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The Role of Land Use Management on Land Degradation: The Case Study of Kashidar Basin in Golestan Province, Iran

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Abstract: Land resources are increasingly under pressure and there are many competing interests. However, unsustainable agricultural expansion and urbanization remain the main driving forces in land resource depletion. Suitable land use management on steep slope farmlands can decrease the destructive effects of farming. The main aim of this paper is showing the role of land use management on soil erosion. The EPM empirical model which developed in former Yugoslavia is one of the applicable models for estimating soil erosion and sediment delivery. With the help of this model, changes in the rate of erosion due to the application of different land management methods can be examined. In order to achieve the objectives of this study, Kashidar watershed in Golestan province -Iran was selected. The required maps and parameters of EPM model were determined in the desired area and with the help of Arc-Gis software, the relations and equations presented in this model, the amount of soil erosion in Kashidar watershed was calculated. The rate of soil erosion was calculated under two different management scenarios of rain fed agriculture and agroforestry system. The results of this study shows that changing the land use from dry farming on steep slope to agroforestry can decrease the soil erosion up to 70 percent. Sustainable land management practices are urgently required because of widespread resource degradation from poor land use practices. Climate change impacts are expected to further aggravate the situation.

Keywords: Land Use, Soil Erosion, EPM, Kashidar

1. Introduction

Today, all developed countries, as well as most developing countries, have realized that land use must be based on planning in order to maximize benefits and protect the natural environment for future use.

The assessment of soil erosion and sediment transport in hydrological catchments is imperative, in different temporal and spatial scales, in order to protect and preserve soil as long as technical constructions such as irrigation dams, hydroelectric projects and flood attenuation structures.[10] Soil erosion is geographically determined as a result of the interaction between natural processes and anthropogenic influences. It is a complex process controlled by numerous factors, such as topography, climate, soil characteristics, forest cover and human activities [1-9]. Irregular and improper use of land resources over the years has led to significant land degradation, resulting in eroded lands, degraded pastures and forests, and the expansion of desert areas on a large scale around the world.

Soil erosion is a natural process, but the natural erosion rate has significantly increased in the last few decades as a consequence of human activity and become a serious environmental problem [11-14]. This process is one of the most significant forms of land degradation that is particularly affected by human activity [15-17] Under natural conditions, taking into account the climate and ecological conditions of each region, there is a proper balance between soil, water, plants and animals, which generally "unscientific and ill-considered human intervention upsets the balance of the system and causes irreparable damage."

Land use planning requires the use of land based on its talent and productive power, and the strict avoidance of allocating land for inappropriate and destructive use.

Since the rate of soil erosion and subsequent production of sediment due to the confrontation and combination of natural factors forming the watershed, including topography, geology of the basin, climate, land use, etc. on the one hand and human actions and activities carried out in the basin The watershed is on the other hand, Therefore identifying sensitive areas to erosion and prioritizing watershed sub-basins in this regard, for proper management of the basin and financial resources and increase the efficiency and profits of activities and measures taken at the watershed level is necessary and important for watershed managers. Is a watershed.

The basis of experimental models for estimating the rate of erosion and sedimentation is to consider a number of important factors and, based on observational methods, measure and statistically relate them to erosion and sediment production. The EPM model is an experimental model developed by Gavrilovich in 1988 after nearly 40 years of research and measurement of erosion and sedimentation in the former Yugoslavia [18]. The EPM model is considered by researchers and experts due to its simplicity and easy accessibility as well as its relatively good results and is highly acceptable.

Human activities on natural fields caused to increase the speed of natural erosion. This phenomenon with loss the soil and water can damage human properties. Water erosion on steep slope lands is one of the most important types of natural erosion on earth surface which can loss huge amount of fertile soils around the world every year.

Unsuitable agricultural activities on steep slope lands can increase the speed of natural erosion and can make heavy socio-economical damages.

