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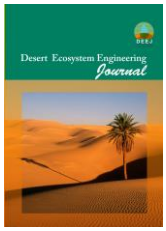

Assessing Land Susceptibility to Wind Erosion in the Sejzi Dust Source, Isfahan

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Extended Abstract

Introduction: Dust storms are a severe environmental phenomenon prevalent in arid and semi-arid regions worldwide. They inflict substantial socioeconomic damage by disrupting communication systems, land and air transportation, and reducing national income. Furthermore, they pose critical risks to human and animal health, sometimes resulting in fatalities. This research aims to address this issue in the dust source areas of eastern Isfahan. The study is designed to identify zones sensitive to wind erosion and dust generation, and to investigate the dynamics of dust storms through an analysis of wind intensity and the calculation of threshold velocities across the study area.

Materials and Methods: This study was conducted to characterize erosive winds, delineate dust sources, and assess land susceptibility to wind erosion in the Sejzi region of Isfahan. Hourly wind speed and direction data from four meteorological stations—Isfahan, East Isfahan, Murcheh Khort, and Kabutarabad—were analyzed to determine the direction, intensity, and energy of erosive winds.

Potential dust source areas were first identified through the interpretation of satellite imagery and subsequent field surveys. Following the confirmation of dust sources, land units were delineated on a map. A total of nine soil samples were collected for the analysis of physical and chemical properties, and an additional six samples were dedicated to determining wind threshold velocity and soil erodibility.

The erosion potential of the soils was quantified using a wind tunnel, where sediment removal rates were measured at various wind speeds to determine the threshold wind velocity through both observational and computational methods. Furthermore, the shear and compressive strengths of the terrain were evaluated, and the physical and chemical properties of the soil samples were analyzed in the laboratory.

Results: The analysis of wind data revealed that the energy of erosive winds, quantified by the Sand Transport Potential (STP) index, is classified as **high** at the East Isfahan station and **medium to low** at the other stations (Isfahan, Murcheh Khort, and Kabutarabad). The prevailing direction of these erosive winds is predominantly from the **east to west**, extending from the Sejzi Plain towards the city of Isfahan.

Laboratory and field measurements of soil properties showed a threshold wind velocity for particle entrainment ranging from **6.5 to 12 m/s**. Furthermore, the geotechnical analysis indicated that the shear strength of the topsoil varies between **1.0 and 2.06 kg/cm²**, while the compressive strength ranges from **1.1 to 2.0 kg/cm²**.

Discussion and conclusion: The findings of this study demonstrate that the Sejzi region poses a significant environmental threat to Isfahan, primarily due to its potent combination of high-energy easterly winds and erodible surface soils. The determined threshold wind velocities (6.5-12 m/s) are frequently exceeded, as evidenced by the wind energy analysis, confirming the high potential for dust emission and transport directly toward the city. Therefore, given this region's critical role as a dust source, the implementation of targeted restoration strategies is not just beneficial but imperative. Any such strategies must be fundamentally informed by the soil's specific physical and chemical properties—such as its low shear strength and specific texture—to ensure effectiveness and long-term sustainability. Mitigation measures could include the stabilization of highly erodible units identified in this study through mechanical methods (such as checkerboards) or biological approaches (using native, drought-resistant vegetation), tailored to the distinct conditions of each mapped land unit.

Keywords: Desert, Dust source, Isfahan, Sajzi plain, Wind Erosion.

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