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CHARACTERISTICS OF THE SOIL COVER OF THE CHIVCHYN MOUNTAINS: BASIC PHYSICAL AND CHEMICAL PARAMETERS AND SOIL TYPES

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The paper presents the results of the analysis of the soil cover of the Chivchyn Mountains (Ukrainian Carpathians). It was found that the predominant types of soils are medium and heavy loams, whereas sandy loam and light clay occur less frequently. An increase in the clay fraction in the valleys of perennial and intermittent streams, lower soil pH values on mountain tops, with the exception of places where limestone reaches the ground surface, were found. The predominance of the sand fraction in the soils of the Chivchyn mountains can lead to a higher risk of landslidesand other erosion processes as a result of heavy precipitation, especially on steep slopes following deforestation. In general, the Chivchyn Mountains region, as well as the Ukrainian Carpathians, is characterized by acidic brown soil formation with the development of soils on eluvial-deluvial deposits

Keywords: Chivchyn mountains, Ukrainian Carpathians, National Nature Park, environmental safety, soils, types, methods, physical and chemical indicators, protection, anthropogenic load

Introduction. We live in a dynamically changing world, and these rapid changes are primarily driven by the growth of anthropogenic pressure on the environment. After all, local environmental problems are only local in a relative sense because the natural environment is unified and they contribute to global environmental change, which ultimately contributes to global warming. Today, most scientists are inclined to believe that humanity has already entered a new era – the Anthropocene (an informal geochronological term), where man has become a key factor that affects climate, biodiversity and the environment as a whole. A particularly large negative burden on biodiversity occurs during the war, which is now typical for Ukraine, which is defending itself from Russian aggression. Thus, the destruction by the Russian occupiers of the only genetic bank of cultivated plants in Ukraine, which was located on the basis of the Yuriev Plant Production Institute of the National Academy of Agrarian Sciences of Ukraine in Kharkiv, as well as objects of the nature reserve fund in the war zone, is an ecocide against the humanity of the planet. Unfortunately, due to the military actions of the Russians, the territories of Donbass and the Azov Sea region are burning, where plants and animals are dying, vegetation and soil cover are being destroyed, and so on. Ukraine is the second largest country in Europe in terms of biodiversity after France. National nature parks are one of the levels (in situ) of nature protection objects within undisturbed full-fledged populations, and their soils are the basis that forms the biodiversity of the territory. So, the role of soils in maintaining the diverse manifestations of life in the biosphere, preserving biodiversity, agriculture and forestry, preserving the gene pool of the human population and the health of each individual cannot be overestimated. Soils should be considered as a derivative and result of the interaction of many abiotic and biotic factors, in particular, the composition of the parent rock, topography, climate influence (moisture, insolation, heat transferred by air masses, etc.), living organisms, in particular, plants and microorganisms that are able to decompose plant and animal residues with the formation of useful bioavailable organic substances.

A diverse combination of environmental factors determines the formation of different soil types. Especially in complex mountain systems, where even minor differences in moisture or light indicators, as well as terrain characteristics, inevitably lead to the formation of different types of soil. The latter, in turn, affect vegetation and the formation of a particular type of dwelling in general.

This area of the Ukrainian Carpathians is characterized by a significant amplitude of the height difference, complexity of the geological structure and frequent exits of limestone deposits to the daytime surface, deep river valleys, steep slopes covered with monodominant spruce stands of different ages and class of bonitet, weak human development due to inaccessibility and close proximity to the state border with Romania. Among the water sources of these territories, bicarbonate-sodium-calcium type waters predominate (Yuzik A.V. et al., 2016).

Relevance of the research topic. The Chivchyn mountains, as one of the well-defined natural regions, remain one of the least explored in the Ukrainian Carpathians at the beginning of the 21st century. In particular, the characteristic of the soil cover still remains a kind of "white spot". A special feature of these lands is the low anthropogenic pressure in the past and today compared to neighboring ones, and nature reserves of national significance have been created and operate here: Verkhovina and Cheremosh National Nature Parks. These places are characterized by significant forest cover with a predominance of European spruce (Picea abies L.). In the south-eastern part of Chyvchyn, spruce grows in class 1–3 bonitet, forming pure monodominant stands. They mainly grow on brown mountain-forest soils on eluvia-deluvia flish rocks, which are laid at a depth of 58-104 cm by the parent rock (Velychko, 2006; Dmytruk et al., 2014).

