

This table lists the detailed taxonomic information for all 74 plant samples used in the $\delta^{13}\text{C}$ isotope and functional trait analyses, including Chinese name, Latin name, family and genus affiliation, and sample ID. The samples were collected from seven representative ecosystem types in the study area: Alpine meadow, Alpine steppe, Alpine shrubland, Temperate grassland, Desert shrubland, Halophytic meadow, and Cropland.

Each plant sample was numbered based on its ecosystem type and specific sampling context and treated as an independent individual in subsequent analyses. For plant species that occurred in multiple ecosystems, repeated occurrences were noted and separately numbered to reflect their responses under different ecological conditions.

All plant samples were collected from natural wild populations and identified in the field by researchers with a background in plant taxonomy. Species identification was based on authoritative botanical references, including *Flora of China*, *Illustrated Handbook of Major Grassland Types*, *Field Guide to Common Plants in Qinghai*, and other regional floras. As all samples were used for laboratory analysis, no physical specimens were retained. This is hereby noted.

Table S1 presents the taxonomic information of collected plant samples, while Table S2 summarizes duplicate plant species and their frequency of occurrence.

Table S1. Taxonomic Information of Collected Plant Samples

ID number	Family	Genus	Latin scientific name
N1	Poaceae	Triticum	<i>Triticum aestivum</i>
N2	Brassicaceae	Brassica	<i>Brassica napus</i>
N3	Poaceae	Hordeum	<i>Hordeum vulgare</i> var. <i>coeleste</i>
N4	Amaranthaceae	Chenopodium	<i>Chenopodium quinoa</i>
N5	Solanaceae	Lycium	<i>Lycium barbarum</i>
N6	Solanaceae	Solanum	<i>Solanum tuberosum</i>
GC02A	Tamaricaceae	Myricaria	<i>Myricaria squamosa</i>
GC02B	Poaceae	Leymus	<i>Leymus secalinus</i>
GC02C	Apiaceae	Pleurospermum	<i>Leymus secalinus</i>
GC02D	Fabaceae	Astragalus	<i>Astragalus membranaceus</i>
GC03A	Tamaricaceae	Myricaria	<i>Myricaria squamosa</i>
GC03B	Poaceae	Achnatherum	<i>Achnatherum splendens</i>
GC03C	Poaceae	Leymus	<i>Leymus secalinus</i>
GC03D	Asteraceae	Aster	<i>Leymus secalinus</i>
GC04A	Tamaricaceae	Myricaria	<i>Myricaria squamosa</i>
GC04B	Amaranthaceae	Kalidium	<i>Kalidium foliatum</i>

