

Table S1 Understory vegetation characteristics of different vegetation types at different slope aspect. Values are in the form of the mean \pm standard error. Different capital letters indicate significant differences between slope aspects ($p < 0.05$), different lowercase letters indicate significant differences between the four vegetation types ($p < 0.05$).

Slope aspect	Land use	Site code	Dominated plant communities	Dominant herbaceous plant	Biomass height (m)	Richness	Biomass coverage (%)	Aboveground biomass (g m ⁻²)	Belowground biomass (g m ⁻²)	Litter biomass (g m ⁻²)
W	Degraded land	WDAA	<i>Artemisia annua</i>	<i>Potentilla chinensis</i> , <i>Artemisia annua</i>	0.24 \pm 0.02a A	0.71 \pm 0.0 4aA	20.11 \pm 6.8 8bA	55.94 \pm 3.52a B	26.48 \pm 4.39b B	54.49 \pm 4.42 dA
	grassland	WGAM	<i>Astragalus melilotoides</i>	<i>Astragalus melilotoides</i>	0.45 \pm 0.08a A	1.15 \pm 0.0 2aA	49.42 \pm 20. 53aA	270.88 \pm 56.1 1aB	39.19 \pm 22.50 aB	96.92 \pm 24.6 3cA
		WGCP	<i>Capillipedium parviflorum</i>	<i>Capillipedium parviflorum</i>	0.55 \pm 0.11a A	1.12 \pm 0.0 9aA	47.61 \pm 24. 66aA	253.4 \pm 30.09a B	73.92 \pm 17.54 aB	96.45 \pm 17.5 0cA
	shrubland	WSHR	<i>Hippophae rhamnoides</i>	<i>Artemisia sacrorum</i> , <i>Capillipedium parviflorum</i>	0.54 \pm 0.17a A	1.14 \pm 0.0 6aA	28.67 \pm 4.7 3bA	236.15 \pm 36.5 7aB	26.61 \pm 9.87b B	141.5 \pm 10.9 9aA
		WSCK	<i>Caragana korshinskii</i>	<i>Artemisia sacrorum</i> , <i>Capillipedium parviflorum</i>	0.67 \pm 0.39a A	1.13 \pm 0.0 2aA	30.94 \pm 17. 13bA	312.83 \pm 8.12a B	29.65 \pm 1.09b B	135.2 \pm 10.5 0aA
	Woodland	WWLG	<i>Larix gmelinii</i>	<i>Astragalus melilotoides</i> , <i>Artemisia sacrorum</i>	0.71 \pm 0.05b A	1.17 \pm 0.0 7bA	35.27 \pm 18. 32bA	268.23 \pm 30.2 1bB	76.71 \pm 6.07a B	122 \pm 7.99b A
		WWPS	<i>Pinus sylvestris</i>	<i>Astragalus melilotoides</i> , <i>Artemisia sacrorum</i>	0.63 \pm 0.14b A	1.11 \pm 0.0 4bA	32.67 \pm 13. 05bA	350.14 \pm 12.3 8bB	49.17 \pm 13.71 aB	113.46 \pm 7.4 3bA
N	grassland	NGAM	<i>Astragalus melilotoides</i>	<i>Astragalus melilotoides</i>	0.55 \pm 0.09a A	1.02 \pm 0.1 7aA	37.79 \pm 1.9 1aA	292.97 \pm 62.3 2aAB	62.75 \pm 20.67 aAB	95.08 \pm 31.9 0cA
		NGBI	<i>Bothriochloa ischaemum</i>	<i>Bothriochloa ischaemum</i> (L.) Keng	0.56 \pm 0.06a A	1.01 \pm 0.1 7aA	67.41 \pm 1.2 8aA	282.81 \pm 70.7 0aAB	79.76 \pm 12.14 aAB	89.55 \pm 13.0 9cA
	shrubland	NSHR	<i>Hippophae rhamnoides</i>	<i>Astragalus melilotoides</i> , <i>Potentilla chinensis</i>	0.72 \pm 0.06a A	1.2 \pm 0.11 aA	56.78 \pm 20. 08aA	305.83 \pm 19.1 1aAB	46.69 \pm 20.66 aAB	175.16 \pm 12. 81aA

