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Anthropogenic modification of the landscapes of the Skole Beskids (Ukrainian Carpathians)

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SUMMARY

Using landscape maps and satellite images, the anthropogenic load on natural territorial complexes was analyzed and the degree of their anthropogenic modification was assessed using the methodology of scoring scales. The main types of anthropogenic pressure on the territory of the Skole Beskids are distributed as follows: forestry covers 81.5% of its area, which is associated with minor or rapidly changing, meadow farming - 15.2% and settlement - 3.3%. In general, this is a physiographic region of the Ukrainian Carpathians that has been little changed by human activity. The average value of anthropogenic modification is 128.6 points and indicates that it is characterized by the second stage of weak anthropogenic modification. The anthropogenic load of the plane character is analyzed in detail and the anthropogenic modification of the Dobzhansky landscape is calculated.

Introduction

Human economic activity in the Skole Beskids is characterized by considerable diversity. Forestry (silviculture) is the most developed here, with agriculture (cattle grazing and arable farming) taking place in much smaller areas, and localized settlement development, road construction and maintenance. Accordingly, there are grounds to distinguish several types of anthropogenic pressure, which can be subdivided into subtypes: forestry (subtypes are associated with the division of forests into different economic groups, a separate subtype is formed by log cabins); grassland management (subtypes are the exploitation of mountain secondary meadows, hayfields and pastures), agriculture; construction and operation of unpaved roads; construction and operation of residential buildings (settlement), economic facilities, paved roads (subtypes are the construction and operation of rural development, urban development, paved roads and railways).

Each type and subtype of anthropogenic load causes changes in natural territorial complexes, which are manifested in the form of land. From the point of view of anthropogenic landscape science, these lands are considered as anthropogenic landscapes, and from the standpoint of the doctrine of anthropogenic modifications of natural territorial complexes, land is anthropogenic modifications. Since there are several land areas in the majors of natural territorial complexes (especially of higher ranks), i.e. several types of anthropogenic modifications, an integral assessment of its anthropogenic modification is relevant.

Theory and Method

This study is based on the theoretical provisions of mountain landscape science, according to which the main object of study of mountainous areas is mountain landscapes and their morphological units - high-altitude areas, strata, tracts and facies *(Miller et al., 2002).* The object of our study was the natural territorial complexes of the landscape and high-altitude terrain rank. Landscape studies of the anthropogenic load on natural territorial complexes are based on the doctrine of anthropogenic modifications of protected areas, which in Ukraine were actively developed by G. P. Miller, A. V. Melnyk *(Melnyk, Miller, 1993),* E. A. Ivanova *(Ivanov, 2017)* and others. According to this doctrine, a person cannot create new landscape complexes by his/her activities, but can only change, transform, and modify the existing PAs. At the same time, anthropogenic modification of PAs is considered as a state that arose under the influence of anthropogenic loads and reflects the degree, a certain stage of their transformation by humans. The concept of anthropogenic modifications of protected areas is based on the following concepts anthropogenic impact - a specific human action that causes changes in the structure and functioning of protected areas (plowing, grazing); anthropogenic load - a set of consistent human actions aimed at meeting certain human needs (agriculture, forestry); anthropogenic changes - changes in the structure, functioning and dynamics of PAs related directly or indirectly to the action of an anthropogenic factor, anthropogenic dynamics - changes in landscape complexes caused by anthropogenic impacts, anthropogenic state - a state that has arisen under the influence of an anthropogenic factor *(Melnyk, 1999).*

The initial basis for the analysis of anthropogenic modification of landscapes and altitudes of the Skole Beskids were the landscape map of scale: 50,000 at the level of altitudes, compiled by Miller G. P. *(Miller et al., 2002)* a landscape map at a scale of 1:50,000 at the level of altitudes *(Burianyk, Melnyk, 2016)*, a map of the physical and geographical zoning of the region *(Burianyk, Melnyk, 2016)*, and a map of anthropogenic loads based on the analysis of topographic maps and satellite images, which reflected three main types of anthropogenic loads - forestry, meadow farming and settlement, i.e. three main categories of land were taken into account, namely forested areas, areas covered with meadow vegetation and buildings. The final map was created in ArcGIS software using 1:50,000 scale topographic maps and 20*20 m resolution satellite imagery. The experience of using ArcGIS software to create a variety of applied maps is highlighted in the works of O. Burianyk,

M. Karabiniuk, Z. Hostiuk *(Burianyk et al., 2021; Karabiniuk et al., 2020; Leta et al., 2023*). Based on the calculations of land areas, anthropogenic modification of landscapes was determined in terms of conventional points. A more detailed study of anthropogenic loads, and, accordingly, anthropogenic modification of high-altitude areas, was conducted in five model landscapes using high-resolution satellite images. We used 5*5 meter resolution satellite images for 2021, which were obtained from the SASPlanet program. Based on the satellite images, a layer was created that reflected the main types of land use in the model landscapes and areas, on the basis of which absolute and relative indicators of the areas of certain types and subtypes of anthropogenic loads were calculated. The following categories of land were identified in the mapping process: forest vegetation (trees and shrubs), meadow vegetation, log cabins, arable land, unpaved roads (dirt roads and tracks), buildings, and paved roads.

Examples

The main types of anthropogenic pressure on the territory of the Skole Beskids are distributed as follows: forestry covers 81.5% of its area, with minor or rapidly changing conditions, meadow farming - 15.2% and settlement - 3.3%. In general, this is a physiographic region of the Ukrainian Carpathians that has been little changed by human activity. The average value of anthropogenic modification is 128.6 points out of 200 possible and indicates that it is characterized by the second stage of weak anthropogenic modification.

