

**Fig. S1.** Comparison of functional traits among different grassland types. a: variability between LA and the NPP of AM and DS; b: variability between SLA and the NPP of AM and DS; c: variability between LDMC and the NPP of AM and DS; d: variability between LN and the NPP of AM and DS; e: variability between LP and the NPP of AM and DS; f: variability between N/P and the NPP of AM and DS. AM represents alpine meadows; DS represents deserts steppe; ns represents the insignificant difference; and \* represents 0.01<P<0.05. SLA represents specific leaf area; LDMC represents leaf dry matter content; LN represents leaf nitrogen content; LP represents leaf phosphorus content; N/P represents leaf nitrogen and phosphorus ratio.



**Fig. S2.** Comparison of AM and DS with different climate factors. a: variability between MAT and the NPP of AM and DS; b: variability between MCMT and the NPP of AM and DS; c: variability between MWMT and the NPP of AM and DS; d: variability between MAP and the NPP of AM and DS; e: variability between ASD and the NPP of AM and DS; f: variability between MAE and the NPP of AM and DS. AM represents alpine meadows; DS represents desert steppes; ns represents no significant difference between them; and \*\*\*\* represents P<0.0001. MAT represents annual mean temperature; MCMT represents mean coldest monthly temperature; MWMT represents mean warmest monthly temperature; MAP represents average annual precipitation; ASD represents annual sunshine hours; MAE represents average annual evaporation.



Fig. S3. Comparison of different soil nutrient factors (soil N, soil P, and soil PH) between AM and DS. a: variability between soil N and the NPP of AM and DS; b: variability between soil P and the NPP of AM and DS; c: variability between soil pH and the NPP of AM and DS. AM represents alpine meadows; DS represents desert steppes; ns represents the insignificant difference between the two; and \*\*\*\* represents P<0.0001.

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