

Investigation Of The Ravine Intensity With The Modern Geoderic Methods Under The Arid Climatic Condition

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Abstract

It is established that the ravine erosion involves the whole area of the investigated territory. Destruction is 2,0-7,0 and more than km/km² on an area of 68,3%. The ravine height and density reach 15,6 pieces/km² in some places the mean-yearly growth of the ravines forms 0,34-7,48 m for length, 0,20-2,48 m for width, 0,10-1,16 m for depth. The ravine water-collecting area affects the development intensity.

From 79 ravine systems having a little water-collecting area-from 0,02 to 0,47 km² destruction in the 4th degree is less than 1,0 km/km², but in 36 ravine systems-from 5,0 to 7,5 km/km², in 12th - from 7,5 to 10,0 km/km², in 4th - from 10,0 to 15,0, but in the 1st of the ravine system-more than 15 km/km². A destruction rate of the separate ravine systems isn't found depending on their water-collecting area that is connected with the conditions of their Location

Key words: arid condition, ravine erosion, intensity of splintering, density

1. Introduction

A problem protecting the soils from erosion is wholly actual for many countries of the world arid zone, including the Azerbaijan Republic. [3].

An opportunity of the agricultural lands increase reduces at the expense of assimilation of the virgin and lealands in the republic year after year, but the areas destructed by erosion rise. Therefore an intensive including of the thrown soils in agricultural rotation by means of increase in their productive ability becomes an urgent problem.

The third-periodic plateau in the Azerbaijan arid zone occupies enough large area in the insufficient humid zone and it is used like winter pastures in agriculture. [4].

As is known, the lealands are naturally subjected to erosion, the other natural conditions are also favourable for erosion development. Under such conditions, utilization from the pastures leads to erosion development everywhere, to different decrease of their productivity, to nakedness of the whole massives and mountain slopes.

As far as the natural conditions and character of the erosion formation in the Azerbaijan zone have their specific peculiarities which were worked out not only for the various districts and soil surface

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including the Azerbaijan regions, a method of the fight against plain and ravine erosion won't be acceptable for this zone conditions.

It is known from the summaries it is necessity followed of the complex measure elaboration over the fight against soil erosion and firstly –study of the areal spreading and intensity in the plain washing-off development and ravine erosion, factors revealing provoked erosion acceleration.

2. Research object and method

The investigations were performed in the territory soils of the third-periodic plateau on an area of 72 000 h in 1995-2010 yy. Soil investigation and its erodity and intensity of the erosion process development were performed by the comparative-geographical, experimental and stationar methods [2,5,7,8].

The objective laws of the ravine development are studied with the registration of the category in economical use of soil, the middle-yearly increase in ravines is determined by the established benchmarks: a dimension of the designed covering was performed by a frame method.

An observation on ravine growth for the length is performed in some ravines of each “key”. At the beginning and end of the year a survey from the ravine top was made by means of fastening to the benchmarks or constant point in the area.

The areas destructed by ravines were established by means of cameral elaboration of from the topographical map on a scale of 1:10 000 and 1:25 000.

The main morphometric and morphological elements of the ravines were defined on a large scaled cartographical basis under cameral conditions, on materials of dimensions indirectly under field situations in a system of the separate ravine system. The ravine growth intensity was established by GIS technology method.

3. Conclusions and discussion

The carried out large scaled soil-erosion investigations indicate that the ravine erosion obtained the largest spreading on the third-periodic plateau among the much various situations by nature in Azerbaijan.

The territory on the third-periodic plateau is wholly in the arid zone where the soils of the semi-desert type of soil formation extend on an area of 78 000 h. [4]. The mountain grey-brown bright and grey-brown soils with the different degrees of solonetzicity, salinity and fine-granular layer capacity, granulometric content and erodibility rate were revealed and mapped by the earliest investigations.

The mountain-brown bright soils involve an extensive territory-37086,6-h or 50,90% from the total areas. From them 4556 h aren't eroded, 7 487,5 h are washed-off to a weak degree, 7 909,5 h- mean and 17152,5 h – strong degree. Depending on a rate of leaching and granulometric content in these soils the humus content vibrates from 0,41 to 2,62 %. The soils are distinguished by a weak

capacity. A sum of absorbed ions in Ca, Mg and Na changes by 7,78-20,0 mg/ekv for the eroding differences that is connected with the soil forming rock structure.

