Supplementary Information for the manuscript:

Spatially asynchronous changes in strength and stability of terrestrial net ecosystem productivity

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Supplementary figures

Supplementary tables

Table S1. Summary of FLUXNET sites used in this study.

Site	Lat (°)	Long (°)	Alt (m)	PFT	n (years)	Age	MATa (℃)	MAP (mm)
AT-Neu	47.12	11.32	970	GRA	11		6.79	669
AU-Dap	-14.06	131.32	-	GRA	7		25.46	1403
AU-DaS	-14.16	131.39	-	SAV	7		26.63	1452
AU-Dry	-15.26	132.37	-	SAV	7		26.72	922
AU-Stp	-17.15	133.35	-	GRA	7		26.07	761
AU-Tum	-35.66	148.15	-	EBF	14		9.52	963
BE-Bra	51.31	4.52	15	MF	9	78	10.84	831
BE-Lon	50.55	4.75	167	CRO	11		11.41	766
BE-Vie	50.31	6.00	493	MF	19	75	8.35	965
CA-Man	55.88	-98.48	259	ENF	15	167	-1.36	316
CA-Qfo	49.69	-74.34	382	ENF	8		1.13	939
CH-Cha	47.21	8.41	393	GRA	10		9.55	1144
CH-Dav	46.82	9.86	1639	ENF	18		3.55	850
CH-Fru	47.12	8.54	982	GRA	10		7.72	1300
CH-Lae	47.48	8.37	689	MF	11	100	7.82	1187
CH-Oe1	47.29	7.73	450	GRA	7		9.27	1222
CH-Oe2	47.29	7.73	452	CRO	11		9.56	2063
CZ-wet	49.02	14.77	426	WET	9		8.40	609
DE-Akm	53.87	13.68	-1	WET	6		9.23	648
DE-Geb	51.10	10.91	161.5	CRO	14		9.67	531
DE-Gri	50.95	13.51	385	GRA	11		8.58	943
DE-Hai	51.08	10.45	430	DBF	13	138	8.33	761
DE-Kli	50.89	13.52	478	CRO	11		7.82	814
DE-Obe	50.78	13.72	735	ENF	7		6.49	1046
DE-Tha	50.96	13.57	380	ENF	19	116	8.91	844
DK-NuF	64.13	-51.39	50	WET	7		0.13	954
DK-Sor	55.49	11.64	40	DBF	19	86	8.40	861
DK-ZaH	74.47	-20.55	38	GRA	15		-8.84	161
FI-Hyy	61.85	24.30	181	ENF	19		4.41	611
FI-Sod	67.36	26.64	180	ENF	14	100	0.75	531
FR-Fon	48.48	2.78	103	DBF	10	150	11.43	691
FR-Gri	48.84	1.95	125	CRO	10		10.96	587
FR-LBr	44.72	-0.77	61	ENF	13	37	13.40	919
FR-Pue	43.74	3.60	270	EBF	15	65	13.76	925
GF-Guy	5.28	-52.92	48	EBF	11		25.61	3110
IT-BCi	40.52	14.96	20	CRO	11		18.06	1200
IT-Col	41.85	13.59	1560	DBF	19	117	7.34	1159
IT-Cpz	41.71	12.38	68	EBF	13		15.40	820
IT-MBo	46.01	11.05	1550	GRA	11		5.21	974
IT-Noe	40.61	8.15	28	SHR	11		16.42	585
IT-Ro1	42.41	11.93	235	DBF	9	7.34	15.47	865

