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APPLICATION OF PHYSICAL-GEOGRAPHICAL MAPPING TO CREATING A DATA BASE FOR THE ENVIRONMENT OF PROTECTED AREAS OF THE LITTLE PIENINY MTS.

Abstract: The paper presents the formation of the data base for the natural environment of the relevant area on the basis of a complex physical-geographical mapping. The data will be a basis to determine various aspects of the environment condition of the 4 nature reserves together with their surroundings

Key words: physical-geographical mapping, uroczysko unit, protected area, nature reserve.

Introduction

The results of physical-geographical mapping in the form of maps of geocomplex types of various level, on a rather detailed scale, together with a versatile characteristics of both types, are commonly considered to be a good base for rational management of the natural environment (Bratkowski 1986, Sołowiej 1987).

The typical physical-geographical mapping, i.e. mapping of geocomplexes, is exceptionally useful on areas with the greatest natural-landscape diversification. It is not possible to distinguish a landscape matrix on such areas, especially in a detailed scale, which excludes the application of the R. T. T. Forman and M. Godron (1986) model "matrix-patches-corridors".

Study area

One of such strongly diversified areas is the Polish part of the Little Pieniny Mts. (Fig.1) with four nature reserves established in 1961-63 (the Homole gorge, the Wysokie Skałki (High Rocks), Zaskalskie-Bodnarówka, the Biała Woda valley) of which the last one is composed of four parts. The reserves are considered to be

