

# ELABORATION OF THE MAIN DIRECTIONS ON PROTECTION OF THE MOUNTAINOUS-MEADOW PEATY SOILS IN THE RIVER BASINS OF THE NORTH-EAST SLOPE IN THE GREAT CAUCASUS

(On the pattern of Gudialchay river)

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The high-mountainous territories of the Azerbaijan part in the Great Caucasus are distinguished by an increasing effect of the different kinds of the human activity on mountain-meadow landscape complexes with their unpredictable consequences, researches to which many scientists' works are dedicated. For this purpose there is necessity to realize a complex analysis of the condition in the mountain-meadow peaty soil formation, their physico-chemical indices and composition, possibilities of the realization in urgent nature-protection. The territory of the Gudialchay river basin running from the north-eastern slope in the Great Caucasus actively involves in a sphere of the activity of the touristic business in background of continuing of the pasture livestock increase; basing on sub-alpine and alpine meadow is frequently mentioned as anthropogenic factor of the of relief formation. In this connection arises necessity of registration and appraisal of all the environmental factors which are able to influence on population's and tourists' life at present and in future.

**Introduction.** The important elements of the mountainous landscapes in the Great Caucasus high-mountainous of Azerbaijan Republic are soil cover under an influence of which a complex system of owning complicates, as is shown by an experiment of the scientific researches requiring for a registration of the ecological necessity and economical reasonability [1, 3, 14].

**Materials and Methods.** The high-mountains from the north-eastern slope in the Great Caucasus are distinguished by a large zone of the mountain-meadow natural zone being used as summer pastures and haylands for centuries. The less inclinations of the surface slopes cause thicker cover of mountain-meadow, including, mountain-meadow peaty soils in comparison with the south macro slope of the Main Caucasus range. This type of the soils occupies large areas in the high-mountainous part of the north-eastern slope of the Main Caucasus mountain range and in the Lateral range of the Azerbaijan part, which cuts through the Gudialchay river flowing into the Caspian Sea and establishing a deep ravine in this region.

Today it is clear that a given area of the Lateral range is characterized by an intensive development of the landslide processes, change of the appearance of the mountainous meadow and haylands to a strong degree, including changes in land rents and creating different social problems for population of many villages in the region as in other countries [11, 13]. From this point of view a modal is a territory around Kalaykhudat village where the landslide processes changed not only micro relief to a considerable degree, but also violated soil cover integrity to a strong degree making the given area

probable stream hearth for the Gudialchay river, occurring the potential danger for the village population's life. An analysis of the scientific literature dedicated to the research of climatical, geomorphological and soil conditions in the upper Gudialchay, together with interpretation of aerophoto on scale of 1:25000 gives an opportunity to reveal main factors of the soil-ecological landscape situation development.

The researches of the given territory are forecasted by separation of the upper stream in the river basin on the topographic map scale of 1:100000 with the definition of the complicated relief on the map scales of 1:25000. In future the separated contours on aerophotos were transferred to topographic basis. The aerophotos of this scale are optimal for the researches in a sphere of the value in soil-erosion process development degree and all the landscape situation.

**Results.** The researches show that the thickest typical mountain-meadow peaty soils of the Azerbaijan part in the Great Caucasus spread on the northern slopes and spurs of Main and Lateral ranges.

The section of 1411 laid by H.A. Aliyev (1978) [2] is characteristic for typical thick mountain-meadow peaty soils on the north slope of Shahdag. The relief of locality is weak-inclined, a gradient change is one meter per 100 m. An exposition is north-west, vegetation is mezophyl-meadow. The high-mountainous clover (*Trifolium repens*, *T. Trincephalum*) from forage plants, *Nymphaea* L., *Alchymella* and many others from mezophyl plants are met. The important rock – limes are Upper Yu-

ra. Moreover relatively sloping relief with the minimal slope locality is probably a main reason of formation of the thick soil profile not characteristic for a great part of the Azerbaijan high-mountains in the Great Caucasus. However, such areas can be characterized by an availability of the strong and medium eroded areas, with the sparse vegetation and deteriorating kind composition. We should note vegetation of the hamlets which are distinguished by thick vegetation, but majority of plants in these areas belong to the weeds, not having valuable nutritious properties, but now and then – poisonous. Soddy-peaty mountain-meadow soils with the medium thick profile (section 1406) at 4 km of northern Shahdag, at altitude of 2700 m were described by H.A. Aliyev (1978). Soils are formed on Yura limestone under alpine meadows.

