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INTERZONAL GEOECOTONE OF CENTRAL EUROPE

This article reviews the Central European region in terms of globalization processes and geoecotonization of its territory; it is noted that this is a region of contacts and interaction of different natural structures, cultures and civilizations, that is a kind of border area, and from the point of view of modern landscape science - natural economic geoecotone. The purpose of the study: taking into account globalization processes, to investigate the current state, landscape structure, opportunities for optimization of interzonal natural economic geoecotone "forest-steppe - steppe" within Central Europe for further rational use of its natural resources.

The current interest in the study of geoecotones with different complexity levels of their organization, patterns of development, especially in the process of anthropogenization, the ability to control this process, will help to solve some theoretical and many empirical problems. Such landscape studies are of particular importance for transition regions, just as interzonal geoecotones. It is pointed out that the interzonal geoecotone "forest-steppe - steppe" of Central Europe is an archetypal natural-economic structure that is used for studying the processes of formation and functioning, as well as the development of measures for the rational use of natural, natural-anthropogenic and anthropogenic landscape complexes of different hierarchical levels.

Keywords: Central Europe, globalization processes, ecotonization, interzonal geoecotone "forest-steppe -steppe", anthropogenization, modern landscapes, rational use of nature.

Ситник О.І., Безлатня Л.О., Денисик Б.Г. МІЖЗОНАЛЬНИЙ ГЕОЕКОТОН «ЛІСОСТЕП-СТЕП» ЦЕНТРАЛЬНОЇ ЄВРОПИ

Глобалізаційні процеси, що впливають на функціонування географічної оболонки або її значної частини, стали поштовхом до оновлення наукового пізнання їх сутності. Показано, що з погляду глобалізаційних процесів й екотонізації простору, як модельний цікавим є Центральноєвропейський регіон. Геополітичне розташування та природні умови Центральної Європи зумовили особливу актуальність її досліджень як у географічному, так і історичному контекстах. Це регіон контактів і взаємодії різних природних структур, культур та цивілізацій, тобто пограничная територія, буферна зона, а з погляду сучасного ландшафтознавства – оригінальний природно-господарський геоекотон; зазначено, що дослідження Центральної Європи, зокрема геоекотонізації території України, як модельного її регіону, є актуальною науковою проблемою. Мета дослідження: з врахуванням глобалізаційних процесів, дослідити сучасний стан, ландшафтну структуру, можливості оптимізації міжзонального природно-господарського геоекотону «лісостеп-степ» у межах Центральної Європи, для подальшого раціонального використання його природних ресурсів. Процес формування нових геоекотонів у Центральній Європі швидко прогресує. Збереження такої тенденції дозволяє припустити, що природне середовище у майбутньому – це сфера панування геоекотонів. У зв'язку з цим, пізнання геоекотонів різних рівнів складності їх організації, закономірностей розвитку, особливо у процесі антропогенізації, можливість контролювати цей процес є актуальним і сприятиме вирішенню окремих теоретичних та багатьох прикладних завдань. Особливе значення дослідження ландшафтів

мають для таких своєрідних територій як міжзональні геоекотони. Міжзональний геоекотон «лісостеп-степ» Центральної Європи є репрезентативною природно-господарською структурою для дослідження процесу формування, функціонування і розробки заходів щодо раціонального використання натуральних, натурально-антропогенних і антропогенних ландшафтів. Натуральні зовнішні межі міжзонального геокотону «лісостеп-степ» Центральної Європи визначити зараз майже неможливо; вони умовні через суцільну антропогенізацію власних і прилеглих ландшафтів. Різноманіття природних умов зумовлене тут просторовим розташуванням на межі двох природних зон – лісостепу й степу, високим заляганням кристалічних порід Українського щита, суттєвими відмінами в рельєфі між південно-лісостеповою та північно-степовою частинами міжзонального геоекотону, що зумовило й різницю в гідрогеологічних та мікрокліматичних умовах, ґрунтовому покриві та біоті. Не менш різноманітні й природні, зокрема, мінеральні й земельні ресурси.

Аналіз геокомпонентів і ландшафтних комплексів міжзонального геоекотону «лісостеп-степ» дав змогу визначити його місце в структурі типологічних класифікацій, що сприяє кращому розумінню природної суті й сучасного стану геоекотону, розробці заходів раціонального використання та оптимізації процесів антропогенізації.

Ключові слова: Центральна Європа, глобалізаційні процеси, екотонізація, міжзональний геоекотон «лісостеп-степ», антропогенізація, сучасні ландшафти, раціональне природокористування.

Relevance of the research topic. One of the impetus for the renewal of apprehension of the geographical layer or its individual parts – are the globalization processes. In XXI century, addressing the issue of globalization processes is relevant for any state, including Ukraine. Firstly, this is due to the involvement of all countries in these processes and the growing dependence of socio-economic development on their dynamics and result. Secondly, because of obvious changes in both the natural and social environment, at all its levels: from the noosphere, as a higher, integrating level, to a lower one, which includes single objects of animate and inanimate nature. The most important place in these changes takes the transformation of human social life, its production and daily activities, which, accordingly, determines the transformation of various geocomplexes and objects. Understanding the patterns of these transformations is possible only by using systemic and synergistic approaches. Thirdly, initially globalization processes were understood in the framework of social science discussion - from philosophy and sociology, to political science and economics. However, any conscious human activity takes place in certain spatial conditions, limited by both the number of resources and their location in space, and its accessibility. The latter determined the understanding of globalization phenomenon within the framework of its actual geographical apprehension.

Considering the globalization processes and ecotonization of the space, Central European Region is extremely interesting. The geopolitical positioning and natural conditions of Central Europe made it especially relevant to the geographic and historical contexts. This is a region of contacts and interactions of natural structures, cultures and civilizations. Central Europe is a borderline territory, a buffer zone, and from the standpoint of modern landscape studies, it is a particular natural economic geoecotone, and at the same time, a wide band of spreading and intertwining Western and Eastern influences, that are connected with the most wide-spread areas of human life. Regarding the natural aspect, it is clearly defined by the territory with corresponding indicators and peculiarities of natural conditions and resources. At the beginning of the XXI century, Central Europe becomes once more an important player in the emerging geographic and geopolitical areas, because of the events that take place there, in particular on the territory of Ukraine. It is at the crossroads of European and Eurasian integration processes, which necessitates a rethinking of

regionalization, the place and role of Central Europe in these processes, understanding it as a transcontinental interaction of the main centers of world dynamics in the XXI century. "… Without a clear geographical indication, Central Europe can be seen as a response to global political challenges" [1, 2]. In this regard, the study of Central Europe, in particular the geoecotonization of the territory of Ukraine as a model region, is an urgent scientific problem.

State of the research, major papers. The process of formation of new geoecotones is progressing rapidly. The persistence of this trend suggests that the natural environment in the future is the sphere of geoecotones domination. Hence, the apprehension of geoecotones with different complexity levels of their organization, patterns of development, especially in the process of anthropogenization, the ability to control this process, according to scientists V.S. Zaletaev (1984, 1989, 1997), V.O. Nikolaev (2003, 2005), E.G. Kolomyts (1988, 1997), V.S. Preobrazhensky (1986, 1988), F.M. Milkov (1977, 1981, 1984), P.G. Shyshchenko (1988, 1999,), V.M. Pashchenko (1988, 1993), M.D. Grodzynsky (1995, 2005), G.I. Denysyk (2012, 2018, 2020), T.V. Bobra, (1999,2002, 2005) P.M. Demyanchuk (2002, 2004, 2005, 2011), etc., is relevant and will help to solve some theoretical and many empirical problems.

Landscape research is of special importance for such peculiar regions as interzonal geoecotones. The interzonal geoecotone in the past "forest-steppe- steppe", and now "forested plains - plains" of the Right Bank of Ukraine, is an archetypal natural-economic structure that is used for studying the processes of formation and functioning, as well as the development of measures for the rational use of natural, natural-anthropogenic and anthropogenic landscapes.

