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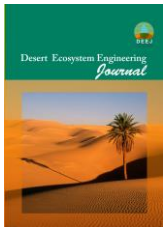

Evaluation of the Vegetation Resilience Capacity Index in the ShazandWatershed, Markazi Province, Iran

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Extended Abstract

Introduction: The sustainability of watersheds is influenced by a wide range of factors, including environmental conditions, land-use patterns, and the inherent resilience of the ecosystem. Resilience, in this context, refers to the ability of the watershed to withstand disturbances, adapt to changing conditions, and recover from environmental stressors such as droughts, floods, or land degradation. Understanding the resilience of a watershed is crucial for managing its resources effectively and ensuring its long-term ecological health. Identifying resilience threshold points in watersheds is particularly valuable, as these thresholds mark the critical limits beyond which the ecosystem may no longer be able to recover or function as it once did. These thresholds can help predict the behavior of these areas when faced with environmental disturbances or long-term changes, such as climate change or increased human activity. By recognizing these threshold points, watershed managers and policymakers can make more informed decisions about land and water management practices to avoid crossing these critical limits and to maintain or enhance the ecological stability of the area. Moreover, identifying resilience thresholds is essential for predicting the watershed's response to stress and improving management strategies. For example, understanding how various factors like vegetation cover, soil quality, and water availability influence resilience can help formulate adaptive management strategies that aim to restore or enhance the resilience of a watershed. These strategies include restoring degraded areas, improving land-use practices, and promoting sustainable resource management.

Materials and Methods: This study used the vegetation resilience capacity index to assess vegetation cover changes in the Shazand watershed in Markazi Province, Central Iran. This index was designed to evaluate the state of vegetation cover compared to the resilience threshold under various environmental changes. Initially, a time series of vegetation cover was estimated using the NDVI index, and the mean and minimum values of vegetation cover were considered as the current and resilient thresholds, respectively. Then, the resilience capacity index was calculated for 24 sub-watersheds, and the studied sub-watersheds were accordingly prioritized for management actions.

Results: The results of this study underscore the critical need to identify resilience thresholds within watersheds, as exceeding these thresholds in certain sub-watersheds can lead to severe consequences such as soil erosion, a decrease in water reserves, and a decline in biodiversity. The results showed that the resilience capacity of the study sub-watersheds ranged from -0.05 to 23.0, corresponding to sub-watersheds 5 and 15, respectively. The results also indicated that sub-watersheds 5 and 6 had exceeded their vegetation resilience threshold. Implementing targeted management programs for vegetation restoration and enhancing resilience in these vulnerable areas is crucial to prevent further degradation. Additionally, the study reveals that land-use changes can have opposing effects on vegetation resilience. In some regions, such changes have contributed to a decrease in resilience. In contrast, in other

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areas, such as near the Mohajeran, improvements in resilience were noted, which emphasizes the importance of proactive land management and the protection of vegetation cover. These findings highlight the role of sustainable land-use practices and the necessity of continuous monitoring to ensure the resilience of watershed ecosystems.

Discussion and Conclusion: In this study, the simple vegetation resilience capacity index was utilized as an innovative and effective tool to assess the resilience of vegetation in the Shazand Watershed. The results demonstrated that the resilience capacity of vegetation varied across different sub-watersheds, highlighting the need for tailored management approaches in certain areas to restore or enhance their resilience. Specifically, some sub-watersheds were found to be more vulnerable, requiring targeted interventions to prevent further degradation. Moreover, the study revealed that land-use management influences vegetation resilience, particularly in urban areas. Effective land management strategies, such as increasing vegetation cover in regions with significant land-use changes, were identified as key measures to improve the resilience capacity of the watershed. This approach not only helps mitigate environmental stressors but also enhances the ecological stability of the region. The findings of this research offer valuable insights and can be applied as a practical tool in management planning, facilitating the conservation and restoration of ecosystems within watersheds. Furthermore, the results can guide the development of efficient and sustainable strategies to combat environmental degradation, ensuring the long-term sustainability of vital natural resources.

Keywords: Integrated Watershed Management; Management Planning, Resilience Threshold, Watershed Elasticity.