UOT 631.48

COMPARATİVE EVALUATİON OF THE SOİLS OF THE NORTHEASTERN SLOPE OF THE LESSER CAUCASUS (İN THE EXAMPLE OF DASHKASAN, GADABEY AND GOYGOL REGİONS)

СРАВНИТЕЛЬНАЯ ОЦЕНКА ПОЧВ СЕВЕРО-ВОСТОЧНОГО СКЛОНА МАЛОГО КАВКАЗА (НА ПРИМЕРЕ ДАШКЕСАНСКОГО, КЕДАБЕКСКОГО И ГЕЙГЁЛЬСКОГО РАЙОНОВ)

L. Sh. KHALİLOVA

Азербайджанский Технологический Университет,
г. Гянджа, Республика Азербайджан, AZ2011, e-mail: lamiyex@list.ru

(Поступила в редакцию 12.09.2023)

The administrative regions included in the north-eastern slope of the Lesser Caucasus are considered to be an important industrial, primarily mining and agricultural area of Azerbaijan. The comparative evaluation (bonitirovka) of lands is important for a number of measures of state importance, including the protection of lands and natural landscape complexes, the calculation of damage caused to them due to these and other reasons, the distribution of lands by category within the borders of the Republic on scientific grounds, as well as the internal transformation of the category and the implementation of other works. is considered a tool. The comparative assessment of soils and landscape complexes on the north-eastern slope of the Lesser Caucasus consisted of the following stages: establishment of the main credit rating scale based on potential fertility indicators; establishment of an open credit rating scale with the application of correction coefficients. Within the research object, the following landscape complexes and reference soils were separated, their main bonity scales were established, and the bonity scores of individual soils were found in comparison with the reference soil: alpine and subalpine meadow and meadow-steppe belt (reference soil: washed black soil-like mountain-meadow); mesophilic forest belt (reference soil: washed mountain black); xerophytic forests, scrub and steppe belt (reference soil: steppe mountain brown).

Key words: *soil, alpine, subalpine, landscape zone, bonitirovka, soil evaluation.*

Административные районы, входящие в состав северо-восточного склона Малого Кавказа, считаются важным промышленным, прежде всего горнодобывающим и сельскохозяйственным регионом Азербайджана. Сравнительная оценка (бонитировка) земель важна для проведения ряда мероприятий государственного значения, в том числе для охраны земель и природно-ландшафтных комплексов, подсчета ущерба, причиненного этими и другими причинами, распределения земель по категориям в пределах границы республики на научной основе, а также внутренней трансформации категорий и выполнения других работ. Сравнительная оценка почвенно-ландшафтных комплексов северо-восточного склона Малого Кавказа состояла из следующих этапов: составление основной шкалы баллов бонитета на основе показателей потенциального плодородия; составление открытой шкалы баллов бонитета с применением поправочных коэффициентов. В рамках исследования выделены следующие ландшафтные комплексы и эталонные почвы, установлены их основные шкалы бонитета, а также установлены показатели качества отдельных почв в сравнении с эталонной почвой: пояс альпийских и субальпийских лугов и луговых степей (эталонная почва: горно-луговая черноземовидная выщелоченная); пояс мезофильных лесов (эталонная почва: горно-черноземная выщелоченная); пояс ксерофитных лесов и кустарниковых степей (эталонная почва: горно-коричневая остепненная).

Ключевые слова: *почвы, высокогорная альпийская и субальпийская ландшафтная зона, мелиорация, оценка почв.*

Introduction

Land cover always has a unique role in the life of human society, landscape and ecosystems . The protection of these systems is relevant in our modern times. In this regard, the protection of land and landscape complexes is of scientific-theoretical and practical importance.

In developed and developing countries of the world, regardless of the social structure and the nature of management, modern land evaluation works are carried out. According to the theory of genetic soil science of lands benchmarking is carried out on the basis of the potential indicators of the soil. In order to determine the potential fertility of the soil, other factors besides its quality ~~are~~ taken into account [23].

