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PRESENT STATUS OF EAST FOREST-STEPPE OF UKRAINE WITH REFERENCE TO RAVINE-BEAM SYSTEM OF «MITRISHIN OVRAG»

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Abstract
The results of the field and analytical research stages regarding the assessment of the current state of eroded soil in the "MitrishinOvrag" ravine-beam system of the Dergachevsky district of the Kharkov region are presented. It is established, that the soil cover of the investigated areas is represented by varieties of washed and washed soils of slope soil formation, and the forest characteristics of these soils are determined. It is shown that on the lands of the ravine-beam system "MitrishinOvrag" at the present time there is a rather constant process of soil formation, without active manifestation of erosion processes, which is confirmed by the results of analytical determinations of the granulometric composition, acidity level, total humus content and gross forms of NPK.

Key words
Eroded soils, granulometric composition of soil, humus, acidity

INTRODUCTION

The intensification of erosion processes and their spread over large areas lead to significant soil degradation, to large losses in the national economy and, in general, to the risk of the safe development of society. Because of erosion processes, the fertility of soils and the effectiveness of fertilizers applied to the soil are reduced, rivers and canals are silted, washed away and filled with shallow land.From erosion, theland fund annually loses large areas that turn from rich landscapes with fertile soils to "barren lands" and deserts. This means that the creation of an effective system of soil protection from erosion is a priority task of the national economy, without its solution it is impossible to achieve sustainable land use and, in general, the safe development of forestry and agriculture (Gordienko et al. 2005,Timchenko et al. 2010, Koco et al. 2016; Zverková, Zverková2013).

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An important part of the complex of measures to combat erosion are the measures of melioration of forests to protect the soil from erosion. Forestry plays a dominant role in regulating and maintaining favorable environmental parameters and ensuring sustainable development of regions on this basis. Basics of the future effectiveness of protective forest plantations are laid even at the stage of their design and transmission of the project to nature. The viability and durability of these plantations depends on how justified the decisions of designers (Regulations 2009; Vilček et al. 2013; Migunova 2007).

The aim of the research was to determine the state of forest plantations, their erosion conditions, and also to change the properties of eroded soils and their forest productivity under the influence of forest plantations.

ANALYSIS OF RESULTS OF RECENT STUDIES

We studied the category of eroded soils on the soils of theravine-beam system "MitrishinOvrag" of the Dergachevsky district of the Kharkov region. The Mitrishinsky ravine was created in 1962 as a sample of the anti-erosion object of the ravine-gully in the Kharkov region on the initiative of URIFFM. In the 60s of the 20th century, various forest cultures were created on this site (Teleshek 1963).From 1991 to 2011 studies on this object were almost never carried out. In 2012, we have re-established studies to determine the current state of erosion activity in the sites under investigation, and on this basis to find the ways of the most reliable and effective ways to combat erosion and flushing of soils of these lands.

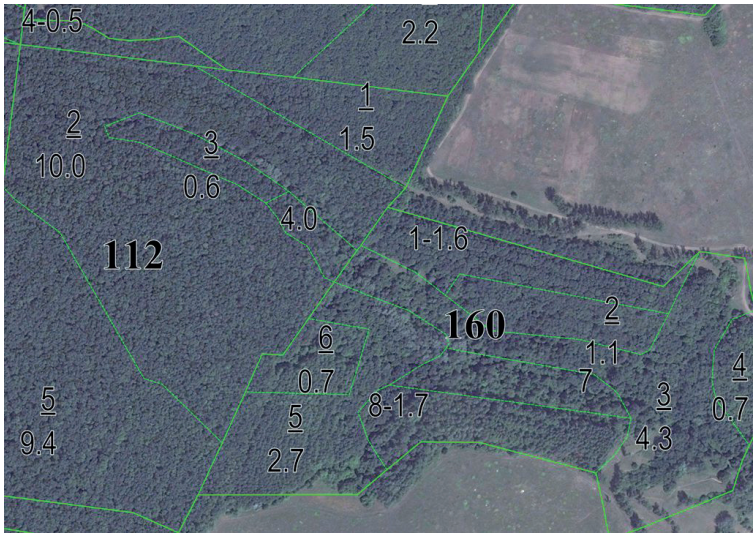

Figure 1
The ravine-beam system "MitrishinOvrag" *(based on Google Maps)*

The ravine-beam system "MitrishinOvrag" is a long erosion formation, 2.5 km long from the floodplain to the watershed. Its catchment area exceeds 600 hectares (Fig.1). The middle part (120 ha) is treeless, and the banks are steep (15-350) convex forms of southern and northern exposures. From the east to the ravine-beam system "MitrishinOvrag" adjoined the land of the former collective farm Kirov Dergachevsky district of the Kharkov region.These lands are located on a fairly steep slope of the right bank of the river Kharkiv, at the foot of which is the village of Tsirkuny. The average annual losses of arable land from water erosion on the investigated site were up to afforestation of 0.8-1.2 ha per year. Products of erosion (melkozem) in the volume of 1200 m3 were taken annually to the valley of the Kharkov River, where they damaged roads, household plots, gardens and floodplain lands.

