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CRISES AND PROSPECTS OF DEVELOPMENT OF LANDSCAPEOLOGY IN THE COUNTRIES OF POST-SOVIET AREA

***key words*:** landscape, system, informatization, synergetics, processes

Landscapeology is an integral part and result of self-development of geography. This is a science about natural and natural-anthropogenic landscapes, their genesis, structure, dynamics, functioning (Nikolaev, 2000.) That is why, watching the state of development of landscapeology one can judge about the state of the whole cycle of physical-geographic science.

Geography, as well as other sciences, submits to the laws in its development, when the periods of evolutionary changes are replaced by revolutionary ones and are accompanied, according to T. Kun (1977) by corresponding paradigms.

In the geographical literature, the articles appear periodically, in which degradation of geographical science, its crisis and loss of authority in the society is ascertained. As attributes of degradation of geography, A.G. Isachenko (1953) considers reduction of professors half as much and falling of circulation of leading geographical journals, I.G. Chervanev (1995) – loss of authority by geographers in the society and, in particular, at secondary and higher school. I.G. Chervanev explains such attitude to geography by following: fundamental sciences (to which traditionally belong physics, chemistry, etc.) investigate the laws, but geography, historically, studies objects. There is no experiment in geography – the soul of research – thus inseparable link "theory-experiment" present in exact sciences is lost here. This fact substantially hampers development of both theory of landscapeology and its practical applications. "Unclaimness" of geography in the informational society to a large degree is influenced by this fact (Bagrov, 2004.)

The reasons of crisis stages always have complex character and can not be reduced to several reasons or factors; otherwise it would make illusion of possibility of simple solution in the science. Indeed, crises are always caused by structural, revolutionary changes, by exhaustion of paradigm, adopted in the given period. Even so, current theoretical beliefs are neither able to explain new experimental facts nor practical applications keep pace with practical inquiries, all being apprehended as lack of social order and practical value of geographic science.

Geography, including landscapeology, was developing due to the **internal and external processes** through a number of stages of scientific development which, having exhausted themselves, were replaced by new ones, thereby creating urge in development of geographical science. We can count seven periods in geography, not including the stage of its formation (fig. 1) The first two periods were characterized by development of geography itself, with emphasis made at comparative country-specific analysis (Simonov, 2008) – it was the period of systematization of geographic knowledge of all previous era of Great geographic discoveries.

Landscape period proper, mainly due to the works of N.A. Solntsev school, refers to the end of 1940s – early 1960s. The next three periods of progress in landscapeology, connected with external processes of development (systemic, ecological, informatizational), advanced sequentially, from the late 1960s up to the beginning of 2000. Ecological stage led to active growth of landscape ecology. Informatizational period had an impact on development and greater resort to geoinformational technologies in the practice of landscape researches. Synergetic stage only starts to develop and is oriented primary at study of such complex landscape properties as non-linearity, fractality of self-organization and self-restoring processes, development of physical and mathematical models of landscape as a whole and its separate properties.

Process stage of development of landscapeology is seeing in active study of processes at macro- and microlevels. The start was given, as we see it, by geochemistry of landscape, but mostly behaviour of chemicals in landscape was studied (Perelman, 1966; Glazovskaya, 1998). But geophysic researches, experimental base for mathematical modeling of landscape, didn't have due development. New impulse into development of landscapeology was given in the period of liquidation of Chernobil aftereffects of 1986. N.A. Solntsev's view of morphologic structure of landscape were laid as the basis of landscape-ecology projections (Davydchuk and others, 1994); study of intrafacial processes on the example of radionuclide migration began in 1992 at the experimental testing areas of Polesie landscapes of Bryansk region (Linnik, 2008). It was the period when bases of new (process) direction were laid that were tested at the organization of network of landscape-radio-ecological monitoring in Bryansk region to attain dynamic parameters of landscape-radio-ecological situation.

Crisis of geography caused by differentiation between separate disciplines In the 1870s geography experienced long theoretical and methodical crisis. Function of discovery and primary description of the new lands was not in need any longer at that time. As a result of differentiation of geography between separate dis-ciplines, the object of research was disappearing.

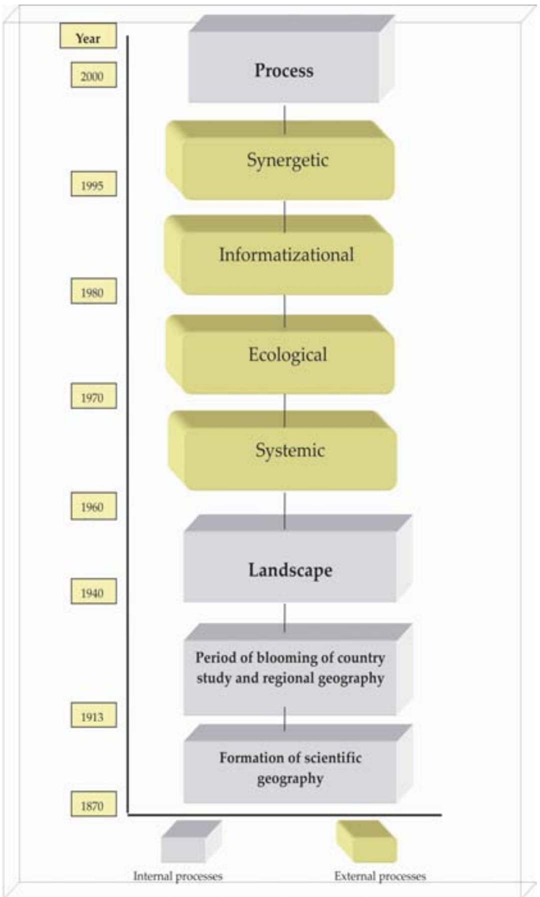

Fig. 1. Stages of development of geography (landsca-peology) due to internal and external processes.

