THE GENERAL AND SPECIAL PRINCIPLES IN LANDSCAPE ECOLOGY

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Abstract

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The general principles formulated by Forman and Godron (1993) are possible to apply for landscape differentiation and characteristic as an object of ecological research. From the system approach we can the general principles use for explanation the attributes of the landscape condition with regard on its evolution process. The mentioned authors summarized the landscape ecology principles in seven spheres. The principles of the structure and function, biodiversity, flow of organism species, redistribution of nutriments, flow of energy, landscape changes and stability.

From the general principles we can infer also the special landscape ecological principles. They came out from the first general principle contained the landscape structure and functions. Forman (Darmstadt, Olson, Forman, 1996) accepted as the special principles the patches, edges or borders, corridors and mosaics. We prefer to complete this enumeration with the principle of porosity, network and matrix.

Forman's theory about the general and special landscape ecological principles moves on the landscape structure research from the static position to the dynamic development. This gives the methodical implement for study the landscape functions and processes.

Key words: system approach, landscape ecology, ecological principles, landscape structure and dynamic

Introduction

Landscape and its development, according to Forman and Godron (1993), is the result of four omnipresent natural processes. They are the relief morphology in interaction of climate, colonisation of vegetation and animals, creation and development of soil as mineral ground staleness wrappage and the disturbance of the natural landscape development. The primary landscape structure was formed by these four natural processes. The man gradual increase the share on landscape forming by changing the quality and dynamic of the natural

processes likewise disturbances, and interjection of the new forms of disturbation. The man contributes to the secondary landscape structure creation.

The general principles formulated by Forman and Godron (1993) are possible to apply for landscape differentiation and characteristic as the object of ecological research. The system approach in general principles (Fig. 1) give the possibility for explanation the attributes and condition of the primary and secondary landscape structure, with regard on its state and evolution process. This process is regulated by the direct and also the backward linkage (Ružička, Mišovičová, 2005). The general principles in landscape ecology summarized Forman and Godron (1993) in seven spheres: the principles of the structure and function, biodiversity, flow of organism species, redistribution of nutriments, flow of energy, landscape changes and stability.

The mentioned spheres generate the integral system of landscape attribute principles. The prime two of spheres are oriented on landscape structure and its characteristic for scope the principles of structure and function together with the biodiversity of biota and abiota. It is based on the premise, that landscape is shaped of surface objects (patches, matrix, corridors), differenced by size, numbers, forms or genesis. The interaction between this surface objects and distribution of species, material and energy is realized. In this distribution are the landscapes heterogeneous, namely in energetic functions and material flow. The total landscape diversity is the implication of natural and anthropogenous evolution and distribution processes but also of the natural heterogeneity.

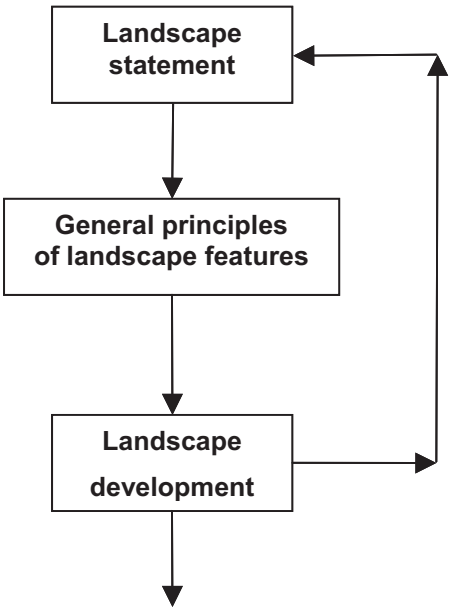

Fig. 1. The position of landscape ecology general principles in the system of landscape development and research.

The connected three principles concentrated on dynamic (the flow of organism species, redistribution of nutriments, flow of energy) are enabling the landscape function fulfilling. The natural or anthropogenous disturbance processes influenced and formed the landscape elements, determined the redistribution of nutriments and supported the landscape streams. The regulation of species circulation supported the environmental diversity. The energy, material and species flow is in the direct coherence with the landscape diversity and heterogeneity.

