5 CONTRIBUTION OF METAGEOGRAPHY AND METALANDSCAPE ECOLOGY TO THE DEVELOPMENT OF LANDSCAPE ECOLOGY IN SLOVAKIA

(Florin ŽIGRAI)

Some remarks to relationship between metageography and metalandscape ecology

In Slovakia, metascientifically oriented landscape ecology situated, as above mentioned, at the crosscut of geographic and ecological/biological sciences was considerably influenced by the geographic holistic way of thinking and philosophically metascientifically generalizing approach what has, beside other, found reflection in the effort to generalize obtained empirical results of landscape-ecological research passing through the theoretical level to the metascientific level. The decisive factor for the penetration of geographic thinking, theory and methods into landscape ecology was obviously the distinctive level of the scale of ecological research at the level of landscape. It led to strengthening of ecological research by spatial relationships at the level of landscape or landscape patterns and landscape ecosystems. It is quite possible that in future, research of ecological relationships of spatial structures at the discerning level of the whole Earth will be an incentive for formulation of new global or planetary ecology, as Eliáš (2003) asserts, which will seek solutions for all-planetary ecological and environmental problems.

Geographical approach of comprehension of landscape ecology and meta-landscape ecology was inidirect realised by the metageography in which was analysed position an relationship between geography, geoecology and landscape ecology. Definition of landscape ecology of Mičian (1999) is that it represents the multidisciplinary scientific branch with integrated geographic and ecological research approaches. So perceived landscape ecology suggests that there are two parallel and mutually supplementing processes of its development in Slovakia – the external represented by interdisciplinary crosscutting line (geographisation – ecologisation- humanisation) and the internal represented by the expanding biotic-abiotic-socio-economic research object line. (Žigrai 2001a,b, Fig. 12).

It was also stated that the content and philosophy of metageography most inclines to meta-landscape ecology. This circumstance also reflects the fact that the research object and approaches of geography make it the scientific discipline that most approximates landscape ecology in which the metascientific integrating superstructure has been already to some extent formulated in Slovakia. For instance Mičian (1995a) perceives metageography either in the narrower sense of word "as the forming geographic discipline (simultaneously entering into science about science) interpreted as science about geography, its rational organisation and optimisation of its development" or in a broader sense of the word when "metageography unites geography with philosophy, above all with its part dealing with science about science".

Both these interpretations of metageography were also applied to metalandscape ecology in Slovakia as partial and still forming landscape-ecological scientific subdiscipline which should deal with the structure of system of landscape-ecological sciences, their

identity, history, relationships among individual parts of this system and the management of the whole system. (Žigrai, 2001b, Fig.13)

Contribution of metageography for the development of landscape ecology in Slovakia reposed first of all on search of its definition and position among the other sciences. Also was noticed on the inevitability of simultaneous presence of geographical (geosystem) and ecological (ecosystem) approaches in the framework of landscape ecological research. This condition presents at the same time the basic metascientific principle of the landscape ecology. Metageography also expanded the metascientific superstructure of landscape ecology, it means the metalandscape ecology on selected geographical characteristic like spatial and synthesis approach.

Delimitation of the position of landscape ecology among nomothetic and idiographic scientific disciplines by similar use of results obtained in the metascientific study of position of geography among them is also interesting (Žigrai 2006a,). Landscape ecology represents a certain platform for the coexistence of nomothetic and idiographic scientific-

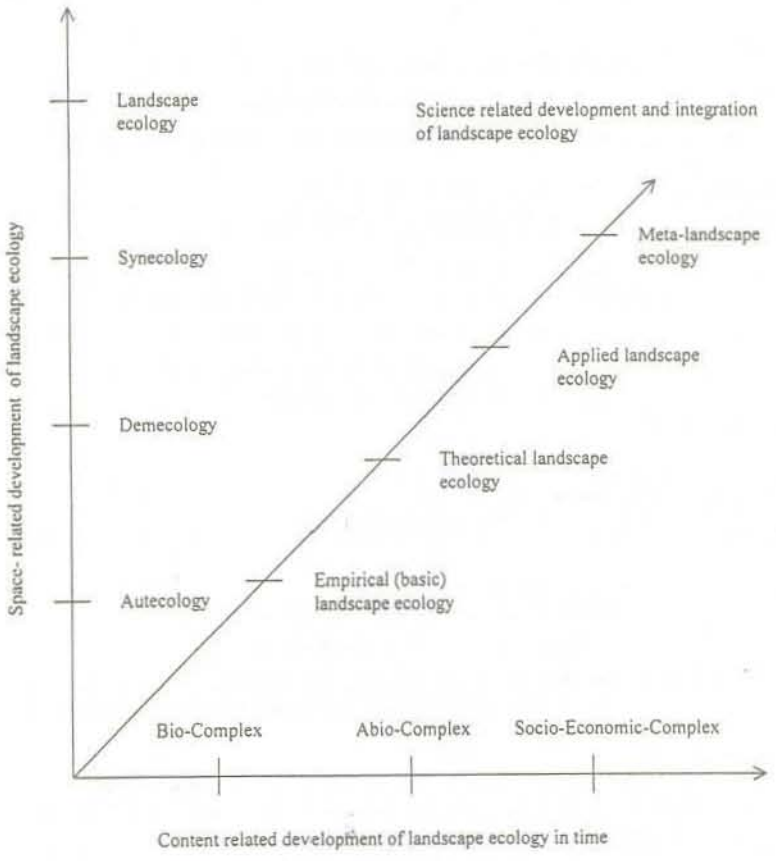

Fig. 12 Scheme of spatial, content and science related development of landscape ecology.

