

коефіцієнтів значущості окремих метричних показників. За результатами розрахунків інтегрального коефіцієнту естетичної цінності ландшафти канівської правобережної нагірної ділянки віднесено до естетично цінних.

Ключові слова: ландшафт, естетична цінність ландшафту, пейзажні властивості, критерії естетичної цінності, «фактори краси»

Introduction. Preserved standard and natural landscapes, biodiversity, balance and environment management in the territories determine the beauty and aesthetic appeal of landscapes, thus increasing their value. Public awareness of the threats of depletion and irrenewability of resources, as well as reducing the possibility of natural self-restoration of geoecosystems, and thus the loss of cultural or natural identity and uniqueness, that forces to reconsider the existing principles of human interaction with nature and find updated approaches of natural resource management. The ecologization of human thinking and behavior is increased by the formation of involvement in the conservation of such special areas (Bauer, 2009; Howley, 2011). The existing concept of ecosystem services considers landscapes as a type of natural capital that ensures harmonious and balanced development and life quality of man and society as a whole (KPMG, 2012). Ecosystem goods and services are understood as the whole spectrum of “goods” and “services” provided by nature. The group of goods (KPMG, 2012) includes non-renewable goods – rocks, minerals, fossil fuels and those that are renewable – animals, plants, water, air, soil, recreation, aesthetics. According to the current classification (Millennium Ecosystem Assessment, 2005, Schirpke, 2016), services provided by ecosystems belong to one of four broad categories that define the functions of natural capital. Among ecosystem services, those that directly affect people are significant, for example, provisioning, regulating and cultural services. Thus, cultural ecosystem services include intangible, provided by ecosystems, which are important in the processes of human cognition of the environment to meet its aesthetic needs, for physical and spiritual growth. These are the resources of the natural and cultural heritage of the regions, the landscapes that form aesthetic scenery, the unique cultural landscapes that are used by human for the purpose of recreation, treatment, rehabilitation. Areas that have landscape-aesthetic resources are not only useful for people, they also significantly contribute to the attractiveness of the region and are correlated with the financial benefits for the development of the region.

The perception of beauty, the picturesqueness of natural or anthropogenic landscapes, has always been a natural process for human, according to the fact that contemplation of the aesthetic is one of the needs necessary for his or her quality of life and

productive work. The need for beauty is one of the strongest manifestations of the inner world of human. The beauty, the aesthetics of the environment is a powerful factor that affects psychophysical states and well-being and has a significant impact on a human behavior.

In recent decades, the role of assessments of the aesthetic potential of territories in the optimization of spatial planning decisions, improvement of settlements, for its recreational use has increased. The study and assessment of landscapes is important in the planning and organization of recreation, rehabilitation and treatment. The aesthetics of the environment is associated with the concepts of quality and comfort of human life and work, with the preservation of the quality of the natural environment.

The purpose of this publication is to assess such qualities of the landscapes of the right-bank upland area of the Kaniv Nature Reserve, which are important for determining their aesthetic value.

The object of this study are the landscapes of the dislocated forest plateau in the Kaniv district of Cherkasy region of Ukraine with the total land area of 11.43 km², with their potential ability to form aesthetically expressive and diverse landscapes. As operational units, we studied homogeneous landscape features (areas and tracts) with the typical appearance of the landscapes of this area only. The choice of this object is explained by the standard landscapes of the Kaniv land of the dislocated loess plateau. The complexity of landscape-forming processes and the intensity of economic development of the landscapes of this area has led to the emergence of unique highly attractive images. One of such images, called “Tarasovi Obrii” (“Taras’ Horizons”), is formed by landscapes from Chernecha Hora (Kaniv) and is considered as a visiting card of Kaniv Region, along with the landscape of Tarasova Hora and the Dnieper River.

The works of Ukrainian researchers, in particular, O. Golubtsov, S. Konyakin, P. Shyshchenko, Y. Shchur, M. Chornyi, L. Chorna, V. Chekhniy are dedicated to research of landscapes of Kaniv land, study of issues of their standarts, preservation of landscape and biological diversity, substantiation of schemes of ecological network of the region.

The interest to the problems of nature and genesis of landscapes of the Kaniv dislocated loess plateau has been developed in the research of many Ukrainian

scientists, physicists, geologists, geomorphologists, biologists, geobotanists, including V. Riznichenko, M. Shcherban, Y. Grubrin, E. Palienko, V. Shevchyk, L. Bakalina, etc. In particular, the works of P. Shishchenko, Y. Shchur, S. Konyakin present the landscape-typological scheme and the results of landscape-morphological analysis of the territory of Kaniv Nature Reserve. Later, in the works of O. Golubtsov and M. Chorny, the results of the study of the landscape structure of the Cherkasy region were presented and landscape optimization schemes of the territory of the Kaniv Biosphere Reserve were developed.

Studies of the beauty of the landscape, its aesthetic qualities and factors that determine the attractiveness, were revealed in the publications of a wide range of researchers. In particular, in the works of D. Linton, G. Buchko, I. Barčáková, V. Nikolaev, D. Dirin, I. Brook, M. Grodzinsky, O. Grodzinska, theoretical and methodological issues of landscape aesthetics are laid down.

Problematic issues of aesthetic assessment in the perception of landscapes have been studied both in the works of these authors and in the studies of K. Eringis, A. Budryunas, Y. Vedenin, L. Filipovich, E. Real, C. Arce, J.M. Sabucedo, B. Kochurova, NV Buchatska, S. Frank et al., U. Schirpke et al., J. Lieskovský et al.

Problematic issues of aesthetic perception of landscapes, the formation of preferences of subjects of perception and their judgments about the beauty of the landscape are considered in the works of R. Kaplan, S. Kaplan, D. Gold, S. Bourassa, N. Bauer et al., D. Gruehn, W. Nohl.

The issue of landscape heritage conservation and ecosystem services in protected areas was studied by V. Stetsiuk, P. Howley, S. Swaffield, W. McWilliam, T. Plieninger et al. Issues of attractiveness and aesthetics of the landscape in spatial and landscape planning were touched upon in the works of V. Stauskas, D. Stefunkova, E. Real et al., A. Jorgensen, L. Szücs et al., O.G. Golubtsov et al.

