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Changes in Landscape Measurements and Examination of Erosion Sensitivity in Sharif Beiglou Watershed in Ardabil Province

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1- Introduction

In recent years, concerns regarding the impact of changing patterns of land-use owing to deforestation and agricultural development or elimination have led to numerous crises in the quality of water and soil resources (Lam et al., 2018). Alterations in land use resulting from human activities, such as deforestation, agriculture and urban growth among other activities, can have far-reaching and long-term consequences such as reduced biodiversity, increased surface runoff, soil erosion, increased greenhouse gases, global warming and energy imbalance on the surface of the ground (Mokhtari et al., 2020). Undoubtedly, all human activities in nature eventually lead to change of land use. Over the past three decades, the evolvement of human needs has led to a significant increase in change of land-use and damage (Hazbavi et al., 2018). Landscape is defined by focusing on the role that humans play in creating and influencing ecological patterns and processes. Therefore, it should be noted that man has always sought to change the appearance of environments where he feels dominant, hence replacing natural spaces with artificial ones in the process, itself leading to environmental instability (Nazarnejad et al., 2017). Landscape measurement criteria is the best way to compare the landscape of a land and different land uses (Akin et al., 2013; Wang et al., 2014). According to the Food and Agriculture Organization (FAO) of the United Nations, 3 million hectares of agricultural lands are lost annually due to erosion. The total annual sediment volume of basins should be evaluated for soil conservation projects, erosion control and sediment reduction methods, as well as the volume of reservoir dams. Estimation of erosion, annual sedimentation and subsequent preparation of landscape for soil erosions are of paramount importance in controlling soil erosion and maintaining mechanical and biological performance. Direct and indirect methods are two general tools employed for measuring soil erosion. In the direct method, the rate of erosion and sedimentation of

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different instruments is measured. In indirect methods, the rate of erosion and the level of sediments are measured based on experimental models and other parameters. It is difficult to prepare models with detailed information on local watersheds due to the lack of sediment measuring stations in most watersheds. Therefore, the use of experimental models is inevitable, but the main problem with the experimental models is the inaccuracies in processing and large amounts of data that must be first digitized by the GIS system and analyzed by mathematical models .

The purpose of this study was to evaluate the changes in land-use measures at the level of class and landscape in Sharif Beiglou watershed for the development of the catchment area in line with the needs of the region. Due to the existence of Sharif Beiglou Reservoir Dam in the above basin, identification of sensitive and critical areas of erosion is necessary to carry out further conservation activities. Also, one of the obvious problems in this basin is the presence of excessive sediment due to the lack of suitable vegetation upstream of the basin. Examining this relationship can provide a good tool for monitoring land change and decision making in management.

2- Methodology

In this research, land-use map was prepared using images from Google Earth 2020, mostly owing to its high resolution and appropriate interpretation of the watershed. Image analysis was performed using ArcGIS 10.3 software. After preparing the land-use map for the area in ArcGIS 10.3 and converting it to raster format, Fragstats 4.2 was used to quantify the land-use measurements at the scope and class level for the watershed. Soil erosion sensitivity coefficient was calculated with EPM model for Shari Beiglou watershed. Then, the data from calculating the measures and the severity of soil erosion were inputted SPSS, determining a significant relationship there between.

3- Results and Discussion

The basis for calculating land-use metrics is land-use map at the level of landscape and class. The analysis of quantitative measures of land-use were performed at two levels of class (the level of each class being unique) and the landscape. According to the results, the maximum number of spots was witnessed in agricultural use, the minimum of which was related to the water body. This finding is not consistent with that of Madadi and Ashrafzadeh (2015), in which the most destruction was reported in the water body. The average spot density of the study area was 0.23, and the maximum value of the spot distance was related to agriculture and pasture, garden, residential and water body, respectively. This shows that human manipulation and interference in this use has been high over time. The value for the index of the largest spot in the study area was 80.65 for the rangeland, and the smallest value was zero assigned to the water body. Increasing the shape of the spot is associated with increasing the irregularity of the shape of the spots. In this regard, Karami et al. (2012) studied and compare the use of North and South Zagros lands with the ecological approach of the land of Kurdistan, Kohgilooyeh and Boyer-Ahmad provinces, and reported that the most and the least are related to agricultural lands and water bodies, respectively. The maximum and minimum total margins for Sharif Beiglou watershed at the level of class, were 68080.023 and 1345.224, respectively. The average total margin for the studied watershed was 50338.672 meters. Similar results have were previously by Kiani and Fiqhi (2015) for northern Iran, in which the margin density was the highest for the rangeland and the lowest for the water body. The spot shape index for all uses was more than 1, indicating the irregularity of the spots at the field level. The maximum and minimum values of this index were witnessed in agriculture (8) and water body (1.27) respectively. The maximum and minimum values for the average spot size were respectively 313.66 and 6.92, (Mokhtari et al, 2020). Moreover, the results showed that the average size of forest spots has increased from 1987 to 2018. The minimum and maximum value for the landscape rupture of the studied watershed was equal to 1 and 0.34, respectively pertaining to residential use, and water body and rangeland. The maximum and minimum values for fragmentation rate was determined to 376.889 and 1.53, respectively. Also, on the surface of Sharif Beiglou watershed 49 spots were identified, with spot density of 1.15, largest spot index of 80.64, total margin of 7558.008, average margin of 17.75, spot shape index of 4.56, and average spot size of 86.79, while the landscape rupture was calculated to be 0.34 and fragmentation rate was calculated to be 1.52. According to the results obtained from the study basin (Esmali and Abdollahi, 2011), agricultural land-use has high erosion, rangeland and garden land uses have moderate erosion, residential land-use has low erosion and water body has partial erosion. In the southwestern part of the basin, owing to agricultural activities, the intensity of erosion is high, while the intensity of soil erosion in the northeastern part is moderate. Owang et al. (2010) examined the watershed upstream of the Yellow China River from 1977 to 2006 and reported that factors including the continuous expansion of bare lands, water areas and agricultural lands has significantly increased soil erosion. Analysis of the results at the spot level confirmed that the amount of sediment transport from the edge of the spot has also increased due to the increase in the margin of the spot. Obtaining and employing such information will definitely help curb regional and local environmental pollution. Also, the landscape of Koozeh Topraqi watershed is composed of pastures, agriculture, rocky outcrops and residential areas with the shares of 29.13%, 64.77%, 3.50% and 0.80%, respectively (Alaei et al., 2019). The data from calculating the measures and the intensity of soil erosion were inputted to SPSS software and the significant relationship there between was determined according to Pearson correlation test. The results indicated that only the fragmentation index (SPLIT) is statistically significant with a negative correlation and is thus an effective measure that can be employed in methods of reducing the severity of soil erosion.

