ANTROPOGHENİC DEGRADATİON OF CHESTNUT SOİLS FROM THE JEYRANCHOL MASSİVE İN DESERTİFİCATİON PROCESS BACKGROUND

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I.A.Guliyev, T.D.Agayev, A.D.Rajabova

Geography Institute of ANAS named after academician H.A.Aliyev, AZ.1143, Baku, H.Javid str.,115, ismayil-quliyev@rambler.ru

Summary. The article is devoted to antropoghenic degradation problem for chestnut soils in the Jeyranchol massive during desertification process background. The article's author analyzes the chestnut soils of the Jeyranchol massive through the perennial soil monitoring results. The antropoghenic loading of the separete winter pasture areas is indicated and evaluated from land degradation standpoint through the statistical data and factual collected materials. The article's author states that a negative effect of the exodynamic processes on the soil covers in the available natural-ecological background in the grew for last 50-60 years, and the soils exposed to different kinds of antropoghenic degradation. At the present, the human's perennial farming activity direction changes, the extensive cattle-breeding is replaced by the intensive agriculture. The exodynamic process, as well as defliation process influence, has been evaluated in the husbandry direction background in the article.

Keywords: antropoghenic degradation, natural-ecological, de-humification, arid, semiarid, genetic horizon, exodynamic, granulometric content, extra arid.

Introduction

Today the negative changes occurring through the antropoghenic factors effect on world's separate regions in the desertification process background on a global scale have been studied by many researches [6,7,8,9,11,13, etc.]. According to these researches' general opinion, these processes, occuring on a regional and local scale, happen in a background of the mutual effect of the ristic exodynamic processes depending on natural-geographical condition of the investigated zone.

The desertification processes, occuring under extraarid, arid, semiarid and semihumid natural condition, unlike ecosystems, possess both unlike and changeable velocity. So, the process rate can't go as linear ascending process till the end: while a environment reaction to negative effects weakens, the process rate weakens and, as a result, surceases.

The natural factors' effect, besides antropoghenic factors in development of the desertification process, is highly appreciated. The climate changes occuring in the earth are considered as the main natural factors, and these are connected with astronomical, astrophysics and inner atmospheric factors [10].

When the human doesn't correctly plan the farming activity, a negative influence of the exodynamic processes on the environment, including soil cover intensifies, on the contrary as a result of the human's correct farming activity these effects weakens, the soilforming process accelerates.

The investigative zone has been studied not only in the direction of lands' antropoghenic degradation but also in fundamental soil researches direction. The monitoring results on soils' physico-chemical indices give an opportunity compare the changes happened for last seventy years.

The drought and aridity degree were determined through the perennial statistical climate indications in the world. Such type of the aridity indices were put forward by De. Marton, Keppen, Torntveit, M.I. Budiko and others. The extra-arid, arid and semiarid areas were shown in M. Tolban's Report (an executive director on the Environment Program of UNO), in the III session of UNEP Administrative Council which was presented in Nairobi [12].

The calculation on these criteria is performed for a little part of the total area in the Azerbaijan Republic that can be entered the arid and mostly semiarid zones in works by A. J. Ayyubov and G. A. Hajiyev [1], who indicated landscape zones on the basis of the humidity indices in Azerbaijan [1]. In these researchers' works the D. I. Shashko's humidity index was used [1]. This index reflects a ratio of the rainfalls quantity for a year or vegetation period to sum of the humidity deficit for the same period. According to this division the east, south-east and north-east

parts are in the arid zone, but the west, north, south-west and north-west parts are in the semiarid, but a little part is still in the semi-humid zone in the north.

Object and method of the research

Research zone is geographically situated among N 41°20'52,8" (north), 41°2'33,6" (south) and E 46°33'38,4" (east), 45°8'13,2" (west) coordinates in the north-west of the Azerbaijan Republic (Fig. 1). It is geomorphologically concerned the Kur intermountain depression. A total zone of the massive is somewhat more than 200000 hectares, is reflects 2,3 % of the total country's soil fund.

