**Table S1** The summary of plant functional trait type and their data type

|  |  |  |
| --- | --- | --- |
| Functional trait type | Date type | Functional trait |
| Flowering period | Numerical | The month begins to blossom |
| Fruit ripening period | Numerical | The month of ripening fruit |
| Fruit type | Name | 1: Caryopsis; 2: Capsule; 3: Achene; 4: Silicle; 5: Nut; 6: Utricle; 7: Berry; 8: Legume; 9: Cremocarp; 10: Follicle; 11: Silique; 12: Cone |
| Growth form | Name | 1: Shrub (SH); 2: Sub-shrub (SS); 3: Perennial bunchgrass (PB); 4: Perennial rhizome grass (PR); 5: Perennial Sedges (PS); 6: Perennial forbs (PF); 7: Annual and biennials herbs (AB) |
| Inflorescence | Name | 1: Capitulum; 2: Spike; 3: Single; 4: Panicle; 5: Monochasium; 6: Raceme; 7: Dichasium; 8: Whorled Umbel; 9: Umbel; 10: Compound Umbel; 11: Compound Capitulum; 12: Corymb |
| Length of the flowering period | Numerical | Number of months of flowering |
| Life form | Name | 1: Phanerophytes (P); 2: Chamaephytes (C); 3: Hemicryptophytes (H); 4: Cryptophytes (Cr); 5: Therophytes (T) |
| Petiole | Binary data | 0: No; 1: Yes |
| Phyllotaxy | Name | 1: Alternate; 2: Base; 3: Opposite; 4: Fascicled; 5: Scattered; 6: Whorled |
| Single or Compound leaf | Name | 1: Single; 2: Compound leaf |
| Water ecotypes | Name | 1: Superxerophyte (SX); 2: Xerophyte (X); 3: Xero-mesophyte (XM); 4: Meso-xerophyte (MX); 5: Mesophyte (X) |
| leaf length | Numerical |  |
| leaf width | Numerical |  |
| plant height | Numerical |  |

**Table S2** Principal component analysis (PCA) results of paleoclimate climate change and current climate variables

|  |  |  |
| --- | --- | --- |
| **Variables** | | Component 1 |
| Present climate | AI | 0.71 |
| MAT | -0.71 |
| Cumulative (%) | 70.30 |
| Paleoclimate change | AMATmid | 0.62 |
| AMATlgm | 0.62 |
| AMAPlgm | -0.48 |
| Cumulative (%) | 64.67 |