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DYNAMICS OF SNOW COVER AND MELIORATE PROPERTIES OF EROSOIN CONTROL PLANTINGS

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The dynamics of snow cover and associated meliorate properties of erosion stands in central part of Dnieper Upland have been researched. It's found out snow distribution dynamics, power snow cover, density, water supply, soil freezing during the 2012-2014 years. Meliorate properties of the stands are distinguished in apparent uniform distribution of snow, water accumulation in it, no deep freezing of the soil , enhancing its permeability.

Erosion control plantings, snow distribution, snow cover, snow density, water supply, soil freezing.

Snow cover - is not just a mixture of deferred snowflakes and special natural body with certain properties, which include thermal conductivity, density and water supplies [7].

The snow that fell in the cold season creating the earth's surface snow cover certain power, which plays an important role in the formation of radiation and heat balance of the surface modes of temperature and soil water regime [4].

Thus, according to V. Pavlovsky presence in the land of snow cover even height 10 cm improves soil temperatures several times, because the snow has high insulation properties [9].

The snow that fell on the earth surface undergoes movement under the influence of winds and blizzards. With some places it deflates in other builds as tents. Distribution of snow cover is largely dependent on topography and character of the region [3].

The more rugged terrain yet uniformly deposited snowpack. On the flat plains of snow is spread relatively evenly. On the plains, which are dissected by valleys, ravines, gullies, much of the snow cover carried by winds into the down places. Size of snowshed area and path length determines the transport snow mostly density

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ravine and river network [2]. Accounting of snow distribution is especially important in areas with significant relief.

In forested areas almost the entire mass of snow remains in its field loss. Protective forest plantations on steep slopes of hydrographic network accumulate more than one third of the snow mass that will wear out from open areas. Also, forest plantations act as detention and even distribution of snow and provide a significant extension of snowmelt [5].

Character of snow distribution greatly affects the duration of snowmelt and different intensity relative to catchment landscape elements [8].

Wood is a factor of accumulation and extension of the melting snow. The intensity and duration of snowmelt on slope lands depend on their exposure and presence of forest cover.

According to V. Bodrov [2], prolongation of melting snow in wood 1-3 weeks in the comparison with the open field. Snowmelt and slow receipt of melt water contribute more intensive soil removal be soil and transferable of surface runoff into the soil.

According to N. Kostiukevych in forest under snow cover distribution depends on the composition, age, density, planting and cutting down on the width of the cutting area. In deciduous stands of snow almost always completely penetrating to the soil surface, whereas it is retained in the spruce trees and then evaporates into the atmosphere. Atmospheric snowfall detained crown depends on their number and temperature and can vary within wide limits. Snowfall dropping at 0ºC, and accumulate in the crowns of deciduous trees (pine, spruce) is the cause of snowbreaks [4].

The **aim of the research** raised the determination of density, water supplies, the dynamics of snow cover and soil freezing in erosion control stands in central Dnieper Upland.

The **object of research** is anti-erosion plantings in central Dnieper Upland. The study was carried out in State Enterprices "Uman forestry" in plantations located in the northern, north-eastern north-western, southern and western slopes.

Method of research. The study was conducted in stands where erosion by weight snow tool BC - 43 [6], each sample plots were made 20-30 measurements. The tool helps identify of snow power, density of the snow cover and snow and the weight with an accuracy of less than 1 gram. Snow depth (60 cm) is determined with an accuracy of at least 0.5 cm of snow density is the ratio of its mass to power, which is calculated by the formula 1. The density of the snow cover, which had just been formed, is about 0.1 $g{\cdot}cm^{-3}$. During the winter it increases under the influence of its own weight, thaws, winds and blizzards approximately by 10 % per month. Prior to the melting density increases 0.3-0.35 (0.5) $g{\cdot}cm^{-3}$ [1, 3].

$$d = \frac{n}{h}; \qquad (1)$$

where n - number of divisions logged against a ruler scales; h - height of snow samples logged against by the divisions on the cylinder, cm. If snow depth over 60 sm, the measurements are made in layers two to three steps and calculations carried out by the density formula 2:

$$d = \frac{n_1 + n_2 + n_3 + ...n_n}{10\,(h_1 + h_2 + h_3 + ...h_n\,)}; \qquad (2)$$

Supply of water in the snow cover is determined by the formula 3.

$$P_{в} = \rho_{c}/h \cdot 10; \qquad (3)$$

where ρ_c – density of snow, h – power of snow cover.

