ACTA GEOGRAPHICA UNIVERSITATIS COMENIANAE No. 49, 2006, pp. 9-17

TO LANDSCAPE ECOLOGICAL RESEARCH OF SELECTED FEATURES IN CULTURAL LANDSCAPE

Martin Balej

Department of Geography, Institute of Science, J. E. Purkinje University, Ústí nad Labem, Czech Republic

Abstract: The author explains basic principles of the project, which is responding to a state, when is missing an integrated methodological procedure, which would supported decision making sphere to optimally decide about development of region with respect to natural and social potential and landscape carrying capacity. In sequence, definitions of biotic, ecological, social, cultural and legislative limits territorial development, natural and social potential territory and landscape carrying capacity are principal objectives of the project (theoretic part). Important output of the project will be standardized methodical procedure, which will be point to finding an optimum socioeconomic development of locations, with regard to social needs (demands) and requirements from sustainable development point of view (practical part).

Key words: Cultural landscape, geography reserch, regional development

1. LANDSCAPE ECOLOGY AND GEOGRAPHY

Even though I know of dozens of definitions of landscape, I still prefer Ernst Neef's opinion that landscape cannot be precisely defined, landscape is the fundamental axiom, landscape exists and the only thesis to state is that landscape is the result of natural evolution, the customs and thinking of the population, and the organisation and existence of society. The undying dynamics of landscape and many stochastic landscape creating processes do not allow this total character of an area to be grasped in a scientific manner, but only allow us to constantly draw near to it. Analogously, neither Míchal nor his "neighbours" can recognise "their elephant" (Míchal, 1993).

The origins of landscape ecology can be seen in the transition from vegetation geography to ecological examination of the landscape. The use of aerial photography was the cause for the change. The term 'landscape ecology' was first used, as widely known, in Carl Troll's paper Luftbildplan und ökologische Bodenforschung. Landscape ecology is a closely related geographical science discipline known in the Czech language as landscape science, and called geo-ecology on the international level by Carl Troll (only

for the purpose of making the English translation easier) (Demek, 1999). Many scientific papers mention the dichotomy in approaches to landscape ecology: the geosystemic (simply speaking, the Central European and Eastern European traditions, especially the German, Slovak, Polish, and Russian schools) and the ecosystemic (the Anglo-American school). Many scientists, however, understand it as a component discipline of modern ecology (Naveh, Lieberman, 1994).

The characteristic trait of the Central-Eastern European concept is the existence of a centralised, integral, comprehensive discipline within physical geography which is represented by complex physical geography, often termed differently in literature, e.g. landscape science, geosystems science, physical geography proper, and geographical landscape ecology (Mosimann, 1999). More Central European authors prefer the shorter term geo-ecology (Billwitz, Kondracki, Richling, Leser, Mičian). As concerns instruction, geo-ecology has been taught in Germany for over ten years, and landscape ecology is taught as part of biology or physical geography (Bastian, Steinhardt, 2002). Also, one cannot help noticing that the potential character of geography as a science correlates with the central topics of landscape ecology as defined by Mosimann (1999).