The region under study is characterized by the complexity and heterogeneity of the geological structure, the contrast and different age nature of the relief, the peculiarity of the climatic situation, the density of the hydrographic grid, a certain originality of the structure of the soil and vegetation cover, which largely determine the features of the ecological state (Velychko et al, 2005).

State of study of the problem, main works. Hoholiev I. M. (Voitkiv and Pozniak, 2009), Pasternak P. S. (Pasternak, 1980), Andrushchenko H. A. (Andrushchenko, 1970), Kuchinsky P. A. (Kuchynsky, 1978), Vernander N. B. et al. studied the soil cover of the Ukrainian Carpathians, including the Chivchyn mountains, at various times (Soviet period) (Velychko et al, 2005); Hamkalo M. Z. (Vernander and Gogolev, 1986), Stefanyk B. B. (Kuchynsky, 1978), Velychko M. V. et al. (Velychko et al, 2005; Velychko, 2006; Yuzik A.V. et al., 2016), Voitkiv P. S. et al. (Velychko, 2006). The soils of the National Nature Park (hereinafter – NNP) "Cheremosh", the main territory of which (land with withdrawal) is mainly located within the Chyvchyn mountains, were studied by Dmytruk Yu. M. et al. (Dmytruk et al., 2014), but the physical and chemical parameters of the soils of the Chyvchyn mountains are studied by the authors for the first time, which is of great scientific importance for the study of both the distribution features of rare and endemic species of this region, which make up more than half of these rare species of the Ukrainian Carpathians, and with their inclusion of plant communities.

On the territory of the Chyvchyn mountains, according to preliminary data (Vernarder N. B. et al., 1961; Hoholiev I. M., 1968; Kuchinsky P. O., 1978), soils are represented by the following main types: brown mountain-forest (brown soils), mountain-meadow-brown earth soils of polonynas (Carpathian Mountain valleys), brown-soil-podzolic soils, sod and meadow soils (Vernander and Gogolev, 1986; Kuchynsky, 1978; Gogolev, 1965). Brown mountain-forest soils of Chyvchyn mountains are formed on slopes of various steepness and exposure under spruce forests up to heights of 1200, and sometimes 1500 m. Mountain-meadow-brown-earth soils are formed on polonynas that arose on the sites of erected spruce forests. Brown-podzolic soils are formed on more or less deep non-gravelly ancient ovial or deluvial deposits. Turf and meadow soils are most often on the first and second, sometimes third above-floodplain terraces.

One of the areas of scientific research Pasternak P. S. was the study of the processes of interaction between forest and soil in the main types of the Carpathians, where he notes that the morphology of brown soils of the Ukrainian Carpathians is quite similar, that is, there is no differentiation of their profile into eluvial-iluvial horizons. There are also no significant differences in the structure and granulometric composition of soil horizons. He did not find any morphological signs of podzolization in soils, but other researchers did (Vernarder N. B. et al., 1961; Hoholiev I. M., 1968; Kuchinsky P. O., 1978) among the types for the Chyvchyn mountains, brown-black-podzolic soils are also mentioned (Pasternak, 1980). The discrepancy can be explained by the fact that Pasternak P. S. most likely did not conduct research on the territory of the Chyvchyn mountains.

The uniqueness of the forests of the Ukrainian Carpathians, in contrast to the rest of the Carpathians

of Europe, here are preserved the primeval brown forests of which were studied by Voitkiv P. S. and Pozniak S. P. (Voitkiv and Pozniak, 2009).

Dmytruk Yu. M. and co-authors in the article "Soil features of the Cheremosh National Nature Park" identified and analyzed individual indicators in accordance with the ecologic-landscape conditions of their genesis of the Cheremosh NNP. The authors found an increased content of humus and mobile phosphorus in these soils; noted a low acidity compared to the soils of other regions of the Carpathians; found that two subtypes of soils prevail on the territory of NNP "Cheremosh", namely: meadow-brown-earth under the meadows and brown mountain-forest under the forest. Regarding soil genesis, the influence of local factors that determine immanent features for specific ecotopes (for example, the genesis of sod soils) was noted. The authors noted that the soils are practically unchanged by anthropogenesis, except for places of continuous logging and the impact of local infrastructure, and suggested organizing active monitoring in the study area to assess global impacts on the ecosystems of the Carpathians. Despite the above, the characteristics of the soil cover of the Chyvchyn mountains for the main studies of physical and chemical parameters and soil types were not carried out.