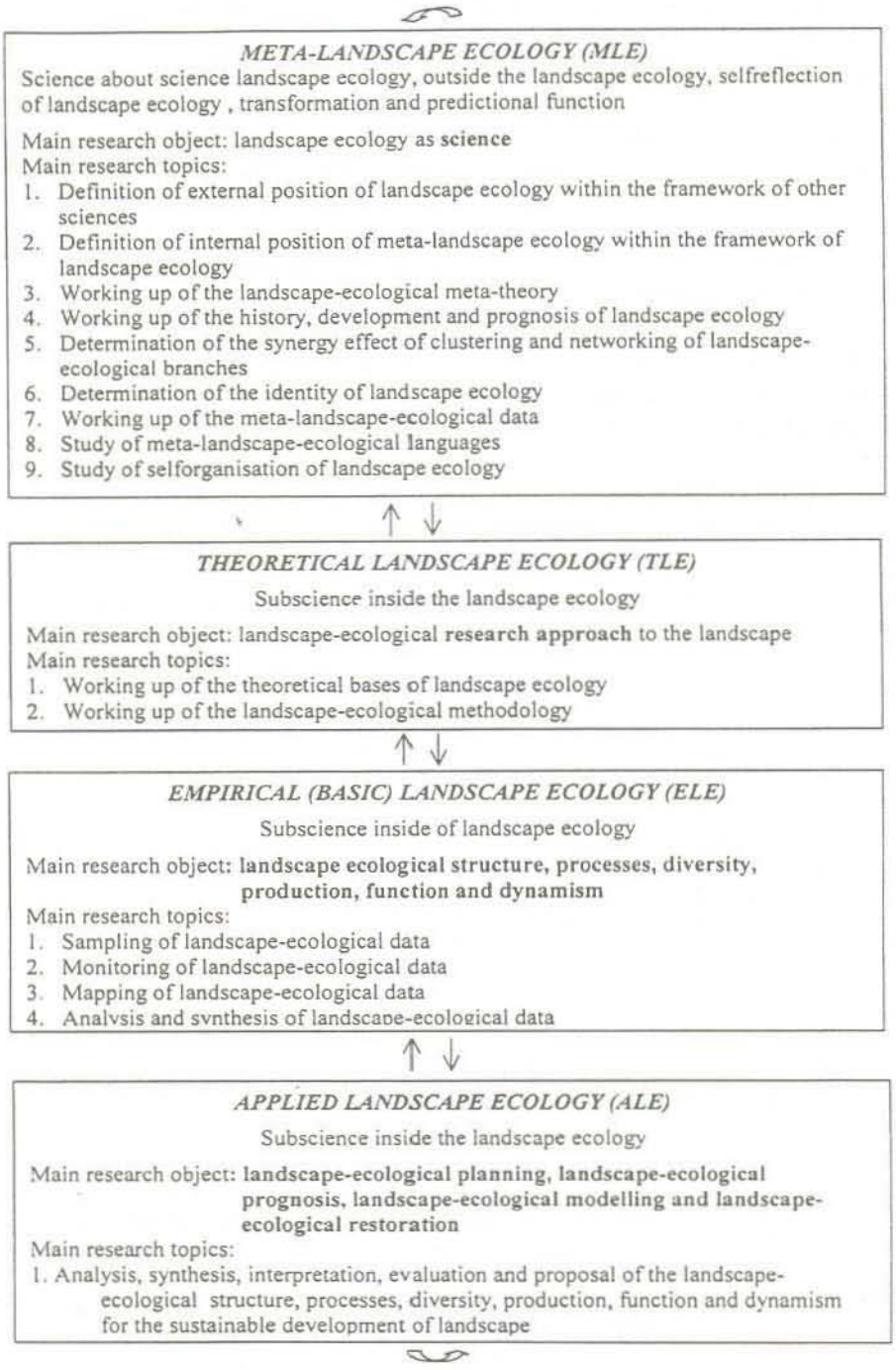

Fig. 13 Scheme of information flow among meta-landscape ecology, theoretical, empirical and applied landscape ecology.

research approach and simultaneously plays an important role of mediator between these scientific disciplines what contributes to its increasing scientific significance. Apart from that, so interpreted landscape ecology can contribute to palliation of the increasing discrepancy of economical and financial interests between universal, it means prevailingly nomothetic, sciences and the regionally specific ones. It also means enhancing of the scientific and social prestige for landscape ecology. (Fig. 14).

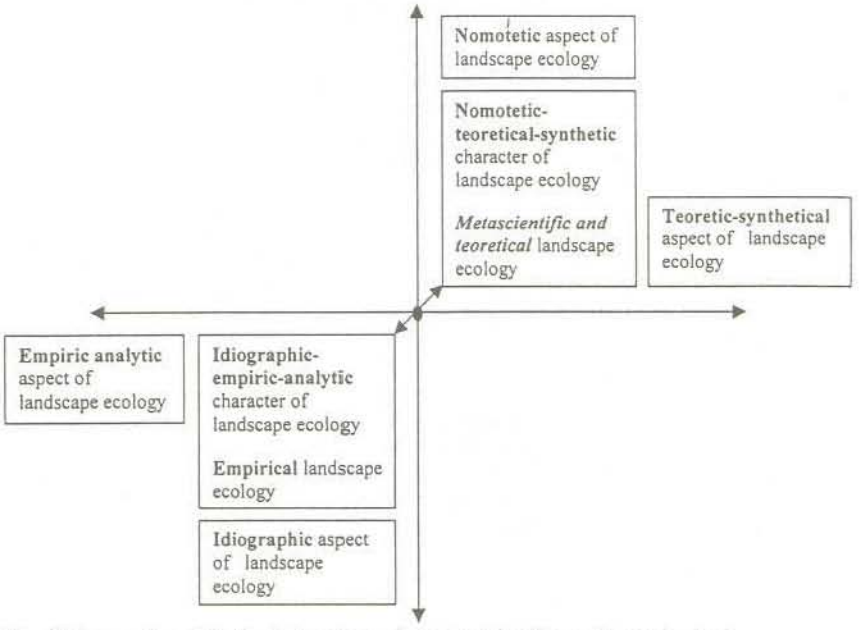

Fig. 14 Scheme of ambivalent structure of nomotetic-theoretic-synthetical and idiographic-empiric-analytical character in landscape ecology.

Some remarks to the philosophical-metascientific background of the origins of landscape ecology and meta-landscape ecology

Viceník (2000a) asserts that observation of development in science and the involved general processes is important for the philosophically oriented metascientific research in Slovakia. Metascience deals with science as such, its origins, development, classification, methodology, language and organization. The main objective of metascience is to generalize the gathered theoretical and methodical knowledge of all sciences into meta-theoretical and methodological position what enables gradual formation of universal meta-theoretical basis and methodological instrumentary as the supporting pillars of metascience itself.

He also pointed to the circumstance that metascience is influenced by certain aspects, of for instance sociology, psychology, ethics, space, ecology or environment, and the like, what has made possible to talk about sociology, psychology, geography or ecology of

science (Viceník, 2000b). Author's reflections have helped the landscape ecologists to understand geography of science and ecology of science as a certain information bridge between partial metasciences i.e. meta-geography and meta-landscape ecology on the one side and metascience as learning about science on the other. In this manner, the meta-theoretical and methodological hinterland of metascience can be enriched by knowledge of individual sciences. On the other side, metascience with its generalizing results influences and generates the origin of special metasciences, for instance, metasociology, metageography, meta-landscape ecology and metaecology. (Fig. 15).

