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**LAND COVER FORMS IN SLOVAKIA IDENTIFIED BY
APPLICATION OF COLOUR INFRARED SPACE PHOTOGRAPHS
AT THE SCALE 1:500 000**

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The aim of the paper is to document the structure of land cover forms in Slovakia identified by application of 35 colour infrared space photographs taken with the KFA camera to the original scale of 1:275 000, which were completed by the LANDSAT images.

Land cover is determined by significant appearance attributes of landscape objects, manifested in space photos by means of characteristic patterns (acceptably homogeneous) which are formed by at least two textures. The authors defined and identified 22 mapping categories (patterns) and present them in the interpretation scheme at the scale 1:500 000. The land cover patterns identified from an environmental point of view and documented the present landscape structure as a reflection of natural, social, economic and political conditions of the Slovak territory.

1 INTRODUCTION

Correct information on land cover (landscape physiognomy) is repeatedly a significant input for spatial decision and planning. Geographers are interested in it particularly in the context with broader time – spatial connections, namely from the aspect of recognizing spatial structure and organizing the cultural landscape [4,5,6,7,8].

Recognition of landscape spatial structure means identification of its elements (objects) both from the viewpoint of their vertical (synergic) relations and from that of identifying their location on the earth surface in the context with their horizontal interactions. In this sense we may evaluate the spatial structure and its changes from the ecological, or environmental aspects.

To understand the spatial organization of the cultural landscape it is necessary, besides to identify the object locations, to recognize also their wider functional interactions. After obtaining this information we are able to proceed to the evaluation of the spatial organization of the cultural landscape also from the economic viewpoint.

Both the recognition and evaluation of landscape structure from the environmental aspect mean above all exactly identifying its human (cultural) layer, which is represented and materialized just in patterns of the land cover. With respect to the used working as well as the source of primary information, aim of the paper was mainly delimiting the physiognomic forms of the landscape, or the land cover, identification of which is the basic condition for recognition of land use (in the sense of T.M.Burley, 1961) and environmental evaluation too.

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By the concept of *land cover forms* (landscape physiognomy) we understand significant appearance characteristics of landscape objects, manifesting themselves in space images and photographs (for instance, space colour infrared photographs) by means of the characteristic patterns (acceptably homogeneous for the competent scale) which are formed at least by two textures (Fig. 1).

The aim of the paper is to document the structure of land cover forms in Slovakia identified by application of colour infrared space photographs, and to present the obtained results by means of an interpretation scheme at the scale 1:500 000 (see the inset).

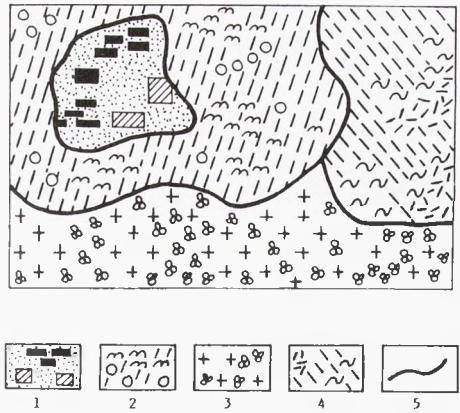


Fig. 1. Land cover forms of hypothetical landscape. 1, 2, 3, 4 – the pattern types, 5 – the pattern boundary.

2 DATA AND INTERPRETATION

In the work 35 colour infrared space photographs – slides taken with the KFA 1000 camera at the original scales 1:200 000 and 1:275 000 have been applied. The original scale and size of the photographs 30x30 cm were adjusted at the Geodetic and Cartographic Enterprise in Prague to the scale 1:500 000. Some colour infrared photographs missing, or as the case may be made at increased occurrence of the clouds were substituted by the LANDSAT images. The interpretation was made with the use of the Interpretoskop C. A component of identification of land cover forms was definition (logical construction) of the mapping categories – patterns. In defining them three basic spatial categories, namely nodes, networks and surfaces as well as their arrangement and mutual relationships in context with their contents were taken into consideration, where the contents resulted from the conception of the investigation concerning the land use of a cultural landscape in the sense of the basic categories, namely settlements and technicized elements, agricultural land, vegetation, water and barren land. The delimited acceptably homogeneous areas have been compared in the sense of the legend of the interpretation scheme with the existing maps: basic maps at the scale 1:50 000, the Types Present – day Landscape at the scale 1:500 000, the Ground Plane Types of Settlements at the scale 1:1 000 000 and others from the Atlas of the SSR [1] (Atlas of the Slovak Republic). The questionable areas were identified on the basis of the results of field mapping. The individual interpretation schemes were redrawn into the basal map of the Atlas SSR [1] at the scale 1:500 000. River network, component of the cited map that was also drawn on the interpretation schemes, was taken as a basis for the identification of the content of these interpretation schemes with the map. Through both the classification and delimitation proper of mappable patterns of land cover we have already preferred their physiognomic manifestation which in the sense of delimitation of the basic categories of patterns is based on A. Coleman's methodology (1969). At the same time the classification scheme respects also the environmental aspect in context in order to comprise various degrees of influence intensity and impact of man's activities on the landscape.



