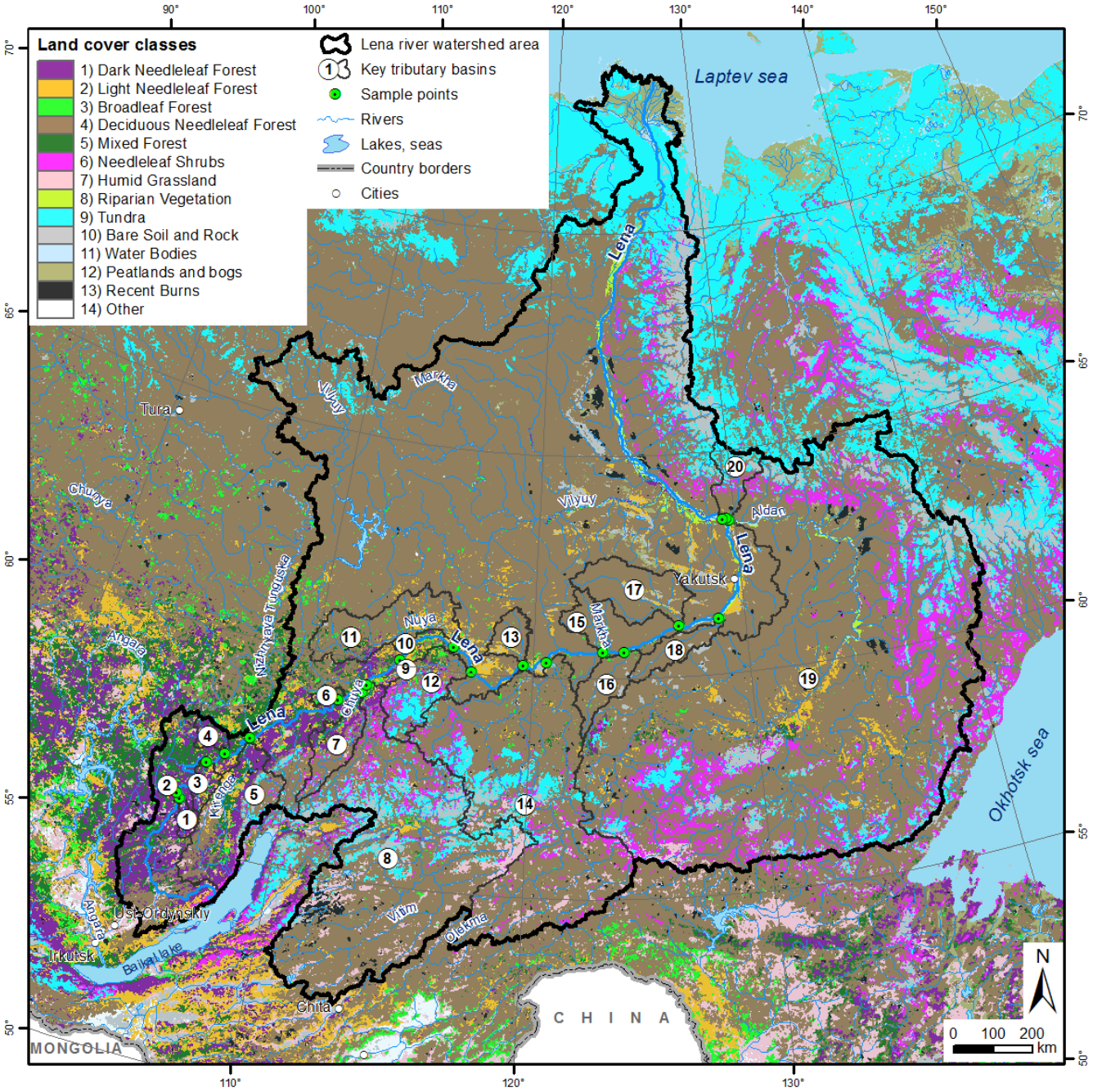


Figure S1. A: Landscape map of the Lena River and tributaries (RLC based). The identification of tributaries (numbers in circles) is provided in Table 1 and Table S1.