The crisis of the science at the end of the 19th – beginning of the 20th cen-turies was characterized not as much as by disintegration of the old geo-graphy, but by formation of modern geography, in connection with deepe-ning of specialized study of nature. Forming of new sciences was headed by the greatest scientists of that time: geomorphology – by F. Richthofen, A. Penck, W. Davis; cli-matology – by A.M. Voeykov; pedology – by V. V. Dokuchaev, G.N. Vysotsky.

Differentiation of physical geo-graphy was accompanied by notions about integration of natural compo-nents. According to V.V. Dokuchaev, "water, air, soils, land, vegetation and fauna are closely connected among themselves to such degree that forms the integral uni-form and indis-soluble nature" (Dokuchaev, 1898). The basic line of integration of com-ponents to comprehensive whole at the end of 19th – first half of 20th centuries went in the direction of forming of regional geo-graphy and country study.

The most valuable achievement of geography of that period was developing of **geographic method of research** – it was the result of it self-development that differ-red geography from other sciences (Getner, 1905).

Crisis of regional geography and country study. Component integration within the limits of separate regions in Europe was deve-loped by E. Reclus (1898), O. Peschel (1879), F. Richthofen (1883), Vidal de la Blache (1913), A. J. Herbertson (1905), etc.

Research of components of the nature separately created scientific preconditions for integration of geographical knowledge that was implemented as physical and geographical division into districts, originally for separate components: botanic and geographic (Beketov, 1884; Keppen, 1885), zoogeographic (Severtsov, 1885; Menzbir, 1914), geomorphologic (Nikitin, 1984), and then complex physical-geographical (Tanfiliev, 1897; Brounov, 1904; Kruber, 1907; Berg, 1913, etc.) Componental integration went in two directions: in natural zones and in physical-geographical areas. The plan of components integration at the description of regions was offered by V. V. Dokuchaev (Dokuchaev, 1898) who believed that the major factors of integration at soil formation are superficial rocks, Earth plastic, surface and ground waters, climate of the country, vegetation, fauna and humans. Regional geographic direction in geography of France was developed by Vidal de la Blache (1913), who considered territorial unity of separate sites of terrestrial surface to be the result of interaction of abiocoen and wildlife when they adapt to each other and converge to equlibruim. He saw separate regions as geographical individualities, or "a geographical organism." The work of A. Herbertson (1906) is marked out among regional geographic works, which is based on grouping of natural phenomena. He considered certain areas of the terrestrial surface to be the whole, not only by their exterior form, but as complexes of a firm surface, waters, air, plants, animals and humans.

Country study and regional geographic direction in development of geography was completed by creation of major works on geography (Dobrynin, 1941, 1948; Armand, 1956; Berg, 1915, 1952; Boli, 1948; Bernar, 1980; Morret, 1938; Lukasheva, 1958, etc.) In total, country study and regional geographic paradigm covers biogeomorphological stage of formation of physical geography, marked by F. N. Milkov (1970.)

The description of countries and areas under the certain plan appeared to provide geography with the independent place among sciences, and at the same time did not contradict habitual representations about uniform complete complex of object of geographical studying. The further isolation of componental sciences led to the loss of common language that was why the componental analytical description of regions became formal. As a result, a number of geographers denied objective existence of separate regions as complete objects. For instance, D. Whittlesey wrote that "region is not object, neither independently existing, nor given by nature." (Whittlesey, 1954) The place of regional geography in the system of geographical sciences was well defined by N. N. Baransky (Baransky, 1960), who wrote that the given science "not applying for a role of a special science, should be only organizational form of association of versatile knowledge in this or that certain country."

Country study and regional geographic paradigm, that defined regions and countries – complete complexes – as objects of geography, gradually played out, and to the middle of the 20-th century **regional geographic crisis** was outlined in the development of geography.

Crisis of ideas of complexity and landscape morphology. During formation of scientific geography, some talented scientists stated ideas about a landscape complex. The first substantiation of the landscape paradigm belongs to S. Passarge (1913), who defined natural landscape as "area in which orography, geological structure, geomorphology, climate, irrigation, vegetation and fauna of the territory find out conformity in all existing points." However his idea was not been apprehended by the western geographers and did not received development.

It was L.S. Berg (1915) whom we are obliged by introduction of scientific concept about the landscape in geography. He not only defined concept of landscape as an object of geographical researches, but also put it as a basis of zone allocation. L.S. Berg (1947) defined a landscape zone as area of prevailing development of the same landscapes.

Development of the teaching of landscapes continued A. D. Gozhev (1930), L. G. Ramensky (1938), M. A. Pervukhin (1938), etc. in the first period of development of landscapeology (1900-1930) the landscape was represented **as a complex of the interconnected components**. For many years, the ideas of landscapeology had an abstract character, and its theoretical positions did not find reflections in regional geographical problems.

In 1940s – early 1950s, a **notion of landscape as a system of morphological units** was forming. The works of S.V. Kalesnik (1940, 1950), N.A. Solntsev (1948), F.N. Milkov (1953, 1966), A.G. Isachenko (1953) K. I. Gerenchuk (1956), G. P. Miller (1957, 1968), G. N. Anenskaya, A. A. Vidina, V. K. Zhuchkova (Anenskaya etc., 1963) determined a wide circulation of the landscape paradigm in geography. Due to efforts of these scientists, the general theory of landscape complex, system of regional and typological units were developed. To the mid-sixties, the teaching about morphological structure of landscape was, in fact, completed, that was marked by creation of technique and practice in landscape mapping.

The further development of geography, including landscape geography, is connected not with internal impulses of self-development, but with distinctive external influence of factors. The most important among them are systemic factors, including synergetic, and ecological and informatizational factors.