This was the basis for conducting further research and providing the authors with their results, which formed the basis of this article.

The aim – is to analyze individual physical and chemical parameters of the soils of the Chyvchyn mountains and establish their types. This will partially eliminate the gap in information about Chivchyn soils, create a basis for further environmental and soil science research and biodiversity protection.

Materials and methods. The object of research is selected in accordance with State Standard 17.4.3.01-2019 "Environmental Protection. Soils. General requirements for sampling", State Standard 17.4.3.01-2019 "Environmental Protection. Soils. Method of sampling and preparation of samples for chemical, bacteriological, helminthological analysis" soil samples of the Chivchyn mountains.

The subject of research is the current hydrogen index (actual acidity, pH), the sum of absorbed bases, hydrolytic acidity, the degree of saturation with bases, and the granulometric composition of the studied soil samples.

The actual acidity of the selected samples was determined potentiometrically using a pH meter using glass and silver chloride electrodes, the latter corresponds to State Standard 17792-72 "Comparison electrode saturated with silver chloride reference 2nd class". They measured the water extraction of soil samples (dilution 1:5) in accordance with State Standard 26423-85 "Soils. Methods for determining the specific electrical conductivity, pH and dense residue of water extract". Hydrolytic acidity was established according to State Standard of Ukraine 7537:2014 "Soil quality. Determination of hydrolytic acidity" by the Kappen's method using sodium acetate. The amount of absorbed bases was established according to State Standard 27821-88 "Soils. Determination of the sum of selected bases by the Kappen's method". The granulometric composition of the selected soil samples was studied by sieve, aerometric and pipette methods in accordance with State Standard of Ukraine B2.1-19:2009 "Methods for laboratory determination of granulometric (grain) and microaggregate composition" and State Standard 12536-67 "Soils. Methods of laboratory determination of grain (granulometric) composition".

To create a sampling map and geospatial analysis The free Quantum GIS ver. Software 2.2.0 Valmiera, Quantum GIS ver. 3.16 Hannover and applications for these software environments Open Layers Plugin, Numerical Digitize Plugin, and Aus Map Plugin, were used respectively. The coordinates are given in the WGS-84 system. To establish the spatial characteristics of these soil sampling sites (quarter, allotment, slope, height above sea level, etc.), electronic forest management materials were used, in particular, quarterly, grids in the format of vector layers of shape files (.shp), as well as the corresponding databases and attribute tables to them.

Also, the materials of the project of organizing the territory of the National Nature Park "Verkhovyna", protecting the reproduction and recreational use of its natural complexes and objects, approved by the Order of the Ministry of Ecology and natural resources of Ukraine dated 12.04.2016 No. 155 (as amended, approved by the Order of the Ministry of Ecology and natural resources of Ukraine dated 01.08.2018 №284) and the project of Organization of the territory of the National Nature Park "Cheremosh", protection of reproduction and recreational use of its natural complexes and objects, approved by the Order of the Ministry of Ecology and natural resources of Ukraine dated 26.08.2016 №313 (as amended by the Order of the Ministry of Ecology and natural resources of Ukraine dated 04.06.2018 №186).

Soil sampling sites: 1) Velyky Kamin mountain, top of mountain N 47°47.200, E 24°57.792, h – 1595; 2) Velyky Kamin mountain, limestone slope, N 47°47.167, E 24°57.815, h – 1547; 3) Velyky Kamen mountain, forest edge, N 47°47.135, E

