

QUANTITATIVE MAPPING AND ASSESSMENT OF ENVIRONMENTALLY SENSITIVE AREAS TO DESERTIFICATION IN CENTRAL IRAN

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ABSTRACT

Desertification is one of the main environmental and also social and economic problems facing Iran. Seventeen out of 31 Iranian provinces, which are home to approximately 70% of the total population, are affected by desertification. This study aimed to use geographic information system (GIS) and fuzzy logic for mapping environmentally sensitive areas to desertification based on Mediterranean Desertification and Land Use approach in Isfahan province, central Iran. Six desertification indicators including climate, soil, vegetation, soil erosion, groundwater, and management and policy quality were used to determine various types of environmentally sensitive areas to desertification. Seventeen desertification indices affecting the quality of each indicator were spatially mapped and assigned a value between 0 and 1 using a fuzzy logic option of ArcSDM3 software in GIS environment. Results showed that a 21.7% of the study area was classified as critical, 70% as fragile and 5.5% as potential, and 2.9% of the area was not affected by desertification. In the town of Borkhar, 64.2% of the area was classified as critical, followed by the towns of Isfahan and Nayin with 40.2% and 31.8%, respectively. Results at provincial scale indicated that the climate indicator and humidity index with a weighting mean of 0.71 and 0.77 were the most affective factors in the desertification of the study area. The developed model in this study can be used for mapping desertification status in other 16 provinces that contain desert areas. These assessments provide a GIS-based desertification database that Iran as a member of the United Nation Convention to Combat Desertification can use to report the condition of desertification at national scale. Copyright © 2013 John Wiley & Sons, Ltd.

KEYWORDS: desertification; UNCCD; MEDALUS; GIS; central Iran

INTRODUCTION

Desertification is defined by the United Nation Convention to Combat Desertification (UNCCD) as 'land degradation in arid, semi-arid and dry sub-humid areas resulting from various factors, including climatic variations and human activities'. It occurs all around the world especially in dry lands, which cover about 41% (6,150 million hectares) of the land (Kassas, 1995).

Arid and semi-arid lands cover more than 70% of Iran and are very prone to desertification. Iran includes 31 provinces with a land area of about 1.64 million square kilometres and an annual temperature ranging from -20 to $+40^{\circ}\text{C}$. The amount of annual precipitation is approximately 1,200 mm in the north and less than 100 mm in the central regions (NAP, 2005). According to the land use/cover map of Iran; deserts, rangelands, agricultural lands, forests and residential areas cover 20%, 55%, 11%, 8% and 6%, respectively (NAP, 2005). Eco-climatic classification shows that 85% of Iran is stratified under dry land categories (Le Houérou, 1992). It is estimated that about 20% of the country has been affected by desertification processes (Pakparvar, 1998). According to the Bureau of Desert Affairs of Iran, 17 provinces have desert areas that are home to approximately 70% of the total population of the country. There are many causes for arid

land degradation, and they vary from one place to another. The main causes of desertification in Iran are water resource depletion, population pressure, excessive grazing, wrong management practices and climatic factors (NAP, 2005).

Iran was one of the first countries to sign the UNCCD in 1996 and became a member of the convention. Since then, several desertification assessment and monitoring projects have been conducted at different scales (Amiraslani, 2005), but the systematic spatial mapping based on scientific technique has not been carried out so far. Therefore, desertification status mapping of the entire country is needed.

Many models of desertification have been presented and applied for assessing and monitoring this phenomenon, and also their advantages and disadvantages have been discussed in previous studies (FAO/UNEP, 1984; Babaev, 1985; Vogt *et al.*, 2011). According to the results of the food and agriculture organization and united nations environment programme's (FAO/UNEP) model, about 70% of dry lands have been globally affected by desertification (UNEP, 1992). ICD is an Iranian Classification of Desertification (ICD) model that was developed by Ekhtesasi and Mohajeri in 1995 for assessing desertification in dry lands of Iran. The main advantage of this model is that it has been developed on the basis of natural and anthropogenic characteristics of Iran's deserts. The ICD approach classifies the severity of desertification to five classes: slight, low, moderate, severe and very severe. The results of applying ICD to parts of central Iran showed that about 75% of desertification in this region has been caused by anthropogenic factors (Ekhtesasi & Mohajeri, 1995).

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