Systemic deadlock in the development of landscapeology. Introduction of the systemic approach led to transition from landscape-mor-phological stage of development to systemic-functional which F. N. Milkov (1981) named as functional-landscape stage. The concept "system" in geography was applied earlier to a designation of complex objects. As the scientific method, the systemic approach was used in the middle of the XX century when studying com-plex dynamic systems with the purpose of revealing holistic properties, character of their internal and external ties as some isolated bodies (Bertalanffy, 1962.) Originally, *landscape was viewed as a geosystem functioning in space, later landscape was considered to be a dynamic system.* (Sochava, 1978; Krauklis, 1979; Beruchashvili, 1986.) Application of the systemic approach in geography enabled it to be a part of new direction of development in natural sciences, to study interrelations between components and geosystems more purposefully, begin studying holistic properties of landscape, solve a number of problems connected with stability and loads on the landscape. Allocation of functional ties allowed to study a mode of functioning and development of landscape complexes. The systemic concept enabled to create new theoretical formulations, especially in concepts of organization and information. Achievements of systemic-functional stage are reflected in many works (Sochava, 1978, 1981; Armand 1975; Reteyum, 1986, 1988; Shvebs, 1988; Shischenko, 1988; Beruchashvili, 1990; Chorley, etc. 1978; Haggett, Chorley, 1971, etc.)

Nevertheless, the systemic concept did not become the powerful instrument of geographical researches. It is explained by unavailability of geography, except for some componental geographical disciplines, to apply mathematical methods of research, on one hand, and by discrepancy, on the other hand, as it was noticed by Armand (Armand, 1975) of models of research: three-dimensional, demanded by concept "system" and two-dimensional, reflected by concept "natural-territorial complex", or "landscape". As a result, there appeared the third **systemic** deadlock in the development of geographic theory.

The ecologization of sciences took geography as well. The ecological paradigm in natural science arose as early as the first half of 20-th century, but it got wide distribution in sciences only in the beginning of seventies, when owing to work made by order of Roman club, possibility of global ecological crisis was realized. There were mainly three ways of ecologization of sciences: 1) application of ecological method of research; 2) integration of geographic and ecological sciences; 3) expansion of subject of investigation (e.g. ecological law.) Ecology embraced philosophical, social, geographical, economic and other directions of science. The concept of ecology became indefinitely wide. There appeared expressions: "technical ecology", "ecology of the soul", etc. The ecological boom spread also to geography, where "ecology of landscape", "landscape ecology", "ecology of human", "social ecology", "geoecology" and others were formed. D. Stoddart (1971), considered conception of ecology as a fundamental organizing concept in geography. The attempts of construction of theory of landscapeology appeared on the basis of concepts of ecology.

Ecological approach revived landscape ecology in the countries of post-Soviet area which, unlike western geography, began to develop only lately. Works of V.B. Sochava (1978) and M.D. Grodzinsky (1993) were pioneer in this respect. Activation of development of landscape ecology (geoecology) took place in the last decades in connection with the necessity to examine affect of anthropogenic activity to the landscape. Confluence of theoretic and methodical positions of classic ecology and landscapeology enabled to formulate many theoretical positions of landscape ecology, such as the concept of landscape-ecological niche, geoecotope, stability of landscape, closed and opened slopes, position, portion character of landscape-forming streams; to develop the system of estimation of the landscape state depending on different types of influence; to solve many applied tasks. Due to ecologization of geography within the framework of landscape science, landscape ecology develops actively – it studies relationships of landscape with the environment, including social environment. In the European countries, landscape ecology develops as independent science (they do not have landscapeology) that studies spatial processes, structure, temporal changes, value and importance of landscape from positions of its subjects – sources of activity that show up in it (Rykhling, 1999.)

Ecological approach, as well as system approach, appeared in landscapeology owing to other sciences, and despite the fact that they allowed to investigate landscape more thoroughly and solve many applied problems, landscapeology as a science should develop due to internal impulses, i.e. find its own theoretical and methodical approaches.

The informatizational period of developing of landscapeology is dated by the beginning of 1970s – when computers began to be used for calculation of parameters of functioning of geosystems (Krauklis, 1979), and also morphometric indicators of landscape structure or the analysis of landscape drawing according to remote sounding (Victorov, 2006.) Introduction of an information technology in landscapeology was restrained not only by weak computer facilities, but also by absence of the specialized software, suitable for decision both theoretical, and applied problems of landscapeology. It is necessary to notice that already to the middle of 80s, the ways of organization of geographical databanks, some prototype of geoinformation systems was offered. Nevertheless, the great bulk of the landscape information was not presented in a digital form that created serious technical problems in applying even such methods, as the mathematical statistics for the landscape analysis.

When professional geoinformation systems (in the middle of 1990s) and digital remote sounding (the end of 1990s) appeared, essentially new possibilities opened. They make possible to pass, in the near future, from statistical methods of descryption of landscape morphological structure to construction of landscape maps on the basis of automated decoding of the polyzonal data of remote sounding with the high position resolution. However creation of mathematical models of the landscape which, using geophysical methods of research give the chance to pass to construction of dynamic models of landscapes with different hierarchy levels are also prospective.

In this connection researches conducted at model landscape testing areas become topical; using the data of remote sounding, they supply with information on modeling of landscape-forming processes at different scale levels of landscape organization.

Synergetics, studying opened, self-developing, dissipative systems, and landscapes among them, seems to work out all problems of science (Paschenko, 1999; Petlin, 2005; Pozachenyuk, 1999.) Study of landscape from the point of self-organization and non-linearity, is, by no means, major break-through of landscape science. But synergetic approach, as well as system approach, (and by itself it presents further development of the theory of systems) is just methodology needed to be developed according to theoretical problems of landscapeology.

Landscapeology as a science should be developed due to the internal processes of self-developing. Many positions of internal development of science were found during formation of geography and landscapeology.