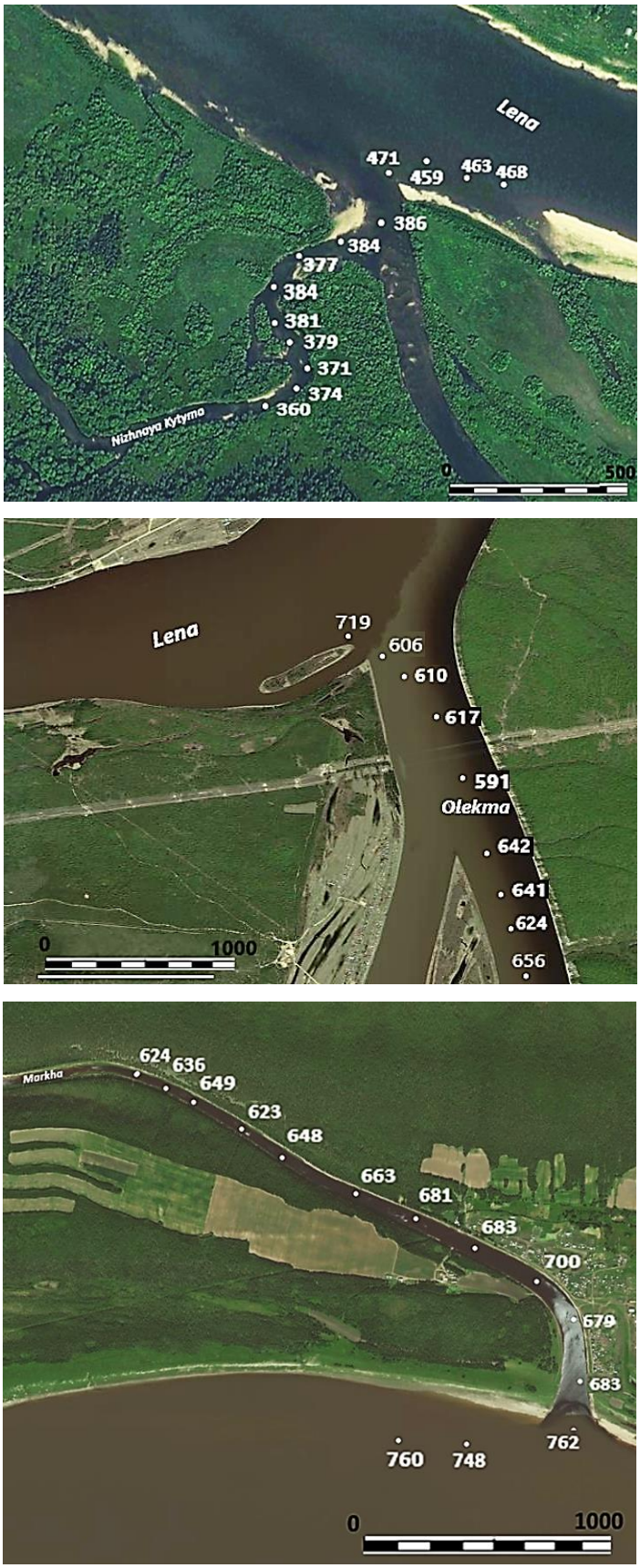
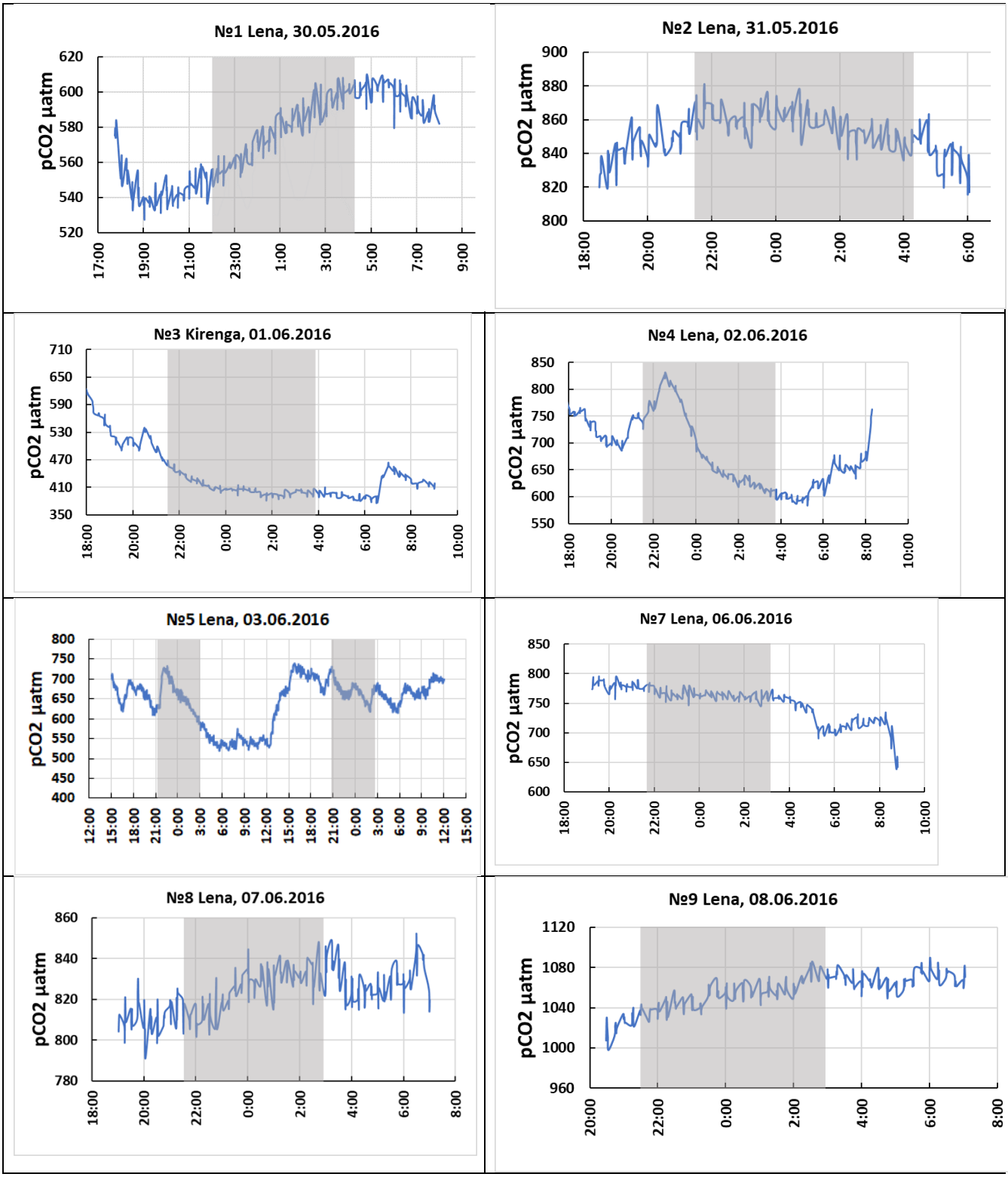