Materials and methods of research. The methodological basis of this study is the starting points of the concept of aesthetic landscape science on the objective factors of aesthetic attractiveness of landscapes (Linton, 1968; Barčáková, 2001; Dirin, 2005; Frank et al., 2013; Erignis, Budrunas, 1971, 1975), which are revealed through a number of physiognomic and compositional parameters of landscapes. Such important factors include features of terrain, floristic, hydrological, landscape diversity, man-made objects, etc. In sum, “beauty factors” will determine the holistic visual prints of landscapes – sceneries in the perception of landscapes by a human (Kaplan 1989; Grodzinsky,

2005; V. Nikolaev 2003, 2013) and others.

It should be noted that the analysis of only objective factors forming the beauty of landscapes without taking into account the judgments of the subjects of the environment aesthetic perception limits the understanding of the true beauty of landscapes, determining people’s preferences and making decisions about the aesthetics of landscapes. However, identifying and evaluating the objective factors of landscape beauty, based on their nature and cultural context of formation, gives reason to understand that a man himself invests in understanding of the landscape aesthetic, and what physical features and traits are decisive in forming its beauty.

The integrity of the visual imprints of landscapes (sceneries) is expressed in sensory perception through their aesthetic qualities: harmony, beauty, contrast, depth, mystery, majesty, intelligibility, diversity, expressiveness, and others. Aesthetic qualities of landscapes are estimated at sensory perception mostly by visual parameters of landscapes (Kaplan, 1989; Nikolaev 2003, 2013; Grodzinsky, 2005). Thus, the aesthetic value of the landscape is manifested through the scenery, which cause the subjects of perception of admiration and positive emotions. In works on aesthetic landscape science it is emphasized that landscapes of a certain territory are a physical basis of a view and in scene all internal communications and properties of a landscape are transferred (Dirin, 2005; Kochurov, Buchatskaya, 2007; Nikolaev, 2003, 2013; Grodzinsky, 2005). The view, as a reflection of the landscape, is also morphologically structured (diverse/monotonous) and has a spatial (compositional) structure. When perceived, scenes are able to form (diverse/monotonous) landscapes, which will determine their aesthetic visual properties: expressiveness, diversity, etc. Landscape properties, as aesthetically valuable, are transmitted by a set of sensory impressions from perceived landscape images (Kochurov, Buchatskaya, 2007). So far component studies of the aesthetics of landscapes have revealed that the active «beauty factors» that affect the beauty and scenery of landscapes include surface terrain, vegetation, hydrological features, diversity, and man-made objects.

Metric indicators of landscape properties, as aesthetically valuable, in such studies are selected those that determine its physiognomic and compositional properties: horizontal and vertical fragmentations of terrain, surface slope, depth of perspective, the degree of mosaic and diversity of landscapes and the degree of forestation. (Eringis, Budryunas, 1971, 1975; Vedenin, Filipovich, 1975; Barčáková et al., 2001; Jaman, Pavlenko, 2010; Frank et al., 2013; Schirpke et al. 2016; Lieskovský et al. 2017). In this study, the

assessment of the aesthetic qualities of the landscapes of the right-bank upland section of the Kaniv Reserve was carried out on the basis of a component analysis of «beauty factors». Morphometric indicators of surface relief, in particular, vertical and horizontal fragmentation, exposure and steepness of the slope, were chosen as criteria for assessing the aesthetic qualities of landscapes. Significant criteria are indicators of landscape diversity (Shannon's entropy) and afforestation. The determined morphological indicators were calculated by mathematical and cartographic methods using the analytical capabilities of GIS. Noting that the assessment of the aesthetic value of landscapes is integral, metrics of landscape properties as aesthetically valuable should be analyzed in parallel with the assessment of such qualitative parameters of landscapes that characterize the sensory perception of scenery: the presence of compositional dominance, multiplicity, aspect presence, etc. Such qualitative parameters of aesthetic evaluation are quite subjective and therefore should be evaluated according to a separate method.

At this stage of the study of the aesthetic value of landscapes, only the objective parameters of the beauty of landscapes are evaluated, which are significant for the qualitative parameters of aesthetic value. Some qualitative parameters were described, in particular aspect, contrast, naturalness, but it was not their influence on the overall assessment that was determined, but their dependence on the surface morphology, the nature of the vegetation, the steepness of the slopes, the number of anthropogenic objects, etc.

The integrated indicator of the aesthetic value of the landscapes of the right-bank upland area of the Kaniv Nature Reserve was calculated in this study by

M.Yu. Frolova (Frolova, 1994), Zh.I. Buchko (Buchko, 1997), D.O. Dirin (Dirin, 2005), B.I. Kochurov, N.V. Buchatskaya (Kochurov, Buchatskaya, 2007), M.O. Dgaman, T.N. Pavlenko (Dgaman, Pavlenko, 2010). To evaluate the aesthetic value of the landscapes of the right-bank upland area of the Kaniv Nature Reserve, the authors determined a score scale for assessing individual criteria of their aesthetic value, which is presented in the Table 1.

Results and analysis. Using practical experience with visual images of the landscapes of the Kaniv Nature Reserve, the authors selected active “beauty factors” and their objective criteria for assessing the aesthetic qualities of the landscapes of this area. On the basis of computer processing of geographical data obtained for many years of experience in the Kaniv Nature Reserve, the restored landscape structure was analyzed, the morphometric indicators of the terrain, forest cover indicators and the diversity of landscapes of the study area were calculated. GEO-data processing was performed using standard tools of ArcGIS modules, in particular, Spatial Analyst, 3D Analyst, Analysis Tools. The initial data for the work on the restored landscape structure and the organization of GEO-data in the form of a Database were opened topographic survey materials (scales 1: 50 000, 1: 100 000, 1: 200 000), remote sensing data for the study area (SRTM 1 Arc-Second) 30m) (NASA), soil maps (scales 1: 200 000, 1:10 000), geological maps, schemes and diagrams of geomorphological structure of different scales, forest management schemes, etc. Computer processing of GEO-data took place in order to inventory the existing natural information on the geodatabase is based on a relational model of GEO-data, which is a two-dimensional table containing