24°56.714 h – 1520; 4) mount Velyky Kamin, spruce forest, N 47°47.336, E 24°56.723, h – 1115; 5) foot of mount Velyky Kamin, bank of the Perkalab River, N 47°47.799, E 24°56.897, h – 1086; 6) mount Hnetesa, mountain top, N 47°44.100, E 24°53.633, h – 1679; 7) mount Hnetesa, polonyna, N 47°44.105, E 24°53.979, h – 1525; 8) mount Hnetesa, upper border of spruce forest, N 47°44.068, E 24°54.028, h – 1493; 9) mount Hnetesa, spruce forest, N 47°44.093, E 24°54.020, h – 1466; 10) mount Hnetesa, hanging swamp, N 47°44.148, E 24°54.489, h – 1365; 11) mount Velyky Preluki, mountain top, N 47°48.235, e 24°53.809, h – 1736; 12) mount Velyky Preluki, middle part, N 47°48.061, e 24°53.846, h – 1736; 13) mount Mali Preluki, polonyna, N 47°48.464, E 24°55.294, h – 1522; 14) mount Chyvchyn, southern slope, N 47°51.427, E 24°42.850, h – 1648; 15) mount Chyvchyn, mountain top, N 47°51.909, E 24°42.637, h – 1938; 16) mount Burkut, forest, N 47°55.491, e 24°40.244, h – 1648; 17) surroundings of the village of Burkut, spruce forest, N 47°56.801, e 24°41.477, H – 1022; 18) mount Tovsta, N 47°48.281, E 24°53.341, h – 1648; 19) bank of the Cherny Cheremosh River, N 47°49.161, e 24°53.596, h – 1469; 20) Hlystovata polonyna, foot, N 47°49.339, e 24°53.450, h – 1478; 21) Hlystovata polonyna – mount Preluki, N 47°49.398, E 24°53.870, h – 1648; 22) polonyna on the Rotundul Ridge, N 47°48.908, E 24°51.752, h – 1655; 23) Rotundul ridge, rocks, N 47°49.054, E 24°51.966, h – 1538.

Results and discussion. The Chivchyn mountains are the northwestern part of the Marmaros Crystal range. This range is the only area in the Ukrainian Carpathians where the oldest metamorphic formations come to the surface, covered by the sedimentary Paleozoic and Mesozoic cover. Rather sharply different from the flysch region morphologically, it is even more different from it in the nature of tectonics, rock types and the history of geological development (Velychko M. V. et al., 2005).

Therefore, when choosing sampling sites, the above-mentioned features of the study area were taken into account. The main results of studies of the soil physical and chemical properties of the Chivchyn mountains (Ukrainian Carpathians) are shown in Table 1. All mechanical elements of the soil in the table are divided into physical sand (the sum of all particles larger than 0.01 mm) and physical clay (the sum of all particles smaller than 0.01 mm) according to Sibirtsev M. M., based on the granulometric composition, the type of soils studied in conformity to the classification of Kaczynski M. A.

It is known that the actual acidity of the soil plays an important role in the development of vegetation and microorganisms and is characterized by the ratio of Free H^+ and OH^- ions in the soil solution. Physical actual acidity is expressed by the pH value, calculated as the negative logarithm of the hydrogen ion concentration. After analyzing the value of the actual acidity (pH) of the studied samples, we conclude that none of them is very acidic (pH up to 3.5). The lowest value of actual acidity – 4.2, among the subjects, is sample No. 1.

It was noted that this sample was taken on the Black Dil ridge, the top of Velyky Kamin mountain. The acidic environment of the soil here is caused by the constant leaching of precipitation (rain, snowmelt), flowing down under the influence of gravity, compounds that, when dissociated in solution, create an alkaline environment, in particular, slightly soluble carbonates and water-soluble bicarbonates. Similar processes occur on other peaks of Chivchyn. Thus, based on the results shown in Table 1, it is possible to trace the general trend of local soil oxidation for mountainous areas in places that are confined to mountain peaks.

Therefore, similar values of the slightly acidic pH index were obtained from the following sampling sites: No. 8 (top of Hnetesa), No. 10 (eastern slope of Hnetesa), No. 12 (top of Velyky Preluki) and No. 13 (northern slope of Mali Preluki). The remaining pH values obtained are close to neutral (ranging from 5.0 to 7.8).

The highest value of the hydrogen index (7.8) among the samples taken was recorded in sample No. 18. the pH values of the samples are also close to neutral 4, 6, 7, 9, 17, 19, 23.

According to the authors, this may be due to the exit near the sampling sites to the daytime surface or the occurrence in close proximity to the daytime surface of limestones, which as a result of chemical weathering, formation reverse reactions of hydrogenic carbonates constantly supply dissociation products to nearby soils – OH– ions, which, in turn, are the cause of a slightly alkaline environment. As an example, sample No. 23 (PH – 6.7), which was taken near limestone rock outcrops on the Rotundul ridge.

