Land suitability map of agricultural areas in Khorezm region

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1. Land suitability map of agricultural areas in Khorezm region

1.1 Introduction

An attempt was made to assess the land condition while taking into consideration environmental and socio-economical parameters that could be drivers of ongoing land degradation processes. Many of these variables have spatial and temporal characteristics and can therefore be monitored through GIS-based tools thus contributing valuable information for assessing land degradation risk. By using an appropriate set of information such as spatial variability of water availability, ground water table depth and its salinity, soil type and its salinity, drainage density, distance and density of population, the land status can be described. The objective of this study was to evaluate the effectiveness of a multi-indicator base approach with the integration of GIS and remote sensing techniques and in turn select the most relevant indicators for assessing land suitability or degradation processes.

1.2 Methodology

The basic idea is to make use of environmental, infrastructural and socio-economic parameters indicating different but main characteristics of the region. These parameters are divided into 10 different degree categories according to a natural breaking method. These originate either from scientific knowledge (e.g. ground water levels critical for capillary rise) or from the data itself. The analysis of the histogram of all occurring values and when using the natural break function in GIS, the data sets could be grouped in ten categories. Overlaying all information in GIS will indicate the land suitability map.

a) Weighted overlay analysis of all parameters similar to Fritsch et al. (2014)
    a. Water availability of agricultural crop fields

Weighted overlay

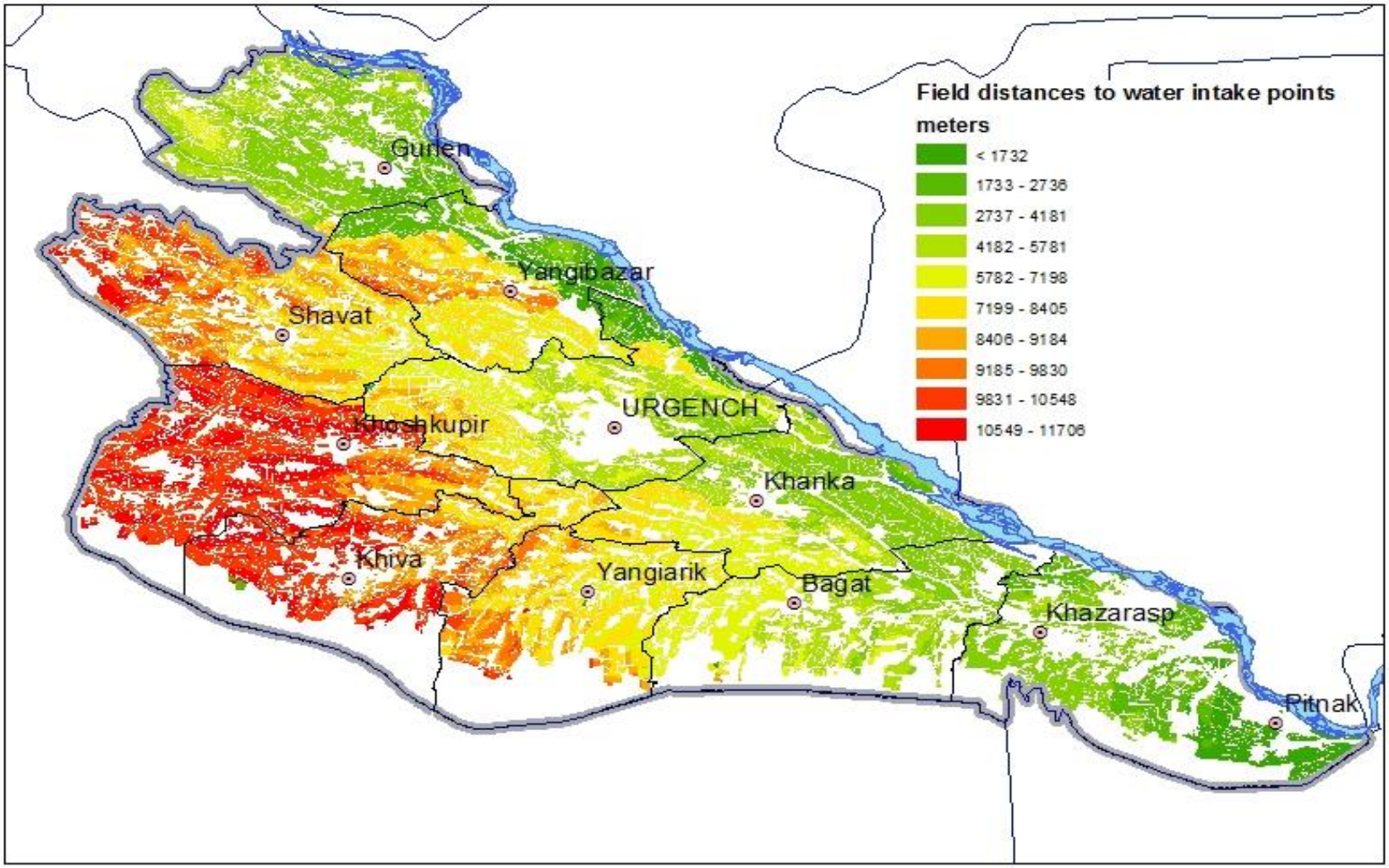
All variables were re-arranged (classified) into the three categories: low, medium and high. For this exercise, all occurring values were analyzed and with the employ of the natural breaking function used to categorize variables. The applied methods revealed the following classifications for each parameter in Kulavat region (Table 1). The table also shows the weights, which was used for the weighted overlay analysis.

