[Supplemental figures and tables]

Table S1. Correlation coefficients between GHG fluxes and environmental factors.

Sphagnum	NEE	R_{TOT}	P_G	CH_4	N_2O	Ln (R_{TOT})	Ln (CH_4)	Soil temp. at 3cm depth	Water table depth
n	240	120	120	183	189	120	183	243	243
NEE	-	-0.318**	-0.643**	-0.116	0.101	-0.422**	-0.224*	-0.399**	-0.077
R_{TOT}		-	0.911**	0.508**	0.200	0.903**	0.696**	0.853**	0.543**
P_G			-	0.480**	0.140	0.891**	0.704**	0.837**	0.502**
CH_4				-	-0.045	0.459**	0.781**	0.378**	0.133
N_2O					-	0.138	0.042	-0.024	0.067
Ln (R_{TOT})						-	0.706**	0.871**	0.546**
Ln (CH_4)							-	0.541**	0.291**
Soil temp. at 3cm depth								-	0.531**
Water table depth									-

Short-*Sasa*	NEE	R_{TOT}	P_G	CH_4	N_2O	Ln (R_{TOT})	Ln (CH_4)	Soil temp. at 3cm depth	Water table depth
n	144	69	69	99	114	69	91	148	148
NEE	-	0.083	-0.556**	-0.047	0.065	0.057	0.021	0.192*	-0.063
R_{TOT}		-	0.778**	0.089	-0.069	0.897**	0.02	0.630**	0.612**
P_G			-	0.207	-0.088	0.713**	0.075	0.382**	0.578**
CH_4				-	-0.091	0.198	0.656**	0.257*	-0.062
N_2O					-	-0.226	-0.214	-0.094	0.105
Ln (R_{TOT})						-	0.215	0.760**	0.616**
Ln (CH_4)							-	0.365**	-0.060
Soil temp. at 3cm depth								-	0.455**
Water table depth									-

Table S1. Continued.

Tall-*Sasa*	NEE	R_{TOT}	P_G	CH_4	N_2O	Ln (R_{TOT})	Ln (CH_4)	Soil temp. at 3cm depth	Water table depth
n	222	95	95	158	176	95	139	226	225
NEE	-	0.085	-0.835**	0.139	-0.032	0.126	-0.074	0.119	-0.001
R_{TOT}		-	0.476**	0.137	0.115	0.909**	-0.008	0.649**	0.673**
P_G			-	-0.169	0.247	0.388**	-0.089	0.147	0.420**
CH_4				-	-0.070	0.179	0.544**	0.077	0.029
N_2O					-	0.098	-0.018	0.053	0.021
Ln (R_{TOT})						-	0.051	0.789**	0.633**
Ln (CH_4)							-	-0.018	-0.149
Soil temp. at 3cm depth								-	0.490**
Water table depth									-

Ilex	NEE	R_{TOT}	P_G	CH_4	N_2O	Ln (R_{TOT})	Ln (CH_4)	Soil temp. at 3cm depth	Water table depth
n	117	45	45	90	96	45	57	120	120
NEE	-	0.184	-0.748**	0.136	-0.027	0.252	0.007	0.105	0.174
R_{TOT}		-	0.514**	0.413	0.126	0.941**	0.338*	0.784**	0.470**
P_G			-	0.036	-0.212	0.415**	-0.261	0.158	0.021
CH_4				-	-0.031	0.343*	0.677**	0.0315	0.009
N_2O					-	0.075	0.086	0.106	0.108
Ln (R_{TOT})						-	0.249	0.856**	0.533**
Ln (CH_4)							-	-0.058	-0.072
Soil temp. at 3cm depth								-	0.655**
Water table depth									-

NEE, net net ecosystem exchange of CO_2; PG, gross photosynthesis; RTOT, total ecosystem respiration. ** and * indicate significant at $P < 0.01$ and $P < 0.05$, respectively.

Table S2. Parameters for estimating total ecosystem respiration (R_{TOT}) and gross photosynthesis (P_G).