In general, acidification of soils is a negative process that leads to impoverishment of the species diversity that can grow on this substrate, due to a decrease in cellulose-destroying and nitrogen-fixing bacteria in the latter and the active leaching of useful nutrients into deeper layers or surface waters.

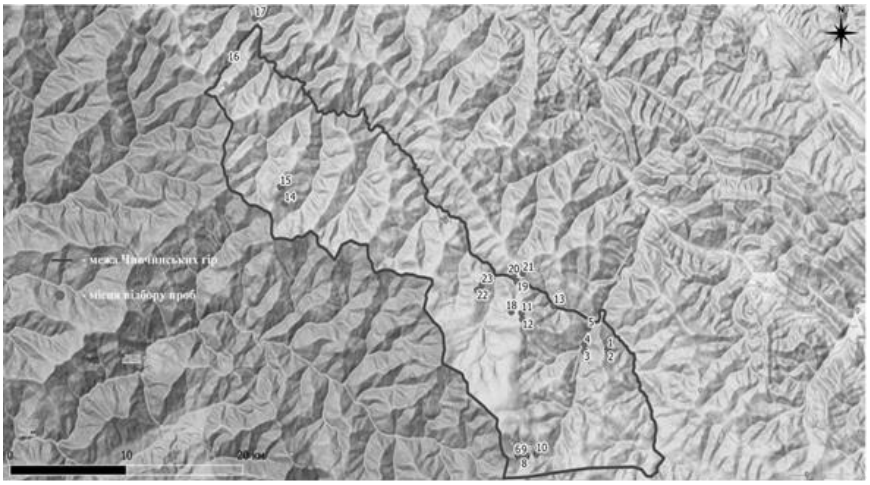

Fig. 1. Map-scheme of sites for selecting justifications in the Chivchyn Mountains

Table 1.

Basic physical and chemical properties of Chivchyn mountain soils

Sample number	pH	Sum of absorbed bases (SAB),mg-eq per 100 g of soil	Hydrolytic acidity, mg-eq per 100 g of soil	Granulometric composition, %								Soil type
				Sand fraction, mm		Coarse dust, мм	Middle dust, mm	Fine dust, mm	Sludge, mm	Physical sand, mm	Physical clay, mm	
				1-0,25	0,25-0,05	0,05-0,01	0,01-0,005	0,005-0,001	< 0,001	> 0,01	< 0,01	
1	2	3	4	5	6	7	8	9	10	11	12	13
1	4.2	1.40	32.20	3.60	13.04	1.38	3.64	1.45	16.89	68.02	31.98	Light loam
2	5.6	23.20	17.50	12.70	17.43	39.15	12.27	4.65	13.80	69.28	30.72	Middle loam
3	4.8	6.60	18.20	13.70	1.15	43.21	18.97	13.50	9.47	58.08	41.92	Heavy loam
4	7.1	49.60	0.70	29.20	1.12	23.48	26.40	12.90	6.90	53.80	46.20	Heavy loam
5	6.2	16.80	5.95	15.30	0.22	46.78	11.50	15.13	11.07	62.30	7.70	Middle loam
6	7.2	49.60	0.35	6.10	29.22	42.48	1555	2.86	3.79	77.60	22.40	Light loam
7	7.0	49.80	0.35	16.20	19.41	47.75	8.03	1.71	6.90	83.36	16.64	Sandy loam
8	4.4	2.00	25.20	3.50	10.04	38.49	21.77	6.46	19.74	52.03	47.97	Heavy loam
9	7.2	49.80	0.52	10.30	23.66	55.64	6.62	2.43	1.35	89.60	10.40	Sandy loam
10	4.4	0.20	29.75	16.50	1.76	39.50	15.84	9.84	16.56	57.76	42.24	Heavy loam
11	7.0	49.40	0.70	11.10	3.75	40.61	10.79	22.95	10.80	55.46	44.54	Heavy loam
12	4.4	1.60	20.30	4.70	0.21	61.69	7.02	8.28	8.10	76.60	23.40	Light loam
13	4.6	3.40	12.90	13.30	0.97	45.71	17.07	16.35	6.60	59.98	40.02	Heavy loam
14	6.0	43.60	31.50	2.80	43.08	16.42	18.05	9.81	9.84	62.30	37.70	Middle loam
15	5.0	6.80	25.20	4.60	48.14	13.95	18.90	4.54	9.87	66.79	33.21	Middle loam
16	5.0	5.60	18.20	4.70	0.98	58.95	8.37	17.55	9.45	64.63	35.37	Middle loam
17	6.4	19.00	5.60	11.20	17.68	42.52	9.70	9.45	9.45	71.40	28.60	Middle loam
18	7.8	48.80	1.22	7.50	32.24	17.03	27.03	2.00	14.20	56.77	43.23	Heavy loam
19	7.2	42.00	0.35	13.40	0.29	29.99	12.04	27.72	16.56	43.69	56.31	Light clay
20	5.0	4.20	19.95	7.30	12.18	41.52	21.97	5.96	11.07	61.00	39.00	Middle loam
21	5.8	45.40	3.68	4.50	35.22	23.38	19.87	14.21	2.82	63.10	36.90	Middle loam
22	5.8	10.8	Not found	3.10	28.56	31.38	14.52	8.64	13.80	63.04	36.96	Middle loam
23	6.7	40.80	2.28	1.60	28.55	49.67	2.54	9.54	8.10	79.82	20.18	Light loam