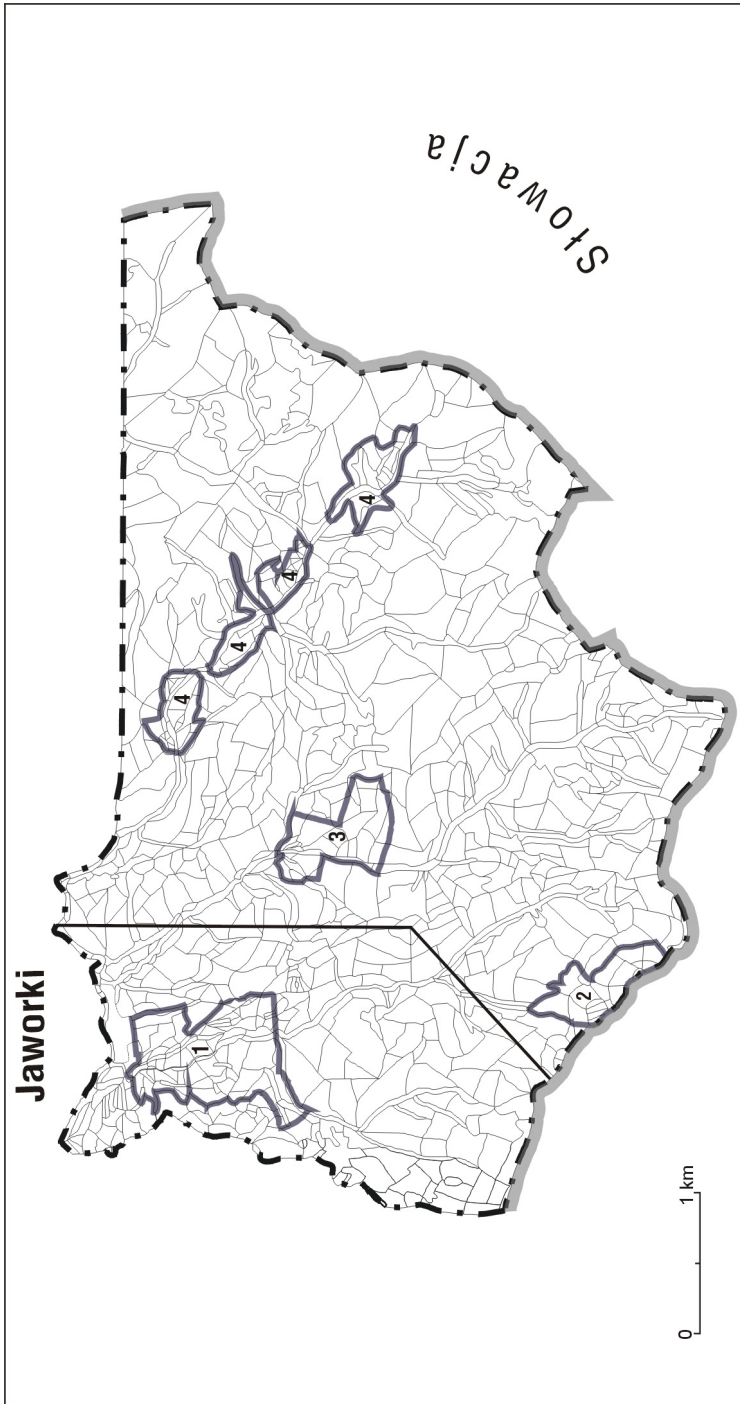


Fig. 1 The research area; eastern part of the northern slope of the Little Pieniny Mts. together with the adjoining fragment of the Sądecki Beskid Mts. in its NE corner. Against the borders of 919 uroczysko units nature reserves are shown: 1 – the Homole gorge, 2 – the Wysokie Skalki (High Rocks), 3 – Zaskalkie-Bodnarówka, 4 – the Biała Woda valley, and the line of the profile from Fig. 2

Ryc. 1. Obszar badań: wschodnia część północnego skłonu Małych Pienin wraz z przyległym fragmentem Beskidu Sądeckiego w rogu północno-wschodnim. Na tle granic 919 uroczysk zarysowano rezerwaty przyrody: 1 – Wąwóz Homole, 2 – Wysokie Skalki, 3 – Zaskalkie-Bodnarówka, 4 – Biała Woda, oraz linię profilu z ryc. 2.

the most unique in the Polish Carpathians. Their surroundings - the northern slope of the border ridge of the Little Pieniny Mts. has preserved, due to among other things, the post-war depopulation its exceptional natural-landscape values. They form the basis for the already worked out (Witkowska-Wawer 1996), though not implemented, concept of the Landscape Park of the Little Pieniny Mts.

Aim and method

The aim of the paper is to point out the usefulness of complex physical-geographical mapping for creating a data base for the environment of protected areas of the Little Pieniny Mts., as a necessary means for the management of these areas and for a further development of various forms of nature protection as well. The basis was created over 2001-2002 in the framework of the master thesis presented below.

The mentioned reserves, constituting small protected areas, are functionally associated with the surroundings. The complex knowledge of relationships between them and their surroundings should contribute to the protection of the mentioned values of the northern slope of the Little Pieniny Mts. Therefore, the main aim of the master thesis by R. Pipała (2002), carried out under the tutorship of W. Ziaja, was a comparison of the structure and functioning of the environment of the reserves relative to their surroundings as well as the assessment of anthropopressure agents affecting the reserves.

On account of the small area of the reserves the scale 1: 10 000 was adopted to geocomplexes of the level of uroczysko units chosen as basic research fields applied to the creation of an environmental data basis.

The eastern part of the northern slope of the Pieniny Mts. was surveyed in the summer of 2001 (together with the adjacent small fragment of the Beskid Sądecki Mts.) covered all the mentioned reserves with their surroundings, starting with the valley bottom of Grajcarek, a tributary of the Dunajec (540 m a.s.l.) up to the border ridge with the highest peak of the Pieniny Mts. – Wysokie Skalki (High Rocks) (1,050 m a.s.l.). The physical-geographical mapping was carried out in the field by applying the Z. Czeppe and K. German method (1978), designating. The location of each geocomplex and drawing its boundaries on to the map (Fig.1), and then entering into an appropriate form the information about the features of all the elements of the natural environment (except for the animals). The original form of the adopted method was modified to record, in greater detail, human activity in a given uroczysko. In according to the adopted method before field studies the required thematic maps were collected or carried out. All other accessible materials were also studied, including the published ones, pertaining to either the elements or of the natural environment at whole as well as human activity in the relevant area. Inventory-making of waste dumps by using the M. Kuczek form (1987) was also performed.

According to the adopted method (Czeppe, German, 1978) the form of each uroczysko includes information on the geographical location, altitude and relative height, slope, exposure, bedrock (kind, dip, age, resistance), Quaternary covers (origin, thickness, profile, permeability), soils (type, subtype, species, agricultural usefulness),

relief (landform, age, microrelief, present-day geomorphological processes), waters (depth of groundwater level, outflows of ground waters, surface waters), climatic conditions (climate vertical zone, mesoclimate type, sunshine duration), land use, forests (percentage share of trees, species composition of the tree storey, undergrowth and ground flora, habitat type of the forest), human activity and trends in development of an uroczysko.

