

**Table S1.** The study site basic informations of the three coniferous forest ecosystems in the semi-arid area of Northwest China.

Forest types	<i>Larix principis-rupprechtii</i>	<i>Pinus tabulaeformis</i>
<b>Site informations</b>		
Coordinates	N: 35°44'16.19", E: 104°1'2.87"	N: 36°5'20.57", E: 108°21'30.78"
Elevation (m a.s.l)	2804.4	1576.2
<b>Climatic factors</b> <sup>[1]</sup>		
Annual precipitation (mm)	450-622	560-620
Average annual temperature (°C)	7.3	9.4
Annual potential evaporation (mm)	1096-1520	1105-1625
Average relative humidity (%)	62.34	59.89
Annual average sunlight (h)	2569.4	2461.5
<b>Vegetation information</b>		
Stand density	2048/hm <sup>2</sup>	2528/hm <sup>2</sup>
Canopy height (m)	15	10
Average DBH (cm)	17.85	14.00
Understory vegetation coverage (%)	40	95
Litter thickness (cm)	12	10
Leaf area index (LAI)	3.49	3.29
Understory dominant vegetation	<i>Rosa sweginzowii</i> , <i>Rosa omeiensis</i> , <i>Cotoneaster multiflorus</i> , <i>Lonicera hispida</i> , <i>Carex rigescens</i> , <i>Aconitum sinomontanum</i> , <i>Fragaria orientalis</i> , <i>Potentilla bifurca</i> , et al.	<i>Berberis kansuensis</i> , <i>Eleutherococcus giraldii</i> , <i>Cotoneaster multiflorus</i> , <i>Cerasus tomentosa</i> , <i>Smilax stans</i> , <i>Carex duriuscula</i> subsp. <i>Rigescens</i> , <i>Medicago lupulina</i> , et al.

Note: <sup>[1]</sup> The climate factor data is obtained from the website of the national greenhouse data sharing platform in the past 20 years (<http://data.sheshiyuanyi.com/WeatherData/>).

**Table S2.** The detailed information about the instruments and installations of the three study sites.

Variables	Sensors	<i>Larix principis-rupprechtii</i>	<i>Pinus tabulaeformis</i>
Flux tower height	—	24 m	25 m
Installation time of flux tower	—	April, 2018	November, 2019
Eddy covariance system	Li7500 DS, LI-COR, USA	18 m	13 m
Air temperature ( $TA$ , °C)	HMP155A, Vaisala, USA	4, 8, 12, 16, 18, 24 m	2, 6, 12, 16, 24 m
Air humidity ( $RH$ , %)	HMP155A, Vaisala, USA	4, 8, 12, 16, 18, 24 m	2, 6, 12, 16, 24 m
Four-component radiation ( $W \cdot m^{-2}$ )	CNR4, Kipp & Zonen, Netherlands	16 m	20 m
Photosynthetic active radiation ( $PAR$ , $\mu mol \cdot m^{-2} \cdot s^{-1}$ )	LI-190R, LI-COR, USA	2, 8, 16 m	4, 20 m
Soil temperature ( $TS$ , °C)	GS3, Decagon, USA	10, 20, 40, 60 cm	10, 20, 40, 60, 80 cm
Soil water content ( $SWC$ , %)	GS3, Decagon, USA	10, 20, 40, 60 cm	10, 20, 40, 60, 80 cm
Precipitation ( $P$ , mm)	RM Young, 52202, USA	16 m	16 m
Wind speed ( $WS$ , $m \cdot s^{-1}$ )	DS-2, Decagon, USA	8, 12, 16, 24 m	2, 6, 12, 16, 24 m
Wind direction ( $WD$ , °)	DS-2, Decagon, USA	8, 12, 16, 24 m	2, 6, 12, 16, 24 m
Air pressure ( $Pa$ , Pa)	CS106, Vaisala, USA	1 m	1 m