A Decision Support System for Environmental Impact Assessment in Landscape Degradation (Case study: Shafarud Watershed in Gilan Province of Iran)

Azari Dehkordi, F.[1*], Khazaei, N. [2]
1- Assist. Prof., Graduate Faculty of Environment, University of Tehran-Iran
2- Ms.C. student, Graduate Faculty of Environment, University of Tehran-Iran noushinkhazaei@yahoo.com
Received: Jan., 2008 Accepted: Nov., 2008

Extended Abstract

Environmental Impact Assessment (EIA) is a critical appraisal of the likely effects of a policy, program, project, or activity on the environment. To assist the decision making authority, assessments are carried out independently of the proponent that may have prepared an environmental impact statement (EIS). Sometimes impact assessing methods, proposed alternatives, plans and the development of policy are against each other. Although EIA and environmental economical theories are useful facilities to measure the environmental capacities, the results are not always effective because of the measurement of quality. A Decision Support Systems (DSS) is a useful instrument for solving these problems. Degradation Model, as a Decision Support Systems, was first introduced in Iran.

In this research, spatial data such as topography, hydrologic network, roads network in 1:25000 scale and land use in the 1:50000 scale are employed. Moreover, the physical landscape metrics are used to execute the landscape degradation assessment model. The landscape metrics are used instead of degradation parameters and human activities intensity.
The landscape degradation is:
$L_D = \Sigma kI/Vi$
Where L_D is equal to degradation coefficient of landscape compartments, ΣkI is the index of intensity of human activities in landscape working units, (I is the indicator of metrics and k is intensity of them) V stands for habitat vulnerability.

According to McGarigal and Marks (1995), the list activities in landscape degradation model is as follow:
Number of Patches in landscape (NumP), Median Patch Size (MedPS), Total Edge (TE), Edge Density (ED), Mean Patch Fractal Dimension (MPFD), Shannon's Diversity index (SDI) and Mean Shape Index (MSI).
Landscape ecological metrics are useful instrument to interference ecology in planning and they help to measure the quantity of landscape processes. At first, all the landscape metrics should be determined for each sub watershed and then the scope of each metric in each sub watershed will be categorized based on the median. The median is a number that divides data into equal parts. In other word, it shows which part is the bigger 50%, and which part is the smaller than 50%. To achieve this, Excel program is used. In the next step, the total metrics is considered as collection of landscape degradation activities. Activities are categorized in terms of quality in 4 classes:
Code (1) Insignificant degradation, Code (2) Medium degradation, Code (3) Intense degradation, Code (4) high intense degradation.

Corresponding author: Tel: +98 21 61113183 E-mail: fazari@ut.ac.ir

After comparing activities intensity (different metrics) with median scale, the intensity of each activity has been determined in working unit.

One method to determine vulnerability is quantitative landscape by extracting, landscape metrics. Based on ecological landscape principals, when number of patches in ecosystem is fewer or when there is equal in land use in an ecosystem or sub watershed, the ecosystem is exposed to much less vulnerability. The number of patches in landscape (Nump) is used to determine the ecological vulnerability. Table 1 shows the level of vulnerability in Shafarud watershed.

Table 1: Vulnerability level in Shafarud landscape

Vulnerability scope(NumP)	Vulnerability level
6.9>I1	Resistant
6.9 >I2≥8.5	Semi- critical
8.5>I3≥ 17.75	Critical
I4 ≥17.75	Vulnerable

To apply the landscape degradation model we considered Shafarud watershed that is located in Gilan. Figure 1 Show the study area.