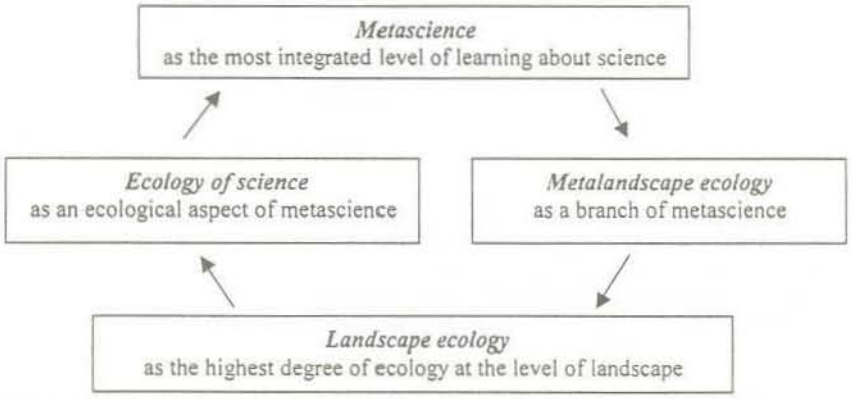

Fig. 15 Scheme of information flow among landscape ecology, ecology of science, metascience and metalandscape ecology

The philosophical metascientific-generalizing approach in Slovakia is based first of all on exploration of the ethical relationship between the human and nature, i.e. penetration of ecological and philosophical paradigms into the landscape ecology (see, for instance Strinka 1992) but also the opposite tendency i.e. „ecologization" of philosophy studied, for instance, by Smolková (1992). Results of specialists in the area of philosophy who dealt with metascientific aspects of ecology and geography of science, like for instance Krchnák (2001), can be also suitably applied to elaboration of metascientifically oriented landscape ecology.

The collaboration between the Slovak landscape ecologists and philosophers proved to be very useful because the specialists in philosophy could apply their broadly conceived methods to landscape-ecological subjects and vice versa, ecologist used the opportunity to interpret their subjects in broader philosophical implications. Bodnár (2005) also pointed to the importance of philosophy as a specific form of reflection in disclosure of the most general properties, laws and methodology of scientific investigation, which fully relates to the meta-landscape ecology.

The contemporary metascientifically oriented trend in the development of the Slovak landscape ecology can be referred to in the international context as specific and unique. The origins of landscape ecology and its metascientifically stressed part included under the

concept of meta-landscape ecology was determined in Slovakia by several external and internal circumstances above all by the world-wide development of science with its typical parallel often contradictory processes such as differentiation/integration, superposition/ separation, globalisation/regionalisation on the one side. On the other side, geoscientific and ecological disciplines were interested in solving the increasingly urgent ecological and environmental problems by holistic approach. The principal research object of meta-landscape ecology ought to be the landscape ecology itself as the science in which the scientific identity, history, inner organization and classification, external position among other sciences and the capacity and intensity of participation and cooperation with them should be identified (Žigrai 2001a).

Along all these general processes, mutual influences and overlapping of geographic, ecological and humanistic scientific disciplines were also important for the landscape-ecological scientific and metascientific research in Slovakia. Precisely landscape ecology became the product with "ecotone" character of such processes as it is situated on the crosscut of three most important developmental processes referred to as "geographisation", "ecologisation" and "humanisation".

The so far obtained results in landscape ecology at the metascientific, theoretical-methodical, empirical, applied and didactic levels also confirm that landscape ecology as a science is situated right at the point of "geographisation" – i.e. effect exerted on non-geographic disciplines by considering prevailingly the spatial aspects of geography and of "ecologisation" - i.e. the effect on non-ecological sciences by stressing the functional aspects of ecology. Apart from that, the character of landscape ecology is indirectly influenced by the process of "humanisation" - i.e. emphasis on social aspects in other than humanistic sciences through human geography and human ecology (Žigrai, 2001a).

While elaborating these metascientific aspects of landscape ecology, it was only partially possible to lean on the domestic and foreign sources because these are not fully involved with the subject. The absence of literature was partially compensated by dialogue with scientists-philosophers dealing beside other with metascientific questions. It was then possible to use, to some extent elaborated, general research structure of metascience as such as a framework into which the specific subject of a particular science – in our case landscape ecology - was set. This was how conditions were created for successful metascientific research of landscape ecology. This new landscape-ecological subdiscipline may form the superstructure of the theoretical part of the landscape ecology and the procedure brings a certain possibility to solve metascientific i.e. philosophical aspects of a specific science, in our case from the position of landscape ecology.

The necessity to handle the metascientific issue of landscape ecology in Slovakia was also due to the dramatic development of landscape ecology at the metascientific level by parallel independent interest of different sciences in the same study subject i.e. the landscape. It was pursued by varied research approaches at varied hierarchic, spatio-temporal levels including the applied level, in an effort to respond to the increasing ecological and environmental problems with negative local, regional, national, continental, even planetary impact.

Landscape ecology in Slovakia tried to adapt to such situation during its more than 40-year history and above all in the last two decades after the foundation of the IALE

by intensive development of empirical landscape research, elaboration of the specific theoretical basis, building the appropriate apparatus by compiling the efficient applied-implementing mechanism for practical landscape planning and by successful introduction of the tuition of landscape ecology as part of university studies.

With regard to the above-mentioned short age of landscape ecology in Slovakia, its rapid development and the increasing integrating and interdisciplinary character above all in solutions of environmental issues and sustainable development, the need to suggest more consistent metascientifically oriented research current emerged. This current should deal with the landscape-ecological science itself, its origins, history, identity and position within the system of sciences.

These efforts manifested above all recently at the turn of millenniums. Such period was obviously a precious opportunity to evaluate the past developments of a particular science and above all to suggest its future development in the forthcoming millennium. Simultaneously, it was a great challenge for any science, including landscape ecology to solve such a difficult task. This was the moment when the metascientific superstructure in form of a more compact learning about the landscape ecology itself, i.e. meta-landscape ecology was most missed. Meta-landscape ecology may, beside other, outline the prognosis of its further development. Among the Slovak ecologists who pointed to the fact were for instance Drdoš (2000), Mičian, (1999), Ružička (1995,1996), Žigrai (2001a, 2003a) and others.

However, in most cases these tasks and challenges were not declared as those of meta-landscape-ecological nature as they were included into the theoretical-methodical landscape ecology although its research content is, as above mentioned, the landscape itself in difference from meta-landscape ecology where the central research subject is landscape ecology as science. Similar traditional interpretation of tasks and objectives of theoretical landscape ecology in foreign literature is the principal reason why the concept of meta-landscape ecology did not emerge. It was rather replaced by the transdisciplinary challenge in favour of further development of landscape ecology (Naveh 1998, and Brandt 1998, 1999).

Author's selected results of metalandscape ecological nature in observation of terminological issues on landscape ecology (Žigrai 1974a,1982), study of the relationship between the basic and applied landscape ecological research (Žigrai 1996b) emphasizing the function and significance of the learning about landscape use in landscape ecology (Žigrai 1998b, 2004a), in search for the landscape ecological identity and position (Žigrai 2001a), assessment of general limits to the development of landscape ecological planning (Žigrai 2000b), in stressing the integrating meaning of landscape ecology for the development of ecology and environmental science (Žigrai 2001f), pointing to the paradigm as a scientifically relevant notion for forecasting of the development in landscape ecology (Žigrai 2002b), in stressing the metascientific aspects of landscape-ecological planning (Žigrai 2005a), in seeking the common and individual identity of landscape planning in the enlarged EU (Žigrai 2005c) have pointed to the great absence of a summarizing landscape-ecological science that should integrated and cover all selected problems. Applying the analogue comparison with other sciences such as metageography (Mičian 1995a), it is meta-landscape ecology that might fulfil the function of such science.