GC05A	Tamaricaceae	Myricaria	<i>Myricaria squamosa</i>
GC05B	Asteraceae	Artemisia	<i>Artemisia japonica</i>
GC05C	Fabaceae	Astragalus	<i>Astragalus membranaceus</i>
GC05D	Poaceae	Leymus	<i>Leymus secalinus</i>
GC05E	Iridaceae	Iris	<i>Iris loczyi</i>
GC06A	Asteraceae	Artemisia	<i>Artemisia desertorum</i>
GC06B	Amaryllidaceae	Allium	<i>Allium przewalskianum</i>
GC07A	Amaranthaceae	Haloxylon	<i>Haloxylon ammodendron</i>
GC07B	Poaceae	Leymus	<i>Leymus racemosus</i>
GC08A	Nitrariaceae	Nitraria	<i>Nitraria tangutorum</i>
CD01A	Cyperaceae	Kobresia	<i>Kobresia humilis</i>
CD02A	Cyperaceae	Kobresia	<i>Kobresia humilis</i>
CD02B	Cyperaceae	Blysmus	<i>Blysmus sinocompressus</i>
CD03A	Poaceae	Leymus	<i>Leymus secalinus</i>
CD03B	Rosaceae	Potentilla	<i>Potentilla sixianensis</i>
CD03C	Boraginaceae	Cynoglossum	<i>Cynoglossum amabile</i>
CD04A	Cyperaceae	Kobresia	<i>Kobresia humilis</i>
CD04B	Poaceae	Poa	<i>Poa annua</i>
CD05A	Juncaginaceae	Triglochin	<i>Triglochin palustre</i>
CD05B	Iridaceae	Iris	<i>Iris lactea var. chinensis</i>
CD05C	Poaceae	Poa	<i>Poa annua</i>
CD06A	Asteraceae	Saussurea	<i>Saussurea japonica</i>
CD06B	Poaceae	Phragmites	<i>Phragmites australis</i>
CD06C	Amaryllidaceae	Allium	<i>Allium przewalskianum</i>
CD06D	Asteraceae	Scorzonera	<i>Scorzonera austriaca</i>
CD06E	Poaceae	Leymus	<i>Leymus secalinus</i>
CD07	Poaceae	Phragmites	<i>Phragmites australis</i>
CY01A	Rosaceae	Potentilla	<i>Potentilla bifurca</i>
CY01B	Poaceae	Stipa	<i>Stipa glareosa</i>
CY01C	Fabaceae	Thermopsis	<i>Thermopsis alpina</i>
CY02A	Poaceae	Leymus	<i>Leymus secalinus</i>
CY02B	Polygonaceae	Polygonum	<i>Polygonum sibiricum</i>
CY02C	Amaranthaceae	Suaeda	<i>Suaeda glauca</i>
CY03A	Poaceae	Poa	<i>Poa annua</i>
CY03B	Poaceae	Roegneria	<i>Roegneria brevipes</i>
CY03C	Fabaceae	Thermopsis	<i>Thermopsis alpina</i>
CY03D	Poaceae	Leymus	<i>Leymus secalinus</i>
CY04A	Poaceae	Littledalea	<i>Littledalea racemosa</i>
CY04B	Poaceae	Leymus	<i>Leymus secalinus</i>
CY04C	Fabaceae	Oxytropis	<i>Oxytropis ochrocephala</i>
CY04D	Rosaceae	Potentilla	<i>Potentilla bifurca</i>
CY05A	Poaceae	Achnatherum	<i>Achnatherum splendens</i>

CY05B	Amaranthaceae	Salsola	<i>Salsola laricifolia</i>
CY05C	Tamaricaceae	Reaumuria	<i>Reaumuria soongarica</i>
CY05D	Asteraceae	Artemisia	<i>Artemisia scoparia</i>
CY05E	Fabaceae	Thermopsis	<i>Thermopsis alpina</i>
CY06A	Poaceae	Achnatherum	<i>Achnatherum splendens</i>
CY06B	Amaranthaceae	Kalidium	<i>Kalidium foliatum</i>
CY06C	Tamaricaceae	Reaumuria	<i>Reaumuria soongarica</i>
CY06D	Amaranthaceae	Salsola	<i>Salsola laricifolia</i>
CY07A	Poaceae	Achnatherum	<i>Achnatherum splendens</i>
CY07B	Amaranthaceae	Kalidium	<i>Kalidium foliatum</i>
CY07C	Nitrariaceae	Nitraria	<i>Nitraria tangutorum</i>
CY07D	Amaranthaceae	Salsola	<i>Salsola laricifolia</i>
CY08A	Poaceae	Achnatherum	<i>Achnatherum splendens</i>
CY08B	Amaranthaceae	Kalidium	<i>Kalidium foliatum</i>
CY08C	Tamaricaceae	Reaumuria	<i>Reaumuria soongarica</i>
CY08D	Amaranthaceae	Salsola	<i>Salsola laricifolia</i>

Note: Each plant individual was assigned a unique identification number during sampling to ensure accurate tracking and differentiation in subsequent analyses.

Table S2. Duplicate Plant Species and Their Frequency of Occurrence

Latin scientific name	Number of occurrences	Duplicate Count (Occurrences – 1)
<i>Leymus secalinus</i>	8	7
<i>Achnatherum splendens</i>	5	4
<i>Myricaria squamosa</i>	4	3
<i>Kalidium foliatum</i>	4	3
<i>Salsola laricifolia</i>	4	3
<i>Kobresia humilis</i>	3	2
<i>Poa annua</i>	3	2
<i>Thermopsis alpina</i>	3	2
<i>Reaumuria soongarica</i>	3	2
<i>Astragalus membranaceus</i>	2	1
<i>Allium przewalskianum</i>	2	1
<i>Nitraria tangutorum</i>	2	1
<i>Phragmites australis</i>	2	1
<i>Potentilla bifurca</i>	2	1