

# Land suitability evaluation for changing spatial organization in Urmia County towards conservation of Urmia Lake



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## ABSTRACT

One of the most effective ways to reverse the decline of Iran's iconic Urmia Lake is to directly confront the development patterns that have contributed to the current crisis. This study's objective is to create a model for conservation of Urmia Lake that identifies suitable lands for agricultural and residential development in Urmia County that are distant from Urmia Lake. This was accomplished through a Geographic Information System-based multi-stage process. The first step involved production of maps based on an initial assessment of the region's geography, geomorphology, landforms, and hazards potential. In the next step, all of the parameters were overlaid and land suitability maps were generated by using determinant maps. In developing the final map, the lands were divided into four classes for future development potential: highly suitable, suitable, marginally suitable and not suitable. The results showed that well away from highly populated regions adjacent to Urmia Lake, there are highly suitable and suitable lands that presently contain 14 and 8 percent of total settlements, respectively. The highly suitable and suitable lands, which cover 5.6 and 6.7% of the total area, may serve as appropriate axes for changing the traditional spatial organization of the region, redirecting future development and consequently decreasing ecological pressure on lands close to Urmia Lake as well as preventing further excessive usage of water resources in the region.

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## 1. Introduction

Urmia Lake, located in the northwestern part of Iran, has an area of approximately 6000 km<sup>2</sup> and contains 102 islands (in its pre-1999 condition). It is one of the great hyper-saline lakes of the world and the largest lake in the Middle East (Ghaheri, Baghal, & Naziri, 1999; Hassanzadeh, Zarghami, & Hassanzadeh, 2012; UNEP & GEAS, 2012). The lake, which is a national park, was added to the Ramsar List of Wetlands of International Importance in 1971 and designated a UNESCO Biosphere Reserve in 1976 (AGH, 2014; Manaffar et al., 2011; Marjani & Jamali, 2014; UNEP & GEAS, 2012). Urmia Lake is home to many faunal species, including a unique brine shrimp species (*Artemia Urmiana*), flamingo, ducks, pelicans, and mammals; it is also habitat for an array of vegetative species. In addition, the lake is a natural asset that has been considered unique in terms of ecological, environmental, cultural, economic, aesthetic, recreational, scientific and conservation values for many years (Abbaspour, Javid, Mirbagheri, Ahmadi Givi, &

Moghimi, 2012; Tourian et al., 2015; UNEP & GEAS, 2012). In recent years, Urmia Lake has experienced a rapid shrinkage. Satellite images reveal that the lake's area was 6100 km<sup>2</sup> in 1995 and has declined to 2366 km<sup>2</sup> in August 2011 (UNEP & GEAS, 2012), and then to 953 km<sup>2</sup> in August 2013 (AGH, 2014). Fig. 1 shows the changes in Urmia Lake's area between 1999 and 2014.

Various factors explain the drying up of Urmia Lake. Demographic developments, human activities and especially demand for water in farming lands near the lake are among the main factors causing the lake's shrinkage (Abbaspour et al., 2012; AGH, 2014; Dehghanzadeh, Safavy Hir, Shamsy Sis, & Taghipour, 2015; Fathian, Morid, & Kahya, 2014; Hassanzadeh et al., 2012; Kakahaji, Banadaki, Kakahaji, & Kakahaji, 2013; Madani, 2014; Tourian et al., 2015; UNEP & GEAS, 2012). This phenomenon is quite comparable to the case of the Aral Sea during the Soviet and post-Soviet eras ((Cai, McKinney, & Rosegrant, 2003; Conte, 1995; Gaybullaev, Chen, & Gaybullaev, 2014; Glantz, 2005; Kravtsova & Tarasenko, 2010; Levintanus, 1992; Lioubimtseva, 2015; Morimoto, Natuhara, Morimura, & Horikawa, 2005; Rafikov & Gulnora, 2014; Rifikov, Rifikova, & Mamadganova, 2014; UNEP & GEAS, 2014). In 1980, the total cultivated area within the Urmia Lake basin was 150,000 ha, but by 2007, it had increased to

