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Assessment of the land reclamation condition using environmental variables in Ellikkala district, Karakalpakistan

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I. Abstract

Adverse amelioration condition of irrigated lands is an increasing problem to maintain sustainable agricultural production. Conventional methodology in land reclamation condition (LR) assessment is based on qualitative analysis of information from: (i) network of piezometer wells (e.g., groundwater table and salinity) and (ii) sampling sites (e.g. soil salinity). This method has certain disadvantages in terms of the time, approach and cost required for objective assessment and interpretation of LR condition. Moreover, the LR condition is affected by variable environmental conditions and management factors such as soil texture, fertility, water availability, drainage density and so on, among others. How can the available data from different organizations be integrated? What are the relationships amongst the factors? These are major issues which are not easily resolved. It is, however, only through an integrated, multi-level, approach that both the land and water management and the existing interactions amongst the individual components of the landscape can be evaluated. Therefore, it is often advantageous to aggregate several indicators into an index allowing different factors to be taken into account simultaneously in order to monitor the state of the environment. In response to these problems, main goal of this study is to explore and review existing assessment methods used in Uzbekistan to assess and map land reclamation condition and find out environmentally sensitive areas, on which further land improvement measures can be taken. The soil (texture), land condition (groundwater table) and water availability (distance to the irrigation systems) have found as main factors effecting on LR condition throughout the study region. The simplicity of approach with available data allows to identify, combine and understand the influencing factors on LR condition for better management of the land and its resources.

II. Study Area

The study was conducted in Ellikkala district of Karakalpakistan, covering an irrigated area of approximately 90,100 hectares, located in the north-western part of Uzbekistan (**Fig.1**).

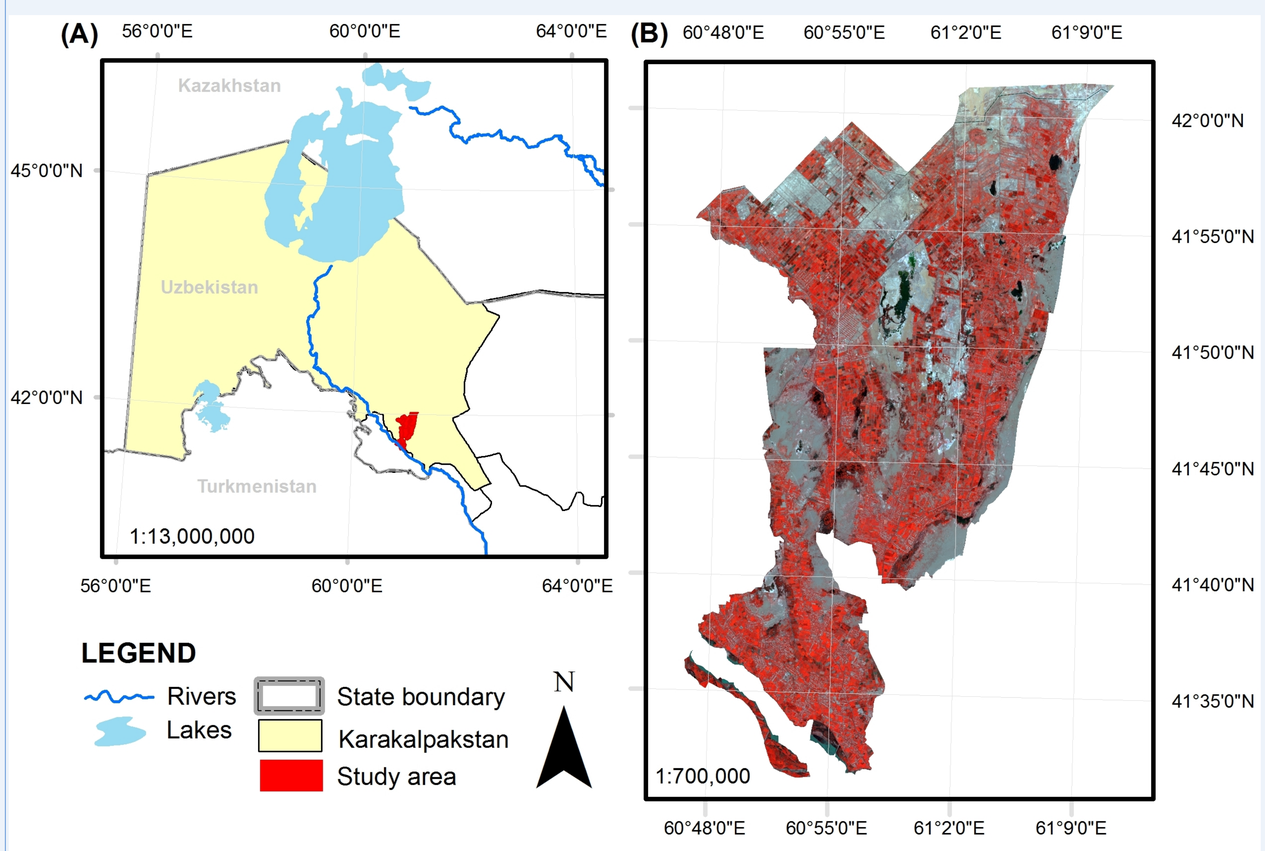

Figure 1: Location of Karakalpakistan region, Uzbekistan (A) and study area (B)
The displayed image (B) correspond to a color composite (bands 5–3–2) of Landsat-8 image acquired on 9-Aug-2015