First, it is the position of V.V. Dokuchaev about soil as integral part of landscape, formed as a result of functioning of the whole (i.e. landscape). System-synergetic conception aims at new vision of some positions of landscapeology, in particular, forms new notions of **landscape components**. In the theory of landsca-peology, as well as in practical nature management, the notion of landscape compo-nents is not adequate to reality extremely. It is accepted landscape component model upon which the solving of practical questions of nature management depends grea-tly. Landscape is a certain integral system, including a human and products of his activity. On this basis, the components of landscape can be divided, depending on their primary origin and functional role, into two groups: natural proper and anthropogenic. We consider **population** and result of its activity – **techno-matter** to be anthropogenic components (tab. 1).

A question about the components of natural subsystem of landscape initially was solved in the field of landscapeology; and the "fragments of separate spheres of landscape mantle: lithosphere, hydrosphere, atmosphere and sphere of distribution of biota" (*Explanatory dictionary…, 1982*) referred to the components. The unclearness of concept "fragments of separate spheres", presumably, has resulted in situation when such properties as relief and climate often attribute to the components, or parts of these spheres are considered the components of other systems. Landscape, as an integral total system, develops by the internal laws, and all external matter which gets in its composition, is processed, according to the thermodynamic conditions of this system (to the different types of landscape). We may give somewhat rough, but analogous and convincing example: all matter, getting into a living organism as food, is decomposed by this organism to elementary parts, inherent only to it, and then synthesis of necessary for this organism structures occurs from initial parts. If we use logic of the above-mentioned reasoning, it is hard to agree that upper part of lithosphere or lower part of atmosphere enter into the composition of landscape unchanged. They are "processed" by landscape. Lithosphere as geological formation has its structure and lithologic composition. Within the framework of landscape, according to G.E. Grishankov and others (Grishankov, Milkov, 1987), destruction of geological structures and mountain rocks occurs, proper deposits of landscape (clays, loams, sands, sandy loam, etc.) geomorphological bodies (dealluviual trails, alluvial cones, landslides, etc.) are formed.

Tab.1. Components of modern landscape.

Subsystems of components	Blocks of components	Components of landscape
Natural	Abiotic	Mountain rocks Landscape gases Water solutions
	Biostagnant	Soils
	Biotic	Ecosystems
Economic	Anthropogenic	Population Technical buildings

Similar processes take place both in atmosphere and hydrosphere: synthesis of "landscape air" proper and "landscape waters" occurs from their transformed parts. Composition of the latter is determined not only by the initial landscape but also by functioning of technical systems, connections with other geosystems et cetera, and it strongly differs from composition of air or waters of free atmosphere and lithosphere. The indicated spheres give material for forming of such components, as **mountain rocks, water solutions and atmospheric air**.

Components of landscape are the certain complex integral systems, heterogeneous in their composition and structure. We may clear see it while viewing soils. There were attempts in the history of science not to consider soils to be landscape component on the basis, that soil is the result of interaction of components of nature (Solntsev, 1963; Armand, 1975; Gerenchuk, 1978 and others). Soil indeed is the certain system composed formally of all other components (but they are already natural components regenerated by soil body.) If followed strictly by logic, it is impossible to disagree that such components as mountain rocks, water solutions and atmospheric air consist of other components in different proportional relations. Therefore soil is considered one of landscape components.

Are vegetation and fauna the exception? It is logical to suppose that *living organisms are included in the landscape not as separate individuals, as they are usually described, but they are, by analogy with other components, structural elements of more common integral formations – ecosystems*, beginning from elementary consortia, biocoenosis and concluding with such large ecosystems like tropical forests, deserts, steppes and others. Therefore, it is necessary to consider eco-systems to be landscape components, but not vegetation and fauna. The notion of ecosystems is well developed in biology, teaching that we should consider species as integral part of its habitat. Such understanding of landscape components is conformed well to realities and is targeted at other approach to conservation of plants and animals, and, consequently, at estimations of influences on them, and making guidelines, et cetera.

Unity of natural geosystems and geosystems created by man is manifested in forming of three types of geosystems: **1) natural weakly transformed, 2) constructional** (created by human and functioning at constant "grants" of matter, energy and information from humans) and **3) derivative** or collateral (created in landscape-geographical fields of structural landscapes), and also post-economic (at the sites of former structural landscapes). Landscapes created by human or under his influence are often called anthropogenic, natural-economic, and natural-economic territorial systems. As a matter of fact, all these terms reflect a single natural landscape, but with the different role of components in its functioning.

Second position of internal self-development of landsca-peology: revivals of teachings of V.V. Dokuchaev and V.I. Vernadsky about bodies. Category of "body" is one of few concepts, which outlived ages. With development of natural science, it gets to all new areas. V.I. Vernadsky (Vernadsky, 1967) named natural body in biosphere "every object logically delimited from environment, that appeared as a result of appropriate natural processes in biosphere or, in general, in the Earth's crust". A.Yu. Reteyum (Reteyum 1986) considers bodies to be objects, isolated in space and time, relatively homogeneous and integral formations with specific organization, structure and composition, being forms of existence of some matter in one of its states or a system of phases, which resists an environment as a unit. Physicists understand body to be physical systems, consisting of the spatially-isolated steady accumulations of enormous amount of particles.

Bodies are titrimetric, and their study on two-dimensional territorial models that dominate in geography is practically impossible. These models are the result of a firmly consolidated chorologic principle in geography, that objectively hampers a transition from two-dimensional models to three-dimensional at the study of geographical reality. Sometimes when studying objects, their spatial properties come to descryptions of horizontal and vertical organization, that are not adequate to properties of three-dimensional space, because not organization of bodies, but organization of spatial directions is studied. Vertical structure here often comes to interaction of components, which, by the way, goes in all directions in three-dimensional space.

V.S. Preobrazhensky and others (Preobrazhensky and others 1988) mark difficulties of transition from two-dimensional to three-dimensional model. Some experience of description of geographical objects and phenomena in three-dimensional space is present in works of A. Gumbolt (1862), G.D. Rikhter (1969), G.Ye. Grishankov (1972). However, the problem of three-dimensional space can not be solved without introduction of concepts "body" and "field" into scie-nce. Some types of bodies, which are studied by geography and some other sciences, are shown in the tab. 2.

