Catena 167 (2018) 340–352

Contents lists available at ScienceDirect

Catena

journal homepage: www.elsevier.com/locate/catena

The spatial distribution of critical wind erosion centers according to the dust event in Hormozgan province (south of Iran)

Tayyebeh Morshedi Nodej[a], Maryam Rezazadeh[b,*]

[a] University of Hormozgan, Bandarabbas, Iran
[b] Faculty of Marine Science and Technology, University of Hormozgan, P.O. BOX: 3995, Bandarabbas, Iran

ARTICLE INFO

Keywords:
Wind erosion
Soil texture
Vegetation cover
Dust
Hormozgan province

ABSTRACT

Wind erosion and its consequent dust storms has become one of the environmental risks in today's world, which has annually caused non-compensable destruction in environment and human health. Since wind erosion is one of the main factors of desertification which could result in dust storms, studying and locating the wind erosion centers in southern parts of Iran is of crucial importance. The aim of this study is to determine the spatial distribution of wind erosion centers associated to local dust event in Hormozgan province (south of Iran). Different factors such as soil features, climate, surface roughness, vegetation cover, topography and the length wind exposure should be investigated for zoning the potential wind erosion regions. Studies showed that many of these factors are relatively uniform for the study region. Therefore, zoning based on all of the above-mentioned factors is not efficient. For this reason, soil texture along with vegetation cover and topography were studied in the current study to zone wind erosion. First, satellite data of soil texture, normalized differential vegetation index (NDVI), and topography were used to address the potential regions of wind erosion in warm and cold periods of the year by ArcGIS. Then, the data of 14 synoptic stations in Hormozgan province were utilized to plot the maps of dust event occurrences. Finally, by combination of the satellite and synoptic data, the map of land sensitivity toward wind erosion was provided, and the obtained results were compared with observations of Forest, Ranges and Watershed Organization (FRWO) of Hormozgan province. The results indicated that there are potential regions for wind erosion and dust sources in the study region. In a way that coastal areas have the highest probability to become wind erosion centers. In this regard, Jask, Bandarabbas and Bandar Lengeh are the first three regions in terms of wind erosion; while Abu Musa has the lowest priority in terms of possessing wind erosion centers. Also, it was revealed that sensitivity to wind erosion and dust storms was higher in warm periods of the year as compared with the cold seasons. The results of this study are in agreement with the observations of FRWO of Hormozgan province. Therefore, desert greening measures and actions to prevent wind erosion can control many of dust storms in the regions.

1. Introduction

Wind erosion is one of the major aspects of land destruction in dry and semi-dry regions (Coppinger et al., 1991) affecting about one sixth of global lands (Skidmore, 2000). Globally, about 549 million ha of lands have been destroyed by wind erosion (Subramaniam and Chinappa, 2002), and 296 million ha of these lands suffer from severe wind erosion (Lal, 2003). Wind erosion is also one of the main factors limiting soil fertility in many places of the world, including Iran (Zhao et al., 2006). Studies have indicated that in warm and dry regions, agricultural lands are more prone to wind erosion due to soil disturbance. Thus, the wind erosion-induced changes are more pronounced in these lands (Zhibao et al., 2000). Studies on wind erosion have shown that the severity of wind erosion depends on two groups of factors: erodibility and erosivity (Qiang et al., 2007; Stout and Zobeck, 1996). Erodibility refers to physical, mechanical and chemical features of the soil as well as its surface condition, whereas erosivity relies on physical properties of the wind such as its velocity (Liu et al., 2007). If the soil surface lacks protective agent, it will be eroded due to shearing force of wind (Vázquez et al., 2005; Cornelis et al., 2004).

Cho et al. (2006) found that wind erosion increases sand percentage and pH of the soil, whereas the clay, organic compounds, and humidity percentage of the soil will be declined as the result of wind erosion. In addition, many of the above-mentioned features of soils such as its elemental percentage and in situ density are gradually changing by wind erosion. This will have negative impacts on soil fertility. Spatial

* Corresponding author.
E-mail address: rezazadeh@hormozgan.ac.ir (M. Rezazadeh).

https://doi.org/10.1016/j.catena.2018.05.008
Received 8 September 2017; Received in revised form 4 March 2018; Accepted 8 May 2018

