GRAZING EFFECTS ON SOIL MECHANICAL STRENGTH AND PHYSICAL FUNCTIONS IN INNER MONGOLIA, CHINA

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SUMMARY

Overgrazing has become over the last decades a major cause of grassland deterioration in Inner Mongolia, China leading to a decline in its productivity and carrying capacity. Among others, an intensified grazing has significant consequences for soil structure, soil mechanical strength as well as its functions. Furthermore, together with decline of soil functions also intensification of water and wind erosion as well as loss of nutrients in soil can be observed. In order to prevent further landscape degradation of Inner Mongolian steppe ecosystems as well as to evaluate a sustainable land management knowledge about the responses of ecosystem to grazing based on scientific research is needed. Furthermore, to understand the changes in environment due to grazing it is important to consider the response of different grassland ecosystems to overgrazing.

The investigations of impact of grazing on environment, in particular on soil mechanical strength and soil physical functions, were carried out under the MAGIM (Matter fluxes in grasslands of Inner Mongolia as influenced by stocking rate) project at the Xilin River Basin in Inner Mongolia, China. Two grassland ecosystems were investigated: *Leymus chinensis* (LCh) and *Stipa grandis* (SG), which are dominant grassland types in the semiarid area in Inner Mongolia. At each site different treatments were investigated: ungrazed since 1979 (UG79), continuously grazed (CG) at the SG site and winter grazed (WG) at the LCh site. An evaluation of soil physical properties was done for different depths, representing each soil horizon, using disturbed and undisturbed (soil aggregates and bulk soil) soil samples. The disturbed soil samples were used for measurement of particle size distribution, soil organic carbon content and contact angle; the soil aggregates were used in order to determine tensile strength, repellency index and to test an influence of repeated freezing and thawing on soil tensile strength; the bulk soil was used to determine water retention characteristics, bulk density, precompression stress under static and cyclic loading conditions, parameters defining soil compressibility, saturated and unsaturated hydraulic conductivities and air conductivity.

The results indicated changes in soil mechanical properties and soil functions related to influence of animal trampling and recovery of soil from grazing as well as different response of two investigated grassland ecosystems to grazing. The studies indicated strong interrelations between soil mechanical properties and soil functions. The results showed an increase in soil mechanical strength due to grazing on aggregate and bulk soil scale. Furthermore, it was shown that grazing causes a significant rearrangement of soil particles leading to homogenization and formation of a platy soil structure which is more pronounced the more often soil is loaded. Together with changes of soil strength also decline in soil functions could be proven as a result of destruction of continuity of soil pore network. Moreover, it was seen that grazing leads to more pronounced deterioration of soil structure as well as more intensive recovery from grazing at the LCh site compared to the SG site.