The characterizing soils are mostly subjected to leaching action of water. Only on the upper layers the unleached soils were washed-off in the inclined plain, maintenance of the water-endurant aggregates of $> 1,0$ mm reaches 43,8%, but it vibrates by 1,6-34,2% in the leached soils. The stream velocity is 0,45-0,055 m/sec. The grey-brown soils occupy 24242,5 h of area or 33,32% of the territory and involve an eastern part of the Palantokan mountain and all the southern slope of the Khojashin mountain. From them 2520,0 h were eroded to a weak degree, 1747,5 h to a mean and 9090,0 h to a strong degree.

Humus content is little – 1,78% on the upper horizon, mobile nitrogen forms 0,15%. These quantities reduce in eroding differences, they reach 0,67% of humus and 0,006% of nitrogen in strong – leached ones. A sum of the absorbed ions in Ca, Mg and Na forms 15,56 – 20,67 mg/ekv from which fall 4,57 – 15,01% from absorbing capacity to a share of absorbing Na that testifies about marked solonetricity in the grey-brown soils of the investigative object.

The grey-brown soils are wholly highly subjected to the water leaching action. It is established that a sum of the water-resistant aggregates with a size of $1 > \text{mm}$ (by Savinov) vibrates on profile by 1,4-27,4% of the leaching velocity of the stream forming 0,039-0,041 m/sec.

As a result of the ravine erosion a significant area of the slopy lands in this territory has already lost its economical importance, sealing of the Mingachevir reservoir with erosion products, brought with deep ravines from the mountain slopes is observed. [9]. Some authors consider that an intensity of the ravines growth under the arid conditions is preserved higher and continues progress [1,10,11].

The observations indicate that the ravine intensive growth on this territory of the third-periodic plateau is firstly connected with the subsoil porousness and sharply falling of the inclined plain to the Kur-Araz Lowland and Mingachevir reservoir. The beginning ravine quickly deepen into the level of water surface, grows length and width by means of its wall tripping. The ravine growth is accelerated in the places of clefts and sinkings formation which are especially abundant on the right-side inclined plain. If the clefts and sinkings are created far from the available ravines and steep coasts of the reservoir, then their growth is subsequently abated, and where the clefts and sinkings reach the ravine they turn into ravine form and accelerate fissured territory.

A reason of the clefts and sinkings formation isn't exactly explained. But it is very possible that compactness occurs on the one hand but on the other hand-emptiness formation on the low layers of the friable subsoil where the descriptive phenomena happen after falling of strong and durable rains. Stretch of such clefts and expedient sinkings reaches 100-180 m. The cleft width at the beginning stage is 3-5 cm, but less in some places. The strewing and their walls tripping occur on measure of the clefts extending by some researchers' data.

A size of the sinkings is also different - the largest diameter of funnels reaches 3,7 m, but depth 8,0 m.

It should be noted that not only friability of subsoil and sharp galling of the erosion basis, but also light granulometric structures of soils and rocks (mainly sandy and light loamy), their non-persistence to erosion, large verticality of slopes with the availability of often repeated steepes, strong plant cover sparseness and shortness of the vegetation period, majority of the herbs extending here influence on the intensity of the ravine development in the arid zone. A principal reason of the large erosion was lowering in the last basis of erosion – deep cut of the Kur riverbed into the district between Khojavshin and Bozdag that gave an importance to the water flow from the stretching mountains under achievement of the Kur river to leach its bank. Many ravines created by means of such way are situated in the different stage of its development.

The performed investigations and calculations derived degrees of the territory destruction with the ravine net on our map showed that a territory of the Mingachevir reservoir was exposed to erosion to a various degree.

The abovementioned data are presented on Table 1 from which is obvious that only 8,3% of the territorial area destroyed weakly (forms less than 0,5 km/ $[(\text{km})^2]$). On the main part of the territory 83,1% a calculation vibrates from 0,5 to 5,0 km/ $[(\text{km})^2]$.

A quantity of the ravine systems with the different area of water-collector and destruction rate

Water-collecting area of the separate ravine systems, km^2	Degree of the ravine system destruction							A quantity of the ravine system, pieces.
	<1	1-3	3-5	5-7,5	7,5-10	10-15	>15	
To – 0,5	4	3	36	19	12	4	1	79
From 0,5 to 1,0	-	3	22	7	-	-	-	32
From 1,0 to 3,0	-	14	27	4	1	-	-	46
From 3,0 to 5,0	-	9	9	2	-	-	-	20
From 5,0 to 7,0	-	4	3	-	-	-	-	7
> 7,0	-	5	1	-	-	-	-	6

The contradictory data were also obtained on ravine systems having a large area of the water-collector. In the ravine systems possessing a water-collecting area 3,0-5,0 km^2 but in the basin the like is 20, a destruction rate in the 9th ravine systems is 1-3 15 km/km^2 , in the 9th – 3-5 km^2 , only it in the 2nd destruction reaches 5-7,5 km/km^2 .

