COMPLEX SITE ANALYSIS AND SYNTHESIS ON A GEOGRAPHICAL SITE AS A METHOD IN THE GEOECOLOGICAL RESEARCH

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Abstract: *The article deals with a complex site analysis and synthesis on a survey (geographical) site as an essential exact method of the geoecological landscape research. The research is realised on the representative points-tesseras, which should have been spread on charakteristic lines. The research gives a catalogue of individuals. On the basis of their common signs, they are put into the types. These research points must be choosen, so that they could be enough representative; they should include different forms of georelief, soil subtypes etc. On this survey (geographical) site, physicogeographical differential and complex analysis is realised and then synthesis. This method is very laborious, demanding on time on material and financial costs, but brings objective results.*

Key words: *geoecological research, complex site analysis, complex site synthesis, tessera*

INTRODUCTION

Currently in topic and choric dimension, one of the most often used methods in the geoecological research is **a complex site analysis** on a survey (geographical) site with a **synthesis** as a follow-up. In the topic dimension, Barch et al. (1988) suggest to use such complex site analysis which divides the landscape on the vertical profile into ‘all possible elements’. The emphasis is put on the elements with the most information about the complex. They especially include the highly integrating partial complexes (soil form, soil moisture mode) with the georelief as a guiding factor for many processes. The climate and the geological composition are highly integrating processes, too. These surveys are realized on representative sites – tesseras located on typical lines. The survey provides us with a catalogue of individuals, which are categorized into so called vertical types – geoforms. The area of a geoform is a geomer. Several equal geomers create a geotop (ecotop). The tessera is the base for various analyses, syntheses, tessera typification, and extrapolation from a tessera to an area.

EXAMPLE OF THE METHOD

Scholz et al. (1979) paper shows an example of the complex site analysis and synthesis usage in the topic dimension. The methodology consists of the following stages:

- **Geotopological differential analysis** – at this stage, the available material about the landscape components is assessed (geological, geomorphological, pedological, hydrological, climatic and botanic) and complemented by the field survey. As a result, we gain the characteristic attributes of the landscape components (e.g. geo-

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relief elements and forms, substrate character), series of attribute thematic maps and charts (results of the measurement).

- **Geotopological complex analysis** – firstly, by the field observation we determine the mosaic of the sites (with the help of the geotopological differential analysis results). The representative sites supply us with the attribute combinations of the landscape components. This allows us to comprehend components' mutual relations and their activities. The lined-up sites have to intersect the typical sites in order to set the geocomplexes bounds exactly.
- **Geotopological synthesis** – the complex geotopological analysis helps organizing the attribute combinations of geocomplexes. Based on this, it is possible to define their homogeneous areas – geotops (ecotops).

MODIFICATION OF THE METHOD

Čech (2003) slightly modifies this method by not using the special terminology – from the geotop through the nanochora, microchora, etc. However, on each taxonomic level, he marks the defined units as physical–geographical complexes (of the corresponding level). He distinguishes three basic stages:

Lead-in stage:

Obtaining, studying, extraction and processing the maps and other basic documents (published and non-published) which deal with the studied area. It is important to have already mastered the theoretical and methodological knowledge about the studied area.

Consulting with various specialists, visiting science and other institutions. Information provided from the literature in the public libraries might be insufficient, it is necessary to fill up on it from archives and libraries at relevant science institutions, state and private organizations or private persons.

This stage also includes making first maps and drafts from existing maps as an important tool for the field research. The typical maps at this stage are a geological map, a geomorphological map with basic forms (valleys, saddles, etc.), a hypsometric map, a map of relative altitudes, a map of real slope inclination, a hydro-geological map, a map of surface water and springs, a map of soil types, a map of potential vegetation, etc. We can also draw a map of spatial structure of physical-geographical complexes by layering the analytical maps (geological, geomorphological, soil, potential natural vegetation).This draft map contains many problematic areas whose joining to a complex or separation to an individual complex depends on the field survey. A suitable way of completing the information about each area is the chart form. The draft maps are the base for the field survey when they are completed, refined and corrected. A preliminary physical–geographical typification can be carried out at this stage; however, the final cartographical outcome is done at the last final stage.

Preparing the material and tools (e.g. a spade, a pedological drill, a compass, a hypsometer, GPS, a notebook, a laser telemeter, a camera, HCl solution, etc.) for the field survey. The field mapping is often done in these map scales: 1:5000, 1:10 000, 1:25 000.

