**Figure S1**

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Fig. S1 spatial distributions of the 36 resampling sites (red dots) and major grassland types in the permafrost region of the Tibetan Plateau. Areas inside the black dotted lines are Qumalai county (northernmost) and Tanggulashan town (southernmost).

**Figure S2**

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Fig. S2 Livestock numbers recorded in Tanggulashan and Qumalai counties of the permafrost region from 2008 to 2018.

Table S1 Change in number of species per family between 2008 and 2018 in the permafrost region of the Tibetan Plateau. Δ Species number is change in total number of species, % is relative rate of change in number of species (ΔSpecies numbers/species numbers in 2008) in all sites. P values were conducted by t test of difference in species numbers between 2008 and 2018. \*, p < 0.05; \*\*, p < 0.01; \*\*\*, p < 0.001.

|  |  |  |  |
| --- | --- | --- | --- |
| Families | Δ Species number | （%） | P value |
| ***Forbs*** |
| Asteraceae | +28 | +32 | < 0.001\*\*\* |
| Scrophulariaceae | +19 | +83 | 0.005\*\* |
| Gentianaceae | +18 | +257 | < 0.001\*\*\* |
| Umbelliferae | +14 | +93 | < 0.001\*\*\* |
| Crassulaceae | +11 | +367 | 0.001\*\* |
| Papaveraceae | +10 | +500 | 0.003\*\* |
| Ranunculaceae | +9 | +56 | 0.027\* |
| Primulaceae | +8 | +30 | 0.088 |
| Brassicaceae | +6 | +22 | 0.245 |
| Liliaceae | +5 | +63 | 0.023\* |
| Caryophyllaceae | +5 | +42 | 0.134 |
| Rosaceae | +4 | +11 | 0.441 |
| Commelinaceae | +2 | +200 | 0.160 |
| Chenopodiaceae | +1 | - | 0.324 |
| Labiatae | +1 | +33 | 0.571 |
| Boraginaceae | 0 | 0 | 1.000 |
| Euphorbiaceae | 0 | 0 | - |
| Polygonaceae | -1 | -13 | 0.661 |
| Saxifragaceae | -1 | -33 | 0.324 |
| Campanulaceae | -1 | -100 | 0.324 |
| ***Legumes*** |
| Leguminosae | -7 | -10 | 0.070 |
| ***Sedges*** |
| Cyperaceae | +11 | +11 | 0.176  |
| ***Grass*** |
| Gramineae | +9 | +9 | 0.278 |