Vegetation	Plot	Total ecosystem respiration				Gross photosynthesis			
		n	a	b	R^2	n	c	K	R
Sphagnum	Sp1	15	27.9	0.0731	0.687**	18	25.2	396	0.805**
	Sp2	15	17.6	0.0932	0.854**	18	20.9	157	0.563*
	Sp3	15	25.3	0.0824	0.835**	18	23.2	218	0.663**
	Sp4	15	11.0	0.103	0.797**	18	17.0	169	0.463
	Sp5	15	11.4	0.119	0.920**	18	19.0	111	0.373
	Sp6	10	35.8	0.079	0.894**	20	22.7	297	0.877**
	Sp7	10	6.43	0.146	0.857**	18	23.5	341	0.876**
	Sp8	10	5.52	0.153	0.900**	20	18.9	217	0.864**
Short-*Sasa*	SS1	15	13.3	0.111	0.899**	18	9.90	46.8	0.218
	SS2	13	9.35	0.123	0.875**	15	9.55	134	-
	SS3	13	11.8	0.121	0.845**	16	13.2	134	-
	SS4	10	11.7	0.155	0.806**	20	22.3	189	0.760**
	SS5	10	29.2	0.114	0.825**	20	24.9	167	0.657**
Tall-*Sasa*	TS1	13	18.9	0.114	0.926**	16	22.9	210	-
	TS2	13	13.8	0.131	0.881**	16	25.6	210	-
	TS3	10	22.4	0.107	0.804**	20	39.8	196	0.592**
	TS4	13	25.2	0.108	0.744**	16	30.6	210	-
	TS5	10	17.8	0.120	0.885**	20	30.3	192	0.436
	TS6	10	27.5	0.123	0.673**	19	63.9	229	0.483*
	TS7	9	19.2	0.160	0.845**	19	69.9	221	0.446
Ilex	I1	10	46.4	0.123	0.941**	20	104	151	0.406
	I2	10	68.2	0.102	0.851**	20	92.0	144	0.550*
	I3	10	40.5	0.118	0.867**	19	76.0	88.1	0.296

Sp1-5, SS1-3 and TS1, 2 and 4 are for 2004. Sp6-8, SS4 and 5, TS3, 5-7 and I1-3 are for June 2005-June 2006.

** and * indicate significant at $P < 0.01$ and $P < 0.05$, respectively.

Table S3. Correlation coefficients between annual GHG budgets and environmental factors.

	R_{TOT}	P_G	NEE	CH_4	N_2O	Moisture content of surface peat	Kaila's degree of humification	Peat C/N ratio	Peat T-N	Peat T-C	Average soil temp. at 3cm depth	Average water table depth	*Sasa* height	Groundwater DOC
n	20	20	20	20	20	20	20	20	20	20	20	20	12	20
R_{TOT}	-	0.959**	-0.804**	-0.586**	0.685**	-0.732**	0.227	-0.505*	-0.140	-0.349	-0.710**	0.812**	0.783**	0.381
P_G		-	-0.939**	-0.568**	0.672**	-0.726**	0.150	-0.451	-0.149	-0.326	-0.656**	0.782**	0.899**	0.278
NEE			-	0.483*	-0.581**	0.640**	-0.040	0.336	0.143	0.262	0.519*	-0.662**	-0.743**	-0.122
CH_4				-	-0.125	0.411	-0.447*	0.526*	-0.228	0.049	0.573**	-0.447*	-0.536	-0.618**
N_2O					-	-0.608**	-0.211	-0.332	-0.367	-0.485*	-0.255	0.592**	0.040	0.175
Moisture content of surface peat						-	-0.130	0.582**	0.620**	0.825**	0.277	-0.610**	0.196	-0.092
Kaila's degree of humification							-	-0.584**	0.367	0.029	-0.538*	0.162	0.430	0.387
Peat C/N ratio								-	-0.063	0.457*	0.461*	-0.248	0.535	-0.368
Peat T-N									-	0.855**	-0.335	-0.190	0.460	0.361
Peat T-C										-	-0.093	-0.278	0.618*	0.144
Soil temp. at 3cm depth											-	-0.438	-0.582*	-0.508*
Water table depth												-	0.708**	0.400
Sasa height													-	0.362
Groundwater DOC														-

NEE, net net ecosystem exchange of CO_2; P_G, gross photosynthesis; R_{TOT}, total ecosystem respiration. ** and * indicate significant at $P < 0.01$ and $P < 0.05$, respectively.