Table 1. Score scale for assessing metric indicators of aesthetic value of landscapes

Criteria	Grade	1	2	3
indicator of horizontal fragmentation of the surface, km/km ²		<0,5...3	0,5-1...2-3	1-2
indicator of vertical fragmentation of the surface, m		<100	100-200	> 200
forestation, %		>60	<30 absent	30-60
measure of Shannon's entropy landscape diversity		< -560	-560 - -490	> -490
the magnitude of the predominant slopes of the surface, °		<3°	3°-12°	12°-20°...>20°

Source: made by the authors based on the analytical capabilities of GIS in spatial analysis of geographical data

metric indicators of landscapes and consisted of the sum of estimates of individual criteria of aesthetics. During unification of metric indicators of aesthetic value of landscapes when drawing up of an estimation scale, the methodical experience is used, which is covered in previous researches of K.I. Eringis, A.R. Budryunas (Eringis, Budryunas, 1975), Yu.A. Vedenin, L.S. Filipovich (Vedenin, Filipovich, 1975),

information about landscapes (rank of the tract): sediments, soils, vegetation type, nature management and a number of morphometric indicators, map of the restored landscape structure of the studied area which became the basis for determining the integrated indicator of aesthetic value of landscapes according to their objective factors of aesthetic attractiveness of landscapes.

The structure and texture of the terrain in a number of inherent parameters (height difference, exposure and steepness of the slopes, the presence of gullies and arroyos, morphosculptures) is considered to be one of the “beauty factors” of the landscape. The surface relief influences such characteristics of landscape aesthetics as: frequency of scenery changes, mosaicism, nature of landscape drawing, panorama, availability of scenery openings, depth of perspective, breadth of scenery perception angles, presence of visual dominants, etc. Such parameter as the exposure of slopes affects the illumination of

a hilly lowland with absolute heights of 200-250 m with a developed erosion network (Palienko, Moroz, Kudelya, 1971; Riznychenko, 1924; Grubrin, 1976) and is called Kaniv Mountains. A fragment of the physical surface of the study area, built on the basis of the digital terrain model (Digital Elevation Model - SRTM 1 Arc-Second (30m)) (NASA), is shown in the Figure 1.

The study area is characterized by a predominance of inclined surfaces and the Figure 2 shows the differentiation of the surface of the study area by the angle of inclination of the surface (fragment).

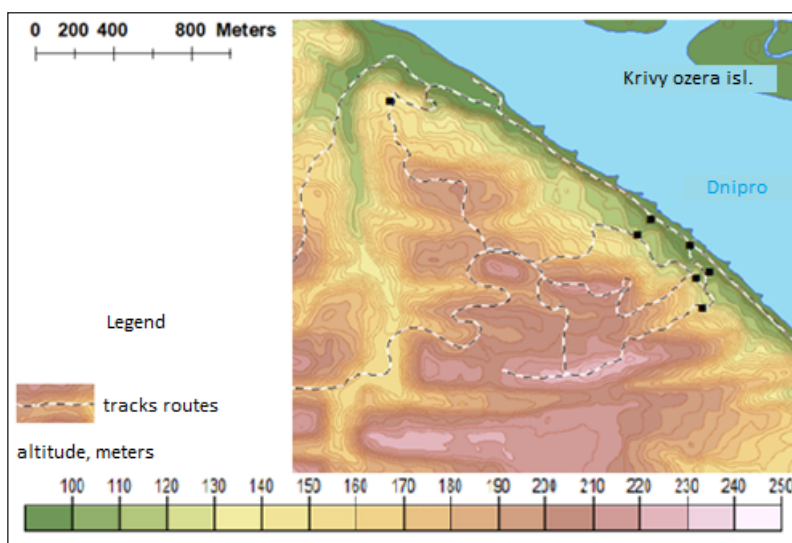


Fig. 1 Physical surface of the right-bank section of the Kaniv Nature Reserve (fragment).

Source: done by the authors based on the analytical capabilities of GIS in spatial analysis of geographical data

landscapes, the type of vegetation and, accordingly, determines a number of visual qualities of the landscape. The presence of slopes, their shape and steepness, affects such characteristics of landscapes as the frequency of landscape changes and versatility. Amplitudes of heights, vertical fragmentation of a terrain form presence of points of landscape opening in the environment, existence of panoramas, visual dominants, depth of perspective, contrast, etc. Morphometric indicators of surface relief can both increase and decrease the quality of landscapes. For example, a slight dissection of the terrain, the predominance of leveled surfaces can lead to monotony of landscapes, lack of variety of plans and panoramas, which, in turn, affects the judgments of the subjects of perception of the aesthetic appeal of a landscape. The research of natural conditions of the study area showed that the right-bank upland area of the Kaniv Nature Reserve belongs to the dislocated loess plateau. The depth of fragmentation of dislocated areas in some places exceeds 100-150 m. In the studies of physiographers and geomorphologists, this area is

The results of morphometric analysis of the digital terrain model of the study area (presented in the Table 2) show the predominance of sloping surfaces of different steepness, which are formed as a result of the long history of Kaniv dislocations. Sloping and slightly sloping hillsides are dominated by 40.9%, which are confined to the watersheds of ridges and inter-ridge lowering of the dislocated plateau, forming a wavy surface relief. 35.7% of steep and precipitous slopes add the expressiveness to the landscape, which are typical for erosion-landslide areas of ancient anthropogenic landslides confined to cirques and modern gullies, creating a variety of attractive transitions from one landform to another. Slightly sloping areas make up a smaller share of the study area of 23.4% and are visually contrasting in relation to the surrounding areas.