Table 1: Natural break function applied to the Khorezm region and resulting classification

Parameters	Classification source	**High** Favorable 1-3	**Medium** Favorable 4-7	**Low** Favorable 8-10	**Weight**
Soil texture	ID	3-4	5-6	1-2	5
	GIS Re-class	1	2	3	
Soil bonity	ID	80-60	60-40	<40	25
	GIS Re-class	1	2	3	
Soil salinity	ID	<=1	2-3	4-5	10
	GIS Re-class	1	2	3	
Irrigation network	ID	3.05 - 7.1	1.07 - 3.04	0 - 1.06	10
	GIS Re-class	1	2	3	
Drainage network	ID	1.76 - 4.46	0.543 - 1.75	0 - 0.542	10
	GIS Re-class	1	2	3	
Groundwater level map	ID	1.61 - 2.79	1.37 - 1.6	0.652 - 1.36	15
	GIS Re-class	1	2	3	
Groundwater salinity map	ID	0.703 - 1.76	1.77 - 2.52	2.53 - 6.81	5
	GIS Re-class	1	2	3	
NDVI	ID				20
	GIS Re-class	1	2	3	

1.3 Results

Fig. 1. Water availability of crop fields based on combined horizontal and vertical distances of water intake point's classification map.



Ground water contribution and waterlogging risk

Fig. 2. Long term fluctuation of ground water table depth

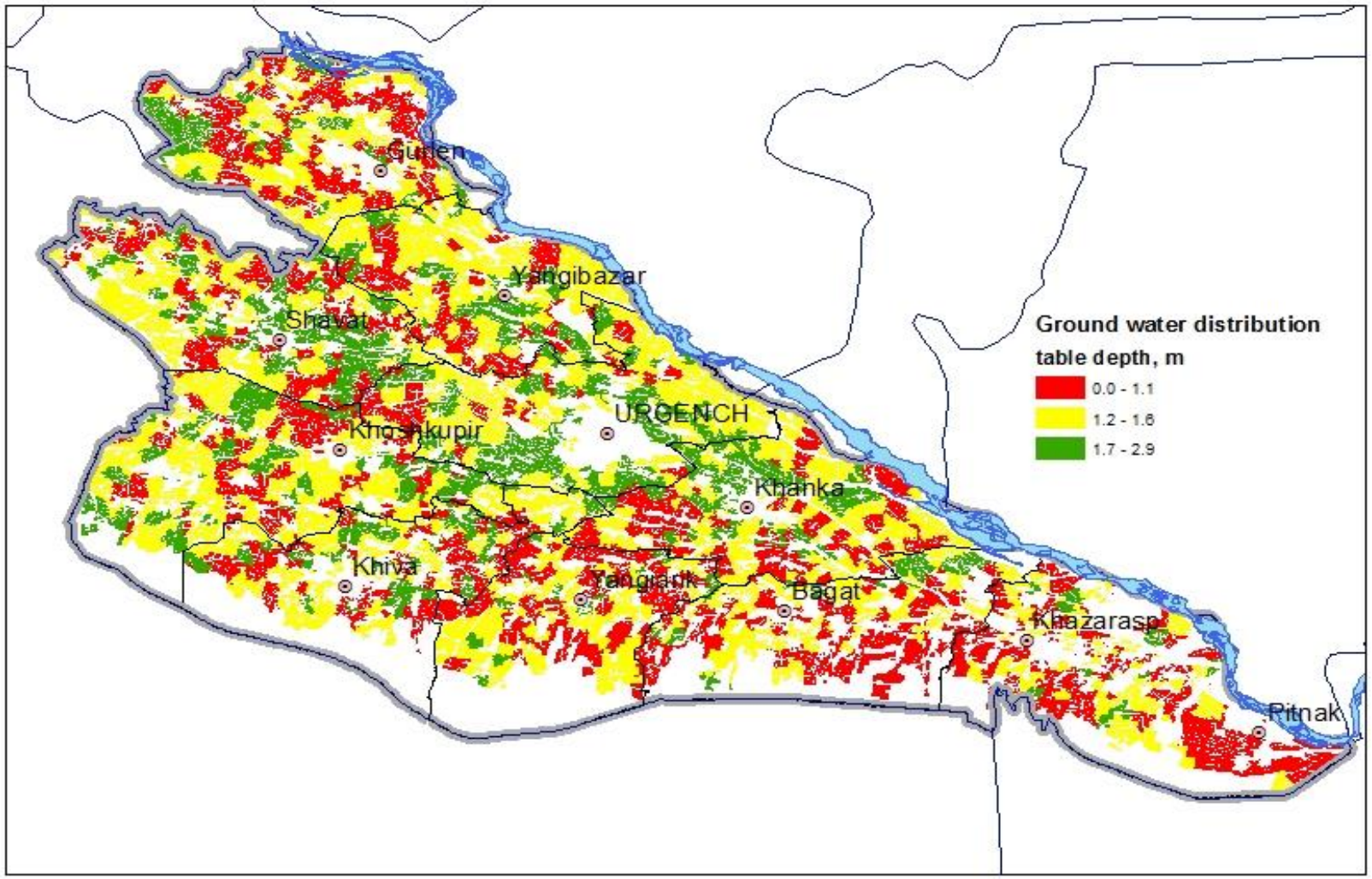
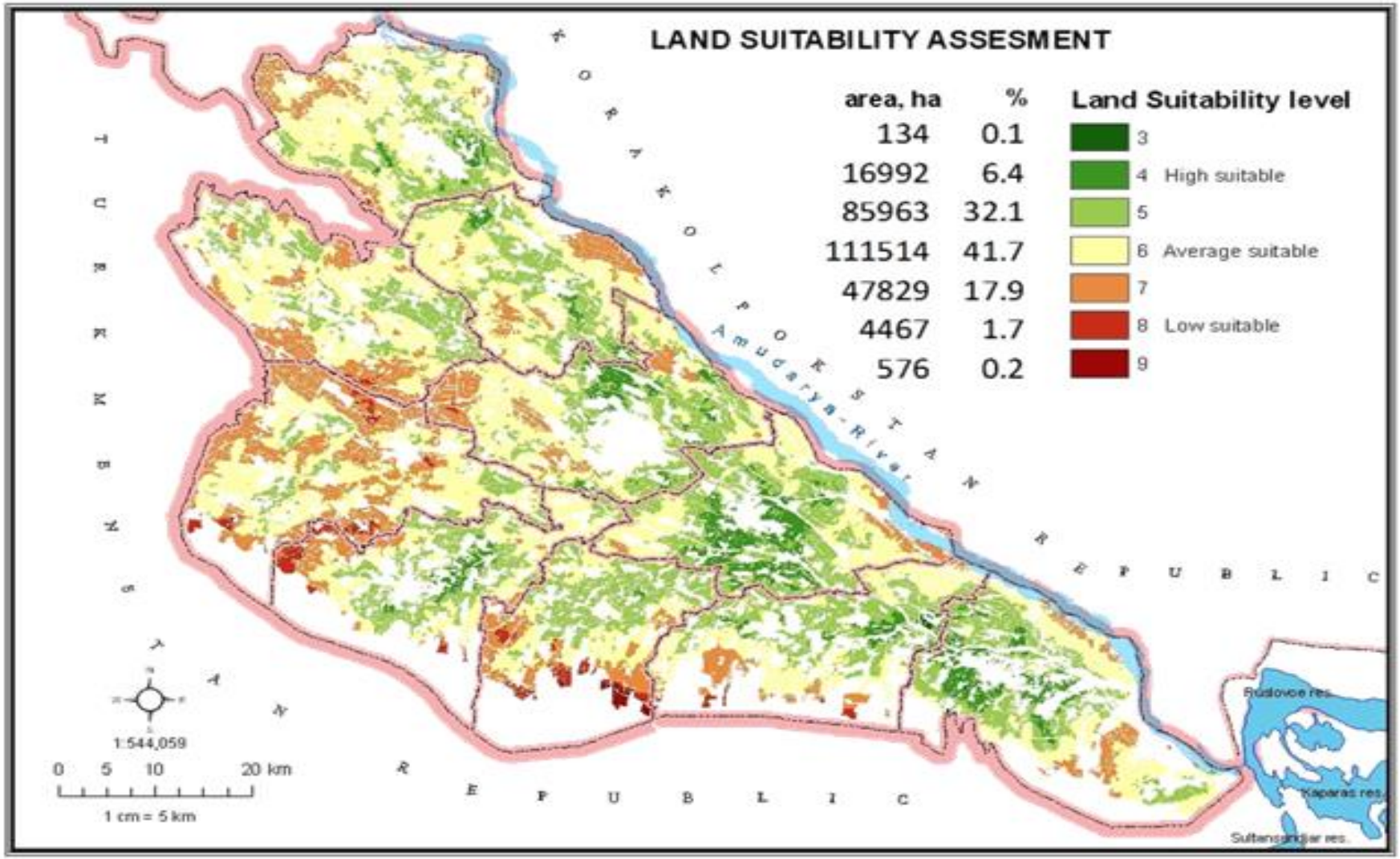


Figure.3. Land suitability assessment map based on table 1 given criteria.



1.4 Discussion

The land suitability map was developed by multiple criterias including environmental and socio-economical parameters such as soil texture and outreaches of irrigation networks, which were found as most relevant indicators that impact land degradation processes in the Khorezm region. Taking into consideration typical soil texture characteristics such as light soils, which has a low water holding capacity and known to be fast depleted from soil nutrients this is an indicator for low soil productivity. In terms of water availability of the irrigated areas, the outreaches of the irrigation networks along the desert at the southern and western parts of the region indicates low suitable lands for cropping as they highly depend, and more than other areas on water supply. In addition, minor spots of low suitable lands can be found along the river and in the eastern part of the region. These are caused by waterlogging typical for light soil textures and often at further distances from settlements. Indicator base assessment of intensive agricultural lands using by GIS base techniques favors to consider indicators on easiest way and provides more information that is reliable.