Table S4. Water table depth, physico-chemical properties of surface peat layer (0-10cm) and ground water DOC (dissolved organic carbon) at grid points.

	Sphagnum-Moliniopsis	*Moliniopsis-Gale*	*Sasa* <50cm	*Sasa* 50-100cm	*Sasa* >100cm	*Ilex*
n	5	7	3	34	8	*3*
Water table depth (cm)	9.6 ± 1.4 a	18.3 ± 3.9 ab	11.2 ± 0.4 ab	16.1 ± 0.8 ab	17.8 ± 1.5 ab	23.1 ± 2.3 b
Moisture content of surface peat (%)	91.8 ± 1.1 b	83.0 ± 3.8 b	87.8 ± 1.4 b	87.7 ± 0.7 b	87.0 ± 1.0 b	72.6 ± 4.6 a
Kaila's degree of humification	15.2 ± 2.1 a	37.8 ± 2.2 c	30.1 ± 1.4 bc	29.2 ± 1.2 b	32.8 ± 3.8 bc	32.4 ± 2.5 bc
Groundwater DOC (mg L^{-1})	25.2 ± 6.0 a	35.4 ± 3.0 a	37.2 ± 6.6 a	33.0 ± 1.9 a	27.0 ± 1.5 a	36.0 ± 2.6 a

Table S5. Correlation coefficients among environmental factors at grid points.

	Water table depth	*Sasa* height	LAI	*Sasa* aboveground biomass	Moisture content of surface peat	Kaila's degree of humification	Groundwater DOC
n	60	50	45	45	60	60	60
Water table depth	1.000	0.552**	0.398**	0.292	-0.754**	0.241	0.231
Sasa height		1.000	0.597**	0.786**	-0.316*	0.327*	0.028
LAI			1.000	0.716**	-0.330*	0.145	-0.135
Sasa aboveground biomass				1.000	-0.180	0.229	-0.040
Moisture content of surface peat					1.000	-0.264	-0.143
Kaila's degree of humification						1.000	0.209
Groundwater DOC							1.000

LAI, leaf area index of *Sasa*. ** and * indicate significant at $P < 0.01$ and $P < 0.05$, respectively.

Table S6. Satellite image band values for each vegetation community

	Sphagnum-Moliniopsis	*Moliniopsis-Gale*	*Sasa*	*Sasa-Gale*	*Ilex*
n	10	12	68	15	4
Band 1	291 ± 0.687 ab	287 ± 1.15 a	302 ± 0.768 c	297 ± 0.616 b	288 ± 1.75 ab
Band 2	299 ± 1.17 a	288 ± 1.83 a	327 ± 1.81 b	305 ± 2.09 a	287 ± 3.33 a
Band 3	215 ± 2.29 bc	194 ± 1.59 a	215 ± 1.78 c	202 ± 1.86 ab	191 ± 3.12 a
Band 4	593 ± 9.38 a	681 ± 15.8 bc	836 ± 8.51 d	710 ± 17.2 c	608 ± 16.1 ab

Mean ± standard error. Numbers within a line followed by different letters differ significantly among the sites. ($P < 0.05$, Tukey-Kramer test). Band 1, bule (445-516 nm); Band 2, green (506-595 nm); Band 3, red (632-698 nm); Band 4, near infrared (757-853 nm).

Table S7. Accuracy rate of vegetation classification by discriminant analysis.

Number of vegetation community observed visually	(n)	Number of vegetation community estimated by satellite bands					Accuracy rate† (%)
		Sasa	*Sasa-Gale*	*Sphagnum-Moliniopsis*	*Moliniopsis-Gale*	*Ilex*	
Sasa	(68)	67	1	0	0	0	98.5
Sasa-Gale	(15)	4	10	0	1	0	66.7
Sphagnum-Moliniopsis	(10)	0	0	10	0	0	100
Moliniopsis-Gale	(12)	0	0	0	12	0	100
Ilex	(4)	0	0	0	1	3	75.0
Total	(109)						93.6

†Number of points correctly discriminated/number of points used in discriminant analysis × 100

Table S8. Coefficients of multiple regression analysis of environmental factors using satellite image bands.