Results. To study the dynamics of snow cover in erosion and gully ravine stands of the SE "Uman forestry" was founded 10 plots. Description plots the dynamics of snow cover and snow water is shown in Table. 1, and the average density of the snow cover is shown in Table 2.

1. Dynamics of snow cover and snow water

Number of samples	Composition	Age, years	Density	Power of snow cover, sm / Stock of snow water, mm·ha^{-1}									
				2012				2013			2014		
				27.01	10.02	09.03	25.12	04.01	05.02	09.03	24.01	03.02	14.02
1	8Oak2Maple	70	0,70	18,6 / 25,1	18,5 / 27,9	10,6 / 33,7	22,2 / 30,3	19,6 / 51,7	8,7 / 50,1	6,4 / 26,7	15,3 / 18,9	21,2 / 31,9	7,4 / 24,7
2	9 Oak 1Hornbeem	71	0,86	20,4 / 54,2	19,8 / 25,3	10,4 / 31,2	22,3 / 30,4	21,0 / 53,3	9,9 / 51,5	8,5 / 33,1	16,0 / 18,6	18,4 / 28,1	7,9 / 29,6
3	9 Oak 1Hornbeem	86	0,86	16,7 / 65,5	17,7 / 25,6	8,7 / 25,1	23,2 / 31,1	22,0 / 56,0	9,0 / 50,6	7,4 / 30,3	13,0 / 14,2	20,6 / 31,2	9,1 / 27,0
4	7 Oak3Ash	49	0,77	17,0 / 23,8	17,1 / 26,6	13,4 / 36,8	23,2 / 31,6	21,5 / 54,1	8,3 / 50,8	10,0 / 35,4	16,5 / 19,5	19,2 / 30,2	8,1 / 26,4
5	10 Oak+Elm	62	0,81	16,9 / 18,3	17,0 / 26,2	15,0 / 40,8	22,3 / 30,5	20,9 / 53,3	9,1 / 49,2	9,5 / 36,6	15,2 / 19,2	17,8 / 28,8	7,2 / 24,6
6	6Rob4Maple	50	0,80	15,3 / 24,0	16,1 / 26,4	14,6 / 35,8	22,8 / 30,9	21,3 / 54,5	9,7 / 51,9	10,1 / 38,0	16,0 / 19,3	20,2 / 31,2	9,7 / 26,7
7	8 Maple 2Betula	40	0,72	16,3 / 28,4	17,0 / 26,3	15,9 / 42,6	20,8 / 29,2	19,2 / 49,4	9,3 / 51,4	8,9 / 33,3	16,9 / 18,9	18,8 / 29,3	8,1 / 25,3
8	8 Oak2 Maple	50	0,80	15,3 / 24,8	16,0 / 25,7	15,0 / 41,9	21,3 / 29,4	20,0 / 51,1	9,4 / 51,0	8,8 / 34,5	17,7 / 19,5	19,7 / 30,6	8,6 / 26,7
9	8Robinia 2 Maple	70	0,70	16,5 / 22,8	16,6 / 25,6	16,6 / 45,2	21,7 / 29,8	20,5 / 50,7	8,4 / 50,0	8,95 / 35,9	14,7 / 16,8	17,4 / 27,7	8,2 / 26,8
10	10 Oak	70	0,80	14,6 / 26,1	15,1 / 26,2	15,8 / 44,8	21,5 / 29,8	19,5 / 50,1	11,2 / 53,1	9,0 / 35,6	14,5 / 18,2	16,5 / 26,6	6,2 / 24,7

2. Average density of the snow cover

Num-ber of samp-les	Compo-sition	Average density of the snow cover for years									
		2012				2013			2014		
		27.01	10.02	09.03	25.12	04.01	05.02	09.03	24.01	03.02	14.02
1	8Oak2Maple	0,13	0,15	0,32	0,13	0,26	0,57	0,42	0,12	0,15	0,33
2	9 Oak 1Hornbeem	0,26	0,13	0,30	0,14	0,25	0,52	0,39	0,12	0,15	0,37
3	9 Oak 1Hornbeem	0,39	0,14	0,29	0,13	0,25	0,56	0,41	0,11	0,15	0,30
4	7Oak3Ash	0,14	0,15	0,27	0,14	0,25	0,61	0,35	0,12	0,15	0,32
5	10Oak+Elm	0,11	0,15	0,27	0,14	0,25	0,54	0,38	0,13	0,16	0,34
6	6Rob4Maple	0,16	0,16	0,24	0,13	0,25	0,53	0,37	0,12	0,15	0,27
7	8 Maple 2Betula	0,17	0,15	0,27	0,14	0,25	0,55	0,37	0,11	0,15	0,31
8	8 Oak2 Maple	0,16	0,16	0,27	0,14	0,25	0,54	0,39	0,11	0,15	0,31
9	8Robinia 2 Maple	0,14	0,15	0,27	0,14	0,24	0,59	0,40	0,11	0,15	0,33
10	10 Oak	0,18	0,17	0,28	0,14	0,25	0,47	0,39	0,12	0,16	0,40