Land valuation is a comparative characteristic of the quality of agricultural and forest land expressed in points

of land areas (crops, perennial crops, mowing and grazing areas) , determination of economic indicators, calculation of land taxes and other cadastre–of land in the implementation of works benchmarking is the primary basis.

Lands comparative evaluation (bonitirovka) reveals the comparison of the quality of soils, which determines how many times any soil is better or worse than another. Through this approach, ecological assessment of soils is carried out in a number of research works.

Thus , in different periods and societies, regardless of the socio-political structure, the assessment of land from various aspects, primarily for fiscal purposes (calculation of land taxes, compensations and compulsory

purchase prices of land, etc.), has always been relevant, scientific-theoretical and practical importance. obtained [20].

Research object and methodology

The object of research . Part of the northeastern slope of the Lesser Caucasus was taken as the object of the study. Its total area is 283,273.33 ha and covers Gadabey and Dashkasan administrative regions. This area has a complex geomorphological structure [1]. The research facility covers areas whose height varies from 1000 to 2000 meters above sea level.

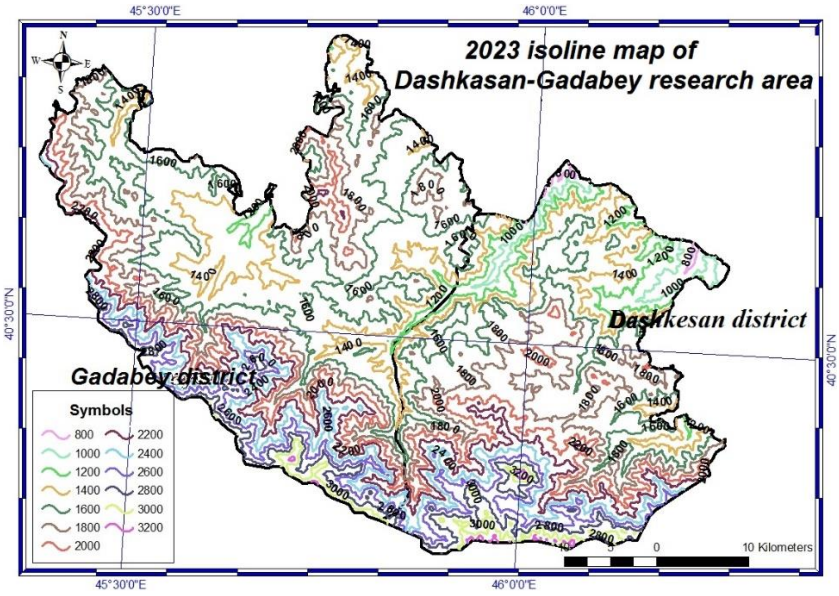


Figure 1. Hypsometric map of the study area

The north-eastern part of the Lesser Caucasus belongs to the types of temperate-hot climate with dry summer and cold climate with dry winter. The average monthly temperature of January is 0.6 º C, the temperature of July is 25.1 º C, the annual air temperature is 13.1 º C. The amount of precipitation varies between 600–800 mm. The hydrographic network of the area includes Goygol (Zivlan village), Ganja river (Canagchi-Dastafur villages) , Ballicali (Garagollar) , Shamkirchay (Astaf village) , Goshgarchay (Khoshbulag) . includes the rivers of the village – Dashka and cities) .

In the area, the broad-leaved mountain – forest landscape covers the slopes with a height of up to 1900 meters . The high border of the mountains is completed with oak forests. Subalpine and alpine meadows are located on the upper border of the forests . Subalpine vegetation of the area covers the altitudes of 1800–2600 m. 39.3 % of the territory is covered with broad-leaved mountain forests and 32.8 % with re-established vegetation instead of shrubs.

