

1 **Supplementary Information (SI) Appendix for**
2 **Effect of climate warming on the annual terrestrial net ecosystem**
3 **CO₂ exchange globally in the boreal and temperate regions**

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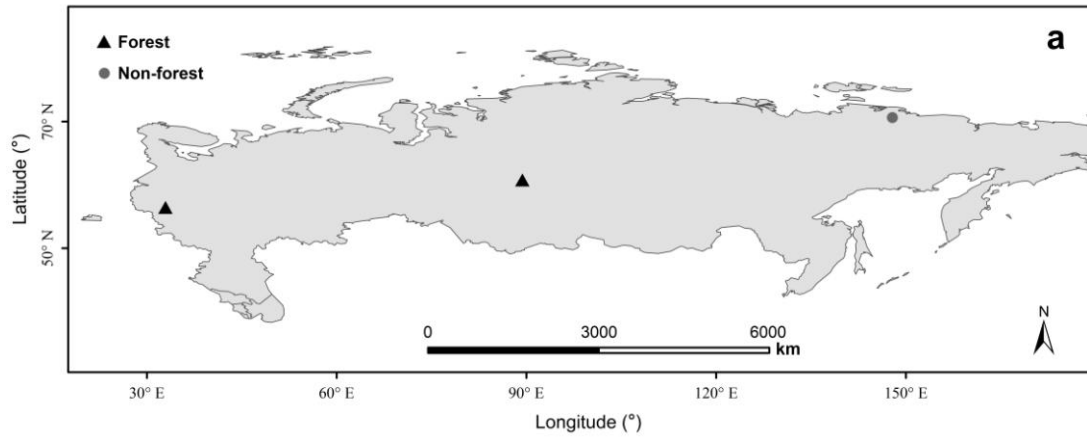
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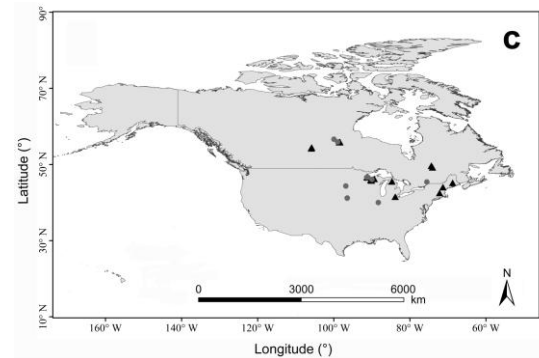
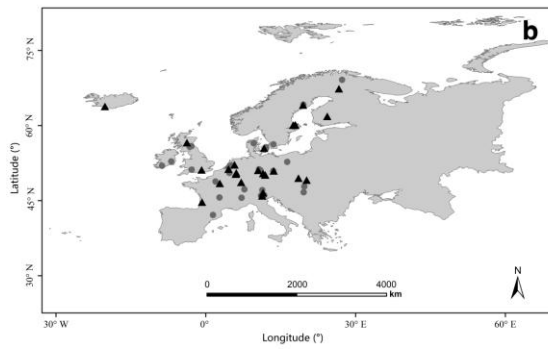
28 **Materials and Methods**

29 *Data*

30 Data sources of GPP and RE were assembled from the FLUXNET Database
31 (<http://www.fluxdata.org/>, Open Data set), European Flux Database (European Fluxes
32 Database Cluster <http://gaia.agraria.unitus.it/>), AmeriFlux (<http://ameriflux.lbl.gov/>),
33 Distributed Active Archive Center for Biogeochemical Dynamics (ORNL DAAC
34 <http://daac.ornl.gov/>). In total, 403 site-years at 101 sites were collected. The
35 datasets covered various ecosystems between 40 °N to 71 °N, except 3 datasets from
36 Russia, all data were primarily in Europe and North America and during the time
37 period from 1991 to 2006 (Fig. S1). Our database included two main climate group,
38 93 of which were from the boreal zone (between 49 and 71 °N), and 310 of which
39 were from temperate zone (between 40 and 64 °N). The collected data were
40 classified by plant functional types (PFTs) according to the International
41 Geosphere-Biosphere Programme (IGBP, 2012, <http://www.igbp.net>). In this study,
42 data were divided into two major parts, 260 of which were from forest sites including
43 deciduous broadleaf forest (DBF, $n=65$), evergreen needleleaf forest (ENF, $n=165$)
44 and mixed forest (MF, $n=30$), 143 of which were from non-forest sites including
45 croplands (CRO, $n=40$), closed shrublands (CSH, $n=5$), grasslands (GRA, $n=61$),
46 open shrublands (OSH, $n=13$) and permanent wetland (WET, $n=24$). Basic
47 information of the database, including site ID, latitude, longitude, PFT, climate group,
48 year of data collection, and reference of each data set, is listed Table S1.



49



50 **Fig. S1 Distribution of geographic locations of the collected sites in (a) Russia, (b)**
 51 **Europe, and (c) North American.** Site information (i.e., latitude, longitude, and
 52 plant functional types) was collected from <http://fluxnet.fluxdata.org/>. The maps
 53 were created with ArcGIS 10.1 (ESRI Inc., USA,
 54 <http://www.esri.com/arcgis/about-arcgis>).