GIS analysis of DEM on the exposure of the surface of the right-bank upland area of the Kaniv Nature Reserve (orientation of the slopes on the sides of the horizon) indicates the predominance of the surfaces of the northern and eastern exposures. Generaliza-

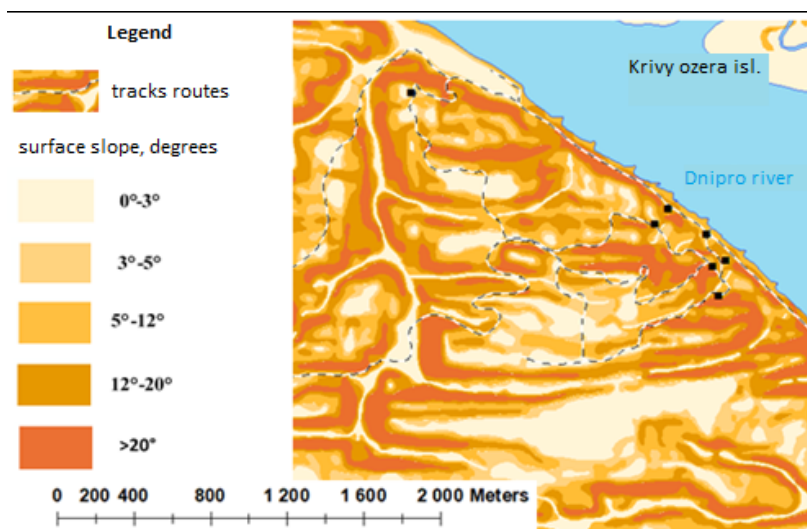


Fig. 2 Steepness of the slopes of the right-bank section of the Kaniv Nature Reserve (fragment). *Source: done by the authors based on the analytical capabilities of GIS in spatial analysis of geographical data*

tion of the results of landscape analysis (GIS-based analysis) by the number and share of landscape tracts by surface exposure for this area are presented in the Table 3, and the Figure 3 shows the differentiation of the study area (fragment) by surface exposure in main directions – north, west, south, and east.

In our case, the predominance of the surfaces of the northern and eastern exposures determines the disclosure of multifaceted landscape views of the left-bank landscapes of the Dnieper Valley from observation points along the edges of the slopes of the plateau of the northern and north-eastern exposures.

Table 2. Quantitative distribution of surfaces according to the slope steepness for the Kaniv right-bank upland area

Surface character: angle of inclination, °	Square, m ²	% of the total area
leveled and slightly inclined surfaces <3°	2 671 542	23.4
gentle slopes 3°-6°	1 690 600	14.8
slightly sloping hillsides 6°-12°	2 987 251	26.1
precipitous slopes 12 ° - 20 °	2 600 534	22.7
steep slopes >20°	1 484 715	13.0
Σ	11 434 642	100

Source: done by the authors based capability on the analytical capabilities of GIS in spatial analysis of geographical data

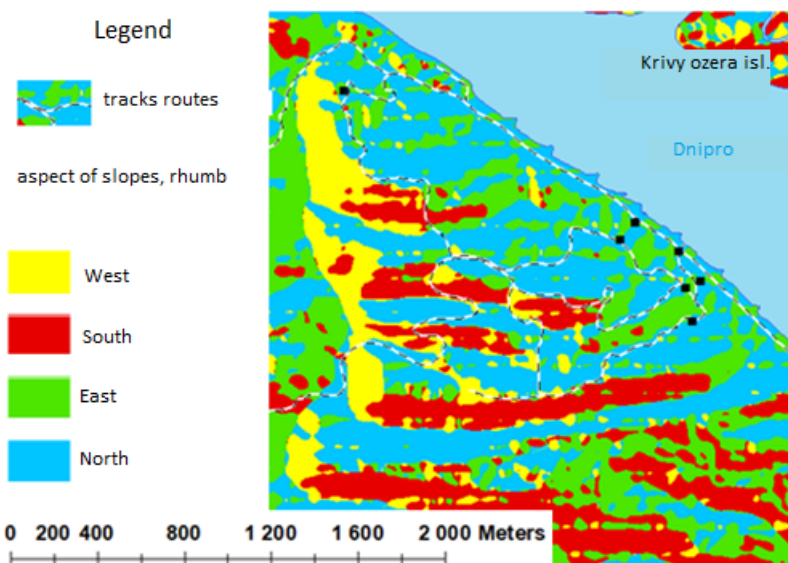


Fig. 3 Exposition of the slopes of the right-bank section of the Kaniv Nature Reserve (fragment). *Source: done by the authors based on the analytical capabilities of GIS in spatial analysis of geographical data*

Table 3. Distribution of landscape tracts by exposure of slopes for the right-bank upland area of the Natural Reserve

Rhumb	Degrees	Quantity	Share, %
north	315 – 45	391 630	31.15635
east	45 – 135	336 287	26.7535
south	135 – 225	304 795	24.24814
west	225 – 315	224 271	17.84201

Source: done by the authors based on the analytical capabilities of GIS in spatial analysis of geographical data

In addition, the northern and eastern exposures are important (the amount of solar radiation received by the surface – insolation) in the formation of the type of vegetation – fresh oak-hornbeams, which also form a distinct multifaceted landscape, especially in spring and autumn.

During the study, in order to determine the aesthetic value of the landscapes of the study area, other morphometric indicators of relief were calculated (their values are summarized in the Table 4), which have an impact not only on the formation of landscape diversity, but also on other landscape qualities of landscapes.

the dislocated plateau, meadow-steppe vegetation on the watersheds provides high indicators of saturation of the opening points of the landscapes of the Kaniv upland area. On the deforested ridges, the edges of the forested watershed slopes of the Kaniv dislocations natural observation decks are located, which offer highly attractive landscapes with rich plans, far-sighted with a deep perspective. For example, from the tops of the Mar'yina, Knyazha, Pylypenkova, and Lysa mountains, panoramic views of the hills of the dislocated loess terrace (north-northeast) and the hilly loess-moraine plain (south-southwest) open up. To the north of the Chernecha, Pylypenkova, and Lysa

Table 4. Morphometric indicators of the terrain and its values for the territory of Kaniv right-bank upland area

Morphometric indicators of the terrain	Value
max elevation mark, m	254
min elevation mark, m	79
vertical fragmentation of the terrain, m	175
length of thalwegs (valley lines), km	33.601
horizontal fragmentation of the terrain km/km ²	2.94

Source: done by the authors based on the analytical capabilities of GIS in spatial analysis of geographical data

