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Evaluation of Erosion Rates in Relation to Vegetation Coverage Level—Case Study: Kukësi and Hasi Regions, Albania

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Abstract: Soil erosion is one of the most destructive phenomena of earth causing the loss of land, leading to increased pollution and sedimentation in streams and rivers, clogging these waterways. Due to soil erosion, degraded lands are also often less able to hold onto water, which can worsen flooding. Among all natural causes of soil erosion such as rainfall intensity, temperature and wind, the human activity; massive deforestation and intensive agriculture, including the latest climate changes are considered as very important factors especially nowadays. Thus, evaluating the soil erosion appears very important in order to prevent the phenomena. In this study the soil erosion in forest and pasture areas in Kukësi and Hasi regions (Albania) was evaluated, and classified depending on the degree of coverage by forest vegetation. Detailed information for the above factor was gathered from site visits and national databases of different institutions. Results show that erosion is present in forest and pasture areas in Kukësi and Hasi Regions and is mainly caused by human activities such as large deforestation, intensive use of agricultural land, etc. There is a need to take effective measures and use advanced methods to prevent or control soil erosion not only in Kukësi and Hasi regions, but in all Albanian watersheds.

Key words: Soil erosion, vegetation coverage, Albania.

1. Introduction

Soil erosion is considered as one of the most destructive phenomena of earth, represented by both surface and depth erosion. Many factors such as geological structure, slope, soil composition and climate changes have been identified as responsible for the relatively significant soil erosion observed in Albania [1, 2]. Moreover, the increased intensity of erosion is closely related with high rate of destruction of vegetation cover and mainly of deforestation. Degradation of vegetation or its complete destruction is determined by many factors, especially by the socio-economic system of each country [3, 4]. This has been also observed in watersheds at Kukësi and Hasi regions, where as a result of negative impacts caused by mankind on the natural environment, the erosion phenomenon is becoming a serious issue, especially during periods of intense precipitation.

This phenomenon is also significantly affecting massive landslides which are already evident in many areas of the country, causing significant damage to the environment and to the local economy. Vegetation, especially forests, plays an important role in preventing soil erosion, but its role of vegetation is not seen immediately after its establishment [5, 6]. Therefore, different hydrotechnical measures need to be carried out in order to preserve and strengthen the waterbed and direct water flow. Taking into consideration all the factors mentioned above and the risk of soil erosion in Kukësi and Hasi regions, the aim of this study was focused on observing the vegetation factor which mostly affects soil erosion in these regions.

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2. Material and Methods

The study area includes Kukësi and Hasi regions, located in the Northern and Northeast part of Albania as can be seen in Fig. 1 [7].

The development of soil erosion in this area is mainly related to the vegetation land cover and other environmental factors like the slope, rainfall, etc.

Vegetation land cover data used for the evaluation of soil erosion rate are collected from the National Forest Inventory and field surveys [8]. The classification of the vegetation coverage is done according to this grouping: <0.3; 0.4-0.7; and >0.7, for 16 forest economies of the study area: Krume, Dukagjin, Mames-Kalimash, Arni, Surroj, Tej Drini i Bardhe, Bushtrice, Tregtan, Terthore e Lumes, Gjallica e Lumes, Shishtavec-Zapod, Goske, Bicaj-Kolosjan, Leproj-Kalimash, Serriqe, and Has i Thatë (Helshan).

For each of these groups of vegetation land cover, the evaluation of soil erosion rate is determined by comparing the open soil profile with the etalon profile in terms of soil erosion in 4 levels as follows (Fig. 2):

Class 1, up to 25% of (A) horizon in most of the surface.

Class 2, from 25%-75% of (A) horizon in most of the surface.

Class 3, over 75% of the horizon and generally also a part of (B) horizon.

Class 4, deeply eroded soil, in such a way that presents a network stream with high depth.

Fig. 1 Location of the study area.

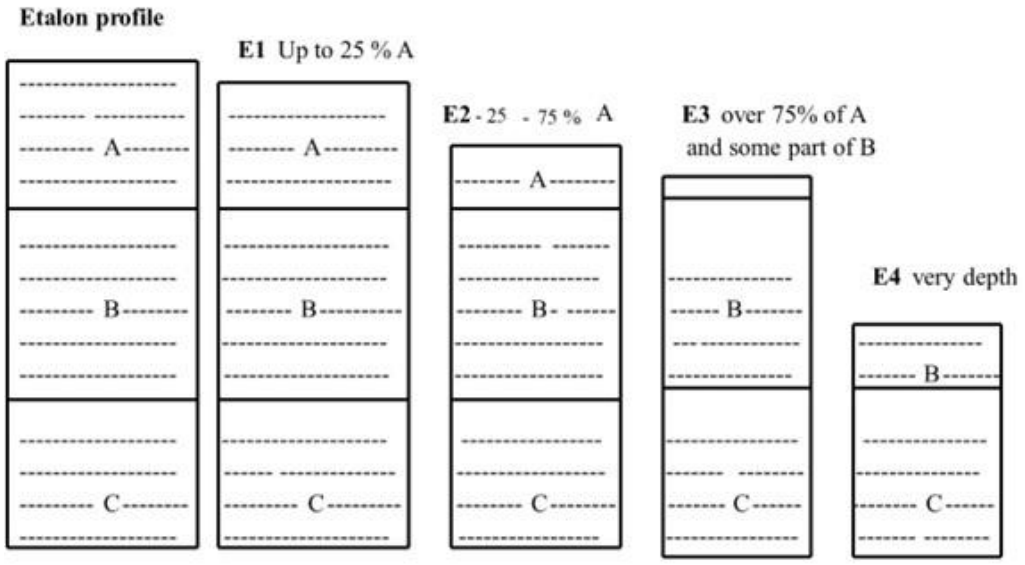

Fig. 2 Classification of soil erosion rate class.

