Response to reviews of manuscript "Excess radiation exacerbates drought stress impacts on stomatal conductance along aridity gradients" bg-2022-50

Response to community comment #2

Dear Zhaoguo Wang,

We would like to thank you for the thoughtful and valuable comments and suggestions on our manuscript entitled "Excess radiation exacerbates drought stress impacts on stomatal conductance along aridity gradients" (bg-2022-50). We have carefully revised our manuscript to take account of your comments and suggestions. Meanwhile, we have rephrased our manuscript title as "Excess radiation exacerbates drought stress impacts on canopy conductance along aridity gradients".

Here are the point-to-point responses (responses in upright Roman in black front) to the comments (original queries in Italic in blue front). The changed figures and tables are presented in the Appendix 1 and Appendix 2 (listed at the end of the "Response to community comment #2").

Specific comments:

1) There are expressions like "drought", "dryness", "low soil moisture" and "soil moisture stress" in this manuscript. I don't think these have the same meaning. Please check and use it properly. Similarly, this manuscript focused on gs, but sometimes there are expressions like "canopy gs".

Response: Thank you very much for your comment. We have replaced "dryness" with "drought", and "soil moisture stress" with "low soil moisture" throughout the manuscript. Meanwhile, we used gs to present stomatal conductance at leaf level, and Gs to present canopy conductance.

2) I think hypothesis should be based on the information provided in the introduction. In terms of the hypothesis 2 "excess solar radiation and low temperatures will result in differences in gs among transects", I don't understand how low temperatures will affect gs according to the information in introduction.

Response: Thank you very much for your comment. We respond to this comment from three aspects.

(1) We clarified that "However, previous studies showed that the direction and intensity of solar radiation and temperature on gs strongly depend on their distribution range and the relationship with aridity. For example, the response of g_s to solar radiation and temperature generally shows an increasing trend up to optimum values (Xu *et al.* 2021), while excess radiation (Costa *et al.* 2015; Doupis *et al.* 2020; Zeuthen *et al.* 1997) and high temperature associated high VPD or low SM (Seneviratne *et al.* 2010) would suppress g_s."

(2) We added the basic climatic context for the three grassland transect in the last paragraph of "**1 Instruction**" section: "The grassland transect span gradients of precipitation, SM, VPD, solar radiation, and temperature, provide an ideal platform for exploration of interactive effects of multiple stressors and biotic factors on G_s (Table S1). In addition, the three grassland transects experienced with different soilar radiation and temperature conditions at a given aridity, due to the difference in the geographical location of the three plateaus. The order of mean annual temperature and solar radiation is LP>MP>TP and LP<MP<TP, respectively."

(3) We rephrased the second hypothesis as: "high solar radiation and low temperatures will jointly suppress Gs at a given aridity among transects. ".

3) The last paragraph should be the last but one paragraph or in the methods.

Response: This paragraph has been revised and removed to section "2.2.3 Stable isotope analysis": "Given that leaf $\delta^{18}O$ at species level was affected by the leaf water evaporation process, variability in g_s should show up in leaf $\delta^{18}O$ (Barbour 2007; Barbour & Farquhar 2000; Farquhar *et al.* 1998). Negative relationship between $\triangle^{18}O$ and gs has been observed at species (Barbour & Farquhar 2000; Cabrera-Bosquet *et al.* 2011; Grams *et al.* 2007; Moreno-Gutierrez *et al.* 2012) and canopy scales (Cabrera *et al.* 2021; Hirl *et al.* 2021), and among communities along soil (Ramirez *et al.* 2009) and climatic (Keitel *et al.* 2006) gradients. Consequently, we selected $1/\triangle^{18}O$ was used as a proxy for g_s in this study."

4) There may be interspecific difference in gs, so information on plant species and species composition of the three study sites should be provided.

The species, genera and families of species occurred in each community have been listed in "**Supplementary 2**" (Please see **Appendix 2**)".

5) The headline of the first part in the discussion should be changed, because the patterns of gs among the tree transects are similar, but differ in magnitude. In addition, the authors attribute this difference to the temperature-induced changes in photosynthesis, which I don't agree. Indeed, gs and photosynthesis are closely correlated, for example, to maximize carbon gain and minimize water loss according to the optimal stomatal behaviour. However, in my opinion, the correlation between gs and photosynthesis is regulated by stomatal behaviour.

Response: Thank you very much for your comment. We respond this comment from two aspects.

(1) The headline has been change as: " 4.3 Differences in canopy conductance among transects" .

(2) The effects of VPD, solar radiation and temperature on the differences in canopy conductance among transects have been rephrased as: "

Significant differences in community $1/\triangle^{18}O$ were found among transects, and the

order of G_s at a given aridity value was LP > MP > TP (Fig.2a). Among transects, only differences in VPD, solar radiation and temperature were significant (P>0.05) (Fig.1 and Fig.S1). In general, plants decrease their g_s to respond to increasing VPD (Grossiord *et al.* 2020). While, intercept of linear regression between aridity and community $1/\triangle^{18}O$ decreased with decreasing VPD among transects (P>0.05) (Fig.3a). It indicated that the difference in VPD was not a contributor to the difference in G_s among transects.

We attribute the differences in G_s among transects to the direct effects of solar radiation and temperature on G_s and photosynthesis (Yu *et al.* 2002). This is inconsistent with the results within transect. High solar radiation exhibited negative effect on intercept of linear regression between aridity and community $1/\triangle^{18}O$ among transects (P<0.05) (Fig.3b). Excess ultraviolet-B radiation (Duan *et al.* 2008), insufficient thermal dissipation, and enhanced photorespiration under high solar radiation (Cui *et al.* 2003) can decrease photosynthesis, ultimately reducing g_s. For example, Yu et al. (2012) observed that photosynthesis of wheat at leaf level on the TP was lower than that on North China Plain due to the high solar radiation.

Transect with low temperature exhibited low intercept of linear regression between aridity and community $1/\triangle^{18}O$ (Fig.3c), it indicated that G_s among transects also inhibited by low temperature. Generally, photosynthesis and G_s increased with temperature below optimum temperature (Xu *et al.* 2021). For example, photosynthesis of wheat was lower in a cold than in a warm environment (Yu *et al.* 2002). ”

6) line 25 delete “at leaf level”.

Response: Change has been done.

7) line 24 change “in one” and “in the other” into (1) and (2), respectively.

Response: Change has been made.

8) I suggest that “interaction effects” may be changed into “interactive effects”.

Response: Change has been made.

Appendix 1

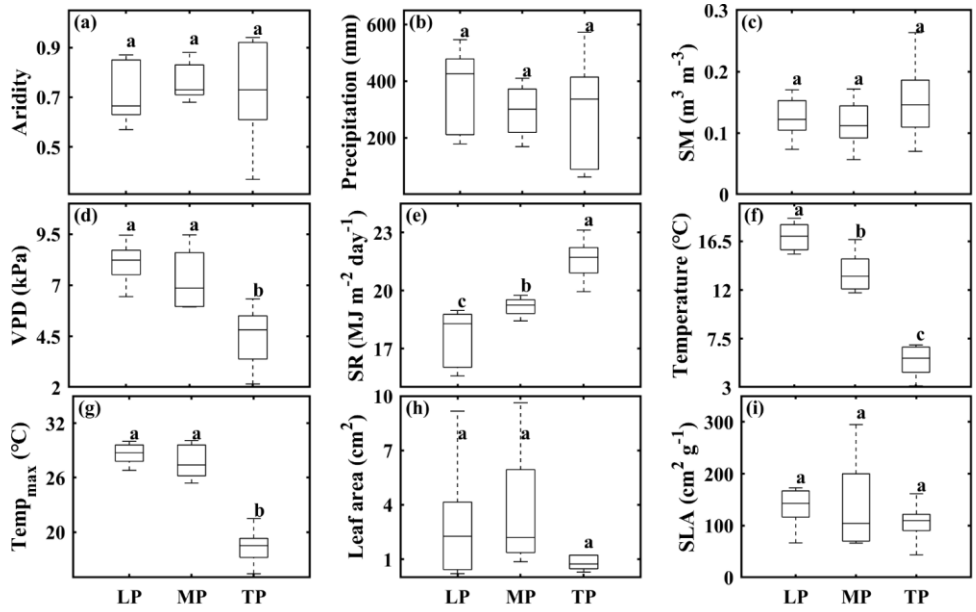

Figure 1. Comparison of aridity (a), growing season precipitation (b), soil moisture (SM) (c), vapor pressure deficit (VPD) (d), solar radiation (SR) (e), temperature (f), maximum temperature ($Temp_{max}$) (g), and community leaf area (h) and specific leaf area (SLA) (i) among transects. LP: Loess Plateau; MP, Inner Mongolia Plateau; TP, Tibet Plateau. Lowercase letters indicate significant differences among transects ($P<0.05$). Error bars indicate standard error of the mean.

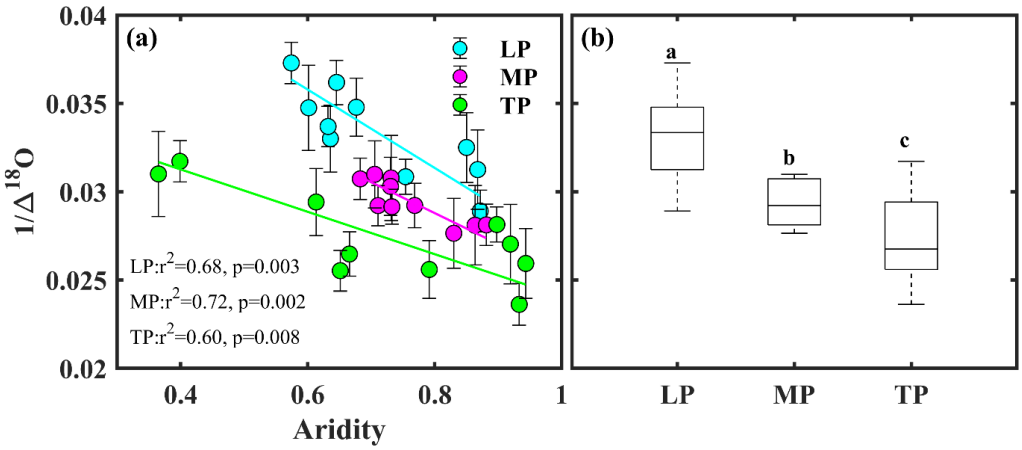

Figure 2. Patterns of $1/\triangle^{18}O$ (a) along aridity gradient within transects, and among (b) transects. Different letters indicate significant differences ($P < 0.001$) among transects and grassland types. $\triangle^{18}O$, ^{18}O enrichment of leaf organic matter above source water; LP, Loess Plateau; MP, Inner Mongolia Plateau; TP, Tibet Plateau.