The research purpose. Taking into account globalization processes, to investigate the current state, landscape structure, opportunities for optimization of interzonal natural economic geoecotone "forest-steppe - steppe" within Central Europe for further rational use of its natural resources.

Methods of research. The theoretical and methodological basis for the apprehension of the interzonal geoecotone "forest-steppe - steppe" are scientific ideas and theoretical study, that were published in the scientific papers of native and foreign scientists, geographers and landscape scientists [3-11]. Constructive geographical and landscape approaches (landscape dynamic, landscape ecological, cartographic, geo-informational, etc.) are involved, as well as the principles and methods of research corresponding to them. Methods of historical geographic, landscape-retrospective and analytical cartographic cognition are used in the process of historical landscape analysis of anthropogenization of the interzonal geoecotone "forest-steppe – steppe" of Central Europe. The application of methods of theoretical generalization and systematization of facts made it possible to determine the place of the studied geoecotone in the hierarchical structure of higher-ranking geoecotones. Field landscape methods were used in the study of development and in the process of cognition of new anthropogenic geoecotones in the interzonal geoecotone "forest-steppe - steppe " in Central Europe. The modeling method is used to build appropriate map charts, develop proposals for improving the structure and rational use of the studied geoecotone landscapes.

Presentation of the main material with substantiation of the obtained scientific results. The unity of the environment, its systemic nature makes it inevitable to turn, on the one hand, to the ideas of V.I. Vernadsky on the noosphere, and, on the other hand - to the ideas of hierarchical systems theory: "the very organization of space creates hierarchy and inequality" [12]. The

Human essence of noosphere is attained in globalization processes through the expansion of various social and economic institutions, primarily global, which cause corresponding changes in the activities of institutions at lower systemic levels, and those, accordingly, already have a direct impact on their environment. Often this influence materializes or leads to the formation of new active natural and economic structures of different hierarchical levels, called "geoecotones". Initially, the term was used in its original meaning - "ecotone" to denote the contacting "micro zones" between neighboring biological communities. That is, the "ecotone" was understood as a narrow transition strip, not an independent, individual, integral landscape complex. Much later, in the 70s and 90s of the twentieth century, the term "ecotone" also started to be used when studying geographical objects. In this regard, it acquired a new meaning and the transitional territorial structures began to be considered as integral landscape complexes with a special structural and functional organization.

Due to the inclusion of processes occurring on the border not only and not so much natural systems as between natural and anthropo-systems, the concept began to acquire a more systemic, synergistic nature, which emphasizes the importance of human activity, anthropogenization of the environment. Thus, the "official" definition of an ecotone gives a significant range of its possible width, which prompts scientists to consider ecotones also such natural formations as semi-desert, forest-tundra zone, foothills, subalpine belt in the mountains and more. In this regard, in geographical and landscape studies, the term "ecotone" was gradually replaced by the term "geoecotone", proposed by V.S. Zaletaev in 1984 [8]. Its denotation is much broader, as it covers the entire hierarchical series of transitional formations - from global to elementary and all their genetic types - phyto-, zoo-, tecto-, geomorpho-, hydro-, climat-, anthropogenic, etc., and has quite a compact terminological expression. When apprehending the full range of geo components and the relationships between them in transition zones, it is necessary to use the term "geoecotone". In those cases when in the process of cognition of contact zones (strips) their landscape structure is investigated, it is legitimate to use the term "landscape ecotone", offered by V.S. Preobrazhensky [13, 14].

In the modern, often destabilized natural environment, significantly increases the variegation and contrast of the spatial structure, new borders get formed - natural and anthropogenic, which in their turn contribute to the development of new material and energy flows, migration and resettlement of living organisms. This facilitates the emergence and functioning of new natural-anthropogenic and anthropogenic transition strips - geoecotones of different spatial scales, with specific properties, structure and stability. The process of further anthropogenization of the landscape domain is inevitable, and this implies a significant increase in its ecotonization and adds to the share in the spatial structure of the landscape area of natural-anthropogenic and anthropogenic boundaries.

The transboundary nature of geoecotone historically intensifies with the strengthening of the anthropogenic impact on the geographical layer as a whole and its individual elements. Geo-ecotones are formed as a special type of landscape complexes and are complex systems characterized by a contradictory unity of internal heterogeneity and functional connectivity. The influence of the anthropogenic factor is so all encompassing that almost any fragment of modern geo-space can be attributed to geoecotones, which appear in a state of bifurcation and uncertainty. Elaborating the opinion of Bobra T.V., that "violation of the natural (normal) spatio-temporal structure of the landscape domain mainly under the influence of

anthropogenic factors, the expansion of various geoecotones determines the external essence of the process of ecotonization of landscape space", we can conclude that geoecotonization is empirically observed manifestation of the effect of globalization processes on the geographical environment, with its modern, relevant form [3, 4]. The interest of geographers, landscape scientists, landscape ecologists and ecologists, and further other specialists in the knowledge of geoecotones is gradually growing. This gives rise to a number of definitions and understanding the essence of the concept of "ecotone" and "geoecotone", which scientists have repeatedly analyzed and summarized. Moreover, some areas of geoecotone research have been actively used. The most successful analysis was conducted by P.M. Demyanchuk [5, 7].

The categorical-conceptual apparatus of the sciences of the natural cycle is formed under the influence of two opposite processes: universalization (in geography, it is associated with the movement towards a unified geography) and additions (including borrowing) and complications (due to expanding contacts of geography with other areas of knowledge and formation of contact areas of research) [7, 13]. However, terms and concepts that have general scientific significance and are used in various sciences, in geography can and should have their own specifics. Such specificity, for example, is provided by the use of the prefix "geo" - in such terms as geospace, geofield, geodynamics, geocomplex, geoprocess, etc. In this aspect, it is advisable to support the opinion of T.V. Bobra [3, 4] that the term "geoecotone" is the most suitable for the general designation of transitional geographical systems, regardless of their rank and origin. In the future, the geoecotone means a peculiar and complex space and time natural, natural-anthropogenic and anthropogenic formations built at the contact of different environments.

The formation of geoecotones is an objective process that leads to the transformation of geographical cognition itself. The term "geotone" should be used in studies of contact zones formed during the interaction of geocomponents of "inanimate" nature; "ecotone" - living, "geoecotone" - when studying the full range of geocomponents and relationships between them in contact areas. In those cases when in the process of cognition of contact zones their landscape structure is investigated, it is legitimate to use the term "landscape ecotone". Geographical and landscape ecotones are also complex natural formations, in the structure of which natural, natural-anthropogenic and anthropogenic, respectively geoecotones and ecotones are clearly distinguished. Accordingly, in the process of research it is necessary to know one natural structure, but in different aspects - geographical and landscape (Fig. 1).

The comprehensiveness of the geoecotones study is determined by its originality and complexity. Among the most characteristic features and properties that distinguish them from other natural formations and require comprehensive research are: distribution areas, shape of areas and its configuration, where linearity clearly prevails as one of the characteristic features of geoecotones; structural and functional frameworks that form geoecotones in any area; hierarchical structure of interrelations and mutual influences between adjacent landscape complexes due to the fact that geoecotones influence the direction and properties of lateral material and energetic, as well as information flows between them; dynamics of geoecotones, which are often much more dynamic due to external factors in comparison with internally homogeneous contacting landscape complexes, paradynamic and paragenetic relationships both in the geoecotone and between them and adjacent

territories; anthropogenization of geoecotones from natural through natural-anthropogenic to anthropogenic, their mapping using historical genetic series; optimization, rational use and, especially, protection of geoecotones as original, and often unique, natural complexes [15].

As noted, the geopolitical location and natural conditions of Central Europe have made it especially relevant in geographical and historical buffer zone, and from the point of view of modern landscape science - a natural and anthropogenic geoecotone. Some scholars believe that the concept of "Central Europe" is most likely a situational entity and the need for its introduction was due to the political situation (especially during the Cold War). After the collapse of the Soviet Union there is no need to designate "our", i.e. European, democratic and "their", i.e. Soviet [1, 2].