On the northeastern slope of the Lesser Caucasus grassy mountain-meadow, brown mountain-forest and brown mountain-forest soils are spread, while brown mountain-forest, black soil, grassy mountain-meadow, etc. are found in Gadabay district. lands are spread. The main part of the study area is grassy mountain-meadow (35 %), brown mountain-forest (36 %) and brown mountain-forest (19 %) soils.

Research methodology . In Azerbaijan [2, 3, 4, 5, 7, 9, 11, 12, 13, 14, 15, 16, 18, 24, 25] and near abroad [8, 10, 17, 19, 22] in the basis of genetic soil science the comparative assessment of land was started in the 60s of the 20th century. A number of valuable works have been done in this field by various researchers. On the basis of these studies, credit scores of lands of different regions of the Republic were found and their price maps (credit rating, agro-production grouping, etc.) were compiled.

Studies on the comparative assessment of soils on the north-eastern slope of the Lesser Caucasus were carried out in three stages: camera preparation, field-laboratory, final.

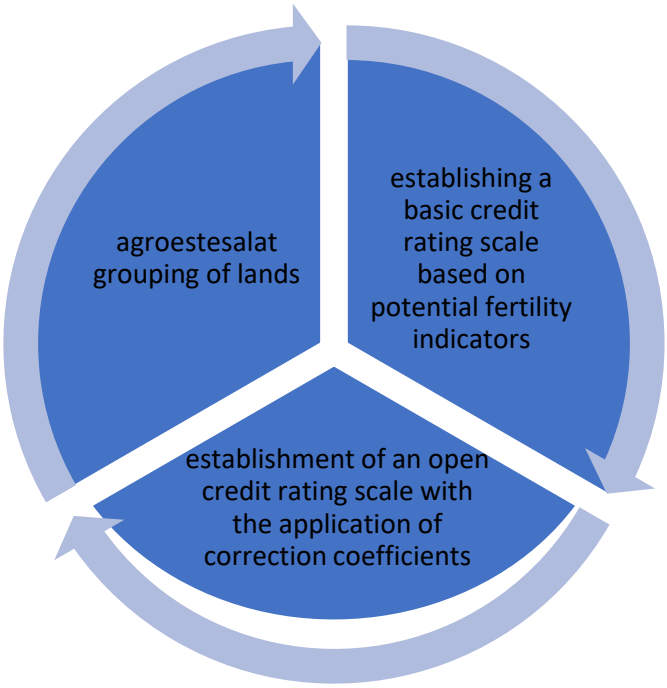
In accordance with the methodology, the soil-climate conditions of the area were analyzed at the stage of camera preparation, and the main soil quality scale was compiled.

Proceeding from the purpose of our research, we made a survey of the soils and landscape complexes on the north-eastern slope of the Lesser Caucasus. comparative evaluation was carried out. Evaluation works were carried out according to the following scheme (Scheme 1).

As can be seen from the diagram, the comparative assessment of lands and landscape complexes affected by the mining industry consisted of the following stages:

- establishment of the main credit rating scale based on potential fertility indicators;
- establishment of an open credit rating scale with the application of correction coefficients;
- agroestesalat grouping of lands.

The assessment of mining-impacted soils under this scheme allowed us to compare the pre- and post-impact conditions of normal soils, and estimate the extent and cost of damage and remediation. At that time, the main credit rating scale was established based on the potential indicators of the soil (humus, nitrogen, phosphorus, potassium, UAC), an open credit rating scale of soil diversity was drawn up with the application of correction coefficients, and agro-production grouping of soils was carried out. average scores are determined.



Scheme 1. The scheme for the assessment of lands affected by the mining industry in stages

As a result of the research, the assessment and agro-production grouping maps of the soils of the northeastern slope of the Lesser Caucasus were drawn up.

Analysis and discussion

The most important operation in the comparative evaluation of lands is the establishment of the basic credit rating scale. Regardless of its purpose and destination, land credit rating within territorial units begins with the compilation of the main credit rating scale according to existing methodical approaches. It is built on the basis of the following principles: selection of reference soil within the area to be evaluated; taking soil potential indicators (humus, nitrogen, phosphorus, potassium, UAC) as a price criterion. Starting from VVDokuchayev and up to the researchers of the modern era, taking fixed diagnostic properties and signs, which are an indicator of soil potential fertility, was accepted as a price criterion.

