Terrain Analysis and Digital Soil Mapping in the Xilin River Catchment, Inner Mongolia

Benjamin Blank
Justus-Liebig-University of Giessen, Germany

Frauke Barthold
Justus-Liebig-University of Giessen, Germany

Thomas Lendvaczky
Ingenieurbuero Feldwisch, Germany

Lutz Breuer
Justus-Liebig-University of Giessen, Germany

Hans-Georg Frede
Justus-Liebig-University of Giessen, Germany

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

Terrain analysis and digital soil mapping in the Xilin river catchment , Inner Mongolia

Benjamin Blank[1] , Frauke Barthold[1] , Thomas Lendvaczky[2] , Lutz Breuer[1] and Hans-Georg Frede[1]
[1] Justus-Liebig-University of Giessen , Heinrich-Buff-Ring 26 , 35392 Giessen , Germany , E-mail :Benjamin .Blank@ agrar . uni-giessen .de ,[2] Ingenieurbuero Feldwisch , Hindenburgplatz 1 , 51429 Bergisch Gladbach , Germany

Key words : classification and regression trees , regionalization , soil type classification , steppe grasslands , overgrazing

Introduction The Xilin river catchment is located about 450 km north of Beijing in the continental Inner Mongolian steppe . The upper catchment comprises an area of roughly 3 .600 km , which is exposed to heavy degradation because of overgrazing by sheep and goat . Information in terms of regional distribution of soils is scarce . For their ongoing work the Research Unit MAGIM Matter fluxes in grasslands of Inner Mongolia as influenced by stocking rate" requires a most recent basis of such information i) to link pedological information to landscape and topographical properties ii) to have information on soil texture for further investigation of landscape scale hydrological properties and erosion potential iii) and to be able to point out pedological units for modelling , scenario analysis , remote sensing campaigns and regionalization .

Materials and methods The generation of the digital soil map for the Xilin river catchment comprises three working phases i) selection of sampling points ii) sampling campaign in the field iii) generation of the soil map . For the selection of sampling points 10 ecological units in total were classified on the basis of a land use classification and a topographical distinction using a Geographical Information System (GIS) . For this purpose six land use classes were derived from a Landsat image of the catchment area from August 2005 . These include bare soil , sand dunes , steppe , marshland and water , mountain meadow and arable land . Furthermore the most abundant land use classes sand dune , mountain meadow and steppe were sub-divided into topographic classes . Therefore the compound topographic index (McBratney et al . 2003) was used as a measure of topographic control on hydrological processes . For soil sampling in each class three sampling points were selected to perform a soil classification by digging of soil pits . Additionally 10 samples in each class were taken with a Puerckhauer auger . Sampling points were randomly spread over the ten classes . To avoid clusters of sampling points , which were likely to occur in classes of little spatial extension , the random distribution was supervised . For the generation of the soil map regionalization of pedological information will be done by classification and regression trees (Breiman et al . 1984) . This method allows identifying relationships between landscape features and soil properties so that soil information from the sampling points can be transferred to places with similar landscape features .

Results Terrain analysis resulted in the development of a sampling scheme for the pedological investigations . First results of the sampling campaign in 2007 show the distribution of soil types throughout the upper catchment . As expected Kastanozems are widely spread in this area . They are predominantly found in the in the land use class steppe . However , even some of the soils at sand dune sites , which were thought to show only little soil formation can be classified as Kastanozem . Regosols are another typical soil type for this class . The land use class bare soil , which is characterized by little or no vegetation , shows a similar distribution of soil types as the sand dune classes . Kastanozems and Regosols are most common , also hybrid forms can be found in which Kastanozems and Regosols are associated . Gleysols are mostly found at sites in vicinity of the Xilin river , which are connected to the groundwater . They can also be found in small valleys or depressions where sub-surface waters from neighbouring areas collect . The richest soils are found in the land use class mountain meadow . Pedogenetic conditions here are most favourable and lead to the formation of chernozems with deep humic Ah horizons .

Acknowledgement We are grateful to the Deutsche Forschungsgemeinschaft (DFG) for their generous funding of the Research Unit 536 MAGIM" .

References

Breiman , L . , Friedman , J . , Olshen , R . et al . , (1984) . Classification and Regression Trees . Pacific Grove : Wadsworth .
McBratney , A .B . , Mendonca Santos , M .L . and Minasny , B . , (2003) . On digital soil mapping . Geoderma 117 , 3-52 .