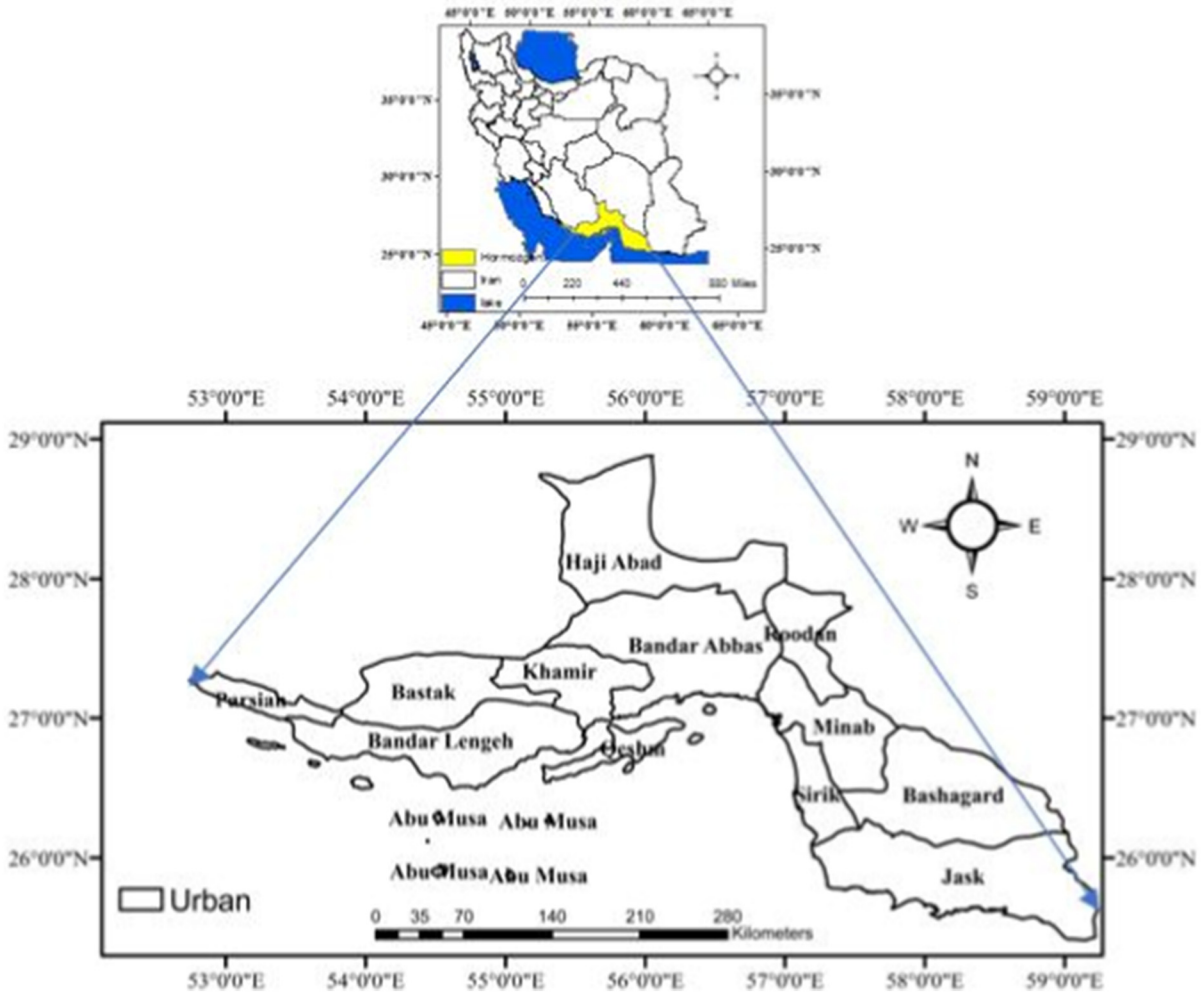

Fig. 1. Geographical position of the studied region.

investigation of wind erosion was performed in Mongolia by wind erosion-induced soil loss equation (WEQ) approach (Mandakh et al., 2016). The results of the mentioned study indicated that desert and semi-desert ecosystems have crucial influence on erosion. Also, the results showed that wind erosion is occurring all around Mongolia by different intensities. For example, the wind erosion potentials in Mongolia are 15–27 t/(hm^2·a) in deserts and semi-desert regions, 10–15 t/(hm^2·a) in dry steppes, and 5–10 t/(hm^2·a) in steppes.

Some studies have addressed wind erosion in Hormozgan province (Akbarian and Bi-Niaz, 2011; Akbarian and Nohegar, 2014; Zareian-Jahromi et al., 2010); however, the spatial distribution of wind erosion sources has not received considerable attention. The only relevant research was the project carried out to identify the wind erosion regions based on the priorities of FRWO of Hormozgan province. Based on the available estimations, > 1.565 million ha of coastal plains of the province are desert lands, among which 209 thousands ha are recognized as wind erosion centers and 475 thousands ha are identified as the regions under the influence of wind erosion (Department of Natural Resources and Watershed Management of Hormozgan Province, Delegation Office, 2010).

As dust storms are disturbing the daily life in southern parts of Iran, identification of the potential conditions for wind erosions can be a proper solution for detecting effective dust supplies. The present study is aimed to determine the spatial distribution of wind erosion sources of Hormozgan province according to dust event, dry and desert climate of the region. By identification of dust supplies in the region, necessary actions can be taken to decrease wind erosion and desertification; therefore, dust storms will be decreased.

This study seeks to determine the critical wind erosion centers using topography, soil texture, and vegetation cover in Hormozgan province (south of Iran). The map of land sensitivity toward wind erosion was also evaluated.

2. Materials and methods

2.1. The Studied region

Hormozgan province by area of 71,200 km^2 is located in the south of Iran beside Oman Sea and Persian Gulf in bonds between about 52°–59° E and 25°–28° N (Fig. 1). 54% of Hormozgan area is coastal desert, which forms about 16% of total deserts of country. Its annual average temperature is 27 °C (Table 1) and its relative humidity varies between 19%–100%. Average precipitation rate of Hormozgan was 215.8 mm in 2005–2015. The water of the province is about 20 billion m^3 and water evaporation is 13 billion m^3. The majority of sedimentations are annually entering Persian Gulf through Hormozgan province (Hormozgan Meteorological Organization, 2013). Based on geological-structural classification, Hormozgan province is limited to central Iran zone from the north, high Zagros structural unit from west and north west, folded Zagros structural unit from eat, Makran structural unit from south east and Persian Gulf from south (Choopani et al., 2005).