The results of a number of applied studies on aesthetic assessments of territories prove the direct dependence of visual aesthetic perception of the surrounding landscape on the nature of surface morphology, namely the location of the point from which the landscape views (Nikolaev 2003, 2013; Dirin, 2005; Kochurov, Buchatskaya, 2007). Visual perception requires a distance between the subjects of perception and landscapes. And such distance is provided by the location of the point of view, which in turn determines a greater or lesser perspective, foresight, versatility of the landscape. Scenery points and landscapes are connected. Even minor changes in the position of the viewpoint lead to a change in the landscape. Observation points also provide a view, the depth of the landscape perspective, the number of plans, etc. Thus, the location of the point itself plays a significant role. Thus, its location on elevated areas provides a broad overview, landscape perspective. The breadth of the view is also influenced by the nature of the ratio of the relief to the silhouette of the forest canopy (Nikolaev, 2003, 2013; Vedenin, Filipovich, 1975). Vertical fragmentation of the surface, linear stretching of

mountains, wide multifaceted landscapes open up to the city of Kaniv, the Trakhtemyriv Peninsula, and the Kaniv Reservoir, so on. To the north of Mar'yina Hora are the steep slopes of the Great and Small Scythian Horodyshe, which are the monuments of archaeological heritage. From the natural observation deck on Velyke Horodyshe there is a far-sighted panorama of the left-bank landscapes of the first floodplain terrace (covered with pine forests) and wide floodplain of the Dnieper, crossed by numerous old rivers strait, floodplain lakes and the floodplain islands of Krivy ozera, Shelestiv and Kruhlyk.

The assessment of the landscape properties of Kaniv scenery will also depend entirely on the metric characteristics of the landscape diversity of the territory, which requires an analysis of its landscape structure. Indicators of landscape and floral diversity determine the visual changes in landscapes, changes in physiognomic parameters, the alternation of different landscapes, the presence of several plans, and others. (Nikolaev, 2003, 2013; Dirin, 2005; Eringis, Budryunas, 1971, 1975; Vedenin, Filipovich, 1975, etc.). As the part of this study, we calculated the Shannon

Landscape Diversity Index to determine the extent of landscape diversity. In our case, some information indicator of the degree of inventory diversity or an indicator of the complexity of the territorial structure is calculated according to the Shannon's formula. Thus, the indicator of the complexity of the territorial structure (the total number of different landscape units

postwar years stimulated the processes of secondary restoration of native landscapes, which allowed us to warn today about the gradual change in the landscape structure of the studied area. The landscape diversity of the studied area reflects the peculiarities of the historical development of Kaniv and reveals the combined effect of the main landscape-forming fac-

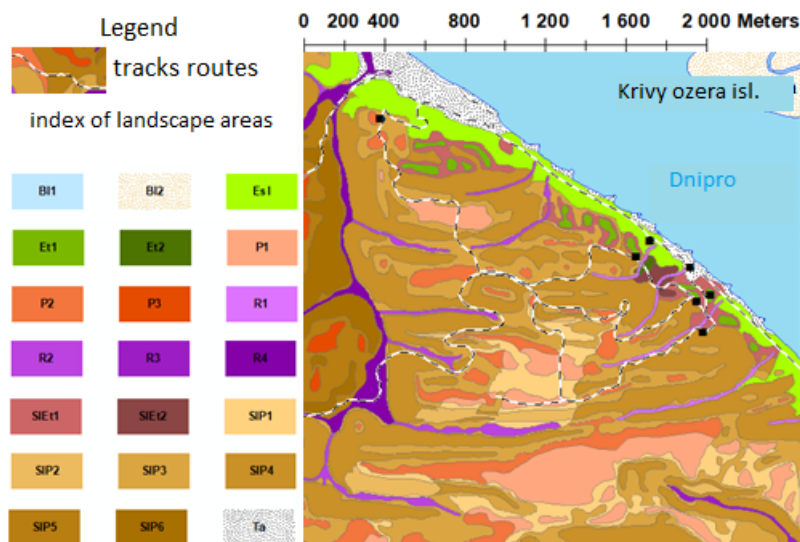


Fig. 4 Fragment of the map of the restored landscapes of the right-bank section of the Kaniv Nature Reserve (for an explanation of the indices, see the Table 5 below)

Source: done by the authors based of the analytical capability of morphological analysis of landscapes

within the study area) is calculated (-322.48), which determines the considerable landscape diversity.

The landscape diversity of the Kaniv Mountains is formed by the simultaneous action of a set of factors, among which the terrain and geological substrate are the most active ones. The geological and geomorphological structure of the studied area directly determines: the differentiation of microclimatic and hydrological indicators of the territory, differences in the spatial structure of the soil cover, which, in turn, affects the diversity and structure of ecotypes. Also, an active factor influencing the landscape diversity in the studied area is anthropogenic. The long history of intensive anthropogenic development of the Dnieper region of Kaniv has led to the practical destruction of the original forest-steppe landscapes. The deforestation of primitive oak forests, which lasted until the beginning of the XX century, led to the intensive development of erosion and geodynamic processes, which stimulated the formation of an extensive ravine-beam network and caused a change in much of the forest landscape on meadow-steppe. The extensive ravine-beam network of the territory of Dnieper region of Kaniv has led to a radical change in the image of local landscapes. Withdrawal of territories from agricultural use and formation of secondary stands in the

tors. Figure 4 shows the fragment of the map of the restored landscapes of the study area.

Landscape representativeness of Kaniv district of Cherkasy region, according to previous landscape-typological studies, consists of complexes: deciduous-forest, forest-steppe, meadow-steppe, mixed-forest coniferous, meadow and swamp types (Golubtsov and Chorny, 2014; Dmitruk, Romanchuk, 2002). Intrazonal ravine-beam and valley-river landscape complexes are also common here. During the landscape morphological analysis and landscape mapping of the studied area, the authors identified 71 homogeneous landscape areas (tract level), which are combined into 21 landscape areas. The Table 5 presents an abbreviated description of the landscape areas of the right-bank section of the Kaniv Nature Reserve.