1.1



3.2.2



1.2



4.1



2.1



4.2



2.2.1



4.3



2.2.2



5.1



2.3



5.2



3.1.1.1



5.3



3.1.1.2



5.4



3.1.1.3



5.5



3.1.1.4



3.1.1.5



3.2.1.1



3.2.1.2

Fig. 2. The generalized manifestation of land cover forms – patterns. Interpretation scheme of land cover forms in Slovakia. (The inset outside the textual part).

3 CHARACTERISTICS OF IDENTIFIED LAND COVER FORMS

Emphasis has been laid on the delimitation of land cover forms. Spatial and spectral resolution of colour infrared space photographs at the scale 1:500 000 allows to identify especially the dominant physiognomic characteristics of landscape imaged on these types of photographs by specific patterns. We can emphasize that the identified patterns are characteristic for the given scale and the type of photographs obtained during vegetation period. Supposing a correct delimitation and objectively existing land cover forms was made, they ought to be identifiable also through patterns formed by respective acceptable homogeneous textures, which are dominant for another state or other determinant stage of their forms.

Figure 2 shows the generalized manifestation of land cover forms of Slovakia, which are formed at least by two textures.

In the sense of the above mentioned technique we created the following legend of the interpretation scheme:

1. Urban and technicized landscape
 - 1.1. Predominantly residential areas
 - 1.2. Areas of production (industrial works), areas of raw material exploitation and transport areas
2. Rural landscape with dispersed and temporary settlements
 - 2.1. Predominantly areas of recreation with dominancy of grassland with expressive of forest and scattered greenery
 - 2.2. Predominantly agricultural areas
 - 2.2.1. Areas with dominancy arable land with less expressive presence of grassland and scattered greenery
 - 2.2.2. Areas of the grassland, arable land and forest
 - 2.3. Mixed areas with dominancy of forest, with less expressive presence of grassland and arable land
3. Agricultural landscape
 - 3.1. Agricultural landscape predominantly with concentrated rural settlements
 - 3.1.1. Areas with dominancy of arable land
 - 3.1.1.1. Arable land of large plots with presence of scattered greenery to 5%
 - 3.1.1.2. Arable land of middle large plots with presence of scattered greenery above 5%
 - 3.1.1.3. Arable land with the less expressive of grassland and forest
 - 3.1.1.4. Areas with dominancy of arable land and numerous presence of swamps
 - 3.1.1.5. Areas with dominancy of arable land with numerous presence of rivers lakes (old branches)
 - 3.2. Agricultural landscape predominantly without settlements
 - 3.2.1. Areas with dominancy of grassland
 - 3.2.1.1. Grassland with no expressive presence of scattered greenery and forest
 - 3.2.1.2. Grassland with no expressive presence of arable land and scattered greenery
 - 3.2.2. Areas with predominance of large areas of orchards and vineyards
 4. Agricultural–forest landscape (predominantly without settlements)
 - 4.1. Areas without expressive dominancy of forest, grassland and arable land
 - 4.2. Areas with line forms of alluvial forests and presence of arable land and grassland
 - 4.3. Areas with dominancy of forest and with numerous presence of grassland
 5. Forest and barren landscape (predominantly without settlements)
 - 5.1. Areas of forest
 - 5.2. Areas of dwarf–pine
 - 5.3. Areas of subalpine and alpine grassland
 - 5.4. Areas of peat bogs
 - 5.5. Areas of rocks and klippen

Urban settlement – technicized landscape

Its physiognomic manifestation is determined by built-up areas of urban settlements and communication network. It is a land cover form with the highest concentration of man's activities and functions. As a geographical object it is connected with settlement functions. We differentiate them in another classification scale according to two basic, in their physiognomy apparently significant, attributes, namely into residential and production areas.

Rural landscape with dispersed and temporary settlements

There is a dispersed settlement here (recreational facilities and agricultural farms) giving a specific character to this landscape type. The dispersed settlements at this differentiating level create a dense network of nodes which split the areal categories of arable land, grasslands and vegetation into the characteristic mosaic of patterns. Their character which definitely is conditioned usually by the manner of utilization is more closely specified just by dominance of areal categories.

Agricultural landscape

From physiognomic point of view it is characterized by a spatial structure of arable land, grasslands, orchards and vineyards as well as by a nodal structure of concentrated rural settlements. It is a type of land cover with lower intensity of man's impact on nature layer of the landscape (with an expressive bioproduction function). We delimitate types of patterns of lower hierarchic degrees by presence and spatial dimension of the basic categories and their spatial arrangement.

Agricultural – forest landscape

It creates a transitive (marginal) type of in the context of land cover intensity. Spatial forms of the agricultural land alternate with spatial and linear forms of forests, swamps, scattered greeneries and with spatial and linear forms of waters. The physiognomic manifestation of the mapped patterns on the lower hierarchic degrees are determined by a spatial dimension and by an arrangement of the above mentioned basic categories.