Drdoš (1988, 1995, 1996, 1999, 2000, 2001, 2002, 2003) also indirectly touched the issue of metalandscape ecology when he elaborated the theoretical-methodical problems of landscape ecology and its relationship to the environmental planning and explained its paradigms, methodology of landscape planning, which is the direct product of landscape ecology, the holistic approach in landscape ecology and its philosophical background. Mičian (1984, 1986, 1989, 1993, 1995b), Miklós (1996) and Ružička (1995, 1996) were involved with the theoretical and methodical questions of landscape ecology, its definition and the necessity of cooperation between landscape ecology and other scientific disciplines above all with geography. It was Oťahel' (1999) who pointed to importance of the social dimension proper to landscape ecology as science in connection with transfer of knowledge obtained under landscape-ecological research into the environmental practice.

The efforts in metascientifically oriented landscape-ecological research in Slovakia has recently resulted in outlining of until then absenting meta-landscape ecology as a consistent metascientific subdiscipline necessary for generalization of gathered theoretical, methodical and empirical knowledge not only at the theoretical level but also at the metascientific level (Žigrai 2001a,b). Meanwhile, meta-landscape ecology should represent a kind of metascientific superstructure of theoretical landscape ecology where obtained results in theoretical landscape ecology are generalized to an extent applicable to other sciences and vice versa, the knowledge of other sciences should be able to enrich the theoretical basis of landscape ecology. These efforts continued in the second approximation of meta-landscape-ecological subject stressing the significance and contribution of meta-landscape ecology not only to the development of landscape ecology as a science but also to the development of its theory, methodology, application and tuition (Žigrai 2003a,b). The following subchapter contains more details about the theme.

With regard to the general structure of metascience as well as the specific nature of landscape ecology in Slovakia, the issue of meta-landscape ecology was suggested. It is first of all the determination of the scientific identity of landscape ecology, outlining of external position of landscape ecology in the framework of other sciences, identification of the internal position of meta-landscape ecology i.e. its relationship to the theoretical, methodical, empirical and applied landscape ecology, research of history of landscape ecology, the study of cluster formation of landscape-ecological branches and subbranches and their linking; elaboration of landscape-ecological metatheory, methodology and metalanguage, as well as the research of organisation, arrangement and classification of landscape ecology as such (Žigrai 2001a).

At present, these selected groups of problems concerning meta-landscape ecology in Slovakia are at a different level of elaboration depending on their significance and interest of researchers. Part of meta-scientifically oriented landscape-ecological was researched above all in the framework of already established theoretical-methodical landscape ecology. Theoretical landscape ecology deals with the theoretical questions of its two central research objects - landscape on the one side and landscape ecology as a science on the other. Meanwhile, it should be stressed that in the framework of this scientific research duality or ambivalence of theoretical landscape ecology, it was so far in Slovakia substantially more concerned with elaboration of theoretical-methodical and empirical-applied aspects than with the proper metascientific part of landscape ecology.

The principal result of the metascientifically oriented landscape-ecological research accomplished so far in Slovakia was the more precise formulation of the scientific identity of landscape ecology which is situated at the crosscut of landscape-ecological research aims, objects and methods and outlining of the external position of landscape ecology among other sciences and internal position within the landscape ecology, as well as elaboration of metascientific landscape-ecological scheme what partially contributed to explanation of internal relationships in the landscape ecology, i.e. to the relationship between the metascientific, empirical and applied landscape ecology. Beside other, it also contributed to identification of the limit of the scientific carrying capacity of landscape-ecological research necessary for functioning of the relationships between the scientific supply and social demand of the proper landscape ecology (Žigrai 1996b, 2001a, 2003a). (Fig. 16).

Some remarks to the significance and contribution of metalandscape ecology to the development of landscape ecology

Based on research of specialised literature, in general, the significance and contribution of metal-landscape ecology to the development of landscape ecology as a scientific discipline is considerably determined by successful implementation of landscape-ecological metatheory, metamethodology and metalanguage which represent the main pillars of meta-landscape ecology, in the theoretical, methodical, empirical and applied landscape ecology. (Žigrai 2003a).

Significance and contribution of meta-landscape ecology for the development of landscape ecology as science in Slovakia was above all in defining identity of landscape ecology and delimitation of geographic-ecological gravitation cores. It will prevent from a too broad or too narrow interpretations of landscape ecology. (Fig. 17). Meanwhile, it was concluded that meta-landscape ecology must be perceived as a guardian of scientific identity of landscape ecology and a tool in search for a unifed science and in this case unifed landscape ecology. Apart from that, it helps to remove intuitiveness and strengthens the objectiveness in defining of landscape ecology.

The study of literature and my own empiric experience obtained during the long-year basic and applied landscape ecological research justify the assertion that the key problem in the development of landscape ecology in Slovakia was precisely the search for its scientific identity, it means decision whether it represents a scientific discipline, methodical approach or activity or whether it is a basis or applied science, whether it belongs among geographic or biological and ecological sciences, whether its research field should be, and whether its principle should be that of segments or wholeness. The conclusion is that the scientific identity of landscape ecology obviously lies at the crosscut of geographic and ecological research approaches what in fact corresponds to Mičian 's (1999) the definition of landscape ecology. (Fig. 18)

The circumstance that the search for scientific identity of landscape ecology is closely connected with the approximate delimitation of its research field and spectre is also worth mentioning. It is important that landscape ecology does not slip to purely geographic or ecological position on the one side or become a bin for several scientific disciplines that lack a distinct profile and identity on the other.