Moreover an absence of horizon B that can be explained by the severe climatical and relief conditions for soil formation, leading to the weak differentiation of the soil profile is observed.

An analysis of description in section №21 laid on the southern slope of the Lateral range in the Gudialchay valley shows that the profile is contracted, a significant insolation (as an eastern exposition) promotes over intensive decomposition of the organic part and formation of the powder-like structure.

The similar features of the profile have also section №22, laid on artificial ancient terrace at a kilometer from Khynalyg to the east, at an absolute height of 1950 meters in 2008.

The mountain-meadow peaty soil is subalpine, weak eroded, skeleton. A slope of the area surface is 27°-30°. The projective coatings are 90-100%. The upper 0-5 cm horizon A1 is characterized by granular-powder-like soddy dark-brown colouring with the rare stones, that can tell about incomplete soil forming process. The low horizon of A2, at a depth of 5-13 cm possesses brown colouring, granular-powder-like structure with the numerous thin and coarse fragments of the rocks. Horizon B at 13-23 cm possesses dark-brown colour, places with the yellowish tint and coarse granular structure. Lower of the soil profile sharply turns into maternal rock.

An analysis of the nutrient quantity in the given section showed that a sum of the absorbing ammonia ( $N/NH_3$ ) on the upper layer formed 35,47 mg/kg, sharply reducing till 18,43 on the second horizon and till 10,35 on the third horizon. On the upper horizon a sum of mobile phosphorus ( $P_2O_5$ ) was 42,50 mg/kg, on the second – 32,50, but on the third – 26,67 mg/kg. Exchangeable potassium ( $K_2O$ ) reduces sharply from 233,77 mg/kg on the

first horizon till 155,44 on the second horizon. On the third horizon the sum decrease is insignificant – to 140,98. A sum of pH on the upper horizon formed 7,7 with the insignificant from depth – 7,85 on the second and 8,05 on the third horizon. The parameters ES – saltiness vibrates by 0,50-0,47-0,45.

A reduction of the soil profile thickness is clearly followed as a result of intensifying of the cattle's pasture.

Peaty and soddy-peaty soils are high humic, besides humic horizon is enough thick. It is explained by an abundance of vegetative residues, admixture of the mushrooms and lichens, by intensity of humusformation process, too. As regards weak peaty-soddy soils of the upper part in the alpine zone, where the slopes are significantly, gulf though more root residues in them, humic content doesn't rise 10-15%. Probably, the humification process in them proceeds weakly and some quantity of humus is leached.

As calculations show in the typical peaty soils where humus quantity reaches now and then 35-40%, on the upper (0-20 cm) layer the humus supply reaches 600 t/h, but nitrogen – about 30 t/h. In soddy-peaty and peaty-soddy mountain-meadow soils on a layer of 0-20 cm of the mean-thick areas the humic supply is equal to 350-370 t/h, low-thick (thin) – 230-240 t/h, nitrogen – corresponding to 18-20 and 7-10 t/h. Of course, these parameters of humic supply are enough high, but we should take into account that in the peaty soils under humus definition it is difficult to choose semidecomposing and smashing vegetation residues, this raises definition consequences.

The consequences of the analysis of absorbing bases and acidity on H.A. Aliyev's data show that the peaty soils in the subalpine zone and low part of the alpine zone are mostly saturated by bases. From 80-90% of sums fall on calcium, hydrogen ion is almost absent. The upper horizons of soddy-peaty soils in the subalpine zone (northern slope) are also saturated with the bases well (40-50 mg-ekv), from the depth their composition gradually decreases. The soddy-peaty soils of the upper part in the alpine zone are less saturated.

And parameter pH changes in a such order of these soils. A reaction of the water suspension is neutral or weak-acid in saturating soils, on the upper part of high mountain – is acid.

Mechanical composition of the soddy-peaty soils is mainly connected with the soil forming rocks of the locality, processes of the root rock weathering. The main types of soils are formed in the clayey shist, lime and sandstone of the Yura age in the

sphere of the Great Caucasus. Therefore they must wholly be clayey and loomy.

The analyses of the granulometric structure show (Table 1.) that the peaty-soddy soils of the northern slope are light-loomy. On the profile of this section clayization of the middle part is clearly observed. Wholly, it is characterized by clayiness.