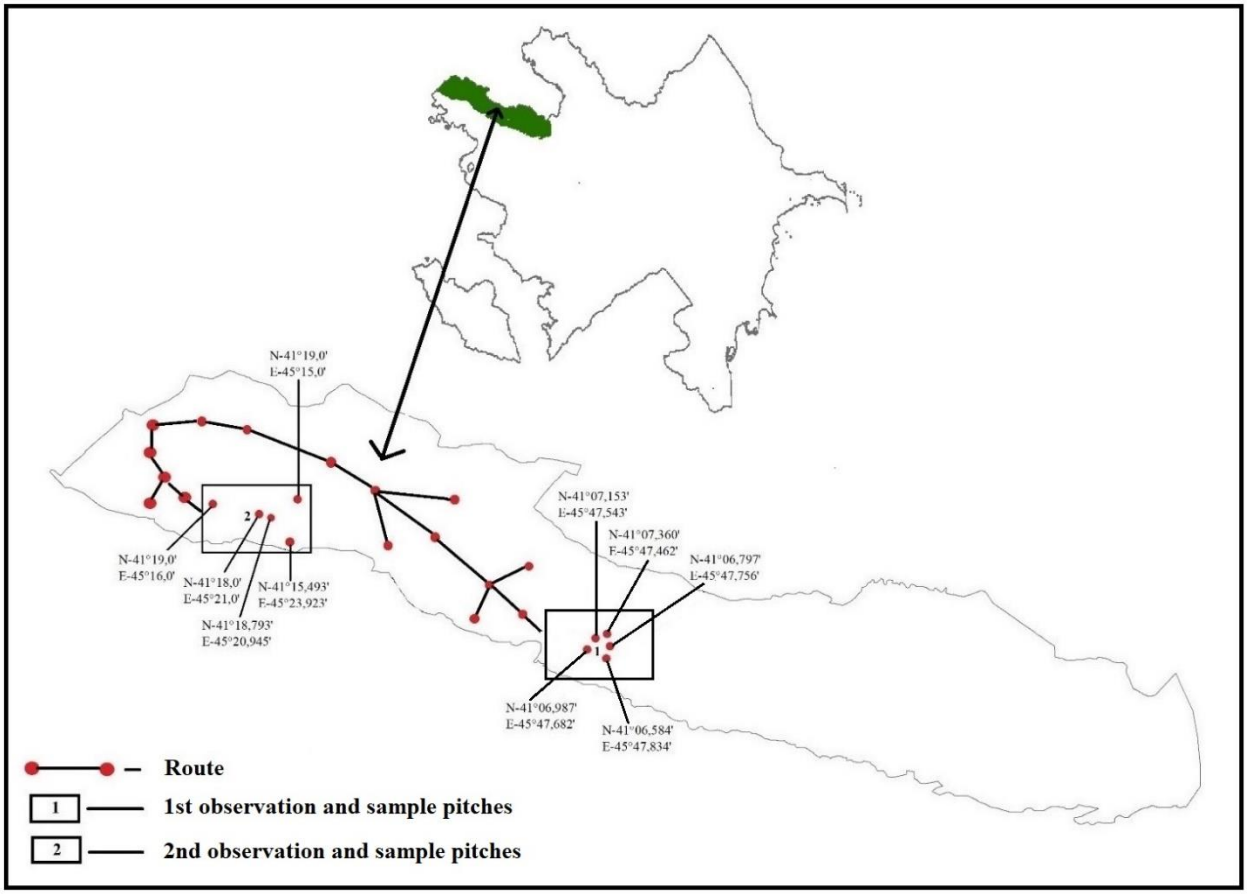

Figure 1.

Practically, the research zone consists of Mergel Statums alternation with dark grey clay. The deposits of the Sarmat stage are widespread in this zone. These deposits are formed from different colorful clay, conglomerates and sandstones [3].

The orographical and geomorphological factors effect on intensity of the exodynamic processes, and soil cover formation in the Jeyranchol low mountainous is great. Especially the relief forms created by the arid-denudation and partly arid-erosion processes are typical. The main elements of the relief are mountain shrubs, fixing surfaces (platean), intermountain plains and depressions, bed-lend relief, plasters and clayey karsts [2].

The Jeyranchol massive possesses mild-warm semidesert and arid field climate. An annual quantity of the total sun radiation changes by 125-130 kcal/cm, average yearly temperature changes by 10-15° C. A sum of the active temperature reaches 3800-4400°. The possible evaporation is unequal in the zone. An annual quantity of rainfall is 383 mm in the west and 200 mm in the east [14].