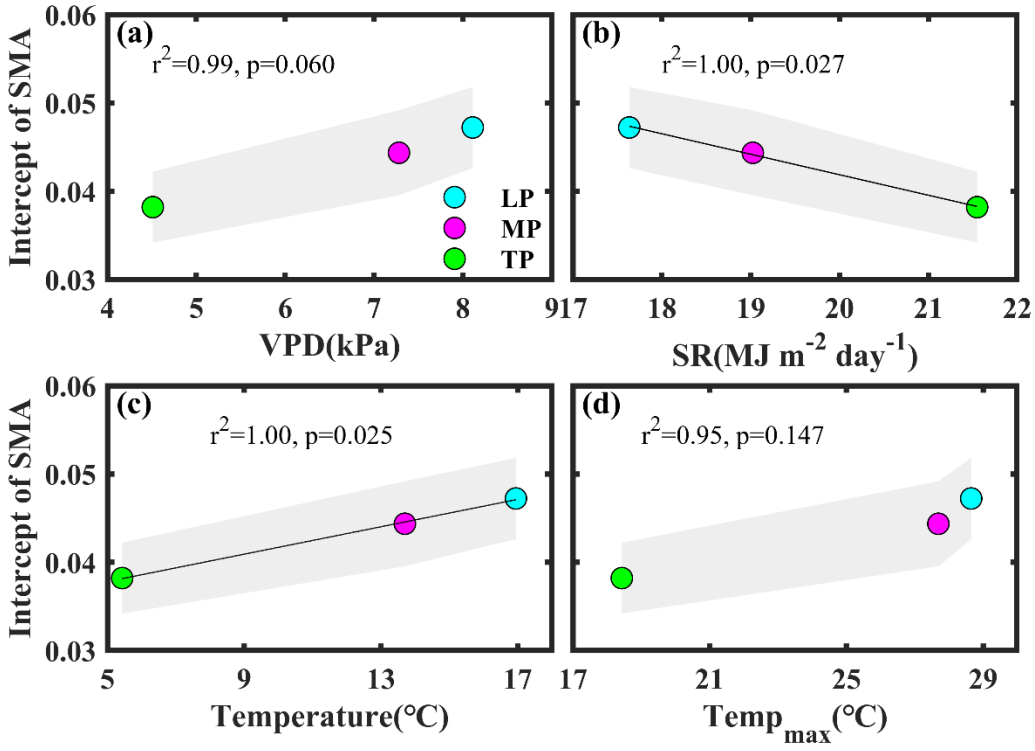

Figure 3. Patterns of the intercept obtained from standardized major axis analysis (SMA) among transects. VPD, vapor pressure deficit; SR, solar radiation; $Temp_{max}$, maximum temperature. LP, Loess Plateau; MP, Inner Mongolia Plateau; TP, Tibet Plateau. Shaded area represents the 95% confidence interval of the SMA intercept.

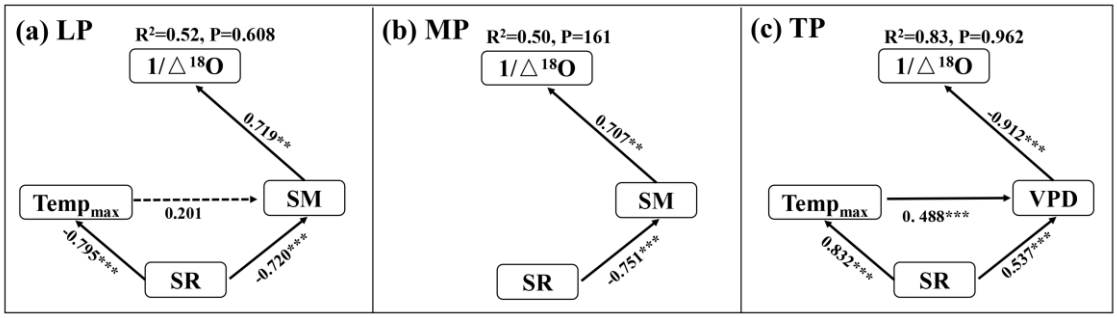

Figure 4. Structural equation models of abiotic factors explaining $1/\triangle^{18}O$ in Loess Plateau (LP) (a), Inner Mongolia Plateau (MP) (b) and Tibet Plateau (TP) (c). $\triangle^{18}O$, ^{18}O enrichment of leaf organic matter above source water; $Temp_{max}$: maximum temperature; SR, solar radiation; SM, soil moisture; VPD, vapor pressure deficit. Solid and dashed arrows represent significant and non-significant relationships in a fitted SEM, respectively. ***, P<0.001; **, P<0.01; *, P<0.05.

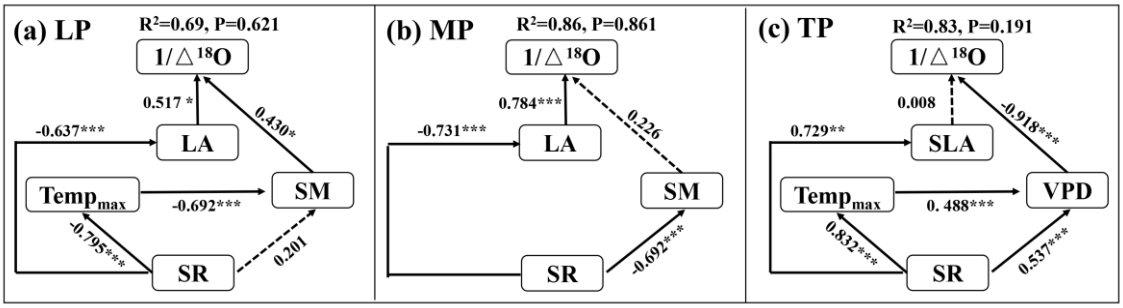

Figure 5. Structural equation models of abiotic and biotic factors explaining $1/\triangle^{18}O$ in Loess Plateau (LP) (a), Inner Mongolia Plateau (MP) (b) and Tibet Plateau (TP) (c). $\triangle^{18}O$, ^{18}O enrichment of leaf organic matter above source water; $Temp_{max}$: maximum temperature; SR, solar radiation; SM, soil moisture; VPD, vapor pressure deficit. LA, log-transformed leaf area; SLA, log-transformed specific leaf area. Solid and dashed arrows represent significant and non-significant relationships in a fitted SEM, respectively. ***, P<0.001; **, P<0.01; *, P<0.05.

Table 1 Pearson's coefficients among community $1/\triangle^{18}O$ and environmental factors and plant properties.

	Loess Plateau	Inner Mongolia Plateau	Tibet Plateau
Aridity	-0.848**	-0.843**	-0.773**
SM	0.719*	0.707*	0.659*
VPD	-0.554	-0.384	-0.912**
SR	-0.639*	-0.728*	-0.850**
$Temp_{mean}$	0.641*	0.303	-0.670*
$Temp_{max}$	0.678*	0.038	-0.852**
LA	0.757*	0.913**	0.610
SLA	-0.519	-0.576	-0.648*

**, P<0.01; *, P<0.05. SM, soil moisture; VPD, vapor pressure deficit; SR, total solar radiation; $Temp_{mean}$, mean temperature; $Temp_{max}$, maximum temperature; LA, log-transformed leaf area; SLA, log-transformed specific leaf area.

Table S1 Geographic and climatic information, $\delta^{18}O$ of precipitation, and community $\triangle^{18}O$ for sampling sites in Loess (LP), Inner Mongolia (MP), and Tibetan (TP), Plateau.

Site	Longitude (°E)	Latitude (°N)	Elevation (m)	Aridity	Temperature (℃)		$Temp_{max}$ (℃)	Precipitation (mm)		Solar radiation (kJ m^{-2} day^{-1})		VPD (kPa)		SM (m^3 m^{-3})	$\delta^{18}O_p$ (‰)		$\triangle^{18}O$ (‰)
					Year	GSW		Year	GS	Year	GS	Year	GS	GS	Year	GS	
LP01	113.36	36.29	804	0.57	11.85	18.19	29.6	599	546	12.95	15.60	4.78	7.53	0.16	-8.70	-6.92	26.82±0.84
LP02	112.29	35.99	894	0.60	9.96	17.60	29.2	549	501	13.31	16.04	3.57	7.41	0.17	-8.80	-6.86	28.78±1.73
LP03	111.64	35.99	833	0.64	10.66	18.61	30	520	475	12.69	15.65	4.04	8.59	0.13	-8.70	-6.79	30.30±1.77
LP04	110.18	36.07	966	0.63	10.72	18.03	29.9	519	478	14.25	17.02	4.52	8.45	0.15	-9.10	-7.09	29.68±1.00
LP05	109.24	36.74	1268	0.65	9.50	16.99	28.7	492	458	15.34	18.28	4.13	8.00	0.12	-9.20	-7.18	27.64±0.96
LP06	107.92	36.93	1383	0.68	7.46	15.71	27.8	424	394	15.32	18.31	2.53	6.44	0.12	-8.60	-6.74	28.75±1.39
LP07	107.19	37.58	1535	0.75	5.23	15.61	27.6	340	311	15.62	18.97	1.88	7.51	0.07	-7.70	-6.01	32.42±0.86
LP08	105.78	37.42	1293	0.85	5.87	16.94	28.8	222	211	15.53	18.95	2.01	8.71	0.10	-6.80	-5.08	30.77±1.95
LP09	104.92	37.44	1378	0.87	7.56	16.50	28.1	196	183	15.49	18.74	3.99	9.44	0.10	-6.30	-4.69	32.00±2.38
LP10	104.44	37.46	1714	0.87	7.71	15.31	26.8	189	179	15.56	18.77	4.75	9.06	0.10	-6.70	-4.83	34.60±1.39
Trend					0.009	0.035	0.024	<0.001	<0.001	0.012	0.005	0.445	0.058	0.007	<0.001	<0.001	
NM01	123.51	44.59	144	0.68	5.10	16.60	29.6	425	410	13.67	17.28	1.11	6.98	0.17	-9.20	-7.14	32.54±0.90
NM02	121.04	44.52	269	0.73	5.80	16.66	30	393	378	14.73	18.44	2.56	8.59	0.11	-9.60	-7.52	32.49±0.71
NM03	120.33	45.11	660	0.71	3.72	13.60	27.4	387	372	14.94	18.81	2.30	6.74	0.15	-10.60	-8.36	32.28±0.65
NM04	118.36	44.77	1019	0.71	0.56	12.03	26.2	345	320	15.09	19.20	1.11	5.96	0.14	-11.40	-8.84	34.23±0.39
NM05	116.52	44.26	1129	0.77	1.17	12.27	26.2	283	267	15.21	19.35	1.53	6.50	0.11	-11.40	-8.67	34.22±1.52
NM06	116.67	43.55	1272	0.73	0.16	11.74	25.4	321	304	15.34	19.31	1.03	5.95	0.11	-11.60	-8.80	33.00±0.79
NM07	117.68	44.51	1024	0.73	1.96	12.10	26.3	319	298	14.88	18.99	1.70	5.94	0.14	-11.30	-8.56	34.31±0.37
NM08	114.89	44.01	1101	0.83	0.10	12.94	27.4	228	219	15.36	19.53	1.33	7.67	0.09	-10.40	-7.87	36.17±0.29
NM09	113.50	43.84	1022	0.86	2.47	14.20	28.3	199	190	15.59	19.76	2.49	9.00	0.06	-9.00	-7.16	35.59±0.63
NM10	112.15	43.63	955	0.88	3.69	14.87	30.1	183	169	15.35	19.57	2.96	9.46	0.06	-8.40	-6.48	35.56±0.21
Trend					0.626	0.995	0.450	<0.001	<0.001	0.026	0.018	0.104	0.015	<0.001	0.134	0.101	
TP01	95.45	31.46	4104	0.40	0.41	5.70	17.2	606	572	17.76	19.94	1.71	2.61	0.19	-16.40	-14.22	31.53±1.35