The third major theoretical position in landscapeology is determination of those structural levels which are examined by science. Every spatio-temporal level is cha-racterized by their objects and processes which determine functioning of these ob-jects. V.I. Vernadsky (1967) at studying of biosphere examines motion of matter and processes both on atomic and molecular and on a biosphere levels. In geography, on some groundless positions objects are studied proportionately to a human and his production (Preobrazhensky and others 1988), or horizontal sizes of these objects in the limits of "some tens meters – natural territorial complexes of lowest ranks (10^2 m) up to some thousands kilometers (10^7-10^8 m. Vertical sizes of geosystems fluctuate from some tens meters (natural territorial complexes of lowest ranks) up to 10-20 km (vertical capacity of geographical sphere, that is from 10^2 to 10^4 m" (Bokov, 1986).

On the same levels processes are studied, while transformation of substances coming into landscape as well as integration of matter proper goes on lower levels of spatial organization.

The analysis of works on geographical sciences shows, that modern geography studies four structural levels of the material world: **intrafacial, facial, landscape** and **geospheric**.

Tab. 2. Types of bodies (objects), studied by physical geography and allied sciences.

Sciences	Types of bodies				
Geology	Mineral	Mountain rock	Structure	Complex	Lithosphere
Meteorology	Baric microbody (layer)	Baric mesobody (whirlwind, stream)	Baric systems (cyclone, anticyclone)	Air masses	Troposphere
Biology	Cell	Organism	Biocoenosis, structure	Class of structures	Biosphere
Land-scapeology	Facies	Natural boundary, natural subboundary	Locality, subzone, altitudinal belt	System of geographic zones	Landscape sphere
Regional physical geography	District	Area	Country	Mainland, ocean	Geographic layer

Intrafacial structural level. One of the tasks of landscapeology is to study pro-cesses and patterns of forming of landscape bodies proper, i.e. to answer the question how landscape bodies are formed in the thermodynamics terms of landscape sphere from the bodies of geographical layer. For example, how are proper landscape mountain rocks (macadam, gravel, loams, clays and other) and landscape bodies (slope wash, terraces, beaches, landslide bodies and others) formed from geological structures (slabs, syneclises, anticlises, et cetera) and mountain rocks (magmatic, metamorphic, et cetera). To the point, the ecological condition of different types of landscape is formed exactly on this structural level. Development of landscape ecology goes in this direction, in connection with the necessities of practice. It is landscape ecology, that is likely to bring method, devices in landsca-peology and will allow studying processes in landscape.

The bodies of facial structural level are composed from the discrete particles of mountain rocks and soils, and similarly by the separate species of plants and animals. The forms of primary integration of geographical bodies are layers, lens, slope wash, tiers. Facies are initial territorial forms of organization in geology, soil science, botany and landscapeology.

Landscape structural level is formed with morphological complexes (natural boundary, locality), and also with zonal structures.

Geospheric structural level consists of mainlands and oceans, and also component geosystems, having the structure of spheres and semi-spheres (litho-, hydro-, atmo-, biospheres.)

Important task of landscapeology is solving the problem of integration of landscape bodies. Presently, patterns of integration of landscape bodies are studied by geology (processes of hypergenesis), soil science (its achievements are not used much in modern landscape science), geochemistry (which develops parallel, not merging with landscapeology).

The study of bodies presupposes **studying of the fields**, appearing around them (geomorphologic, insolational, wind, biocenotic, anthropogenic and others). In particular, actuality of problem is increased in connection with forming fields with domination of destructive processes round the economic objects (natural-economic systems). Quite often, negative area of influence of economic object exceeds the sizes of more than twice (sometimes in ten times). This position requires an obligatory account at nature management. It is possible to assert that the field of influence around the anthropogenic object is like an ecotone, but with opposite to natural ecotone properties. If natural ecotone has advanced complication of structure and organization, in comparison with geosystems having formed it, ecotones formed around anthropogenic objects, on the contrary, are characterized by simplification (often by homogeneity of structure) and obvious decline of geosystem organization. Therefore, transitional areas between anthropogenic objects and environment are possible to call **anthropoecotones**. In most cases, anthropoecotones merge with each other, forming continuous destructive areas, or superimpose on each other, forming seats of strongly changed landscapes that often are centers of ecological instability. We may call the process of merging and superimposition of anthropoecotones, followed by structure simplification and decline of organization level of landscapes, development of destructive processes **the process of anthropoecotonization of landscape sphere**. It is a very dangerous process, attaining a macroregional level and threatening by destabilization of the whole landscape sphere.

The problem of studying of spatio-temporal laws of organization of landscapeology is traced, perhaps, through all time stages of its development and development of geography. Much has already been done here. The work of M.D. Grodzinsky (Grodzinsky, 2005) is summarizing in this respect. Spatial laws were studied, in most cases, being based on observation and method of analysis and synthesis.

Nevertheless, **the law of geography on geographical zonality** is not logically sustained in all climatic regions of differentiation into natural zones. Formulated by V.V. Dokuchaev, and specified by A.A. Grigoriev and M.I. Budyko, this law in its perfect form is manifested only within the limits of so called plakor (flat interfluve) plains. In some cases deviations are observed. So, in high latitudes, isolation of zones occurs according to distribution of not the proportion of heat and moisture, as at allocation of zones on plakor plains, but of heat only; the primary factor of differenttiation within the limits of hydromorphic plains is the level of ground waters. In mountains allocation of zones occurs depending on absolute height. The deviation from zonality is caused sometimes by lithology of rocks: in the zone of coniferous woods, in the regions where calcareous rocks outcrop, having more heat capacity, geosystems of the southern zone – deciduous woods – are formed. Therefore, besides the term "zonality", terms "azonality", "intrazonality" are used. Though two last terms are debatable enough.