Characterizing landscape qualities as signs of aesthetic value of Kaniv Mountains landscapes should not be limited to the analysis of landscape structure or the nature of the terrain surface (Linton, 1968; Eringis, Budrunas 1971, 1975; Vedenin, Filipovich, 1975; Barčáková, 2001; Barčáková, 2001; 2013; Dirin, 2005; Frank et.al., 2013; Howley, 2013, etc.). Relevant information on the biological indicators of the aesthetic value of landscapes can be obtained based on the results of the field geobotanical research.

Table 5. Description of landscape areas for the map of restored landscapes of Kaniv right-bank upland area

Index	Description of the areas
P1	ridge-hilly undulating well-drained watersheds of loess height with sod podzolic soils at the outcrops of Cretaceous sandstones overlain by sands on the tops in complexes with slightly inclined inter-ridge lowerings with gray podzolic loess soils and soils
P2	ridge-hilly undulating well-drained watersheds of loess height with sod podzolic soils at the outcrops of Cretaceous sandstones overlain by sands on the tops in complexes with slightly inclined inter-ridge lowerings with gray podzolic soils under the loess sediments in the oak-hornbeam forests
P3	undulating hills of well-drained watersheds of the ancient alluvial-terraced plain with sod podzolic sandy-gravelly soils on the outcrops of sandy deposits of the lower anthropogen lined with Cenomanian sandstones under dry pine forest and acacias in alternation with oak-hornbeam forests
Et1	pseudoterasses of early anthropogenic erosion-landslide circuses with gray podzolic soils on loess under oaks and hornbeams and cultivated garden vegetation
Et2	pseudoterasses of early anthropogenic erosion-landslide circuses with sod podzolic sandy-gravelly soils on wedges of sandy deposits of the lower anthropogen lined with Cenomanian sandstones under dry pine trees
Es1	erosion-landslide slopes of early anthropogenic pseudoterasses under oaks and hornbeams (sometimes with cultivated vegetation)
SIEt1	slopes of pseudo-terraces of early anthropogenic erosion-landslide circuses with gray podzolic soils on loess under oaks and hornbeams (sometimes with cultural garden vegetation)
SIEt2	slopes of pseudoterasses of ancient anthropogenic erosion-landslide circuses with sod podzolic sandy-gravelly soils on wedges of sandy deposits of the lower anthropogen lined with Cenomanian sandstones under dry pine forests
SIP1	sloping and slightly sloping hillsides of ridge-hilly undulating and hilly well-drained watersheds with sod podzolized soils at the outcrops of Cretaceous sandstones overlain with Cenomanian sands on the tops and weakly sloping well-drained inter-ridge lowerings with gray podzolic soils in forests under meadow-steppe plant formations
SIP2	precipitous and steep slopes of ridge-hilly undulating and hilly well-drained watersheds with sod podzolized soils at the outlets of Cretaceous sandstones overlain by Cenomanian sands on the tops and slightly sloping well-drained clear-ridged lowerings with gray and light gray podzolic soils on loess under meadow-steppe plant formations
SIP3	steep and slightly sloping slopes of ridge-hilly undulating well-drained watersheds with sod podzolic soils at the outlets of Cretaceous sandstones overlain by Cenomanian sands on the tops and weakly sloping well-drained inter-ridge lowerings on gravel ridges
SIP4	steep and precipitous slopes of ridge-hilly wavy well-drained watersheds with sod podzolized gravelly soils at the outlets of Cretaceous sandstones overlain by Cenomanian sands on the tops and weakly sloping well-drained inter-ridge lowerings of ridges of forest-like
SIP5	precipitous and slightly sloping hillsides of undulating hills of well-drained watersheds of the ancient alluvial-terraced plain with sod-slightly podzolic, sod podzolic sandy-gravelly soils on the outcrops of sandy deposits of the lower anthropogenic subsoil
SIP6	steep and precipitous slopes of undulating hills of well-drained watersheds of the ancient alluvial-terrace plain with sod podzolic sandy-gravelly soils on the outcrops of sandy deposits of the lower anthropogen lined with Cenomanian sandstones under alternate gravels and dry pine forest and acacias in alternation with oak-hornbeam forests
B11	sandy-silty bottom of the Dnieper and silty-sandy bottoms of the Dnieper riverbeds with plant formations of aqual river complexes
B12	sand channel floodplains with initial soil formation with willow and grass-sedge weeds and slightly undulating sloping reduced periodically flooded plains with sod underdeveloped sandy soils under coarse-grass weeds, willow or poplar-black alder plantations and sedge moisture-loving weeds in the coastal strip. The slopes of the areas are gently sloping and sloping with coastal sedge-black alder plantations and sedge weeds
Ta	leveled artificial coastal pseudoterrace on a proluvial plume with washed-out transformed sandy slightly sodden soils under lawns, ornamental plantations, sedges and acacias occupied by road infrastructure and sparse buildings with sloping and slightly sloping hillsides transport infrastructure and road complexes)
R1	narrow, deep ravines in loess soil of sandy-loamy composition with sloping slightly turfed and steep not turfed slopes often with outcrops of rocks with sod gleyed soils on the bottoms on deluvial loams of medium and heavy-loamy composition under gravel vegetation
R2	complexes of narrow, deep branched ravines in loess rocks with flat extensions with sloping slightly turfed and rocky outcrops of slopes with sod gleyed and gleyed soils along the bottoms on medium-heavy composition of deluvial loams under hornbeam vegetation
R3	wide, deep ravines and gullies in loess soil of loamy composition with sloping slightly turfed and steep non-turfed slopes often with rock outcrops with sod gleyed and gleyed soils on the bottoms on medium-heavy composition of deluvial loams under vegetation of hornbeam groves with sod gleyed hard loam soils on deluvial-proluvial deposits under moisture-loving weeds and black alders
R4	wide, shallow ravines and beams in sandy rocks with flat extensions with sloping and slightly sloping hillsides with sod sandy-loamy soils on the outcrops of sandy late anthropogenic sediments lined with Cenomanian sandstones with sandstones rocks slightly sloping with sod sandy loam soils under forests and shrubs, moisture-loving vegetation

Source: done by the authors based of the analytical capability of morphological analysis of landscapes

Thus, botanical and phenological descriptions of vegetation, in particular, changes in their physiognomy/aspect presence, allow us to record the change in the visual characteristics of individual landscapes during the seasons (Shevchyk, 2012). In the future, this allows us to study the aspect of landscapes, as the aesthetic quality of landscapes. An abbreviated list of aspecting grassy species of the right-bank upland area of the Kaniv Nature Reserve, which especially affect the physiognomy of its landscapes, can be seen in the Table 6.

