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GEOGRAPHICAL LANDSCAPES AS A BASIS OF STUDYING OF MEDICAL-GEOGRAPHICAL CONDITIONS

SUMMARY. The connection of the landscape structure with medico-geographical situation including the properties of mesoclimate, geochemical conditions and natural focal diseases preconditions, is considered in the article at the example of the Yarkovo disctrict.

KEY WORDS. Landscapes, medico-geographical conditions, natural hotbed of diseases.

The properties of environmental factors cause the specifics of their influence on humans. The most important geophysical factors are the ultra-violet radiation, the temperature mode, the precipitation dynamics. Natural geochemical factors are defined as the influence of a microelement ratio in soil, water, air. The activity of natural and biological factors reveals itself in the presence of centers of infectious diseases, distribution of natural allergens, etc. [1].

Due to interrelation and interconditionality of natural components, the medico-geographical situation is defined by the properties of natural and territorial or natural and anthropogenous complexes (landscapes). Therefore, complex medico-geographical studying of the territory is extensively carried out on the landscape basis [2-3].

To study medical-geographical regularities, the Yarkovo district was chosen, as it is located between theindustrially mastered Tyumen and Tobolsk districts on the bordeliner of the southern taiga and subtaiga.

Geomorphologically, the territory under study is a low plain, slightly rolling at some places with the absolute height of 40-60 (in the northeast up to 80) m. The height amplitude does not exceed 18 m, the flood plain of the Tobol River has the width ranging from 3-4 km to 5 km. The slightly rolling watershed surface is replaced by the acclivous poorly dissected slopes, often forested, or the slopes abruptly breaking into the flood plain. Sometimes the relief is of a crest character with often boggy intercrest falls occasionally reaching huge sizes.

According to the geomorphological elements, in the medico-geographical situation there may be singled out major tendencies: on the drained territories zonal diseases (such as tick-borne encephalitis, rabies) are widespread, on boggy and lake spaces and in river valleys intrazonal natural focal diseases (such as tularemia, opisthorchiasis, diphyllobothriasis) are encountered.

The climate has a direct impact on humans, influencing their health and creating work and leisure conditions. The properties of selected meteorological elements of the district are given in Table 1.

Table 1

Major climate indicators on the Yarkovo district

Average long-term	Indicator
1011,5	The greatest value of atmospheric pressure — February
997,4	The smallest value of atmospheric pressure — July
1827	The sum of positive temperatures over +10°
- 18,4	The average temperature of January (the coldest month), °C
+18,2	The average temperature of July (the warmest month), °C
- 46	The minimum temperature, °C
+40	The maximum temperature, °C
405	The sum of annual precipitation, mm
330	The sum of the warm period precipitation, mm
225	The sum of precipitation over the period of temperatures over +10°C
36	The average of the greatest decade snow heights over the winter, cm

The meteoelement change depends on the landscape conditions. In strongly boggy places or in dark-coniferous forests the relative humidity raises and the duration of the non-freeze period increases. On high open spaces the speed of air streams amplifies, that creates discomfort conditions (especially in transitional seasons), etc (Table 2).

The indirect climate influence on a human body is shown through the appearance and distribution of infectious diseases (acute respiratory infections, influenza). Many diseases depend on a season (dysentery, tick-borne encephalitis). In summer the content of pollen increases in the air, allergic diseases are more often registered, the air transferable infections easily extend. In cold seasons the heat loss through the respiratory organs can cause disorders in thermoregulation and disease of the upper respiratory tracts. Besides, pathogenic microflora penetration is facilitated; protective reactions of an organism are weakened.

Surface waters have both direct and indirect influence on human health.

The hydrographic network of the district is presented by big (the Tobol, Tura, Tavda) and small (the Iska, Tap, Yurga, Nerda, Kalymka, etc.) rivers and lakes.

The chemical composition of water should be included into the number of most important indicators, since the mineral exchange of an organism depends on the inflow of vital biogene elements and microelements together with water. The endocrine system diseases may be connected with the lack of such necessary elements, as I, Ca, F, P and the excess of harmful substances, therefore the issue of drink water quality is of utmost importance now. The soil-making processes in turf-podsolic soils of the forest zone contribute to the formation of hydrocarbonate surface waters of low and medium mineralization and to the accumulation of a significant amount of organic substances.

The underground waters are, as a rule, fresh (no more than 0.5 g/l); according to their chemical composition they are mainly bicarbonate-calcium. The presence of the general iron, manganese, phenols at quantities several times exceeding admissible norms, is a natural process caused by fulvic and humic acids, and is shown practically everywhere.