There are attempts in the scientific literature to present the law of zonality with much smaller quantity of restrictions. We are talking about the approach of allocation of system of natural zones within the limits of landscape levels, developed by G.E. Grishankov (1977). Landscape levels are the planetary geomorphologic formations, rather homogeneous in character of the relief and soil humidification, but different in displays of geographical zonality. Isolated zone systems are presented within the limits of landscape levels. And here the multifunctional approach to allocation of criteria of zonality is traced. Leading criteria of allocation of natural zones are their own at each landscape level: at hydromorphic level – the level of ground waters; at plakor level – proportion of heat and moisture; at foothill level – absolute and relative heights, position (spatio-temporal relations with objects of environment); within the limits of mid- and high-mountainous level - true altitude, macroposition. This approach enables to consider zone organization as three-**dimensional model of geosystems**.

Within the limits of each region, depending on its properties the system of intraregional laws is formed: hydromorphic zone, landscape layerage, surface microzonality, positionality. **Hydromorphic zonality** is connected with the change of salinity of ground waters with occurrence depth from 0 up to 6-8 m. Landscape structure of such plains is specified by a combination of three basic hydromorphic zones: nondrained, slightly drained and relatively drained zone of plains.

The leading factors of the landscape organization on **placor plains** are relative height, lithology, degree and character of relief ruggedness. **Landscape layerage** is formed according to the vertical distinctions of landscapes connected with the change of geomorphologic conditions (degree and character of ruggedness, rock lithology, speed and direction of geomorphologic processes, etc.). **Surface microzonality** is traced in change of landscapes with relative height of the slope and connected with distinction of processes proceeding in different parts of the slope. The major factor of the intralandscape organization at mid-mountainous level is height above sea level and a macroposition of slopes.

Position is spatio-temporal relations of geosystem to other geographical objects and fields (Pozachenyuk, 1984, 1986). Positioning is allocated as a principle of landscapeology. Positioning attitudes may be both direct, and indirect.

Typification of positions may occur in several directions (tab. 3). Position depending on its type may be **spatially-field and linearly-streaming**. The subtype is allocated depending on position of landscape in the system of its dynamic transformations – **temporal position**, and in system of spatial changes – **spatial position**. The class of a position is allocated depending on location of landscape concerning separate streams or structures - tectonic, insolational, circulating, biotic, anthropogenous, etc., and also depending on position in spatially-field system (so-called cumulative positions are formed) – foothill and seaside. Kinds of position are formed according to spatial orientation and remoteness of object in the system of relations.

Tab. 3. Directions of classification development of the geographical position.

Type	Subtype	Class	Kind
Linearly-streaming	Spatial Temporal	Tectonic Insolational Biotic Circulating Anthropogenous	Near, far N, S, W, E, NE, NW, SW, SE Near, far Windward, leeward Near, far
Spatially-field	Spatial Temporal	Foothill Seaside	Near, far Near, far

Under influence of position in landscape structure, position landscape lines and position landscape zones are formed. Taking into account intraregional laws of the organization of landscape enables to create new models of the landscape, make land system and take actions on sustainable development of the region.

The organization of wildlife management depends on dominating outlook and the paradigm of wildlife management accepted on its basis. When classical outlook prevails, opposing the subject-object relations where the person and its activity is not a structural element of complete system "nature-society", wildlife management is based on the **principle of restriction**. The basic paradigms of wildlife management, corresponding to the given outlook, are **conservative and rational use of natural resources**. The essence of conservative wildlife management was in the tendency of keeping unchangeable the certain quantity of natural geosystems (for example, system of nature protection territories). Rational wildlife management, while having progressive onset, is based on anthropocentrism.

Presently, the concept of sustainable development is being formed on the basis of system-synergetic picture of the world, and **in geography – coadaptive (adaptive) concept and on its basis – coadaptive paradigm of wildlife management**. Terms "adaptation" (adapto – to adjust), "coadaptation" (coadaptatio) originated in biology and reflected the various parts of the process of organisms adaptation to the environment (Paramonov, 1988). In the 60s, the term "sustainability" was used when descrybing ecosystems and separate populations, meaning the development of the population coordinated with development of that ecosystem to which it belonged and not leading to destruction of the wholel ecosystem. From here the term "sustainable development" originated meaning the development of the society comprehensible to preservation of the human ecological niche, and therefore conditions for development of civilization. The term "sustainable development" came from biology (more precisely, from "biological ecology" and population dynamics).

In the strategy of sustainable development the term "coevolution" is being actively applied (Lavrov, 1989; Moiseyev, 1992.) Initial concept "coevolution" meant in biology the accelerated historical development of two regular groups having differrent origin, but connected with each other by close ecological relations (trophic, competitive, spatial, etc.) Further on, with distribution of the concept of sustainable development the concept "coevolution" extended from narrow biological content and was transferred by V.I. Moiseyev (1992) to the process of interaction of the society and nature and was understood as parallel, joint, interconnected evolution of nature and society. Discrepancy of speeds of the natural evolutionary process, going very slowly, and social and economic development of the mankind occurring much more quickly, leads to degradation of nature at uncontrollable form of mutual relations.

In geographical sciences coadaptive (adaptive) concept was being developed with the use of such concepts as adaptive geography (Shvebs, 1991), adaptive-landscape agriculture (or landscape-contour system of agriculture) (Dokuchayev, 1950; Kiryushin, 1993; Kashtanov et al., 1994; Nikolaev, 1992; Shvebs, 1985, and others), coadaptation (Pozachenyuk, 1999). The theory of the cultural landscape developed by V.A. Nikolaev (2000, and others), is based, inherently, on the adaptive approach. In other kinds of wildlife management it is also possible to meet elements of adaptation, i.e. coordination of "adaptation" of economic activity to the environment. For example, record of properties of landscape components in construction, development of normative loadings on the landscape, elements of territorial planning in view of structure of the landscape, etc. It is possible to speak about adaptive system not only of agriculture, but also of any kind of wildlife management (for example, adaptive system of industrial recreational and other land tenure.)