METHODOLOGY DESCRIPTION

The purpose of our research was to determine the state of forest plantations, their anti-erosion effectiveness, as well as changes in the properties of eroded soils and their overall forest productivity under the influence of forest plantations.

The studies were based on classical methods and methodological approaches of soil science, agrochemistry, forest science, forest taxation, typology and mathematical statistics. Along with standard methods, Field-Map advanced measurement technology (which was provided by the staff of the Forestry Monitoring and Certification Laboratory of the URIFFM) was used to conduct field works and inventory forest plantations. With the help of Field-Map, a network of trial plots was designed. When using the GPS receiver in the field GPS equipment, we solved the navigation problems and local coordinates were fixed to the global coordinate system, which enabled us to build a map of the terrain on the screen with real-time measurements, placing all the measured objects on it directly Work in the forest. When using a laser rangefinder-altimeter in the set, the slope of the relief of the investigated territory, the distribution of height and stocks of stands were determined.

During our research, four test areas (TS) were laid in the "MitrishinOvrag" ravine-beam system (Fig.2):

1 - the area of the upper part of the ravine;
2 - zone of the middle part of the ravine;
3 - zone of the lower part of the ravine - thalweg;
4 - opposite weakly-hollow zone of the upper part of the ravine.

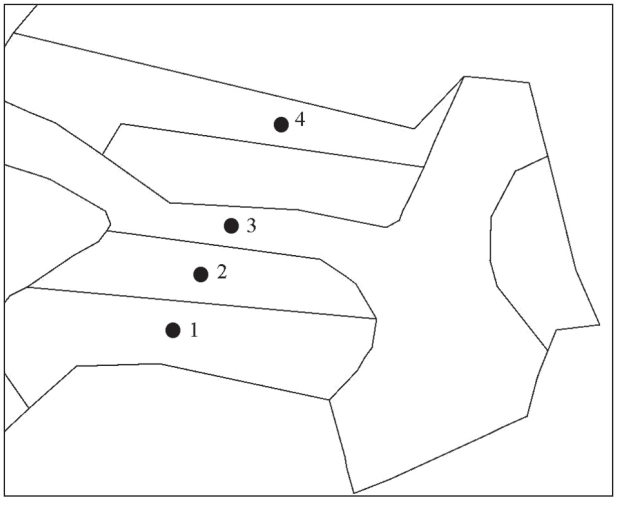

Figure 2
Scheme of laying trial plots in the ravine-beam system "MitrishinOvrag"

On each TS, the composition of tree and shrub vegetation is described, its taxation characteristics are given, soil sections are laid and described, soil samples are selected. Sampling of soil samples was carried out from each genetic horizon of four soil sections, which were laid in the zone of influence of erosion processes of different intensity on soils. Soil samples were analyzed according to generally accepted methods (Sokolova 1975, Arinushkina 1970, Regulations 2003,Regulations 2005).

RESULTS OF THE RESEARCH

The soil cover of the sites studied is represented by varieties of soils of slope soil formation (washed off and washed): dark gray podzolized weakly washed soils on forests (TS 1, 4) and dark gray podzolized ones on red-brown clays (TS 3). We also describe the soil formed under the influence of the alluvial soil-forming process - alluvial sod-layered soil (TS 2).

Maternal breed of the investigated soils because of differentmaintenance of dispersible faction(≤ 0,001 mm) on the scaleof N.A. Kaczynskogocharacterized by such grain-sizecomposition:TS 1 - heavy loam with a fraction of physical clay 53.26-53.66%, TS 2 - sandy loam (13.15-16.33%), TS 3 - loam medium (42.24%), TS 4 - loam medium (43.66%) (Table 1).Soil samples analyses were performed at the Laboratory of Analytical Environmental Research, V. N. KarazinKharkiv National University.