55 **Table S1** Basic information (including site ID, latitude, longitude, plant functional type (PFT), climate group, year of data collection, and
 56 reference) of the database used in this study. All the information gathered from <http://fluxnet.fluxdata.org/>.

Site ID	Latitude ¹	Longitude ²	PFT	Climate group	Year	Reference
AT-Neu	47.12	11.32	GRA	Temperate	2002-2004	1
BE-Bra	51.31	4.52	MF	Temperate	1997-1998, 2000-2002, 2004-2006	2
BE-Jal	50.56	6.07	MF	Temperate	2006	----
BE-Lon	50.55	4.74	CRO	Temperate	2004-2006	3
BE-Vie	50.31	6.00	MF	Temperate	1996-2006	4
CA-Man	55.88	-98.48	ENF	Boreal	1994-1995, 1997-2003	5
CA-Mer	45.41	-75.52	WET	Temperate-Continental with hot or warm summers	1999-2005	6
CA-NS1	55.88	-98.48	ENF	Boreal	2002-2005	7
CA-NS2	55.91	-98.52	ENF	Boreal	2001-2005	7
CA-NS3	55.91	-98.38	ENF	Boreal	2001-2005	7

CA-NS4	55.91	-98.38	ENF	Boreal	2003-2004	7
CA-NS5	55.86	-98.49	ENF	Boreal	2001-2005	7
CA-NS6	55.92	-98.96	OSH	Boreal	2001-2005	7
CA-NS7	56.64	-99.95	OSH	Boreal	2002-2005	6
CA-Qcu	49.27	-74.04	ENF	Boreal	2001-2006	8
CA-Qfo	49.69	-74.34	ENF	Boreal	2003-2006	9
CA-SF1	54.49	-105.82	ENF	Boreal	2003-2005	10
CA-SF2	54.25	-105.88	ENF	Boreal	2003-2005	10
CH-Oe1	47.29	7.73	GRA	Temperate	2002-2006	11
CH-Oe2	47.29	7.73	CRO	Temperate	2005	11
CZ-BK1	49.50	18.54	ENF	Temperate-Continental with hot or warm summers	2000-2006	12
DE-Bay	50.14	11.87	ENF	Temperate	1996-1999	13
DE-Geb	51.10	10.91	CRO	Temperate	2004-2006	14

DE-Gri	50.95	13.51	GRA	Temperate	2005-2006	15
DE-Hai	51.08	10.45	DBF	Temperate	2000-2006	16
DE-Kli	50.89	13.52	CRO	Temperate	2004-2006	17
DE-Meh	51.27	10.65	GRA	Temperate	2003-2006	18
DE-Tha	50.96	13.57	ENF	Temperate	1996-2006	19
DE-Wet	50.45	11.46	ENF	Temperate	2002-2006	20
DK-Fou	56.48	9.59	CRO	Temperate	2005	----
DK-Lva	55.68	12.08	GRA	Temperate	2005-2006	15
DK-Ris	55.53	12.10	CRO	Temperate	2004-2005	17
DK-Sor	55.49	11.65	DBF	Temperate	1996-2006	21
ES-VDA	42.15	1.45	GRA	Temperate	2004-2006	22
FI-Hyy	61.85	24.29	ENF	Boreal	1996-2006	23
FI-Kaa	69.14	27.30	WET	Boreal	2000-2006	----

FI-Sod	67.36	26.64	ENF	Boreal	2000-2006	23
FR-Fon	48.48	2.78	DBF	Temperate	2005-2006	22
FR-Gri	48.84	1.95	CRO	Temperate	2005-2006	22
FR-Hes	48.67	7.06	DBF	Temperate	1997-2006	24
FR-LBr	44.72	-0.77	ENF	Temperate	1996-1998,2000,2003-2005	25
FR-Lq1	45.64	2.74	GRA	Temperate	2004-2006	15
FR-Lq2	45.64	2.74	GRA	Temperate	2004-2006	15
HU-Bug	46.69	19.60	GRA	Temperate	2002-2006	----
HU-Mat	47.85	19.73	GRA	Temperate	2004-2006	26
IE-Ca1	52.86	-6.92	CRO	Temperate	2004-2006	15
IE-Dri	51.99	-8.75	GRA	Temperate	2003-2005	27
IS-Gun	63.83	-20.22	DBF	Temperate	1996-1998	----
IT-Lav	45.96	11.28	ENF	Temperate	2000-2002,2004,2006	28