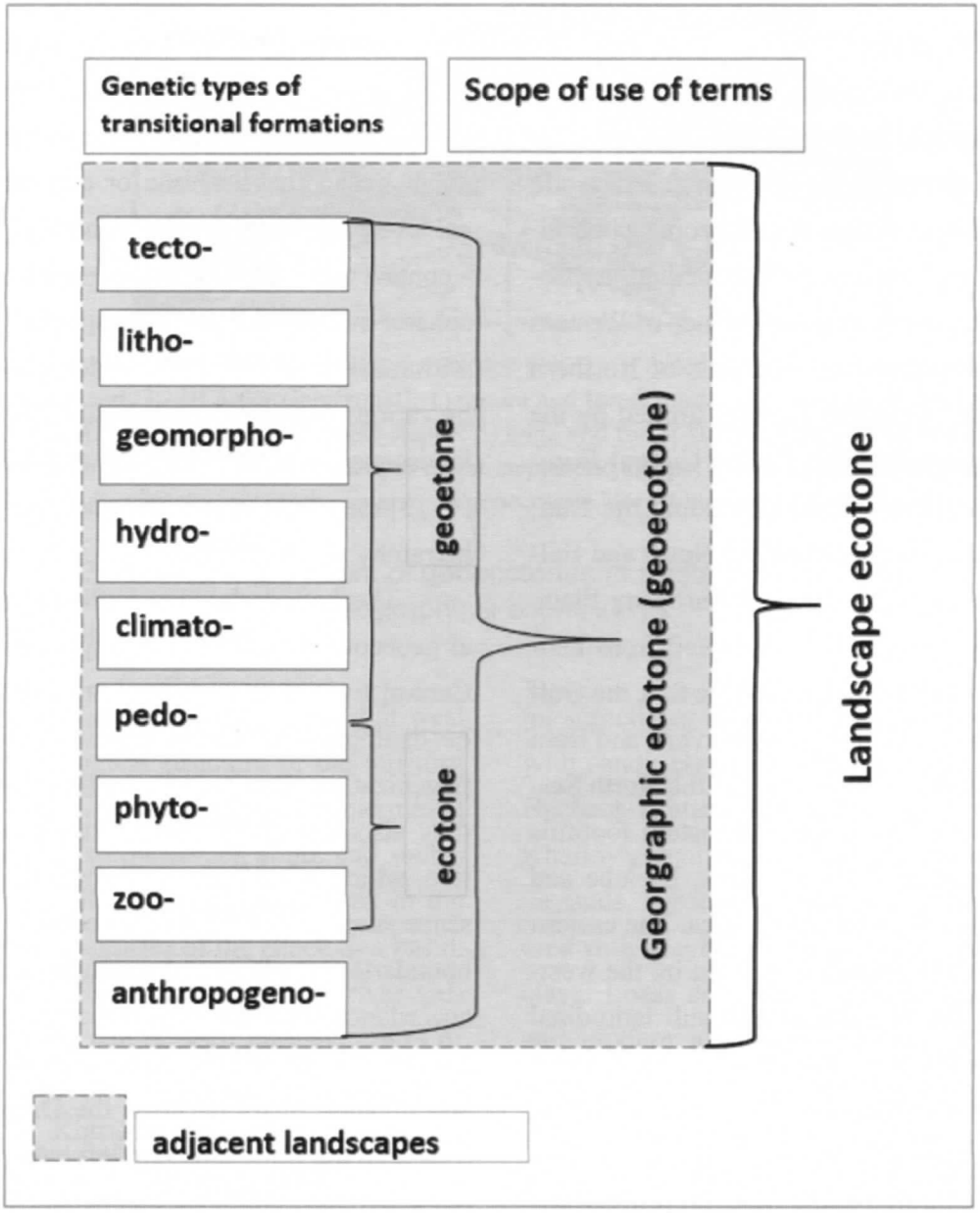


Fig.1. Correspondence of terms to the areas of their use [7, 15]

contexts. It is a region of contacts and interactions of different natural structures, cultures and civilizations. This is the so-called border area, the

H.J. Mackinder notes that Europe and European history should be seen as phenomena that depend on Asia and its history, whereas Europe-

an civilization is largely the result of a constant struggle against Asian invasions that has lasted for centuries. Accordingly, Central Europe should be understood not only as a geographical region, but also as a certain mental, spiritual entity. K. Danny notes that the actual geography (geological and geomorphological structure, hydro-climatic features, soil, vegetation, and fauna) in itself is not an important determinant in understanding the region; it all depends on how this space is conditioned socially and politically [1].

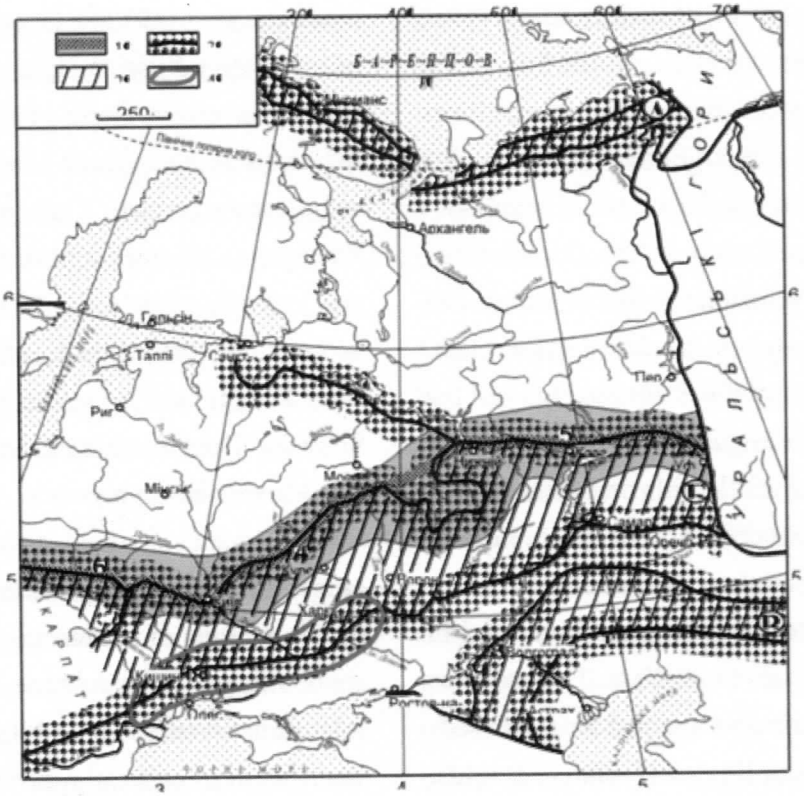
Regarding the understanding of Central Europe as a geographical region, it is a territory that includes the central parts of Europe, which are distinguished by geological and geomorphological structure and occupy an intermediate hypsometric position between the highlands of Western and Southern Europe, the midlands of Northern and Lowlands of Eastern Europe, limited by the stretch of "forest formation". The Central European Plain, the Carpathians (including the Danube Plains) and the islands of the North and Baltic Seas adjacent to the Central European Plain, forms Central Europe. It is separated from Fennoscandia by the straits of the Baltic Sea, the Gulf of Finland, the Neva and the Svir rivers, and from the British Isles with the waters of the North Sea. In the south, the Hercynide, the eastern foothills of the Alps and the Morava, Sava, Danube and Black and Azov Seas bound the area. The eastern border of Central Europe is defined by the western spurs of the meridional and sub latitudinal chain of hills (Vepsov, Tykhvyn, Valdai, Central Russia, Smolensk-Moscow, Don Ridge) and the Don River before it flows into the Taganrog Bay. This region is formed at the junction of the Eastern European Precambrian Platform and the Mediterranean belt [1, 16]. Given the current globalization processes, geographical and geopolitical situation, in terms of social geography, Central Europe is a territory consisting of states with different levels of socio-economic development and dissimilar cultures, where a kind of geopolitical sub-poles were created [1, 2, 17].