TP02	93.53	31.85	4509	0.37	-1.50	3.14	15.4	593	560	17.57	20.02	1.72	2.17	0.21	-17.70	-15.86	32.25±1.65
TP03	92.01	31.64	4587	0.61	-4.37	4.40	17	430	414	18.62	20.91	1.06	3.39	0.26	-18.00	-16.50	34.00±0.17
TP04	90.74	31.38	4617	0.65	-6.76	5.89	17.8	426	414	18.99	21.41	0.34	4.27	0.17	-18.40	-16.57	39.17±1.41
TP05	89.72	31.54	4588	0.67	-3.06	6.93	19.2	426	412	18.80	21.27	1.51	4.94	0.15	-18.20	-16.39	37.77±0.51
TP06	87.82	31.87	4570	0.79	-2.57	6.77	19.2	286	261	19.27	22.01	2.18	5.50	0.15	-16.50	-14.99	39.07±1.32
TP07	85.84	31.92	4938	0.90	-3.77	3.74	17.6	125	95	19.28	22.22	2.49	4.70	0.13	-15.20	-13.71	35.54±0.74
TP08	83.34	32.41	4578	0.94	-3.90	5.71	20.1	75	62	18.99	22.08	2.32	5.77	0.11	-14.40	-12.85	38.56±1.43
TP09	81.23	32.30	4558	0.92	-3.49	5.29	19.3	102	89	19.41	22.50	2.37	5.45	0.07	-15.10	-12.78	36.99±0.51
TP10	80.15	32.48	4328	0.93	-1.27	6.73	21.5	89	78	19.86	23.12	3.10	6.33	0.09	-14.70	-12.41	42.34±0.60
Trend					0.356	0.360	0.006	<0.001	<0.001	<0.001	<0.001	0.069	<0.001	0.006	0.027	0.039	

$Temp_{max}$, maximum temperature ; VPD, vapor deficit pressure; SM, soil moisture; $\delta^{18}O_P$, the $\delta^{18}O$ of precipitation; GSW, growing season. Trend indicates variation in variables along the aridity gradient.

Table S2 Differences in climatic variables among three transects.

	Transect	Period	Mean	Standard deviation	Minimum	Maximum	P value
Aridity	LP		0.71	0.12	0.57	0.87	0.693
	MP		0.76	0.07	0.68	0.88	
	TP		0.72	0.21	0.37	0.94	
Precipitation	LP	Year	405	157	189	599	0.329
	MP		308	84	183	425	
	TP		316	208	75	606	
	LP	Growing season	374	141	179	546	0.408
	MP		293	82	169	410	
	TP		296	204	62	572	
Soil moisture	LP	Growing season	0.12	0.03	0.07	0.17	0.148
	MP		0.11	0.04	0.06	0.17	
	TP		0.15	0.06	0.07	0.26	
Vapor Pressure deficit	LP	Year	3.62a	1.10	1.88	4.78	<0.001
	MP		1.81b	0.71	1.03	2.96	
	TP		1.88b	0.79	0.34	3.10	
	LP	Growing season	8.11a	0.91	6.44	9.44	<0.001
	MP		7.28a	1.33	5.94	9.46	
	TP		4.51b	1.39	2.17	6.33	
Solar radiation	LP	Year	14.61b	1.19	12.69	15.62	<0.001
	MP		15.02b	0.54	13.67	15.59	
	TP		18.86a	0.72	17.57	19.86	
	LP	Growing season	17.63c	1.41	15.60	18.97	<0.001
	MP		19.02b	0.72	17.28	19.76	
	TP		21.55a	1.04	19.94	23.12	
Temperature	LP	Year	8.65c	2.21	5.23	11.85	<0.001
	MP		2.47b	2.04	0.10	5.80	
	TP		-3.03a	1.96	-6.76	0.41	
	LP	Growing season	16.95c	1.16	15.31	18.61	<0.001
	MP		13.70b	1.84	11.74	16.66	
	TP		5.43a	1.30	3.14	6.93	
Maximum temperature	LP		28.65a	1.06	26.80	30.00	<0.001
	MP		27.69a	1.73	25.40	30.10	
	TP		18.43b	1.76	15.40	21.50	

LP: Loess Plateau; MP, Inner Mongolia Plateau; TP, Tibet Plateau. Lowercase letters indicate significant differences among transects ($P<0.05$).

Table S3 Characteristics of leaf $\delta^{18}O$ and $\triangle^{18}O$ at species level for sampling sites in Loess (LP), Inner Mongolia (MP), and Tibetan (TP) Plateau.

Sites	Number	Leaf $\delta^{18}O$					$\triangle^{18}O$				
		Mean	Max	Min	STD	CV	Mean	Max	Min	STD	CV
LP01	25	19.70	26.12	14.70	2.86	0.15	26.79	33.18	21.69	2.92	0.11
LP02	33	22.72	28.13	14.97	2.81	0.12	29.64	35.10	21.96	2.83	0.10
LP03	25	23.43	28.31	17.69	2.96	0.13	30.44	35.20	24.37	2.87	0.09
LP04	28	22.84	31.46	18.59	3.61	0.16	29.99	38.66	25.70	3.63	0.12
LP05	41	21.01	31.46	15.70	3.27	0.16	28.15	38.66	22.85	3.29	0.12
LP06	33	20.90	30.01	16.48	3.34	0.16	27.88	38.89	23.16	3.39	0.12
LP07	33	24.73	31.23	18.33	3.20	0.13	30.79	36.24	24.58	3.07	0.10
LP08	19	27.43	32.96	20.25	3.27	0.12	32.58	37.99	25.21	3.09	0.09
LP09	27	26.51	35.35	19.58	4.35	0.16	31.37	39.99	24.15	4.24	0.14
LP10	15	25.73	32.68	22.04	3.48	0.14	30.43	37.31	26.76	3.47	0.11
LP	279	22.69	35.35	12.07	4.42	0.19	32.29	43.89	21.69	4.4	0.14
MP01	18	23.04	29.24	17.42	3.57	0.15	30.61	36.58	24.68	3.87	0.13
MP02	37	23.48	28.73	18.69	2.26	0.10	31.18	36.44	25.87	2.21	0.07
MP03	30	23.54	30.97	19.31	2.71	0.12	31.95	39.55	27.80	2.82	0.09
MP04	17	22.85	28.10	17.46	3.25	0.14	31.83	37.13	26.41	3.26	0.10
MP05	13	26.54	31.73	22.60	2.59	0.10	35.27	40.62	31.12	2.66	0.08
MP06	22	25.85	32.65	21.14	3.25	0.13	34.62	41.68	28.42	3.47	0.10
MP07	15	24.03	27.40	21.24	2.27	0.09	32.76	36.14	29.92	2.29	0.07
MP08	22	27.59	31.71	21.71	3.05	0.11	35.57	39.73	29.65	3.08	0.09
MP09	17	28.23	31.56	23.18	2.36	0.08	35.41	39.57	30.37	2.22	0.06
MP10	12	29.16	32.33	21.36	2.90	0.10	36.13	41.23	30.04	2.65	0.07
MP	203	25.07	32.65	17.42	3.46	0.14	33.17	41.68	24.68	3.42	0.1
TP01	59	18.45	27.91	12.07	3.79	0.21	33.51	42.07	26.49	4.40	0.13
TP02	38	18.86	27.91	13.12	4.15	0.22	34.85	42.07	29.31	4.27	0.12
TP03	15	18.63	25.90	14.16	4.25	0.23	35.00	42.07	28.22	4.41	0.13
TP04	19	20.28	25.90	14.16	3.90	0.19	36.93	42.07	28.22	4.11	0.11
TP05	19	19.72	25.90	14.90	2.60	0.13	36.34	41.29	31.71	2.34	0.06
TP06	13	19.38	25.24	12.07	3.19	0.16	34.84	41.29	26.49	3.62	0.10
TP07	21	20.06	30.81	13.73	4.12	0.21	34.28	43.74	27.70	3.63	0.11
TP08	9	23.88	26.37	21.27	2.03	0.09	37.06	39.16	34.47	1.99	0.05
TP09	9	24.62	29.61	19.05	3.11	0.13	37.83	42.89	32.19	3.15	0.08
TP10	3	29.09	30.95	27.40	1.78	0.06	42.00	43.89	40.29	1.80	0.04
TP	205	19.72	30.95	12.07	4.13	0.21	35.08	43.89	26.49	4.15	0.12
Three Plateau	687	22.69	35.35	12.07	4.42	0.19	32.29	43.89	21.69	4.4	0.14

Table S4 Results of standardized major axis (SMA) line-fitting for the relationship between canopy stomatal conductance (using $1/\triangle^{18}O$ as proxy) and aridity.

		Intercept	slope	r^2	P
Loess Plateau	Estimate	0.047	-0.196	0.68	0.003
	Lower	0.043	-0.027		
	Upper	0.052	-0.014		
Inner Mongolia Plateau	Estimate	0.044	-0.020	0.72	0.002
	Lower	0.040	-0.027		
	Upper	0.049	-0.014		
Tibet Plateau	Estimate	0.038	-0.015	0.60	0.008
	Lower	0.034	-0.022		
	Upper	0.042	-0.011		

Different letters indicate significant differences ($P < 0.001$) among transects in intercepts and slopes.

Table S5 Pearson coefficients for correlations among canopy stomatal conductance (Gs) and environmental factors and plant properties.

Transect	Variables	Gs	Aridity	Precipitation	SM	VPD	SR	MAT	MATMAX	LA	SLA
Loess Plateau	Gs	1									
	Aridity	-0.848**	1								
	Precipitation	0.856**	-.997**	1							
	SM	0.719*	-.781**	.795**	1						
	VPD	-0.554	0.616	-0.563	-0.251	1					
	SR	-0.639*	0.810**	-.827**	-.851**	0.217	1				
	$Temp_{mean}$	0.641*	-0.665*	.710*	.766**	0.074	-.849**	1			
	$Temp_{max}$	0.678*	-0.698*	.737*	.751*	-0.026	-.795**	.980**	1		
	LA	.757*	-.881**	.863**	0.567	-.751*	-.637*	0.425	0.481	1	
	SLA	-0.519	0.460	-0.454	-0.499	0.356	0.422	-0.433	-0.483	-0.533	1
Inner Mongolia Plateau	Gs	1									
	Aridity	-.843**	1								
	Precipitation	.919**	-.945**	1							
	SM	.707*	-.941**	.877**	1						
	VPD	-0.384	.736*	-0.490	-.741*	1					
	SR	-.728*	.725*	-.846**	-.751*	0.196	1				
	$Temp_{mean}$	0.303	-0.002	0.298	-0.009	.647*	-0.615	1			
	$Temp_{max}$	0.038	0.270	0.018	-0.235	.814**	-0.386	.943**	1		
	LA	.913**	-.721*	.875**	0.625	-0.218	-.731*	0.434	0.189	1	
	SLA	-0.576	.803**	-0.627	-.681*	.849**	0.310	0.397	0.628	-0.410	1
Tibetan Plateau	Gs	1									
	Aridity	-.773**	1								
	Precipitation	.675*	-.978**	1							
	SM	.659*	-.787**	.795**	1						
	VPD	-.912**	.931**	-.868**	-.820**	1					
	SR	-.850**	.963**	-.936**	-.801**	.943**	1				

	$Temp_{mean}$	-.670*	0.325	-0.189	-0.454	0.622	0.393	1			
	$Temp_{max}$	-.852**	.795**	-.740*	-.795**	.935**	.832**	.760*	1		
	LA	0.610	-0.620	0.504	0.219	-0.624	-.658*	-0.401	-0.536	1	
	SLA	-.648*	0.558	-0.486	-.779**	.715*	0.516	.724*	.729*	-0.078	1

**, P<0.01; *, P<0.05. gs, stomatal conductance; SM, soil moisture; VPD, vapor pressure deficit; SR, total solar radiation; $Temp_{mean}$, mean temperature; $Temp_{max}$, maximum temperature; LA, log-transformed leaf area; SLA, log-transformed specific leaf area.