As a spacious mountain-meadow massive, becoming enough characteristic for the subalpine subzone, we selected the environs of the Khynalyg village with the spreading mountain-meadow peaty soils. It is situated in the southern branches of the Lateral mountain range system with the coarse weak-inclined areas. The upper part of the subalpine meadows in the given area characterizes section №21. It was laid at a kilometre to the north-east from the Khynalyg village, hear the plateau forming hillocks, obstructed weeds, to the south-east from the Gyzylgaya peak at an altitude of 2500 m. The soil is peaty, friable soddy, medium eroded. On inclination of the slope is 45°.

The other area in which section №20 was laid is situated to the north-west from Khynalyg at altitude of 2200 m, on the slope with the inclination of

45° on the left bank of the Rozer river, left tributary of the Gudialchay. The weedy vegetation develops under conditions of the intensive soil erosion. The given area is actively used as by-village pasture land by the village population. The alluvial and proluvial river-bed deposits testifying its hydro-energy develop along the Rozer river-bed. The soil is medium eroded.

The data of the analyses of the soil samples revealed an aggravation of the nutrient quantity parameters in this type of soil (Table 2), including humus and nitrogen. On section №21 horizon A1 0-10 cm is characterized by the humus quantity in 9,21%, by reduction on the low layers till 7,03 and 5,48%. Such situation eloquently testifies degradation of the whole mountain-meadow landscape because of continuing an application of the removal cattle-breeding in the summer pastures. Rather frequently these pastures are places of the origin of the aggressive character facies – ravines, deprive soddy coating in the bare areas displaying in the form of hearths of the sheet and linear erosion from soil cover.

Table 1

## Mechanical composition of peaty-soddy soils (with processing HCL)

№ section	Depth, cm	Loss by boring, %	Fraction fraction (mm) (in %)						
			1-0,25	0,25-0,05	0,05-0,01	0,01-0,005	0,005-0,001	<0,001	<0,01
by H.A.Aliyev									
344	0-3	-	3,8	11,8	37,6	6,8	12,4	27,6	46,8
	5-12	-	6,6	29,4	25,2	9,8	12,8	16,4	39,0
	18-30	-	9,5	13,5	27,8	13,6	21,4	14,2	49,2
	35-42	-	41,9	14,6	12,3	6,4	13,6	11,6	31,2
	45-55	-	11,6	22,0	20,4	14,0	20,4	11,2	46,0
1406	0-15	6,61	0,25	34,63	44,88	6,40	5,12	8,72	20,24
	15-52	0,46	0,46	24,18	23,24	11,60	23,76	52,76	52,12
1398	0-24	1,23	10,79	47,93	22,56	4,48	6,32	5,92	18,72
	24-38	6,79	9,25	20,43	27,68	13,12	19,44	10,08	42,64
665	0-6	-	9,8	38,5	9,2	6,6	11,5	24,4	43,5
	10-15	-	6,4	9,6	15,4	13,0	17,9	37,7	68,5
	25-30	-	7,8	15,1	9,9	13,6	22,2	31,3	67,2
	50-55	-	19,4	3,2	12,0	11,2	28,8	25,3	65,4
	95-100	-	33,7	31,5	4,8	5,0	10,8	14,2	35,0
by I.I. Mardanov									
21.	A1 0-10	-	2,09	22,38	34,08	7,57	21,88	12,00	41,45
	A2 10-18	-	4,85	18,46	43,14	3,74	14,76	15,05	33,55
	BC18-30	-	1,16	18,19	44,07	5,13	12,35	19,10	36,58
20.	A <sub>1</sub> 0-5	-	2,51	21,14	33,26	6,74	21,57	-	-
	A <sub>2</sub> 5-15	-	3,25	19,81	41,10	4,33	16,27	-	-
	B 15-25	-	1,76	19,23	40,26	5,52	13,32	-	-
	C 25-30	-	1,68	18,31	36,75	11,85	12,08	-	-

Table 2

## A quantity of nutrient in mountain-meadow peaty soils

No section, its geographical location, at altitude	Erodibility degree	Horizon, depth in cm	N/NH <sub>3</sub> mg/kg	K <sub>2</sub> O mg/kg	Mobile phosphorus (P <sub>2</sub> O <sub>5</sub> ) mg/kg MT/KT	pH	ES salinity
21. at 1 kilometre to the north-east from Khynalyg, 2500 m	Medium eroded	A1 0-10	21,34	253,05	47,50	7,65	0,51
		A2 10-18	14,55	241,00	33,75	7,95	0,44
		BC 18-30	12,07	219,31	25,55	8,05	0,43
20. to the north-west from Khynalyg, 2200 m	Medium eroded	A <sub>1</sub> 0-5	39,91	266,30	68,77	7,15	0,51
		A <sub>2</sub> 5-15	25,22	177,13	48,75	7,05	0,42
		B 15-25	14,55	162,67	41,25	7,25	0,40
		C 25-30	10,35	149,42	37,50	7,35	0,39