Coadaptive paradigm of wildlife management is based on basic theoretical representations mentioned below: integrity of system “nature-society”; human and its economic activity as a structural part of the whole system. On this basis, the landscape consists not only of natural components, but also of anthropogenous, and in system “nature-society” natural and economic (or socioeconomic) subsystems are allocated.

Human and its economic activity as a structural part of system “nature-society” should carry out the certain function directed on steady functioning of all system. Function of mankind consists in development of the noosphere. The given concept conforms to the notion of "noosphere" of Teyar de Charden (1965), and V.I. Vernadsky (1975). V.I. Vernadsky (1975) put two complete and inseparable notions in the concept of “noosphere”. Sources of the first one are based on processes of evolutionary development of the planet. V.I. Vernadsky on the basis of empirical material and on the ground of ingenious generalization drew a conclusion about organizing roles of living substance in transformation (formation) of lithosphere, atomsphere, etc. He determined a geological role of living substance. He understood noosphere as a biosphere chemically changed by the human. The given understanding agrees with idea of Teyar de Charden that "superlife" should come irrespective of actions of people as a result of natural process of self-development. But it does not mean, as I. Zabelin (1968) considers, that without purposeful participation of the human the process of noosphere-genesis will be carried out.

The second outlook notion of V.I. Vernadsky concerns understanding of the huge responsibility of mankind for the future development of nature. V.I. Vernadsky (1975) wrote, that the development of the society harmonized with nature, the responsibility for nature and its future would demand the special organization of the society, creation of special structures which would be capable to provide that joint coordinated development. That’s why the term noosphere is more often interpreted as sphere of intellect. Expressing these two notions about V.I. Vernadsky's noosphere in a language of modern scientific paradigm, one may say, that its formation will go through knowledge of laws of general evolutionary process (self-organization of nature) and operated development of the society, relatively to its own activity. On the assumption of above-mentioned, one of possible understanding of noosphere is the following: the *noosphere is the condition of geographical environment which is characterized by coordinated development of the society with evolutionary process of self-organizing of nature, including Space***.** The beginning of this process coincides with comprehension of whole-planet necessities of sustainable development of the system “society-nature”.

A leading principle of interaction of the society with environment is a **principle of compatibility**. The socioeconomic subsystem should be compatible in space and time with natural subsystem, i.e. it must develop and exist in coordination with development of that system to which it belongs and not lead to destruction of all the system. It will provide sustainable development of system "nature-society" with minimal destructive processes and a favorable ecological condition.

The essence of coadaptive concept of wildlife management consists in such organization of the territory when region would function as complete sustainable system where the economic subsystem is coordinated with natural subsystem according to the principle of compatibility of components of nature of natural landscape.

The demand for landscapeology will be fuller provided that it from a descriptive science will turn to a science which can model various conditions of the landscape, at various kinds of wildlife management and loadings, predict processes occurring in it, including destructive, develop coadaptive technologies of wildlife management. There should be a speciality "nature manager" in the society (to some extent now its role is carried out by the ecologist). The task of such expert would be to estimate the landscape and ways of its potential use and to direct coadaptive development of economic and natural subsystems within the limits of uniform system "nature-society". It would be the most demanded and vital speciality. But for this purpose geographers-landscapeologists need to investigate the landscape at different levels of its organization, giving special attention to the intrafacial level where transformation of natural bodies occur; to develop adaptive technologies of every kind of wildlife management; to learn to build the activity from positions of priorities of sustainable development of the system "nature-society", in other words landscape sphere. The basic methods of this period are field and laboratory geochemical researches, modeling of various processes and conditions and their forecast on the basis of GIS-technologies.

Nowadays these processes in geography are very active and it is possible to state that geography passes to a *new stage of the development which is based on internal processes of science self-development and we may call it for convenience process* (fig. 1). Landscapeology starts to study processes actively, both at macro, and micro-(intrafacial) levels. Research activization of the processes of macrolevel in the countries of the post-Soviet area during last decades is connected with rapid development of landscape ecology. Studying of processes at intrafacial level, first of all, occurs through studying of processes of the landscape pollution connected with various anthropogenous loadings, through studying of conditions of landscape (Petlin, 1998), development of such directions as geochemistry and geophysics of the landscape. The works on studying of radioactive pollution of the territory play a special role in the establishment of behaviour laws of substances at intrafacial level. In this respect the essential contribution to development of landscapeology was made by works of V.G. Linnik (2008). Empirical researches (Petlin, 1998; Linnik, 2008), show, that there is strongly pronounced intrafacial differentiation of processes. Spatial ordered structures established inside facies and allocated in order of uniformity, reach the sizes from 30 cm up to 1,5-2,0 and are obliged to their formation to nanorelief (Linnik, 2008).

Studying processes of this structural level it is expedient to consider **portional character of landscape-forming streams**. Landscape is an open nonlinear nonequilibrium system which development depends on the whole environment. Interaction with environment occurs via system-forming streams of substance, energy and information (water, mineral, biocoenotic, power, etc. streams). In space and in time, receipt of streams in the landscape occurs discretely (insolational stream, introduction of the certain types of air masses, gravitational displacement, etc.), i.e. with the certain interval of time in the form of separate "portions". These "portions" are characterized by weight and frequency of receipt changing in time. We shall name such property of system-forming streams **portionality** (Pozachenyuk, 1993, 1985).

Portionality of landscape-forming streams differs from the concept "partiality" (from Latin *partialis* – part, partial, separate). In landscapeology the concept "partiality" is used in this or that meaning for revealing internal laws of geosystem. Concept "portionality" (from Latin *portio* - the certain share, quantity) is though relative, but not identical. V.N. Solntsev (1981) used this concept for a designation of separate portions of radiation coming into the landscape.