Jeyranchol combines 8,6 % of sorf content of the Azerbaijan flora as a winter pasture in itself [5]. The plant cover of the zone is divided into semidesert, field, forest (tugay) and sparse arid forest groups. The semidesert plant spread on the steep southern slopes of the mountains in the east part of the zone. For example, Artemisia Ler China Web, Salsola dendroides Pall, Salsola ericoides Bieb, Kochia prostrata, Acgilops cylindrical Host, Avena persika Stend, Carduus arabicus Iacq and others.

The interchangeable communities in Jeyranchol are mixed and they include overgrown semi-desert element (species of the genus Artemisia U.m.g). The evaluating agents are Botriochloa ichaemum, Agropyroncristatum, Stipa caspia. The species of the genus are scattered Medicogo L., Acgilops L., Alyssum L., Bromus L., Erempyrum (Leded) aub. Ct Spach, Poa L Artemisia L., plantoqo L. and others [5].

A little part of the total Jeyranchol zone consists of tugay-type forests spreading along the Kur and Gabirri (Iori) rivers and Eldar-pine-juniper, sparse gum arid forests on the north slopes of the Chobandag-Eldaroyugu low-upland.

Field Researches. The soil research works of the field were performed in the zone 2014-2015 and 2018-2019. An aim is to evaluate an influence of the human's activity on soil cover in the background of the natural exodynamic processes and to use from these lands correctly and rationally. From this point of view, the observation and sample pitches have been selected taking into account different directions of the human's activity and unlike geographical condition (Tab. 1).

The specific soil type in the zone is chestnut soil. Therefore, the both samples are chosen from this soil type. Though the selected zone reflects the same type of soils, a direction of the human's farming activity is unlike in the observation pitches.

The field researches were wholly performed on the basis of the comparative geographical method. Besides, learning the damage for soil cover as a result of grazing on separate pasture area during the soil research, the influence of the exodynamic processes creating degradation was also investigated.

Main character of the observation and sample pitches

Table 1

Observation pitches	Soils	Geomorphological placement, height (m) / geometric center coordinate of the area	Plants / covering (%) / phitomass, 1 m^2/gr. (dry)	Farming direction / us period, year
1	Ordinary chestnut (Kastanozems)	Monoclinal inter shrubs plains / 282 m / N 41°18,0' E 45°21,0'	Old ploughing place, different grass-grain-like / 40/95	Sown area /5-10
2	Ordinary chestnut (Kastanozems)	Weak inclined wave-like plain / 391 m / N 41°07,153' E 45°'47,543'	Wormwood, different grass /90/172	Winter pasture / 180-100

The anthropogenic loading and its results in the three administrative regions falling into the Jeyranchol massive have been defined through the statistical data and factual materials. Fitomass was studied in five secondaries during autumn ephemeris.

The physico-chemical composition of ordinary chestnut (Kastanozems) soils was performed by the chemist-analysts in the department of the Azerbaijan soil resources geography in the Geography İnstitute named after H.A. Aliyev.

In the soil samples humus and total nitrogen quantity was fixed by I.V.Tyurin method, absorbed Ca^{++} and Mg^{++} by D.V.İvanov's method, pH by potentiometer in water solution, calcareous (CO_2) by Sheibler method in calcimeter apparatus, easily solved salts in the soil, hygroscopic humidity by a weight method dried in drying cupboard at 105° C temperature for 6 hours. Granulometric composition is fixed by N.A. Kachinsky's method – $Na_2P_2O_7$ [4].

Discussion and results

The research zone is used as a winter pasture for last 100 years. The cattle are unsystematically grazed in these zones for seven months. As a result, the soil cover of the geographical zone exposes to degradation to a different degree depending on natural-ecological condition. The joint analysis of the field and statistic materials creates imagine about the natural-ecological background violation to a different degree in the separate subzones of the research zone (Tab. 2).

