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AGROECOLOGICAL RESOURSES OF CLIMAT PECULIARITIES OF VOLYN WOODLANDS (POLISSYA)

Volyn Polissya is one of the most picturesque areas. Various natural landscapes – wooden, meadow, marsh, aquatic are united here. Economic development led to the essential changes of natural environment. Considerable areas of swampy & overdamp lands are drained & are used in agriculture & forestry. Direct interference of a man is manifested also in modern troubles, which very often are equal to ecological crises. It's natural, that nowadays the whole territory of Polisia is characterized as a natural & antropogenetic complex. Any changes of one of natural components lead to breaches of interrelationships inside natural complex as well as to manifestation crisis states. Soil as a four-phased polifunctional structural system & as final product of such interaction is especially sensitive to such changes. That's why the analysis of quantitative & qualitative indices of temperature & soil humidity (dampness) the temperature & humidity of circumterranious layer of air demand the complex approach & detailed analysis. It is emphasized in scientific publications not once, that the territory of Volyn Polissya in our time is characterized by the increase of the aridizational processes, & in some separate cases such fact is stressed, that for this region the stable tendency to dryness is characteristic. What are all these conclusions based on? To find the answer to this question the materials of observations on meteorological stations (MS) of Volyn & Rivne regions (MS Swityaz, Lubeshiv, Kovel, Manevishi, Sarny) were worked up by us within the period of 1988-2005.

Analyzing the hydrothermal conditions by modern agrolandscapes of Polissya by climatograms we mention that spatial distinctions of warmth & dampness re-distribution are rather considerable. Even with equal meanings of hydrothermal coefficient (HTC) of Selyaninov the duration period with dryness & with (extreme) excessive dampness is different. Thus, the leading role in re-distribution warmth & humidity belongs to local indices [3]. The most changeable climatic conditions are characteristic to the northern districts of Volyn Polissya. (MS Lubeshiv – 35 per cent, & within the limits of northern Polissya it's only 15 per cent). The hydrothermal conditions of circumterraneuos air layer are rather distinctive (different) not only in a cycle of long standing, but also within the limits of one warm period. The characteristic feature is the alternation of dry & damp states of the circumterraneous layer of atmosphere. The most dry periods are observed at the beginning of vegetation period & in April in Volyn Polisia they are characterized as extremely dry (HTC=0,41), & within the limits of the northern part this index is a bit higher (HTC=0,75). So the beginning of vegetation period over the territory of Volyn Polissya is dry & the period from May to July is the most humid (HTC=1,17-1,87). In August the dry conditions are formed chiefly only in the extreme West (MS Swityaz, Kovel) the correlations of warmth & humidity remain optimal [4]. Beginning with September till the end of the vegetation period in regime of long standing the hydrothermal conditions of circumterraneous layer are characterized as humid & extremely humid. In some years in the North HTC is 5,0 (September 1994). Thus, the most unstable hydrothermal conditions of the circumterraneous atmosphere layer are characteristic to northern and eastern districts of Volyn Polisia. In the West (MS Swityaz) the ecological & climatic conditions are less changeable. The hydrothermal conditions of the circumterraneous air layer reflect the influence of local factors to the development of modern soil formation processes of Volyn Polisia & their study is necessary in the analysis in ecological & climatic conditions of climatic regime formation & is an integral part of soil monitoring system.

The most active part in the formation of hydrothermal regime of circumterraneous air layer plays the upper (active) soil layer (0+20sm) which determines the development conditions of plants' root system. That's why the soil temperature is one of the main indices, which influence the growth, development & geographical spreading of plants' groups & also the yield of agricultural crops. The soil temperature is difficult for studying & depends on many factors, which act simultaneously, but with different force of influence. It's also set up many regularities of spatial & temporal changes of soil temperature & with this connection the manifistation of such indices as the quantity of sun warmth which is on the soil surface, the warmth soil properties, the plant & snow cover etc. On the basis of the estimation of climateformation role of these indices the characteristic of thermal soil resources is presented.

The zone distribution of warmth on the investigated territory changes under the influence of the local factors: the character of plant cover, regief etc. The most sensitive to the changes of warmth regime is the upper soil layer (0-20sm). The thermal soil regime is defined by its type, granulometrical composition &

physical properties. As far as for the investigated territory the considerable diversity of coloures of soil cover is characteristic. The thermal soil resources are rather distinctive in the same climatic conditions.