The two last principles, characterized the landscape changes and dynamic stability, resulted from the mentioned five principles. The both principles reflected the landscape response on the continuous disturbation processes. The disturbing intensity influenced the manner of landscape (structure) changes. The landscape homogeneity is never attainable, nevertheless in consequence of the disturbance. The landscape homogeneity theoretical must be left. The character and intensity of disturbance processes increased or reduced the landscape diversity. The landscape tended successive to equilibrium if the horizontal structure is preserved.

The ecological landscape stability is designated also as toughness or ability to disturbance resistance effect. The character of landscape elements determined its stability. The landscape element without vegetation is biological changeless, but this was not the ecological stability. The landscape element with high share of biomass is resistant to disturbance and assigned high degree of ecological stability. The restoration after disturbance is very slow. The physical stability is property for landscape without biomass. The landscape with few biomasses warranted the fast landscape system regeneration. The sufficient biomass in landscape supported the high resistance against disturbance.

The system linkages of landscape ecological principles (Fig. 2), express, the position of these principles in landscape evolution. The backward linkages between the principles and the integral system of landscape state are illustrated. The landscape development process advanced usual in spiral. The present state resulted from the process based on the general landscape principles (Forman, Godron, 1993) and is not identical with the landscape starting point.

The special landscape ecological principles are induced from the general principles. The basis is given in the first principle directed on the landscape structure and function. Forman (Darmstadt et al., 1996) presented four special principles for better identification the space characteristic and diversity of landscape structure. The principle of patches valuated its size, number and location in landscape. The landscape diversity depends on the number of patches and its size. The hub and edge are in the large patches separated. The small patches, without the hub contributed to landscape diversity. They give quantum biotopes for the potential coexistence of different living kind.

The corridors principle, is able to be as line, strip, or possible like stream concomitant. To the special principles belongs also the edge or borders, it is connected with the mentioned special principles, like its component with different attribute of patches or corridors. The species diversity influenced besides the structural characteristic also the size or breadth. The species diversity grows with the breadth of corridors.