Cattle density on separate areas of the Jeyranchol winter pasture
Table 2

Regions and areas	Hectare	Cattle number (head)	Factual number (head)	A norm adopted for dry field and semidesert (h/head)	Coefficient (for a factual state)	Autumn fitomass (1 m^2 dry mass with gram, in five secondaries)	Covering degree with plant, (by %)
Aghstafa							
74(h)	91	618	720	1/1	1/7,9	127,5	50-55
82 (h)	122	884	955	1/1	1/7,8	135,7	60-65
75 (h)	63	300	375	1/1	5,9	118,9	50-55
Gazakh							
73 (h)	47	224	276	1/1	1/5,8	110,5	40-45
102	63	163	+	1/1	1/2,5	146,7	55-60
167	203	580	618	1/1	1/3,0	130,2	55-60
Tovuz							
270	155	609	645	1/1	1/4,2	153,5	55-60
301	201	570	605	1/1	1/3,0	131,3	60-70
306	102	375	418	1/1	1/4,0	128,7	60-70

As it can be seen from the table 2, the anthropogenic loading (grazing with the cattle) is more than a norm. According to the information of the Food and Agriculture Organisation Comission of UNO (FAO) the grazing normatives have been determined for arid and semiarid zones [10]. This loading effects on plant cover of the zone, as it is seen from data in table 2, the surface quantity of dry mass and the covering degree with the plant are twice lower for normative in the development phase of the spring and autumn ephemer and ephemeroids. Zones selected as half- stationary in the Jeyranchol massive are similar zones, but they are different for the anthropogenic loading and usage direction. The soil research performed in these unlike zones and its consequences can give an opportunity for the correct risks' evaluation which will happen in the background of new farming directions in the nearest future.

As it is clear from the analysis results of the soils granulometric composition, the physical clay quantity on genetic layers of the soil sections in the zone changes between light loamy and light clayey ones. These indices are characteristic to chestnut soils. The physical clay is strong changing on genetic layers of soils in some cases, that is related to the paleo-geological features and physical weathering process. An effect of the exodynamic degradation process accelerating in soil falls into arid and semiarid landscape. One of the most important processes is wind erosion. Wholly the north-west and south-east winds are superior for the Jeyranchol massive, these winds blow in a hot period of the year. An average velocity of the winds is 4-5 m/sec in the west, 2-3 m/sec in the east. But a maximum velocity of these winds can reach 13-14 m/sec in April. We can

come to such a conclusion from general observations that 70-80 % rapid winds are in this zone and these winds are considered dusty eddy. These winds are harmful for the arid zone and the process accelerates transpiration process in plants. The wind dries the grass concerning the ephemeris and grain-like during spring.

The ploughing zone was selected as the first observation and sample pitch. İt is known from these observations that is the wind velocity is 4,5 m/sec and these winds continue for 15-20 days in a year, it can winnow away 550-570 t fertile layer each hectare of soil. As it can be seen from the granulometric analysis results of many soil sections in the first observation and sample pitch that a coefficient index of the organic-mineral particles consisting of little fractions, on the upper fertile layer is comparatively lower under an influence of the wind erosion in these soils.

So, if the zone is used with purpose of agriculture for long years, this index can get a greater difference under an influence of the wind erosion. The environment reaction possesses alkaline reaction to a weak and mean degree, and the soil weakly changes along the profile. Ca^{2+} cation is superior and is quantity on accumulative or ploughing layer, that is comparatively more - in comparison with the genetic stratums, - and it is connected with the biological period in the arid landscape and an effect of the human's farming activity (Fig. 2).

