Supplementary Material

Supplementary Table S1 Brief information of sites used in this study

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| No. | Site Name | Latitude (°N) | Longitude (°E) | AET (kgH2O m-2 yr-1) | Measuring period | References |
| **Forests** |
| 1 | Danzhou Rubber2 | 19.54 | 109.47 | 127 | 2013-2019 | ChinaFLUX |
| 2 | Danzhou Rubber1 | 19.55 | 109.48 | 132 | 2017-2019 | Geng et al., 2020 |
| 3 | Xishuangbanna Rubber | 21.93 | 101.27 | 552 | 2011 | Song et al., 2014 |
| 4 | Xishuangbanna Forest | 21.96 | 101.21 | 758 | 2003-2008 | Zhang et al., 2010 |
| 5 | Dinghushan Forest | 23.17 | 112.54 | 380 | 2003-2011 | Yan et al., 2013liu et al., 2015 |
| 6 | Ailaoshan Forest | 24.54 | 101.03 | 2508 | 2009-2016 | Tan et al., 2011Song et al., 2017 |
| 7 | Qianyanzhou Forest | 26.74 | 115.06 | 112 | 2003-2014 | Xu et al., 2017 |
| 8 | Huitong forest | 26.79 | 109.59 | 313 | 2008 | Zhao et al., 2011 |
| 9 | Yueyang forest | 29.53 | 112.86 | 28 | 2010-2013 | Gao et al., 2015 |
| 10 | Gonggashan Forest1 | 29.57 | 101.99 | 3808 | 2015 | Zhang et al., 2018 |
| 11 | Gongga mountain mixed forest | 29.59 | 102.03 | 2976 | 2016 | Sun et al., 2020 |
| 12 | Gonggashan Forest2 | 29.6 | 102.05 | 2953 | 2016 | Sun et al., 2020 |
| 13 | Linan forest | 30.18 | 119.34 | 113 | 2011-2016 | Liu et al., 2018 |
| 14 | Tianmushan Forest | 30.35 | 119.44 | 1229 | 2013-2014 | Niu et al., 2016Fang, 2016 |
| 15 | Anji Forest | 30.48 | 119.67 | 282 | 2011-2016 | Liu, 2018Song et al., 2017 |
| 16 | Jurong Forest | 32.12 | 119.2 | 219 | 2008, 2011 | Zhang, 2010Li, 2012 |
| 17 | Jiuzhaigou Forest | 33.16 | 103.88 | 3029 | 2014-2015 | Yan et al., 2017 |
| 18 | Baotianman Forest | 33.5 | 111.94 | 1328 | 2017 | Niu et al., 2018 |
| 19 | Xiaolangdi forest | 35.02 | 112.47 | 353 | 2008-2010 | Tong et al., 2017 |
| 20 | Guantan Forest | 38.53 | 100.25 | 2868 | 2011 | Zhu et al., 2014 |
| 21 | Minqin | 38.6 | 102.95 | 1380 | 2014-2015 | Zhang et al., 2016 |
| 22 | Daxing Forest | 39.53 | 116.25 | 36 | 2007-2009 | Kang et al., 2015 |
| 23 | Aolinpike park forest | 40.02 | 116.38 | 41 | 2012-2014 | Xie et al., 2016 |
| 24 | Badaling Forest | 40.37 | 115.94 | 525 | 2012-2017 | Ma et al., 2018Ma et al., 2019 |
| 25 | Songshan forest | 40.51 | 115.79 | 944 | 2019 | Li et al., 2020 |
| 26 | Miyun Forest | 40.53 | 116.62 | 1007 | 2015 | Tie et al., 2018 |
| 27 | Kubuqi Forest | 40.54 | 108.69 | 1027 | 2005-2006 | FLUXNET2015 |
| 28 | Changbaishan Forest | 42.4 | 128.1 | 751 | 2003-2019 | Zhang et al., 2012 ChinaFLUX |
| 29 | Laoshan Forest | 45.33 | 127.67 | 672 | 2004, 2008 | Wang et al., 2008Qiu et al., 2011 |
| **Graassland** |
| 30 | Lijiang Grassland | 27.17 | 100.23 | 3618 | 2012-2015 | Wang et al., 2017 |
| 31 | Gongga Mountain shrubland | 29.89 | 102.01 | 3968 | 2016 | Sun et al., 2020 |
| 32 | Dangxiong Grassland | 30.5 | 91.07 | 4367 | 2004-2008 | Chai et al., 2018 |
| 33 | Bange Grassland | 31.42 | 90.03 | 4719 | 2015 | Wang et al., 2018 |
| 34 | Naqu Fenced Grassland | 31.64 | 92.01 | 4609 | 2012-2019 | Zhang et al., 2018ChinaFLUX |
| 35 | Naqu Grassland | 31.65 | 92 | 4619 | 2012-2014 | Zhang et al., 2015An et al., 2019 |
| 36 | Ruoergai Grassland | 33.89 | 102.14 | 3433 | 2010-2011 | Shang et al., 2016 |