The variety of colors of aspecting plant species (trees, shrubs, grasses) of the Kaniv right-bank upland area, especially those that affect the physiognomy of its landscapes in different seasons, is summarized in the Table 7.

The Figure 5 shows the chart of color distribution of aspecting plant species by months of the year. The distribution indicates that the flora of Kaniv dislocations in summer, autumn and spring is characterized by the most expressive physiognomy. Such a rich aspect is aesthetically valuable for such natural landscapes as the landscapes of the Kaniv right-bank upland area.

Local meadow-steppe plant formations of the right-bank upland area of the Kaniv Nature Reserve are characterized by a pronounced feature of pheno-

the flowering of ephemerals and ephemeroïds: snowdrops *Scilla bifolia* L., snowdrop *Galanthus nivalis* L., anemone *Anemone nemorosa* L., Marshall Persian *Corydalis marsh.* and hollow growth of *Corydalis cava* L. Schweigg. et. Short. On the edges there are spreading bushes of flowering thorns *Prunus spinosa* L., wild apple *Malus sylvestris* Mill. and pears *Pyrus communis* L., which creates attractive visual accents.

There are stands for the aesthetic attractiveness and variability of the physiognomy (according to the seasons) of the forests growing in the study area. The stands, with admixtures of various herbaceous and shrubby species, with a distinct seasonal aspect, create separate curtains, thus diversifying the landscape. For example, the heart-shaped linden *Tilia cordata* Mill., which is sometimes found in the second / third tier of hornbeam forests and everywhere on the Reserve estate, contributes to the diversification of aesthetic impressions. Linden blooms later than other trees, in early summer, and further saturating the air with the aroma of its flowers, complementing the holistic image of the landscape. The multifaceted forests of the right-bank upland area of the reserve are in autumn, before the beginning of November. It is in the autumn season that maples *Acer platanoides* L., *Acer negundo* L., hornbeam *Carpinus betulus* L., rowan *Sorbus aucuparia* L., birch *Betula pendula* Roth., Maiden grape

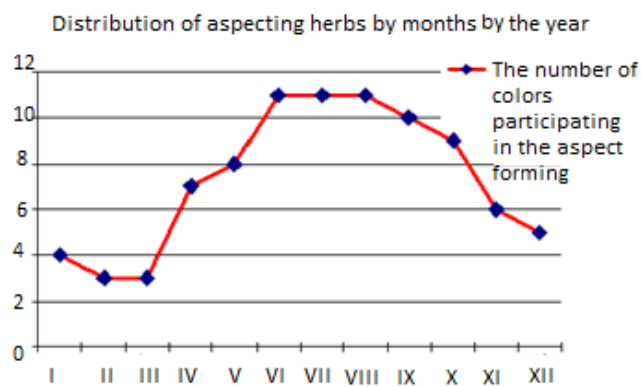


Fig. 5. Aspecting plant species of the Kaniv right-bank upland area of the nature reserve by months by the year.
Source: done by the authors based of the analytical capability of applied geobotanical studies

logical changes in the aspects of vegetation in connection with the successive flowering of bulbs, cereals and grasses. Peculiar accents or landscape dominants that diversify the landscapes of these areas are shrub species represented by steppe cherry *Prunus fruticosa* Pall., Thorn *Prunus spinosa* L., dog rose *Rosa canina* L., hawthorn *Crataegus pseudokyrstostyla* Kud. Different types of deciduous forests of the Kaniv Mountains also change their appearance during the growing season: in winter, spring, summer they look different. In spring, the physiognomy of fresh hornbeam forests of the Kaniv Reserve is determined primarily by

Parthenocissus quinquefolia are added to the landscapes. These wood species are aspected by a wide range of colors from light yellow to reddish-brown. Aesthetically attractive is the change in the characteristics of the aspect from a uniform green to a colorful yellow, red.

In addition, the nature of the distribution of vegetation is manifested in the forest afforestation of the territory. Afforestation can both positively and negatively affect the landscape qualities of landscapes. Thus, the optimal values of forest cover are values in the range of 30-60%, according to some studies – 25-

Table 6. Abridged list of aspecting grassy species of the territory of Kaniv right-bank upland area