The field research. The georelief is one of the most significant factors influencing the spatial structures of physical–geographical units. Therefore, it is likely that the geomorphological survey is carried out at first. The attention should be focused on mapping the basic mezzo and micro georelief forms. The draft maps are completed and corrected (e.g. springs locations, real vegetation, anthropological objects, rock components in quarries).

THE STAGE OF THE GEOECOLOGICAL FIELD SURVEY

The methodology of the geoecological field survey. The main method is the complex site analysis on a research site (geographical site, tessera). To make these sites as representative as possible, we use the information from the draft maps of physical – geographical complexes, typification, the georelief map and other basic documents. If there are any problematic areas, the sites are densified in order to get the highest possible homogeneity. The georelief forms are often an important factor for placing the sites. There are usually more sites on one form of georelief. To analyze the components on a site we should create a form of inventory reports of the sites (chart 1). For each physical–geographical component there exist some questions to which answers offer real characteristics. The content of the inventory reports is determined by the assumed content of the physical–geographical map, tools, the length of the research, etc. Some characteristics are possible to be completed before the field survey starts, e.g. a general categorization of the studied area into regions (e.g. reference to a hydrogeological structure or a type of potential vegetation). The main issue is the choice of those representative characteristics which are possible to be followed on every site in the whole area.

An inventory report of a representative site	
The number of a representative site:	Date: Time: Author:
Location: Cadastre:	Particular location:
Geomorphologic classification:	Unit: .
(Mazúr-Lukniš 1986)	Subunit: Part
Lithosphere	
Geological classification:	
Rock type :	Rock subtype:
Rock color:	Rock age:
Georelief	
Altitude: Inclination:	Exposition:
Genetic form:	
Geometric form:	
Mantle rock type:	
Geomorphologic processes:	
Atmosphere	
Climatic area (Atlas krajiny 2002):	
Climatic district (Atlas krajiny 2002):	
Climatic-geographic classification (Atlas SSR 1980):	
Annual precipitation: January temperature:	July temperature:
Unfavorable climatic influences on the site:	
Position of the area to the unfavorable influences:	
Micro- and topic climate: .	

Hydrosphere
Drainage:
Hydro geologic unit:
Hydro geologic structure:
Permeability type:
Momentary depth of the underground water level:
Momentary depth of the surface water level:
Natural surface drainage: .
Natural underground drainage:
Floods: Flow/strength:
Pedosphere
Soil surface covered:
Soil group:
Soil type: Soil subtype:
Soil variety:
Physiological depth of soil:
Depth of A horizon:
Horizon identification:
Characteristics according to the horizons (color, structure, moisture, consistence, soil skeleton, granularity, root system density, reaction to 10% HCL solution, etc.):
Biological activity:
Phytosphere
Phyto geografic zone (Atlas SSR 1980):
Phyto geografic sub zone (Atlas SSR 1980):
Potential natural vegetation:
Real vegetation:
Physiognomic form: .
Ecological form:
Dominant type: Vitality of the dominant type:
Stage identification:
Canopy thickness (stage E3):
Thickness (stage E2, E1):
Health condition (all stages):
Age of the wood species (stage E3, or E2):
Variety of sorts (all stages):
Anthropogenic change of vegetation:
Physiognomic -variety structure of the forest crop:
Exploitation of the forest crop:
Renewal of the forest crop:
Wood species damage (agent and volume of the damage):
Zoosphere
Biotop:
Type of found animal:
Locating the animal:
Site of the animal:
Stadium of animal's evolution:
Group:

Anthrop sphere
Found anthropologic object:
Location of the nearest anthropologic object:
Found anthropologic influence/intensity of the influence:
Area protection level:
Category and name of the protected area: .

Chart 1 An inventory report of a representative site form (Čech, 2003)

FINAL STAGE:

The synthesis of the obtained information at the research sites and processing of the text and the map part. The inventory report of the research sites provides us with the valuable information on the landscape zone components. The final stage adds the missing spatial dimension and we create the individual homogenous spatial physical–geographical complexes of the geotop (ecotop) character (IHSPGC). The areas of these complexes are defined on the basis of data analysis obtained by the field survey on the sites and from other documents. The borders are determined according to the significant changes in the main differentiation actor – mostly georelief, soil types or their combination. In many cases, the neighboring representative sites have the same characteristics (e.g. when located on the different parts of the same slope). This means that they belong to the area of one IHSPGC, or by generalization, they have become a part of one IHSPGC. Therefore, one representative site need not be one IHSPGC. For a better overview, it is possible to create the inventory reports with combined and unified data from each representative site. We group the physical–geographical complexes on the basis on their mutual signs into the types of the homogenous spatial physical-geographical complexes (THSPGC). These types can be put into several taxonomic levels. The last section is the composition of the text and the map part (Programs CorelDraw, ArcView, etc.).