| 37 | Shuanghu Grassland | 34 | 90 | 4988 | 2012-2013 | Ma et al., 2015 |
| 38 | Sanjiangyuan Grassland | 34.35 | 100.55 | 4076 | 2006, 2008 | Tian et al., 2020 |
| 39 | Lanzhou Grassland | 35.95 | 104.13 | 1778 | 2007-2013 | Ping et al., 2018Yang et al., 2019 |
| 40 | Haibei Grassland | 37.37 | 101.18 | 3823 | 2015-2016 | Li et al., 2018Kato et al., 2006 |
| 41 | Shapotou Grassland | 37.53 | 105.03 | 1304 | 2009-2012 | Gao et al., 2012Gao et al., 2016 |
| 42 | Haibei Shrubland | 37.68 | 101.34 | 3422 | 2003-2012 | Li et al., 2016 |
| 43 | Yanchi Shrubland | 37.71 | 107.23 | 1542 | 2012-2016 | Jia et al., 2016Jia et al., 2020 |
| 44 | Yanchi Desert | 37.83 | 107.49 | 1421 | 2017, 2019 | Wang, 2020 |
| 45 | Yakou Grassland | 38.01 | 100.24 | 4039 | 2015 | Sun et al., 2019Wang et al., 2019 |
| 46 | Arou Grassland | 38.05 | 100.46 | 2985 | 2013-2019 | Zhang et al., 2020ChinaFLUX |
| 47 | Shule Grassland | 38.42 | 98.32 | 3875 | 2008-2012 | Wu et al., 2020 |
| 48 | Sunan Grassland | 38.42 | 99.86 | 4043 | 2013-2018 | Gao, 2020 |
| 49 | Yulin Grassland | 38.45 | 109.47 | 1235 | 2012-2015 | Gong et al., 2018 |
| 50 | Huazhaizi Desert | 38.77 | 100.32 | 1729 | 2012 | Wang et al., 2019 |
| 51 | Shenshawo Desert | 38.79 | 100.49 | 1544 | 2012 | Wang et al., 2019 |
| 52 | Liudaogou Grassland | 38.79 | 110.37 | 1154 | 2012-2016 | Qi et al., 2019 |
| 53 | Dashalong Grassland | 38.84 | 98.94 | 3797 | 2013-2016 | Wang et al., 2019 |
| 54 | Bajitan Grassland | 38.92 | 100.3 | 1564 | 2012-2014 | Wang et al., 2019 |
| 55 | Linze Grassland | 39.38 | 100.13 | 1384 | 2008-2010 | Zhao et al., 2016 |
| 56 | Badain Jaran Grassland | 39.79 | 102.44 | 1194 | 2012 | Hu et al., 2015 |
| 57 | Kubuqi Grassland | 40.38 | 108.55 | 1173 | 2006 | Gilmanov et al., 2010 |
| 58 | Xilamuren Grassland | 41.36 | 111.17 | 1651 | 2013 | Zhang et al., 2016 |
| 59 | Guyuan Grassland | 41.77 | 115.68 | 1389 | 2012-2013 | Xin et al., 2014 |
| 60 | Siziwang Grassland1 | 41.78 | 111.9 | 1432 | 2010-2011 | Shao et al., 2017 |
| 61 | Siziwang Grassland2 | 41.79 | 111.9 | 1430 | 2010-2012 | FLUXNET2015 |
| 62 | Luodi | 42 | 101.13 | 936 | 2012-2014 | Wang et al., 2019 |
| 63 | Duolun Grassland | 42.05 | 116.28 | 1313 | 2005-2008 | ChinaFLUX |
| 64 | Duolun Degraded Grassland | 42.06 | 116.28 | 1317 | 2009-2010 | FLUXNET2015 |
| 65 | Desert | 42.11 | 100.99 | 924 | 2015-2016 | Wang et al., 2019 |
| 66 | Horqin Grassland | 43.29 | 122.28 | 201 | 2008-2013 | Li et al., 2016 |
| 67 | Tongliao Grassland | 43.35 | 122.65 | 205 | 2015 | Gong et al., 2018 |
| 68 | Horqin Deserat | 43.35 | 122.65 | 205 | 2013-2016 | Chen, 2018 |
| 69 | Neimeng Grassland | 43.55 | 116.68 | 1255 | 2004-2014 | ChinaFLUX |
| 70 | Xilinhaot fenced Grassland | 43.55 | 116.67 | 1246 | 2006 | Chen et al., 2009 |
| 71 | Xilinhot Degraded Grassland | 43.55 | 116.67 | 1246 | 2006 | Chen et al., 2009 |
| 72 | Xilinguole Grassland | 44.08 | 113.57 | 971 | 2008-2010 | Wang et al., 2018 |
| 73 | Fukang Grassland | 44.28 | 87.93 | 475 | 2004-209 | Liu et al., 2016 |
| 74 | Tongyu Grassland | 44.59 | 122.52 | 169 | 2011-2017 | Zhao et al., 2019 |
| 75 | Changling Grassland | 44.59 | 123.51 | 141 | 2009-2020 | Qu et al., 2016ChinaFLUX |