In general, acidification of soils is a negative process that leads to impoverishment of the species diversity that can grow on this substrate, due to a decrease in cellulose-destroying and nitrogen-fixing bacteria in the latter and the active leaching of useful nutrients into deeper layers or surface waters.

If the actual acidity depends on the content of sources of hydrogen ions in the soil – organic acids, hydrolytic salts, etc., then a more complete picture of the content of positive particles in the soil-absorbing complex (SAC), such as hydrogen and aluminum ions, gives the value of potential acidity, one of the forms of which is hydrolytic acidity (HA).

The HA value is determined during the interaction of the solid phase of the soil with salt solutions that are composed of weak acid and alkali, most often sodium acetate. In this case, sodium is absorbed and acetic acid is formed, therefore, the soil acts as stronger than acetic acid. The higher the hydrolytic acidity value of each individual sample, the less alkaline earth metal ions, such as Ca2+ and MD2+, it contains.

Another criterion that allows us to estimate the content of Ca2+ and MD2+ ions in the studied sample in combination with others (K+, Na+, NH4+) is the sum of the absorbed bases (SAB). As you know, if only the above ions are present in the soil sample, then such soil should be considered saturated with bases, if there are also H+ and Al3+ ions, then it is unsaturated. The degree of base saturation (DBS) can be estimated as a fraction of the co divided by the absorption capacity (sum of SAB and HA) and multiplied by 100%. DBS of the studied soil samples of the Chivchyn Mountains is shown in Table 2.

Table 2.

Degree of soil saturation of the Chivchyn mountains (Ukrainian Carpathians)

Sample number	Absorption **capacity (SAB + SC), mg-eq per 100 g of soil**	**DSB, %**	**Degree of saturation with bases**
1.	33.60	4.17	very low
.	40.70	57.00	middle
3.	24.80	26.61	very low
4.	50.30	98.61	high
5.	22.75	73.85	increased
6.	49.95	99.30	high
7.	50.15	99.30	high
8.	27.20	7.35	very low
9.	50.32	98.97	high
10.	29.95	0.67	very low
11.	50.10	98.60	high
12.	21.90	7.31	very low
13.	16.30	20.86	very low
14.	75.10	58.06	middle
15.	32.00	21.25	very low
16.	23.80	23.53	very low
17.	24.60	77.24	increased
18.	50.02	97.56	high
19.	42.35	99.17	high
20.	24.15	17.39	very low
21.	49.08	92.50	high
22.	Not determinet	Not determinet	Not determinet
23.	43.08	94.71	high

Analyzing the data in Table 1 regarding the granulometric composition of the studied soil samples of the Chivchyn mountains, we conclude that loam prevails.

Spatial analysis confirms the analogy with other mountainous regions, that in the soils of the Chivchyn mountains, the highest content of clay elementary soil particles (ESP) is confined to the valleys of permanent, and less often – temporary watercourses. Thus, the highest clay content among all the studied samples (56.31 %) was found in sample No. 19, which was taken in the valley of the Preluki stream. Similar results were obtained for samples No. 4 (46.20% clay, Perkalab river valley), No. 8 (47.97 %, G slope Preluki, near the Bosrivka streambed), No. 10 (42.24%, Mynchel streambed), No. 11 (44.54%, subalpine meadows, near the nameless left tributary of the Maskotyn river), No. 13 (40.02%, Maskotyn river valley) and No. 18 (43.23%, the south slope of the mount Tovsta, near the channel of the Preluki stream).