	Sasa height (cm)	Average water table depth (cm)			Moisture content of surface peat (%)			Groundwater DOC (mg L^{-1})		
n	*Sasa*†	*Sphagnum*	*Sasa*†	*Ilex*	*Sphagnum*	*Sasa*†	*Ilex*	*Sphagnum*	*Sasa*†	*Ilex*
Band 1	1.01	1.53		-0.964			1.93			
Band 2								-0.867		0.967
Band 3	0.118	-0.670			0.428	0.069				
Band 4									-0.0365	
NDVI										
RVI			2.87							
Constant	-371	-289	5.13	301	-0.00957	72.8	-485	285	61.5	-239
n	67	18	67	3	18	67	3	18	67	3
R^2	0.485	0.363	0.054	0.997	0.254	0.049	0.998	0.292	0.093	0.995
P	< 0.01	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.01	< 0.05

NDVI = (Band 4 - Band 3) / (Band 4 + Band 3), RVI = Band 4/ Band 3. †Short- and tall-*Sasa*.

Table S9. Verification of vegetation classification and sasa height estimation using satellite bands.

Number of vegetation community observed visually	(n)	Number of vegetation community estimated by satellite bands					Accuracy rate (%)
		Sphagnum-Moliniopsis	*Moliniopsis-Gale*	*Sasa*	*Sasa-Gale*	*Ilex*	
Sphagnum-Moliniopsis	(7)	2	2	0	3	-	28.6
Moliniopsis-Gale	(6)	0	6	0	0	-	100
Sasa	(10)	0	0	10	0	-	100
Sasa-Gale	(3)	0	0	1	2	-	66.7
Ilex	(0)	-	-	-	-	-	-
Total	(26)						76.9

†Number of points correctly discriminated/number of points used for verification × 100

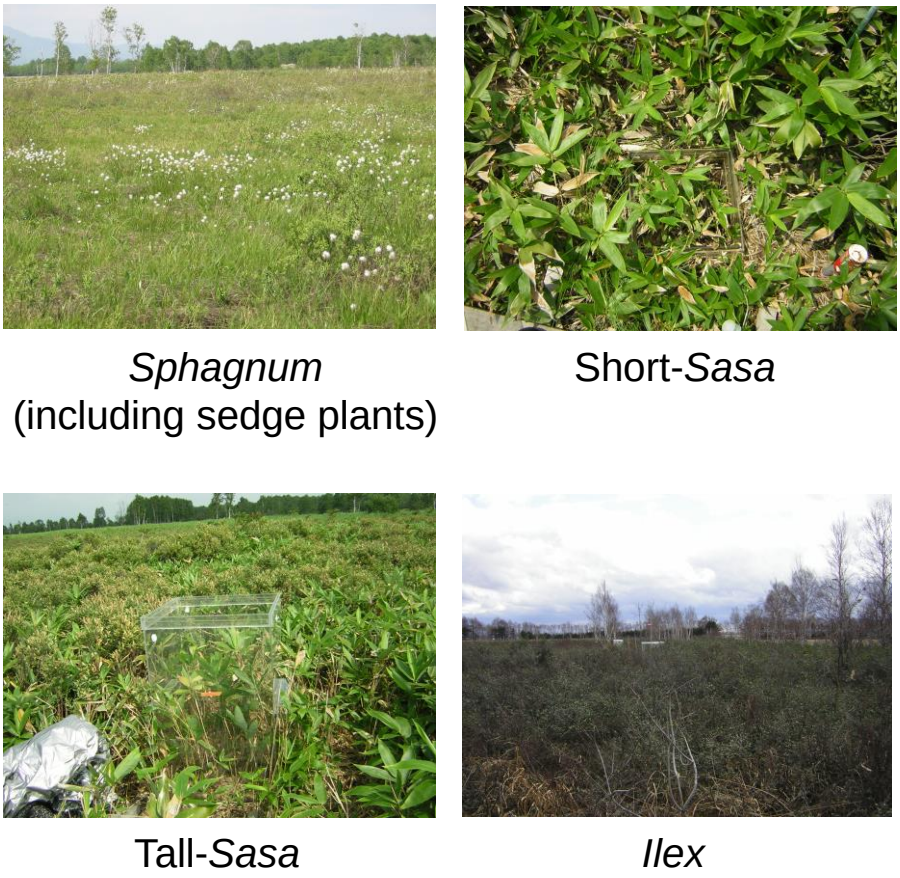

Figure S1. Vegetation of the study field (Bibai wetland).