Supplementary Table S2 Correlation coefficients between environment factors in Forests(F) and Grasslands(G)

|  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
|  FG | LAT | MAT | MAP | PAR | AI | VPD | *ρ*c,yr | SW | SOC | STN | LAI | MLAI |
| LAT  |  | -0.72 | -0.87 | -0.26 | -0.76 | 0.06 | 0.06 | -0.55 | 0.08 | 0.28 | -0.61 | -0.35 |
| MAT | 0.29 |  | 0.48 | 0.53 | 0.30 | 0.49 | 0.19 | 0.61 | -0.56 | -0.58 | 0.50 | 0.23 |
| MAP | -0.58 | -0.32 |  | -0.13 | 0.97 | -0.38 | 0.08 | 0.48 | 0.14 | -0.07 | 0.49 | 0.43 |
| PAR | -0.05 | 0.32 | -0.64 |  | -0.33 | 0.72 | 0.11 | 0.36 | -0.68 | -0.51 | 0.23 | -0.18 |
| AI | -0.65 | -0.41 | 0.98 | -0.61 |  | -0.53 | 0.05 | 0.32 | 0.29 | 0.02 | 0.39 | 0.40 |
| VPD | 0.53 | 0.86 | -0.65 | 0.51 | -0.73 |  | 0.21 | 0.20 | -0.74 | -0.64 | 0.02 | -0.24 |
| *ρ*c,yr | 0.63 | 0.51 | -0.35 | 0.02 | -0.43 | 0.58 |  | 0.20 | -0.63 | -0.40 | -0.18 | -0.19 |
| SW | -0.33 | -0.31 | 0.01 | 0.12 | 0.06 | -0.22 | -0.38 |  | -0.24 | -0.21 | 0.28 | 0.15 |
| SOC | -0.63 | -0.51 | 0.71 | -0.44 | 0.76 | -0.65 | -0.64 | 0.38 |  | 0.78 | -0.07 | 0.16 |
| STN | -0.62 | -0.52 | 0.72 | -0.44 | 0.76 | -0.66 | -0.65 | 0.33 | 0.99 |  | -0.11 | 0.11 |
| LAI | -0.40 | -0.22 | 0.65 | -0.36 | 0.64 | -0.45 | -0.39 | 0.19 | 0.60 | 0.63 |  | 0.86 |
| MLAI | -0.27 | -0.32 | 0.47 | -0.32 | 0.48 | -0.45 | -0.41 | 0.26 | 0.50 | 0.53 | 0.93 |  |

LAT: latitude; MAT: mean annual air temperature; MAP: mean annual precipitation; PAR: annual total photosynthetic effective radiation; AI: aridity index; VPD: saturated water vapor pressure difference; *ρ*c,yr: annual mass CO2 concentration; SW: soil water content; SOC: soil organic carbon content; STN: soil total nitrogen content; LAI: mean annual leaf area index; MLAI: maximum leaf area index.

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