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Digital Soil Mapping of the Kharaa basin

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1. Introduction

This work should be one further step acquiring a more detailed soil database including physical soil properties which will be essential for further environmental modeling approaches and decision support making.

Methodologies of soil mapping developed in either country by member in cooperation with Russia and Mongoliaor basic soil map of our studying are that produced in between 1978-1981 years. Although this soil map had information of soil ue ts, genus, about how soiuse insoiland, it did not have specific data, properties of soil characters sone of the best availababa-guides were methodologies of soil landscape mapping of the Mongolia and Russia. Soil mapping standards were not developed before in Mongoliaor produced only many soil map of small scale. But these maps were not any properties either above 1:1,000,000 scale.

The adapted working method could be used for future investigations to support soil mapping and soil surveys.

The major goals of this study are:

* to produce a digital soil map of the Kharaa river basin
* to identify potential data gaps and general constraints of this method
* to communicate the results and techniques of the 'Digital soil mapping' towards soil science community and data users

The Soil Mapping survey in the Kharaa watershed evolved from the methodologies of Mongolia that were developed in cooperation with the MOMO project and Institute of Geography, MAS (Mongolian Academy of Sciences).

2. Data

2.1 Soil data and auxiliary information

Soil mapping in general requires (i) a predefined model of soil formation, (ii) data on soil properties and on other environmental variables that have significant impact on soil formation and thus on the spatial distribution of the soil properties. By this study, we determined that traditional soil mapping and DSM do not differ much. In the Kharaa basin, 70 percent of all profile did not have soil profile positions or soil properties at a given location depend on their geographic position and also on the soil properties at neighboring locations. This fact was utilized by geostatistics and GIS programming which were predicted soil properties of a studying site from known observations neighboring the point.

Soil profile observations are typically the most valuable part of soil survey and they represent the major input into the soil spatial inference system. But some soil characters were missing while we were collecting a soil data. Soil profile data is directly to interpolate that is not good. Namely the results of interpolation can be often poor when non-representative profiles are used to characterize areas. So Gaps data and window with voids were found by PEDOTRANSFER.

2.2 Auxiliary sources of soil-related information

Typically, there are four major groups of the auxiliary information: climate, organism, relief, parent material and time. McBratney et al. (2003) further added to this list the geographical location of the soil profiles and the available soil properties that show correlation with the ones to be estimated. In 2005 years, Dr.Batkhishig.O and Iderjavkhlan.S estimated relationships between soil properties and landscape (Surface factors) within Huvsgul project (WORLD BANK, GEF) or by this estimation, in forest steppe zone, we tested approaches that to calculate a soil properties from elevation, aspect and slopes.

We used the the regression-kriging model or used to interpolate soil variables from profile observations using auxiliary information.

In study, we used three types of soil auxiliary information (in statistical terms 'predictors'): (a) remote sensing images; (b) topographic information and (c) thematic maps interesting for soil mapping.

3. Methodology

The soil maps were produced at a scale of 1:250 000 and the map units were established on the basis of reoccurring patterns of physical features related to the degree of 'brokenness' of the land, soil texture, soil depth and moisture regime. However the criteria classes were modified for use in our study to accommodate firstly the scale of mapping. We used a empirical and physical methodologies for this studying. Mapping methodologies is that predicted point data, then it was gone into raster dataset (Figure 1).

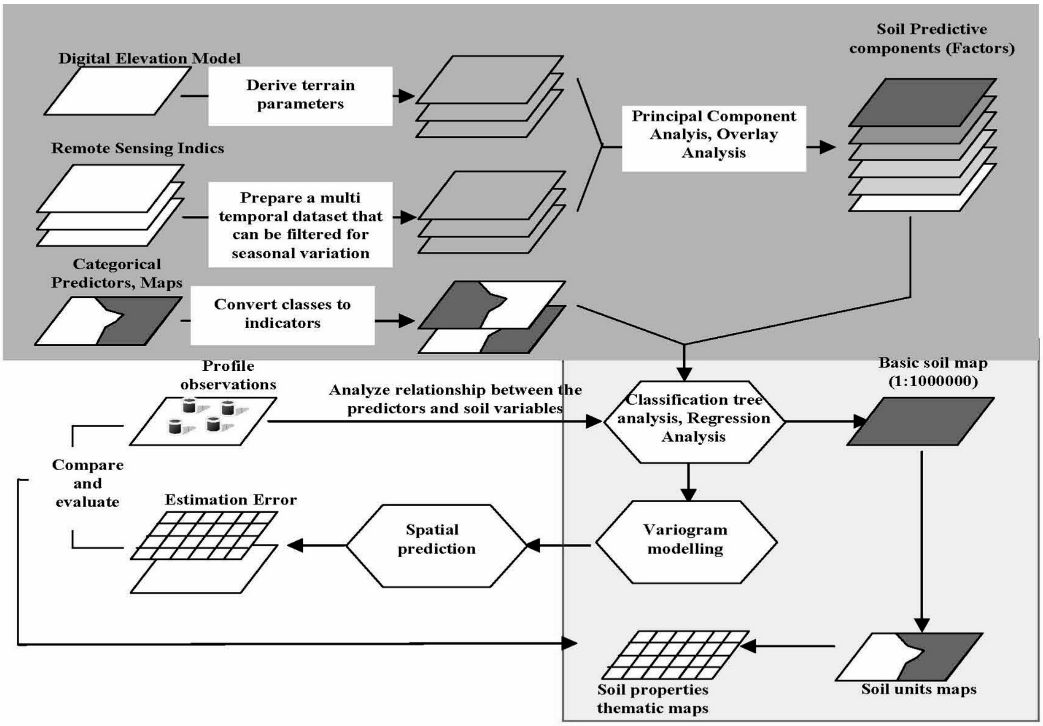

Fig. 1. This flow diagram used to make a digital soil mapping or to interpolate soil variables from profile observations using auxiliary information (IDERJAVKHLAN.S 2008)