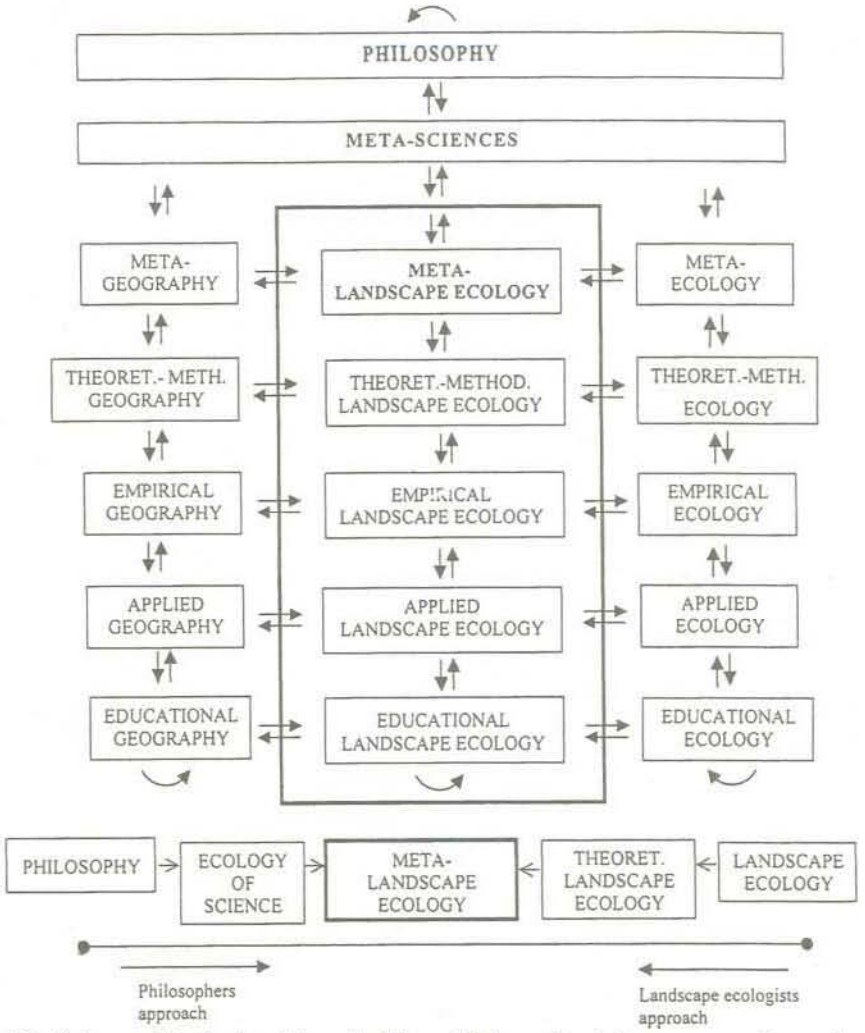

Fig. 16 Scheme of the horizontal-vertical flow of information between geography, ecology, landscape ecology and philosophy on meta-scientific, theoretical-methodological, empirical, applied and educational level, as well as the philosophers and the landscape ecologists approaches at solving metalandscape-ecological problems

The specific feature of landscape ecology as a particular scientific discipline is in the contemporary and inseparable spatio-temporal representation of individual geographic and ecological research approaches to the solution of landscape-ecological issues obviously representing the most important metascientific principle and simultaneously characteristics of this ecological subdiscipline. Observation of this metascientific landscape-ecological principle requires beside other consequent consideration of traits proper to geography and ecology in research of landscape-ecological structure, function, dynamics, diversity and the energy and/or biomass flows.

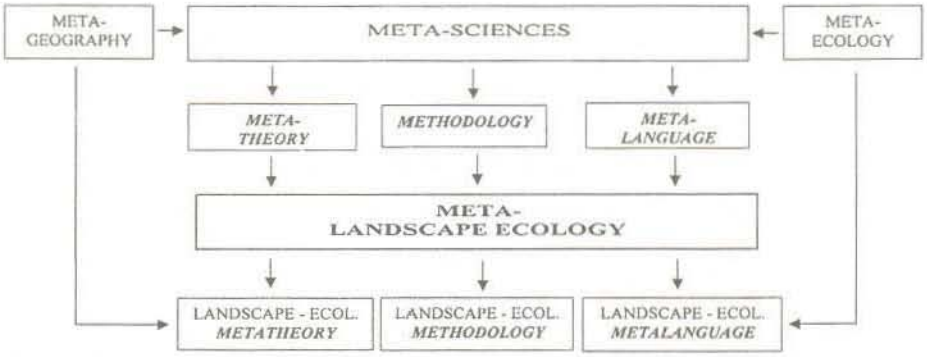

Fig. 17 The importance of meta-landscape ecology for the development of landscape ecology as science

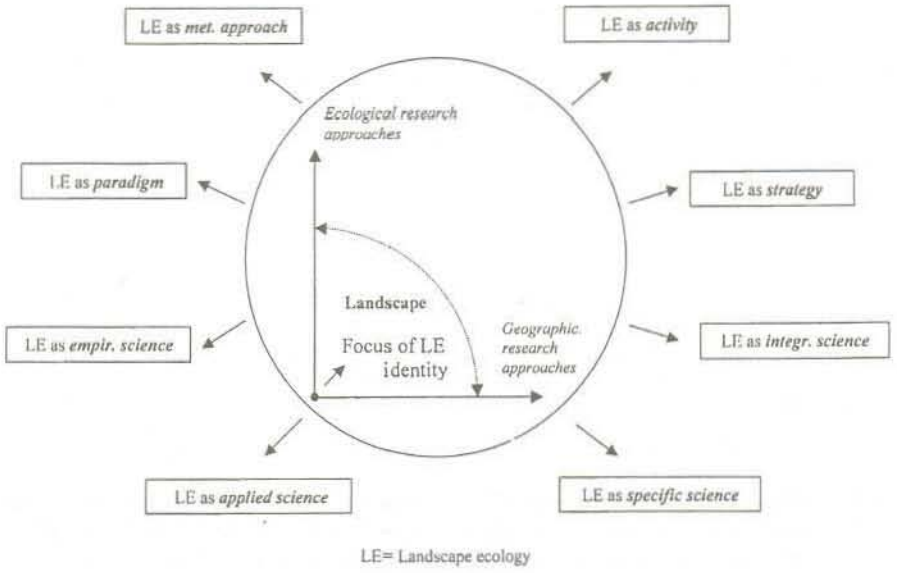

Fig. 18 Scheme of a meta-scientific „compass" seeking the scientific identity of landscape ecology

Based on the results of landscape-ecological research reached in Slovakia, landscape ecology is interpreted as a science both in the narrow and stricter senses of the word - as a special ecological discipline core of which is in the study of landscape ecosystems or those at the level of landscape by geo- and ecosystemic approaches – and in the broader

sense as a boundary or crosscut geographic-ecological scientific discipline, the core of which is in the study of relationships between the landscape and humans using geographic and ecological approaches.

This dual interpretation of landscape ecology and landscape-ecological research is, to some extent, a reflection of the scientific background that existed in Slovakia in the past. It stimulated the origins and development of landscape ecology in Slovakia. Biological-structural approach was represented by the scientific discipline landscape biology (Ružička 1965), and the geographic-potential approach is represented by the learning about the landscape (Drdoš 1965), Mazur, 1980, Mičian, Zatkalík 1984, Miklós, Izakovičová 1997, Minár et al. 2001 and others).