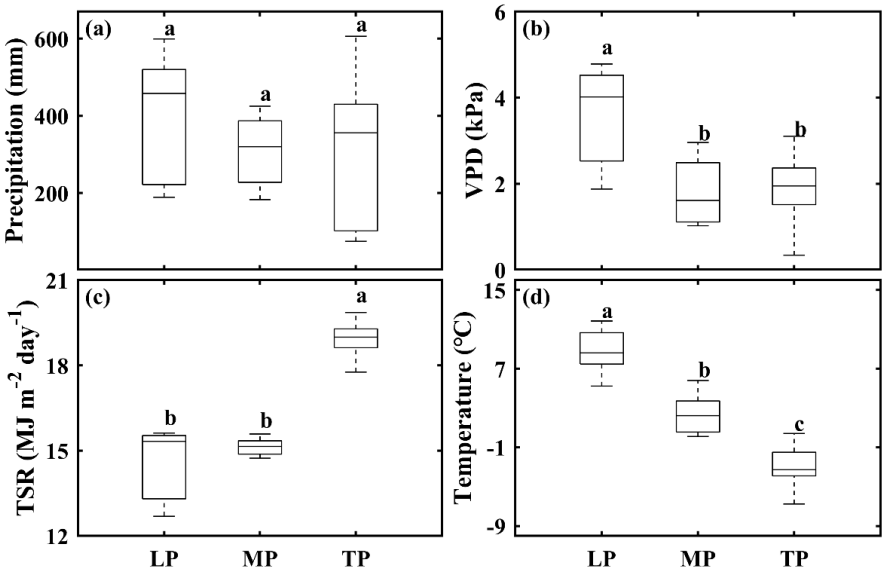

Figure S1. Comparison of annual mean precipitation (mm) (a), vapor pressure deficit (VPD) (b), total solar radiation (TSR) (c), and air temperature (°C) (d) among three transects. LP: Loess Plateau; MP, Inner Mongolia Plateau; TP, Tibet Plateau. Lowercase letters indicate significant differences among transects ($P<0.05$). Error bars indicate standard error of the mean.

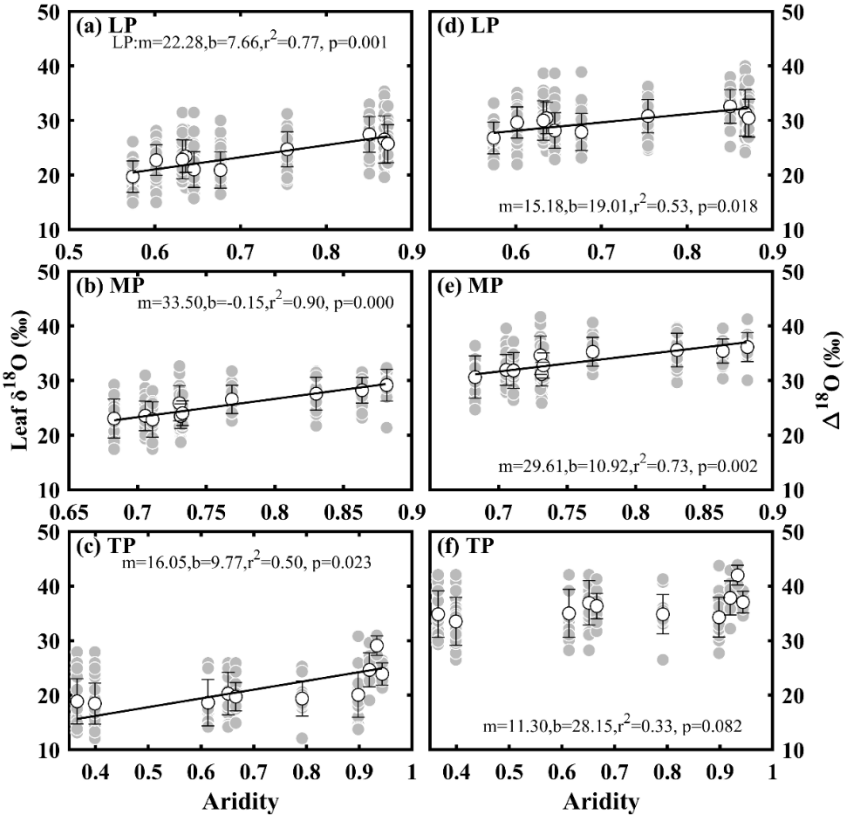

Figure S2. Patterns of leaf $\delta^{18}O$ and $\triangle^{18}O$ at species level along aridity gradient in Loess (LP), Inner Mongolia (MP), and Tibetan (TP), Plateau. m, slope of the linear regression; b, intercept of the linear regression.

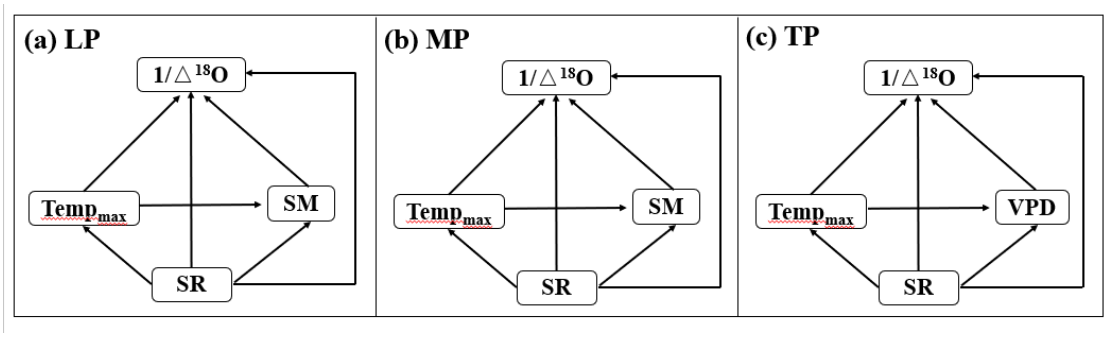

Figure S3. Hypothetical structural equation models of abiotic factors explaining $1/\triangle^{18}O$ in Loess Plateau (LP) (a), Inner Mongolia Plateau (MP) (b) and Tibet Plateau (TP) (c). $\triangle^{18}O$, ^{18}O enrichment of leaf organic matter above source water; $Temp_{max}$: maximum temperature; SR, solar radiation; SM, soil moisture; VPD, vapor pressure deficit.

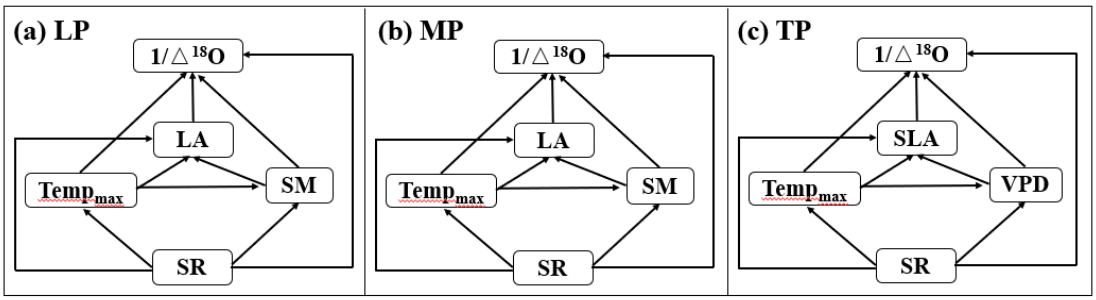

Figure S4. Hypothetical structural equation models of abiotic and biotic factors explaining $1/\triangle^{18}O$ in Loess Plateau (LP) (a), Inner Mongolia Plateau (MP) (b) and Tibet Plateau (TP) (c). $\triangle^{18}O$, ^{18}O enrichment of leaf organic matter above source water; $Temp_{max}$: maximum temperature; SR, solar radiation; SM, soil moisture; VPD, vapor pressure deficit. LA, log-transformed leaf area; SLA, log-transformed specific leaf area.

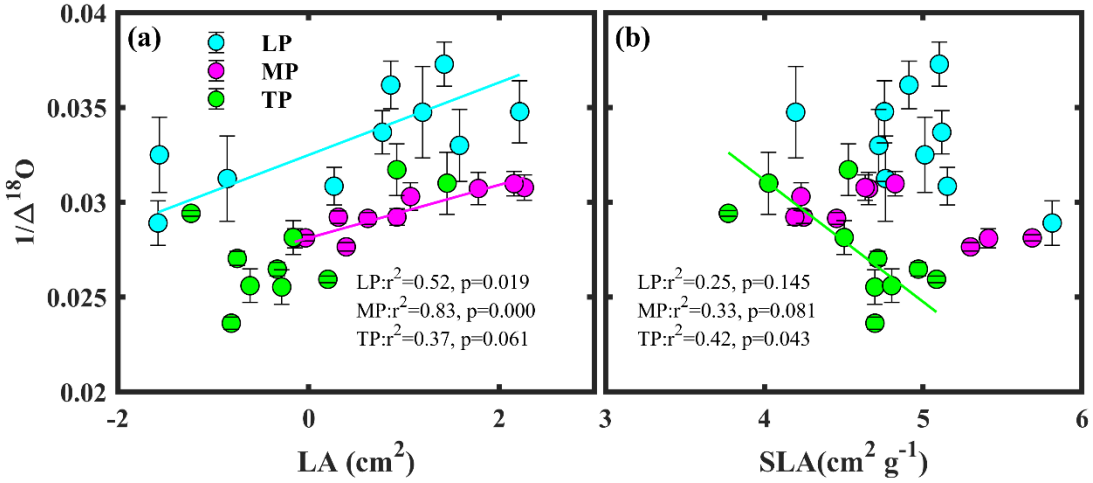

Figure S5. Relationship between community $1/\triangle^{18}O$ and log-transformed leaf area (LA) (a) and specific leaf area (SLA) (b).