System-forming streams are characterized not only by discreteness (portionality), but also by continuity – a continuity of inflow of portions of substance and energy in the landscape. The parity of properties of portionality and continuity of system-forming streams changes in a wide range. Portionality can be of two types depending on the character of occurrence: **discrete portionality** and **portionality of intensity**. The streams have discrete portionality when inflow of substance or energy in the landscape completely interrupts for one or another time interval. The example are streams of water in the form of precipitation (rain, snow, dew) when the quantity of precipitation changes at one interval of time, or duration of intervals between precipitation changes, but quality of discreteness remains. Discrete portionality is brightly revealed in geological processes in the form of earthquakes or volcano eruptions; landslide, gravity-screes and other processes have portionality character among geomorphological processes. Discreteness of such sort of streams is a prevailing property, and continuity seems to recede to the background and is expressed in the form of compulsion, inevitability of inflow of substance and energy portions in the geosystem.

Portionality of intensity is characteristic for continuously going processes when inflow of substance and energy occurs in time constantly. Then property of continuity acts on the foreground, and property of portionality is revealed in the form of change of stream intensity. Rock drift on flysch ledges in mountainous Crimea during the cold period of year goes up to 16 times more quickly, than in warm period, and in extreme conditions when thawing of snow and humidifying are replaced by freezing and fast drying of rocks, conditional-instant speed of drift increases in tens and hundreds times. In this case process has portional character (Klyukin, 2007).

Geosystem functions continuously at portional inflow of substance, energy and information in it, i.e. its vital functions are continual because the break in activity leads to destruction. As a result, dialectic contradiction between continuity of functioning and development of geosystem and discreteness of inflow of substance and energy streams is revealed. This contradiction is realized differently in different zones of landscape sphere. The essence of the given realization consists in the following: the geosystem should adapt to portional inflow of substance, energy and information.

The record of portionality of inflowing substance or energy can be carried out by two criteria: according to volume of inflowing portions and depending on frequency of their inflow. The volume of inflowing portions, from the point of view of geosystem functioning, can be minimal, optimal and maximal. The maximal portions of streams (the small amount of deposits which is not reaching root system; small quantities of solar radiation not influencing snow thawing, etc.) have rather weak influence on intensity of interaction in geosystem. In this connection it is necessary to establish the minimal portions of various types of substances which start to influence geosystem. It is necessary to know also the maximal portion of inflowing substance and energy which will lead to radical reorganization of structure of landscape or its destruction that defines parameters of landscape stability. These problems in many respects are solved by landscape ecology. But frequently average values for the periods which do not reflect internal essence of development of process are used in the decision of applied problems. For example, in most cases a condition connected with air pollution is estimated as arithmetic-mean for a decade, month, year, etc. while it would be necessary to generalize data proceeding from portional character of air masses, i.e. for quantity of days with low-gradient types of weather (windspeed at 3-5 km/sec), leading to accumulation of harmful substances and types of weather leading to dispersion of pollutants (windspeed at more than 5-7 km/sec.)

Depending on a time interval of inflow of portions of substance and energy in geosystem, it is possible to distinguish **portionality time types**: instant, hourly, daily, days-long, seasonal, long-term and century-long. Instant portionality is especially characteristic for the geological bodies, capable to accumulate greater pressure and discharge it instantly in the form of earthquakes. The instant discharge is characteristic for such intrageosystem processes as avalanches, mud flows, landslips, etc. Hourly (from one to several hours) portionality is inherent in atmospheric and water streams. Geosystem does not have mechanism of adaptation to instant extreme portions of substance and energy. Stability of geosystems is explained by the fact that these instant portional flows have mainly local character. Daily portionality is observed in flows of solar energy in geosystem and related to the rotation of Earth on its axis. Many hypergene, soil, physical and chemical, biochemical, biocenotic processes are connected with it. Depending on daylight hours, in particular, the plants of long and short day are distinguished. Days-long portionality of inflow of portions of substance and energy in geosystem is determined by duration of different types of weather and changing of these types. Seasonal portionality stipulates accumulation of heat in geosystem which is indirectly measured by the sum of positive temperatures and sum of the moisture accumulated in it. Geosystem adapts to the seasonal portionality through changing of the seasonal states and change of processes dynamics.

In the basis of long-term portionality, rhythmic changes of sun activity, speed of Earth rotation on its axis, lag effect of the interactive systems are underlain. Geosystem adapts to long-term portionality by transition from one invariant to other. Evolutional development of geosystems is determined by slow (continuous) change of streams. The rapid, sharp changes of streams must lead not to the evolution, but to degradation of geosystem.

Thus, modern landscapeology has large potential of development as due to further influence of external (scientific) theoretical and methodical approaches (systemic, synergetic, ecologic, informatizational), and mainly due to the internal processes of self-development of landscape science: study of landscape bodies and their fields, structural and functional laws of organization of landscape objects in space and time, consideration of processes, characteristic for every structural level of organization of landscape sphere, including the processes of intrafacial level, from where begins origin of landscape-forming processes due to the synthesis of natural bodies composing landscape, where "the soul" of landscape is. On the view of the author, stormy development of landscapeology and its recognition in practical activity will only happen, when it pass to research processes of interfacial processes.

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SUMMARY

In the article, reasons of crisis situations in development of geography, including landscape science, are analyzed. It is stated that geography develops due to internal and external processes. Seven periods of scientific development of geography are denoted: the first two of them, the stage of development of the regional planning and landscape stage, took place within the framework of geography due to the internal processes of self-development of the science; the next four periods (systemic, ecological, informatizational, synergetic) reflected the external processes of development of all science, including geography. Presently landscapeology begins to develop again due to internal reserves, studying processes (process stage).

The future of landscape science is seen in the study of landscape bodies and their fields, laws of organization of landscape objects in space and time, consideration of processes, characteristic for every structural level of organization of landscape sphere, including the processes of intrafacial level.