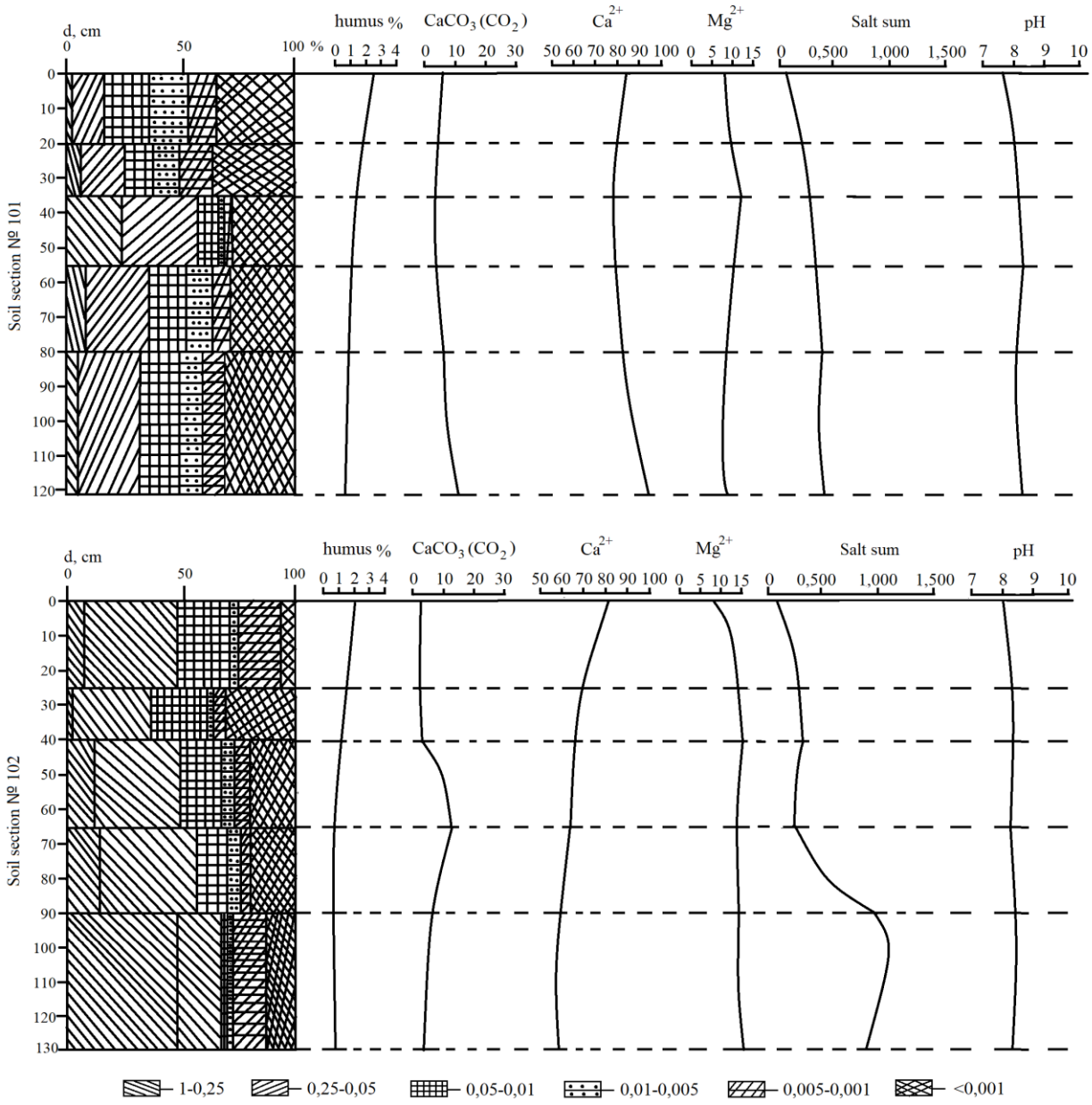

Figure 2.

The salt quantity grows towards the low layers. It is seen from the results of the total water weight analysis that SO_4^{2-}, Cl^- from anions strongly increase on the maternal rock horizon (Tab. 3).

Through the comparison results in the same soil type, the serious reductions are observed in total humus and nitrogen quantity on the upper accumulative stratum. This decrease is mostly land and its main reason is connected with the de-humification and denitrification processes happened by the exodynamic effect. These processes are positively occurred in the same geographical zone, but in the soils where irrigation can be applied. As a result of the correct agrotechnical approach and irrigation application a balance changed to the positive in the meadow-chestnut soils.