In spite of relatively less absolute height in comparison with such peaks as Bazarduzu, Tufandagh and Shahdagh, in Khynalyg, characterizing by a presence of A probability arises that just the melted waters of these massives at a period of the intensive melting is a reason for enleaching in heap friable-disintegrated substance, widely spreading on the southern slopes in the Gudialchay river channel, running through some landscape zones, intensifying danger in this fragment of the high-mountainous zone in the north-eastern slope of the Great Caucasus. Even this territory isn't distinguished by a presence of a great quantity in the populated areas and danger of the exodynamical processes effect on people's dwelling is relatively limited, but a situation can be cardinally changed with the continuation active involvement in the given territory, locating in immediate proximity to the village of Khynalyg, having ethnographic importance in a touristic activity under conditions of the park regime.

**Discussion.** Besides territorial reserves, subalpine and alpine meadows are a zone of the active land use as summer pastures, which play a great role in population's provision with meat and dairy products in Azerbaijan, Georgia and south of Russia. As alternatives of the traditional system of economizing the development of the tourism is offered for achievements of the ecological balance in the mountainous countries with the similar natural conditions [4].

The north-eastern slope of the Great Caucasus, including its high mountainous part presenting by the mountain-meadow and rocky-nival landscape zones besides development of the unfavourable natural-destructive processes are attractive for conduction of the touristic routes because of presence

of both natural and historical monuments, such pedestrian tours mainly can give an opportunity for the tourists to observe a diversity of the natural conditions and consequences of the natural calamities becoming integral part of these natural complexes.

The measures on widening of the touristic business in the high mountains are in need for an appraisal of the natural resources and territories relatively possibilities of conduction of the recreation activity, gradation of the separate massives on possible risks under realization of the intended functions what is a theme of the investigations of the scientists' in other mountainous countries [8, 10, 15].

For the present a system of the tourists' notification is absent in a case of probability of heavy rains, hails, landslide reduction, and etc. The given work can prevent a lot of trouble of the tourists' in the high mountainous territory, amend in a choice of the touristic routes and definition of their time, what is also actual for other regions of the world. Besides a danger of soil biot aggravation exists in consequence of uncontrolled development of ecotourism, as for instance, in some districts of Kazakhstan [6]. Active involving in the given territory in the sphere of touristic business makes possible to perform important measures of the security, systematic character which can prevent tragic consequences of the careless attitude to the natural calamity. An availability of such dangers is commented in many researchers' works in the mountainous countries having the same border [12].

The offered measures are in a state essentially to change an appearance of the mountainous slopes being subjected to destructive processes to a strong degree, leading to their degradation and taking a decisive step in creation of the nature reserve system in Azerbaijan land use.



A radical measure of the fight with the soil erosion is prohibition in its use as a pasture or regulation of the cattle grazing in a basin of stream-bearing rivers with the application of the pasture enclosing system.

The hydrotechnical measures take an important pace in the system of the antierosion measures. Their main aim is to fasten river banks by planting of the bushy plants stable for washing off. It is possible to create stone mounds (shaft) along the banks, streams parallel to the river-beds, capable of slope defence from temporary water streams, arising as a result of the downpours and intensive snow melting. These mounds (shafts) must occupy a river valley for all its stretch, so their fragmentariness doesn't ensure a security of all the populated areas, along its channel, including mountain-meadow zone.

There is necessity of realization of the forest planting in the low subalpine zone on the weak inclined slopes of the valleys – moreover the bushes and trees in these slopes should be maintained. On the steep slopes the forest planting is complicated and therefore first it is required to plant across bushy plants with the height of 30-40 cm which are in a state to detain washing – off thin soil and to create small terraces, moreover planting of willows, white acasia and other quick-growing bushy and wood plants can be recommended.

On the whole sowing of grass in such slopes become difficult and require an attraction of the significant financial means because of more steepness and unsteadiness of the friable matter of scattering and crumbling. Besides, young grass in view of the weak development of surface and especially underground (sub-soil) part protects slope surface weakly, transfer the surface flow into intersoil to a considerable degree.

