Effects of Grazing on Wind Driven Matter Fluxes in the Xilingele Grassland, Inner Mongolia

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Introduction Wind erosion and dust storms are common phenomena in the Xilingele region (Inner Mongolia) and contribute considerably to the redistribution of organic and mineral material in the ecosystem grassland . Fine material deposited by dust storms since long , which is reflected in the grain size distribution of the upper layers of the local loess soils . Activated by an increasing grazing pressure during the last decades , dust emission by local wind erosion had become an important opposing process . Still in the 1980s the Xilingele region was presented as one of the most representative and best-preserved grasslands of Inner Mongolia (Li et al . 1988) . Since the 1990s , land degradation induced by overgrazing had become very serious (Li et al . 1997) . The main functions of the grassland ecosystems consequently have become disturbed and the region is endangered to shift from a natural dust sink to a potential dust source . The objective of this study was to identify the effect of grazing intensity on the wind borne carbon and nitrogen flux .

Material and methods The measurements were made in the spring of 2005 and 2006 about 70 km to the south of the district capital Xilin Hot . Enclosures with defined grazing intensities were used and grouped in ungrazed (0 ewes per ha) , lightly grazed (< 1) , moderately grazed (1-2) and heavily grazed (> 2) . To identify the effect of grazing on the grass conditions the spatial distribution of vegetation height and plant coverage were measured within the enclosures . Dust emission and deposition were measured with MWAC poles (Modified Wilson And Cooke") and DDS (Dust Deposition Samplers") , which are common trap systems to quantify wind erosion (Zobeck et al . , 2003 ; Goossens 2005) . Up to 23 MWAC poles with four to five traps at heights between 13 and 140 cm and 13 DDS were placed in the enclosures . The C_{org} and N_t contents of the trapped dust were determined on a CNS 2000 LECO-Analyzer .

Results The sediment contents of C_{org} and N_t were similar in both years (on average 36 .2 mg C g^{-1} and 3 .37 mg N g^{-1}) and around 50 % higher compared to average soil contents . Thus , the C-and N-balance is determined by the balance of dust material or the intensity of dust storms , finally . The dust deposition of dust storm sediments at ungrazed sites was 2 -5 times higher than at heavily grazed sites . Local wind erosion was only measured at grazed sites , which were partly net dust emitters . The critical vegetation height , in which dust deposition and dust emission were in equilibrium , was between 4 and 9 cm (= moderate grazing) . Heavy grazing resulted in an annual loss of 17 -134 kg C_{org} ha^{-1} and 1 .5 -12 .4 kg N_t ha^{-1} . Lightly grazed sites gained 7 -40 kg C_{org} ha^{-1} and 0 .7-6 .6 kg N_t ha^{-1} per year . The largest matter gain was measured at ungrazed sites with up to 105 kg C_{org} ha^{-1} and 9 .8 kg N_t ha^{-1} per year . Caused by stronger dust storms in 2006 both , the dust deposition at ungrazed sites and the dust emission at heavily grazed sites were up to five times higher compared to 2005 .

Conclusions In the Xilingele region , grazing intensity has a major effect on the matter balance by wind erosion processes . Not only the loss of nutrients increased exponentially , but also the gain by dust storm sediments was significantly reduced with increasing grazing intensity . The annual variation of wind erosion processes showed that the processes could be much higher in very dry and windy years .

References

Goossens , D . (2005) . Quantification of the dry aeolian deposition of dust on horizontal surfaces : an experimental comparison of theory and measurements . *Sedimentology* , 52(4) , 859-873 .

Li , B . , Yong , S . , Liu , Z . (1988) . The vegetation of the Xilin river basin and its utilization . In : Inner Mongolia Grassland Ecosystem Research Station , 84-183 . Beijing . (Chinese with English abstract) .

Li , B . , Li , Q .F . , Yang ,C . (1997) . International Symposium on Grassland Management in the Mongolian Plateau . Beijing .

Zobeck , T .M . , Sterk , G . , Funk , R . , Rojot , J .L . , Stout , J .E . , Van Pelts , R .S . (2003) . Measurement and data analysis methods for field-scale wind erosion studies and model validation . *Earth Surface Processes and Landforms* , 28(11) , 1163-1188