CONCLUSION

The complex physical-geographical landscape survey in topic dimension, together with the complex site analysis and synthesis on a geographical site, is a financially and physically demanding, time-consuming process; nevertheless, it guarantees obtaining relevant and objective information about physical-geographical landscape as a whole and its spatial differentiation.

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References
BARSCH, H., BILLWITZ, K., REUTER, B. (1988): Einführung in die Landschaftsökologie. Potsdam (PH).
ČECH, V. (2003): Fyzickogeografická analýza a regionalizácia krajiny centrálnej časti pohoria Galmus a priľahlej časti Hornádskej kotliny. Dizertačná práca: KgaG FHPV PU Prešov, 350 p.
SCHOLZ, D., SCHOLZ, E., KIND, C., BARSCH, H. (1979): Geographische Aarbeitsmethoden. Gotha (Hermann Haack).

KOMPLEXNÁ STANOVIŠTNÁ ANALÝZA A SYNTÉZA NA GEOGRAFICKOM BODE AKO METÓDA GEOEKOLOGICKéHO VÝSKUMU

Zhrnutie

V súčasnosti jedna z najpoužívanejších metód geoekologického výskumu v topickej a chorickej dimenzii je tzv. komplexná stanovištná analýza na výskumnom (geografickom) bode a následná syntéza. Barch et al. (1988) v rámci topickej dimenzie navrhuje použitie komplexnej stanovištnej analýzy, ktorá si vyžaduje krajinu na vertikálnom profile rozložiť do „všetkých možných prvkov“, pričom je potrebné položiť dôraz na tie prvky, ktoré majú o celkovom komplexe najväčšiu výpoveď. Sú to najmä vysoko integračné čiastkové komplexy (pôdna forma, vlhkostný režim pôdy), ku ktorým pristupuje georeliéf ako riadiaci faktor pre mnohé procesy. Doplňujúce, hoci vysoko integračné sú aj klíma a geologická stavba. Tieto výskumy sa vykonávajú na reprezentačných bodoch - tesserách, ktoré majú byť rozložené na charakteristických líniách. Výskumom sa získa katalóg indivíduí, ktoré sa podľa rovnakých znakov zaraďujú do typov, nazývaných aj vertikálnymi typmi a označujú sa ako geoformy. Areál geoformy je geomer. Areály viacerých rovnakých geomerov tvoria geotop (ekotop). Tessera (výskumný bod) je základom pre rôzne analýzy, komplexné analýzy, syntézy, typizáciu tessier, extrapoláciu z tessery do priestoru, atď.

Príkladom použitia postupu komplexnej stanovištnej analýzy a syntézy v topickej dimenzii je práca Scholza et al. (1979). Metodika spočíva v týchto troch krokoch:

- Geotopologická diferenciálna analýza - v tomto kroku sa vyhodnotia dostupné materiály o krajinných zložkách územia (geologické, geomorfologické, pedologické, hydrologické, klimatické, botanické, resp. lesnícke) a doplnia terénnym výskumom. Výsledkom sú charakteristiky znakov jednotlivých krajinných zložiek (napr. prvky a formy georeliéfu, charakter substrátu, atď.), série tématických máp znakov a tabuľky (výsledky meraní).
- Geotopologická komplexná analýza - v prvom kroku sa observačným spôsobom stanovuje mozaika stanovíšť v skúmanom území (na základe výsledkov geotopologickej diferenciálnej analýzy). Cieľom je na reprezentačných bodoch stanovišťa zistiť kombinácie znakov krajinných zložiek, čo dovolí pochopiť systém ich vzájomných vzťahov a ich spoločné pôsobenie. Body musia byť zoradené na líniách, ktoré pretínajú typické miesta stanovišťa, aby bolo možné presne vyhraničiť geokomplexy.

- Geotopologická syntéza - komplexná geotopologická analýza dovoľuje usporiadať znakové kombinácie geokomplexov, na základe ktorého sa môžu stanoviť ich homogénne areály - geotopy (ekotopy).

Príkladom použitia tejto metódy s určitou modifikáciou je práca Čecha (2003). Autor nepoužíva špeciálne názvoslovie - od geotopu cez nanochory, mikrochory a pod., ale na každom taxonomickom stupni vyčlenené jednotky označuje ako fyzickogeografické komplexy (príslušného rádu).

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