The Italian biologist (ornithologist)/ecologist Ingegnoli advocates a thesis that landscape ecology can be titled a „new science of ecology" or a "pioneering ecological approach" (Farina, 1997). Analogously, Ingegnoli is convinced, like Sanderson and Harris (Ingegnoli, 2002, Sanderson and Harris, 2000), that landscape ecology is not a new discipline but rather a chapter of general ecology, successful on a typical spatial level, but also very important thanks to its ability to direct the entire science of ecology towards a truly unified discipline with extensive applications. Therefore, in his monograph, Ingegnoli continues with chapters called Towards Extending the Basics, Towards a Unified Ecology, and a sub-chapter, The Basis for a More Unified Discipline (meaning ecology). He speaks of the landscape as a system of eco-coenotopes, a true biological system. Thus, landscape ecology must be understood as a discipline similar to medicine, founded in biology but trans-disciplinary (not in a Jantschian sense). Indeed, if the landscape is a biological level, then the physiology of ecology/pathology is a relationship allowing for clinical diagnosis of the landscape with an ensuing correct case history. Nonetheless, landscape ecology needs developing not as a simple prognostic science but as a prescriptive one – just like medicine. Ingegnoli quotes 'ecotissue' as a supporting pillar on which a unified ecology must be built ("Ecology or ecologies?"). He places great emphasis on the landscape and integrates the three fundamental spatial dimensions (local – regional – global) (Ingegnoli, 2002). Landscape ecology shows that many conventional ecological definitions and principles (population, secondary succession, climax, etc.) are too limited or not applicable to complex systems, and that space and form can affect many ecological processes. He thus changes many conventional ecological principles, aiming at unifying ecology. Representatives of the ecosystemic approach (though they dislike such classification) thus admit that a real and complete integration of natural and human eco-coenotopes is only possible on the landscape level. That is why the principal exponent, R. T. T. Forman, speaks in his monographs of interconnecting the ecology of landscapes, the ecology of regions, and the total human ecosystem, not failing to include anthropogenous or technogenous elements (Forman, 2003, 1990, Forman, Godron, 1993).

The differences in approaches to landscape ecology in various countries of the world stem from their histories and traditions. The considerable variability in European landscape ecology is also contributed to by the large number of national IALE societies

and the weak co-operation (only the Landscape Tomorrow Project may be mentioned); American landscape ecology is, generally speaking, one stream of thought as it is one strong national culture and a strong ecological tradition.

The survey by Bastian and Steinhardt is very inventive in this field, identifying the spatial differentiation of opinions on the general character of landscape ecology as a science. Only 5 % of respondents (286 experts on theoretical as well as applied landscape ecology world-wide) had difficulties placing it within a graph whose orthogonal co-ordinate system had the transition from geography to biology (ecology) on the vertical axis, and the transition from a basic science to an applied science on the horizontal axis. The respondents were asked to mark the position of landscape ecology. Seventy per cent of the respondents supported the inter-disciplinary approach, 19 % wished for more axes than the biology/ecology and geography. The majority of US respondents understood the inter-disciplinarity as using e.g. GIS, etc. It is interesting that a mere 4 % of the US respondents required co-operation with social scientists, whereas it was 25 % in the UK and 35 % in the German respondents. Many argued for multi-disciplinarity rather than inter- or trans-disciplinarity. The reason for that remains unclear, though. Articles in Landscape Ecology were also analysed, and their majority topic orientation was identified as follows: habitat fragmentation, support for biological diversity, resource management, and sustainable development (Bastian, Steinhardt (eds.), 2002).

Jantsch distinguishes between two general groups of approaches: the scientific, based more or less on scientific disciplines (mono-, multi-, pluri- and cross-disciplinarity), and the meta-scientific, based on disciplines overlapping in their objects (inter- and trans-disciplinarity). Multi-disciplinarity is present in landscape ecology, including pluri-disciplinarity and covering a certain degree of mono-disciplinarity, but so far lacking a common goal, aim and co-ordination. Cross-disciplinarity has spread widely, but is not usually entitled as such. It is, in fact, related to the roots of landscape ecology in geography and ecology, having at the same time different traditions in the Central European (or Eastern European as the case may be) and the Anglo-American areas (even though such a division has a very strong 'ecotone' as well as effect). Inter-disciplinarity, unfortunately, only occurs rarely, with trans-disciplinarity being present only exceptionally so far. They are both, however, widely requested and discussed. Leser and Finke consider landscape ecology an inter-disciplinary discipline of geography, ecology and biology, being pressed by its inclusion of many disciplines, but not being pressed by their common goals, aims and co-ordination; as the inclination towards the ecosystemic approach prevails in landscape ecology, though, it is of a cross-disciplinary character rather than inter-disciplinary (Bastian, Steinhardt, 2002).