3. Results and Discussion

The total area of forest economies (the study area) is 114,641.96 ha, while the division according to the vegetation coverage rate is presented below (Table 1).

As it can be seen from Table 1 and Fig. 3, most (47%) of the forest and pasture area of Kukësi and Hasi regions is part of the interval less than 0.3, followed by 30% in the range 0.4-0.7, and 23% in the interval > 0.7.

From these results it is evident that the forest vegetation in these economies is destroyed, which directly affects the dynamic and development of soil erosion in the study area.

Based on the comparison of the actual profile with the etalon profile, the rate of soil erosion for the study area is presented in Table 2.

As seen from the above table, erosion in forested areas of Kukesi and Hasi is quite large, where around 51% of the surface area takes part in the third and fourth class of soil erosion rate, while 49% in the first and second class.

Evaluation of erosion rate related to the vegetation coverage is made after determining the classes of coverage of forest vegetation (< 0.3; 0.4-0.7; and > 0.7).

Table 3 presents the distribution of erosion rate in function of the degree of vegetation coverage of Kukesi and Hasi regions.

As can be seen from Table 3, surfaces with vegetation coverage less than 0.3, are the most affected by erosion, because of degradation of vegetation, while in areas with vegetation coverage (more then 0.7) no erosion of class E4 is found.

Table 1 Forest area of Kukesi and Hasi region according to coverage rate.

Area according to coverage rate (ha)		
< 0.3	0.4-0.7	> 0.7
53,656	34,905.65	26,080.31

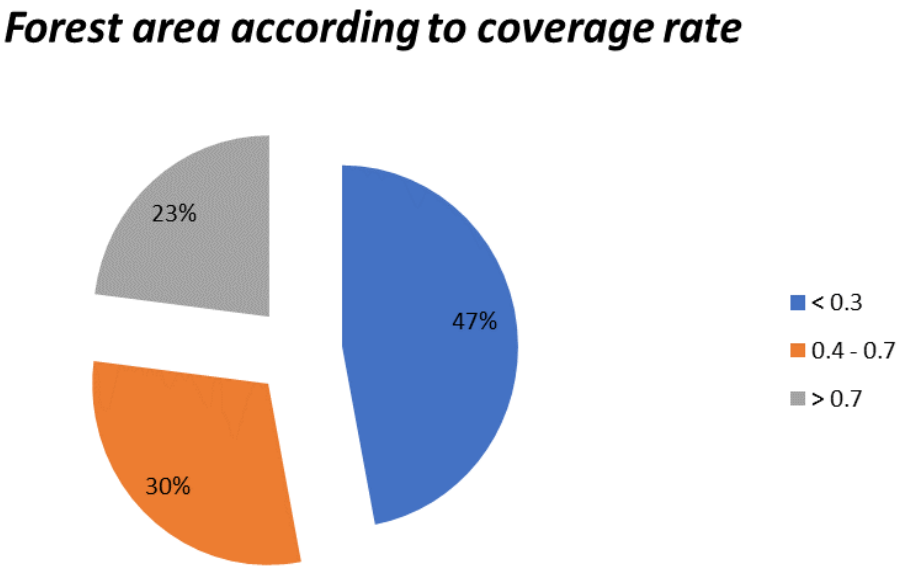

Fig. 3 Division of forest area according to coverage rate.

Table 2 Erosion rate.

Study area		Erosion rate							
		E1		E2		E3		E4	
ha	%	ha	%	ha	%	ha	%	ha	%
114,641.96	100	14,219	12	42,824.4	37	45,610.5	40	12,168.5	11

Table 3 Evaluation of the erosion rate according to the vegetation coverage.

Class	(%) of eroding horizons	Area in (ha) divided according to vegetation coverage			Total (ha)
		<0.3	0.4-0.7	>0.7	
E1	Up to 25% (hor. A)	8,048.4	13,962.3	20,864.2	42,874.9
E2	26%-75% (hor. A)	21,462.4	13,962.2	3,912	39,336.6
E3	Over 75% (hor. A-hor. B)	16,096.8	5,235.9	1,304.1	22,636.8
E4	Deeply eroded	8,049.36	1,745.3	-	9,794.66

4. Conclusions and Recommendations

From the results of this preliminary study we can conclude that:

- 47% of studied area has a vegetation coverage rate less than 0.3; while 30% of it has a vegetation coverage rate in the interval 0.4-0.7, and only 23% has a vegetation coverage rate more than 0.7.
- The study of vegetation shows that intervention with negative effects on the forest environment from anthropogenic factors, seems to be quite large.
- The current rate of erosion turns out to be quite critical. It is divided into four classes, where first class includes 14,219 (ha) or 12% of the total area, the second class 42,824.4 (ha) or 37%, the third class 45,610.5 (ha) or 40% and the fourth class 12,168.5 (ha) or 11%.
- According to the classification made by grouping classes of erosion according to vegetation coverage, the surfaces of small-scale (< 0.3) vegetation coverage have more erosion of third and fourth class.

To better understand the situation and take action in order to improve and protect the studied area from the erosion phenomena further studies should be carried out.

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