Given that Central Europe is the so-called border area, buffer zone, natural and anthropogenic geoecotone, scientists identify the relevant interzonal geoecotones within it the Eastern European physical-geographical country is taken as a model of regional macrogeoecotone, within which the position of Central Europe is determined (Fig. 2) [1, 7, 16].

Obviously, when studying the full range of possible dimensions and organization levels of various transition bands, it is appropriate to talk about geoecotones of one or another hierarchical level, starting from the planetary (epigenetic) - contact zone between three geospheres: hydrosphere, atmosphere and lithosphere, and ending with local transition strips, which are determined by various factors of topological differentiation of landscapes. F.M. Milkov [18] and V.B. Sochava [7, 13] once pointed out the possibility of such a hierarchy of geoecotones.

The boundaries that outlined the interzonal geoecotone of the forest-steppe and steppe of Central Europe in its natural state can no longer be distinguished due to their complete anthropogenization. Presumably, in their natural state, they also repeatedly changed their spatial location, which is partially confirmed by paleo landscape studies [6, 13]. Modern conditional natural boundaries (northern and southern) are defined in accordance with the physical and geographical zoning of Ukraine [19]. According to this zoning and division of its territory, the Dnipro, respectively, on the right bank and left bank, the geoecotone between the forest-steppe and steppe strips includes the southern part of the forest-steppe and northern steppe with a total area of about 80 thousand km2 on the Right Bank of Ukraine and about 140 thousand. km2 - on the Left Bank.

The general features of the nature of the interzonal geoecotone "forest-steppe - steppe" of



Geoecotones. 1 - I order (main): middle landscape belt. 2 - II order (zonal): A - forest tundra; B - Forest-steppe; B - Semi-desert. 3 - III order (interzonal): 1) tundra and forest tundra; 2) forest tundra and taiga; 3) taiga and mixed forests; 4) mixed forests and forest-steppe; 5) taiga and forest-steppe; 6) mixed forests and deciduous forests; 7) deciduous forests and forest-steppe; 8) forest-steppe and steppe; 9) steppe and semi-deserts; 10) semi-deserts and deserts. 4 - object of research - interzonal geoecotone "forest-steppe" of Central Europe.

Fig. 2. Hierarchical system of geoecotones of Eastern Europe physical geographical country [12]

Ukraine largely determines its length from west to east. The geological structure of the territory of the right-bank component is predetermined by its positioning in the center, south and south-west of the Ukrainian Shield, as well as in the southwestern repositories of the Black Sea basin. Within the shield and on its hills, in river valleys, deep beams, can be seen intrusive rocks of the charnockite from Kropyvnytskyi-Zhytomyr, Dnipro-Tokiv, Korosten and other complexes, including crystalline shale-type rocks, as well as metamorphic rocks. On the uneven surface of the Precambrian foundation, there are small ridges, shafts, deflections and tectonic cracks. The Precambrian foundation is covered with a layer of paleogenic and anthropogenic sedimentary rocks, with the thickness from several meters to 100-120 m, sometimes up to 500 m. The drops are filled with sandy-clay and brown-coal deposits of the Buchach stratum. Above are situated Kyiv marl, Kharkiv greenish sands with glauconite and Poltava sands. These rocks are almost everywhere covered with a layer of variegated and reddish-brown clays. Loess sediments, moraine loams, ancient and modern alluvium, represent anthropogenic sediments. Within the southwestern wing of the Black Sea basin above the local base of erosion lie Sarmatian, miotic and Pontic sediments, covered with anthropogenic red-brown clays, forest-like loams and, in places, sandy alluvium [7, 13, 19].

The high positioning of the Ukrainian Shield foundation, especially its individual blocks (Kropyvnytskyi, Prydniprovsky, etc.), widespread outcrops of crystalline rocks on the surface sig-

nificantly affect the nature of surface forms [19].

In the southern direction, the surface of the geoecotone declines, due to the deeper slopes formation of the Ukrainian Shield. However, the general segmentation of the relief remains substantial, which significantly marks the interzonal geoecotone in the adjacent forest-steppe and steppe. In Prydnistrovia it is a hilly Baltic plain, in the middle current of the Southern Buh and the upper reaches of the Ingulets, the sloping plains are characterized by gentle hills on a general placor background. The surface of the geoecotone is composed of loess species, its watersheds capacity reaches 3.4 meters, and on the slopes and in the hollows, it increases to 10-20 m. The presence of easily erodible Antropocene and Neogene sediments, significant amplitudes of relative heights, a large amount of precipitation contribute to the development of intense erosion processes, making the geoecotone surface within the Right Bank of Ukraine a kind of transit zone transporting matter from the forest-steppe to steppe. In this regard, the relief has signs of leveling the surface, which was formed because of denudation and accumulation of alluvial, deltaic, lacustrine formations. The territory is characterized by significant valley-beam fragmentation and depth of incision of valleys and beams, asymmetry and curvity of watersheds.

According to the scheme of geomorphological zoning, the left-bank territory of the geoecotone is located within the Dnipro and Poltava terrace plains, South-Dnipro denudation and Pryazovsk structural-denudation uplands, Bakhmut-Toretsk reservoir denudation, and Donetsk denudation uplands, the Central Russian region of strata-denudation elevated plains, which determines the features of the earth's surface. The surface of the geoecotone is characterized by a significant degree of fragmentation of the ravine-beam network and river valleys. It should be noted that the areas occupied by the Donetsk and Pryazov uplands are more elevated [19, 21]. Geographically, the spurs of the Middle Russian Upland are connected with the southwestern slope of the Voronezh massif, the crystalline basement of which is covered by a sedimentary layer of Carboniferous, Cretaceous, Paleogene, Neogene and Anthropocene age. The spurs are characterized by a hilly relief with a developed network of wide and deep (up to 100 m) river valleys of the Desna, Sula, Psela, Vorskla, Siversky Donets, passable water-glacial valleys and a ravine-beam network.

Climatic features of the interzonal geoecotone "forest-steppe and steppe" are determined by the location of the territory within the temperate-continental climate zone. Annual amounts of solar radiation are 4100-4400 MJ / m^2, only in the south-western part can reach 4600-4700 MJ / m^2. The average annual radiation balance varies from north to south from 1800 to 1950 MJ / m^2 on the Right Bank and from 1750 to 2000 MJ / m^2 on the Left Bank. The duration of sunshine is 1900-2200 hours / year. January average temperatures vary from -6°C to -3°C within the right-bank part, from -7°C to -4°C - within the left-bank part, and the average July temperature varies, respectively from +20°C to +22°C. A characteristic feature of the interzonal geoecotone is high evaporation: 500-600 mm in the north and 800 mm in the south, the coefficient of humidity varies from 1.2 to 0.8. In general, the area constitutes of the areas with unstable (transitional) and insufficient moisture [13, 19].

The location of a large part of the geoecotone territory to the south of the Voyeikov axis affects the nature of atmospheric circulation. With the predominance of western air mass transfer, eastern and northeastern continental, as well as Mediterranean tropical air masses play an important role in shaping climatic conditions.

Conditions of humidification of the territory influence modern physical-geographical processes, formation of a hydrographic network. The

river network of the interzonal geoecotone "forest-steppe - steppe" is poorly developed. In most of the right-bank part, the density of the river network is 0.3-0.5 km / km^2, in the south-west of the territory - 0.1-0.2 km / km^2, the runoff modulus in the north is 2 l / s km^2. The density of the river network of the left-bank territory of the geoecotone is 0.15-0.2 km / km^2, the runoff modulus is 2 l / s km^2. Local runoff resources are 50-75 m^3 / km^2 per year in the north, 25-30 m^3 / km^2 per year in the south. The runoff is formed mainly due to melted snow water, which accounts for 70-80% of annual runoff. A peculiar feature of the interzonal geoecotone is that within its borders, large rivers (Dnipro, Southern Buh, Dniester, Siversky Donets) are transit and they receive few tributaries. Atmospheric precipitation plays a significant role in the formation of groundwater [7, 19].