IV. Results and Discussions

The low areas (11%) in terms of LR condition are found in the central and northern parts of the study area (**Fig.3**). These lands are not profitable to grow cotton, potato, legumes and pulses. Hence these crops need to be replaced into sunflower, corn and beet. The areas of medium condition and good condition comprise 70% and 7% of the total land area, respectively. The other parts (12%) of the study area belong to non-assessed class.

By noticing the evaluation of environmental factors, the soil (texture), land condition (groundwater table) and water availability (distance to the irrigation systems) have the intensive effect on LR condition throughout the study region.

The approach allows to identify, combine and understand the influencing factors on LR condition for better management of the land and its resources.

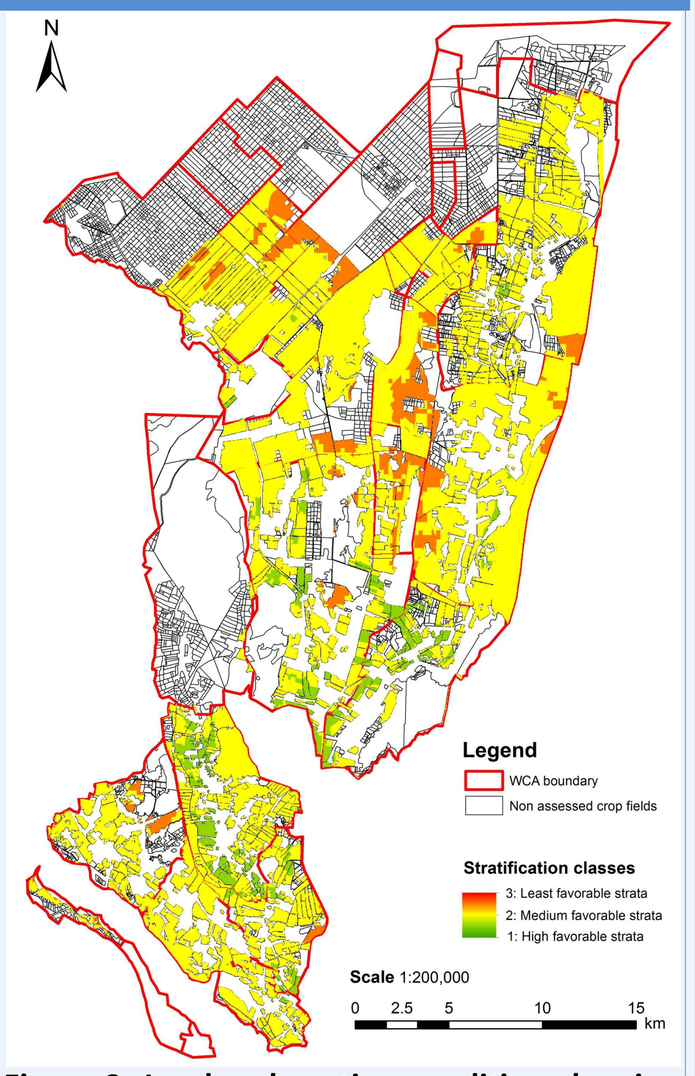

Figure 3: Land reclamation condition showing three different sensitivity classes

III. Data and Methodology

The GIS software, with available soil, vegetation, hydrological and infrastructure data (**Tab.1**) was employed to create thematic layers[1] and to assess land reclamation condition in Ellikkala district, Karakalpakistan (**Fig.2**).