4- Conclusion

The results showed that in the study basin, agricultural applications have high erosion, rangeland and garden applications have moderate erosion, residential applications have low erosion while water body has partial erosion. At the level of landscape, for Sharif Beiglou basin, the number of spots was 49, the spot density was 1.15, the largest spot index is 80.64, the total margin was 75508.008, the margin density was 17.75, the spot shape index was 4.56, the average spot size was 86.79, and landscape rupture was 0.34 and fragmentation was determined to be 1.52. At the class level, the amount of fragmentation in the water body was the highest. Therefore, it can be concluded that its relationship with their assemblies has been severed. Finally, with the intervention of changes in land features, the study of soil erosion was optimally performed, in that the erosion potential map indicated that areas with high erosion are affected by the measurement indicators and the hydro-geomorphological properties used.

Keywords: Land use, Land degradation, Landscape, EPM, Sharif Beiglou.

5- References

Akın, A., Erdoğan, A., Berberoğluc, S. (2013). The Spatiotemporal Land use/cover Change of Adana City. *International Archives of the Photogrammetry, Remote Sensing and Spatial Information Sciences,* 7, 11-17.

Alaei, N., Mostafazadeh, R., Esmali Ouri, A., Sharari, M., & Hazbavi, Z. (2019). Assessing and comparing the continuity of the landscape in the Koozeh-e-Topraqi watershed, Ardabil province. *Applied ecology,* 8 (4): 34-19.

Esmali, A., & Abdullahi, K. (2011). Watershed management and soil protection. Mohaghegh Ardabili Publications, 574 p.

Hazbavi, Z., Jantiene, B., Nunes, J.P., Keesstra, S.D., & Sadeghi, S.H.R. (2018). Changeability of reliability, resilience and vulnerability indicators with respect to drought patterns. *Ecological Indicators,* 87, 196-208.

Kiani, W., Jurisprudence, J. (2015). Investigation of the cover / use structure of Sefidrood watershed using ecological criteria of the land feature. *Environmental Science and Technology,* 17, 141-133.

Karami, A., Fiqh, J. (2012). Monitoring and comparing the use of North and South Zagros lands with the ecological approach of the land landscape (Case study: Kurdistan, Kohgiluyeh and Boyer-Ahmad provinces). *Land Management,* 4 (6), 34-5.

Lam, N.S., Cheng, W., Zou, L., & Cai, H. (2018). Effects of landscape fragmentation on land loss. *Remote Sensing of Environment,* 209, 253–262.

Madadi, H., Ashrafzadeh, M. (2010). Investigation of land cover changes in the area of Bamdaj wetland with the ecological approach of land appearance. *Journal of Science and Technology,* 9 (1): 51-61.

Mokhtari, M., Abedian, S., & Qolpour, M. (2020). Detection and modeling of forest land use change trends in Qarahsu watershed using land features. *Applied ecology,* 8 (4): 18-1.

Nazarnejad, H., Hosseini, M., & Irani, T. (2018). Using Landscape Measurements in Assessing Landscape Structure Changes in Qarahsoo Watershed in Kermanshah. *Geography and Environmental Hazards,* 26, 36-23.

Wang, X., Blanchet, G.B., & Koper, N. (2014). Measuring habitat fragmentation: An evaluation of landscape pattern metrics. *Methods in Ecology and Evolution,* 5, 634–646.