Results

Over an area of 12,86 sq.km (in perpendicular projection) 919 uroczyskos were surveyed. Their typology was carried out by grouping them according to the similarity of component features and relationships between them. The criterion for combining the uroczysko units in types is the similarity of the units terms of origin, geology, landform, morphometric features as well as the trend in development and the internal facies structure (German 1979). Considering the location of the prevailing part of the investigated territory beyond the flysch Carpathians in the Pieniny Klippen Belt, the rules of typology adopted by J. Balon (1991) for the Tatra Mts. were used according to which the surveyed uroczysko units were grouped into types according to: bedrocks, Quarternary covers (showing also their origin), landforms, and the slope inclination. Among the given criteria the greatest importance was attached to relief features, first of all to morphometry which decides about the intensity of the dynamics of slope uroczysko units (inclination) and which also differentiates the systems of river terraces and of top flattenings (heights). Considering the kind of bedrock two types of uroczysko units were separated; those developed on the flysch of the Outer Carpathians and those originated on the carbonate bedrock of the Pieniny Klippen Belt. Equally essential were the landforms and water conditions features smaller valleys: V-shaped incisions with permanent streams and of periodically drained dells as well as flat-bottomed waterlogged tielkes and of dry accumulation valleys. According to these criteria 35 types of uroczysko units were distinguish in that 17 slope-type, 6 valley-type, 2 terrace-type, 2 types of erosional flattenings and 8 other types of uroczysko units.

The vegetation was a criterion for distinguish of the subtypes of forest and forestless uroczysko units.

For each of the uroczysko units mesoclimatic affiliation was determined following the L. Kostrakiewicz classification (1979, 1982). The features of soils were soil-agricultural map 1: 5,000 (also for areas covered by forest). Although the features of mesoclimate and soils do not constitute typological criteria each type of the uroczysko is marked by its specific mesoclimatic and soil characteristic since they are dependent on other elements of the environment.

The types and subtypes of the uroczysko units were characterized by a description and in tables. The territorial differentiation of their structure and functioning was shown in maps, statistically analysed and illustrated. Special attention was paid to the manifestations of anthropopressure in the natural environment of the study area, in particular of the nature reserves, in that to the vanishing traces of the former

agriculture (from before the displacement of the Lemko population in 1947) as well as to the results of present-day forest and pastoral economy, and of tourism. Detailed structure and functioning of the reserves against a background of the surroundings was presented.

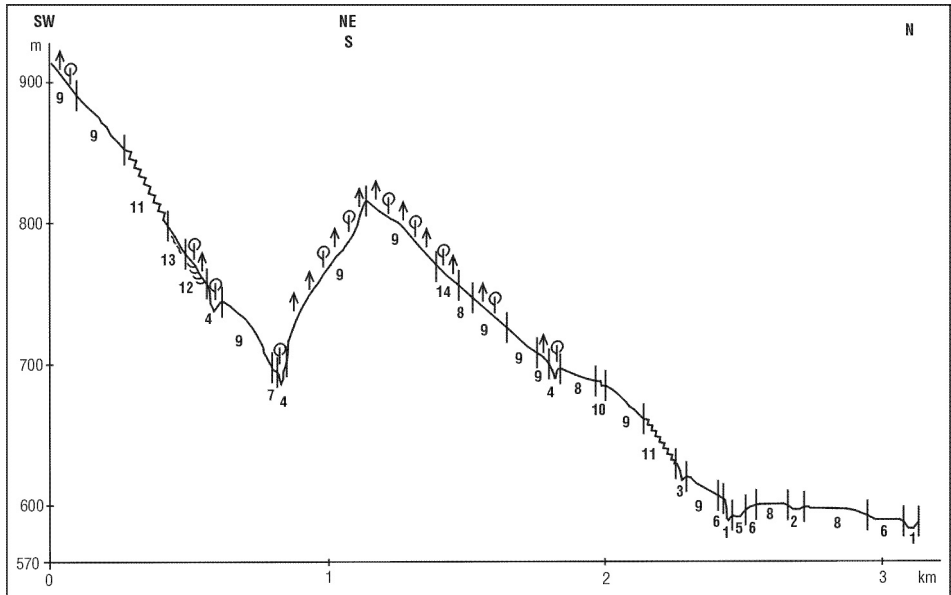


Fig.2. Catena or the sequence of the types of uroczysko units from the Biała Woda valley bottom up to the border ridge of the Little Pieniny Mts., along the line of hypsometric profile drawn in Fig. 1