Forest, grassland and barren landscape

The physiognomic manifestation of this land cover (or unused land) is determined by natural formation of forests, grasslands, shrubberies and rocks. It is a type of landscape in which natural attributes are concentrated expressively. Both the shape and size of the areas, as well as the intensity of utilization are corresponding, namely with the terrain landscape conditions.

4 CONCLUSION

Obtained results about the land cover forms of Slovakia are presented by the interpretation scheme at the scale 1:500 000. The land cover patterns are identified from an environmental point

of view. They are documented by the present landscape structure of humanized landscape as a reflection of natural, social, economic and political conditions of the Slovak territory. The information, which is being presented in this way, can be used as a suitable foundation for the solution of problems connected with spatial organization of cultural landscape.

5 REFERENCES

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FYZIOGNOMICKÉ FORMY VYUŽITIA KRAJINY SLOVENSKA V MIERKE 1:500 000 IDENTIFIKOVANÉ APLIKÁCIOU SPEKTROZONÁLNYCH KOZMICKÝCH SNÍMOK

Korektné informácie o aktuálnom využívaní krajiny, resp. fyziognomických formách krajiny (*land use/land cover*) sú jedným zo základných vstupov priestorového rozhodovania a plánovania. Formy land cover diferencujú priestorovú štruktúru kultúrnej krajiny a ich poznanie je dôležité najmä z hľadiska širších časovo-priestorových súvislostí. V tomto kontexte možno získať veľmi cenné informácie interpretáciou údajov diaľkového prieskumu Zeme. Pri zostavení interpretačnej schémy fyziognomických foriem využitia krajiny Slovenska v mierke 1:500 000 sa využili spektrozónálne kozmické snímky.

Cieľom práce bolo dokumentovať štruktúru súčasného využitia krajiny Slovenska, charakterizovanú prostredníctvom jej fyziognomických foriem. Formy land cover určujú signifikantné vzhľadové znaky objektov krajiny, prejavujúce sa na snímkach charakteristickými vzorkami – patternami (akceptovateľne homogénnymi), ktoré sú tvorené najmenej dvoma textúrami (obr. 1).

Informácie o výskyte a plošnom rozsahu fyziognomických foriem krajiny boli získané analógovou interpretáciou 35 spektrozónálnych kozmických snímok - pozitívov na transparentnej podložke, urobených komorou KFA - 1000, v originálnych mierkach 1:200 000 a 1:275 000, upravených v Zememeračskom ústave v Prahe do mierky 1:500 000. Chýbajúce spektrozónálne snímky, prípadne snímky so zvýšeným výskytom oblačnosti sa nahradili snímkami družice LANDSAT. Analógová interpretácia vychádzala z analýzy homogénnych vzoriek - patternov fyziognomických foriem krajiny, na snímkach tvorených akceptovateľne homogénnymi textúrami. Súčasťou identifikácie fyziognomických foriem bolo definovanie patternov. Pri definovaní sa rešpektovali 3 základné priestorové kategórie: uzly, siete, povrchy a ich usporiadanie a vzájomný pomer v kontexte s obsahovou náplňou, vyplývajúcou z konvencie výskumu využitia kultúrnej krajiny v zmysle základných kategórií: sídla a technizované prvky, poľnohospodárske kultúry, vegetácia, voda a na povrch vystupujúci skalný podklad. Vyčlenené akceptovateľne homogénne areály boli v zmysle legendy interpretačnej schémy porovnávané s existujúcimi základnými mapami v mierke 1:50 000. Mapou súčasných typov krajiny v mierke 1:500 000, Mapou pôdorysov sídel v mierke 1:1 000 000. Sporné plochy boli určené na základe výsledkov terénneho mapovania.

Výsledkom uvedených operácií je interpretačná schéma obsahujúca 22 delimitovaných a hierarchizovaných fyziognomických foriem využitia krajiny Slovenska v mierke 1:500 000. Schéma rešpek-

tuje nielen konvencie geografického výskumu, ale aj environmentálny aspekt v kontexte postihnúť stupňa premeny prírodnej krajiny a intenzity vplyvu človeka a jeho aktivít na krajinu. Takto prezentované informácie môžu byť vhodným podkladom jednak pre experimentálne práce spojené s aplikáciou texturálnej analýzy foriem súčasného využitia krajiny na báze multispektrálnych kozmických obrazových záznamov, ako aj pre riešenie problémov spojených s priestorovou organizáciou kultúrnej krajiny.

Obr. 1. Fyziognomické formy hypotetickej krajiny. 1, 2, 3, 4 - typy patternov, 5 - hranice patternov.

Obr. 2. Zovšeobecnenie prejavu fyziognomických foriem krajiny - patternov.

Príloha - Interpretačná schéma foriem využitia krajiny Slovenska.