Suitable land management especially land use change has effective role on soil erosion in these lands. One of the methods which by using that can estimate the effects of land use changes on soil erosion is the EPM empirical model. In this model by providing some natural specifics of watershed as like as soil and surface lithology, present land use, topography and present situation of erosion can estimate the intensity of erosion. Because of constantly of some natural parameters same as lithology and topography, evaluation of different land use scenarios effects is possible.

2. Objectives and Methods

Kashidar basin with 150 km^2 area located at the south-east of Caspian sea in the Golestan province-Iran. The geographical coordinates of this basin is 36,55 to 37,05 north latitude and 55,27 to 55,40 east longitude [19]. Figure 1 showing the location of this basin.

Figure 1. *Location map of Kashidar basin.*

Maximum and minimum elevation of this basin are 2500 and 915 meter from sea level respectively and average land slope is 29 percent.

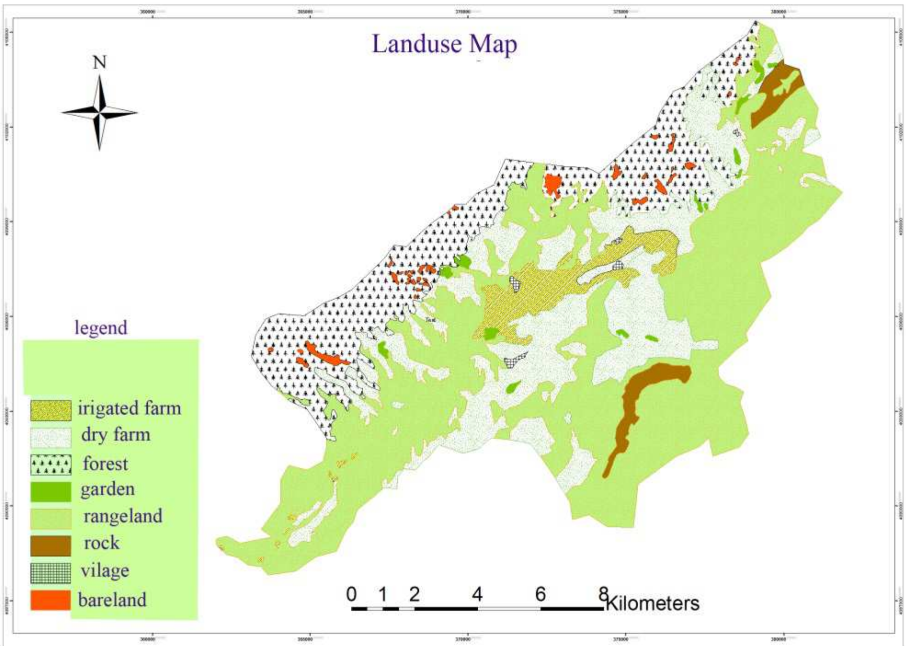

Figure 2. *Landuse map of Kashidar basin.*

Table 1. *Classification of erosion intensity.*

Erosion class	Severity of erosion	Range of Z	The average value Z
V	Very intense	1 <	25.1
IV	Severe	71.0 < Z < 1	85
III	medium	41.0< Z < 7.0	55
II	Low	2.0 < Z < 4.0	3
I	Very little	19.0 >Z	1

Annually average rainfall is 225 mm and its climate is mountainous dry cold. The land use condition of this basin presented in table 2.

Figure 3. *Land use of kashidar basin.*

Table 2. *Land use condition of Kashidar basin.*

Land use	Forest	Rangeland	Garden	Dry farming
Area (ha)	3216	7028	149	3523

The EPM empirical model which developed in former Yugoslavia is one of the applicable models for estimating soil erosion and sediment delivery. Z factor or erosion intensity coefficient calculating by

$$Z= Y*Xa*(I^{0.5} + \psi) \quad (1)$$

Which in this equation (Y) is coefficient of soil and lithology sensitivity to erosion, (Xa) is land use coefficient, (ψ) is present situation of erosion and (I) is average land slope. in the EPM model, intensity of soil erosion can be recognized by the amount of Z factor based on table 3.