The thickness of the snow cover and soil freezing investigated in December, January, February and March during 2012-2014/

On December of 2011, 2013, 2014 snow cover was observed, but in the same month of 2012. it was formed on the basis unfreezing soil and distributed almost uniformly from 20,8-22,8 cm thick layer of snow density ranged from 0,13-0,14 $g{\cdot}cm^{-3}$, a supply of water in it reached 29,2-30,8 $mm{\cdot}ha^{-1}$.

On January 2012, the snow continued to fall on unfreezing soil, but its distribution was uneven thickness of the layer of 14.6 to 20.4 cm. snow density was 0,11-0,18 $g{\cdot}cm^{-3}$, and the supply of water - 18-65 $mm{\cdot}ha^{-1}$. January 2013 was characterized by weak frosts (-5ºC - 8ºC). Due to the large capacity of the snow cover, which reached 19,5-22,0 cm (under control of 20-22 cm) soil freezing occurred. Revealed processes of sublimation of snow, intensity of expression are dependent on the exposure of the slope. The density of the snow was 0,24-0,26 $g{\cdot}cm^{-3}$, a supply of water - 50,7-56,0 $mm{\cdot}ha^{-1}$. In January 2014 there was snowfall and a permanent snow cover capacity 13,0-17,7 cm.

On February 2012, the depth of soil freezing reached 0.5-2.5 cm (under control of -12-16 cm), due to the exposure of the slopes. The density of the snow was 0,13-0,17 $g{\cdot}cm^{-3}$, a supply of water - 25-27 $mm{\cdot}ha^{-1}$. This period is marked by the sublimation of snow. On February 2013 the temperature of air was +2ºC, capacity snowpack - 8,3-11,2 cm (under control - 8 cm) , the density of the snow - 0,59-0,47 $g{\cdot}cm^{-3}$, the supply of water in the snow - 49.2 - 53.1 $mm{\cdot}ha^{-1}$. The first ten days of February 2014 was characterized by low temperatures to -15(20)ºC, but soil freezing in the stands did not occur, while the control of freezing was 18 17 sm. At this period there were more snowfall and power was 17.4 -21.2 cm and the density of the snow 0,15-0,16 $g{\cdot}cm^{-3}$. On the second decade of February there was zero temperature, which resulted in the melting snow. Snow power was 6,2-9,7 cm, and a supply of water 24,7-29,6 $mm{\cdot}ha^{-1}$.

On March 2012, it’s found the freezing of soil only on wind blown slopes 1-1.5 cm depth, snow density was 0,24-0,32 $g{\cdot}cm^{-3}$ and the supply of water was 31-

45 mm·ha^{-1}. On March 2013 the air temperature was +4ºC, which affected the capacity of the snow cover (6,4-10,1 cm), density (0,37-0,47 g·cm^{-3}) and the supply of water in it (26-37 mm·ha^{-1}). On March 2014 there was no snow cover and soil was non-freezing.

Conclusions. In studying the dynamics of snow cover erosion in erosion control plantations, the thickness of the snow cover and its distribution was quite uniform.

The average thickness of the snow cover in the middle period in 2012 was 20.4 cm, 2013 - 19-22 cm, 2014 - 17,4-21,2 cm.

Average snow water supply for plots in spring 2012 was totaled 37.8 mm·ha^{-1} 2013 - 33,9; 2014-23,5 mm·ha^{-1}.

Frozen solid ground in protective plantations ranged from 0.5 to 2.5 cm, 4,8-7,2 times less compared to the control.

Thus, meliorate properties of plantations emerged: the uniform distribution and snow accumulation of moisture in it, and the lack of deep freezing of the soil, enhancing its permeability.

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