In the ravine systems having the largest area in limits from 5,0 to 28,8 km^2 , a degree of the destruction in the ravine systems isn't high, vibrates mainly from 1 to 3 km/km^2 , rarely from 3 to 5 km/km^2 .

As is obvious from the description, a rate of destruction in the separate ravine systems is found depending on their water-collecting area, more over, the largest destruction is noted in the ravine systems, possessing water-collecting area that is connected with the conditions of their location. The ravines belong to 1 and 2 branching order in the basin territory, but here branching places have 3 and 4 orders (Table 4).

At survey of the topographical basis the relation of the 1st and 2nd branching orders to coastal zone of the reservoir, inclined slopes and mountain low parts is distinguished.

The largest orders of branching possess spreading on the upper parts on the steep slopes. Dependence of the territory destruction rate on depth of the erosion local bases isn't noted. As is obvious from the given Table 5 in limits of the comparative heights from 0-117 to 0-417 and a rate of the territory destruction changes in the little limits from 2,28 to 3,45 km/km². So at the basis depth by 417 a degree of destruction is less (2,49 km/km²) than at the depth by 217 m (3,23 km/km²).

It is evidently connected with that that a lower part of the slopes with the larges depth of the local bases from erosion is low-grade, besides there is a less destructed inclined plain, which reduces a total degree of destruction, between mountainous part and reservoir here. The areas with the least depth of the local bases in erosion with their steep short slopes are indirectly turn to the lake.

Table 4: Places of the branching order spreading in the third-periodical plateau

Branching order	The places of the most spreading orders
1	Coastal zone of the reservoir, low-grade south and eastern slopes of Palantokan mountain, east and western part of the Khojashin ranges, areas of the western Bozdag range (environs of Kirov mountain), rightcoast and leftcoast river of lory.
2	Lower part of the Bozdag slopes, coastal zone of the reservoir, a Lower part of the north-eastern slopes in the Palantokan range.
3	Steep slopes in the central part of the Bozdag range, an upper part of the north-eastern slopes in Palantokan range
4	Steep slopes of the north-western mountain of Babaeldag, the steep slopes in the western part of the Khojashin range.

As is indicated above there are 750 ravine systems in the Mingachevir reservoir basin. From these ravine systems ten thousand tons of soil and subsoil are taken off by rain waters every year. However not all the ravine systems have a relation with the reservoir and not all the materials of erosion fall into reservoir.

The calculations derived on the sheets of the larges caled topographical basis show that from all

the ravine systems having 750 pieces, only its 3rd river-bed penetrating into depth on the inclined plain corresponding on destruction degree reaches the final point - reservoir carried out a great quantity of erosion product and landslides of the unsteady rocks from the mountains. (Table 5).

Table 5. Degree of the territory destruction depending on depths of the erosion local bases, km/km^2

№ n/n	Depth of erosion local bases ,m	Area, km^2	Net stretch km	Destruction degree. km/km^2
1	From 0 to 117	8,75	19,4	2,28
2	From 0 to 217	217,10	718,3	3,29
3	From 0 to 317	170,94	589,2	3,45
4	From 0 to 417	73,95	196,4	2,49

In a line of such ravine systems in the dense.

The ravine systems not having a direct relation with each other, reach the plains and water stream with the leached materials is fan-shapedly dispersed on the upper and middle parts of the inclined plain.

4. Conclusion

A combination of the whole components line in the territory of the third-periodical plateau in the arid-denudation landscape promotes intensive development from the ravine erosion.

It is established that uneroded soils from the whole area of the territory occupy 21,3%, mean and strong washed off – 49,3%, outlet of the root rocks – 15,7%.

The ravine erosion involves 68,3% of the territory from the whole area where the destruction area is 2,0-7,0 and more than $km/ [km]^2$. The height and density of the ravines reach 15,5 $km/ [km]^2$ in some places. The ravine middle yearly growth is at a length of 0,34-7,48 m, at a width – 0,20 – 2,48 m, at a depth – 0,10 – 1,16 m.

The water-collecting area affects the development intensity of the ravines. The ravines mainly belong to the first and second order of branching on the third-periodical territory, but there are the III and IV branching orders which are related to the steep slopes of the upper parts in the ravine systems.

For the purpose of weakening the erosion process and reducing the intensity of the Mingachevir reservoir ravines it is necessary to perform organisation – economical, agrotechnical, meliorative and hydrotechnical measures.

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