Results of the total water weight analysis in the first and second observation and sample pitch

Table 3

Section,№	Depth, cm	Dry residue, %	Salt sum,, %	mg/ekv						
				HCO_3^-	Cl^-	SO_4^{2-}	Anions sum	Ca^{2+}	Mg^{2+}	Kations sum
S-1	0-18 18-35 35-46 46-68 68-125	0,099 0,039 0,88 0,188 0,265	0,064 0,039 0,065 0,157 0,177	0,45 0,40 0,25 0,30 0,35	0,50 0,20 0,20 0,20 0,97	0,085 0,031 0,088 1,844 1,404	1,035 0,677 1,330 2,344 2,724	0,675 0,375 0,75 1,375 0,625	0,375 0,25 0,125 0,375 0,25	1,05 0,625 0,875 1,75 0,875
S-3	0-15 15-27 27-43 43-68 68-105	0,112 0,090 0,077 0,096 0,158	0,108 0,054 0,045 0,046 0,141	0,50 0,45 0,50 0,50 0,50	0,25 0,25 0,25 0,15 0,25	0,072 0,062 0,032 0,034 0,629	0,822 0,762 0,782 0,658 1,379	0,5 0,375 0,375 0,375 0,5	0,25 0,375 0,375 0,25 0,25	0,75 0,75 0,75 0,625 0,75
S-101	0-20 20-35 35-55 55-80 80-120	0,100 0,300 0,195 1,347 0,813	0,093 0,296 0,180 1,230 0,719	0,50 0,65 0,60 0,55 0,55	0,60 3,85 2,45 6,65 8,75	0,261 0,316 0,278 12,25 2,405	1,361 4,816 3,428 19,449 11,705	0,50 0,50 0,25 11,125 1,625	0,125 0,125 0,25 1,375 0,875	0,625 0,625 0,5 13,5 2,5
S-102	0-25 25-40 40-65 65-90 90-130	0,070 0,140 0,199 0,269 0,244	0,064 0,133 0,197 0,258 0,219	0,55 0,50 0,60 0,65 0,65	0,35 1,45 1,65 1,90 1,75	0,034 0,269 0,684 1,317 0,791	0,934 1,769 3,034 3,967 3,291	0,375 0,25 0,25 0,25 0,25	0,375 0,125 0,25 0,25 0,125	0,75 0,375 0,5 0,5 0,375

The soils' mechanical content possesses a light loamy character according to the physical clay number in the natural zone with wormwood and different grass in the ordinary chestnut soils' background as the second observation and as a sample pitch. The soils' mechanical composition has a light feature as a result of the relief leaching and inclination towards the Kur valley in the south, south-west. The particles with 0,25-0,05 mm size change by 39,31-55,5 % on many upper layers of the soil sections. A quantity of organic substances, including humus and nitrogen is accordingly 2,5-3,9 and 0,17-0,20 % on the upper accumulative layer of the soil. Calcium carbonate ($CaCO_3$) grows towards depth in these soils Ca^{2+} of the absorbed bases occupies a leading place, then Mg^{2+} and Na^+ cations. The environment reaction (pH) possesses weak alkaline and alkaline environment (Fig. 3).