The predominance of native loess rocks, the relative flatness of the relief contributed to the formation of gray and dark gray forest soils, which occupy small areas in the north and podzolic chernozems, which in the southern direction are replaced by typical ordinary chernozems. In general, the soil cover of the geoecotone is dominated by ordinary medium- and low-humus chernozems, which are mainly eroded. Floodplains are covered with alluvial meadow soils, which in the south of the geoecotone are saline. The latitudinal zonation of the geoecotone soil cover is clearly defined, which is one of its distinctive features. It is the distribution of typical chernozems in the north and common in the south, as well as partial consideration of the remnants of natural vegetation, that the boundaries of the geoecotone and its structural parts are distinguished. However, theoretical calculations of heat supply on the slopes and, accordingly, moisture coefficients show the probability of formation of typical chernozems on the slopes of the northern exposure at a distance of up to 25 km south of the distribution line of typical and common chernozems in plain watersheds, and ordinary chernozems – 25 km north of the conditional line (Fig. 3) [22, 23].

Field studies give reason to doubt the efficiency of demarcating forest-steppe and steppe by a single line drawn between deep and ordinary chernozems in the classical sense. It would be expedient to allocate a transition zone between the forest-steppe and the steppe as natural zones. This belt should include the area within which ordinary chernozems on the southern slopes and deep or podzolic chernozems on the northern slopes are distinguished [7, 13, 22, 23].

The vegetation is dominated by the remnants of deciduous forests in the north of the geoecotone, consisting only of oak (Quercus) plantations or with an admixture of hornbeam (Carpinus), elm (Úlmus), linden (Tilia), maple (Acer). Forest tracts are largely confined to the hills and their slopes, dissected interfluves and river valleys. In the south (steppe part) of the geoecotone the woody vegetation is represented by riparian forests. The northern steppe flora also differs from the herbaceous meadow groups of the forest-steppe, where perennial xerophilous grasses dominate, and weeds are of subordinate importance. In comparison with forest-steppe phytocenosis in the north of the geoecotone, in its southern part where the steppe phytocenosis has more ephemerals and ephemeroids, wormwood and halophytic vegetation, there the vegetation cover is thinning. That is, within the geoecotone from north to south there is a clear change in vegetation from a typical forest-steppe to a typical steppe [23].

Interzonal geoecotone is rich in various natural resources: land (presence and predominance in the structure of the soil cover of chernozems); mineral - significant reserves of brown coal (Olexandria brown coal basin), coal (Donetsk coal basin), iron and manganese ore (Kryvyi Rih iron ore district, Nikopol manganese deposit), uranium (Zhovti Vody) and polymetallic ore (Pobuzke

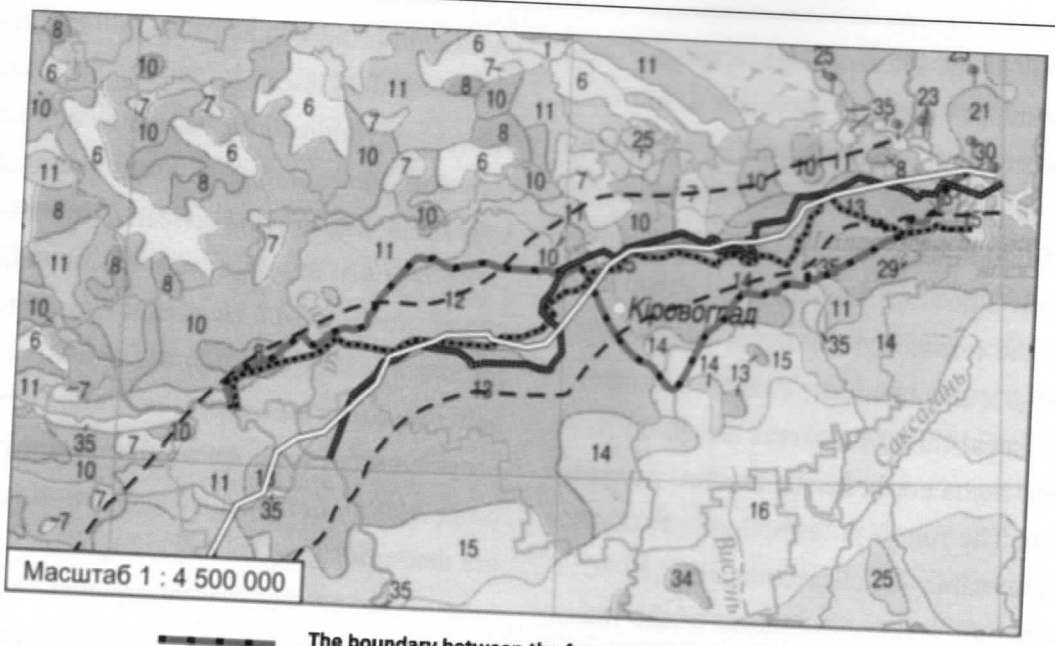


Fig. 3. The boundary between the forest-steppe and the steppe on the soil maps of Ukraine in different years of publication (by [22])

deposit), graphite (Zavallivske deposit), building materials and other minerals; climatic (heat and moisture ratio from 1.2 to 0.8); recreational - the presence of the Dnipro, Southern Buh and their tributaries, numerous reservoirs and ponds, etc. At the same time, long-term, especially agricultural, and intensive, in particular mining development of geoecotone did not contribute to the preservation of pure nature and the formation of protected areas.

In the studied interzonal geoecotone, the southern forest-steppe and north-steppe landscapes closely interact. The boundary between the forest-steppe and the steppe was established according to various criteria. G.M. Vysotsky (1915), I.K. Pachosky (1911), D.G. Vilensky (1926) and other famous scientists, considered this problem. The botanists paid considerable attention to this issue; they determined the boundary between the studied areas by the distribution of indicative plant species. By the beginning of the twentieth century, the man has already developed most of the forest-steppe and steppe and it has become problematic to establish the exact limit of specific plant species distribution.

On pre-war maps, the geobotanical and soil boundary between the forest-fteppe and the steppe was drawn on the basis of the boundary between typical and ordinary chernozems established for watershed conditions, taking into account the classic differences between these subtypes due to the presence or absence of white soft carbonates spots at depths up to 120-30 cm. In the area of Kropyvnytskyi, this border ran 10-15 km south of the city. In the postwar period, it was moved 20 km north of Kropyvnytskyi along the southern

border of the then existing natural forests on the watersheds. The formation of the southern forest-steppe subtype of landscapes with mild humus and solonetzic chernozems on forest-like loams of lowlands and poorly drained plains took place in the non-glacial regions. The moisture balance here is close to neutral. The gradual increase in the dryness of the climate to the south contributed to the sulfate-chloride salinization of soils and waters. Groundwater lies here much deeper than in the northern forest-steppe. Prior to plowing, the southern forest-steppe landscapes were dominated by grass-fescue-feathergrass steppes, with the large islands of forests scattered on the background. Their remnants are now represented by separate forests of the Middle Pobuzhye, the Black Forest in the Kropyvnytsky region, partly upland oak groves, and so on. Meadow steppes are preserved in fragments on the steep slopes of river valleys and gullies, on the edges of forest tracts [7, 13, 22-24].