The criteria (Soil predictive components) classes finally chosen were:

* Deposit : mode of deposition of parent material; fluvial (alluvial), eolian, glaciofluvial, glaciolacustrine, morainal and organic
* Natural zone, landcover : surface expression; level, inclined, undulating, rolling, hummocky, ridged
* local relief: 15 - 600 m (12 class)
* clay content (0-255 color, 5 class)
* moisture regime , NDWI : (0-255 color, dry, fresh, moist, wet)
* drainage: rapid (includes very rapid), well (includes moderately well), imperfect, poor (includes very poor)
* etc.

We had written a total 11 criteria using auxiliary sources and properties of soil data.

4. Results

4.1 Soil correlation

In the first step, the soil groups of the Soil Map of Mongolia were correlated with the soil units of the legend of the FAO Soil Map of the World (SMW) (FAO-2006) and the Soil Taxonomy (ST) (USDA, 1999). Furthermore, all soil datas of the original Mongolia were described by attributes, diagnostic horizon according to the FAO Revised Legend and the Soil Taxonomy. In the second step, neighboring soil mapping units were combined to fit the 1:5 million scale, when containing genetically, morphologically, and analytically related soils. When appropriate, other relevant information was shown as soil phases.

Two main difficulties had to be addressed in creating soil texture attributes. The first dealt with differences in information on the soil texture shown on the Mongolia and that required by the FAO standards. The second difficulty relates to the differences in the definition of textural fractions in Mongoliaand the FAO. However, the differences are not too big and the general textural classes could roughly be correlated for practical tasks at this scale.

4.2 Mapping survey and Soil Map of the Kharaa watershed

The soil coverage presented for 1:250,000 soil map is a generalized version of the soil map of Mongolia at the scale of 1:1,000,000. The generalization procedure has passed through two types of aggregation: 1) generalization of the thematic content, and 2) a generalization of the mapping units or polygon geometry. But it could not be good. The generalization of the thematic content mainly deals with aggregation of soil classes presented in the map legend. But we had done only major soil groups of FAO and Mongoliaor did not finish a soil units and legend. Frequently, the process of scaling up soil information is based on vaguely defined arguments, like the notions of their representativeness, genetic unity, structure of land cover. The total soils number in the original soils map is 14. The revised and new generalized version contains 29 (Figure.2).

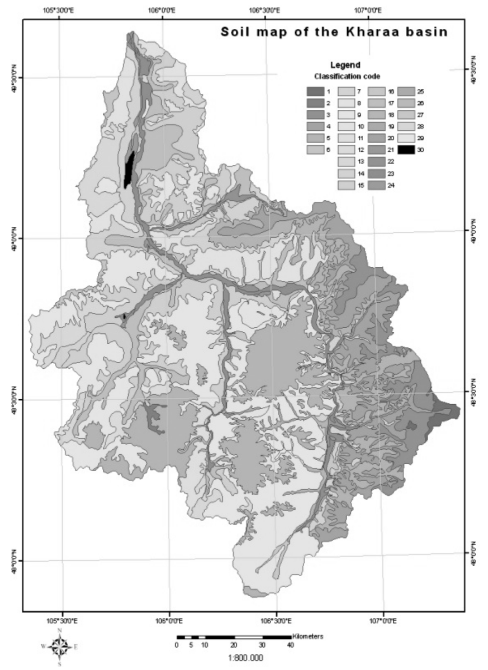

Fig 2. Revised soil map of Kharaa basin

4.3 Soil data survey reference in the Kharaa watershed

The objectives of this study are to collect soil survey information from the Kharaa study area, determine the soil types at the Kharaa river basins, and characterize the physical and chemical properties of the soils and to do digital soil mapping. 29 soil types representative of 88 soil profiles data in the North Mongolia were selected, and a detailed description of the soil profile at each of these soil types was made by predicted analysis. Soil profile information from different sources was collected from the horizons and collected, analyzed for bulk density, Nitrogen, pH, cation exchange capacity, and other chemical and physical properties, using Mongolian standard procedures.

5. Conclusions

Digital soil mapping is useful for various environmental issues related to soil, like soil degradation due to land management, soil capacities and its sensitivity to threats. So we pressy made the digital soil mapping in the Kharaa basin by reason which to save any time, cost and to be designed soil mapping in Mongolia. Even this studying works will not finish, it may be possible that to use a this maps or the input data should be then relevant to the purpose of the study.

We had made works as under :

* First version of soil map of the Kharaa basin

* Thematic maps of properties of soil characters in the Kharaa basin

* Designed a small Soil information system from soil profile data in North Mongolian

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