Figure S1. B: Examples of pCO_2 measurements in the main Lena stem and its tributaries Nizhnaya Kytyma No 2 (top), Olekma No 14 (middle) and Markha No 15 (bottom). The numbers represent 5-min averaged pCO_2 (µatm) values.


№1 Lena, 30.05.2016
pCO2 µatm
620
600
580
560
540
520
17:00
19:00
21:00
23:00
1:00
3:00
5:00
7:00
9:00
№2 Lena, 31.05.2016
pCO2 µatm
900
880
860
840
820
800
18:00
20:00
22:00
0:00
2:00
4:00
6:00
№3 Kirenga, 01.06.2016
pCO2 µatm
710
650
590
530
470
410
350
18:00
20:00
22:00
0:00
2:00
4:00
6:00
8:00
10:00
№4 Lena, 02.06.2016
pCO2 µatm
850
800
750
700
650
600
550
18:00
20:00
22:00
0:00
2:00
4:00
6:00
8:00
10:00
№5 Lena, 03.06.2016
pCO2 µatm
800
750
700
650
600
550
500
450
400
12:00
15:00
18:00
21:00
0:00
3:00
6:00
9:00
12:00
15:00
18:00
21:00
0:00
3:00
6:00
9:00
12:00
15:00
№7 Lena, 06.06.2016
pCO2 µatm
850
800
750
700
650
600
18:00
20:00
22:00
0:00
2:00
4:00
6:00
8:00
10:00
№8 Lena, 07.06.2016
pCO2 µatm
860
840
820
800
780
18:00
20:00
22:00
0:00
2:00
4:00
6:00
8:00
№9 Lena, 08.06.2016
pCO2 µatm
1120
1080
1040
1000
960
20:00
22:00
0:00
2:00
4:00
6:00
8:00