Table 1: Source and scale of agro-ecological parameters used in GIS

#	Parameters	Scale	Year	Source of data	Remarks
1	Soil texture map with explications	1:25,000	2005	SRISSA	Scientific Research Institute of Soil Science and Agrochemistry (SRISSA), Uzbekistan
2	Soil bonitet map	1:25,000	1999	Goskomzem - SRISSA	State Committee of Land resources, geodesy, cartography and cadaster (Goscomzem) - SRISSA
3	Soil salinity map	1:25,000	2001-2003	ME	Melioration Expedition (ME), Khorezm branch
4	Irrigation network	1:25,000	2001-2010	SamAero-Geod	Samarkand Aero geodetic Enterprise of the Admin. Board of geodesy and cartography, 2001. (re-correction was done 2010)
5	Drainage network	1:25,000	2001-2010	SamAero-Geod	Samarkand Aero geodetic Enterprise of the Admin. Board of geodesy and cartography, 2001. (re-correction was done 2010)
6	Groundwater table map	GPS base coordinates	1990-2004	ME	Melioration Expedition (ME), Khorezm branch
7	Groundwater salinity map	GPS base coordinates	1990-2004	ME	Melioration Expedition (ME), Khorezm branch
8	Normalized differential vegetation index (NDVI)[2]	30 m	2013-2015	Landsat 8 OLI	Cloud-free Landsat 8 OLI archive data were acquired through EarthExplorer at http://earthexplorer.usgs.gov $NDVI = (R_{NIR} - R_{red})/(R_{NIR} + R_{red})$

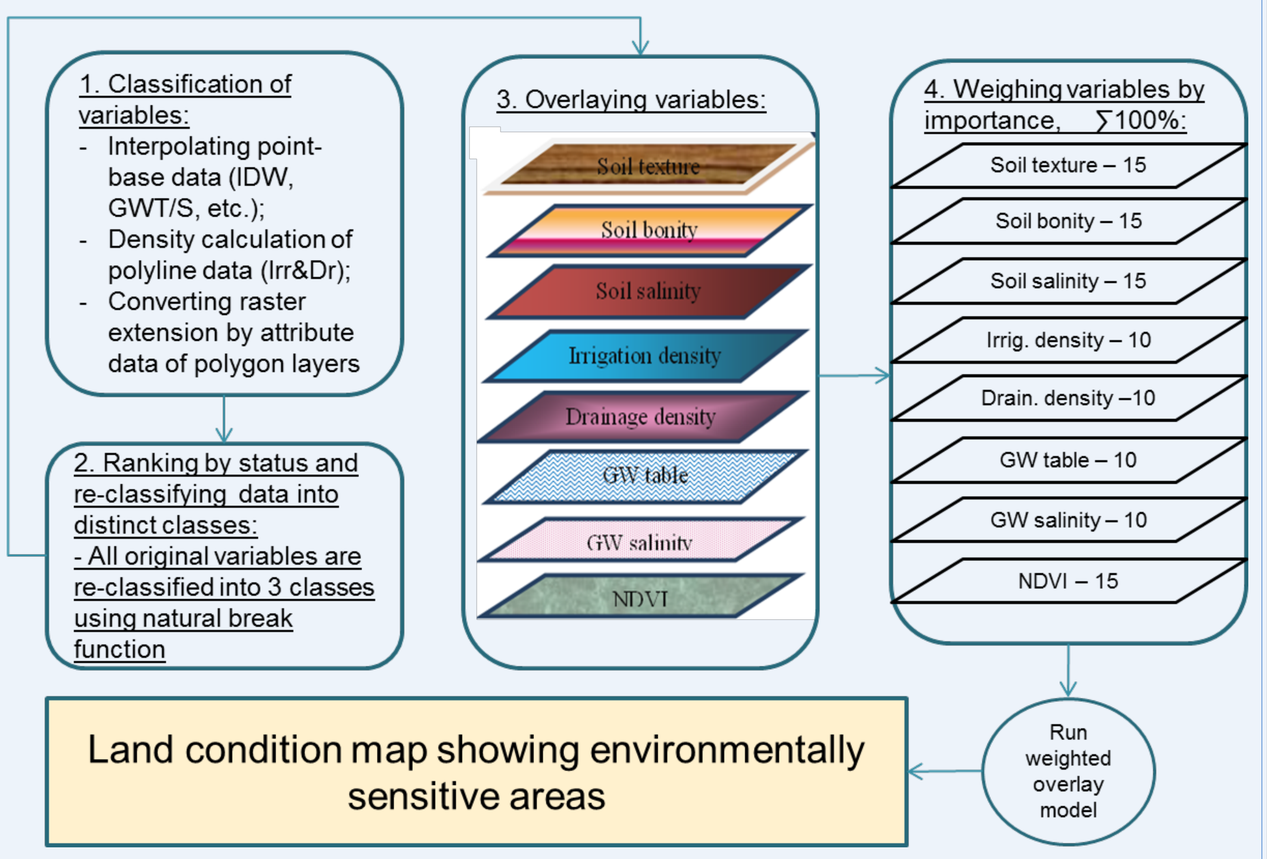

Figure 2: Flow-chart - mapping of thematic layers and the environmentally sensitive areas

V. References and Acknowledgements

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2. Rouse J.W., Haas R.H., Schell J.A., Deering D.W., 1973. Monitoring vegetation systems in the great plains with ERTS. In: Third ERTS Symposium, NASA SP-351, vol. 1, NASA, Washington, DC, pp. 309-317.

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