Table 1 The granulometric composition of the studied soils of the ravine-beam system "MitrishinOvrag"

№ TS	Horizon	Depth (cm)	Content of particles of different sizes (%)			The name of the granulometric composition of soils
			> 0,01 Mm	< 0,01 Mm	< 0,001 Mm	
1	He	10-20	57,75	42,25	25,55	Middle Loam
	HI	50-60	51,71	48,29	36,63	Heavy Loam
	Ih	70-80	51,07	48,93	36,23	Heavy Loam
	Pi(h)	95-100	46,74	53,26	36,9	Heavy Loam
	Pk	110-130	46,34	53,66	35,97	Heavy Loam
2	He	0-15	65,79	34,21	20,91	Middle Loam
	Ph	25-35	78,24	21,76	19,12	Light Loam
	P/D	40-50	83,67	16,33	14,24	Sandy loam
	P/D	60-70	84,06	15,94	15,58	Sandy loam
	P/D	90-100	86,85	13,15	11,97	Sandy loam
3	He	10-20	52,75	47,25	26,31	Heavy Loam
	Hi	50-60	77,35	22,65	14,26	Light Loam
	HI	70-80	60,59	39,41	24,29	Middle Loam
	HI	95-100	69,52	30,48	19,05	Middle Loam
	Ph	110-130	57,76	42,24	27,89	Middle Loam
4	He	10-20	64,17	35,83	15,68	Middle Loam
	Hi	40-50	56,31	43,69	25,99	Middle Loam
	Ih(p)	70-100	50,93	49,07	34,18	Heavy Loam
	Pk	160-165	56,34	43,66	25,58	Middle Loam

The fractional composition of the mechanical elements of the humus horizon of the investigated soils reflects the quantitative indices of the granulometric composition of the parent rock, but some of its features are noted. The main difference between the upper and lower parts of the profile of the dark gray podzolized weakly washed soils (sections 1, 4) with respect to the profile of the soddy alluvial layered soil (section 2) and dark gray washed (section 3) is the decrease in the silt in the humus-eluvial horizons in comparison with The parent rock (see Table 1).

The accumulation of silty particles in the humus horizon of alluvial turf soil and dark gray soiled is the result of the sod process, and also lessive - the mechanical movement of clay particles from the upper part of the slope, that is, the result of slope soil formation.

For dark gray podzolized weakly washed soils of the upper parts of the slopes, differentiation of the profile is observed according to the type of glow-reduction of the content of mud particles in the upper part of the profile and their accumulation in the middle. However, in this case, the sod process and the process of glowing, now occurring under the influence of forest vegetation, are superimposed on the active in the past process of flushing out mineral particles from higher flat areas located above the ravine.

On the whole, the granulometric composition of individual soil horizons in the investigated areas varies from sandy loam to heavy loam and varies depending on the genesis of the soils and the prevailing elementary soil processes. Analyzing the level of actual acidity of the studied soils in the humus-eluvial horizons, it can be noted that in the overwhelming majority they are characterized by a weakly acid reaction (Table 2).Soil samples analyses were performed at the Laboratory of Analytical Environmental Research, V. N. Karazin Kharkiv National University.

Table 2 The acidity level of the studied soils of the ravine-beam system "MitrishinOvrag"

№ TS	Horizon	Depth (cm)	pH Aqueous	Degree of acidity and alkalinity
1	He	10-20	5,6	Moderately acidic
	Hl	50-60	6,2	Weakly acidic
	Ih	70-80	6,3	Weakly acidic
	Pi(h)	95-100	6,2	Weakly acidic
	P(k)	110-130	6,1	Weakly acidic
2	He	0-15	5,6	Moderately acidic
	Ph	25-35	5,2	Sour
	P/D	40-50	5,3	Sour
	P/D	60-70	4,9	Sour
	P/D	90-100	5,0	Sour
3	He	10-20	6,8	Close to neutral
	Hi	50-60	6,8	Close to neutral
	Hl	70-80	6,7	Close to neutral
	Hl	95-100	6,8	Close to neutral
	Ph	110-130	6,8	Close to neutral
4	He	10-20	5,4	Sour
	Hi	40-50	6,1	Weakly acidic
	Ih(p)	70-100	5,4	Sour
	Pk	160-165	7,8	Moderately acidic

The maximum acidity values for dark gray podzolized soil on forests under pine plantations are fixed in the upper horizons of the soil, which gradually decrease with the approach to the parent rock (from moderately acidic reaction to weakly acid).