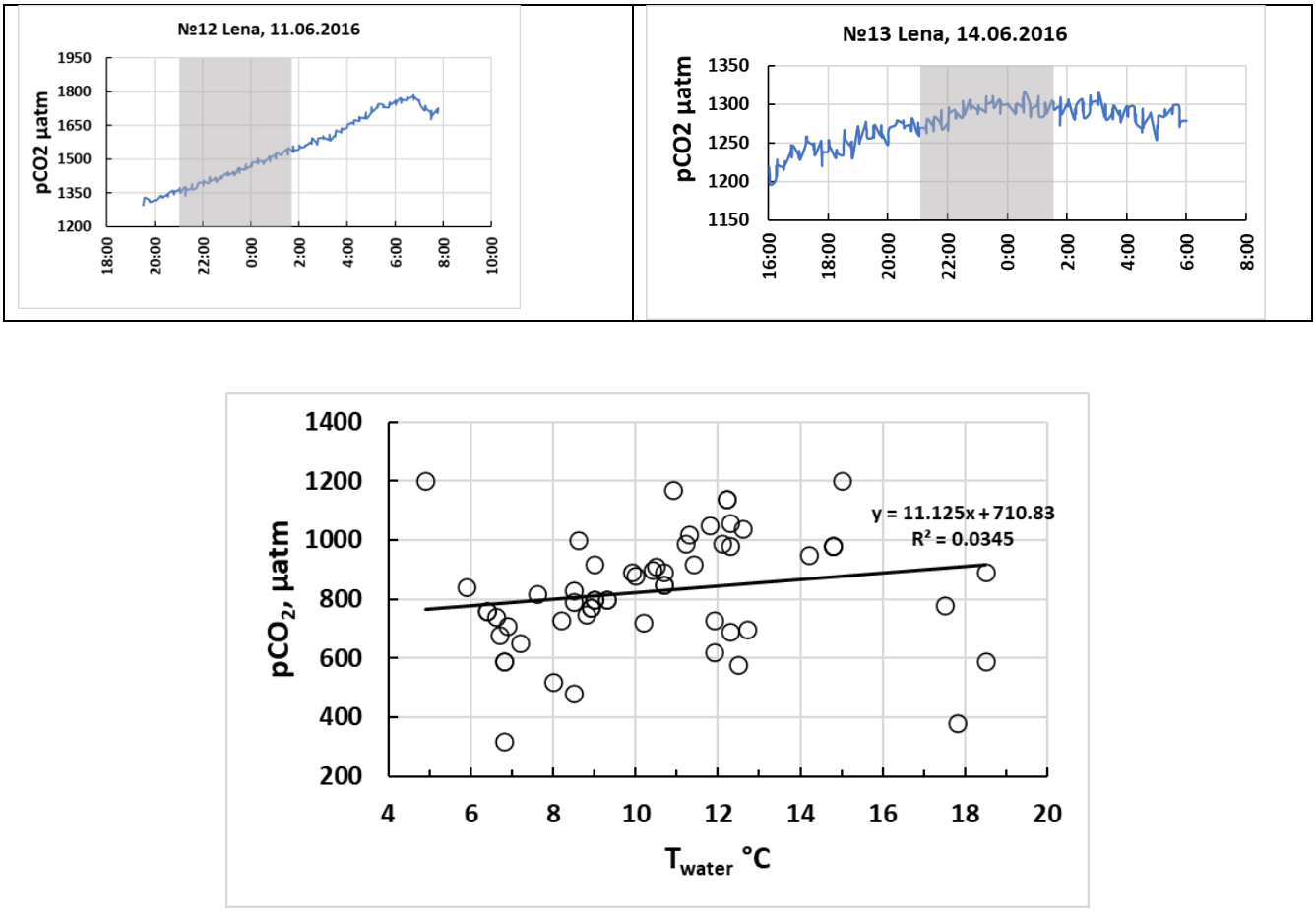
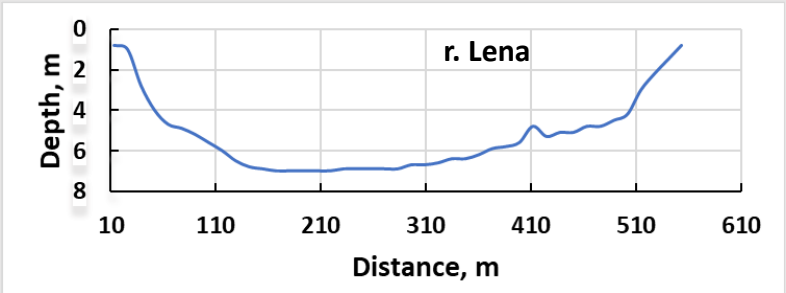
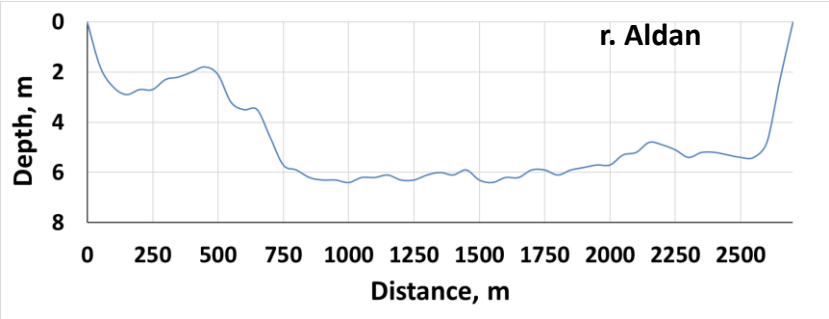