Appendix 2 Information of coexisting species in each community in Loess Plateau (LP), Inner Mongolia Plateau (MP), and Tibet Plateau (TP).

Transect	Site	Species	Genus	Family
LP	1	Allium tenuissimum	Allium	Amaryllidaceae
LP	1	Artemisia annua	Artemisia	Compositae
LP	1	Artemisia scoparia	Artemisia	Compositae
LP	1	Bothriochloa ischaemum	Bothriochloa	Poaceae
LP	1	Carex korshinskyi	Carex	Cyperaceae
LP	1	Cirsium arvense	Cirsium	Compositae
LP	1	Cleistogenes hackelii	Cleistogenes	Poaceae
LP	1	Cynanchum thesioides	Cynanchum	Apocynaceae
LP	1	Erigeron canadensis	Erigeron	Compositae
LP	1	Heteropappus altaicus	Heteropappus	Compositae
LP	1	Lespedeza bicolor	Lespedeza	Fabaceae
LP	1	Leymus chinensis	Leymus	Poaceae
LP	1	Medicago ruthenica	Medicago	Fabaceae
LP	1	Polygala tenuifolia	Polygala	Polygalaceae
LP	1	Rubia cordifolia	Rubia	Rubiaceae
LP	1	Salix gordejevii	Salix	Salicaceae
LP	1	Ulmus pumila	Ulmus	Ulmaceae
LP	1	Vicia amoena	Vicia	Fabaceae
LP	1	Viola philippica	Viola	Violaceae
LP	1	Youngia japonica	Youngia	Compositae
LP	1	Ziziphus jujuba	Ziziphus	Rhamnaceae
LP	1			Scrophulariaceae
LP	2	Heteropappus altaicus	Heteropappus	Compositae
LP	2	Agropyron cristatum	Agropyron	Poaceae
LP	2	Anemone chinensis	Anemone	Ranunculaceae
LP	2	Artemisia lavandulifolia	Artemisia	Asteraceae
LP	2	Astragalus scaberrimus	Astragalus	Fabaceae
LP	2	Bothriochloa ischaemum	Bothriochloa	Poaceae
LP	2	Caragana sinica	Caragana	Fabaceae
LP	2	Carex korshinskyi	Carex	Cyperaceae
LP	2	Cleistogenes hackelii	Cleistogenes	Poaceae
LP	2	Cleistogenes songorica	Cleistogenes	Poaceae
LP	2	Dianthus chinensis	Dianthus	Caryophyllaceae
LP	2	Echinops sphaerocephalus	Echinops	Compositae
LP	2	Gueldenstaedtia verna	Gueldenstaedtia	Fabaceae
LP	2	Incarvillea sinensis	Incarvillea	Bignoniaceae
LP	2	Lespedeza davurica	Lespedeza	Fabaceae
LP	2	Lespedeza juncea	Lespedeza	Fabaceae
LP	2	Patrinia scabiosifolia	Patrinia	Caprifoliaceae
LP	2	Periploca sepium	Periploca	Apocynaceae
LP	2	Plantago depressa	Plantago	Plantaginaceae
LP	2	Poa annua	Poa	Poaceae
LP	2	Polygala tenuifolia	Polygala	Polygalaceae
LP	2	Potentilla supina	Potentilla	Rosaceae
LP	2	Rosa xanthina	Rosa	Rosaceae

LP	2	Rubia cordifolia	Rubia	Rubiaceae
LP	2	Saussurea japonica	Saussurea	Compositae
LP	2	Scorzonera sinensis	Scorzonera	Compositae
LP	2	Setaria viridis	Setaria	Poaceae
LP	2	Themeda triandra	Themeda	Poaceae
LP	2	Thymus mongolicus	Thymus	Lamiaceae
LP	2	Tripolium pannonicum	Tripolium	Compositae
LP	2	Viola philippica	Viola	Violaceae
LP	2	Ziziphus jujuba	Ziziphus	Rhamnaceae
LP	3	Agropyron cristatum	Agropyron	Poaceae
LP	3	Artemisia leucophylla	Artemisia	Compositae
LP	3	Astragalus scaberrimus	Astragalus	Fabaceae
LP	3	Bothriochloa ischaemum	Bothriochloa	Poaceae
LP	3	Bupleurum chinense	Bupleurum	Apiaceae
LP	3	Carex korshinskyi	Carex	Cyperaceae
LP	3	Cleistogenes hackelii	Cleistogenes	Poaceae
LP	3	Cleistogenes songorica	Cleistogenes	Poaceae
LP	3	Echinops sphaerocephalus	Echinops	Compositae
LP	3	Heteropappus altaicus	Heteropappus	Compositae
LP	3	Lespedeza davurica	Lespedeza	Fabaceae
LP	3	Poa annua	Poa	Poaceae
LP	3	Poa sphondylodes	Poa	Poaceae
LP	3	Polygala tenuifolia	Polygala	Polygalaceae
LP	3	Potentilla discolor	Potentilla	Rosaceae
LP	3	Potentilla tanacetifolia	Potentilla	Rosaceae
LP	3	Selaginella tamariscina	Selaginella	Selaginellaceae
LP	3	Serratula centauroides	Serratula	Compositae
LP	3	Stipa sibirica	Stipa	Poaceae
LP	3	Themeda triandra	Themeda	Poaceae
LP	3	Tripolium pannonicum	Tripolium	Compositae
LP	3	Viola philippica	Viola	Violaceae
LP	3	Vitex negundo	Vitex	Lamiaceae
LP	3	Wikstroemia chamaedaphne	Wikstroemia	Thymelaeaceae
LP	3	Ziziphus jujuba	Ziziphus	Rhamnaceae
LP	4	Agropyron cristatum	Agropyron	Poaceae
LP	4	Agropyron desertorum	Agropyron	Poaceae
LP	4	Artemisia annua	Artemisia	Compositae
LP	4	Artemisia argyi	Artemisia	Compositae
LP	4	Artemisia argyi	Artemisia	Compositae
LP	4	Artemisia dalailamae	Artemisia	Compositae
LP	4	Astragalus melilotoides	Astragalus	Fabaceae
LP	4	Astragalus scaberrimus	Astragalus	Fabaceae
LP	4	Bothriochloa ischaemum	Bothriochloa	Poaceae
LP	4	Carex korshinskyi	Carex	Cyperaceae
LP	4	Cleistogenes hackelii	Cleistogenes	Poaceae
LP	4	Gueldenstaedtia verna	Gueldenstaedtia	Fabaceae
LP	4	Heteropappus altaicus	Heteropappus	Compositae
LP	4	Ixeris polycephala	Ixeris	Compositae
LP	4	Lespedeza bicolor	Lespedeza	Fabaceae

LP	4	Poa annua	Poa	Poaceae
LP	4	Polygala sibirica	Polygala	Polygalaceae
LP	4	Polygala tenuifolia	Polygala	Polygalaceae
LP	4	Potentilla discolor	Potentilla	Rosaceae
LP	4	Potentilla tanacetifolia	Potentilla	Rosaceae
LP	4	Rosa xanthina	Rosa	Rosaceae
LP	4	Scorzonera sinensis	Scorzonera	Compositae
LP	4	Vicia amoena	Vicia	Fabaceae
LP	4	Viola philippica	Viola	Violaceae
LP	4	Wikstroemia chamaedaphne	Wikstroemia	Thymelaeaceae
LP	4	Yulania denudata	Yulania	Magnoliaceae
LP	4	Ziziphus jujuba	Ziziphus	Rhamnaceae
LP	5	Artemisia annua	Artemisia	Compositae
LP	5	Artemisia argyi	Artemisia	Compositae
LP	5	Artemisia frigida	Artemisia	Compositae
LP	5	Artemisia japonica	Artemisia	Compositae
LP	5	Artemisia scoparia	Artemisia	Compositae
LP	5	Astragalus scaberrimus	Astragalus	Fabaceae
LP	5	Bothriochloa ischaemum	Bothriochloa	Poaceae
LP	5	Caragana microphylla	Caragana	Fabaceae
LP	5	Carduus nutans	Carduus	Compositae
LP	5	Cirsium arvense	Cirsium	Compositae
LP	5	Cleistogenes hackelii	Cleistogenes	Poaceae
LP	5	Cleistogenes serotina	Cleistogenes	Poaceae
LP	5	Cynanchum thesioides	Cynanchum	Apocynaceae
LP	5	Dracocephalum moldavica	Dracocephalum	Lamiaceae
LP	5	Eragrostis pilosa	Eragrostis	Poaceae
LP	5	Erigeron annuus	Erigeron	Compositae
LP	5	Glycyrrhiza uralensis	Glycyrrhiza	Fabaceae
LP	5	Gueldenstaedtia verna	Gueldenstaedtia	Fabaceae
LP	5	Incarvillea sinensis	Incarvillea	Bignoniaceae
LP	5	Ixeris polycephala	Ixeris	Compositae
LP	5	Kalimeris hispida	Kalimeris	Compositae
LP	5	Koeleria pyramidata	Koeleria	Poaceae
LP	5	Lespedeza davurica	Lespedeza	Fabaceae
LP	5	Lespedeza juncea	Lespedeza	Fabaceae
LP	5	Leymus chinensis	Leymus	Poaceae
LP	5	Oxytropis myriophylla	Oxytropis	Fabaceae
LP	5	Poa annua	Poa	Poaceae
LP	5	Poa sphondylodes	Poa	Poaceae
LP	5	Polygala sibirica	Polygala	Polygalaceae
LP	5	Potentilla supina	Potentilla	Rosaceae
LP	5	Potentilla tanacetifolia	Potentilla	Rosaceae
LP	5	Rubia cordifolia	Rubia	Rubiaceae
LP	5	Sibbaldianthe bifurca	Sibbaldianthe	Rosaceae
LP	5	Sonchus arvensis	Sonchus	Compositae
LP	5	Taraxacum mongolicum	Taraxacum	Compositae
LP	5	Tripolium pannonicum	Tripolium	Compositae
LP	5	Viola philippica	Viola	Violaceae