For soddyaluvial soil (section 2), the degree of acidity increases from moderately weakly acid in the horizon He to acidic in the parent rock, which is quite logical given the genesis of these soils.

The acidity of the dark gray soil on the red-brown clays (section 3) remains at the same level in all horizons (close to neutral), while the dark gray in the forests (section 4) varies from acidic and slightly acidic to moderately alkaline, which is explained by the chemical composition Maternal breeds.

The content of general humus and its total reserves is an integral index of soil formation. According to the obtained data, the content of humus in the investigated series of soils is within the "very low" range (according to the parameters of the humus state proposed by L.Grishina and D.Orlov) (Table 3). Low values of humus can be explained by the prolonged and intensive impact of erosion processes on the soils of the ravine-gully landscape studied, as a result of which significant losses of humus occurred. Forest vegetation significantly contributed to the attenuation of erosion processes and activated the processes of humus accumulation. However, it should be borne in mind that 50 years is a rather insignificant period in order to speak of a significant increase in the humus content. Most likely, this period can be called a period of stabilization of humus formation with a tendency to accumulate it.

Despite the closeness of the location of the studied soils and approximately the same age of the landscape, the soils differ in the level of humus content of the He horizon and in the total reserve of humus, which decrease from the upper weakly sloping slopes to the middle parts and the soils of the thalweg. Thus, while in the humus-accumulative horizon of soils with weakly sloping slopes, the humus content is 1.60 and 1.65%, then 1.19% on the slope, and 0.88% on the thalweg.

The results of humus content indicate that higher values are characteristic of soils with a more or less stable level of soil formation - on the upper parts of weakly sloping slopes, while soils with an unstable level on slopes and thalwegs are distinguished by a decrease in the content of organic matter.Soil samples analyses were performed at the Laboratory of Analytical Environmental Research, V. N. Karazin Kharkiv National University.

The C:N ratio, which characterizes the enrichment of organic matter to nitrogen, in the humus-eluvial horizon of the investigated soils, on the whole indicates a sufficiently high supply of nitrogen and a diagnostic system. L. Grishina and D. Orlov is the middle (cut 1), high (cut 2) and very high (cut 3). The C:N ratio in the humus-eluvial horizon of section 4 reaches 14, which characterizes it as very low in nitrogen supply.

Table 3 Parameters of the humus state of the investigated soils of the ravine-beam system "MitrishinOvrag"

№ TS	Horizon	Depth (cm)	Humus content (%)	Carbon content (C) (%)	Nitrogen content (%)	C:N	Enrichment of humus Nitrogen, by the ratio C:N
1	He	10-20	1,60	0,926	0,091	10	middle
	HI	50-60	0,21	0,049	0,085	0,6	very high
	Ih	70-80	0,21	0,049	0,020	2,5	very high
	Pi(h)	95-100	0,03	0,017	0,020	0,9	very high
	Pk	110-130	0,03	0,017	0,007	2	very high
2	He	0-15	1,19	0,689	0,111	6	high
	Phi	25-35	0,28	0,162	0,020	8	middle
	P/D	40-50	0,05	0,029	0,007	4	very high
	P/D	60-70	0,13	0,075	0,033	2	very high
	P/D	90-100	0,10	0,058	0,033	2	very high
3	He	10-20	0,88	0,510	0,133	4	very high
	Hi	50-60	0,70	0,405	0,800	0,5	very high
	HI	70-80	0,64	0,371	0,073	5	high
	HI	95-100	0,75	0,434	0,080	5	high
	Ph	110-130	0,10	0,058	0,032	2	very high
4	He	10-20	1,65	0,955	0,067	14	very high
	Hi	40-50	0,80	0,463	0,060	8	high
	Ih(p)	70-100	0,49	0,284	0,020	14	very high
	Pk	160-165	0,36	0,208	0,098	2	very high

Comparing the soils with respect to the content of the total forms of NPK and Ca, it can be stated that high concentrations (especially in the He horizon) are characteristic of the soiled soil, which is quite natural (Table 4). At the same time, the growth of nutrients occurs not only due to their additional mechanical injection with soil particles, but also because of their migration along the profile associated with a sufficiently high level of water supply of placer soils.Soil samples analyses were performed at the Laboratory of Analytical Environmental Research, V. N. Karazin Kharkiv National University.