Table 2

Medical-geographical properties of landscapes of the Yarkovo region

Landscapes	Medico-geographical conditions		
	Mesoclimate properties	Geochemical situation*	Preconditions NFD**
1. Gently undulating light-loamy plain with fir-tree and birch and cedar woods, pine and cedar woods on turf-podsolic and greensward heavily podsolic soils	Increase in relative air humidity, decrease in daily temperature amplitude	Unfavourable Mo J F P/ Co Zn Mn Cu	Trichinosis(3), alveococcosis (2), toxoplasmosis (1), tick-borne encephalitis (1)
2. Gently undulating light-loamy plain with pine and fir-tree and birch green mossy woods on turf-podsolic-gley soils	Increase in relative air humidity, decrease in daily temperatures	Unfavourable Mo J F P/ Co Cu Mn	Trichinosis(3), leptospirosis (2), tick-borne encephalitis (1), tick-borne rickettsiosis (1)
3. Gently undulating crest sandy plain with pine linchen- mossy woods, grassy and pine-birch, occasionally marshy woods on greensward heavily and lightly-podsolic soils	Decrease in relative air humidity, increase in daily temperatures, decrease in wind speed	Unfavourable Mo J F/Co Zn Mn Cu. The lack of Iodine and silver can lead to a thyroid gland disease	tick-borne encephalitis (3), tick-borne rickettsiosis (3), trichinosis(3), tularaemia (1), toxoplasmosis (1)
4. Gently undulating, occasionally cresty layered clay-sandy plain with pine linchen, pine-birch, birch, birch-fir-aspen grassy woods on greensward-podsolic, greensward-podsolic-gley soils	Decrease in relative air humidity, increase in daily temperatures, decrease in wind speed	Unfavourable F Mo J/ Zn Cu	Tick-borne encephalitis (2), trichinosis (2), toxoplasmosis (1)
5. Flat layered clay-sandy plain with fir- birch, birch-pine and birch moss-grassy woods on greensward heavy-podsolic contact-gley and peat-podsolic soils	Increase in relative air humidity, decrease in daily temperatures	Unfavourable Mo J/ Co Zn Cu	Tick-borne encephalitis (3), tick-borne rickettsiosis (3), trichinosis (2), alveococcosis (1) leptospirosis (1)

Table 2 cont.

6. Flat-steep layered clay-sandy plain with birch-fir-and birch moss-grassy woods on greensward heavy-podsolic soils	Decrease in daily temperature amplitude, accumulation of cold air at the depressions	Unfavourable Mo J F/ Co Zn	tick-borne encephalitis (3), tick-borne rickettsiosis (3), trichinosis (2), alveococcosis (1)
7. Flat-steep layered clay-sandy plain with pine and pine-birch grassy woods on greensward podsolic soils	Increase in non-freeze period duration at the heights, increases accumulation of cold air at the depressions	Unfavourable Mo J F/Co Zn Mn Cu	Trichinosis (3), tick-borne encephalitis (1), tick-borne rickettsiosis (2), alveococcosis (1), toxoplasm osis (1)
8. Gently undulating layered clay-sandy plain with aspen-birch, birch grassy and marsh-grassy woods on greensward light-podsolic and gray forest soils combined with peat podsolic gleyed soils	Increase in relative air humidity, decrease in wind speed	Unfavourable and favourable Mo J F P/ Co Cu Mn; J P Ca/ Mn Ni	tick-borne encephalitis (3). tick-borne rickettsiosis (3), trichinosis (2), toxoplasmosis (1), alveococcosis (1)
9. Flat steepy hummocky sand-loamy plain with pine, pine-birch moss-grassy woods on greensward podsolic soils	Decrease in relative air humidity, increase in daily temperatures	Unfavourable Mo J F/C Zn Mn Cu	Trichinosis (3), tick-borne encephalitis (2), tick-borne rickettsiosis (2), alveococcosis (2), toxoplasmosis (1)
10. Gently undulating loamy plain with steppificated, mainly cultivated meadows on meadow and black-earth soils and with birch grassy woods on gray soils	Increase in daily temperature amplitude, increase in wind speed, increase in non-freeze period duration	Unfavourable Ca J /Mn Ni Cr Fe Mg J P Ca/ Mn Ni	Relatively free of NFD