Latin name of the species	The growing season	Color of aspect
<i>Tragopogon ucrainicum</i>	blossoming: June-September	bright yellow
<i>Dianthus pseudosquarrosus</i>	blossoming: June-October	pale pink
<i>Verbascum phoeniceum</i>	blossoming: May-July	bright violet
<i>Centaurea borysthena</i>	blossoming: June-August	pink
<i>Genista tinctoria</i>	blossoming: June-July	yellow
<i>Euphorbia seguieriana</i> Neck.	blossoming: May-June, September-October	yellow, greenish-yellow
<i>Campanula persicifolia</i>	blossoming: June-September	violet-blue
<i>Thymus marschallianus</i>	blossoming: June-August	pale pink
<i>Dianthus membranaceus</i>	blossoming: June-October	bright pink, violet
<i>Helichrysum arenarium</i>	blossoming: July-September	yellow
<i>Galium verum</i>	blossoming: June-September	pale yellow, yellow
<i>Verbascum nigrum</i>	blossoming: June-October	bright yellow
<i>Hypericum perforatum</i>	blossoming: June-September	yellow
<i>Salvia pratensis</i>	blossoming: May-September	blue-violet
<i>Achillea millefolium</i>	blossoming: June-October	greenish-white
<i>Euphorbia cyparissias</i>	blossoming: May-June, September-October	yellowish, yellow-green
<i>Potentilla argentea</i>	blossoming: June-September	yellow
<i>Veronica spicata</i>	blossoming: May-August	bright cyan/blue, pink, violet/white
<i>Medicago falcata</i>	blossoming: June-August	yellow
<i>Trifolium pratense</i>	blossoming: May-September	pink, violet-pink
<i>Vicia cracca</i>	blossoming: May-October	light purple
<i>Lathyrus latifolius</i> L.	blossoming: June-August	bright pink to red
<i>Lotus ucrainicus</i>	blossoming: June-August	bright yellow
<i>Trifolium arvense</i>	blossoming: May-September	pale pink
<i>Trifolium repens</i>	blossoming: May-September	white, pale pink or pale yellow
<i>Melilotus officinalis</i>	blossoming: June-September	yellow, whitish-green
<i>Campanula patula</i>	blossoming: May-July	lilac
<i>Tanacetum vulgare</i>	blossoming: June-September	bright yellow
<i>Origanum vulgare</i>	blossoming: June-August	pink or dark-pink
<i>Scabiosa ochroleuca</i> L.	blossoming: May-September	pale yellow
<i>Falcaria vulgaris</i> Bernh.	blossoming: May-July	white
<i>Scilla bifolia</i>	blossoming: march-April	blue violet
<i>Melampyrum nemorosum</i>	blossoming: June-August	violet-orange
<i>Corydalis marschalliana</i>	blossoming: march-April	light-yellow or cream
<i>Corydalis cava</i>	blossoming: march-April	from white, cream to purple, purple-violet
<i>Galanthus nivalis</i>	blossoming: march-April	white and green
<i>Anemone nemorosa</i>	blossoming: April-May	white, pale pink
<i>Dentaria bulbifera</i>	blossoming: April-May	white, pale pink
<i>Aegopodium podagraria</i>	blossoming: June-July	white
<i>Galium odoratum</i>	blossoming: May	white
<i>Stellaria holostea</i>	blossoming: April-May	white
<i>Lathyrus vernus</i>	blossoming: April-May	purple, blue
<i>Geum urbanum</i>	blossoming: May-June	yellow
<i>Campanula trachelium</i>	blossoming: May-July	blue and violet
<i>Convallaria majalis</i>	blossoming: May	white
<i>Pulmonaria obscura</i>	blossoming: April-May	pink, violet or blue
<i>Viola mirabilis</i>	blossoming: April-June	violet, pale blue
<i>Allium ursinum</i>	blossoming: April-May	white
<i>Platanthera bifolia</i>	blossoming: June-July	white

Source: done by the authors based of the analytical capability of applied geobotanical studies

50% (Jaman, Pavlenko, 2010). With smaller or larger values of forest cover, the attractiveness of landscapes decreases, as the contrast of landscape changes decreases; with excessive forest cover values, the rate of landscape opening points in landscapes also decreases, even with positive morphometry.

vidual metrics for the landscapes of the studied area:

where, $k = 1.5-2.5$ – low-value landscapes, $k = 2.6-3.5$ – valuable landscapes, and $k = 3.6-5.0$ – high-value landscapes.

Conclusions. The study identified objective criteria for the aesthetic value of the landscapes of the right-

Table 7. Background and complementary aspect colors of plant species of the Kaniv Mountains

Season	Background color	Additional colors
winter	white, black, green	brown
spring	green, brown	white, pink, blue, violet, purple, lilac, cyan, cream, yellow, mauve
summer	green, light yellow, straw	white, pink, blue, violet, purple, lilac, cyan, cream, bright yellow, mauve, red, pale green
autumn	green, brown	yellow, orange, red, blue, purple, brown

Source: done by the authors based of the analytical capability of applied geobotanical studies

According to the calculations during the component analysis, the forest cover of the study area was 75.9%. This value of forest cover is excessive and, in some cases, could reduce the aesthetics of the landscapes of the Kaniv Mountains. However, taking into account the standard of hornbeam-oak forests of the Kaniv Nature Reserve, the natural landscapes of the territory, as well as the nature of the comparison of the relief with the silhouette of the forest canopy, this indicator is positive (Vedenin, Filipovich, 1975).

In determining the aesthetic value of landscapes according to the above objective criteria, it was argued that each of the criteria included in the assessment has an equivalent effect on the formation of landscape aesthetics (Eringis, Budryunas, 1975; Vedenin, Filipovich, 1975; Frolova, 1994; Buchko, 1997); Dirin, 2005; Kochurov, Buchatskaya, 2007; Jaman, Pavlenko, 2010). Thus, the sensitivity coefficients of the scores of each individual indicator were derived by bringing the values of the score to 1, the results of the calculations are presented in the Table 8.

The calculation of the integrated coefficient of aesthetic value k of the landscapes of the right-bank upland section of the Kaniv Nature Reserve is the sum of the values of the coefficients of sensitivity of indi-

bank upland section of the Kaniv Nature Reserve. As a result of the performed landscape-morphological analysis, morphometric analysis of the terrain, analysis of afforestation and analysis of aspecting plant species and seasonal changes of physiognomy of the territory, indicators of aesthetic value of Kaniv Mountains landscapes were calculated. The determined indicators formed the basis for further elucidation of the integral coefficient of aesthetic value of the landscapes of the studied area. The calculated integrated coefficient of aesthetic value showed that the studied landscapes belong to the category of aesthetically valuable ($k = 3.4$).

The method used to assess the aesthetic appeal of landscapes according to objective criteria is considered as the part of a comprehensive aesthetic assessment of the landscapes of the Kaniv Mountains. Comprehensive aesthetic evaluation should take into account a wider range of active factors that affect the subjective criteria for evaluating aesthetic qualities: expressiveness, beauty, contrast, depth, diversity and others. In particular, hydrological features, anthropogenic (cultural) transformations of landscapes. Identifying and evaluating objective factors of landscape beauty, based on the natural

Table 8. Integral coefficient of aesthetic value of the studied landscapes of Kaniv Nature Reserve

Indicator	Indicator value	Score	The coefficient of significance of the score
indicator of horizontal fragmentation of the surface, km/km ²	2.94	2	0,7
indicator of vertical fragmentation of the surface, m	175	2	0,7
forest cover, %	75.9	1	0,3
the magnitude of the predominant slopes of the surface, °	3°-12°	2	0,7
measure of Shannon's entropy of landscape diversity	-322.5	3	1
Integral coefficient of the aesthetic value of the landscapes, k			3.4

Source: done by the authors based of own studies of aesthetic value

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