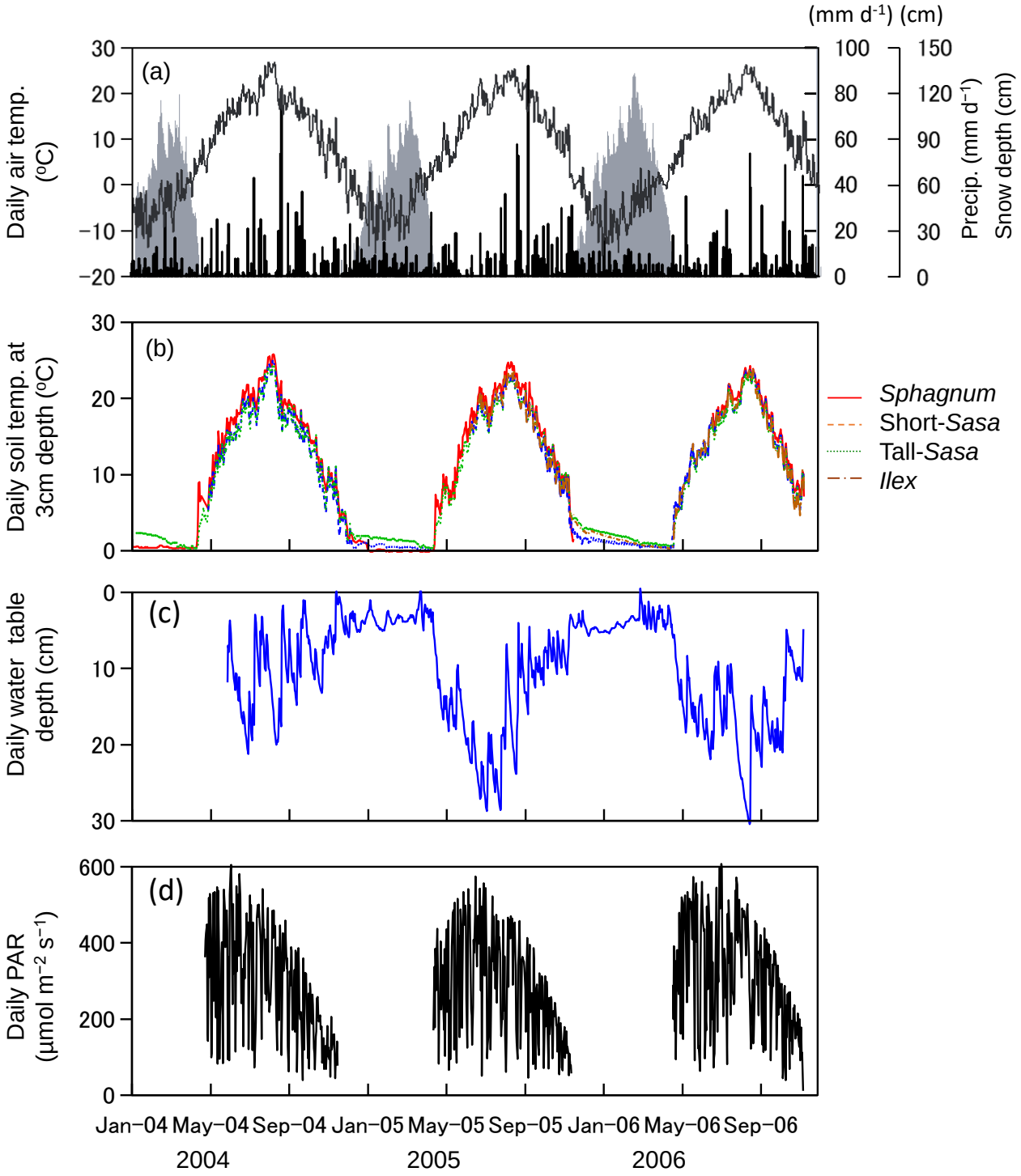

Figure S2. Seasonal changes in air temperature, precipitation and snow depth (a: line, black and grey bars, respectively), soil temperature at 3cm depth (b), water table depth in a *Sphagnum* plot (c) and PAR (photosynthetically active radiation) (d).