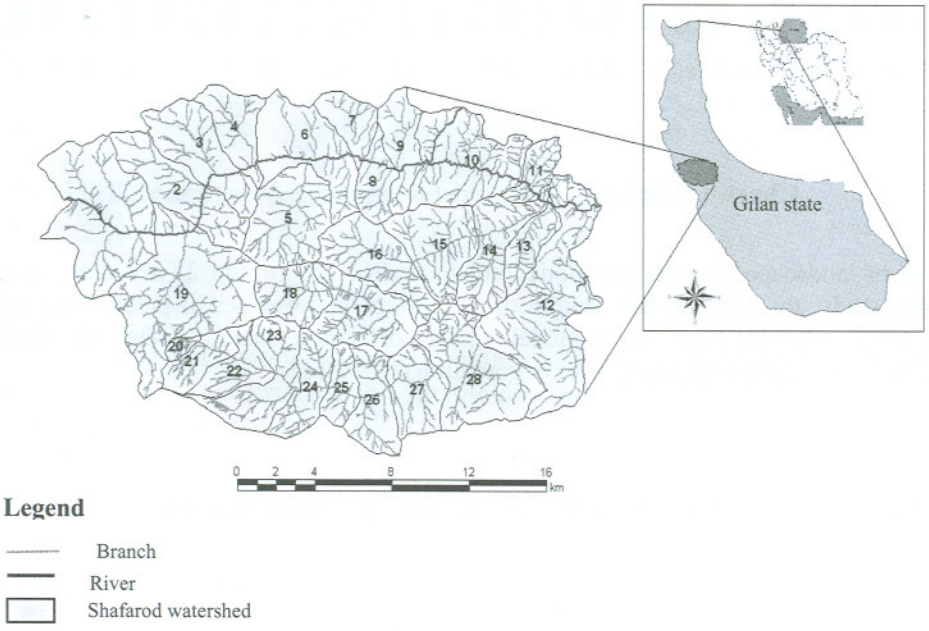

Fig. 1: Location of the Shafarud watershed in Gilan, Iran

Table 1 shows degradation scope in Shafarud watershed based on development & protection ratio according to the fuzzy logic classification. In chart 1 the Hierarchy of degradation in each sub watershed shown.

It aims to show those classes to which L_D belongs and to show the degradation which belongs to that special class.

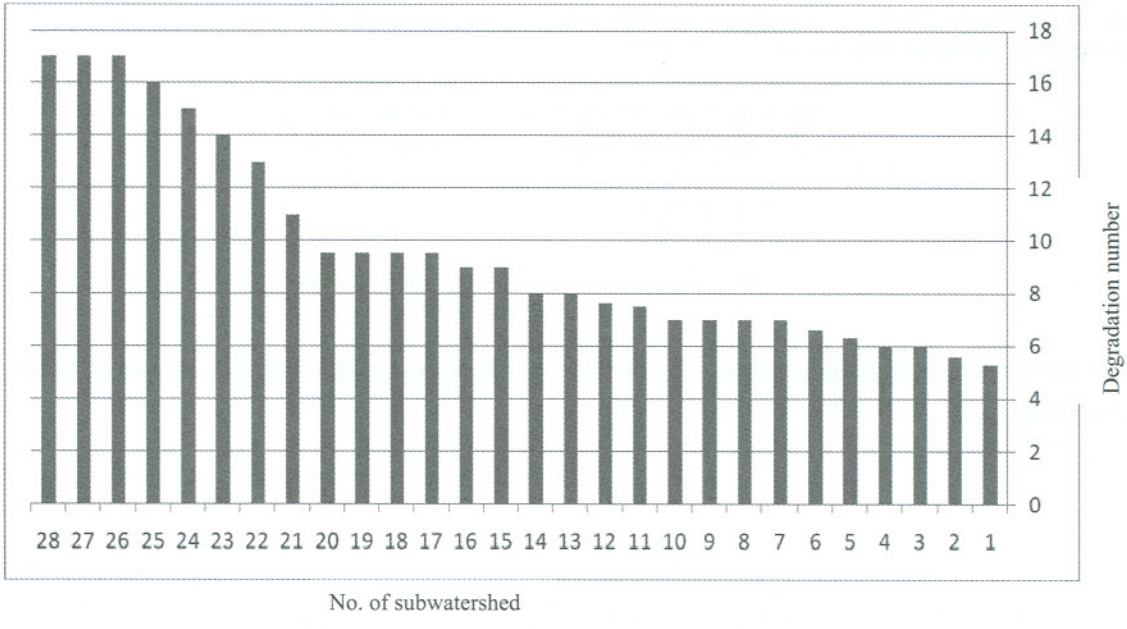

Chart. 1: Hierarchy of degradation in each sub watershed

After computation of landscape degradation model, subwatershed 25, 26 and 27 are the maximum number of degradation. In this study, the satellite data, length of road, slope and number of patches are correlated and the data is extracted from landscape degradation model. These correlation illustrated that the red class in imaging data is accomplished the highest correlation with degradation (R^2= 0.61).

Key words

Degradation Model, Landscape Ecology Metrics, Rapid Environmental Impact Assessment, Shafarud,Gilan