The southern forest-steppe landscapes of the interzonal geoecotone change from west to east, from north to south and differentiate in height [19, 20]. The landscape structure of the northern part of the ecotone (southern part of the Podil and Prydniprovska uplands) combines watershed slightly wavy areas with typical chernozems, strongly wavy areas with podzolic chernozems and dark gray forest soils. They have small slopes and are arable land of high potential productivity. The slopes of watershed plains, river valleys and beams are cut, the density of dissection reaches 1.2 km / km2. Gorge-beam areas have eroded light gray and gray forest soils under forests and shrubs; under meadow steppes, chernozems of medium and low humus content are also widespread. Floodplains and terraces occupy small areas. Valley landscapes are characterized by a combination of terraced areas with meadow chernozems and meadow-chernozem soils, and floodplain areas with meadow, meadow-swamp soils, floodplain forests. Floodplain terraces with typical low-humus chernozems on loess medium-loamy rocks are productive agricultural lands. The first floodplain terraces are composed of ancient alluvial, sandy and loamy deposits, where sod podzolic soils have been formed and oak-pine plantations have been preserved in fragments [19, 20, 24]. The southern part of the interzonal geoecotone is dominated by the northern steppe subtype of landscapes, due to the balance of heat and moisture, where chernozems are common, which were formed on loess-like deposits under the steppe vegetation. In their natural state, these were herbaceous-fescue-feather-grass steppes on ordinary chernozems with riparian (on podzolic chernozems) and pine forests, on the terraces of sands. In modern conditions, these steppes are almost completely plowed and occupied with crops of wheat, corn, sunflower and other crops. On the slopes of hills and river valleys in some places there are anthropogenized riparian forests and shrubs, which are not present in other subzones of the steppe zone [13, 19].

The landscape structure of the southern part of the geoecotone (southern slopes of the Podil and Prydniprovska uplands) is dominated by: landscape areas of loess undulating plains with ordinary medium-humus and low-humus chernozems, significantly eroded, mostly plowed or occupied by orchards and vineyards (within the South-Dnipro slope-upland region, these areas occupy up to 75% of the territory); ravine-beam and valley-slope landscapes with washed away ordinary chernozems with meadow-steppe vegetation and places with riparian forests formed of oak, ash, maple and shrubs; floodplain-terraced landscapes with ordinary chernozems; floodplains with chernozem-meadow and meadow saline soils in some places with areas of groves of oak, willow, birch. Sloping ravine-beam and ravine landscape areas occupy up to 10-20% of the territory [7].

Changes in the balance of heat and moisture from west to east and from north to south, geological and geomorphological conditions and landscape structure led to the division of the interzonal geoecotone into four natural areas: South Podillia and South Dnipro upland southern forest-steppe and South Podillia South Dnipro with slope-upland north-steppe.

Prolonged and intensive, especially agricultural (ubiquitous) and mining (mostly in the eastern part) development of the interzonal geoecotone did not contribute to the preservation of raw nature and the creation of protected areas. Today, most nature conservation sites are concentrated within the South Dnipro Highlands: unique forests - Black, Nerubayivsky, Polovchansky, Zelena Brama, Savransky and other forests, the world-famous arboretum "Sofiyivka" and more. In other natural areas, there are far fewer protected areas. Only in 2009 the first reserve "Karmelyukove Podillya" was created in the South Podillia upland region. There are even fewer of them in the northern steppe part of the interzonal geoecotone - the dendrological park "Veseli Bokovenky" within the South-Dnipro slope-upland region.

The central part of the interzonal geoecotone is represented by the border between the forest-steppe and the steppe, which was formed as a result of the interaction of the northern forest-steppe and southern steppe landscapes. Compared with the left-bank section of the interzonal geoecotone, in the right-bank section the central part, the strip of direct contact, stands out more clearly and is presented almost identically by different authors. It is possible to outline the central part of the interzonal geoecotone only conditionally, although on maps this boundary (transition strip) is shown quite clearly.

It is known that the general direction of the boundaries of natural strips is determined by climatic conditions. Crucial to this is the nature of the summer season, which confirms the almost complete coincidence of the boundaries of some natural strips with the July isotherms. The July isotherms clearly coincide with the boundary between forest-steppe and steppe. Moreover, this boundary, or the central part of the interzonal geoecotone, coincides with the boundary between the Atlantic-continental and continental climatic regions within the Right-Bank Ukraine. The same applies to the boundary between podzolic and ordinary chernozems, and so on. However, if the climate and partly the soils determine the general direction of the boundaries of natural strips, and in our case the central part of the interzonal geoecotone of the forest-steppe, this does not always apply to its individual areas [7, 13].

After the climate, the relief and geological structure of the territory are important factors that determine the boundaries of natural bands, and, accordingly, the central part of interzonal geoecotones. In particular, some details of the central part of the geoecotone (the boundary between the forest-steppe and the steppe) are also due to geomorphological conditions and, to a lesser extent, the geological structure, namely the presence of sands or swamps. Dissected hills receive more precipitation their washed-out soils are more suitable for forest vegetation than lowlands. As a result, the hills push the northern boundary of the steppes to the south. The dependence of the northern boundary of the steppes, or the southern boundary of the forest-steppe, on geomorphological conditions was shown at the end of the 19th century by A.M. Krasnov [7], G.I. Tanfilev [22, 26], I.K. Pachosky [13] and other scientists, and later proved by F.M. Milkov [20, 25]. Given all this, the modern transitional (central) part of the interzonal (forest-steppe - steppe) geoecotone is shown in the works of F.M. Milkov [20, 25], P.G. Shishchenko [19] and G.I. Denysyk [6, 7, 13, 15]. Analytical review of previous developments and field research allowed to establish that the width of the contact zone of the interzonal (for-

est-steppe - steppe) geoecotone reaches: 95-80 km in the west, up to 70 in the center and 45-50 km in the east.

We can describe geoecotones as voltage bands with maximum gradients of changes in the parameters of landscape systems. In addition, geoecotonic landscape complexes are characterized by specific properties and complex territorial structure. Increased fluctuation activity of environmental factors is one of the main features of geoecotonic areas, which determines the specific structure of geoecotone, mode of operation, mechanisms of stability, and conditions for the development of geoecotone systems. Geoecotones determine the possibilities of continuity of biogeocenotic cover, performing a connecting function, in fact, they play the role of "seams" between different natural or natural and anthropogenic geosystems and, at the same time, perform the role of natural membranes, buffer as well as refugium function [5, 7, 13].

Geoecotones differ in size, morphological expressiveness, genesis, functions, age, nature of dynamic processes, and others. Based on the generalization of the study results obtained by different authors, the interzonal geoecotone of the forest-steppe and steppe zone of Central Europe can be classified as typological, by the rank of geoecotones - to macrogeoecotone, by the rank of contacting geosystems - to zonal.

By the nature of morphological expressiveness, different authors distinguish: gradual, mosaic, island and other geoecotones. However, a detailed analysis shows that it is advisable to combine all of them into three main types: diffuse, striped, mosaic.

The interzonal geoecotone selected by us can be classified as diffuse, which is manifested in the gradual change of soils (dark gray regraded - regraded chernozems - ordinary low- and medium humus chernozems - ordinary low humus chernozems - ordinary medium humus chernozems - ordinary low humus weak chernozems) and, accordingly, in the gradual, vague transition of one group to another.

According to the genesis, i.e. the main factor that led to the emergence of the transition zone, there are two groups of types of geoecotones:

1) biogenic: phyto-, zoo-, anthropogenic;

2) abiogenic: tecto-, litho-, geomorpho-, edaphon-, halo-, hydro-, climatogenic.

The interzonal geoecotone of the forest-steppe and steppe zone of Ukraine can be attributed to biogenic-abiogenic. The latitudinal location of the geoecotone indicates the decisive role of climate in its formation. In terms of geomorphological structure, the territory of the geoecotone covers the adjacent upland and lowland areas: part of the Baltic erosion-denudation, South Pobuzke loess, Ingulo-Ingulets accumulative loess dissected plains; Dniester-Buh mildly dissected, Dniester-Bug slightly undulating, Western Black Sea flat undulating loess plains.