Analyzing the temperature regime of heterogeneous as to their granumetrical composition & their thermal resources, we use the data of temperature observations in the layer of 0-20sm under black fallow (according to the elbow-shaped thermometer of Savinov) because under the influence of vegetative cover the temperature contrasts are smoothed out. To characterize the regime of soil temperatures in different depths the data of periodical observations of long standing at the Volyn meteorological stations & Sarny mash station (for peat soils) were used. The geographic distribution of temperature surface soil layers under black fallow in the conditions of plain territory is influenced by the atmosphere climate & soil cover properties. Among climatic factors are: the quantity of solar radiation, which comes in to the soil surface & depends on the latitude of location; the indices of effective irradiation; the temperature regime of the air, wind etc. To the soil properties, which determine the regularity of temperature distribution on its surface, the soil colouring, the meaning of albedo depends on it; the contents of humus, granulometrical composition & degree of humidity (dampness) are referred. With this it's important to mention the variations of granulometrical composition of soils. Thus, in the districts of meteorological station Swityaz, Manevichi, Sarny the soils are sandy, in the scientific research station of Sarny they are peat drainaged, in MS of Kovel & Lubeshiv the soils are sandy loamed. In summer the warmest surface of drainaged peat soil is from June till August, the average monthly temperature of the surface of drainaged peat soil is higher than 30^{o}C. The difference of temperatures of surface of drainaged & undrainaged peat soil is from April till October & it's within the limits of 7 to 9,9^{o}C. Such distinctions are conditioned by the change of water & physical properties of peat as a result of drainaged meliorations. Under the herbaceous cover the difference of temperature of peat surface on drainaged & undrainaged areas is considerably smaller (3-4^{o}C). Since September the temperature of soil surface begins to descent (by 8,3-5^{o}C). In November the average monthly meanings are stil above zero, but as a rule the transition of temperature of soil surface over 0^{o}C falls on this very period. In winter the average temperature of soil surface with the lack of snow cover doesn't differ greatly of the average air temperature. The average meanings of all types of soils change from –0,5 to –5,2^{o}C.

The lowest absolute minimum was marked on MS of Manevichi (-44^{o}C). The annual amplitude of temperature of soil surface within the limits of Volyn region is 27-28^{o}C according to average meaning & 98-100^{o}C according to absolute one.

In spring the transition of temperature of soil surface over 0^{o}C is observed at the end of the second ten-day period of March. The duration of period with soil temperature above 0^{o}C in the region fluctuates from 264 (MS Swityaz) to 259 (MS Manevichi) days. The period with the temperature of soil surface of more than 5^{o}C is approximately 50-60 days shorter & lasts since the middle of the first ten-day period of April till the end of October-beginning of November. At the beginning of the third ten-day period the transition over 10^{o}C is marked & ends mainly at the first ten-day period of October. The maximum sum of positive temperatures of soil surface is observed on drainaged peat soils (4514^{o}C), and minimum is on the surface of light loamed soils of Volyn Opillia (3360^{o}C). Rather high meaning of temperature sum are characteristic to sandy soils – 3620^{o}C (MS Sarny) & 3565^{o}C (MS Swityaz). Thus, the warmest surface of drainaged peat & sandy soils & the cooler is on the overhumid plots. Among sandy loamed soils the turf & carbonate soils are distinguished as soils with high average monthly meanings of temperatures of soil surface & with the sum of temperatures higher than 0^{o}C. Such distinctions of many years' standing meanings are determined by the regime of soils humidity, and their colouring.

The working up of these observations for the analysis of duration period with the temperature of soil surface over 10^{o}C & with the sum of temperatures higher than pointed limits shows (illustrates) that the highest sums of temperatures are marked on the drainaged peat soils (3994^{o}C) with the reduction of duration the analyzed period. The variation coefficient (C_v) changes within the limits of 16% (sandy & sandy loamed) & 25% (peat drainaged). Such meanings depend on water & physical soil properties.

The earliest transition of temperatures of arable layer (5-20sm) over 10^{o}C is marked on sandy & sandy loamed soils & falls on the beginning of the third ten-day period of April. According to data of observation on Sarny peat station on peat soils the dates of transition of soil temperature on the depth of 5-20sm come rather later & fall on the period since the 30 of April till the 4th of May. In autumn the transition over +10^{o}C goes on more smoothly at the end of the first ten-day period of October.

The main reason of coincidence of dates of transition over mentioned limits is the equalization of humidity stock in soil due to reduction of its expenses for evaporation & transpiration. In such conditions the soils, which are characterized by larger thermal capacity, are cooled slower.

Approximately the same picture is observed with the analysis of transition of soil temperatures of arable layer over 15 & 20°C.

The period of duration with the temperature higher than +10°C in soil thickness of 15-20sm changes within the limits of 161 & 173 days. The shortest one is on the drainaged peat soils. The longest duration is in the sandy soils in MS Switzyaz, because the meteorological station is situated near the lake Switzyaz, which influences the milder climatic conditions. That's why the period of duration with the soil temperature is higher than 20°C, somewhat lower than on such soils on other meteorological stations.