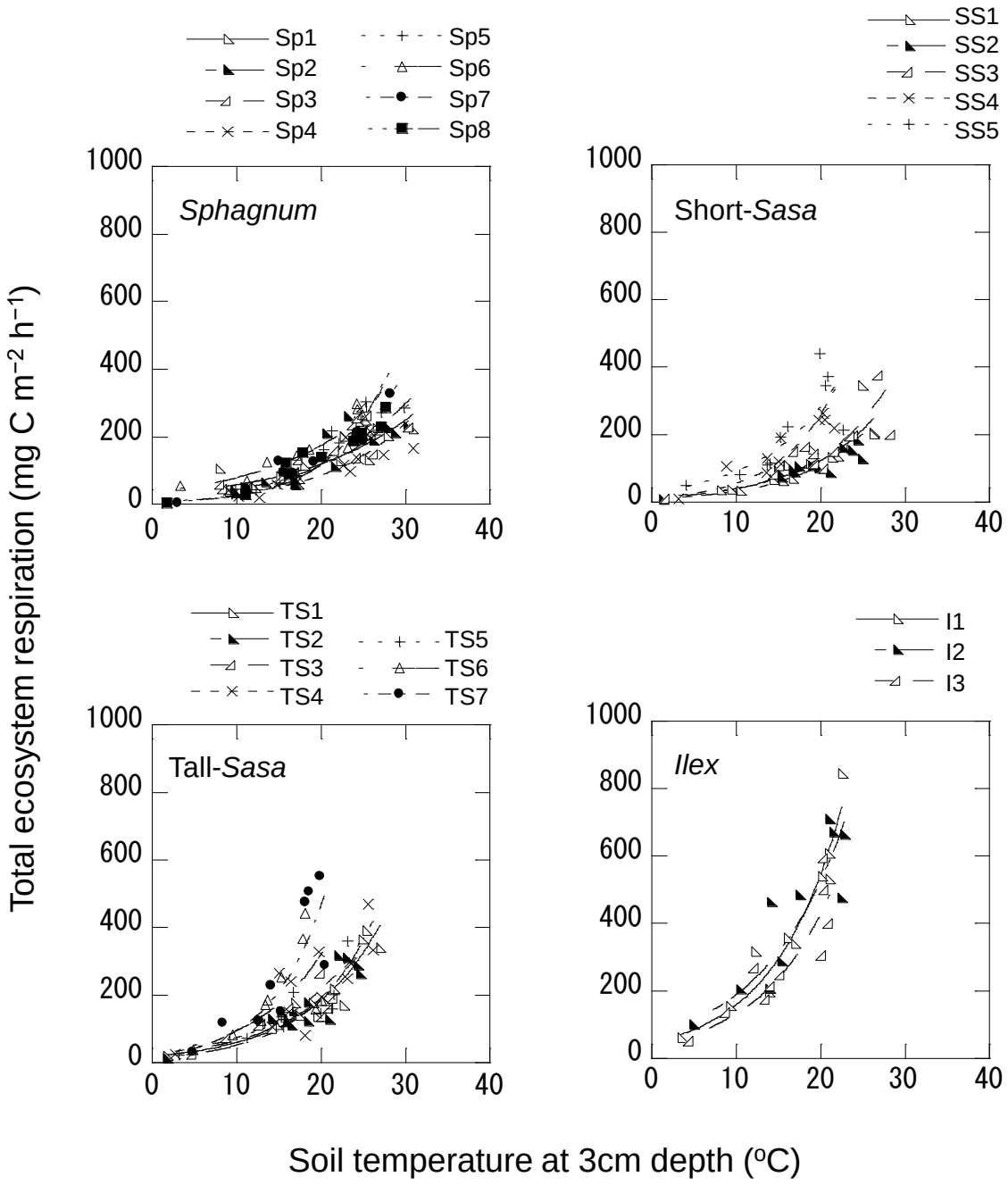

Figure S3. Relationships between soil temperature at 3cm depth and total ecosystem respiration at each measurement plot.