Trans-disciplinary landscape ecology calls for the integration of all the elements of the geosphere, including the biosphere and human-made elements comprising the noosphere and technosphere (or anthroposphere). A holistic research of the landscape, be it by geographers or ecologists, calls for an approach that will bridge the conventional scientific approaches to trans-disciplinarity and systems theory. That is what can nowadays be called 'globalisation of scientific disciplines', meaning reducing the imaginary distances between scientific theories, all the more valid for their applications. In landscape ecology, where the application dimension is very strong (and can even be called the motive), this 'globalisation' is projected most markedly. Some say that landscape ecology needs both approaches – the meta-scientific approach brings in the

theoretical basis from the other disciplines to help build up and transcend, while the scientific approach is needed with regard to its higher level of complexity.

2. GEOGRAPHIC PROJECTS IN THE CZECH REPUBLIC

When monitoring the scientific activity in geography, one must cope with the fact that the database that is maintained in the Czech Republic is not very suitable for our aims. Research plans as well as individual geographic projects can be found in a number of departmental groups. Along with the central group 'Terrestrial Magnetism, Geodesy, Geography', more or less geography oriented projects occur in another eight groups. Three of them can be classified under physical geography (Hydrology and Limnology; Geology and Mineralogy; Atmosphere Sciences and Meteorology), another three are close to social-economic geography complemented with regional development (Economy; Sociology and Demographics; Urban, Regional and Transport Planning), while the remaining two areas deal with environmental topics seen more or less generally (Health Impacts of the Environment; Protection of Landscape Areas). This more than schizophrenic situation may actually be an advantage as it allows for registering projects close to geography in more areas, thus increasing their chance of admission and implementation. On the other hand, though, it contributes to reducing 'geographic powers' and weakens the unique, crucial aspect of geography: its potential to integrate, to 'build bridges' between component geographic disciplines.

What then, is the standing of geography as a discipline? How many research plans and projects are being worked on, on what topics, how financially demanding are they and who funds them most often? Who takes part in their implementation, which places and/or individual researchers are successful? Are there areas in research that can be defined as prominent rather than peripheral? It was these questions that were the background of our effort to excerpt the Central Project Register (CPR) database, accessible from the website of the Czech Government's Research and Development Council and part of the Research and Development Information System maintaining information on research and development projects funded from public budgets in accordance with Act no. 130/2002, on Public Funding of Research and Development. The database has been maintained and administered by the Research and Development Council since 1993.

The first group under assessment consists of currently handled research plans (1999 – 2004) involved in geography. Sixteen projects of varied focus were identified in the quoted disciplines. Two complex research plans are being dealt with by geographers, or geographic research institutes (Charles University in Prague, University of Ostrava), while geographers are taking part in another one (J. E. Purkyne University in Usti nad Labem). The other projects are very specialised. Over 300 further projects were included in the selection, one third of which are classified in the area of Economics; further ranks, of more or less identical numbers, fall under the primary groups of Terrestrial Magnetism, Geodesy, Geography; Hydrology and Limnology; Protection of Landscape Areas. The total costs of these projects exceed 1,400 million CZK, averaging approx. 4.7 million CZK per project. Most funds are directed towards the groups Health Impacts of the Environment and Protection of Landscape Areas. The most financially demanding

projects are found here (averaging 28.5 million CZK in the first group). The share of government subsidies in the projects' total budgets is also exceptional in this group, being in the region of 80 %. The standing of 'conventional geography' is below average compared with the other disciplines. The geographic projects are less financially demanding, they appear in various disciplinary groups, focusing mostly on either physical or social geography, and their frequency is below the average for the other scientific disciplines.