Table 1

Average meanings of long standing of a sum of positive temperatures of arable soil layer under black fallow

Meteorological stations	Sum of soil temperatures (°C) on different depths			
	5sm	10sm	15sm	20sm
above 0°C				
Kovel	3460	3433	3412	3390
Lubeshiv	3237	3181	3160	3041
above +5°C				
Kovel	3443	3420	3401	3381
Lubeshiv	3212	3151	3132	3027

On the depth of 5sm the sums of positive temperatures are always higher than 3000°C. With the depth the temperature sum reduces. These meanings are more changeable, for sandy loamed soils of Polissya, where the difference in sum of temperatures on these depths equals 70°C, that is the smallest meaning in Volyn region. The largest meanings are marked on peat drainaged soils & reach 283°C. Such distinctions in quantitative indices are conditioned by heat capacity & heat conductivity of soils, The warmest are sandy & sandy loamed soils, on which the sum of active temperatures on the depth of 20sm fluctuates within the limits of 3001 & 3117 (table2).

Table 2

Sums of active air temperatures & arable soil layer under black fallow

Meteorological Stations (MS)	Sums of soil temperatures (°C) on different depths & in the air				
	Air	5sm	10sm	15sm	20sm
Kovel	2600	3203	3179	3155	3117
Lubeshiv	2695	2946	2890	2857	2754
Switzyaz	2490	3194	3108	3143	3001

On damp sandy loamed soils of the northern part of Polissya the sums of active temperatures are somewhat lower than 2754°C. The difference of sums of active temperatures in soil layer of 15-20sm on light loamed & sandy loamed soils is 82°C, in over-damped sandy loamed soils of the North of Polissya the amplitude of fluctuations is rather considerable & is 192°C. The biggest overfall of the sums of active temperatures on the depths of 15-20sm is marked on drainaged hydromorphal soils - 257°C.

In some years the sums of temperatures of arable soil layer considerably exceed the sizes of long standing. Such phenomena are more often observed on sandy, sandy loamed & on drainaged peat-bogged soils. Beginning with 1989 including 1999 on MS Kovel the periods with temperatures of soil on the depth of 20sm over +25°C are observed. Sums of such temperatures fluctuate from 102°C (1992) to 659°C (1994). Such periods mainly fall on the second-third ten-day period of July & on the first-second ten-day period of August & are distinguished as critical ones. With such temperature conditions the process of exchange on the surface soil layer are actually in the state of rest, the plants stop their vegetation, in many cases they die even in sufficient dampness. On sandy loamed soils in MS Lubeshiv such periods are mentioned more seldom the temperatures higher than +25°C penetrate to the depth of 15sm, only in August of 1994 such meanings were marked on the depth of 20sm, with this the sum of temperatures was 178°C. On the depth of 5sm in the some period the sum of temperatures higher than +25°C was 883°C. Such heat regime conditioned by the properties of sandy & sandy-loamed soils & by modern physical & geographical processes.

In studying of thermal soil resources rather simple in its calculation with the elements of soil climate is the coefficient of soil heat by V.N.Dimo (K_{s-h})). This ciefficient is defined as the ratio of the sum of active soil temperatures on the depth of 20sm to the sum of these temperatures in the air. Within the limits of investigated territories the mostly warmed is the arable layer of sandy & sandy loamed soils. So the highest

meaning of K_{s-h} is on sandy & sandy loamed (MS Kovel) & sandy (MS Swityaz) soils – 1.20. Sandy loamed soils on MS Lubeshiv are characterized by a coefficient of soil-heat of 1.02. In the worst way the drainaged hydromorphal soils are warmed (K_{s-h}=0,56).

Analysing the intensity of soil warming in a warm period of a year we mention that on sandy loamed soils (MS Kovel) the coefficient of soil-heat changes from 0.90 in April to 1.57 in October. Within the limits of MS Lubeshiv at the beginning of the warm period K_{s-h} is 0.51, and in October it's 1.35. Some deviations are observed on the background of gradual increasing of soil warmth. The sharp increase of heat-index on all types of soils is marked from April till May (it's double-increased). For sandy-loamed soils the even warmth in the period from June till August & insignificant increase in September-October is a characteristic one. The rapid increase of temperature of arable soil layer from April till May is accompanied with considerable expenses of humid supplies with insignificant quantities of atmosphere precipitations the growth & development of agricultural crops, natural vegetation are reduced.

Thus, on the background of manifestation of global warmth processes on the planet & in particular, in moderate latitudes of northern hemisphere, the increase of thermal resources of investigated territories is determined.

Taking into account the main tendencies of formation of thermal soil regime we conclude that it'll promote the rational usage of agroclimatic & soil resources of Volyn as well as the increase of the agricultural crops.

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