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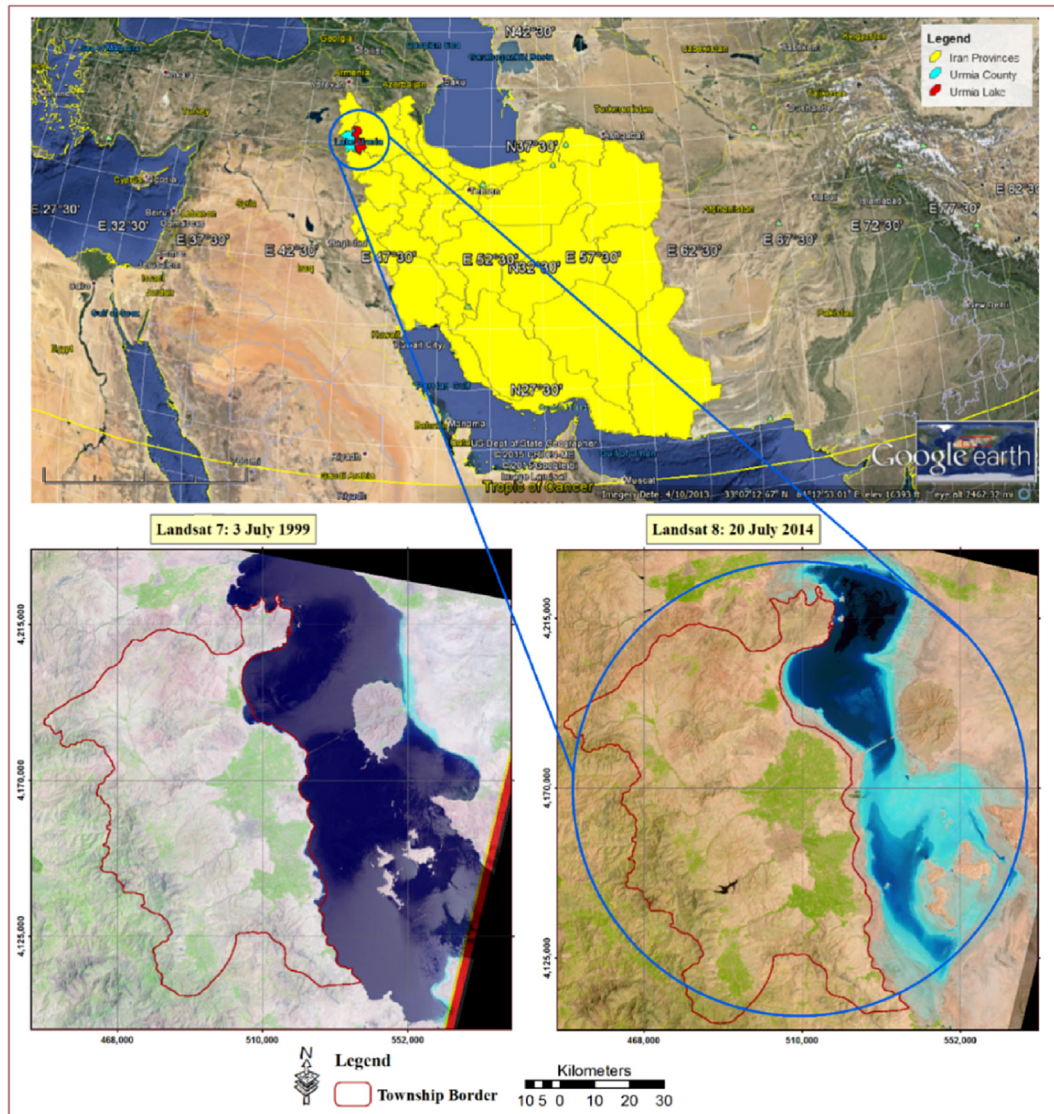


Fig. 1. Urmia Lake in 3 July 1999, 20 July 2014.

400,000 ha (TMU & CIWP, 2012). In short, the total area of cultivated lands has increased dramatically, nearly tripling in less than three decades. Consequently, during this period, the usage of water by the agricultural sector has increased from 1.8 billion cubic meters (BCM) to 5.5 BCM (Ibid).

The Urmia Lake watershed, with a total area of 51,876 sq<sup>2</sup> and a population of approximately 6.4 million, is an important agricultural region (UNEP & GEAS, 2012). One of the highly populated areas in this region is the eastern part of Urmia County. This area, which is located in the western portion of the Urmia Lake watershed, contains around 15 percent of the total cultivated lands in the watershed (TMU & CIWP, 2012). The population density of this area is approximately 621 persons per sq<sup>2</sup>, while it is less than 125 persons per sq<sup>2</sup> for the entire Urmia Lake watershed. In addition, approximately 511 million cubic meters (26 percent) out of 1959 million cubic meters of total groundwater withdrawals in the Urmia Lake watershed takes place in this area (UNDP/GEF, 2008). Also worth noting is that approximately 17 percent of surface water in the Urmia Lake watershed historically has flowed to Urmia Lake from sub-basins of Urmia County, but these waters no longer enter the Lake because of damming and creation of reservoirs (Marjani &

Jamali, 2014). This area is also considered the center of economic activity and agricultural development for Urmia County and the Urmia Lake watershed.

The overall aim of this study is to explore the changing spatial organization of Urmia County and examine alternative spatial organization strategies for conservation of Urmia Lake, such as proposing new areas for agriculture and housing development far from Urmia Lake, which would decrease the population concentrations in areas close to the lake.

In order to propose changes in the spatial organization of Urmia County, initial assessment of the region's geography needs to address this critical question: is there suitable land for future development outside of coastal areas of Urmia Lake that could attract people away from densely populated coastal areas? The present study assumes that there are suitable lands for development in such areas. In addition, it aims to identify and propose suitable lands outside of coastal areas as an alternative setting for the region's future development. Regarding the above assumptions, the issue of land is considered as the most important limitation and effective natural factor in reconfiguring spatial organization processes in the region.

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