IT-Ro2	42.39	11.92	160	DBF	11	16.37	15.45	786
IT-SRo	43.73	10.28	6	ENF	14	57	15.21	878
IT-Tor	45.84	7.58	2160	GRA	7		2.97	776
NL-Hor	52.24	5.07	2.2	GRA	8		10.60	1035
NL-Loo	52.17	5.74	25	ENF	18	90	10.07	865
RU-Fyo	56.46	32.92	265	ENF	17		5.23	566
US-ARM	36.61	-97.49	314	CRO	10		15.27	646
US-Blo	38.90	-120.63	1315	ENF	11	17	11.25	1401
US-Cop	38.09	-109.39	1520	GRA	7		13.62	203
US-GLE	41.37	-106.24	3197	ENF	11	65	-0.03	1405
US-Ha1	42.54	-72.17	340	DBF	22	84.5	8.16	1186
US-Los	46.08	-89.98	480	WET	15	45	4.86	787
US-Me2	44.45	-121.56	1253	ENF	13	71	7.50	512
US-MMS	39.32	-86.41	275	DBF	16	75	12.37	1083
US-Ne1	41.17	-96.48	361	CRO	13		10.62	839
US-Ne2	41.16	-96.47	362	CRO	13		10.34	861
US-Ne3	41.18	-96.44	363	CRO	13		10.44	697
US-NR1	40.03	-105.55	3050	ENF	17	97	2.29	727
US-PFa	45.95	-90.27	470	MF	20	39.5	5.74	606
US-SRG	31.79	-110.83	1291	GRA	7		18.77	388
US-SRM	31.82	-110.87	1120	SAV	11		19.01	333
US-Syv	46.24	-89.35	540	MF	14	70	3.96	734
US-Ton	38.43	-120.97	177	SAV	14		16.33	555
US-Twt	38.11	-121.65	-	CRO	6		14.75	359
US-UMB	45.56	-84.71	234	DBF	15		7.16	613
US-Umd	45.56	-84.70	239	DBF	8	90	7.09	738
US-Var	38.41	-120.95	129	GRA	15		15.87	563
US-WCr	45.81	-90.08	520	DBF	16	80	5.63	732
US-Whs	31.74	-110.05	1370	SHR	8		17.58	284
US-Wkg	31.74	-109.94	1531	GRA	11		17.33	293
ZA-Kru	-25.02	31.50	359	SAV	11		21.88	449

Lat, latitude; Long, longitude; Alt, altitude; PFT, plant functional type; n, data record length; Age, stand age; MATa, mean annual air temperature; MAP, annual precipitation. ENF, evergreen needleleaf forest; DBF, deciduous broadleaf forest; EBF, evergreen broadleaf forest; MF, mixed forest; SHR, shrubland; GRA, grassland; CRO, cropland; SAV, savanna.