LP	5	Ziziphus jujuba	Ziziphus	Rhamnaceae
LP	6	Allium senescens	Allium	Liliaceae
LP	6	Anemone chinensis	Anemone	Ranunculaceae
LP	6	Artemisia argyi	Artemisia	Compositae
LP	6	Artemisia japonica	Artemisia	Compositae
LP	6	Astragalus scaberrimus	Astragalus	Fabaceae
LP	6	Carduus nutans	Carduus	Compositae
LP	6	Cleistogenes hackelii	Cleistogenes	Poaceae
LP	6	Cleistogenes serotina	Cleistogenes	Poaceae
LP	6	Echinops sphaerocephalus	Echinops	Compositae
LP	6	Elymus dahuricus	Elymus	Poaceae
LP	6	Imperata cylindrica	Imperata	Poaceae
LP	6	Kalimeris hispida	Kalimeris	Compositae
LP	6	Lappula myosotis	Lappula	Boraginaceae
LP	6	Leontopodium leontopodinum	Leontopodium	Compositae
LP	6	Lespedeza bicolor	Lespedeza	Fabaceae
LP	6	Linum usitatissimum	Linum	Linaceae
LP	6	Medicago ruthenica	Medicago	Fabaceae
LP	6	Patrinia heterophylla	Patrinia	Caprifoliaceae
LP	6	Phlomoides umbrosa	Phlomoides	Lamiaceae
LP	6	Phragmites australis	Phragmites	Poaceae
LP	6	Poa sphondylodes	Poa	Poaceae
LP	6	Polygala tenuifolia	Polygala	Polygalaceae
LP	6	Potentilla chinensis	Potentilla	Rosaceae
LP	6	Potentilla sericea	Potentilla	Rosaceae
LP	6	Ranunculus japonicus	Ranunculus	Ranunculaceae
LP	6	Rubia cordifolia	Rubia	Rubiaceae
LP	6	Setaria viridis	Setaria	Poaceae
LP	6	Sibbaldianthe bifurca	Sibbaldianthe	Rosaceae
LP	6	Sonchus arvensis	Sonchus	Compositae
LP	6	Stipa bungeana	Stipa	Poaceae
LP	6	Stipa capillata	Stipa	Poaceae
LP	6	Taraxacum mongolicum	Taraxacum	Compositae
LP	6	Tripolium pannonicum	Tripolium	Compositae
LP	7	Agropyron cristatum	Agropyron	Poaceae
LP	7	Artemisia argyi	Artemisia	Compositae
LP	7	Artemisia scoparia	Artemisia	Compositae
LP	7	Astragalus adsurgens	Astragalus	Fabaceae
LP	7	Astragalus galactites	Astragalus	Fabaceae
LP	7	Astragalus melilotoides	Astragalus	Fabaceae
LP	7	Astragalus propinquus	Astragalus	Fabaceae
LP	7	Bassia scoparia	Bassia	Amaranthaceae
LP	7	Carex korshinskyi	Carex	Cyperaceae
LP	7	Cleistogenes hackelii	Cleistogenes	Poaceae
LP	7	Cleistogenes songorica	Cleistogenes	Poaceae
LP	7	Convolvulus arvensis	Convolvulus	Convolvulaceae
LP	7	Gueldenstaedtia verna	Gueldenstaedtia	Fabaceae
LP	7	Haplophyllum dauricum	Haplophyllum	Rutaceae
LP	7	Heteropappus altaicus	Heteropappus	Compositae

LP	7	Ixeris polycephala	Ixeris	Compositae
LP	7	Koeleria pyramidata	Koeleria	Poaceae
LP	7	Lespedeza bicolor	Lespedeza	Fabaceae
LP	7	Leymus chinensis	Leymus	Poaceae
LP	7	Medicago ruthenica	Medicago	Fabaceae
LP	7	Medicago sativa	Medicago	Fabaceae
LP	7	Melilotus albus	Melilotus	Leguminosae
LP	7	Polygonum sibiricum	Polygonum	Polygonaceae
LP	7	Scorzonera sinensis	Scorzonera	Compositae
LP	7	Setaria viridis	Setaria	Poaceae
LP	7	Sibbaldianthe bifurca	Sibbaldianthe	Rosaceae
LP	7	Sonchus arvensis	Sonchus	Compositae
LP	7	Stipa capillata	Stipa	Poaceae
LP	7	Stipa splendens	Stipa	Poaceae
LP	7	Suaeda glauca	Suaeda	Amaranthaceae
LP	7	Taraxacum mongolicum	Taraxacum	Compositae
LP	7	Thermopsis lanceolata	Thermopsis	Fabaceae
LP	8	Allium tenuissimum	Allium	Amaryllidaceae
LP	8	Alopecurus aequalis	Alopecurus	Poaceae
LP	8	Artemisia scoparia	Artemisia	Compositae
LP	8	Astragalus galactites	Astragalus	Fabaceae
LP	8	Astragalus propinquus	Astragalus	Fabaceae
LP	8	Bassia dasyphylla	Bassia	Amaranthaceae
LP	8	Carex korshinskyi	Carex	Cyperaceae
LP	8	Cleistogenes hackelii	Cleistogenes	Poaceae
LP	8	Convolvulus ammannii	Convolvulus	Convolvulaceae
LP	8	Echinochloa crus-galli	Echinochloa	Poaceae
LP	8	Eragrostis pilosa	Eragrostis	Poaceae
LP	8	Peganum harmala	Peganum	Nitrariaceae
LP	8	Reaumuria soongarica	Reaumuria	Tamaricaceae
LP	8	Stipa capillata	Stipa	Poaceae
LP	8	Tragus racemosus	Tragus	Poaceae
LP	8	Tribulus terrestris	Tribulus	Zygophyllaceae
LP	8	Zygophyllum mucronatum	Zygophyllum	Zygophyllaceae
LP	9	Allium mongolicum	Allium	Amaryllidaceae
LP	9	Allium polyrhizum	Allium	Amaryllidaceae
LP	9	Artemisia annua	Artemisia	Compositae
LP	9	Artemisia argyi	Artemisia	Compositae
LP	9	Artemisia capillaris	Artemisia	Compositae
LP	9	Artemisia scoparia	Artemisia	Compositae
LP	9	Asparagus cochinchinensis	Asparagus	Asparagaceae
LP	9	Astragalus galactites	Astragalus	Fabaceae
LP	9	Caragana stenophylla	Caragana	Fabaceae
LP	9	Chloris virgata	Chloris	Poaceae
LP	9	Cleistogenes hackelii	Cleistogenes	Poaceae
LP	9	Convolvulus ammannii	Convolvulus	Convolvulaceae
LP	9	Convolvulus arvensis	Convolvulus	Convolvulaceae
LP	9	Convolvulus tragacanthoides	Convolvulus	Convolvulaceae
LP	9	Echinochloa crus-galli	Echinochloa	Poaceae

LP	9	Euphorbia humifusa	Euphorbia	Euphorbiaceae
LP	9	Heteropappus altaicus	Heteropappus	Compositae
LP	9	Reaumuria soongarica	Reaumuria	Tamaricaceae
LP	9	Salsola collina	Salsola	Amaranthaceae
LP	9	Salsola passerina	Salsola	Amaranthaceae
LP	9	Stipa capillata	Stipa	Poaceae
LP	9	Suaeda glauca	Suaeda	Amaranthaceae
LP	9	Tribulus terrestris	Tribulus	Zygophyllaceae
LP	9	Zygophyllum mucronatum	Zygophyllum	Zygophyllaceae
LP	10	Heteropappus altaicus	Heteropappus	Compositae
LP	10	Lepidium apetalum	Lepidium	Brassicaceae
LP	10	Saussurea japonica	Saussurea	Compositae
LP	10	Alopecurus aequalis	Alopecurus	Poaceae
LP	10	Artemisia ordosica	Artemisia	Compositae
LP	10	Reaumuria soongarica	Reaumuria	Tamaricaceae
LP	10	Eragrostis pilosa	Eragrostis	Poaceae
LP	10	Allium polyrhizum	Allium	Amaryllidaceae
LP	10	Suaeda glauca	Suaeda	Amaranthaceae
LP	10	Alopecurus aequalis	Alopecurus	Poaceae
LP	10	Chenopodium album	Chenopodium	Amaranthaceae
LP	10	Carex korshinskyi	Carex	Cyperaceae
LP	10	Artemisia capillaris	Artemisia	Compositae
LP	10	Salsola passerina	Salsola	Amaranthaceae
LP	10	Cleistogenes hackelii	Cleistogenes	Poaceae
MP	1	Heteropappus altaicus	Heteropappus	Compositae
MP	1	Echinochloa crus-galli	Echinochloa	Poaceae
MP	1	Setaria viridis	Setaria	Poaceae
MP	1	Incarvillea sinensis	Incarvillea	Bignoniaceae
MP	1	Artemisia ordosica	Artemisia	Compositae
MP	1	Chloris virgata	Chloris	Poaceae
MP	1	Chenopodium glaucum	Chenopodium	Amaranthaceae
MP	1	Bassia scoparia	Bassia	Amaranthaceae
MP	1	Lactuca sativa	Lactuca	Compositae
MP	1	Phragmites australis	Phragmites	Poaceae
MP	1	Medicago sativa	Medicago	Fabaceae
MP	1	Carex korshinskyi	Carex	Cyperaceae
MP	1	Calystegia pellita	Calystegia	Convolvulaceae
MP	1	Polygonum sibiricum	Polygonum	Polygonaceae
MP	1	Leymus chinensis	Leymus	Poaceae
MP	1	Artemisia sphaerocephala	Artemisia	Compositae
MP	1	Aeluropus littoralis	Aeluropus	Poaceae
MP	1	Medicago sativa	Medicago	Fabaceae
MP	2	Adenophora stricta	Adenophora	Campanulaceae
MP	2	Agropyron cristatum	Agropyron	Poaceae
MP	2	Allium anisopodium	Allium	Amaryllidaceae
MP	2	Allium ramosum	Allium	Amaryllidaceae
MP	2	Amethystea caerulea	Amethystea	Lamiaceae
MP	2	Anemarrhena asphodeloides	Anemarrhena	Asparagaceae
MP	2	Artemisia desertorum	Artemisia	Compositae

MP	2	Artemisia lavandulifolia	Artemisia	Asteraceae
MP	2	Artemisia sieversiana	Artemisia	Compositae
MP	2	Artemisia sphaerocephala	Artemisia	Compositae
MP	2	Atraphaxis manshurica	Atraphaxis	Polygonaceae
MP	2	Carex pediformis	Carex	Cyperaceae
MP	2	Chenopodium acuminatum	Chenopodium	Amaranthaceae
MP	2	Chloris virgata	Chloris	Poaceae
MP	2	Cleistogenes hackelii	Cleistogenes	Poaceae
MP	2	Clematis hexapetala	Clematis	Ranunculaceae
MP	2	Corispermum mongolicum	Corispermum	Amaranthaceae
MP	2	Cynanchum thesioides	Cynanchum	Apocynaceae
MP	2	Dysphania aristata	Dysphania	Amaranthaceae
MP	2	Enneapogon desvauxii	Enneapogon	Poaceae
MP	2	Ephedra sinica	Ephedra	Ephedraceae
MP	2	Eriochloa villosa	Eriochloa	Poaceae
MP	2	Erodium stephanianum	Erodium	Geraniaceae
MP	2	Euphorbia humifusa	Euphorbia	Euphorbiaceae
MP	2	Glycyrrhiza uralensis	Glycyrrhiza	Fabaceae
MP	2	Iris tenuifolia	Iris	Iridaceae
MP	2	Lespedeza davurica	Lespedeza	Fabaceae
MP	2	Medicago ruthenica	Medicago	Fabaceae
MP	2	Phragmites australis	Phragmites	Poaceae
MP	2	Salsola collina	Salsola	Amaranthaceae
MP	2	Serratula centauroides	Serratula	Compositae
MP	2	Setaria viridis	Setaria	Poaceae
MP	2	Stipa capillata	Stipa	Poaceae
MP	2	Stipa sibirica	Stipa	Poaceae
MP	2	Thalictrum squarrosum	Thalictrum	Ranunculaceae
MP	2	Tribulus terrestris	Tribulus	Zygophyllaceae
MP	3	Allium tenuissimum	Allium	Amaryllidaceae
MP	3	Anemarrhena asphodeloides	Anemarrhena	Asparagaceae
MP	3	Artemisia annua	Artemisia	Compositae
MP	3	Artemisia lavandulifolia	Artemisia	Asteraceae
MP	3	Astragalus adsurgens	Astragalus	Fabaceae
MP	3	Astragalus propinquus	Astragalus	Fabaceae
MP	3	Carex korshinskyi	Carex	Cyperaceae
MP	3	Cleistogenes hackelii	Cleistogenes	Poaceae
MP	3	Convolvulus arvensis	Convolvulus	Convolvulaceae
MP	3	Eriochloa villosa	Eriochloa	Poaceae
MP	3	Erodium stephanianum	Erodium	Geraniaceae
MP	3	Euphorbia humifusa	Euphorbia	Euphorbiaceae
MP	3	Gerbera anandria	Gerbera	Compositae
MP	3	Heteropappus altaicus	Heteropappus	Compositae
MP	3	Leontopodium leontopodinum	Leontopodium	Compositae
MP	3	Lespedeza davurica	Lespedeza	Fabaceae
MP	3	Lespedeza juncea	Lespedeza	Fabaceae
MP	3	Leymus chinensis	Leymus	Poaceae
MP	3	Linum stelleroides	Linum	Linaceae
MP	3	Miscanthus sacchariflorus	Miscanthus	Poaceae