Ryc. 2. Katena, czyli następstwo typów uroczysk od dna doliny Białej Wody po graniczny grzbiet Małych Pienin, wzdłuż linii profilu hipsometrycznego zaznaczonej na Ryc. 1

Explanations:

The type of uroczyskos (all on the bedrock of the Pieniny klippen belt): 1 - river and stream beds, 2 - tielkes, 3 - dells, 4 - V-shaped valleys, 5 - road cuts, 6 - Pleistocene river terraces 7-25m high, 7 - Holocene river terraces 1-4,5 m, 8 - smooth waste-mantle slopes inclined 3-10°, 9 - smooth waste-mantle slopes inclined 10-25°, 10 - terraced waste-mantle slopes inclined 3-10°, 11 - terraced waste-mantle slopes inclined 10-25°, 12 - landslide slopes inclined up to 45°. 13 - creeping slopes inclined up to 35°, 14 - rounded ridge culminations. Subtypes of forest uroczysko units marked by tree signatures.

Objaśnienia:

Typy uroczysk (wszystkie na podłożu pienińskiego pasa skałkowego): 1 - łożysk rzek i potoków, 2 - wądołów, 3 - debrzy, 4 - dolin wciosowych, 5 - holwegów, 6 - rzecznych teras plejstocenijskich o wysokości 7-25 m, 7 - rzecznych teras holocenijskich o wysokości 1-4,5 m, 8 - gładkich stoków zwietrzelinowych, nachylonych 3-10°, 9 - gładkich stoków zwietrzelinowych, nachylonych 10-25°, 10 - sterasowanych stoków zwietrzelinowych, nachylonych 3-10°, 11 - sterasowanych stoków zwietrzelinowych, nachylonych 10-25°, 12 - stoków osuwiskowych, nachylonych do 45°, 13 - stoków zżaziskowych, nachylonych do 35°, 14 - zaokrąglonych kulminacji grzbietowych. Podtypy uroczysk leśnych zaznaczono sygnaturami drzew.

For reasons of limited space of the article it is not possible to give even a summary characteristic of the types of the uroczysko. Fig. 1 presents only the borders of the uroczysko units, which makes it possible to note the diversification of their surface and shapes. The position of the fourteen out of thirty five types of the uroczysko units was shown in Fig.2, in a characteristic catena of the research area, reaching from the valley floor of the Biała Woda stream up to the border range of the Little Pieniny Mts.

Summary and conclusions

Study area reveals a high complexity of the structure of the natural environment, first of all owing to the differentiation of the bedrock, the relief, and land use.

The most important features of the structure of the research area are: very small average area of an uroczysko (1.4 ha), high diversification of the uroczysko area (from 0.04 to 16 ha), high diversification of the number of the uroczyskos in a type (from 1 to 295, 26.2 on average), high area diversification of uroczysko types (from 0.0097 to 5,6544 sq. km), the domination of uroczysko and types of uroczysko situated on slopes, the domination of 9 types of uroczysko with smooth, waste-mantle slopes of medium inclination (10-15 degrees) developed on the bedrock of the Pieniny Klippen Belt, both in terms of the number (32.1%) and of surface (43.9%), a high correlation between the area of an uroczysko and the number of uroczysko units in a type.

As far as functional issue is concerned there dominate transportation types of uroczysko units, this due to the prevalence of slope uroczysko units situated between the input and output geocomplexes.

The predominance of slope uroczysko units brings about that among morphogenetic processes there dominate denudational ones (chiefly slopewash, physical weathering and falling away from rock walls).

In the types of uroczysko the subtype of forestless uroczysko occurs more frequently than that of forest ones, which points to a higher differentiation of the structure of the natural environment of the forestless areas. It is a specific feature of the study area that more resistant rocks more often build the bedrock of forestless uroczysko while less resistant ones - of forest uroczysko. In the subtype of forestless uroczysko a higher variety of landforms is found than in the subtype of forest uroczysko.

The main factors of environmental anthropopressure of the relevant area are forestry, pastoral economy and tourism. As a result of the stoppage of agricultural use 117 uroczysko units were afforested, thus increasing by 31.7% the surface of the forests since 1947. The effect of that change is a steady, mosaic arrangement of forest and forestless uroczyskos (meadow-pasture ones). The area is relatively clean. Waste dumps are to be found only in 3 uroczysko units. Along the tourist tracks some littering, usually of scattered character, used to take place.