Table 3. *Intensity of soil erosion based on Z factor in EPM model.*

Amount of Z factor	Z>1	1>Z>0.7	0.7>Z>0.41	0.4>Z>0.2	Z<0.19
Intensity of erosion	Very high	High	Moderate	Low	Very low

And also amount of soil erosion can be calculated by equation (2).

$$Wsp=T.H.\pi.Z^{1.5} \quad (2)$$

Which (Wsp) is specific erosion (m^3/km^2/y), (T) is temperature degree coefficient, (H) is annual rainfall (mm), (Л) is 3.14 and (Z) comes from equation (1). specific weight of soil considered 1.4 ton / M^3.

With determining of needed data of EPM model, amount of soil erosion for tow land use scenario will calculate. In the first scenario land use is dry farming on steep slope lands and second scenario is Agroforestry on steep slope land instead of dry farming.

3. Results and Analysis

After providing needed data for EPM model include of lithology map, land use map, present situation of erosion and slope map by using of Arc-Gis soft wear, amount of Z factor under the 2 scenario determined. Results of this action presented in tables 4 and 5.

Table 4. *Amount of Z factor under the first scenario (dry farming).*

Parameter	Y	Xa	ψ	I	Z
Quantity	1.2	0.9	0.67	29%	1.3

Figure 4. *Present condition of erosion of kashidar basin.*

Table 5. *Amount of Z factor under the second scenario (agroforestry).*

Parameter	Y	Xa	ψ	I	Z
Quantity	1.2	0.4	0.67	29%	0.58

By using Z factor and equation (2), amount of soil erosion calculated under the 2 scenario. Results of this action presented in tables 6 and 7.

Table 6. *Amount of specific soil erosion under the first scenario (dry farm).*

Parameter	T	H	Л	Z	Wsp (t/ha/y)
Quantity	1.08	225	3.14	1.3	15.8

Table 7. *Amount of specific soil erosion under the second scenario (agroforestry).*

Parameter	T	H	Л	Z	Wsp (t/ha/y)
Quantity	1.08	225	3.14	0.58	4.7

4. Conclusion

Land use management has effective role on soil erosion and land degradation. As presented results in tables 6 and 7 shows, land use changing from dry farming on steep slope lands to Agroforestry can decrease the soil erosion up to 70 percent.

Therefore conserving of soil and water resources as a production field is the most important action in order to achieve the sustainable development. Erosion not only impoverishes the soil and abandons the fields, leaving a lot of irreparable damage, but also causes a lot of damage by depositing materials in waterways, reservoirs, dams, ports and reducing their dewatering capacity.

For proper management of watersheds and achieving sustainable development goals, due to limited financial resources, allocating funds to higher priority areas will play an effective role in maximizing benefits and will be more effective. This is easily achieved by using the experimental EPM model, whose input information is generally available and easily accessible, and the results can be used in the proper management of watersheds.

References

[1] Mitasova, H.; Hofierka, J.; Zlocha, M.; Iverson, L. Modeling topographic potential for erosion and deposition using GIS. Int. J. Geogr. Inf. Sci. 1997, 10, 629–641.

[2] Bakker, M.; Govers, G.; Kosmas, C.; Vanacker, V.; Van Oost, K.; Rounsevell, M. A soil erosion as a driver of land use change. Agric. Ecosyst. Environ. 2005, 105, 467–481.

[3] Cerdan, O.; Govers, G.; Le Bissonnais, Y.; Van Oost, K.; Poesen, J.; Saby, N.; Gobin, A.; Vacca, A.; Quinton, J.; Auerswald, K.; et al. Rates and spatial variations of soil erosion in Europe: A study based on erosion plot data. Geomorphology 2010, 122, 167–177.