The Dobzhansky landscape has the highest anthropogenic load, and, accordingly, the most modified one (Fig. 1), since here, in addition to the land typical for the Skole Beskids, a significant area is occupied by arable land, buildings and paved roads. Therefore, for example, let us consider in more detail the features of its anthropogenic modification (Table 1).

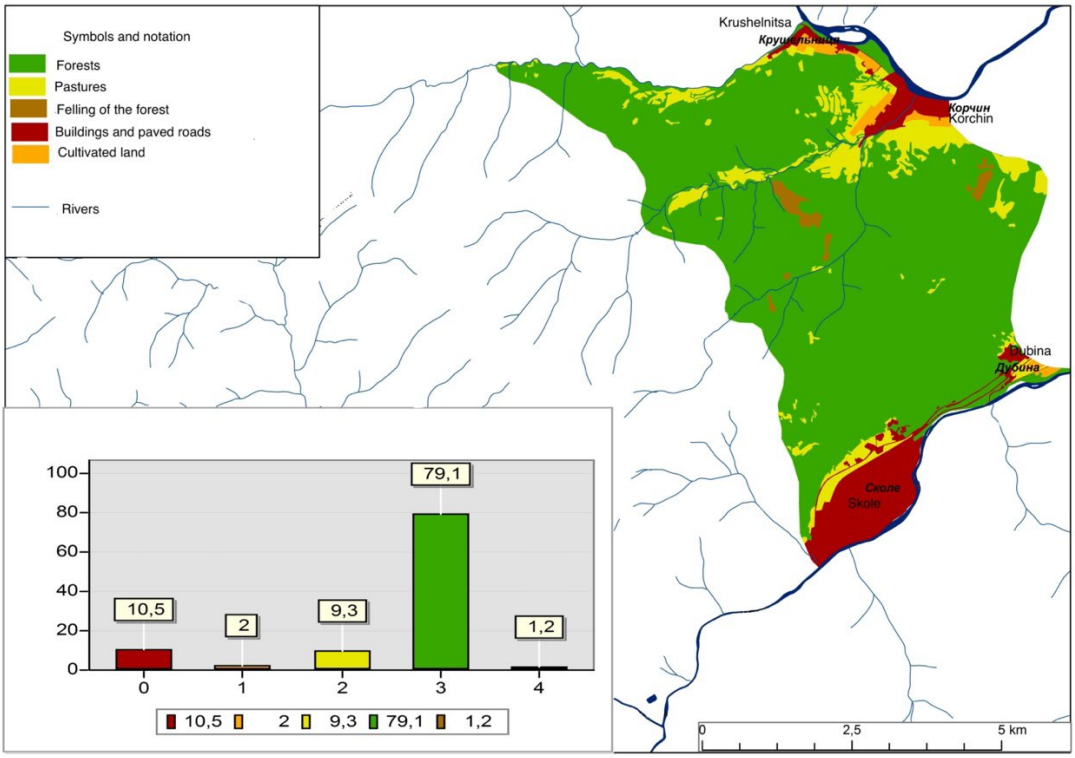

Figure 1 *Land use structure of the Dobzhansky landscape*

Table 1 *Anthropogenic modification of the Dobzhansky landscape (in terms of points)*

Type and subtype of anthropogenic modification		Land and other property	Land area, km²	Evaluation of the modification	
				%	in terms of points
Biotic	А	Forests of group I	1524, 3	40,3	32,1
	Б	Forests of group II	1398, 8	38,5	29,3
	В	Felling	42,9	1,2	1,2
Bio-microclimatic	А	Mountain secondary meadows	172,7	4,7	12,1
	Б	Hayfields and pastures	170,8	4,5	11,9
Bio-soil-microclim		Cultivated land	52,1	2,0	6
Bio-soil-water-microclimatic		Farm paths and runs	-	-	-
Bio-summer-soil-water-microclimatic	А	Village developmen	135,8	2,5	20,7
	Б	City development	136,2	5,6	35,8
	В	Paved roads and railways	62,3	1,2	7,5
General modification	Total		3695, 9	100	156,6

The analysis of types and subtypes of anthropogenic modification in the Dobzhansky landscape showed that the largest area is occupied by the biotic type of modification (80% of the total landscape area) of subtype A, i.e., the main share is occupied by forests of the first category. The bio-microclimatic type of modification occupies 9.3% of the landscape and is represented almost equally by subtypes A and B (mountain secondary meadows, hayfields and pastures). The bio-soil-microclimatic type of modification covers a small area of 1.4% of the landscape and is represented by one subtype A (arable land). The bio-soil-water-microclimatic type of modification is absent in this landscape. A significant proportion of the Dobzhansky landscape is characterized by bio-summer-soil-water-microclimatic modification, which occupies 9%, dominated by two subtypes A and B, i.e. urban and rural development.

Conclusions

The results showed that in all landscapes of the Skole Beskids the share of forest land is the highest and amounts to more than 69%. Therefore, forestry activities are the main factor in shaping the environmental situation in the region. It has led to the presence of large areas of log cabins, which in some landscapes occupy 10% of the landscape area. The second most widespread anthropogenic factor is meadow farming - meadows occupy up to 24% of the landscape area. Areas with meadow vegetation are used for pasture and haymaking. The anthropogenic load associated with agriculture and development occupies the smallest areas and amount to 2.6% and 10%, respectively. The analysis of the specifics of economic activity in terms of altitude showed that the most developed altitude is

the terraced bottoms of intermountain valleys, where most settlements are located and a dense network of dirt and asphalt roads is laid. The least developed area is the steeply sloping erosion-denudation forested midlands, where forestry prevails.

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