Out of the four nature reserves the most liable to anthropopressure is the Homole Gorge (motor air pollution due chiefly to mass tourism, noise, trampling of the grass, faecal pollution) and the Biała Woda valley (water pollution by the road running along the valley bottom as well as other hazards to be observed in the Homole Gorge). The reserve of the Wysokie Skałki (High Rocks) is chiefly threatened by tourists

(trampling) and by sheep grazing along the northern border, while Zaskalskie-Bodnańka by the use of the stream as a way for timber removal (hydrocarbon pollution which is toxic for water organisms, mechanical damage of the river bed, plants and soils).

In the nature reserves the area of the uroczysko units is nearly twice lesser (on average 0.66 ha) as compared with the whole study area, which points to an exceptional diversification of the natural environment of the reserves. The secondary plant succession observed in the whole study area is the fastest in the reserves grazed long before their establishment, i.e. the Biała Woda or the Homole gorge (Fig. 3). This results in overgrowing of meadow-pastures habitats by forest, which can involve the impoverishment of rare species the flora.

The results of the research contain a large amount of systematized and easily accessible information on the state of the natural environment in protected areas and on the whole eastern part of the northern slope of the Little Pieniny Mts. They can be applied to various purposes, both theoretical and practical. They can be useful in the future because they characterize the state of the natural environment and human activity in it (also landscape condition) in 2001, thus enabling comparative studies in the development of “man-environment” relationships, which would facilitate taking decisions on further protective measures in that unique area.



Fig. 3 The lower part of the nature reserve Homole gorge – overgrowing, chiefly by spruce and juniper of the former pastures, since the establishment of the reserve in 1963.

Ryc. 3. Dolna część rezerwatu przyrody Wąwóz Homole – zarastanie, głównie świerkiem i jałowcem dawnych pastwisk, od założenia rezerwatu przyrody w 1963 r.

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Wykorzystanie kartowania fizycznogeograficznego w tworzeniu bazy danych o środowisku obszarów chronionych Małych Pienin

Streszczenie

Celem artykułu jest wykazanie przydatności kompleksowego kartowania fizycznogeograficznego do tworzenia bazy danych o środowisku obszarów chronionych Małych Pienin. Taką bazę danych utworzono dla wschodniej części północnego skłonu tych gór, obejmującej cztery rezerваты przyrody i stanowiącej część projektowanego Parku Krajobrazowego Małych Pienin, w celu zbadania struktury i funkcjonowania środowiska rezerwatów przyrody na tle ich otoczenia. W 2001 r. przeprowadzono

terenowe kartowanie 919 uroczysk, które następnie zgrupowano w 34 typy. Wydzielono też podtypy uroczysk leśnych i bezleśnych. Obszar badań wykazuje dużą złożoność struktury środowiska przyrodniczego. Jej najważniejszymi cechami są: bardzo mała powierzchnia średnia uroczyska (1,4 ha), duże zróżnicowanie powierzchniowe uroczysk (od 0,04 do 16 ha), duże zróżnicowanie liczby uroczysk w typie (od 1 do 295, średnio 26,2), duże zróżnicowanie powierzchniowe typów uroczysk (od 0,0097 do 5,6544 km²), dominacja uroczysk i typów uroczysk położonych na stokach. Głównymi czynnikami antropopresji na środowisko badanego obszar są leśnictwo, pasterstwo i turystyka. W wyniku zaprzestania użytkowania rolnego 117 uroczysk uległo zalesieniu powiększając o 31,7% powierzchnię lasów od 1947 r. Spośród czterech rezerwatów przyrody najbardziej narażone na antropopresję są dwa – Wąwóz Homole i Biała Woda. W rezerwatach przyrody jest ponad dwukrotnie mniejsza powierzchnia średnia uroczyska niż w całym obszarze badań, co świadczy o wyjątkowo dużym zróżnicowaniu ich środowiska przyrodniczego. Zgromadzone wyniki badań zawierają wielką ilość usystematyzowanej i łatwo dostępnej informacji. Mogą one być wykorzystywane w różnych celach, teoretycznych i praktycznych, np. do studiów porównawczych lub zarządzania obszarami chronionymi.

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