Contribution and significance of meta-landscape ecology to the development of theoretical-methodical landscape ecology materialized through its principal, above-mentioned implementation tools represented by the landscape-ecological metatheory, methodology and metalanguage. This was the partial contribution of meta-landscape ecology to the orientation of landscape-ecological empirical knowledge and methodical approaches of landscape research concentrated first of all on the theory of hierarchy, scale, dimensions and spatial landscape processes. Meanwhile, it helped elaboration of integrating and interacting holistic landscape-ecological research approaches and reducing the distance between the action and conditions of basic and applied landscape-ecological research, which is limited by the border of scientific efficiency on the one side and the socio-financial carrying capacity on the other. (Fig. 19)

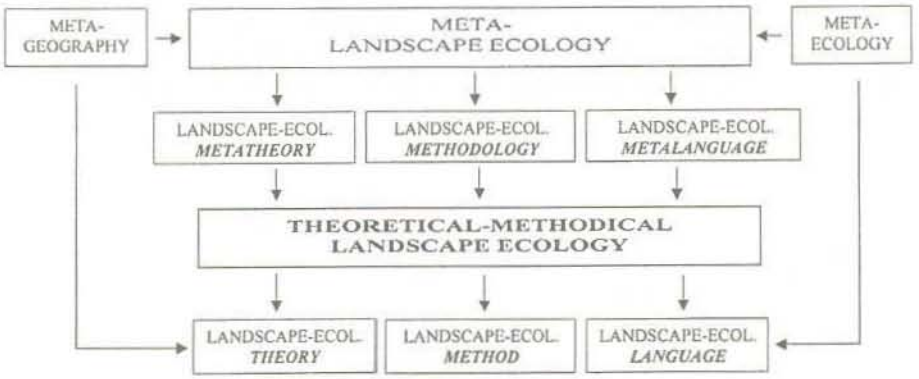

Fig. 19 The importance of meta-landscape ecology for the development of the theoretical-methodical landscape ecology

Contribution and significance of meta-landscape ecology to the development of empirical, i.e. the basic landscape ecology lies in derivation of landscape-ecological metadata, metaanalysis and metasystems of general metadata, meta-analyses and metasystems. These help in selection of particular landscape-ecological data and in elaboration of analyses and syntheses necessary for the research of principal subjects of empirical landscape ecology, such as landscape structure and diversity, landscape-ecological functions and processes,

as well as production and dynamics of landscape systems or ecosystems. Apart from that, it helps using the results already implemented in theoretical-methodical landscape-ecological research and makes it possible to use the knowledge of metadata for acceleration of their inclusion into the content and spatio-temporal context of the landscape-ecological phenomenon, object and process. (Fig. 20)

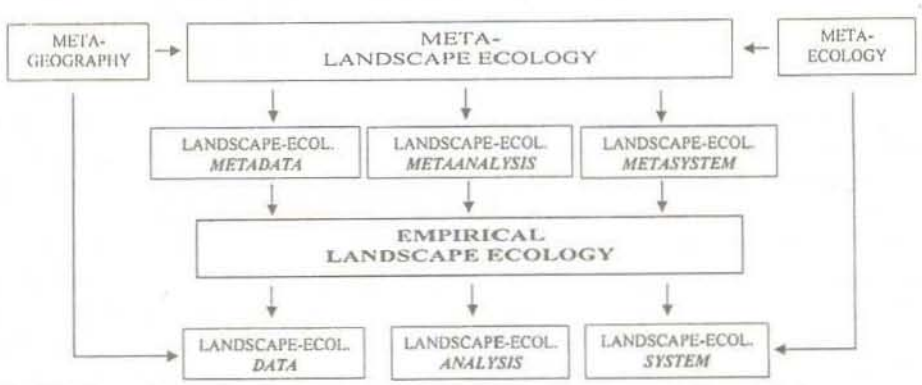

Fig. 20 Importance of meta-landscape ecology for the development of empirical landscape ecology

Contribution and significance of metalandscape ecology to the development of applied landscape ecology is in transformation of landscape-ecological metatheory, methodology and metalanguage into applied landscape-ecological metatheory, methodology and metalanguage. (Fig. 21)

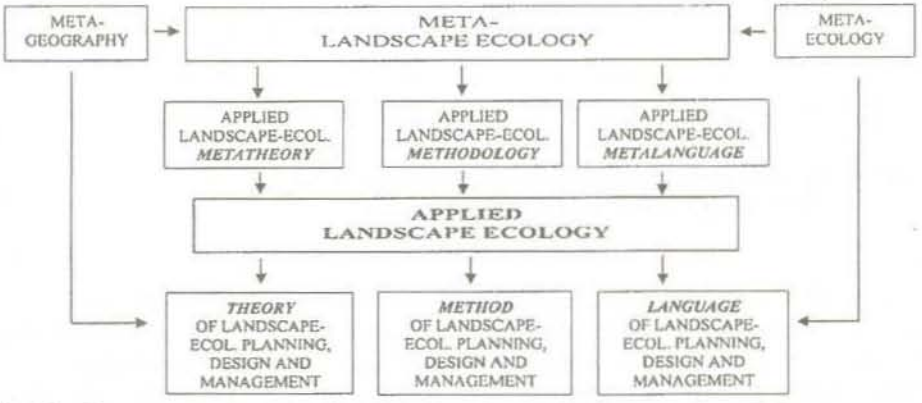

Fig. 21 Importance of meta-landscape ecology for the development of applied landscape ecology

Applied landscape-ecological metatheory deals with the generalization of theoretical reflections about philosophy and strategy of landscape-ecological planning, design and management.

Applied landscape-ecological methodology follows the ways of generalization of individual methodical procedures used for acquisition, interpretation, evaluation and implementation of landscape-ecological data about the corresponding objects and processes for the needs of landscape ecological planning, design and management.

The applied landscape-ecological metalanguage studies its common features and structure and seeks for the possibilities of terminological links and compatibility in the framework of landscape-ecological planning, design management and between them. In this way, these landscape-ecological meta-derivates can greatly contribute to development of theory, methodology and language of landscape-ecological planning, design and management.

Contribution of meta-landscape ecology to the development of applied landscape ecology is above all in elaboration of the general theory of landscape-ecological planning, design and management and strengthening of transdisciplinary holistic approach necessary for landscape-ecological planning, design and management. (Fig. 22).

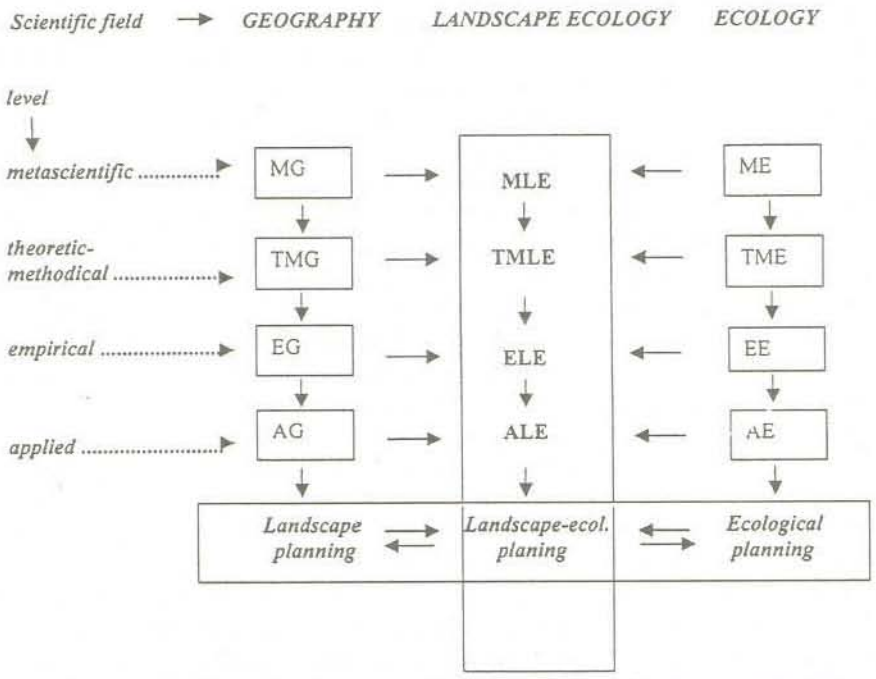

Fig. 22 Scheme of information flow among landscape planning, landscape ecological planning and ecological planning.