		NSCK	Caragana korshinskii	Artemisia sacrorum,Capillipedium parviflorum	0.41±0.05a A	1.09±0.0 4aA	25.11±6.7 1aA	300.94±33.4 4aAB	43.08±8.75a AB	167.37±12. 24aA
	Woodland	NWLG	Larix gmelinii	Artemisia sacrorum,Capillipedium parviflorum	0.77±0.06a A	1.12±0.0 8aA	31.79±28. 25aA	295.86±32.6 4aAB	88.27±6.15a AB	140.2±16.1 0bA
		NWPS	Pinus sylvestris	Astragalus melilotoides	0.63±0.05a A	1.13±0.0 2aA	63.67±14. 98aA	411.27±49.2 6aAB	47.07±9.84a AB	130.38±14. 98bA
	grassland	SGAM	Astragalus melilotoides	Astragalus melilotoides	0.51±0.08b A	1.12±0.0 1aA	43.46±13. 38abA	304.11±14.5 6bAB	77.84±42.56 aAB	110.62±23. 76cA
		SGCP	Capillipedium parviflorum	Capillipedium parviflorum	0.42±0.15b A	1.18±0.0 9aA	40.55±12. 51abA	276.32±63.5 4bAB	76.38±49.01 aAB	108.54±6.0 2cA
	shrubland	SSHR	Hippophae rhamnoides	Artemisia sacrorum,Potentilla chinensis	0.66±0.12b A	1.19±0.1 1aA	28.33±18. 58bA	397.55±19.1 7aAB	56.71±6.77a AB	207.31±14. 62aA
S		SSCK	Caragana korshinskii	Capillipedium parviflorum,Lespedeza bicolor	0.41±0.05b A	1.1±0.03 aA	25.11±5.4 2bA	361.4±11.68a AB	47.7±7.11aA B	198.08±13. 97aA
	Woodland	SWLG	Larix gmelinii	Artemisia sacrorum	0.75±0.01a A	1.09±0.1 2aA	54.67±21. 36aA	317.5±20.12a AB	91.97±3.46a AB	149.14±12. 11bA
		SWPS	Pinus sylvestris	Astragalus melilotoides, Artemisia sacrorum	0.69±0.10a A	1.1±0.11 aA	60±17.58a A	459.27±38.9 2aAB	73.73±7.92a AB	138.7±11.2 7bA
	grassland	EGAS	Astragalus melilotoides	Artemisia sacrorum	0.54±0.12a A	0.9±0.06 aA	55.87±14. 29aA	337.29±56.7 4bA	109.63±18.7 1aA	106.87±15. 61cA
		EGSM	Astragalus melilotoides	Artemisia sacrorum	0.55±0.12a A	0.96±0.1 1aA	51.75±23. 80aA	350.39±37.6 8bA	103.14±3.28 aA	114.63±2.9 3cA
E	shrubland	ESHR	Hippophae rhamnoides	Artemisia sacrorum,Potentilla chinensis	0.7±0.24aA A	1.27±0.0 8aA	37.22±6.7 4aA	428.69±34.7 4abA	63.33±3.28c A	214.75±32. 17aA
		ESCK	Caragana korshinskii	Capillipedium parviflorum,Lespedeza bicolor	0.69±0.38a A	1.05±0.0 1aA	35.42±17. 95aA	414.61±34.5 8abA	49.49±13.33 cA	205.19±30. 74aA

Woodland	EWLG	<i>Larix gmelinii</i>	<i>Artemisia sacrorum</i>	0.77±0.11a A	1.03±0.2 5aA	40.1±12.9 0aA	364.47±53.4 2aA	92.56±5.59b A	152.01±9.1 7bA
	EWPS	<i>Pinus sylvestris</i>	<i>Astragalus melilotoides</i>	0.6±0.15aA	0.9±0.22 aA	59±13.89a A	552.13±32.9 7aA	73.8±13.84b A	141.37±8.5 3bA

Table S2 Soil characteristics of different vegetation types at different slope aspect. Values are in the form of the mean ± standard error. SWC: soil water content; SBD: soil bulk density; SOC: soil organic carbon; TN: text Normalization; TP: total phosphorus. Different capital letters indicate significant differences between slope aspects ($p<0.05$), different lowercase letters indicate significant differences between the four vegetation types ($p<0.05$).