MP	3	Polygala tenuifolia	Polygala	Polygalaceae
MP	3	Polygonum divaricatum	Polygonum	Polygonaceae
MP	3	Potentilla betonicifolia	Potentilla	Rosaceae
MP	3	Potentilla verticillaris	Potentilla	Rosaceae
MP	3	Salsola collina	Salsola	Amaranthaceae
MP	3	Sanguisorba officinalis	Sanguisorba	Rosaceae
MP	3	Serratula centauroides	Serratula	Compositae
MP	3	Stipa sibirica	Stipa	Poaceae
MP	3	Thalictrum petaloideum	Thalictrum	Ranunculaceae
MP	4	Agropyron cristatum	Agropyron	Poaceae
MP	4	Allium bidentatum	Allium	Amaryllidaceae
MP	4	Anemarrhena asphodeloides	Anemarrhena	Asparagaceae
MP	4	Bassia prostrata	Bassia	Amaranthaceae
MP	4	Carex korshinskyi	Carex	Cyperaceae
MP	4	Cleistogenes hackelii	Cleistogenes	Poaceae
MP	4	Dysphania aristata	Dysphania	Amaranthaceae
MP	4	Iris tenuifolia	Iris	Iridaceae
MP	4	Koeleria pyramidata	Koeleria	Poaceae
MP	4	Lappula myosotis	Lappula	Boraginaceae
MP	4	Leymus chinensis	Leymus	Poaceae
MP	4	Medicago ruthenica	Medicago	Fabaceae
MP	4	Potentilla acaulis	Potentilla	Rosaceae
MP	4	Salsola collina	Salsola	Amaranthaceae
MP	4	Scorzonera sinensis	Scorzonera	Compositae
MP	4	Stipa capillata	Stipa	Poaceae
MP	4	Veratrum nigrum	Veratrum	Melanthiaceae
MP	5	Allium anisopodium	Allium	Amaryllidaceae
MP	5	Agropyron cristatum	Agropyron	Poaceae
MP	5	Cymbaria daurica	Cymbaria	Orobanchaceae
MP	5	Chenopodium glaucum	Chenopodium	Amaranthaceae
MP	5	Chenopodium acuminatum	Chenopodium	Amaranthaceae
MP	5	Artemisia frigida	Artemisia	Compositae
MP	5	Bassia prostrata	Bassia	Amaranthaceae
MP	5	Carex korshinskyi	Carex	Cyperaceae
MP	5	Cleistogenes hackelii	Cleistogenes	Poaceae
MP	5	Allium tenuissimum	Allium	Amaryllidaceae
MP	5	Leymus chinensis	Leymus	Poaceae
MP	5	Stipa capillata	Stipa	Poaceae
MP	5	Salsola collina	Salsola	Amaranthaceae
MP	6	Agropyron cristatum	Agropyron	Poaceae
MP	6	Cleistogenes squarrosa	Cleistogenes	Poaceae
MP	6	Ephedra sinica	Ephedra	Ephedraceae
MP	6	Sibbaldianthe bifurca	Sibbaldianthe	Rosaceae
MP	6	Allium condensatum	Allium	Amaryllidaceae
MP	6	Artemisia annua	Artemisia	Compositae
MP	6	Chenopodium glaucum	Chenopodium	Amaranthaceae
MP	6	Artemisia frigida	Artemisia	Compositae
MP	6	Bassia prostrata	Bassia	Amaranthaceae
MP	6	Thermopsis lanceolata	Thermopsis	Fabaceae

MP	6	Koeleria pyramidata	Koeleria	Poaceae
MP	6	Gueldenstaedtia verna	Gueldenstaedtia	Fabaceae
MP	6	Carex korshinskyi	Carex	Cyperaceae
MP	6	Allium tenuissimum	Allium	Amaryllidaceae
MP	6	Iris tenuifolia	Iris	Iridaceae
MP	6	Leymus chinensis	Leymus	Poaceae
MP	6	Allium ramosum	Allium	Amaryllidaceae
MP	6	Stipa sibirica	Stipa	Poaceae
MP	6	Poa annua	Poa	Poaceae
MP	6	Stipa capillata	Stipa	Poaceae
MP	6	Axyris amaranthoides	Axyris	Amaranthaceae
MP	6	Salsola collina	Salsola	Amaranthaceae
MP	7	Agropyron cristatum	Agropyron	Poaceae
MP	7	Scutellaria scordiifolia	Scutellaria	Lamiaceae
MP	7	Astragalus melilotoides	Astragalus	Fabaceae
MP	7	Cymbaria daurica	Cymbaria	Orobanchaceae
MP	7	Euphorbia fischeriana	Euphorbia	Euphorbiaceae
MP	7	Koeleria pyramidata	Koeleria	Poaceae
MP	7	Astragalus galactites	Astragalus	Fabaceae
MP	7	Allium bidentatum	Allium	Amaryllidaceae
MP	7	Carex korshinskyi	Carex	Cyperaceae
MP	7	Cleistogenes hackelii	Cleistogenes	Poaceae
MP	7	Allium tenuissimum	Allium	Amaryllidaceae
MP	7	Iris tenuifolia	Iris	Iridaceae
MP	7	Leymus chinensis	Leymus	Poaceae
MP	7	Stipa capillata	Stipa	Poaceae
MP	7	Anemarrhena asphodeloides	Anemarrhena	Asparagaceae
MP	8	Heteropappus altaicus	Heteropappus	Compositae
MP	8	Agropyron cristatum	Agropyron	Poaceae
MP	8	Cymbaria daurica	Cymbaria	Orobanchaceae
MP	8	Artemisia annua	Artemisia	Compositae
MP	8	Chenopodium acuminatum	Chenopodium	Amaranthaceae
MP	8	Allium polyrhizum	Allium	Amaryllidaceae
MP	8	Artemisia frigida	Artemisia	Compositae
MP	8	Asparagus schoberioides	Asparagus	Asparagaceae
MP	8	Bassia prostrata	Bassia	Amaranthaceae
MP	8	Astragalus galactites	Astragalus	Fabaceae
MP	8	Allium bidentatum	Allium	Amaryllidaceae
MP	8	Carex korshinskyi	Carex	Cyperaceae
MP	8	Cleistogenes hackelii	Cleistogenes	Poaceae
MP	8	Allium tenuissimum	Allium	Amaryllidaceae
MP	8	Iris tenuifolia	Iris	Iridaceae
MP	8	Leymus chinensis	Leymus	Poaceae
MP	8	Allium ramosum	Allium	Amaryllidaceae
MP	8	Convolvulus ammannii	Convolvulus	Convolvulaceae
MP	8	Stipa capillata	Stipa	Poaceae
MP	8	Neopallasia pectinata	Neopallasia	Compositae
MP	8	Salsola collina	Salsola	Amaranthaceae
MP	9	Artemisia argyi	Artemisia	Compositae

MP	9	Scorzonera sinensis	Scorzonera	Compositae
MP	9	Eragrostis pilosa	Eragrostis	Poaceae
MP	9	Tribulus terrestris	Tribulus	Zygophyllaceae
MP	9	Allium polyrhizum	Allium	Amaryllidaceae
MP	9	Asparagus schoberioides	Asparagus	Asparagaceae
MP	9	Peganum harmala	Peganum	Nitrariaceae
MP	9	Iris lactea	Iris	Iridaceae
MP	9	Corispermum mongolicum	Corispermum	Amaranthaceae
MP	9	Allium bidentatum	Allium	Amaryllidaceae
MP	9	Carex korshinskyi	Carex	Cyperaceae
MP	9	Cleistogenes songorica	Cleistogenes	Poaceae
MP	9	Caragana stenophylla	Caragana	Fabaceae
MP	9	Convolvulus ammannii	Convolvulus	Convolvulaceae
MP	9	Stipa capillata	Stipa	Poaceae
MP	9	Salsola collina	Salsola	Amaranthaceae
MP	10	Setaria viridis	Setaria	Poaceae
MP	10	Tribulus terrestris	Tribulus	Zygophyllaceae
MP	10	Asparagus schoberioides	Asparagus	Asparagaceae
MP	10	Corispermum mongolicum	Corispermum	Amaranthaceae
MP	10	Allium bidentatum	Allium	Amaryllidaceae
MP	10	Carex korshinskyi	Carex	Cyperaceae
MP	10	Cleistogenes songorica	Cleistogenes	Poaceae
MP	10	Iris tenuifolia	Iris	Iridaceae
MP	10	Caragana stenophylla	Caragana	Fabaceae
MP	10	Stipa capillata	Stipa	Poaceae
MP	10	Salsola collina	Salsola	Amaranthaceae
TP	1	Allium przewalskianum	Allium	Amaryllidaceae
TP	1	Allium ramosum	Allium	Amaryllidaceae
TP	1	Anaphalis xylorhiza	Anaphalis	Compositae
TP	1	Androsace tapete	Androsace	Primulaceae
TP	1	Androsace umbellata	Androsace	Primulaceae
TP	1	Arenaria brevipetala	Arenaria	Caryophyllaceae
TP	1	Artemisia argyi	Artemisia	Compositae
TP	1	Aster tataricus	Aster	Compositae
TP	1	Astragalus propinquus	Astragalus	Fabaceae
TP	1	Calamagrostis lahulensis	Calamagrostis	Poaceae
TP	1	Caragana sinica	Caragana	Fabaceae
TP	1	Carex korshinskyi	Carex	Cyperaceae
TP	1	Chenopodium glaucum	Chenopodium	Amaranthaceae
TP	1	Elymus dahuricus	Elymus	Poaceae
TP	1	Eragrostis pilosa	Eragrostis	Poaceae
TP	1	Euphorbia stracheyi	Euphorbia	Euphorbiaceae
TP	1	Gentiana scabra	Gentiana	Gentianaceae
TP	1	Gentiana straminea	Gentiana	Gentianaceae
TP	1	Gentiana szechenyii	Gentiana	Gentianaceae
TP	1	Gentianopsis paludosa	Gentianopsis	Gentianaceae
TP	1	Geranium wilfordii	Geranium	Geraniaceae
TP	1	Gueldenstaedtia verna	Gueldenstaedtia	Fabaceae
TP	1	Gueldenstaedtia verna	Gueldenstaedtia	Fabaceae