In the landscape territorial structure, geoecotones perform a barrier, contact, membrane, compensating, refugium, purification, connecting, evolutionary, migratory, recreational, environmental, and aesthetic function [5]. In general, geoecotones are characterized by multifunctionality, which is determined by their complex structural organization. The interzonal geoecotone selected by us, occupying a significant area, has, accordingly, a complex structural organization and, thus, is multi-functional. However, given the size and spatial location of the geoecotone, the different types of horizontal connections, the priority of the membrane function is the most typical.

By age, the interzonal geoecotone "forest-steppe – steppe" of Central Europe can be attributed to both young and mature. The type of structural organization that provides the formation of specific mechanisms of resistance

to changing environmental conditions, violated by anthropogenic influences and the peculiarity of this area is that it is in a state of constant rapid transformation. However, the duration of existence and conditions of formation of forest-steppe and steppe zones in Central Europe indicate the maturity of the transitional ecotone.

According to the display of dynamic processes, we can attribute the selected geoecotone to conservative and stabilizing, which is associated with the formed mechanisms of stability that provide a balance between the action of external and internal factors and determine the self-development of geoecotone.

Conclusion. An analytical review of literary and cartographic sources makes it possible to conclude that the study of geoecotones, as a kind of phenomena of the Earth's landscapes and its individual regions, is given considerable attention. However, studies of the general patterns of development and structure of geoecotones, their specific features (combination of a set of features that are common to adjacent genetically different landscape objects and the formation of individual features of transitional formations) and, in part, the possibility of rational use. Less attention is paid to specific, including interzonal geoecotones, which within a given state have significant economic and environmental significance. In Central Europe, these include the geoecotone formed and functioning between the forest-steppe and the steppe.

The natural boundaries of the interzonal geocotone "forest-steppe – steppe" of Central Europe are now almost impossible to determine. They are conditional due to continuous anthropogenization. In the administrative division, it occupies the territory (partially or fully) of 9 regions, with a total area of over 220 thousand km2, with a population of about 18 million people.

The diversity of natural conditions is determined by the spatial location on the border of two natural zones - forest-steppe and steppe, high occurrence of crystalline rocks of the Ukrainian Shield, significant differences in relief between the southern forest-steppe and northern steppe parts, which caused the difference in hydrogeological and microclimatic conditions, soil cover and biota. Within the geoecotone, three main water rivers of Ukraine flow - Dniester, Southern Buh and Dnipro. No less diverse are natural, including mineral and land, resources, which led to the classification of economic areas within the geoecotone - Industrial Prydniproviya and Donbass.

The diversity of the landscape structure is thanks to the location of the interzonal geoecotone within 2 subzones, 2 edges, 5 natural areas and 27 districts. In general, the landscape structure is dominated by watersheds of slightly undulating, riparian and ravine-beam areas with appropriate sets of tracts types.

The analysis of geocomponents and landscape complexes of the interzonal geoecotone "forest-steppe - steppe" allowed to determine its place in the structure of typological classifications. By area, it belongs to macrogeoecotones, by genesis - biogenic-abiogenic, by age - mature, by morphological expressiveness - diffusion, by function - membrane, by dynamic processes - conservative stabilizing. Typological features of the interzonal geoecotone "forest-steppe - steppe" of Ukraine give the opportunity not only to better understand its natural essence, but also to learn about the current state, further develop measures for rational use and optimize the processes of anthropogenization.

References

1. Kravtsova I. V. (2020). Geographic phenomenon of Central Europe. Social and geographic processes in the Central Europe: problems, tendencies, directly: materials of the international. sciences. geogr. conf. (Beregove, 26-27 march. 2020

p.): At 2 t Uzhhorod: TOV «RIK-U». 1. 309-316. [In Ukrainian]. [Кравцова І. В. Географічний феномен Центральної Європи. Соціально-географічні процеси в Східно-Центральній Європі: проблеми, тенденції, напрями: матеріали міжнар. наук. геогр. конф. (Берегове, 26-27 бер. 2020 р.): у 2 т. Ужгород: ТОВ «РІК-У», 2020. Т. 1. С. 309-316.]

2. Kravtsova I. V. (2021). Garden and park landscapes are like about the recreation and tourism of Central Europe. Theoretical and applied directly to the development of tourism and recreation in the regions of Ukraine: materials of the VII international. nauk.-practical. conf., assigned to the 70th anniversary of the National Academy of Sciences of Ukraine (Kropyvnytskyi, 1-2 quarters. 2021 p.) / for zag. ed. D. of Geogr. Sc. O. V. Kolotukhy. Dnipro: Seredniak T. K. 137-145. [In Ukrainian]. [Кравцова І.В. Садово-паркові ландшафти як об'єкти рекреації та туризму Центральної Європи. Теоретичні і прикладні напрямки розвитку туризму та рекреації в регіонах України: матеріали VII міжнар. наук.-практ. конф., присвяченої 70-річчю утворення Льотної академії НАУ (Кропивницький, 1-2 квіт. 2021 р.) / за заг. ред. д.г.н. О. В. Колотухи. Дніпро: Середняк Т. К., 2021. С.137-145.]
3. Bobra T. V. (2005). On the question of the concepts of «border» – «ecotone» in geography. Problemy material'noi kul'tury. Geograficheskie nauki. Simferopol'. 7-12. [In Russian]. [Бобра Т. В. К вопросу о понятиях «граница» – «экотон» в географии. Material culture problems. Geographical sciences. Simferopol, 2005. С. 7-12.]
4. Bobra T. V. (2009). New directions of landscape research. Geopolitics and ecogeodynamics of regions 1. 20-32. [In Russian]. [Бобра Т. В. Новые направления ландшафтных исследований. Геополитика и экогеодинамика регионов. 2009. Т.5. Вып.1. С.20-32.]
5. Demianchuk P. M. (2002). On the question of classification of geoecotones. Scientific notes of VSPU. Series: Geography.Vinnytsia. 3. 21-27. [In Ukrainian]. [Дем'янчук П. М. До питання класифікації геоекотонів. Наукові записки ВДПУ. Серія: Географія. Вінниця, 2002. Вип. 3. С. 21-27.]
6. Denysyk H. I. (2001). Forestfield of Ukraine. Vinnytsia: PP «Vydavnytstvo «Tezys». 284. [In Ukrainian]. [Денисик Г. І. Лісополе України. Вінниця: ПП «Видавництво «Тезис», 2001. 284 с.]
7. Denysyk H. I., Sytnyk O. I., Chyzh O. P., ta in. (2020). Interzonal geoecotones of Ukraine: monograph / ed H.I. Denyska, O.I. Sytnyka. Vinnytsia: TOV «Tvory». 368. [In Ukrainian]. [Денисик Г. І., Ситник О. І., Чиж О. П., та ін. Міжзональні геоекотони України: монографія / за ред. Г.І. Денисика,О.І. Ситника. Вінниця: ТОВ «Твори», 2020. 368 с.]
8. Zaletaev B. C. (1984). Ecotonic ecosystems as a geographic phenomenon and problems of ecotonization of the biosphere. Modern probl. Geographer. ecosystems. Moscow: IG AS USSR. 53. [In Russian]. [Залетаев В. С. Экотоновые экосистемы как географическое явление и проблемы экотонизиции биосферы. Совр. пробл. Географ. экосистем. Москва: ИГ АН СССР, 1984. С. 53.]
9. Kolomyts E. G. (1997). Zonal-belt ecotone in the system of large lowland catchments. Ecotones in the biosphere. Moscow: RAAS. 34-50. [In Russian]. [Коломыц Э.Г. Зонально-поясной экотон в системе больших равнинных водосборов. Экотоны в биосфере. Москва: РАСХН, 1997. С. 34-50.]
10. Nikolaev V. A. (2003). Landscape ecotones. Bulletin Moscow un-that. Ser. 5 Geography. 6. 3-10. [In Russian]. [Николаев В. А. Ландшафтные экотоны. Вестн. Моск. ун-та. Сер.5 География. 2003. № 6. С. 3-10.]
11. Solov'eva V. V. (2008). The structure and dynamics of the vegetation cover of ecotones of natural and technical reservoirs of the Middle Volga region: author. diss. ... doct. biol. Sciences: 03.00.16. Tolyatti. 43. [In Russian]. [Соловьёва В. В. Структура и динамика растительного покрова экотонов природно-технических водоемов Среднего Поволжья: автореф. дисс. ... докт. биол. наук: 03.00.16. Тольятти, 2008. 43 с.]
12. Brodel' F. (1994). What is France? have 2 books. Moscow: Publishing house named after Sabashnikovs, 1994. Book. 1: Space and history. 405. [In Russian]. [Бродель Ф. Что такое Франция? у 2 кн. Москва: Изд-во им. Сабашниковых, 1994. Кн. 1: Пространство и история. 405 с.]
13. Denysyk H. I., Sytnyk O. I. (2012). Interzonal geoecotone «forest-steppe-steppe» of the Right