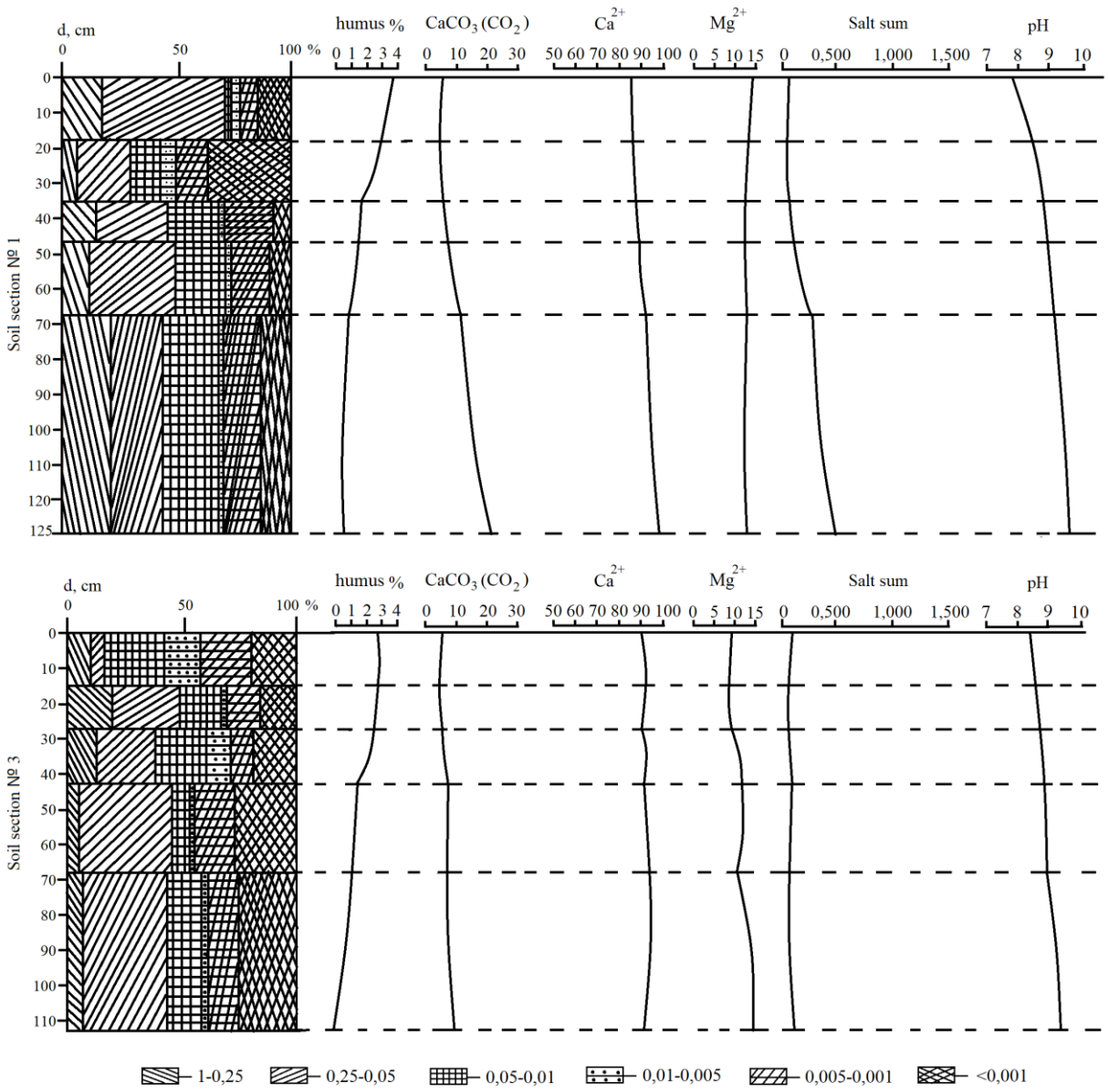

Figure 3.

We can come to a conclusion that these soils are saturated with bases. Some kinds of the chestnut lands are salinized with the easily salved salts towards depth. The gypsum salts ($CaSO_4 \cdot 2H_2O$) are found on B/C and C horizons of the soils. At is seen from the results of the total water weight a sum of dry residue, salts including a quantity of cation and anion in both pitches grows towards depth on soil section profile. These indices are indicating a relation of the salts number distribution on separate genetic layers with the maternal rocks. Cl^- və SO_4^{2-} from anions, Ca^{2+} and $Mg^{2+}$from cations are superior (Tab. 3).

Though the landscape is arid, the salts' migration, either towards depth along the profile or to depression plactors in a horizontal direction, is clearly observed in these soils. The lands which

are a crop of the modern natural condition in the Jeyranchol massive expose to degradation depending on antropoghenic loading state under influence of the exodynamic processes.

This degradation happened under an influence of the 90-95 % nomadic livestock from XX century to the beginning of the XXI century. At present a direction of the human's farming activity is on agriculture in the zone. An effect on soils will change in comparison with the previous years. As it was mentioned above, the tillage areas mostly exposed to deflation process.

While the tillage areas expand in the research zone, the loading will gradually increase in the winter pasture areas and so, degradation process in soil cover and desertification will accelerate in the zone.

Conclusion

1. According to the analysis of the long monitoring results in the chestnut soils of the Jeyranchol, low upland that the human's farming activity in a direction of livestock for a long year causes the exodynamic processes' acceleration in the region, as a result of the soils' physical features deteriorate, a quantity of nutrient decreases for last 60-70 years.
2. Development on a new farming tendency in the zone raises antropoghenic loading at least twice, therefore it will accelerate exodynamic processes, including deflation process.

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