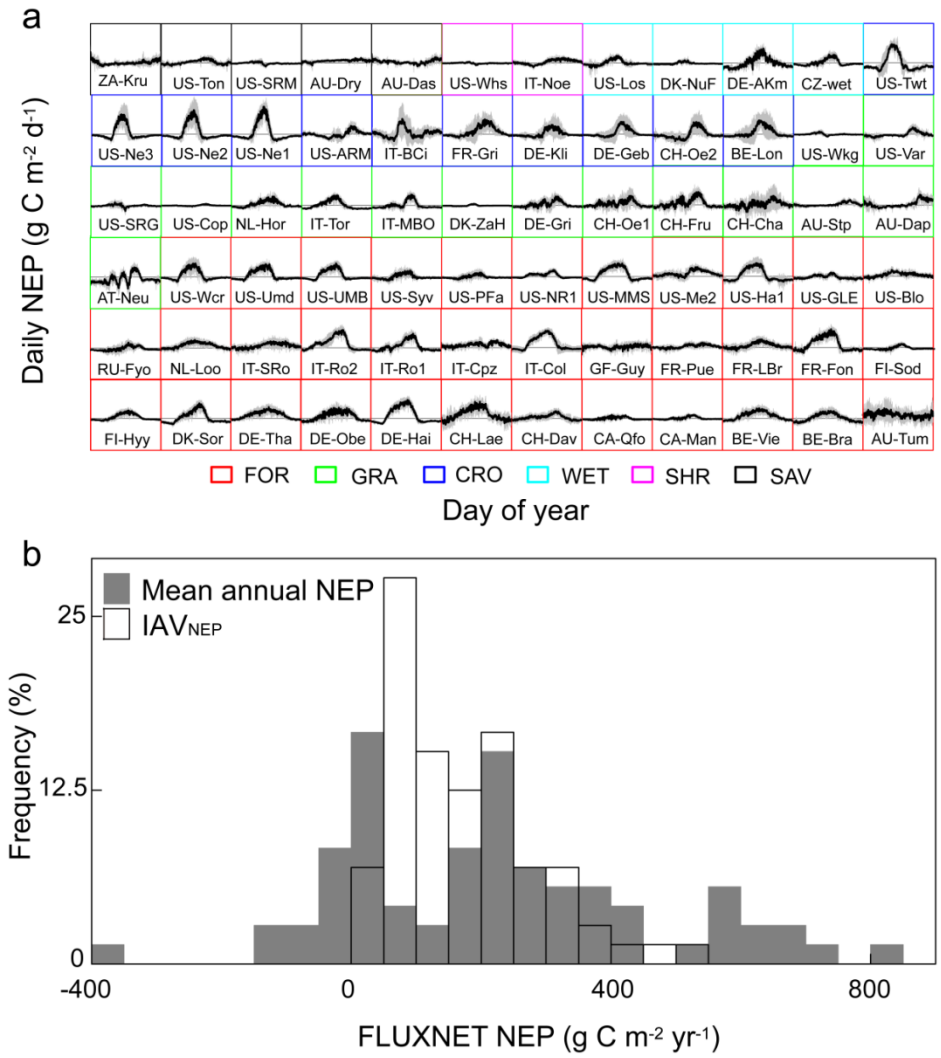
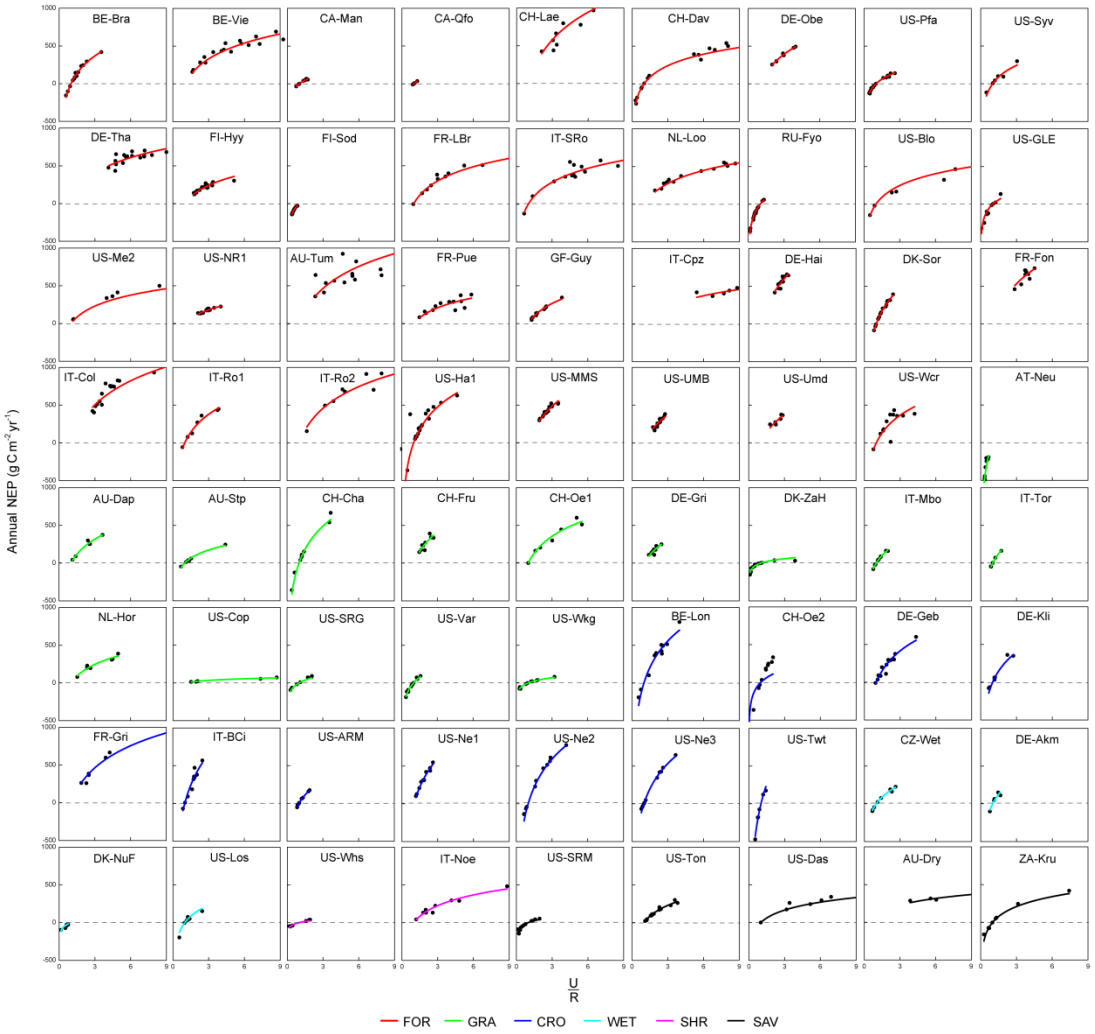