The percentage of physical sand in the studied samples, the size of the ESP is more than 0.01 mm, ranges from 43.69 % (sample No. 19, light clay) to 89.60% (No. 9, sandy loam). The average percentage of ESP of physical sand in all the studied

samples of Chivchyn is 65.06%, which indicates a relatively young age of these soils, because the ESP data are nothing more than fragments of one size and genesis rocks crushed by time and environmental conditions.

Analyzing geospatial and data of Table 2, we conclude not only about the diversity of the characteristics of the Chivchyn soil cover, but also the proximity of more "rich" soils to the channels of streams and rivers. Thus, increased, high start of samples No. 4 (98.61 %, Perkalab riverbed), No. 5 (73.85 %, Perkalab riverbed), No. 6 (99.30 %, Hnetesa, near Bosrovka stream), No. 7 (99.30%, Hnetesa, near Bosrovka stream), No. 9 (98.97 %, Hnetesa, near samples 6-7), No. 17 (77.24 %, Chorny Cheremosh River valley), No. 18 (97.56 %, south slope of Tovsta, near the source of the nameless right tributary of the river Chorny Cheremosh), No. 19 (99.17%, Preluki streambed). Exceptions to this trend are the results of analysis of samples No. 10, 21, 23. Therefore, there is a need for further detailed research.

The established granulometric composition with a predominance of physical sand leads to the formation of the following soil properties of the Chivchyn mountains:

1) well pass and filter the moisture of atmospheric precipitation to deeper waterproof soil horizons or parent rock, poorly retain it, which leads to an oversaturation of moisture in deeper layers at the interface of the water-permeable layer-waterproof coating (water-permeable layer-parent rock);

2) poor in bioavailable nutrients organic substances and inorganic water-soluble mineral compounds due to leaching of the latter into deeper strata;

3) there is a high probability of negative erosion events such as landslides, mudslides, etc. during heavy precipitation and oversaturation of moisture layers at the border of the watertight layer or parent rock, especially on steep slopes after continuous deforestation.

Conclusions. According to the results of the study, it was found that the mountainous region of the Chivchyn Mountains is poorly disturbed due to anthropogenic activity, variegated in the geological structure and distribution of soil types. An increase in the percentage of clay elementary soil particles in the valleys of permanent and temporary watercourses, more acidic pH values on mountain tops, with the exception of places where limestones directly reach the daytime surface, were found. The predominance of physical sand in Chivchyn soils can lead to landslides and other erosion processes phenomena as a result of heavy precipitation, especially on steep slopes under deforestation. In general, the region of the Chivchyn mountains, as well as the Ukrainian Carpathians as a whole, is characterized by acidic brown soil formation with the formation of rounded eluvial-deluvial soils..

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ХАРАКТЕРИСТИКА ҐРУНТОВОГО ПОКРИВУ ЧИВЧИНСЬКИХ ГІР: ОСНОВНІ ФІЗИКО-ХІМІЧНІ ПОКАЗНИКИ ТА ТИПИ ҐРУНТІВ

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У статті подано результати аналізу ґрунтового покриву Чивчинських гір (Українські Карпати). Встановлено, що переважаючими типами ґрунтів є середньо- та важкосуглинкові, меншою мірою — супіщані та легкоглинисті. Виявлено збільшення частки глинистих елементарних ґрунтових частинок у долинах постійних і тимчасових водотоків, а також більш кислі значення pH на вершинах гір, за винятком ділянок, де вапняки виходять безпосередньо на денну поверхню. Переважання фізичного піску в ґрунтах Чивчинських гір може зумовлювати розвиток зсувних процесів та інших ерозійних явищ унаслідок інтенсивних опадів, особливо на крутих схилах за умов вирубки лісів. Загалом для регіону Чивчинських гір, як і для Українських Карпат, характерне формування кислих бурих ґрунтів із розвитком округлих елювіально-делювіальних ґрунтових утворень.

Ключові слова: Чивчинські гори, Українські Карпати, національний природний парк, екологічна безпека, ґрунти, типи, методи, фізико-хімічні показники, охорона, антропогенне навантаження

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