Contribution and significance of metalandscape ecology to the development of other scientific disciplines

Contribution and significance of meta-landscape ecology to the development of other scientific disciplines in Slovakia was above all in verification of the possibilities to use the elaborated metascientific landscape-ecological scheme of the horizontal-vertical flow between geography, ecology, landscape ecology and philosophy at the metascientific, theoretical-methodical, empirical, applied and didactic levels creating the core of meta-landscape ecology as a certain example for building the metascientific superstructure to the already existing scientific disciplines and subdisciplines, for establishing of the new boundary scientific branches and creation of certain scientific background and promoting the corresponding paradigm or activity to the level of a scientific discipline.

In this way, the scheme of information flow in meta-landscape ecology which represents its metascientific core was implemented in the position and meaning of landscape ecology for the solution of environmental problems (Žigrai 2000a), in application of landscape and environmental ecology in landscape and environmental planning (Žigrai, Hreško 2001), in landscape archaeology as a contact scientific discipline between geography and archaeology (Žigrai, Chrastina 2002), in metascientific issues of religion geography (Matlovič, Žigrai 2002), in metascientific contribution of landscape ecology for the development of landscape design (Žigrai 2002d), in landscape architecture at the interface of science and study subject at the university level (Žigrai 2002e), in the position, significance and tasks of metaenvironmental history (Žigrai 2003c), in metascientific aspects of learning about sustainable development of society and the environment (Žigrai, Huba 2004), in the significance of metageography for the linkage between the basic and applied geographic research (Žigrai 2004c), in the cultural environmental science and environmental culturology as the scientific bridge between the environment and culture (Žigrai 2004d), in the metascientific meaning of the landscape architecture for research of transformation concerning historic spaces (Žigrai 2004e), in the metascientific meaning of regional geography in the context of the present regional development (Žigrai 2004f), in metascientific aspect of landscape-ecological planning (Žigrai 2005a), in the character of the landscape as metascientific research object (Žigrai 2005d), in ethnography as a bridge between geography and ethnology (Žigrai 2005e), in the learning about landscape protection as its necessary scientific background (Žigrai 2005f), in the significance and position of geography at the interface of nomothetic and idiographic scientific disciplines (Žigrai 2006a), in significance of regional geography in the process of "globalisation" v. "regionalisation" of science (Žigrai 2006b), in the metascientific approach to implementation of the *European Convention about the Landscape*, in the metascientific approach to implementation of the *European Convention about the Landsc*ape in landscape concepts in V4 states (Žigrai 2006c), as well as in the scientific background of the background of landscape ecology in changing socio-economic and environmental conditions of Slovakia (Žigrai 2006d).

Several examples of the applied above-mentioned metalandscape-ecological model in several disciplines has highlighted the possibility of its universal use and justified its further elaboration.

Contribution of landscape ecology to the development of metalandscape ecology

The significance of metal-landscape ecology for the development of landscape ecology based on deduction principle is not a one-way process - it is mutual because the results of landscape ecology can contribute through induction to meta-landscape ecology. The contribution of landscape ecology to the development of meta-landscape ecology in Slovakia was in the effort to generalize the results reached in theoretical, methodical, empirical, applied and didactic landscape ecology in order to enrich the content of meta-landscape ecology and particularly its pillars – landscape ecological metatheory, methodology and metalanguage.

The development of meta-landscape ecology is greatly influenced by the development of landscape-ecological paradigms, which represent certain generally accepted approaches and techniques in a certain time interval and in a certain scientific space. It is the reason why there is the necessity to research not only into the history of the development of paradigms but also into the possibility to forecast their future development (Žigrai, 2002b).

Contribution of the theoretical landscape ecology to the development of landscape ecological metatheory

Landscape ecology and its predecessor landscape biology have gradually built in Slovakia during their 40-year development a theoretical basis of landscape ecology characterized by interpretation of landscape ecology above all in its broader, i.e. more liberal sense of word through generalization of results achieved by the basic and applied landscape ecological and landscape biological research. It is claimed that the core of landscape ecology is in the study of the relationships between the landscape and humans using geographic-ecological approaches without abandoning the key principle of landscape ecology that is the unity of space and relationships.

The contemporary landscape-ecological theory in Slovakia should be interpreted as a synthesis of theoretical results obtained in several scientific disciplines of geographic and biological/ecological nature. The basis of landscape ecology as a science emerged from the position of biology through phytocenology, geobotanics and biology of the landscape that have virtually helped to open the door to the biological disciplines and simultaneously widen their horizon by a new holistic landscape-based view at the distinctive scale corresponding to the landscape level. The key position in terms of metascience was played by introduction of landscape biology as a new science placed at the interface of biology and geography and their branches (Ružička, 1965a, b, 1967). Landscape biology has greatly enriched landscape-ecological metatheory by new theoretic knowledge and generalization of landscape research and research of its structure from the biological and ecological points of view and also outlined the possibilities of linkage with theory of landscape structure research generated in geography and later in landscape ecology.

Geography has brought a great theoretical contribution to the landscape ecology placed at the crosscut of ecology and geography. For more details see the Chapter 3. devoted to the contribution of physical geographical disciplines to the development of landscape

ecology. The circumstance that elaboration of theoretical problems of the learning about the landscape (Drdoš 1965, Mičian, Zatkalík 1984 and others) also constituted an important contribution is also worth mentioning. These geographic approaches and their more elaborated theory of the holistic approach have facilitated the orientation of landscape ecology in the theory of spatial dimension of the landscape and its empirical application to selected territories of Slovakia.

The above quoted brief remarks about formation of the landscape-ecological theory in Slovakia reveal that the combination of geographic and ecological-biological theoretical approaches represent the greatest contribution to the development of the landscape-ecological metatheory where the necessity of the theoretical bridging between geographic and ecological-biological disciplines in the framework of landscape-ecological research has been confirmed. Both the geographic paradigms quoted in the chapter about contribution of geographic disciplines to the development of landscape ecology and the paradigms generated in the ecological and environmental disciplines and the philosophical disciplines (Hrušková, 1993, Krchnák, 1993, Smolková 1993 a Viceník 1993) to the development of landscape ecology) helped this theoretical integration.

