

Grazing effects on productivity and herbage quality of an Inner Mongolian steppe ecosystem

- Results of a four-year grazing experiment -

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Degradation and decreasing productivity patterns increasingly demand sustainable grazing management practices for Inner Mongolian rangelands. Therefore, the present thesis focuses the grazing-induced degradation process and analyse effects of sheep grazing over a gradient of seven grazing intensities. Seven grazing scenarios from ungrazed to very heavy grazed are analysed. We hypothesize that the Mixed System MS (annual alternating grazing and hay-making) compared to the Traditional System TS (grazing and hay-making on the same fields each year) allows higher stocking rates and slows down the degradation process. Vegetational and animal responses to grazing are analysed during short- and mid-term periods reflected by a two-year (2005-2006) and a four-year (2005-2008) experimental period, respectively. Generally, increasing grazing intensity reduces herbage mass regardless the experimental duration. In the short-term herbage accumulation may be positively affected by very light grazing but negatively effected by heavy grazing. Four-year dataset (2005-2008) rather suggest consistent negative effects of grazing on herbage accumulation with the strongest reduction of productivity on very heavily grazed treatments. Hence, grazing intensification negatively affects steppe ecosystem functioning including detrimental effects on litter accumulation and soil coverage. Nevertheless, the positive effect of grazing on relative growth rate suggests compensatory growth responses. Precipitation, however, is the most dominant factor controlling productivity and increasing precipitation leads to increasing grazing tolerance of the steppe. Grazing intensification negatively affects steppe ecosystem functioning due to the detrimental effects on litter accumulation and soil coverage.

Analysis of crude protein, in vitro digestibility, metabolizable energy, and fibre fractions shows consistent positive effects of precipitation and grazing on herbage quality. Sheep performance is strongly affected by the intensity of grazing. Live weight gains per sheep and per area seem to be maximised at light and at heavy grazing levels, respectively. High live weight gains per ha under heavy grazing reflect the current grazing management practice, seeking high area related outputs.

The mid-term analysis of two different grazing management systems shows higher efficiency of the MS. In particular herbage accumulation can be increased by the implementation of the MS. It is concluded that the MS is a feasible measure in order to sustain high production potential of forage/meat and ecosystem functioning of semi-arid grassland ecosystems in Inner Mongolia as well.