According to the rules adopted in production, the main credit rating scales are drawn up by cadastral (price) regions. At this time, the location of one or more administrative districts within the cadastral (price) district is not important. The cadastral (price) district unites homogeneous (similar) areas in terms of relief, climate, soil cover. This is considered a very important condition for ensuring the objectivity of the research

After studying the real condition of the lands of the research object on the basis of fund and field-laboratory research materials, and determining the degree of changes that have occurred in them, the evaluation works were started.

Taking separate landscape complexes as a territorial unit and evaluating the land within them and deriving the average score for landscape zones was first proposed by B. A. Budagov and G. Sh. Mammadov [13]. This approach was used by us when establishing the main scale of the soils of the north-eastern slope of the Lesser Caucasus. At this time, within the research object, the following landscape complexes and standard soils were separated, their main credit rating scales were established, and the credit scores of individual soils were found in comparison with the standard soil (Table 1):

- Alpine and subalpine meadows and meadows – steppe belt (standard soil : washed black soil-like mountain-meadow);

- Mesophilic forest belt (standard soil : washed mountain black);
- Xerophytic forests, thickets and steppe zone (reference soil : steppe brown).

When establishing the main credit scale of the soils of the northeastern slopes of the Lesser Caucasus, total humus, nitrogen, phosphorus and UAC (sum of absorbed bases) were taken as price criteria.

Table 1. **The north-eastern slope of the Lesser Caucasus soil and landscape complexes the main credit rating scale**

Landscape types	The name of the lands	Basic credit scores of lands	Area	
			Yes	%
Alpine and subalpine meadow and meadow-steppe belt	Primitive mountain-meadow	68	4129.3	1.46
	Residual carbonate mountain-meadow	74	3694.35	1.30
	Grassy mountain-meadow	90	37901,1	13,38
	A mountain-meadow like washed black soil	100	18826.56	6.65
	Washed mountain grass steppe	95	9750.9	3.44
	On the alpine and subalpine meadow and meadow-steppe belt:	91	74302,21	26,23
Mesophilic forest belt	Steppe brown mountain forest	85	3627.5	1.28
	Washed brown mountain forest	81	4413.65	1.55
	Typical brown mountain forest	71	40138.19	14,17
	Washed mountain black	100	31511.71	11,12
	Typical mountain black	95	3323.92	1.17
	Carbonated mountain black	90	6120.09	2.16
	On the belt of mesophilic forests:	83	89135.06	31,47
Xerophytic forests, shrubland and steppe belt	Steppe mountain forest brown	64	2708.7	0.96
	Carbonate mountain forest brown	72	5204.46	1.84
	Typical mountain forest brown	66	300	0.11
	Washed mountain forest brown	90	7613.4	2.69
	Steppe mountain brown	100	35133.3	12.40
	Dark mountain gray-brown	95	17878.35	6.31
	Common mountain gray brown	85	8817.35	3.11
	Light mountain gray-brown	80	12770.82	4.51
	Late light mountain grey-brown	72	7032.03	2.48
	Light gray-brown	68	22250.65	7.85
	The grass is gray-brown	82	127	0.04
	Xerophytic forests in the shrubland and steppe zone:	85	119836.06	42.30
On the North-East slope of the Lesser Caucasus (Dashkasan, Gadabey, Goygol administrative regions):		86	283273.33	100

As can be seen from Table 1, the credit scores of the land on the main scale for the landscape zones were as follows:

On the alpine and subalpine meadow, meadow-steppe belt : Grassy mountain-meadow, mountain meadow-steppe and shale-like mountain-meadow soils are typical for this zone in the northeastern slopes of the Lesser Caucasus.