Simultaneously, it meant further condensation of the core of landscape-ecological metatheory situated on the crosscut of external geographic and ecological-environmental theories and methodology entering the landscape ecology with the bridged theory and methodologies of the basic and applied landscape-ecological research within the proper landscape ecology. It also meant widening of the spectre of varied theoretical approaches and their obligatory cooperation in the framework of landscape-ecological metatheory what has formed the necessary metatheoretical base for the solution of the topical ecological and environmental problems.

Contribution of methodical landscape ecology to the development of landscape-ecological methodology

The contribution of the methodical landscape ecology to the development of landscape-ecological methodology in Slovakia has most efficiently manifested in elaboration of landscape structure. It was based on the assumption that the key of the landscape-ecologically oriented landscape study is precisely its structure and particularly its biological-ecological value expressed, beside other, by physiognomic and formative types of vegetation as its sensitive indicators. Landscape structure was understood as certain outer physiognomic syntheses of the action attributable to inner genetic-functional phenomena and processes.

Delimitation of individual groups of landscape elements in the framework of the secondary landscape structure, subsequent identification of their biological-ecological values and their comparison in individual territorial transects and within them the corresponding key areas, constitute the principal results of the landscape-structurally oriented basic landscape-ecological research in Slovakia presented in publications like for instance Ružička et al. (1967), Ružičková, Ružička (1973), Ružička, Ružičková (1973), Ružička, Ružičková, Žigrai (1978), Ružička, Drdoš (1970), Ružička et al. (1983) a Ružička (1995). Research of landscape structure in selected territorial transect and individual key areas

(Drdoš et al.,1972; Daget et al.,1972; Bottlíková et al., 1976 and others) was accompanied by a distinct methodical strengthening of the ecological approach to landscape structure research by means of ecological profiles and its linkage to landscape-biological methodical approaches.

Contribution of applied landscape ecology in Slovakia to the development of landscape-ecological metatheory, methodology and metalanguage

Efforts to apply rapidly the obtained results of the basic landscape-biological or landscape-ecological research to the solution of problems of ecological and environmental nature have been developed in Slovakia. These problems were increasingly emerging and accumulating as the negative phenomenon accompanying intensive industrialization and urbanization of the country. Solution of so complex ecological and environmental problems required elaboration of the theoretical basis and methodical instrumentary that would facilitate rapid and scientifically efficient solutions to this undesirable situation. One of the possible tools appeared to be the biological or later landscape-ecological planning although no experience existed in this field in Slovakia. Rapid solution to these problems was only possible after addressing and joining experts in individual geoscientific disciplines and humanities. These experts were expected to prepare a particular landscape-biological plan following a complete and unified methods and in the common planning territory. Gradually, the theoretical and methodical basis for biological planning in the landscape were developed. (Ružička, Ružičková, Žigrai 1975,1978).

Progressively, indispensable knowledge was obtained along with elaboration of several biological landscape plans with varied themes and linked to varied territories. This knowledge was step by step transformed to a complete methodology, which culminated later at the turn of the 1970s and 1980s when the foundations of a new, almost revolutionary, landscape-ecological planning method were laid (Landscape ecology planning) LANDEP (Ružička, Miklós 1981,1982, 1984, 1990).

The main contribution of the LANDEP methodology as the result of long-year continuity of research and accumulation of theoretical, methodical and practical knowledge of a wider interdisciplinary group of scientists is its systemic openness, universal use, information power, moreover it is territorially targeted, and directly applicable. These indisputable advantages are attributable to its inner five level structure and to the close two-way text and cartographic links of the LANDEP methodology starting by the analysis, through synthesis, interpretation, evaluation and ending by the proposal of ecologically optimal landscape use.

Based on a successful presentation of particular landscape-ecological plans prepared by means of this methodology at numerous international scientific events, thanks to having it tested in several European and other countries (Germany, Bulgaria, Netherlands, Denmark, Finland, Austria, Mexico, Nepal or Vietnam, etc.), its publishing in Slovakia and abroad, foreign experts are also aware of this landscape-ecological planning method and it distinctly enriched the methodology of the landscape ecological planning in an international context.

Final remarks

It is obvious from the above quoted remarks about the metascientific background to the origins of landscape ecology in Slovakia, to the contribution and significance of meta-landscape ecology for the development of landscape ecology at metascientific, theoretical-methodical, empirical and applied levels and to the contribution and significance of meta-landscape ecology for the development of other scientific disciplines that the level of elaboration of the subject at individual levels of proper landscape ecology varies. The most efficient action of meta-landscape ecology is naturally its effect on development of theoretical-methodological landscape ecology situated closest to meta-landscape ecology in the inner sequential chain of landscape ecology. Beside, until now it was precisely the theoretical landscape ecology that substituted the interests and mission of meta-landscape ecology. Establishment of metalandscape ecology as an independent landscape-ecological subdiscipline means easing the burden of the superstructure from the theoretical landscape ecology which can thus solely concentrate on solutions to theoretical problems as the landscape is its central research subject.

The relationship of meta-landscape ecology to the empirical and applied landscape ecology as well as to the didactics of landscape ecology is more complicated what makes its significance rather blurred. In future, it will be necessary to pay more attention precisely to these landscape-ecological scientific derivates because meta-landscape ecology representing generalization will make it possible to outline the direction of their specific individual development on the one side and search for more efficient cooperation with other scientific disciplines at meta-scientific level with regards to their crosscut nature on the other.

It is also possible to state that the meta-landscape ecology as a newly forming scientific landscape-ecological subdiscipline contributed to the development of theory, methodology, empiric exploration, application and didactics of landscape ecology in Slovakia at two levels:

a) At an internal level in the framework of landscape ecology - it relieved the theoretical landscape ecology from its metascientific superstructure so that it can focus on elaboration of theoretical aspects of landscape ecology, i.e. generalization of knowledge obtained by empirical and applied ecological research of the landscape. Besides, meta-landscape ecology forms by means of metatheory, methodology, metalanguage and metadata a certain metascientific framework for the development of methodical, empiric, applied and didactic landscape ecology.

b) At an external level, meta-landscape ecology acts as a mediator or "speaker" of landscape ecology in establishing contacts with other scientific disciplines necessary for cooperation and participation of other scientific disciplines in solution of crosscut issues such as sustainable socio-economic development of the society maintaining the ecological-environmental potential of the environment and landscape as its part.

Based on above quoted remarks, it is possible to say that the contribution of landscape ecology to the development of meta-landscape ecology in Slovakia lies in enrichment of its metatheoretical and methodological spectre by new theoretical-methodological approaches of basic and applied landscape ecological research.

In future it will be necessary to intensify the information flow between landscape ecology and meta-landscape ecology as its metascientific superstructure, what will beside other, contribute to the expansion of the theoretical methodological spectre of basic and applied landscape ecological research, to increase of the significance of landscape ecology and its position among the nomethetic and idiographic scientific disciplines and to an increased efficiency of implementation of results reached in the basic landscape-ecological research in applied landscape ecology.