For the purpose of fastening scattering planting of the pine tree (*Heracleum L.*) can be offered. This tree isn't insistent for fertile soil and is in a state to be grown in stony areas, scattering, crumbling. Many slope areas can be fastened by dike construction from this plant during some years. We can suppose that a quick efficiency from this measure application can probably obtain in the north-eastern slope of the Great Caucasus, including, the Gudialchay river valley, possessing relatively less energy of the relief less intensity of display of the morphoclimatical factors, especially torrents, influencing on friable fragment matter transference. Pine-tree (*Heracleum L.*) is a good forage plant and that's why it can be used with the purpose of fodder economy development.

The soil-ecological conditions of the high mountainous part in the Gudialchay river basin are distinguished by an influence of the complicated complex in the natural and antropogenic factors forming theoretical basis in economizing traditional system. Beside the severe climate conditioning a development of the pasture cattle-breeding with the refusal from never cultivating mountainous agriculture, the factors of the relief and lythological composition of rocks leading to erosion development and karst process play a great role in improvement of soil cover. Study of these factors, ecological situation appraisal and elaboration of the nature protective measures for the given territory and the territories having the same border in the North slope of the Great Caucasus are always the focus of attention of many geographers, soil scientists and representatives of other scientific disciplines [5, 7, 9]. In this connection the necessity of finding of the balance between nature protective and economical activity exists in the world of the active development of the touristic business with the calculation of reveal in possibilities of melioration and recultivation of soil cover in the mountainous meadows.

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# **РАЗРАБОТКА ОСНОВНЫХ НАПРАВЛЕНИЙ ПО ЗАЩИТЕ ГОРНО- ЛУГОВЫХ ТОРФЯНИСТЫХ ПОЧВ В РЕЧНЫХ БАССЕЙНАХ СЕВЕРО- ВОСТОЧНОГО СКЛОНА БОЛЬШОГО КАВКАЗА (на примере реки Гудиялчай)**

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Высокогорные территории азербайджанской части Большого Кавказа отличаются возросшим

влиянием различных видов человеческой деятельности на горно-луговые ландшафтные комплексы с их непредсказуемыми последствиями, исследованию которых посвящены работы многих ученых. Для этого необходимо осуществить комплексный анализ условий формирования торфянистых горно-луговых почв, их физико-химических показателей и состава, возможностей реализации неотложной природоохранной деятельности. Территория бассейна реки Гудиялчай, расположенная на северо-восточном склоне Большого Кавказа, активно вовлечена в сферу деятельности туристического бизнеса. В связи с этим, возникает необходимость регистрации и оценки всех факторов окружающей среды, которые могут повлиять на жизнь населения и туристов в настоящее время и в будущем.

## **BÖYÜK QAFQAZIN ŞİMAL-ŞƏRQ YAMACININ ÇAY HÖVZƏLƏRİNDƏ TORFLU- DAĞ-ÇƏMƏN TORPAQLARIN MÜHAFİZƏSİNİN ƏSAS İSTİQAMƏTLƏRİNİN İŞLƏNİB-HAZIRLANMASI (Qudyalçayın timsalında)**

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Böyük Qafqazın Azərbaycan hissəsinin yüksək dağlıq əraziləri dağ-çəmən landşaft komplekslərinə insan fəaliyyətinin ayrı-ayrı sahələrinin artan təsirinin gözlənilməz nəticələrinə görə fərqlənir və bu məsələlərin tədqiqinə bir sıra alimlərin əsərləri həsr edilmişdir. Bu məqsədlə torflu dağ-çəmən torpaqlarının formalaşması, onların fiziki-kimyəvi göstəriciləri və tərkibi təxirəsalınmaz təbiəti mühafizə tədbirlərinin həyata keçirilməsi imkanlarının kompleks təhlilinin həyata keçirilməsi zəruridir. Böyük Qafqazın şimal-şərq yamacından axan Qudyalçay hövzəsi mal-qaranın sayının subalp və alp çəmənlərinə əsaslanaraq davamlı surətdə artırılması şəraitində turizm biznesi fəaliyyətinə fəal cəlb olunmuşdur. Bu, tez-tez relyefəmələgəlmənin antropogen amili kimi göstərilir. Bununla əlaqədar olaraq, hal-hazırda və gələcəkdə yerli əhalinin və turistlərin həyatına təsir göstərə biləcək ətraf mühitin bütün amillərinin nəzərə alınması və qiymətləndirilməsi zərurəti yaranır.

**Məqaləyə aqrar elmlər üzrə elmlər doktoru  
A.F.Həsənova rəy vermişdir.**