As concerns the beneficiaries of the projects classified in the above selected disciplinary areas, a dominance can be observed in the TGM Water Management Research Institute and Hydro-Dynamics Institute of the Czech Academy of Sciences (8 and 6 projects respectively), the Charles University Biology Faculty and the Geonics Institute of the Czech Academy of Sciences (16 and 7 projects respectively), the Atmospheric Physics Institute of the Czech Academy of Sciences (9 projects), the University of Economics (42 projects) and the Nature and Landscape Protection Agency (4 projects). Unfortunately, the number of researchers in the geographic CPR projects is not high at all; identical names re-appear instead, keeping the potential of geography as a discipline integrating the natural and social elements of landscape at various spatial levels (global to local) underused concerning CPR projects.

3. PROJECT BY THE CZECH MINISTRY OF LABOUR AND SOCIAL AFFAIRS

An example of a geographical CPR project handled by a geographical research institute is the project by the Czech Ministry of Labour and Social Affairs (MLSA) entitled Methodology for Evaluating the Environmental and Social Connections of the Economy Transition: the Theory and Application (hereafter referred to as the Project), won by the Geography Department of Institute of Science in Usti nad Labem. The Project belongs to a group of large projects registered in the CPR database, being also a long-term project, and to be run in 2004 – 2008 (five years).

In line with the above described theoretical position of geography as a science examining the landscape in a geosystemic manner, the Project includes an emphasis on polycentrism, involving all the landscape elements beyond the choric scope. The theoretical level focuses on assessing the development and spatial differentiation of socio-geographical systems in the environment of a cultural landscape of contrasting types. Contrasting landscape types were selected on purpose: borderlands vs. interior, periphery vs. core, desolate vs. stable, mountains vs. valleys, so that the results could be made general for different areas of the same types. The Project results will be applied to help decision makers reach well-founded decisions concerning the optimal directions of the social-geographic development of an area with respect to its natural and social potentials (respecting their bearing capacity, of course), existing social and environmental burdens, natural resources, and abiotic, environmental, social, cultural-historical and legislative limitations.

The central motive of the Project responds to the current need to find specific approaches to monitoring and/or directing the social-geographic development of selected, mostly peripheral, rural, non-built-up areas in the context of a transforming

economy, the Czech Republic joining the EU, and the sustainability of such development. On the practical level, the Project focuses on creating a methodological system reflecting the social and environmental effects of the economic transition in the Czech Republic after 1989.

Specifically, the research team works on developing a comprehensive methodological system applicable in decision making which may specify the regional and local policies in regional economic development by defining natural and social potentials, existing environmental and social burdens, defining natural resources, abiotic, environmental, social, cultural-historic and legislative limitations to economic development, the bearing capacities of the potentials and their suitability for economic exploitation.

4. SCALING

In the Project, problems related to 'scale' must be reflected, the 'scale' representing a range of temporal and spatial levels (dimensions, scales), during which or from which signals or geographical information are perceived. We cope, that is realise the stochastism present in landscape processes, with Haggett's three types of problems related to a change in the temporal or spatial level: the cover (if geographers wish to provide a precise, well-arranged and rational description and interpretation of the multifarious character of the earth's cover, then not only the amplitude but mainly the magnitude of the task is enormous), the connections (each change in the 'scale' brings the problem of verifying the new evidence and its validity), and the standardisation (the need to standardise data of different types, or locations existing under different conditions and asking for a general opinion, while individual influences are at work inside them).

Up-scaling (bottom-up) or down-scaling (top-down) are defined as transferring specific geographic information from one object to the same object but on a different scale. Both 'directions' will be applied under the Project, and will be lead between the micro-regional level (micro-chora) – model locations of the above-mentioned types, the regional level (mezo-chora) – spatial differentiation of phenomena observed in the Usti Region, and the national level (macro-chora) – the context of the Czech Republic (economic, environmental, social and geo-demographic frameworks) – the 'comparison level' – average data for the Czech Republic. Concerning the temporal dimension, the following time horizons are distinguished: the 'pre-transition' horizon (mainly data from 1980 – 1985, reflecting the political regime in Czechoslovakia), the transition horizon (mainly data from 1990 – 1995, reflecting the economy in transition), and the interpretation and proposition horizon (2000 data and a prognosis for the following years, reflecting the effects of the Czech Republic joining the European Union and the notion of sustainability). The various levels emphasise the work of the various driving forces in a Brandtian algorithm of Pressure, State, Impact, Response – DPSIR.