The total area of alpine and subalpine meadow and meadow-steppe belt is 74,302.21 ha, primitive mountain-meadow land is 4129.3 ha (1.46 %), carbonate residual mountain-meadow – 694.35 ha (1.30 %). grassy mountain-meadow – 37901.1 ha (13.38 %), washed-out black-soil-like mountain-meadow – 18826.56 ha (6.65 %), and washed-out mountain grass steppes – 9750.9 ha (3.44 %) .

distributed within this zone were as follows: primitive mountain-meadow – 68 points, carbonate-residual mountain-meadow – 74 points, grassy mountain-meadow – 90 points, washed-out black soil-like mountain-meadow – 100 points, washed-out mountain grass steppe – 95 points. The average score for alpine and subalpine meadow and meadow-steppe zone was 91 points.

On the mesophilic forest belt : on the northeastern slope of the Lesser Caucasus, the mesophyll forest belt is represented by different subtypes of brown mountain forest soils and black soils, depending on the composition of soil-forming rocks, the slope and slope of the terrain. This belt covers heights of 1600–1800 m above sea level. Soil-forming rocks consist of sedimentary rocks of volcanic and eruptive origin, typical for the Lesser Caucasus.

The total area of this zone was 89135.06 ha, grayed brown mountain forest – 3627.5 ha (1.28 %), washed brown mountain forest – 4413.65 ha (1.55 %) , typical brown mountain forest – 40138.19 ha (14.17 %) , washed mountain black – 31511.71 ha (11.12 %), typical mountain black – 3323.92 ha (1.17 %), carbonated mountain black – 6120.09 ha (2.16 is %) .

The average score and area of soil subtypes within this zone are distributed as follows: greyish brown mountain forest – 85 points, washed brown mountain forest – 81 points, typical brown mountain forest –

71 points, washed mountain black – 100 points, typical mountain black – 95 honey, carbonated mountain black – 90 points. The average score of mesophilic forests was 83 points.

Xerophytic forests, thickets and steppes . The xerophytic forest belt was formed in areas with hot and dry summers and humid and mild winters. The average annual temperature here is 8.5–110 ºC, the amount of precipitation varies between 400–600 mm.

In the northeastern part of the Lesser Caucasus, the lowest layer of the vegetation of this zone consists of light oak and oak-beech mixtures composed of grasses and shrubs. As a result of deforestation, in some parts of the territory, the process of steppe has gone or the land has been involved in agricultural circulation. Soil-forming rocks consist of carbonate sedimentary rocks and rocks of volcanic origin. For the xerophilic forest zone, the typical subtypes of brown soils, leached and carbonated and their species diversity are relevant. Below is a description of some of the soil subtypes common within this belt.

(0.96 %) in gray mountain forest brown soils , carbonate mountain forest brown – 5204.46 ha (1.84 %) , typical mountain forest brown – 300 ha (0.11 %) , washed mountain forest brown – 7613.4 ha (2.69 %) , gray mountain brown – 35133.3 ha (12.40 %), dark mountain gray-brown – 17878.35 ha (6, 31 %), ordinary mountain gray-brown – 8817.35 ha (3.11 %), light mountain gray-brown – 12770.82 ha (4.51 %), late light mountain gray-brown – 7032.03 ha (2 ,48 %), light gray-brown – 22250.65 ha (7.85 %), grass gray-brown – 127 ha (0.04 %) .

This belt covers both low mountain and foothill areas. The average score and area of the soil subtypes distributed within this zone were as follows: grazed mountain forest brown – 64 points; carbonate mountain forest brown – 72 points, typical mountain forest brown – 66 points, washed mountain forest brown – 90 points, grayed mountain brown – 100 points, dark mountain gray-brown – 95 points, ordinary mountain gray brown – 85 points, light mountain gray-brown – 80 points, late light mountain gray-brown – 72 points, light gray-brown – 68 points, meadow gray-brown – 82 points. The average score of xerophytic forests, shrubs and steppes zone was 85 points.

