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Identifying the quantitative characteristics of the erosion processes provoked by fire on the mountain slopes surrounding the Naghvarevi stream in the Borjomi valley

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Abstract

In the burnt valley of Borjomi, in the existing Naghvarevi stream, based on the conducted research, it was determined that sustainable ecological balance is disturbed in the mentioned valley. Because of this, 5–10 t/ha of eroded mass gets into the bed of the Naghvarevi stream every year. In order to stop it, it is necessary to carry out effective and operative measures against the erosive processes.

Keywords: Erosion, eroded mass, fire area.

Introduction

In the Borjomi valley, as a result of the ecocide carried out by Russia in August 2008, the forest massifs near the Borjomi resort, the village of Khandaki in Kaspi region, Surami, Kiketi, Khaishi, Ateni, Kharagauli National Park and the central highway were destroyed.

The Borjomi valley is the subject of our study from the above-mentioned fire areas because the forest area destroyed as a result of natural disasters reached 950 hectares in this district alone (a total of 1100 hectares of forests were destroyed throughout Georgia) and the vital function of 290,000 m³ of timber was stopped. As a result of the fire, the vegetation on the mountain slopes was completely destroyed, Due to which erosion-flood events were activated, new vulnerable areas were created.

The current processes, in themselves, have contributed to increase of ecological risks, As a result, in the resort areas, the status of which mentioned above almost every region owns, the flow of tourists and vacationers decreased, which had a negative impact on the development of the infrastructure of this sector and, accordingly, on the economic indicators of the region. Based on the above, in order to assess the vulnerability of the slopes of the mountains burned in Borjomi valley, we carried out field-reconnaissance works during which particularly vulnerable areas were identified, namely, the right tributary of the Gujarula river, Naghvarevi stream (village near Daba), where active erosive processes provoked by fire were identified (Photo



Photo 1: The initial stage of the erosion processes.

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Photo 2. Active erosion processes.

Considering all the above, the results of the field-reconnaissance work carried out in the catchment basin of Nagharevi stream, aerial photo material, it was calculated according to the proven methodology, the erosion coefficient of vulnerable slopes of Nagvarevi stream catchment basin, according to the R. Morgan scale the degree of damage to the eroded slopes of the mountain has been determined and quantitative characteristics of the eroded mass.

The empirical relationship for calculating the erosion coefficient has the following form:

$$E = [0.58 + 1.40(F_1/F_0)] (t/T)^{0.21},$$

1

Where, F_1 - Is an area of bare territory in the river catchment basin (km^2); F_0 - The total area of the river catchment area (km^2);

t - Period of the research year (year); T - Total period of observation (year).

Based on the use of the erosion of mountain slopes coefficient erosion class and quantitative characteristics of the eroded mass are determined. (Table 1)

Table 1: Determining the class and quantitative characteristics of erosion.

Erosion class	Verbal assessment	Erosion intensity (ton/ha/year)	Visual evaluation criteria
1	Very insignificant	<2	The hardening of the soil and the origin of the crusts are not recorded. There are no signs of over washing. There are no signs of water erosion, Bare root system and channels.
2	Insignificant	2-5	Origin of crusts in single places. Localized washing of the surface in individual places without or with minor washing of the soil. Grooves every 50-100 meters. Minor water erosion. Washing out the foundation in areas where stones or bare roots protect the underlying soil layer.
3	Medium	5-10	Signs of wash off. Intermittent grooves in every 20-50 meters. By water erosion the foundation is washed away and roots are bared, on which the imprint of the soil surface level is visible. Danger of contamination problem in the lower part of the slope.
4	High	10-50	United and Permanent gutter drainage network in every 5-10 meters or the origin of ravines in every 50-100 m. of the seeds and washing of young plants. Possible need for re-seeding. Contamination and sedimentation problems at the bottom of the slope.
5	Strong	50-100	A permanent network of grooves every 2-5 m or ravines every 20 m. It is difficult to get to the object. The restored vegetation cover is weak and Remedial measures are required. Road damage due to erosion and sedimentation.
6	Very strong	100-500	A frequent network of grooves, ravines in every 5- 10 meters. A strong crusting of the soil around them. Danger of stripping the pipeline. Strong sludgeing, pollution and the possible problem of eutrophication.
7	Catastrophic	>500	An intensive network of grooves and ravines; big ravines (>10000m ²) in every 20 meters. Most of the surface has been washed away and the pipeline has been uncovered. Severe damage is caused by erosion and sedimentation both on-slope and beyond the slope.

The values obtained as a result of the calculations are given in Table 2:

Table 2: Values of the coefficient of erosion of mountain slopes in the Nagarevi stream basin.

№	The name of the river	Catchment area (km ²)		Erosion coefficient (E) values by years					Erosion class	Erosion intensity per year (t/ha)
		Whole F ₀ (Km ²)	Eroded F ₁ (km ²)	2010	2015	2020	2025	2030		
1	2	3	4	5	6	7	8	9	10	11
1	Naghvarevi stream	6,44	0,68	0,39	0,54	0,63	0,68	0,73	Third	5-10

Conclusion

Thus, we have studied and evaluated Naghvarevi stream catchment basin-current erosive processes provoked by fire, based on which we can conclude that, in the mentioned valley, the sustainable ecological balance is violated. Because of this, 5–10 t/ha of eroded mass gets into the bed of the Naghvarevi stream every year. To stop it, it is necessary to carry out effective and operative measures against erosion processes.

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