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The influences of land use patterns on wind erosion of meadow grasslands

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Introduction More than half of the world's pasturelands are overgrazed and subject to erosive degradation (Pimentel *et al* . 1995) . Climate change and human economic activities in arid areas have increased the deleterious impacts of wind erosion (Shi P J *et al* .2004) . This study examined the effects of land-use patterns on the ability meadow grasslands to resist wind erosion .

Materials and methods The research site was located in Xieertala in Hulunbeier , which is located in the transition area between the west Daxinanling and the Mongolian Plateau . The grazing intensity in these pastures was related to the vegetation cover which was , in turn , related to the distance from the inhabited area . The vegetation cover of pasture at the following distances from the inhabited area :150m , 1000m , 2500m was 20% ,40% and 60% , respectively with corresponding grazing intensities considered as mild , moderate and severe . Croplands were also present within the meadow grassland at a distance of 1300m , where summer wheat was grown that was then tilled after harvest . In a representative point within each sample plot , we excavated a soil sample of a length , width and height of 95cm ,30cm ,20cm in October 2006 . A vegetation survey was conducted around each sample point of the meadow grassland , in August 2006 . The survey items included the vegetation cover , species composition and the aboveground biomass of various plant species .

Results As grazing intensity increased , the change of plant species and reduction of vegetation cover increased the potential for wind erosion of the soil . When the meadow grassland was mildly grazed , the vegetation cover maintained about 60% , which reduced the amount of soil erosion even at wind speeds of 25 m/s . When the vegetation cover of meadow grassland was reduced to less than 35% , soil erosion rapidly increased at lower wind speeds .

Table 1 *Effects of land using on the vegetation .*

Land using Patterns g/m^2	total of plant species	plant species inper square	cover meter	overground %	litter biomass g/m^2
mild grazing	49	23 .8±4 .7	63±5 .7	188 .55±57 .99	91 .47±31 .62
moderate grazing	48	18 .4±2 .8	42±6 .4	99 .20±11 .64	64 .63±17 .31
severe grazing	35	18±3 .5	22±5 .6	46 .75±14 .8	23 .61±8 .4
No-tillage cropland	0	0	0	0	0

Table 2 *Dominance of main plant species under different land using patterns .*

mild grazing		moderate grazing		severe grazing	
species	dominance	species	dominance	species	dominance
S .baicalensis	0 .21868	A .chinense	0 .4008	C .korshinskyi	0 .3599
A .chinense	0 .18298	C .korshinskyi	0 .1795	C .squarrosa	0 .2253
C . pediformis	0 .11203	C .squarrosa	0 .1093	P .turczaninovii	0 .0220
P .chinensis	0 .07208	A .laciniata	0 .0411	A .chinense	0 .0212

Table 3 *Relationship between land use and the rate of wind erosion under different wind speed . g . $(m^2 .min)^{-1}$*

Wind speed $m \cdot s^{-1}$	mild grazing	Moderate grazing	Severe grazing	No-tillage cropland
15	0	0	2 .03	2 .94
20	0	0 .88	3 .16	7 .21
25	0 .05	1 .56	9 .72	68 .12

Conclusions When the Hulunbeier meadow grassland is mildly grazed with vegetation cover maintained about 60% , the dominant species of the community are Stipa baicalensis and A .chinensis , and the vegetation system can maintain it's integrity against wind erosion . The mild grazing is , therefore , a sustainable land utilization mode . Correspondingly , the other land utilization modes in the experiment can cause serious wind erosion , especially in the no-tillage cropland within the meadow grassland . As the no-tillage cropland has reduced vegetation the soil wind erosion rates achieve 682 .1kg/hm^2 when the wind speed is 25 m/s , which approaches the average formation quantity of soil (1000kg/hm^2) in a year .