Slope aspect	Land use	Site code	SWC (%)	BD (g cm ⁻³)	Clay (%)	Silt (%)	Sand (%)	pH
W	Degraded land	WDAA	0.08±0.03cC	1.63±0.03aA	10.25±0.23dD	9.12±0.12bB	80.63±0.32abAB	8.5±0.11aA
		WGAM	0.1±0.01bcC	1.58±0.01aA	13.63±0.09bD	5.22±0.17cB	81.15±0.14aAB	7.6±0.19bA
	grassland	WGCP	0.1±0.03bcC	1.66±0.03aA	13.19±0.09bD	5.52±0.17cB	81.29±0.14aAB	7.44±0.19bA
		WSHR	0.11±0.02abC	1.25±0.02bA	12.42±0.23cD	8.36±0.21bB	79.21±0.28bAB	6.97±0.07cA
	shrubland	WSCK	0.13±0.01abC	1.23±0.03bA	12.86±0.23cD	8.06±0.21bB	79.07±0.28bAB	6.99±0.07cA
		WWLG	0.12±0.01aC	1.26±0.02bA	20.11±0.34aD	18.77±0.43aB	61.12±0.77cAB	7.53±0.02bA
N	Woodland	WWPS	0.16±0.01aC	1.24±0.01bA	20.55±0.26aD	18.47±0.17aB	60.98±0.43cAB	7.55±0.02bA
		NGAM	0.1±0.03bBC	1.56±0.01aA	13.45±0.36bB	7.49±0.33bC	79.06±0.28bA	7.48±0.05aB
	grassland	NGBI	0.1±0.01bBC	1.63±0.13aA	13.01±0.36bB	7.79±0.33bC	79.2±0.28bA	7.33±0.05aB
		NSHR	0.12±0.04abBC	1.22±0.13bA	10.79±0.46cB	7.62±1.88bC	81.59±1.45cA	6.83±0.10bB
	shrubland	NSCK	0.12±0.02abBC	1.2±0.07bA	11.23±0.46cB	7.32±1.88bC	81.45±1.45cA	6.85±0.10bB
		NWLG	0.13±0.01aBC	1.25±0.07bA	18.38±0.08aB	28.19±0.28aC	53.43±0.29aA	7.48±0.05aB
S	Woodland	NWPS	0.16±0.01aBC	1.22±0.02bA	18.82±1.00aB	27.89±0.28aC	53.29±0.72aA	7.5±0.05aB
		SGAM	0.1±0.01bAB	1.53±0.02aB	14.73±0.22bC	4.45±0.39cB	80.82±0.61aB	7.35±0.04aC

	SGCP	0.11±0.02bAB	1.6±0.08aB	14.29±0.22bC	4.75±0.39cB	80.96±0.61aB	7.2±0.03aC
shrubland	SSHR	0.12±0.02aAB	1.21±0.08bB	11.56±0.09cC	8.03±0.15bB	80.42±0.24bB	6.56±0.04bC
	SSCK	0.13±0.01aAB	1.19±0.13bB	12±0.09cC	7.73±0.15bB	80.28±0.24bB	6.58±0.04bC
Woodland	SWLG	0.13±0.03aAB	1.24±0.13bB	20.09±0.23aC	29.93±0.29aB	49.98±0.13cB	7.29±0.05aC
	SWPS	0.16±0.01aAB	1.22±0.07bB	20.53±0.35aC	29.63±0.29aB	49.84±0.62cB	7.3±0.05aC
grassland	EGAS	0.11±0.01aA	1.34±0.11aB	13.44±0.13bA	6.55±0.12bA	80.01±0.01bC	7.16±0.02bB
	EGSM	0.11±0.02aA	1.41±0.12aB	13±0.13bA	6.85±0.12bA	80.15±0.01bC	7.01±0.01bB
E shrubland	ESHR	0.11±0.01abA	1.14±0.09bB	10.65±1.04cA	6.15±1.22bA	83.2±1.30aC	6.34±0.27cB
	ESCK	0.14±0.02abA	1.12±0.05bB	11.09±1.04cA	5.85±1.22bA	83.06±1.30aC	6.36±0.27cB
Woodland	EWLG	0.13±0.01bA	1.2±0.03bB	18.94±0.20aA	25.01±0.22aA	56.05±0.02cC	7.26±0.04aB
	EWPS	0.17±0.01bA	1.17±0.03bB	19.38±0.20aA	24.71±0.22aA	55.91±0.02cC	7.28±0.04aB

Profile figure 1-3