5. METHODS AND METHODOLOGIES

Respecting the requirements for maximum brevity of the paper, I shall limit myself to a mere listing of the methods and methodologies to be applied on the constituent temporal and spatial levels. They will subsequently be subjected to modifications and changes as well as correlation analyses, and supplemented with several others so that a unique integrated methodology can be compiled bringing input information for well-founded decision making.

Fragstats – software that enables gripping a pattern, composing and arranging a landscape texture, and that calculates so-called landscape metrics: e.g. change indexes, intensity metrics, balance metrics, trend indicator, nearest neighbour index, juxtaposition index, contagiousness index, proximity index, facet density, average facet size, largest facet index, facet size to facet shape – compactness, landscape similarity index, total facet edges, facet edge density, edge contrast index; fractal geometry and fuzzy theory – which helps examine regularities in the irregularity of landscape texture when working with landscape metrics (Farina, 2000); Method of Multi-criteria Assessment and Optimization, developed by Grabaum on a computer-based method of combining landscape ecology assessment with optimisation; EIA (Environmental Impact Assessment) – consisting of area analyses, syntheses and subsequent mapping of the environmental and urbanism values of an area with a final synthesis; the Querfurt method of landscape assessment and optimisation aimed to defining an optimum land use pattern; the Torgau method of assessing alternative approaches in conflict situations (Krönert, Steinhardt, Volk, 2001); the LANDEP methodology (Landscape Ecological Planning), environmental bearing capacity of the landscape, environmental limitation to landscape usage (Hrnčiarová, Izakovičová, 1999, Izakovičová, Miklós, Drdoš, 1997, Izakovičová, Hrnčiarová et al., 2001, Ružička, Miklós, 1982, Ružička, Miklós, 1982); environmental sensitivity index ESI, and agricultural suitability index ASI (Ángyán, Balázs, Podmanicky, Skutai, 2003); the British LEP methodology (landscape ecological planning) (Bell, 1999).

6. ANTICIPATED DIFFICULTIES

Handling such a comprehensive geographic project whose important part is the application level, one will necessarily face a number of very serious difficulties. To name a few: the assessment of the aesthetics of the landscape or the landscape texture, which verges on subjectivity and moves away from scientific reality; hard-to-achieve simplification and subsequent easy applicability of the final methodology; data precision; only tiny legislative support for the application of results in land use planning processes; the lack of political will to apply long-term plans as they are not attractive to politicians; ignorance of the notions of sustainable development among politicians, officials and the public.

Of course, it is true that what is spoken may not be heard, what is heard may not be understood, to understand may not mean to agree, to agree may not mean to try, and to try may not mean to apply. 'The hardest thing, of course, is to tell how things should be

in the landscape.' (Hynek, 1996). I totally agree with that, but I also say that continuing to ask yourself questions, trying to answer them knowing that the process may never be finished and that each answer brings new questions, that is what makes man and science, science.

References

ÁNGYÁN, J., BALÁZS, K., PODMANICKY, L., SKUTAI, J. 2003. *Sustainable development of European landscapes as a multidimensional environmental and societal issue.* In Helming, K., Wiggering, H. (eds.): Sustainable Development of Multifunctional Landscapes. Springer, New York, 125-142.

BASTIAN, O., STEINHARDT, U. (eds.) 2002. *Development and perspectives of landscape ecology.* Kluwer Academic Publ., Dorddrecht, 498.