The end of Table 2

11. Ridge-shrub-sphagnum boggy landscapes with sparse pines and birches on swampy peat and peat-gley soils	Smoothed daily temperature amplitude, increased humidity, increased fog days	Unfavourable J Ag Mg/ Ni P Ca	Tularaemia (3), leptospirosis (2)
12. Flat equal and hillocky marshy, hypnum-sedge, bogs on peat-gley soils	Smoothed daily temperature amplitude, increased humidity, long cold spell	Unfavourable J Ag Mg/ Ni P Ca	Almost free of causative agents
13. Flat equal and hillocky, grassy, shrub-grassy marshes, occasionally with pines and birches, on swampy peat soils and peat-gley soils	Smoothed daily temperature amplitude, increased humidity, long cold spell	Unfavourable J Ag/ Fe Mn Mo Ca NP. The molybdenum excess facilitates the increased deposition of salts	Tularaemia (3), leptospirosis (2)
14. Flat, occasionally crested, floodplains with willow-cereal woods on floodplain podsolized soils with mixed herbs and cereal meadows on greensward meadow soils, with sedge and mixed herbs on alluvial meadow soils	Increased relative humidity, increased wind speed, some increase in non-freeze period duration	Scarcely favourable and relatively favourable Be Mo P N/ Mn Li Co K Se	Opisthorchiasis (3), diphyllobothriasis (3), tularaemia (3), leptospirosis (3), tick-borne encephalitis (2)
15. Farmlands on the place of natural woods and meadows, mainly with gray forest soils	Increase in daily temperature amplitude, increased wind speed	Favourable J P Ca/ Mn Ni	Almost free of causative agents

*geochemical situation is characterized by the ability of soils to self-purification, the presence of chemical elements: lack/eccess or sufficiency.

** NFD — natural focal diseases: levels of foci intensity — high (3), average (2), low (1).

Water participates in the formation of natural preconditions of human diseases, their origin and distribution. The percentage of diseases which have been hypothetically connected with the water factor (water dependent diseases), is more than 40% in the structure of sickness rate of the population [4]. The most dependent on the natural waters quality are infectious and parasitic diseases and those of the digestive tract.

The zonal soil type of the most part of the territory includes turf-podsolic and their various subtypes (turf-heavily- and slightly-podsolic, turf-podsolic-gley), in the south, within the limits of subtaiga, grey forest soils are found, they are better mastered agriculturally. Among azonal soil types the most typical are upland and lowland marshes, meadow-swamps, and alluvial soils [5].

There are more than thirty chemical elements with which biochemical endemias are connected and which form soluble mobile connections, easily acquired by plants [6]. Spatial combinations of all these conditions are closely connected with the landscape structure of the territory; therefore geochemical endemias are confined to a particular landscape (Table 2).

According to the self-cleaning ability, the soil of the considered territory are divided into the following groups: a) unfavourable with a slow process of self-cleaning (greensward-podsolic, podsolic-marshy); b) scarcely favourable with a delayed process of self-cleaning (meadow-swampy, floodplain); c) rather favorable with a strong self-cleaning ability (meadow-black-earth soil); d) favorable with an intensive process of self-cleaning (grey forest soils) (Table 2).

The natural vegetation, apart from its direct influence on humans, has an indirect impact, carrying out a stabilizing function in the natural-territorial complexes, supporting habitat quality. The wood vegetation is presented by coniferous, deciduous and mixed forests. The greatest areas are occupied by small-leaved birch and aspen forests (sometimes with the presence of linden) with dense cereal and mixed herbs cover. The dark-coniferous forests formed by fir-trees with the presence of the cedar and abies are presented in the north of the district. On sandy soils the pine woods of rather high efficiency grow, they reach the 2^{nd} and 3^{d} classes of soil quality. On areas free from wood vegetation, meadows are formed: on the raised sites there are cereal and mixed herbs meadows, along the river valleys there are sedge and sedge-horse-tails, often with shrubs. Among treeless bogs there are a lot of mossy, swampy bogs with willows. The most drained and less boggy locations (near the rivers and on high sites) are cultivated (Fig. 1).

Among the diverse functions of a vegetative cover, the recreational (medical and improving, aesthetic) function has a direct medico-geographical value. Within the territory of the district, cases of mushroom poisoning, various allergies connected with flowering of plants are noted. The vegetation creates environment for causative agents and carriers of natural focal diseases, such as tick-borne encephalitis, tularemia, echinococcosis, alveococcosis and others.

The influence of animals on human health is various. These are predators representing the greatest danger in a native habitat, stray dogs who may be rabies carriers; poisonous animals (vipers, bees, wasps, hornets); animals containing causative agents of natural focal diseases (tick-borne encephalitis, trichinosis, alveococcosis, tularemia, toxoplasmosis, leptospirosis etc.). One may be infected with opisthorchiasis and diphyllobothriasis after taking in raw and poorly cooked fish. Many representatives of midges serve as carriers of causative agents of natural focal diseases, in particular tularemia and anthrax.

