'Alpine meadows' of the Tibet Plateau are a synanthropic pseudoclimax

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Introduction Alpine meadows (Atlas of Tibet 1990) extent over the humid south-eastern half of the Tibetan Plateau covering ca . 450 ,000 km with 2-3 cm tall golf course-like Cyperaceae mats . The turfs of the endemic *Kobresia pygmaea* protect the headwaters of major Asian rivers against erosion , and are the most important rangelands for the Tibetan yak pastoralists . Their distribution ranges between 38°N and 28°N . They form the earth' highest plant communities (5960 m , Miehe 1989) and occupy south-facing pastures down to relative 800 m in the forest belt of the outer declivity of the Plateau . With respect to their large altitudinal range of nearly 3000 m and a latitudinal distribution of 1400 km the *Kobresia* pastures show a great uniformity in structure . They are widely believed to be natural (e .g . Song et al . 2004) despite the overall presence of livestock . We challenge this assumption .

Results and discussion The most elucidating feature is that the dominating species have their main above-surface phytomass beyond the grazing reach of large herbivores . The dominance of these small species is apparently grazing induced . Results from grazing exclosures in the southern and north-eastern highlands that we have maintained since 1997 and 2002 , respectively revealed that taller grasses emerging from a bud bank overgrow the Cyperaceae mats once grazing ceases (see Figure 1) .

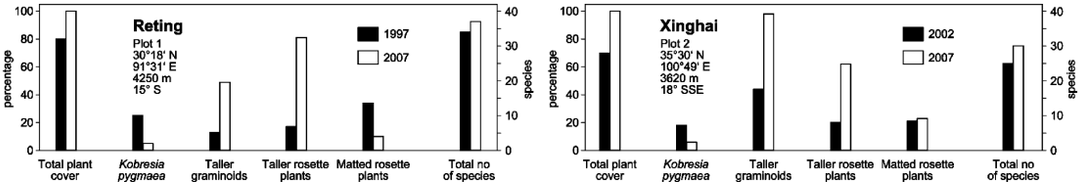

Figure 1 *Changes of grassland structure after grazing exclosure .*

Experiments in the Haibei Alpine Meadow Research Station (37°37′N/101°19′E , 3200 m) revealed that the relatively tall *Kobresia humilis-Festuca*-grassland is replaced by *Kobresia pygmaea* and rosette plants under increased grazing pressure . Reverse trends are experienced here as well : Controlled low stocking rates resulted in the recovery of taller forage plants while rosettes and cushions of grazing weeds disappear (Zhou et al . , 2005) . Palaeo-ecological findings of identified charcoal (Kaiser et al . ,2007) and pollen-analyses (Herzschuh et al . ,2006) support the conclusion that early pastoralists burned forests to get rangelands . It is , however , not clear whether forests were directly replaced by mats of *Kobresia pygmaea* . First ^{14}C datings of *Kobresia pygmaea*-bearing topsoils are available from 31°29′N/92°00′E (ca . 4500 m) and 30°04′N/86°56′E (ca . 5050 m) : Macroremains and pollen extracted from the turfs give evidence of a modern turf genesis . Bulk-soil datings from the lowermost part of the turfs have a Late Holocene age comprising the last c . 2000 years . The turfs result from the transformation of pre-existing topsoils comprising a secondary penetration and accumulation of roots (Kaiser et al . ,2008) .

Conclusions Palaeo-ecological investigations , surveys of forest relics , preliminary results of grazing exclosures and the dominance of certain plant life forms support our view that the Kobresia pastures are a synanthropic pseudoclimax replacing tall grassland and forests . The turf cover as well is grazing induced .

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