Fig. S2. Diurnal variations of pCO_2 in the Lena main stem and some tributaries, and a lack of linear relationship between water temperature and pCO_2 in the Lena River and tributaries. Shaded (grey) area represents the night time. In some cases (No 4, 5 Lena) we observed local maxima of pCO_2 non-linked to any particular period of the day or night, which exceeded the average values by ca. 20-30%.



Distance to the right shore, m	10	100	250	300	520
pCO_2, µatm	566	566	567	567	578
CH_4 µmol L^{-1}	0.043	0.041	0.033	0.033	0.053
DOC, mg L^{-1}	7.43	7.42	7.19	7.19	8.12
DIC, mg L^{-1}	6.12	6.59	5.71	4.99	4.57



Distance to the left shore, m	50	650	1550	2600
pCO_2, µatm	980	980	980	1200
CH_4 µmol L^{-1}	0.065	0.075	0.084	0.088
DOC, mg L^{-1}	7.85	7.80	9.80	8.20
DIC, mg L^{-1}	6.47	6.47	6.71	6.21

Figure S3. Spatial (across the river stem) variations in CO2, CH4, DOC and DIC concentration in the Lena River upper reaches (N 58.5769° ; E 109.8650°, 867 km from the beginning of the route (A) and the Aldan River mouth (N 63,4208°; E 129,7098°).

Marked loadings are >0.70)		
	Factor 1	**Factor 2**
Dark Needleleaf Forest	0.247	0.704
Light Needleleaf Forest	0.962	0.057
Broadleaf Forest	0.835	0.264
Deciduous Needleleaf Forest	0.992	0.019
Mixed Forest	0.842	0.292
Needleleaf Shrubs	0.980	0.012
Humid Grassland	0.392	0.464
Riparian Vegetation	0.927	-0.111
Tundra	0.979	0.146
Bare Soil and Rock	0.992	0.044
Water Bodies	0.981	0.054
Peatlands and bogs	0.989	0.012
Recent Burns	0.902	0.224
Soil C stock, 0-100 cm	0.302	-0.570
pCO_2	0.719	-0.593
CH_4	0.022	-0.708
DOC	-0.329	-0.622
DIC	-0.313	-0.589
Temperature	-0.641	0.504
Precipitation	0.465	0.589
Expl.Var	12.5	3.5
Prp.Totl	0.59	0.16