BELL, S. 1999. *Landscape – pattern, perception and process.* Taylor and Francis, New York, 344.

DEMEK, J. 1999. *Vybrané kapitoly z krajinné ekologie.* PF MU, Brno, 102.

FARINA, A. 1997. *Principles and Methods in Landscape Ecology.* London, Chapman and Hall, 235.

FARINA, A. 2000. *Landscape Ecology in Action.* Kluwer Ac. Publish., Dordrecht, 332.

FORMAN, R. T. T. 2003. *Land Mosaics. The Ecology of Landscapes and Regions.* Cambridge, Cambridge University Press, 632.

FORMAN, R. T. T. (ed.) 1990. *Changing Landscapes: An Ecological Perspektives.* New. York, Springer-Verlag, 427.

HRNČIAROVÁ, T., IZAKOVIČOVÁ, Z. (eds.) 1999. *Krajinnoekologické plánovanie na prahu 3. tisícročia.* ÚKE SAV, Bratislava, 385.

HYNEK, A. 1996. *Mentální mapy kulturní krajiny.* In Svobodová, H. (ed.): Krajina jako domov. IMPRESO, Žďár nad Sázavou, 7-16.

INGEGNOLI, V. 2002. *Landscape Ecology: A Widening Foundation.* A Holistic Unifying Approach. Springer-Verlag, New York, 340.

IZAKOVIČOVÁ, Z., HRNČIAROVÁ, T. et al 2001. *Environmentálne hodnotenie sídelného prostredia.* ÚKE SAV, Bratislava, 287.

KRÖNERT, R., STEINHARDT, U., VOLK, M. (eds.) 2001. *Landscape balance and landscape assessment.* Springer, New York, 304.

MÍCHAL, I. 1993. *Ekologická stabilita.* Brno, Veronika, 243.

MIKLÓS, L., IZAKOVIČOVÁ, Z. 1997. *Krajina ako geosystem.* VEDA, Bratislava, 152.

MOSIMANN, T. 1999. *Angewandte Landschaftsökologie – Inhalte, Stelliny und Perspektiven.* In Schneider-Silwa, R., Schaub, D., Herold, G.: Angewandte Landschaftsökologie. Grundlangen und Methoden, Spinger-Verlag, 5-23.

NAVEH, Z., LIEBERMAN, A. 1994. *Landscape Ecology.* Theory and Aplication. Springer, New York, 249.

RUŽIČKA, M., MIKLÓS, L. 1982. *Landscape Ecological Planning, LANDEP, in the Process of Territorial Planning.* In Ekológia, ČSSR, vol. 1, No. 3, 297-312.

Ke krajinně-ekologickému výzkumu vybraných prvků kulturní krajiny

Resume

Autor nejprve stručně komentuje situaci na poli krajinné ekologie, pozici geografie vůči ní, zabývá se statistickým vyhodnocením výzkumných projektů řešených v České republice za posledních 10 let a tematicky zasahujících do této problematiky. Soustředí se speciálně na výsledky geografických pracovišť v Česku a nato charakterizuje záměry

nového dlouhodobého financovaného výzkumného projektu svého pracoviště, který odráží komplexní povahu geografie jako vědy a tedy geosystémový přístup geografie ke krajině, čímž se snaží zaplnit volný výzkumný prostor v problematice krajinné ekologie v Česku.

Tým Katedry geografie Ústavu přírodních věd UJEP pracuje na vytvoření komplexního metodického systému, který je aplikovatelný v decizní sféře a může zpřesňovat regionální a lokální politiku územního ekonomického rozvoje, definováním přírodního a sociálního potenciálu, současné ekologické a sociální zátěže, vymezením přírodních zdrojů, abiotických, ekologických, sociálních, kulturněhistorických a legislativních limitů ekonomického rozvoje, únosnosti potenciálů a vhodnosti jejich ekonomického využití.