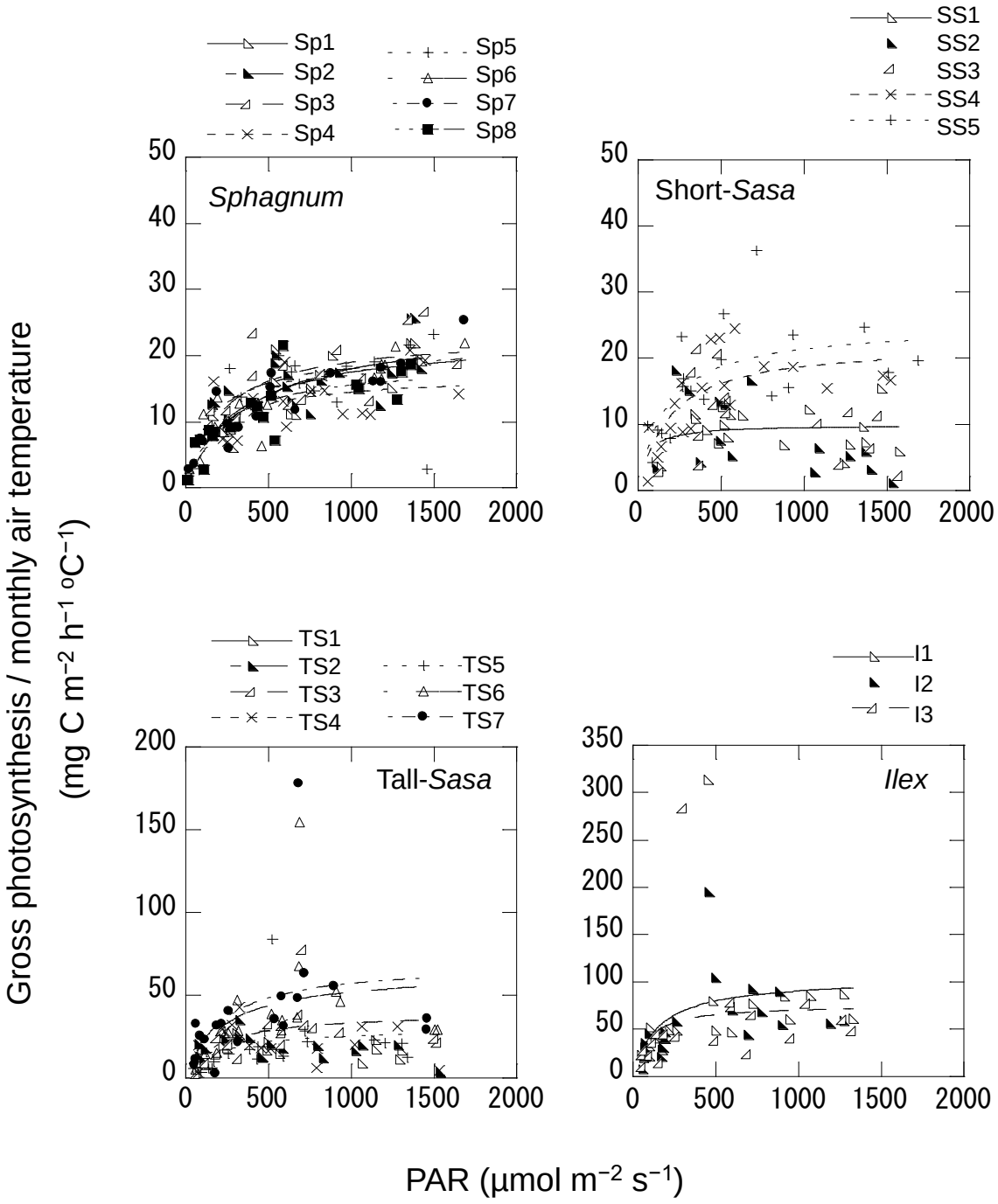

Figure S4. Relationships between photosynthetically active radiation (PAR) and gross photosynthesis / monthly air temperature at each measurement plot.