TP	1	Heracleum hemsleyanum	Heracleum	Apiaceae
TP	1	Heteropappus altaicus	Heteropappus	Compositae
TP	1	Incarvillea sinensis	Incarvillea	Bignoniaceae
TP	1	Iris tectorum	Iris	Iridaceae
TP	1	Kobresia littledalei	Kobresia	Cyperaceae
TP	1	Leontopodium leontopodinum	Leontopodium	Compositae
TP	1	Phlomis younghusbandii	Phlomis	Lamiaceae
TP	1	Plantago depressa	Plantago	Plantaginaceae
TP	1	Poa annua	Poa	Poaceae
TP	1	Polygonum divaricatum	Polygonum	Polygonaceae
TP	1	Potentilla chinensis	Potentilla	Rosaceae
TP	1	Potentilla multifida	Potentilla	Rosaceae
TP	1	Potentilla saundersiana	Potentilla	Rosaceae
TP	1	Przewalskia tangutica	Przewalskia	Solanaceae
TP	1	Scorzonera sinensis	Scorzonera	Compositae
TP	1	Scrophularia ningpoensis	Scrophularia	Scrophulariaceae
TP	1	Sibbaldianthe bifurca	Sibbaldianthe	Rosaceae
TP	1	Silene gallica	Silene	Caryophyllaceae
TP	1	Stipa capillata	Stipa	Poaceae
TP	1	Stipa purpurea	Stipa	Poaceae
TP	1	Taraxacum mongolicum	Taraxacum	Compositae
TP	1	Vicia amoena	Vicia	Fabaceae
TP	2	Anaphalis xylorhiza	Anaphalis	Compositae
TP	2	Artemisia argyi	Artemisia	Compositae
TP	2	Aster souliei	Aster	Compositae
TP	2	Aster tataricus	Aster	Compositae
TP	2	Astragalus strictus	Astragalus	Fabaceae
TP	2	Carex korshinskyi	Carex	Cyperaceae
TP	2	Elsholtzia densa	Elsholtzia	Lamiaceae
TP	2	Eragrostis alta	Eragrostis	Poaceae
TP	2	Euphorbia fischeriana	Euphorbia	Euphorbiaceae
TP	2	Geranium wilfordii	Geranium	Geraniaceae
TP	2	Gueldenstaedtia verna	Gueldenstaedtia	Fabaceae
TP	2	Heracleum hemsleyanum	Heracleum	Apiaceae
TP	2	Kobresia pygmaea	Kobresia	Cyperaceae
TP	2	Lancea tibetica	Lancea	Phrymaceae
TP	2	Lasiocaryum densiflorum	Lasiocaryum	Boraginaceae
TP	2	Persicaria vivipara	Persicaria	Polygonaceae
TP	2	Phlomoides rotata	Phlomoides	Lamiaceae
TP	2	Poa annua	Poa	Poaceae
TP	2	Polygonum sibiricum	Polygonum	Polygonaceae
TP	2	Potentilla anserina	Potentilla	Rosaceae
TP	2	Potentilla parvifolia	Potentilla	Rosaceae
TP	2	Potentilla saundersiana	Potentilla	Rosaceae
TP	2	Przewalskia tangutica	Przewalskia	Solanaceae
TP	2	Sibbaldianthe bifurca	Sibbaldianthe	Rosaceae
TP	2	Stipa capillata	Stipa	Poaceae
TP	2	Taraxacum mongolicum	Taraxacum	Compositae
TP	2	Urtica hyperborea	Urtica	Urticaceae

TP	3	Astragalus propinquus	Astragalus	Fabaceae
TP	3	Carex korshinskyi	Carex	Cyperaceae
TP	3	Eragrostis alta	Eragrostis	Poaceae
TP	3	Kobresia pygmaea	Kobresia	Cyperaceae
TP	3	Lancea tibetica	Lancea	Phrymaceae
TP	3	Leontopodium leontopodinum	Leontopodium	Compositae
TP	3	Poa annua	Poa	Poaceae
TP	3	Potentilla anserina	Potentilla	Rosaceae
TP	3	Potentilla saundersiana	Potentilla	Rosaceae
TP	3	Saussurea japonica	Saussurea	Compositae
TP	3	Sibbaldianthe bifurca	Sibbaldianthe	Rosaceae
TP	3	Taraxacum mongolicum	Taraxacum	Compositae
TP	4	Astragalus arnoldii	Astragalus	Fabaceae
TP	4	Callianthemum pimpinelloides	Callianthemum	Ranunculaceae
TP	4	Carex korshinskyi	Carex	Cyperaceae
TP	4	Eragrostis alta	Eragrostis	Poaceae
TP	4	Euphorbia fischeriana	Euphorbia	Euphorbiaceae
TP	4	Heteropappus boweri	Heteropappus	Compositae
TP	4	Kobresia pygmaea	Kobresia	Cyperaceae
TP	4	Leontopodium leontopodinum	Leontopodium	Compositae
TP	4	Oxytropis stracheyana	Oxytropis	Fabaceae
TP	4	**Pedicularis alaschanica**	Pedicularis	Scrophulariaceae
TP	4	Poa setulosa	Poa	Poaceae
TP	4	Przewalskia tangutica	Przewalskia	Solanaceae
TP	4	Rhodiola smithii	Rhodiola	Crassulaceae
TP	4	Saussurea japonica	Saussurea	Compositae
TP	4	Stipa capillata	Stipa	Poaceae
TP	4	Taraxacum mongolicum	Taraxacum	Compositae
TP	5	Arenaria edgeworthiana	Arenaria	Caryophyllaceae
TP	5	Astragalus adsurgens	Astragalus	Fabaceae
TP	5	Astragalus tribulifolius	Astragalus	Fabaceae
TP	5	Carex korshinskyi	Carex	Cyperaceae
TP	5	Carex littledalei	Carex	Cyperaceae
TP	5	Dolomiaea souliei	Dolomiaea	Compositae
TP	5	Dracocephalum heterophyllum	Dracocephalum	Lamiaceae
TP	5	Eragrostis pilosa	Eragrostis	Poaceae
TP	5	Heteropappus boweri	Heteropappus	Compositae
TP	5	Kobresia pygmaea	Kobresia	Cyperaceae
TP	5	Leontopodium leontopodinum	Leontopodium	Compositae
TP	5	Poa annua	Poa	Poaceae
TP	5	Potentilla chinensis	Potentilla	Rosaceae
TP	5	Potentilla supina	Potentilla	Rosaceae
TP	5	Rhodiola smithii	Rhodiola	Crassulaceae
TP	5	Sibbaldianthe bifurca	Sibbaldianthe	Rosaceae
TP	5	Stipa capillata	Stipa	Poaceae
TP	5	Stipa purpurea	Stipa	Poaceae
TP	5	Youngia japonica	Youngia	Compositae
TP	6	Astragalus adsurgens	Astragalus	Fabaceae
TP	6	Carex korshinskyi	Carex	Cyperaceae

TP	6	Dracocephalum heterophyllum	Dracocephalum	Lamiaceae
TP	6	Heteropappus boweri	Heteropappus	Compositae
TP	6	Incarvillea lutea	Incarvillea	Bignoniaceae
TP	6	Lagotis brachystachya	Lagotis	Plantaginaceae
TP	6	Oxytropis microphylla	Oxytropis	Fabaceae
TP	6	Przewalskia tangutica	Przewalskia	Solanaceae
TP	6	Rhodiola smithii	Rhodiola	Crassulaceae
TP	6	Sibbaldia parviflora	Sibbaldia	Rosaceae
TP	6	Sibbaldianthe bifurca	Sibbaldianthe	Rosaceae
TP	6	Stipa capillata	Stipa	Poaceae
TP	6	Stipa purpurea	Stipa	Poaceae
TP	7	Androsace tapete	Androsace	Primulaceae
TP	7	Arenaria brevipetala	Arenaria	Caryophyllaceae
TP	7	Astragalus propinquus	Astragalus	Fabaceae
TP	7	Carex korshinskyi	Carex	Cyperaceae
TP	7	Eragrostis pilosa	Eragrostis	Poaceae
TP	7	Kalimeris hispida	Kalimeris	Compositae
TP	7	Kobresia pygmaea	Kobresia	Cyperaceae
TP	7	Lagotis brachystachya	Lagotis	Plantaginaceae
TP	7	Lasiocaryum densiflorum	Lasiocaryum	Boraginaceae
TP	7	Leontopodium leontopodinum	Leontopodium	Compositae
TP	7	Lepidium capitatum	Lepidium	Brassicaceae
TP	7	Poa annua	Poa	Poaceae
TP	7	Polygonum sibiricum	Polygonum	Polygonaceae
TP	7	Potentilla parvifolia	Potentilla	Rosaceae
TP	7	Potentilla plumosa	Potentilla	Rosaceae
TP	7	Pycnoplinthus uniflora	Pycnoplinthus	Brassicaceae
TP	7	Sibbaldia parviflora	Sibbaldia	Rosaceae
TP	7	Sibbaldianthe bifurca	Sibbaldianthe	Rosaceae
TP	7	Stipa purpurea	Stipa	Poaceae
TP	7	Taraxacum mongolicum	Taraxacum	Compositae
TP	8	Artemisia desertorum	Artemisia	Compositae
TP	8	Astragalus propinquus	Astragalus	Fabaceae
TP	8	Astragalus tribulifolius	Astragalus	Fabaceae
TP	8	Carex korshinskyi	Carex	Cyperaceae
TP	8	Heteropappus boweri	Heteropappus	Compositae
TP	8	Oxytropis microphylla	Oxytropis	Fabaceae
TP	8	Poa annua	Poa	Poaceae
TP	8	Ptilotrichum canescens	Ptilotrichum	Brassicaceae
TP	8	Stipa capillata	Stipa	Poaceae
TP	9	Artemisia desertorum	Artemisia	Compositae
TP	9	Astragalus hendersonii	Astragalus	Fabaceae
TP	9	Carex korshinskyi	Carex	Cyperaceae
TP	9	Oxytropis glacialis	Oxytropis	Fabaceae
TP	9	Oxytropis microphylla	Oxytropis	Fabaceae
TP	9	Ptilotrichum canescens	Ptilotrichum	Brassicaceae
TP	9	Sibbaldianthe bifurca	Sibbaldianthe	Rosaceae
TP	9	Stipa tianschanica	Stipa	Poaceae
TP	10	Stipa tianschanica	Stipa	Poaceae

TP	10	Ajania fruticulosa	Ajania	Compositae
TP	10	Oxytropis microphylla	Oxytropis	Fabaceae