Potential and effective soil fertility is influenced not only by humus and other soil constituent properties, but also by other factors. This includes the granulometric composition of the soil, salinization and salinization of the soil, the thickness of the soil profile, stony, sclerotized, irrigation and other factors. Due to the fact that these properties and compositions of the soil are of a local and special nature (for example, signs of salinization and salinization, erosion and the height of the soil profile are typical for stony areas), it is impossible to use them as a price criterion. However, finding the bonity scores of soil types and sub-types, taking into account other properties and composition of the soil, is both scientific and theoretical. it is also of practical importance.

In accordance with the adopted methodology, correction coefficients are used when finding the final credit scores of soil diversity. Starting from the 60s and 70s of the 20th century, the development of correction coefficients for these and other properties and compositions of soils under various agricultural crops in different regions of Azerbaijan was started. Some of the correction coefficients are general (for all soils), and the other is special (taking into account the agro-ecological requirements of individual plants). These correction coefficients were used when finding the final credit scores of the soil diversity included in the open credit rating scale of the Lesser Caucasus (table 2).

Table 2. **Correction coefficients of soil properties and composition**

Lands	Granulometric composition				
	Clay	Heavy gilly	Medium grainy	Light gilly	Beach
For all lands	0.80	0.90	1.00	0.89	0.70
	Thick	Medium thickness	Sleep		
	1.0	0.80	0.60		
	Partnership				
	Unaffiliated	Weak	Moderate and severe		
	1.00	0.90	0.60		

Credit scores of soil types spread within soil subtypes were determined using the following formula.

$$\mathbf{B_n = B_x T_ş x T_{şr} x T_q x T_{ql}}$$

Here, $\mathbf{B_n}$ – the final credit score of soil diversity; **B** – the main credit score of the land; **Tsh –** correction coefficient of salinization**;** $\mathbf{T_{shr}}$ **–** coefficient of correction of participation; $\mathbf{T_q}$ **–** correction coefficient of granulometric composition; $\mathbf{T_{gl}}$ **-** correction coefficient of soil profile thickness.

Using the correction coefficients, the final rating scale of the administrative regions of the north-eastern slopes of the Lesser Caucasus and landscape complexes was established (table 3). After applying correction coefficients, the final rating within the landscape complexes of soil subtypes took the following form:

Alpine and subalpine meadow and meadow-steppe zone: The average score of soil subtypes distributed within this zone was as follows: primitive mountain-meadow – 37 points; mountain-meadow with carbonate remains – 47 points; Cimli mountain-meadow – 62 points; washed black soil-like mountain-meadow – 74 points; washed mountain grass steppe – 63 points. The average score for alpine and subalpine meadow and meadow-steppe belt was 63.

On the zone of mesophilic forests: the average score and area of soil subtypes within this zone are distributed as follows: grayish brown mountain forest – 70 points; washed brown mountain forest – 65 points; typical brown mountain forest – 51 points; washed mountain black – 68 points; typical mountain black – 70 points; carbonated mountain black – 73 points. The average score of mesophilic forests was 58 points.

Xerophytic forests, thickets and steppes. The average score and area of soil subtypes distributed within this zone were as follows: barren mountain forest brown – 47 points; carbonate mountain forest brown – 56 points; typical mountain forest brown – 35 points; washed mountain forest brown – 62 points; steppe mountain brown – 62 points; dark mountain gray-brown – 67 points; ordinary mountain gray brown – 60 points; light mountain gray-brown – 55 points; late light mountain gray-brown – 54 points; light gray-brown – 62 points; grass gray-brown – 76 points. The average score of xerophytic forests, shrubs and steppes zone was 55 points. For the northeastern slope of the Lesser Caucasus, this indicator was 60 points. Based on the comparison of the final credit scores of the lands, the comparative value coefficients of the lands of the northeastern slope of the Lesser Caucasus were determined (table 3).