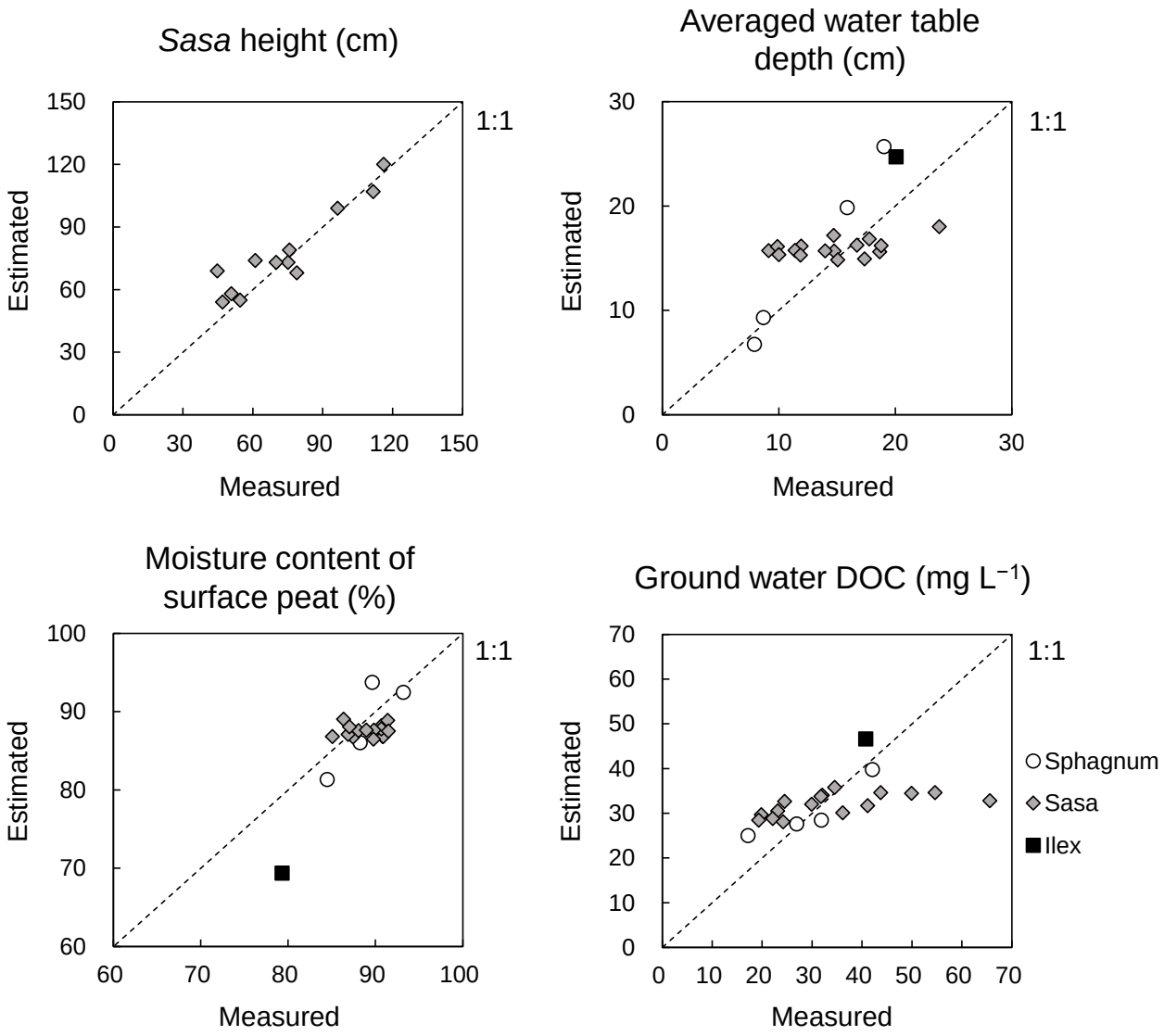

Figure S5. Relationships between measured values of environmental factors and their estimated values using satellite bands.