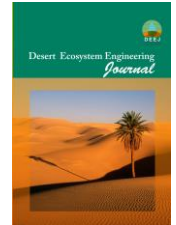




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Relationship between habitat quality and amount of exploitation of *Ferula assafoetida* to spatially estimate its economic value In South Khorasan Province

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Introduction

Quantifying ecosystem services within habitats provides a relative understanding of an ecosystem's status. However, for effective development, proper utilization, and informed decision-making, the spatial valuation of these services is essential after they have been quantified. Understanding the economic value of ecosystem services and biodiversity is crucial for several reasons. Notably, the persuasive power of economic language, specifically the monetary value that nature provides, serves as a powerful tool to communicate the importance of conservation to a broader, and often skeptical, audience. Consequently, when ecosystem service management becomes an institutional priority, various policies can be implemented to influence human interaction with the environment and to promote sustainable conservation planning of these valuable resources. This study aims to estimate the spatial economic value by quantifying habitat service quality in South Khorasan Province using the InVEST model.

Materials and Methods

This research focuses on the rangelands of South Khorasan Province. Specifically, the primary habitats of *Ferula assafoetida* are located in the Tabas and Boshruyeh counties. Initially, habitat quality was modeled using the InVEST method. This model is capable of assessing habitats based on human threats, the relative weight of each threat, land use, habitat sensitivity to threats, distance from habitat to threat sources, and habitat presence or absence. Subsequently, using reliable data on *Ferula assafoetida* harvesting in these rangelands, the relationship between habitat quality and plant yield was examined. This relationship was analyzed through spatial statistics, comparing habitat quality maps with the average yield in productive rangeland areas of *Ferula assafoetida* within the study area. The findings were then extrapolated to the entire rangeland area of *Ferula assafoetida* within the region, based on the derived regression equation. Finally, yield was estimated based on habitat quality and the corresponding spatial regression equation. In the final stage, using the pixel-level yield estimates and the market price of *Ferula assafoetida* products, the economic value of the rangeland areas was calculated.

Results

The threats identified in the habitat quality modeling included those arising from transportation (major roads, secondary roads, and railways), industry and mining, settlements, agriculture, dust sources, and grazing areas. Based on spatial statistical analysis, a spatial regression equation ($Y = 0.000003 + 0.008542X$) was derived, relating habitat quality maps to yield in productive areas. This equation was then extrapolated to the entire *Ferula assafoetida* rangeland area within the study region, and the estimated yield was mapped accordingly. Subsequently, the economic value of the *Ferula assafoetida* rangelands was determined based on the yield map and market prices, resulting in a pixel-level map illustrating the spatial distribution of economic value in millions of Rials. Spatial statistics indicated that the highest economic value within the studied pixels (900 square meters, equivalent to 0.09 hectares) was 0.085 million Rials, or 850,000 Rials. The mean and variance of the economic value in the rangeland areas were estimated to be 0.042 million Rials and 0.026 million Rials, respectively. The total economic value was estimated at 443,466.1 million Rials, approximately 0.44 trillion Rials.

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Discussion and conclusion

The habitat service quality distribution map for South Khorasan Province, based on the habitat quality index, revealed that the majority of high-quality areas are concentrated in the northeastern part of the province. This concentration is attributed, in part, to the more favorable climate and higher average rainfall in these regions. Similar conditions are observed in the western-central part of the province, albeit these areas are situated within the desert regions of South Khorasan. Methodologically, this study diverges from other research, such as Sekouti Eskooie (2014), which utilized the soil quality index to evaluate rangeland production potential. While rangeland production potential represents another form of ecosystem service, this study focused on assessing the habitat quality index by considering habitat threat factors and sources, and habitat ecosystem services. Regarding the economic valuation of medicinal plants, numerous studies have been conducted, often overlooking the spatial aspect of habitat value. For example, Khosravi and Mehrabi (2005) performed an economic analysis of *Ferula assafoetida* harvesting in the Tabas region. Over a four-year harvesting period across seven *Ferula assafoetida* habitats in Tabas County, they reported a total revenue of approximately 6,030.5 million Rials, with a production yield of 96,440 kilograms. Although direct comparison between their findings and this study is challenging due to temporal and inflationary differences, the non-spatial and quantitative nature of their reported figures is evident. Employing such assessments provides policymakers with valuable information to balance financial benefits with the preservation of diverse plant species, especially in areas prone to land degradation. The innovative and practical approach of this study offers land managers a rapid understanding of the area, considering cost, time, and data volume constraints. A key advantage of this research is its potential to justify and promote the sustainable utilization of medicinal plants. This is crucial because economic development, job creation, and export promotion depend on awareness of ecosystem status and the value of medicinal plant habitats, which this study addresses.

keywords: Threat, Habitat service, South Khorasan, Market price, Benefit.