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Prediction of the Effects of Implementing Ecological Management Scenarios on Landscape Structure for Chehel-Chai Watershed in Golestan Province of Iran

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Abstract

Understanding watershed components and their structure and natural processes is a crucial aspect of grasping how human activities can degrade or improve the condition of a watershed. Landscape indices can be used to quantify the condition of landscapes and to determine the impacts of human interventions in the environment. This paper outlines one component of a study being undertaken to provide a new tool for integrated watershed management. The study aims to assess the biophysical and socio-economic impacts of 32 vegetation-based management scenarios in the Chehel-Chai Watershed. The Chehel-Chai River is a tributary of the Gorgan-Rud River system lying southeast of Minoo-dasht in Golestan Province, Iran. The use of landscape structure indices to predict the ecological impacts of management

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scenarios is the focus of this paper. Five possible management actions including terracing, orchard development, agro-forestry, tree plantation, and riparian restoration have been considered. Scenario rules for each management activity were developed based on field observations, scientific recommendations, and expert knowledge for the study area. Ecological indices used in this study included Weighted Mean Patch Size Index (WMPSI), Weighted Land Cover Area Index (WLCAI), Total Core Area (TCA), Forest Connectivity Index (FCI), and Riparian Proportion Index (RPI). Ecological impacts of each management scenario are predicted based on the value of these indices. The best management option will correspond to the highest score. The analysis indicates that considering WMPSI, Scenario 26 (orchard development, agro-forestry, and riparian restoration) and Scenario 11 (orchard development, agro-forestry) are the best. In contrast, considering WLCAI, and RPI, Scenario 32 (a combination of terracing, orchard development, tree planting, agro-forestry, and riparian restoration actions) is identified as the best scenario; while Scenario 1 (current condition) was the best considering the TCA and the FCI. The assessment approach used in this study can provide a basis for prediction of the ecological impacts of management actions. Further research into prediction of impacts on physical and socio-economic sources can make available the required information to achieve the aims of an integrated watershed assessment and management.

Keywords: Landscape ecology, Indices, Scenarios, Chehel-Chai watershed.