Water Fluxes in the Xilin River Catchment, Inner Mongolia, at Different Scales

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The 21st International Grassland Congress / 8th International Rangeland Congress took place in Hohhot, China from June 29 through July 5, 2008.

Proceedings edited by Organizing Committee of 2008 IGC/IRC Conference

Published by Guangdong People's Publishing House

Presenter Information

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Key words : hydrological modeling , catchment hydrology , steppe grasslands , overgrazing

Introduction Degradation of grasslands caused by overgrazing can heavily influence hydrological processes and can thus have a strong impact on other ecosystem functions .Within the work of the Research Unit MAGIM Matter fluxes in grasslands of Inner Mongolia as influenced by stocking rate" the hydrology of the Xilin river catchment in the continental Inner Mongolian steppe is examined from plot scale to catchment scale with the aim to characterize the crucial hydrological processes in this area and to point out how overgrazing and grassland degradation alters them .

Materials and methods On the plot scale experiments were carried out to examine soil physical properties and to quantify soil moisture following a geostatistical sampling scheme .Eddy covariance was used to record water fluxes on the site scale .On the regional scale research focuses on catchment hydrology by nested catchment sampling .At this scale various techniques are applied .Discharge measurements were carried out in different parts of the Xilin river .Mean residence time (MRT) of waters in the relevant hydrological compartments will be determined by sampling of 2H and 18O isotopes in precipitation , groundwater and surface waters .End member mixing analysis (EMMA) is used to interpret the geographic source of stream water by determining the characteristic composition of its solutes .Furthermore groundwater monitoring of wells throughout the whole catchment and in a measuring field site is used for chemical analysis of the groundwater and for quantifying the role of the groundwater in catchment hydrology .Experiments and investigations were carried out on specifically set up experimental plots , representing various grazing intensities , as well as in pristine areas throughout the whole catchment .Process oriented modelling is applied on all scales in order to increase process understanding as well as to develop scenarios of possible water budget changes .

Results For soil physical properties a strong effect of grazing could be shown due to increased mechanical stress under higher grazing .In terms of soil moisture a slight trend indicating decreasing soil moisture contents could be detected while the grazing intensity was increasing .The total amounts of soil water content differed only little .Also in the case of evapotranspiration no pronounced differences between areas of different grazing intensities could be found .We conclude that clear differences exist in terms of the processes that are involved in the partitioning of water fluxes , i .e .interception , transpiration , evaporation and infiltration .On sites of a higher grazing intensity the vegetation density decreases , thus the evaporation gains more importance compared with transpiration .These field observations could be successfully simulated using field scale deterministic modelling approaches .Hydrological investigations on the catchment scale revealed that discharge is not only generated by precipitation and surface runoff but must be the product of various processes in which precipitation stored as snow , snow drift and the lateral flow on frozen soil layers towards the river might play an important role .First uncalibrated simulations utilizing a catchment scale model show that especially spring snow melt as well as peak flows in summer are biased compared to observational data from the Xilinhot gauging station .Nevertheless , the model captures the overall winter and summer characteristics .The preliminary results suggest that adjustments in the snow subroutines as well as changes in surface properties are needed .The results also underscore the importance of further precipitation observations throughout the catchment to better capture the spatial variation in the meteorological input .

Acknowledgement We are grateful to the Deutsche Forschungsgemeinschaft (DFG) for their generous funding of the research unit MAGIM" .