Table 3. **The final rating scale of the soils of the north-eastern slope of the Lesser Caucasus**

The name of the lands	Basic credit scores of lands	Final credit score	In TM	Area	
				Yes	%
Alpine and subalpine meadows and meadows – steppes Belt					
Primitive mountain-meadow	68	37	0.59	4129.3	1.46
Residual carbonate mountain-meadow	74	47	0.75	3694.35	1.30
Grassy mountain-meadow	90	62	0.98	37901,1	13,38
A mountain-meadow like washed black soil	100	74	1.17	18826.56	6.65
Washed mountain grass steppe	95	63	1.00	9750.9	3.44
On the alpine and subalpine meadow and meadow-steppe belt :	91	63	1.00	74302.21	26,23
Mesophilic forest belt					
Steppe brown mountain forest	85	70	1.11	3627.5	1.28
Washed brown mountain forest	81	65	1.03	4413.65	1.55
Typical brown mountain forest	71	51	0.81	40138.19	14,17
Washed mountain black	100	68	1.08	31511.71	11,12
Typical mountain black	95	70	1.11	3323.92	1.17
Carbonated mountain black	90	73	1.16	6120.09	2.16
On the belt of mesophilic forests:	83	63	1.00	89135.06	31.47
Xerophytic forests, thickets and steppes Belt					
Steppe mountain forest brown	64	47	0.85	2708.7	0.96
Carbonate mountain forest brown	72	56	1.02	5204.46	1.84
Typical mountain forest brown	66	35	0.63	300.0	0.11
Washed mountain forest brown	90	62	1.13	7613.4	2.69
Steppe mountain brown	100	62	1.13	35133.3	12.40
Dark mountain gray-brown	95	67	1.22	17878.35	6.31
Common mountain gray brown	85	60	1.09	8817.35	3.11
Light mountain gray-brown	80	55	1.00	12770.82	4.51
Late light mountain grey-brown	72	54	0.98	7032.03	2.48
Light gray-brown	68	62	1.13	22250.65	7.85
The grass is gray-brown	82	76	1.38	127.0	0.04
Xerophytic forests on the shrub and steppe belt :	85	55	1.00	119836.06	42.30
On the North-East slope of the Lesser Caucasus (Dashkasan, Gadabey, Goygol administrative regions):	86	60		283273.33	

As can be seen from the table, within the alpine and subalpine meadow and meadow-steppe zone, the TMD is 0.59–1.17, within the mesophilic forest zone 0.81–1.16, and in the xerophyte forest, shrubland and steppe zone between 0.85–1.38 hesitated.

Conclusıon

1. Based on the results of large-scale soil surveys on the north-eastern slope of the Lesser Caucasus and the potential indicators of the soils affected by the mining industry (humus, nitrogen, phosphorus, potassium, UAC), a basic credit rating scale was established, an open credit rating scale of soil species diversity was drawn up with the application of correction coefficients, and (comparative value coefficients of lands) were found and the average scores of landscape complexes were determined.

2. Within the research object, the following landscape complexes and reference soils were separated, their main bonity scales were established, and the bonity scores of individual soils were found in comparison with the reference soil: alpine and subalpine meadow and meadow-steppe belt (reference soil: washed black soil-like mountain-meadow); mesophilic forest belt (reference soil: washed mountain black); xerophytic forests, scrub and steppe belt (reference soil: steppe mountain brown).