Table 4 The supply of nutrients to the studied soils of the ravine-beam system "MitrishinOvrag"

№ TS	Horizon	Depth (cm)	Content of common forms (%)			
			N	P_2O_5	K_2O	CaO
1	He	10-20	0,09	0,08	0,31	0,32
	Hl	50-60	0,085	0,04	0,33	0,36
	Ih	70-80	0,02	0,04	0,42	0,34
	Pi(h)	95-100	0,02	0,05	0,40	0,35
	Pi(k)	110-130	0,01	0,04	0,40	0,35
2	He	0-15	0,11	0,05	0,31	0,32
	Phi	25-35	0,02	0,03	0,23	0,27
	P/D	40-50	0,01	0,02	0,15	0,195
	P/D	60-70	0,03	0,015	0,17	0,20
	P/D	90-100	0,03	0,015	0,14	0,16
3	He	10-20	0,13	0,11	0,50	0,42
	Hi	50-60	0,80	0,05	0,28	0,24
	Hl	70-80	0,07	0,08	0,45	0,34
	Hl	95-100	0,08	0,07	0,35	0,30
	Ph	110-130	0,03	0,06	0,41	0,37
4	He	10-20	0,07	0,08	0,30	0,26
	Hi	40-50	0,06	0,08	0,43	0,34
	Ih(p)	70-100	0,02	0,08	0,46	0,38
	Pk	160-165	0,10	0,06	0,31	6,68

In general, the upper humus horizons of soils of the ravine-beam system are sufficiently provided with the basic elements of their biological absorption and migration. The exception is sandy loamy alluvial soils), which is related to their genesis.Thus, the lowest amounts of potassium and phosphorus are found in sandy-loamy alluvial soil (with the exception of the No horizon), which is entirely due to the mineralogical composition of the parent rocks of alluvial origin. The content of potassium and calcium in the profiles of the remaining soils is quite stable due to their heavy granulometric composition. On afforested areas, the calcium content naturally increases sharply (from 0.3 to 6.7%).

Thus, our studies have revealed that a fairly stable process of soil formation, without an active manifestation of erosion processes, is currently taking place on the lands of the ravine-beam system "MitrishinOvrag". This is evidenced by the genetic horizons of slope soils, which are homogeneous in color and structure,

fixed by tree and shrub vegetation, where the active movement of the soil mass along the slope ceased with the beginning of the soil-forming process under the influence of forest and grass vegetation. The thickness of the upper humus horizons ranges from 36 in the upper part of the slope to 105 cm in the lower part. Fresh ravines, razmoin, naked areas, outcrops of parent rocks, significant areas with uncovered vegetation are not observed. Moreover, all the surveyed areas are characterized by the presence of a well-developed, abundant natural renewal of various tree and shrub species (mainly vegetative and also of seed origin): red and common oak, hazel, maple, acacia, common ash, hazel, mountain ash, As well as a fully viable undergrowth of these breeds (Lisnyak A. A. 2015).

It is indisputable that the plantations of the main layers of various sections of the ravine-beam system in the vast majority do not differ in significant timber reserves (especially commercial quality), but their basic meliorative soil protection function is the consolidation of operating gullies, they have been and continue to be effectively carried out, resulting in active erosion processes Terminate or significantly slow down. It should be noted that forest plantations of this unique site require sanitary cuttings, thinning to improve the condition and growth of trees and shrubs, increase the forestry and anti-erosion effect of forest plantations.Cuttings care should promote the formation of healthy and sustainable protective plantations, which for a considerable period will perform an important soil protection function.

CONCLUSIONS

The laid ecological slope row of the soils of the ravine-beam system "Mitrishin Ovrag", where wood cultures were created in the 60s of the 20th century, allowed us to trace the intensity of erosion processes for today. It is established that the soil cover of the investigated areas is represented by varieties of washed and washed soils of slope soil formation, however, for today a fairly stable process of soil formation is taking place, without active manifestation of erosion processes.

The main difference between the upper and lower parts of the profile of the investigated soils is the decrease in the silt in the humus-eluvial horizon in comparison with the parent rock, and the granulometric composition of individual soil horizons varies from sandy loam to heavy loam and varies depending on the genesis of the soils and the prevailing elementary soil processes. The supply of basic nutrients is higher in the upper humus horizons, while downward along the profile, they decrease and increase the inorganic (mineral) proportion, which is also related to their genesis.The level of the actual acidity of all investigated soils in the humus-eluvial horizons is within the limits of a weakly acidic and close to a neutral reaction. The results of the content of total humus indicate that its higher values are observed on the upper parts of weakly sloping slopes, while on the slopes and thalwegs the soils are distinguished by a decrease in the content of organic matter.

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