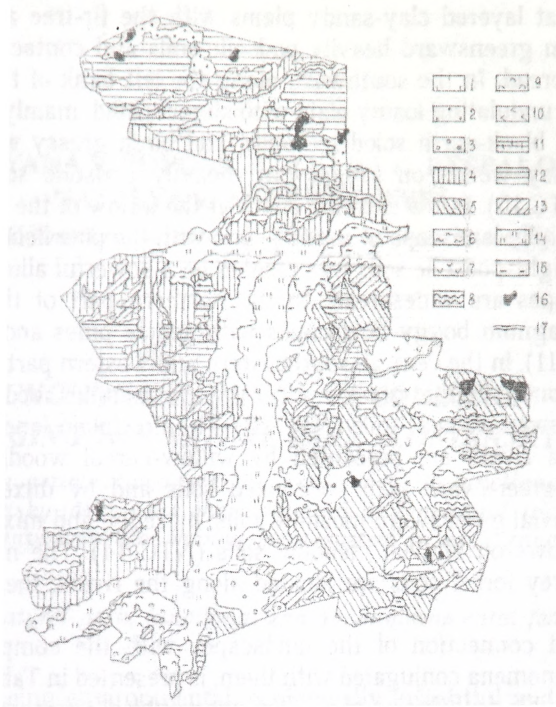

Fig. 1. The landscapes of the Yarkovo district
(the numbers of conventional signs correspond to the numbers of the landscapes in Table 2)

The natural hotbeds of diseases are territorially connected with certain habitats in natural territorial complexes (NTC), therefore, landscapes have differences in character of disease preconditions (Table 2). The character of natural hotbeds may significantly change under the influence of economic activity (the expansion of the natural foci of tick-borne encephalitis is promoted by the replacement of the cut-down coniferous forests by small-leaved forests, their cluttering, livestock grazing on forest pastures). In fact, some originally natural focal diseases (for example, brucellosis, anthrax) became professional, and their landscape confinement is not expressed or is poorly expressed.

For the assessment of the complex medico-geographical situation in the Yarkovo district, the landscape map made by L.N. Vdovyuk was used.

According to the landscape conditions (Table 2, Fig. 1) the northern part of the district is a gently undulating light-loamy plain with fir-tree and birch and cedar woods, fir-tree and birch woods and pine green mossy forests on peat and peaty-podsolic-gley soils (NTC 1, 2). The right bank of the Tobol, the interfluve of the rivers Nerda and Tap is a light-drained gently undulating crest sandy plain with the pine lichen mossy woods and pine and fir-tree and birch grassy woods on greensward heavily-podsolic soils (NTC 3). The western part of the district (the interfluve of the rivers Tavda and Iska) is a gently undulating, occasionally cresty, clay-sandy plain with pine and pine-spruce-birch grassy woods on greensward heavily-podsolic soils (NTC 4). In the eastern part of the district, on the right bank of the Nerda river

landscapes of flat layered clay-sandy plains with the fir-tree and birch mossy and grassy woods on greensward heavily podsolic soils and contact-gley soils (NTC 5) are quite widespread. In the southwest, along the left bank of the Tura downstream there is a gently undulating loamy plain with steppificated, mainly cultivated meadows on meadow and black-earth solodized soils, and birch grassy woods on gray forest soils. Pine grassy woods on greensward heavily podsolic soils are occasionally encountered (NTC 10). In the extreme south at the inflow of the Nerda and Tal rivers into the Tobol a hilly landscape of sandy plains with the pine lichen and grassy woods on greensward light-podsolic soils was created on a powerful alluvium stock (NTC 9). Marshy landscapes are widespread. In the northern part of the district there are ridge-shrub-sphagnum boggy landscapes with sparse pines and cedars on swampy peat soils (NTC 11), in the central, southeastern and western parts there are flat equal and hillocky hypnum-sedge, grassy, shrub-grassy marshes, occasionally with pines and birches, on swampy peat soils (NTC 12). The floodplain landscapes of the Tobol, Tavda and Tura rivers are presented by willow-cereal woods on the floodplain podsolized and greensward gley podzolized soils and by mixed herbs and cereal meadows on alluvial greensward meadow soils, by sedge and mixed herbs and sedge-reedgrass meadows on alluvial meadow soils (NTC 14). The most drained terrace surfaces with grey forest soils are located along the rivers, they are now occupied with farmlands.

The revealed connection of the landscapes with the complex of the medico-geographical phenomena conjugated with them, is presented in Table 2, it allows giving a forecast of possible pathologies of medico-geographical character.

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