IT-LMa	45.58	7.15	GRA	Temperate	2003-2006	----
IT-Mal	46.12	11.70	GRA	Temperate	2003-2006	15
IT-MBo	46.02	11.05	GRA	Temperate	2003-2006	29
IT-Ren	46.59	11.43	ENF	Temperate	1999-2006	30
NL-Ca1	51.97	4.93	GRA	Temperate	2003-2006	15
NL-Haa	52.00	4.81	GRA	Temperate	2003-2004	----
NL-Hor	52.03	5.07	GRA	Temperate	2004-2006	31
NL-Lan	51.95	4.90	CRO	Temperate	2005-2006	----
NL-Loo	52.17	5.74	ENF	Temperate	1996-2006	32
NL-Mol	51.65	4.64	CRO	Temperate	2005-2006	----
PL-wet	52.76	16.31	WET	Temperate	2004-2005	33
RU-Cok	70.62	147.88	OSH	Boreal	2003-2005	----
RU-Fyo	56.46	32.92	ENF	Temperate-Continental with hot or warm summers	1998-2004	34

RU-Zot	60.80	89.35	ENF	Boreal	2002-2004	----
SE-Deg	64.18	19.55	WET	Boreal	2001-2005	35
SE-Faj	56.27	13.55	WET	Temperate	2005-2006	36
SE-Fla	64.11	19.46	ENF	Boreal	1996-1998,2001-2002	37
SE-Nor	60.09	17.48	ENF	Temperate-Continental with hot or warm summers	1996-1999,2003,2005	38
SE-Sk1	60.13	17.92	ENF	Temperate-Continental with hot or warm summers	2005	----
SE-Sk2	60.13	17.84	ENF	Temperate-Continental with hot or warm summers	2004-2005	----
SK-Tat	49.12	20.16	ENF	Temperate-Continental with hot or warm summers	2005	----
UK-AMo	55.79	-3.24	WET	Temperate	2005	----
UK-EBu	55.87	-3.21	GRA	Temperate	2004, 2006	39
UK-ESa	55.91	-2.86	CRO	Temperate	2003-2005	40
UK-Gri	56.61	-3.80	ENF	Temperate	1997-1998, 2000-2002, 2005-2006	41

UK-Ham	51.15	-0.86	DBF	Temperate	2004-2005	----
UK-PL3	51.45	-1.27	DBF	Temperate	2005-2006	----
UK-Tad	51.21	-2.83	GRA	Temperate	2001	----
US-Bar	44.06	-71.29	DBF	Temperate-Continental with hot or warm summers	2004-2005	42
US-Bkg	44.35	-96.84	GRA	Temperate-Continental with hot or warm summers	2004-2006	43
US-Bo1	40.01	-88.29	CRO	Temperate-Continental with hot or warm summers	1996-2007	22
US-Ha1	42.54	-72.17	DBF	Temperate-Continental with hot or warm summers	1991-1998, 2004-2005	44
US-Ho1	45.2	-68.74	ENF	Temperate-Continental with hot or warm summers	1996-2004	45
US-Ho2	45.21	-68.75	ENF	Temperate-Continental with hot or warm summers	1999-2004	46
US-Los	46.08	-89.98	CSH	Temperate-Continental with hot or warm summers	2001-2005	47
US-Ne1	41.17	-96.48	CRO	Temperate-Continental with hot or warm	2001-2005	48

				summers		
US-Ne2	41.16	-96.47	CRO	Temperate-Continental with hot or warm summers	2001-2005	48
US-Ne3	41.18	-96.44	CRO	Temperate-Continental with hot or warm summers	2001-2005	48
US-Oho	41.55	-83.84	DBF	Temperate-Continental with hot or warm summers	2004-2005	49
US-PFa	45.95	-90.27	MF	Temperate-Continental with hot or warm summers	1996-2000,2003	50
US-Syv	46.24	-89.35	MF	Temperate-Continental with hot or warm summers	2002-2006	51
US-UMB	45.56	-84.71	DBF	Temperate-Continental with hot or warm summers	1999-2003	52
US-WCr	45.81	-90.08	DBF	Temperate-Continental with hot or warm summers	1999-2006	53
US-Wi0	46.62	-91.08	ENF	Temperate-Continental with hot or warm summers	2002	----
US-Wi1	46.73	-91.23	DBF	Temperate-Continental with hot or warm summers	2003	----

US-Wi2	46.69	-91.15	ENF	Temperate-Continental with hot or warm summers	2003	----
US-Wi4	46.74	-91.17	ENF	Temperate-Continental with hot or warm summers	2002-2005	----
US-Wi5	46.65	-91.09	ENF	Temperate-Continental with hot or warm summers	2004	----
US-Wi6	46.62	-91.30	OSH	Temperate-Continental with hot or warm summers	2002	----
US-Wi7	46.65	-91.07	OSH	Temperate-Continental with hot or warm summers	2005	----
US-Wi8	46.72	-91.25	DBF	Temperate-Continental with hot or warm summers	2002	----
US-Wi9	46.62	-91.08	ENF	Temperate-Continental with hot or warm summers	2004-2005	----

57 ¹ Positive value indicates north latitude.

58 ² Negative value indicates west longitude.

59 Different plant functional types: CRO, croplands; CSH, closed shrublands; GRA, grasslands; MF, mixed forests; WET, permanent wetlands;

60 DBF, deciduous broadleaf forests; ENF, evergreen needleleaf forests; OSH, open shrublands.

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