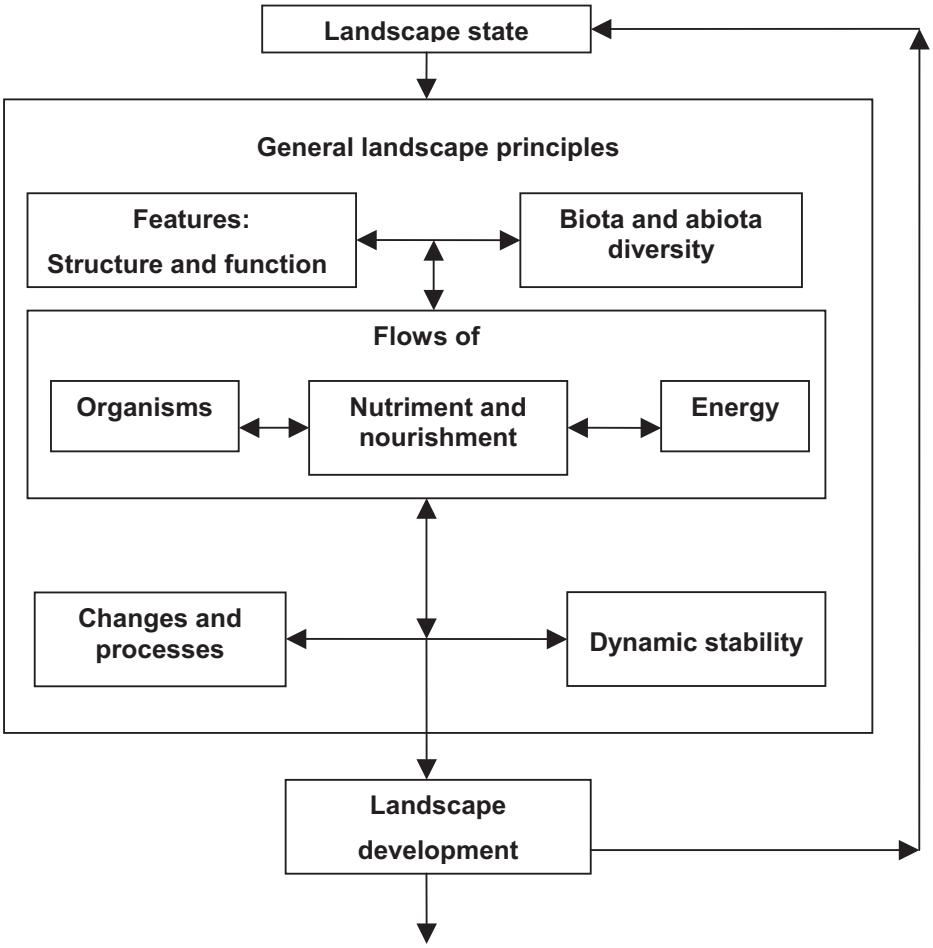

Fig. 2. System linkages of ecological research the landscape general principle attribute.

The fourth special principle in the landscape structure Forman state the mosaic from all structural attributes.

Forman in the mentioned paper (Darmstadt, Olson, Forman, 1996) unexpected incorporate, in the special landscape structure principles, the porosity, network and matrix. The porosity is indicated by patches, the network is possible to induce from corridors. The porosity is significant for the connectivity or the level of isolation the patches in the matrix.

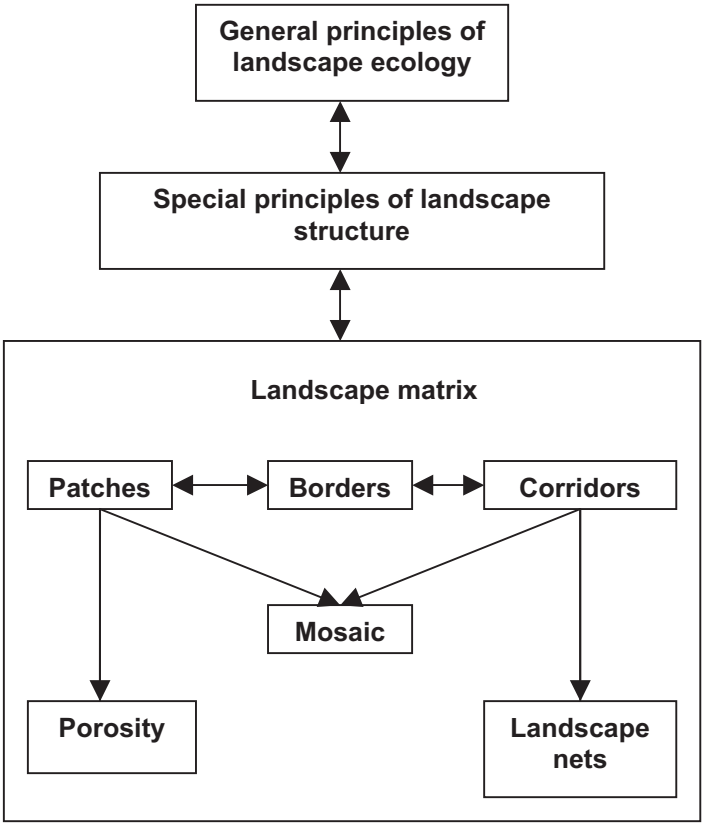

Fig. 3. System of the landscape structure special principles on the matrix ground, like the part of landscape ecology general principles system.

The high number of patches indicated the high porosity with the good flow of energy and material in the matrix and in the landscape structure. Matrix makes the frame for the all special principles jointed in integrated system (Fig. 3).

The theory of general and special landscape ecology principles elaborated by R.T.T. Forman, passed on the landscape structure research from the static position to the dynamic development. This gives the methodical implement for study the landscape functions and processes.

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References

Darmstadt, W.E., Olson, J.D., Forman, R.T.T., 1996: Landscape ecology principles in landscape architecture and land-use planning. Island Press, Washington DC, 80 pp.

Forman, R.T.T., Godron, M., 1993: Landscape ecology (in Czech). Academia, Praha, 584 pp.

Ružička, M., Mišovičová, R., 2005: System ecology (in Slovak). Edícia Biosféra C 1, Združenie BIOSFÉRA, Nitra, 80 pp.