LİTERATURE

1. Ecological atlas of the Republic of Azerbaijan / Mammadov G.Sh., Khalilov MY, Mammadova SZ. Baku: Baku Cartography Factory, 2009, 156 p.
2. Evaluation of the soils under perennial crops of the Azerbaijan SSR and their efficient use. Baku, 1980, 39 p.
3. Recommendations on the valuation of the lands of the Azerbaijan SSR and their effective use. Baku, 1978, 37 p.
4. Babayev MP, Jafarov AB, Orujova N., Mirzazadeh R., Bayramov E. Scientific recommendations on the study, use and evaluation of small farm lands. Baku, 2008, 88 p.
5. Jafarov A. B., Yusifov M. A., Sultanova N. A. Evaluation of small agricultural lands // Works of the Society of Soil Scientists of Azerbaijan, volume VIII, 2001, p. 133–134.
6. Mammadov G.S. State land cadastre of the Republic of Azerbaijan: legal, scientific and practical issues. Baku: Elm, 2003, 448 p.
7. Aivazov F. D. Agroecological features and soil improvement in winter pastures of the Adzhinour steppe for the purposes of their rational use: Author's Ref. dis. … cand. c.-x. Science Baku, 1989, 23 p.
8. Akbirov R. A. Бонитировка почв и качественная оценка земел лесостепной зона Республики Башкоростан на агроекологической основе // Vestnik OGU, No. 9, 2005, p. 134–17.
9. Aliyeva R. A. Качественная харанистрация и бонитировка почв Salyanskogo district of the Azerbaijan SSR: Author's reference. dis. ... kand.s.-kh.nauk. Baku, 1971, 23 p.
10. Aparin B. F., Bulgakov D. S., Rusakov A. V. Бонитировка почв и основы государство земельного кадастра. SPB: СбпГУ, 2002, 88 p.
11. Akhadov D. R. Agroecological features and bonitirovka of tea-friendly soils of moist subtropics in the southern part of the Lankaran region: Author's Ref. dis. ... канд.с.-х. Science Baku, 1979, 22 p.
12. Badalov Sh. A. Agroecological characteristics and bonitirovka of grape-friendly soils of mountain Shirvani with the goal of their rational use: Author's Ref. dis. ... kand.s.-kh.nauk. Baku, 1981, 22 p.
13. Budagov B. A., Mamedov G. Sh. Бонитировка типов ландставтов Азербазерской SSR // Доклады AN Азерб.ССР, т.XVIII, 1987, №7, С.67–71.
14. Велиев А. Г. dis. ... kand.s.-kh.nauk. Baku, 1981, 20 p.
15. Hasanov Sh. G. Natural and genetic features and improvement of soil in south-western Azerbaijan. Baku, 1972, 220 p.
16. Huseynov S. M. Bonitirovka vynogoprogodnyh soils on the basis of agroecology in the Nagorno-Karabakh autonomous region of the Azerbaijan SSR. Autoref. dis. ..канд.с.-х. Science Baku, 1985, 20 p.
17. Ivanov V. F., Ivanova A. S. Methodology of soil remediation under multi-year plantations // Pochvovedenie, 2001, No. 11, pp. 1377–1382.
18. Kasumova T. T. Soil-ecological conditions and evaluation of the fertility of soil and fruit plantations in the Kuba-Khachmas zone of Azerbaijan. Autoref., Baku, 1992.
19. Kuprichenkov M. T. Бонитировка почв. Stavropol: АГРУС, 2005, 284 с.
20. Mamedov G. Sh. Agroecological characteristics and improvement of pasture lands in the western part of the Milskoy Plain: Author's Ref. dis. … cand. c.-x. Science Baku, 1978, 28 p.
21. Mamedov G. Sh. Agroecological features and soil improvement in Azerbaijan. Baku: Elm, 1990, 172 p.
22. Medvedev V. V., Plisko I. V. Bonitirovka and quality assessment of arable lands of Ukraine. Kiev, 2006, 386 c.
23. Methodical guidelines for soil bonification of fodder fields of the Azerbaijan SSR. Baku: Elm,1978,38 p.
24. Methodological recommendations for soil bonification of grape and tea crops of the Azerbaijan SSR. Baku, 1979, 22 p.
25. Methodological guidelines for soil testing for the purpose of the land cadastre of the Azerbaijan SSR. Baku, 1979, 20 p.
26. Salaev M. E. Diagnosis and classification of soil in Azerbaijan. Baku: Elm, 1991, 240 p.