SECTION 18.
GEOGRAPHY AND GEOLOGY

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LANDSCAPE REPRESENTATIVENESS OF THE RICHANSKE ZOOLOGICAL RESERVE (ZAKARPATTIA REGION)

Under the conditions of increasing anthropogenic pressure on natural landscapes, climate change, environmental degradation, and the fragmentation of ecological networks, the preservation of biodiversity and the maintenance of ecological balance within protected areas have gained particular importance. Zoological reserves, as a form of nature conservation, play a crucial role in safeguarding rare animal species and their habitats, while also serving as centers for sustainable environmental management. One such site is the Richanske Zoological Reserve, located within the mountainous system of the Ukrainian Carpathians, in the Bronka River basin of the Zakarpattia Region [1, 2, 5].

Given the considerable total area of the Richanske Zoological Reserve (2,408 he) the analysis and geoinformation processing of available medium-scale cartographic materials for the study region are insufficient for a comprehensive examination and substantiation of the landscape organization patterns within the reserve. Therefore, one of the primary objectives of our landscape-ecological research was the cartographic survey conducted in accordance with the methodology of landscape mapping for mountainous and foothill areas developed by H.P. Miller [3], combined with the application of modern geoinformation technologies. As a result of the mapping of geocomplexes and the analysis of the area's landscape organization, a high-quality large-scale landscape map was created at the tracts (landscape unit) level for a key area in the western isolated part of the Richanske Zoological Reserve, covering 440 hectares in the lower reaches of the

Bronka River basin. Based on this map, the landscape representativeness of each tract type was calculated (Table 1). This particular territory represents a micro-model of the current mid-mountain landscape structure of the Carpathian region and is distinguished by its morphological, expositional, and phytocoenotic diversity [4, 6].

Table 1

Landscape Representativeness of Tracts Types within the Key Area of the Richanske Zoological Reserve

№ Tracts	Name of the Landscape Tracts	Area, км^2	%
1	Convex Dome-Shaped Summits	12,5	2,8
2	Stepped and Steep Ridge Surfaces	17,1	3,9
3	Gentle and Slightly Sloping Ridge Surfaces	18,6	4,2
4	Saddle Surfaces on a Leveled Watershed Ridge	2,6	0,6
5	Steep Convex Surfaces of Ridge Spurs	32,2	7,3
6	Steep and Very Steep Convex Slopes of Northwestern and Northern Exposure	112,3	25,5
7	Very Steep and Steep Rubble Slopes of Northeastern Exposure	39,8	9,0
8	Steep Convex Slopes of Southwestern Exposure	7,0	1,6
9	Very Steep and Steep Undulating Slopes of Western Exposure	63,7	14,5
10	Deeply Incised Catchment Funnels of Northern and Northwestern Exposure	82,4	18,7
11	Slightly Incised Catchment Funnels of Northeastern Exposure	11,9	2,7
12	Slightly Incised Catchment Funnels of Southwestern and Western Exposure	13,8	3,1
13	Narrow V-Shaped Valleys of Permanent Watercourses (Gullies)	15,9	3,6
14	Leveled Terraced Floors of River Valleys	10,7	2,4
	Total	440,5	100,0

[Author's own development]

As a result of the cartographic survey conducted within the key area of the Richanske Zoological Reserve, 14 main types of landscape tracts were identified, forming the structural framework of the landscape mosaic. These units differ in morphological features (landform shape, aspect, and slope gradient), geological substrate, soil types, moisture conditions, and vegetation characteristics. A dominant role is played by tracts located on slopes of varying exposure and steepness, which together account for more than 60 % of the study area. The largest proportion belongs to the category of steep and very steep convex slopes with northwestern and northern exposure (112,3 hectares), representing approximately 25,5 % of the

surveyed territory. These slopes are characterized by high steepness, susceptibility to erosion processes, and a distinctive vegetation structure dominated by shade-tolerant species such as beech, spruce, and fir, growing on gravelly brown soils. Their dominance in the landscape structure is determined by the specific geographic location of the Richanske Reserve, situated primarily on the left bank of the Bronka River basin, which flows westward.

The second most widespread type of tracts within the key study area of the Richanske Reserve consists of deeply incised catchment funnels with northern and northwestern exposure, occupying an area of 82,4 hectares (18,7 %). These tracts perform an important hydrological function: they accumulate surface and subsurface runoff, feed local watercourses, and influence both the microclimate and the phytocoenotic structure of the surrounding units.

Within the key study area of the Richanske Zoological Reserve, a substantial portion is also occupied by very steep and steep undulating slopes of western exposure (63,7 hectares, 14,5 %). These tracts are characterized by active erosion-accumulation processes and a mosaic soil structure. Due to the variability of the microrelief, this area exhibits alternating microforms such as small erosion features, landslide scarps, and moisture-accumulating zones, which contribute to high biotic diversity. These tracts were formed as a result of the deep incision of the perennial watercourses Kurta and Mykytivskyi into the spurs of the ridge bearing the same name, which led to its dissection and the fragmentation of tracts exposure patterns.

The morphological and denudational features of the ridge zone within the Richanske Zoological Reserve are reflected in the presence of gentle and slightly sloping ridge surfaces (18,6 hectares), convex dome-shaped summits (12,5 hectares), and stepped, steep ridge surfaces (17,1 hectares), primarily oriented in the northwestern and western directions within the key study area. Although these tracts occupy relatively limited areas, they possess significant structural importance as watershed zones.

The tracts of saddle surfaces (2,6 hectares) and the leveled, terraced valley floors (10,7 hectares) are distinguished by favorable moisture conditions and the accumulation of deluvial and alluvial deposits. These areas are home to meadow-forest complexes that include elements of secondary clay meadows, hygrophilous forests, and young tree stands. They play an important role in terms of ecosystem services, such as moisture retention, biofiltration, and the regulation of surface water runoff.

Conclusions. Thus, a key feature of the mapped area is its high degree of landscape mosaicism, resulting from the combination of steep and very steep slopes, catchment funnels, landslide scarps, and fragmented ridge elements. This structural

configuration promotes the formation of diverse tracts types even within a relatively small area. A total of 14 tracts types were identified within the 440-hectare key area, which reflects the overall complex internal morphological organization of the Richanske Zoological Reserve's territory.

From a landscape-representative perspective, the key area is typical of the western part of the mid-mountain erosion-denudation low-mountain region of Zakarpattia Region. It reflects the characteristic features of the corresponding physical-geographical zone: a dense erosion network, asymmetric slopes, a complex hydrographic system, and a mosaic of forest and meadow ecosystems. The predominant geosystems are natural territorial complexes with a high degree of preservation, which is largely attributable to the protected status of the Richanske Zoological Reserve, limited anthropogenic interference, and complex terrain conditions. Therefore, the cartographic survey of the key area not only enabled a detailed representation of the current landscape structure, but also provided a foundation for the typological classification of NTCs and the subsequent assessment of their geoecological state.

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