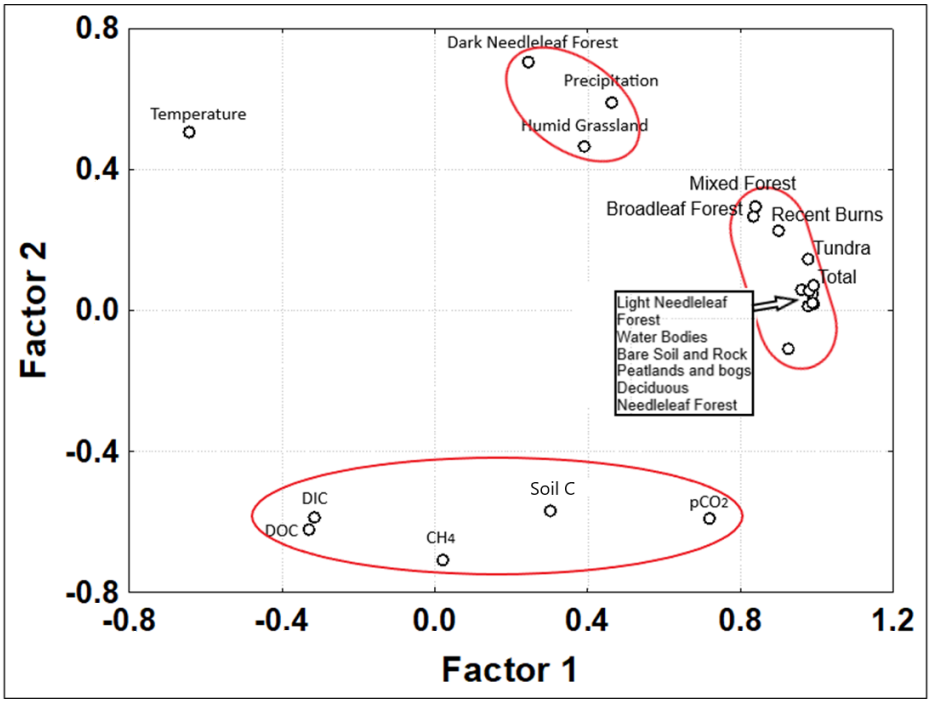


Figure S4. Results of PCA treatment of the data on the Lena River tributaries.

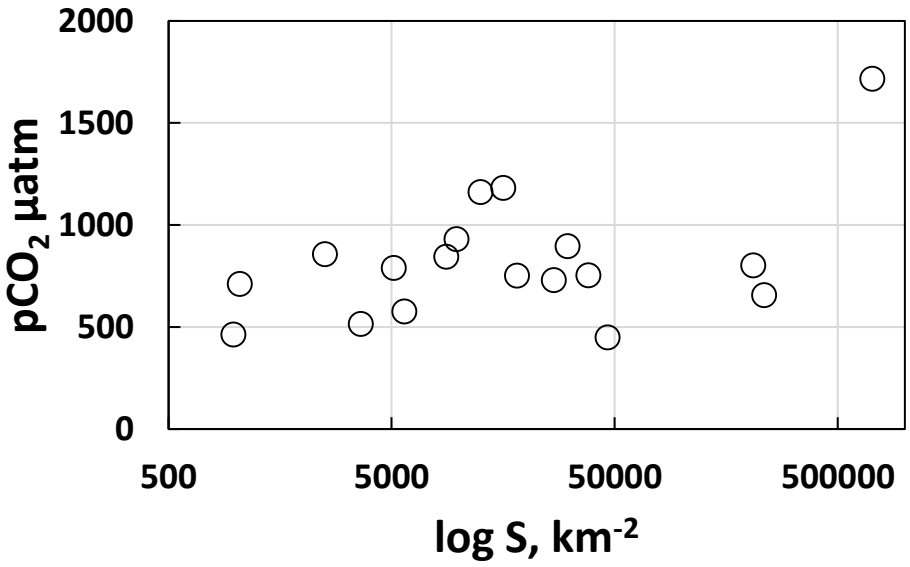


Figure S5. Lack of tributary watershed size on the pCO_2 in water (without Aldan).