Figure S1. The micrometeorological tower sites with over 5 years of measurements in the FLUXNET2015 Dataset. **a**, Interannual variation of terrestrial NEP among biomes. The solid lines represent the multi-year mean NEP and the shades show the interannual variation of annual NEP. **b**, Frequency distribution of mean annual NEP and interannual variability (IAV) of annual NEP (quantified as the standard deviation of annual NEP).



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42 **Figure S2.** Logarithm regression of annual NEP and $\frac{U}{R}$ for 72 FLUXNET sites (of

43 the form $\mathrm{NEP} = \beta \cdot \ln(\frac{U}{R})$). Each site with at least 5 years of data.

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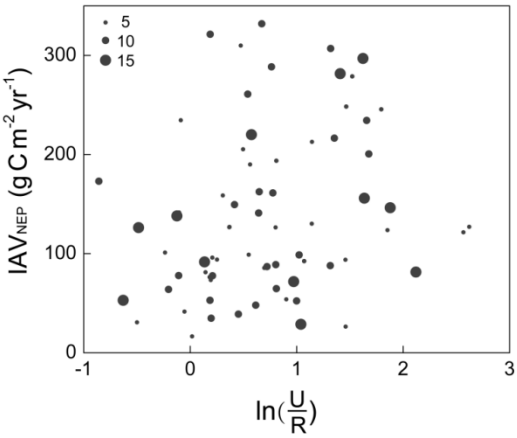

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46 **Figure S3.** The relationship between IAV in NEP (IAV_{NEP}: quantified as the standard
47 deviation of annual NEP) and $\ln(\frac{U}{R})$ (R^2 = 0.048, P = 0.052). The number of
48 site-years at each site is indicated with the size of the point.

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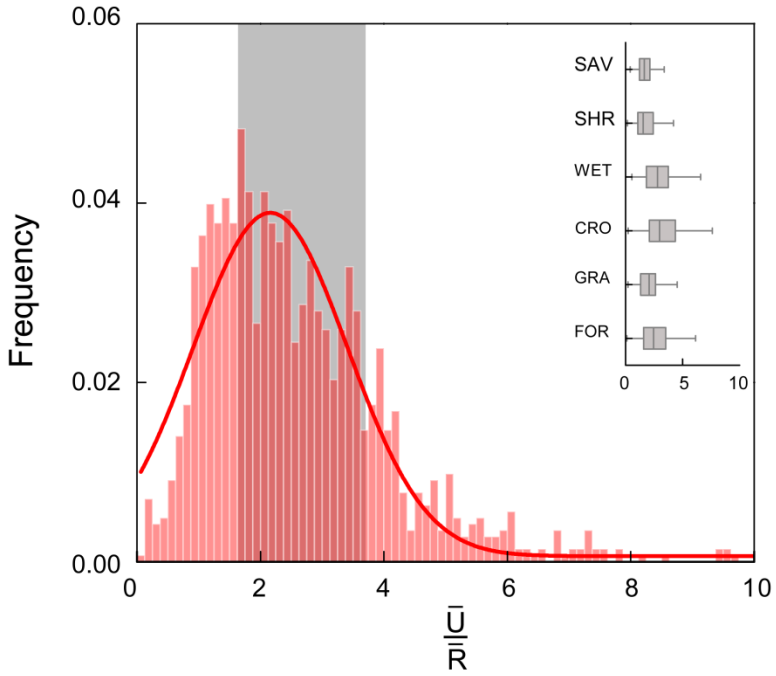

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51 **Figure S4.** The frequency distribution of ratio $\frac{\bar{U}}{\bar{R}}$ in this study (red) and the range of
52 ratio $\frac{\bar{U}}{\bar{R}}$ reported by Churkina et al. (2005) (grey shading). The inset panel shows
53 distribution of $\frac{\bar{U}}{\bar{R}}$ over different plant functional types.