Bank of Ukraine. Vinnitsa: PP «TD «Edelveis i K». 217. [In Ukrainian]. [Денисик Г. І., Ситник О. І. Міжзональний геоекотон «лісостеп-степ» Правобережної України. Вінниця: ПП «ТД «Едельвейс і К», 2012. 217 с.]

14. Preobrazhenskii B. C. (1986). Organization, organization of landscapes (preprint). Moscow: Institute of Geography of the USSR Academy of Sciences, 20. [In Russian]. [Преображенский В. С. Организация, организованность ландшафтов (препринт). Москва: Ин-т географии АН СССР, 1986. 20 с.]
15. Denysyk H. I. (2014). Anthropogenic landscape science: a textbook. Part 1: General anthropogenic landscape science. Vinnytsia: Vinnytska oblasna drukarnia. 334. [In Ukrainian]. [Денисик Г.І. Антропогенне ландшафтознавство: навчальний посібник. Ч. 1: Загальне антропогенне ландшафтознавство. Вінниця: Вінницька обласна друкарня, 2014. 334 с.]
16. Hudzevych A. V. (2005). Regional physical geography (Europe and Asia): textbook. Vinnitsa: «Vindruk». 464. [In Ukrainian]. [Гудзевич А. В. Регіональна фізична географія (Європа та Азія): навч. пос. Вінниця: «Віндрук», 2005. 464 с.]
17. Smal I. V., Kharchenko O. M. (2013). Socio-economic geography of the world. Regions and countries: Europe: a textbook. Nizhyn: NDU. M. Gogol. 499. [In Ukrainian]. [Смаль І. В., Харченко О. М. Соціально-економічна географія світу. Регіони і країни: Європа: навчальний посібник. Ніжин: НДУ ім. М. Гоголя, 2013. 499 с.]
18. Mil'kov F. N. (1984). The triad rule in physical geography. Geography. Moscow: MSU Publishing House. 15. 18-25. [In Russian]. [Мильков Ф. Н. Правило триады в физической географии. Землеведение. Москва: Изд-во МГУ, 1984. Т. 15. С. 18-25.]
19. Marynych O. M., Shyshchenko P. H. (2005). Physical geography of Ukraine: textbook. Kyiv: Znannia. 511. [In Ukrainian]. [Маринич О. М., Шищенко П. Г. Фізична географія України: підручник. Київ: Знання, 2005. 511 с.]
20. Mil'kov F. N. (1950). Forest-steppe of the Russian Plain. Experience in landscape characterization. Moscow: Publishing House of the USSR Academy of Sciences. 296. [In Russian]. [Мильков Ф. Н. Лесостепь Русской равнины. Опыт ландшафтной характеристики. Москва: Изд-во АН СССР, 1950. 296 с.]
21. Physico-geographical zoning of the Ukrainian SSR / ed.V. P. Popova, A. M. Marinicha, A. I. Lan'ko (1968). Kyiv: KGU. 683. [In Russian]. [Физико-географическое районирование Украинской ССР / под ред. В. П. Попова, А. М. Маринича, А. Й. Ланько. Київ: КГУ, 1968. 683 с.]
22. Topol'nii S. F. (2009). Soils of the Bug-Dniester interfluve within the transition of forest-steppe to steppe: author's ref. dis. … Cand. biol. sciences: 03.00.18.Kharkiv. 18. [In Ukrainian]. [Тополь-ний С. Ф. Ґрунти Буг-Дністровського межиріччя в межах переходу лісостепу у степ: автореф. дис. … канд. біол.. наук: 03.00.18. Харків, 2009. 18 с.]
23. Udra I. Kh. (1996). Biogeographical interpretation of forest-steppe nature and its surveying in Ukraine. Ukr. geogr. magazine. 3. 11-18. [In Ukrainian]. [Удра І. Х. Біогеографічна інтерпретація природи лісостепу та його межування в Україні. Укр. геогр. журнал. 1996. № 3. С. 11-18.]
24. Mirzadinov P. A., Kurochkina L. YA. (1985). Desert ecotones and their classification. Desert development problems. 2. 29-36. [In Russian]. [Мирзадинов Р. А., Курочкина Л. Я. Экотоны пустыни и их классификация. Проблемы освоения пустынь. 1985. № 2. С. 29-36.]
25. Mil'kov F. N. (1986). Physical geography: landscape studies and geographic zoning. Voronezh: VGU. 328. [In Russian]. [Мильков Ф. Н. Физическая география: учение о ландшафте и географическая зональность. Воронеж: ВГУ, 1986. 328 с.]
26. Tanfil'ev G. I. (1894). Pridely lesov na yuge Rossii. Sankt-Peterburg. 174. [In Russian]. Origin and types of natural boundaries. Izv. VGO. 3. 273. [In Russian]. [Арманд Д. Л. Происхождение и типы природных границ. Изв. ВГО. 1955. Т. 87. Вып. 3. С. 273.]
27. Hrodzynskyi M. D. (2005). Cognition of the landscape: place and space: a monograph. Kyiv: Kyiv University, 2. 503. [In Ukrainian]. [Гродзинський М. Д. Пізнання ландшафту: місце і простір: монографія. Київ: Київський університет, 2005. Т. 2. 503 с.]
28. Gumilev L. N. (2002). Ethnogenesis and the

Earth's biosphere. Sankt-Peterburg: Ehkopros. 226. [In Ukrainian]. [Гумилев Л. Н. Этногенез и биосфера Земли. Санкт-Петербург: Экопрос, 2002. 226 с.]

29. Makunina G. S. (1999). Ecotones in the landscape structure of the land surface. West. Moscow unthat. Ser. 5. Geography. No. 6. S. 16-20. [In Russian]. [Макунина Г. С. Экотоны в ландшафтной структуре поверхности суши. Вест. Моск. ун-та. Сер.5. География. 1999. № 6. С. 16-20.]
30. Petlin V. M. (1999). Landscape boundaries - functional properties and structure. Experimental eniology. Lviv, Issue 1. pp. 19-24. [In Ukrainian]. [Петлін В.М. Ландшафтні межі – функціональні властивості і структура. Експериментальна еніологія. Львів, 1999. Вип. 1. С. 19-24.]
31. Tanfil'ev G. I. (1987). Prehistoric steppes of European Russia. St. Petersburg, Vol. 1. S. 1-30. [In Russian]. [Танфильев Г. И. Доисторические степи Европейской России. Санкт-Петербург, 1897. Т.1. С. 1-30.]
32. Yagomyagi YU., Kyul'vik M. (1988). The role of ecotones in the landscape. The structure and landscape-ecological regime of geosystems. Scholarly notes Tartus. University: Proceedings of Geography. Tartu, Issue 808. pp. 96-117. [In Russian]. [Ягомяги Ю., Кюльвик М. Роль экотонов в ландшафте. Структура и ландшафтно-экологический режим геосистем. Уч. зап. Тартус. ун-та: Труды по географии. Тарту, 1988. Вып. 808. С. 96-117.]