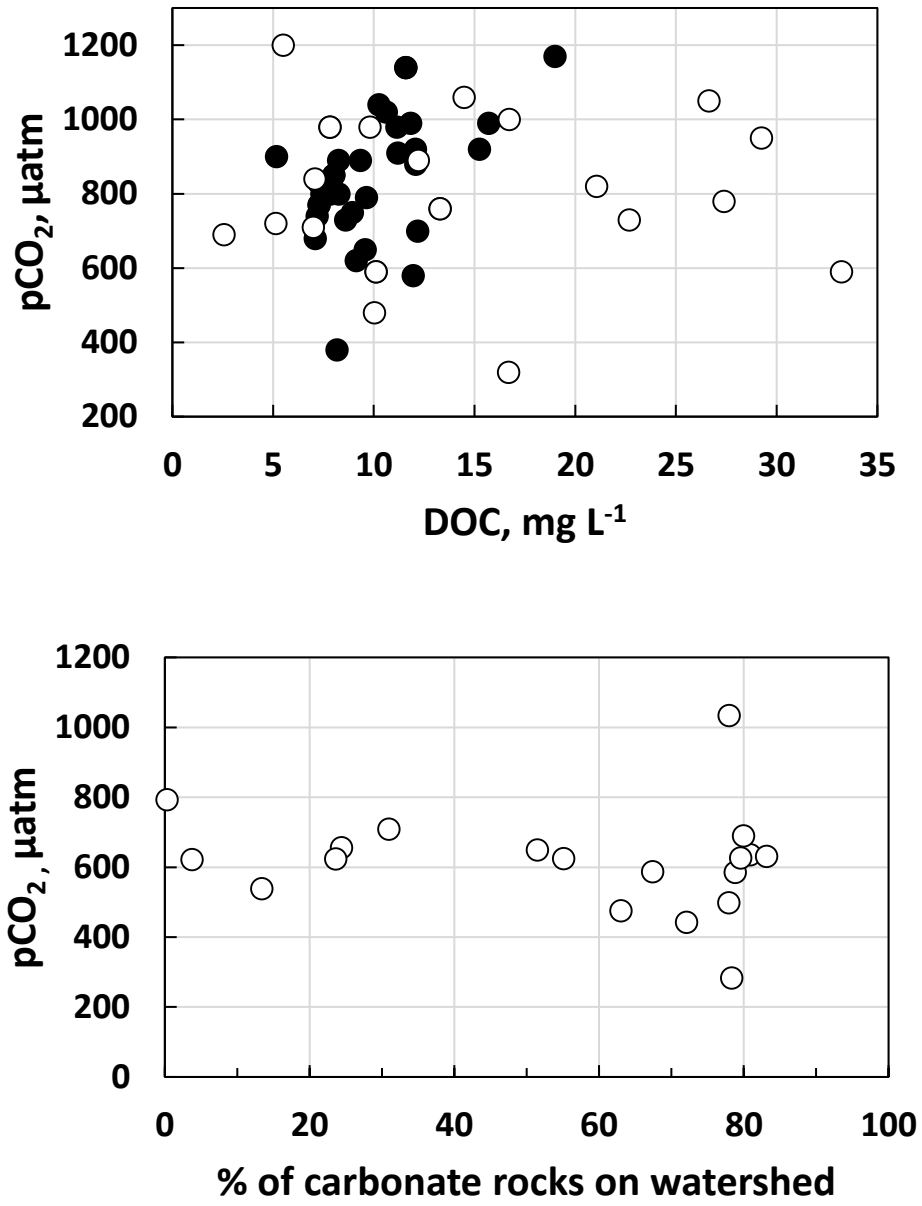


Figure S6. Lack of relationship between (**A**) DOC in the Lena River (closed circles) and its tributaries (open circles) and (**B**) percentage of carbonate rocks in the tributary watershed and the pCO_2 in the river water.