[4] Životić, L.; Perović, V.; Jaramaz, D.; Đorđević, A.; Petrović, R.; Todorović, M. Application of USLE, GIS and Remote Sensing in the Assessment of soil erosion rates in Southeastern Serbia. Pol. J. Environ. Stud. 2012, 21, 1929–1935.

[5] Leh, M.; Bajwa, S.; Chaubey, I. Impact of land use change on erosion risk: An integrated remote sensing, geopraphic information system and modeling methodology. Land Degrad. Dev. 2013, 24, 409–421.

[6] Serpa, D.; Nunes, J. P.; Santos, J.; Sampaio, E.; Jacinto, R.; Veiga, S.; Lima, J. C.; Moreira, M.; Corte-Real, J.; Keizer, J. J.; et al. Impacts of climate and land use changes on the hydrological and erosion processes of two contrasting Mediterranean catchments. Sci. Total Environ. 2015, 538, 64–77.

[7] Zhang, B.; He, C.; Burnham, M.; Zhang, L. Evaluating the coupling effects of climate aridity and vegetation restoration on soil erosion over the Loess Plateau in China. Sci. Total Environ. 2016, 539, 439–449.

[8] Khaledian, Y.; Kiani, F.; Ebrahimi, S.; Brevik, E.; Aitkenhead-Peterson, J. Assessment and monitoring of soil degradation during land use change using multivariate analysis. Land Degrad. Dev. 2017, 28, 128–141.

[9] Stefanidis, S.; Chatzichristaki, C. Response of soil erosion in a mountainous watershed to temperature and precipitation trends. Carpathian J. Earth Environ. Sci. 2017, 12, 35–39.

[10] Efthimiou, N., Lykoudi (2016). SOIL EROSION ESTIMATION USING THE EPM MODEL. Bulletin of the Geological Society of Greece. Vol. 50.

[11] Sharma, A.; Tiwari, K. N.; Bhadoria, P. B. Effect of land use land cover change on soil erosion potential in an agricultural watershed. Environ. Monit. Assess. 2011, 173, 789–801.

[12] Tošić, R.; Dragićević, S.; Lovrić, N. Assessment of soil erosion and sediment yield changes using erosion potential model–case study: Republic of Srpska (BiH). Carpathian J. Earth Environ. Sci. 2012, 7, 147–154.

[13] Tošić, R.; Kapović, M.; Lovrić, N.; Dragićević, S. Assessment of soil erosion potential using Rusle and Gis: A case study of Bosnia and Herzegovina. Fresenius Environ. Bull. 2013, 22, 3415–3423.

[14] Kostadinov, S.; Braunović, S.; Dragićević, S.; Zlatić, M.; Dragović, N.; Rakonjac, N. Effects of erosion control works: Case study-Grdelica Gorge, the South Morava River (Serbia). Water 2018, 10, 1094.

[15] Uddin, K.; Matin, M. A.; Maharjan, S. Assessment of Land Cover Change and Its Impact on Changes in Soil Erosion Risk in Nepal. Sustainability 2018, 10, 4715.

[16] Perović, V.; Kadović, R.; Đurđević, V.; Braunović, S.; Čakmak, D.; Mitrović, M.; Pavlović, P. Effects of changes in climate and land use on soil erosion: Case study of the Vranjska Valley, Serbia. Reg. Environ. Chang. 2019, 19, 1035–1046.

[17] Ozsahin, E.; Duru, U.; Eroglu, I. Land Use and Land Cover Changes (LULCC), a Key to Understand Soil Erosion Intensities in the Maritsa Basin. Water 2018, 10, 335.

[18] Gavrilovic, Z., (1988). The use of an empirical method (Erosion Potential Method) for calculating sediment production and transportation in unstudied or torrential streams. International conference of river regime, 18-20 May, Wallingford, England, 411-422.

[19] General office of natural resources and watershed management of Golestan province-Iran, (2001). executive study of kashidar basin. Vol 1.