FROM ECOLOGY AND SPATIAL PLANNING TO URBAN AND TERITORIAL ECOLOGY

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Abstract. Urban ecology has emerged as a new and distinct branch of ecology in the 1920's, and its evolution has already covered three steps. However, in Romania, urban ecology and its recognition are only in its early stages. This perspective was revealed by the meeting of the Romanian Ecological Society that envisaged the restructuring of the latter. The debates revealed the need for articulating a common position beyond the specific language of professionals whose interests converge in the field: architects, urban planners and geographers, in addition to ecologists. This paper aims to shape out the current challenges of Romanian urban ecology, from theoretical and practical standpoints, in relationship to the Romanian Ecological Society and contribution to the sustainable development of the country.

Keywords: urban planning, spatial planning, space, territory, human settlements, sustainability.

Rezumat. De la ecologie şi planificare spaţială la ecologie urbană şi teritorială. Ecologia urbană a apărut ca ramură distinctă a ecologiei în anii '1920, trecând deja prin trei etape de evoluţie. Totuşi, ecologia urbană şi recunoaşterea sa sunt abia la început în România. Această perspectivă a rezultat în urma întâlnirilor având ca scop restructurarea Societăţii Române de Ecologie. Dezbaterile au evidenţiat necesitatea articulării unei poziţii comune, dincolo de limbajul specific al profesioniştilor ale căror preocupări se intersectează în domeniu: arhitecţi, urbanişti, geografi, în plus faţă de ecologi. Lucrarea îşi propune să formuleze principalele preocupări ale ecologiei urbane româneşti, din perspective teoretice şi practice, în raport cu Societatea Română de Ecologie şi dezvoltarea durabilă a României.

Cuvinte cheie: planificare urbană, planificare spaţială, spaţiu, teritoriu, aşezări umane, dezvoltare durabilă.

CONTEXT

The process of restructuring the Romanian Ecological Society started in 2018, providing opportunities for a series of meetings and debates related to its goals and contribution to the sustainable development of Romania. During the process, a group with similar interests was formed around the "Ecology of human settlements". This article is a "manifesto" aimed at stating the position of its members, as a separate voice situated at border between the "disciplines of the organized space" (BOTEZ & CELAC, 1980) – geography and urbanism, and ecology, as an integrative discipline emerged amidst the life sciences (general biology). The group consists of architects and urban planners interested in ecology (Professor Cătălin Niculae Sârbu, PhD, Habil., Architect, Associate Professor Gheorghe Ionaşcu, PhD, Architect), geographers interested in ecology (Associate Professor Gabriela Manea, PhD, Geographer) and ecologists interested in urban and spatial planning issues (Associate Professor Alexandru-Ionuţ Petrişor, PhD, PhD, Habil., Ecologist). Regardless of the professional background, the authors attempt to establish, based on their research experience, a view of the state of the art of urban ecology in Romania, which is common, as it can be seen through the unavoidable overlaps of the discourses.

URBANISM, ECOLOGY AND DEVELOPMENT: A HISTORIC PERSPECTIVE (CĂTĂLIN NICULAE SÂRBU)

Changes in the living environment constitute probably the most solid paradigm of urbanism (along with centrality as an ordering principle), permanently supported by the purpose for which cities are created – the welfare of their dwellers. This direct practical relationship between the human settlement (and, implicitly, the science of its organization and edification) and nature (understanding the structure and functioning of the environment as a global system) shift the focus on the relationship between the two disciplines with theoretical and applied interests in the multi-scale geographical space. Sustainability relates to the theoretical hypothesis according to which human civilization, and implicitly human settlements, depend on the processes of the ecosphere. Nevertheless, there is a need to stress out their integration, from the standpoints of advancing the knowledge and of social practices. Interests in nature and human settlements are present (although sporadically) in the works of Greek philosophers, although focused on the citadel as functional unit – the *state city* (PLATON, 2005).

The elements of morphology and functioning of permanent human settlements were characterized in the beginning by issues like symbols and developing social structures (*prehistoric settlements*) (LEVI-STRAUSS, 1973) and are still present in the concept of city and urban management. If during the "Era of Lights" (*French encyclopedias*) the distinction between natural sciences and what used to be considered art (including crafts) was clearly phrased, the progress, understood not only as accumulation of facts, but also as application of knowledge, imposed directing the new science of ecology toward practical challenges of mankind.

This idea did not emerge at once, provided that the concept of progress, often approached by philosophers *(Baruch Spinoza, 17th century)*, included and stimulated a rational knowledge of the world especially after the Illuminist

Age and became a central paradigm of the current civilization. Nevertheless, the statement "*progress remains anthropogenic*" (VAN DOREN, 1967, pp. 57) seems to ignore nature, considered an unlimited resource for mankind. Progress was understood as a manner of controlling nature – "*progress through man's control over nature*" (VAN DOREN, 1967, pp. 58), a vision shared, among others, by Bacon, Descartes, or Voltaire; science was the way to ensure the progress (VAN DOREN, 1967, pp. 59).

The emergence of ecology, defined for the first time by HAECKEL (1866) as an integrative science (possible attempt to build up a super-science of biology) coincided with the maturity phase of the industrial revolution, a moment when the issue of urban development started to become one of the most important challenges for the physical administration of territories (*destruction of fortifications in large European capitals – Paris or Vienna, large scale urban restructuring resulting from sprawl, and later pressures induced by the emergence and land scale use of cars*).

The idea of a relationship and the unity between man and nature became an issue again (BONNEFOUS, 1970; COMMONER, 1972) and even a dominant paradigm in studying the relation.

The idea that development was continued, linear and indefinite was nuanced and even abandoned in economy, understanding the finitude of resources and the fact that resources increased linearly while consumption increased exponentially (MEADOWS et al., 1972). Recent studies of the correlation and deterministic relations in the urban sprawl outlined the differences between predicted linear growth and the supra or sub-linear growth of parameters characterizing the urban development (WEST, 2017).

Nevertheless, while phrasing and changing the goals and policies of sustainability during the last more than 30 years, economists seem to focus predominantly on the manmade capital, while ecologists (and environmental activists) focus on what (not only) economists call **natural capital** (ARONSON et al., 2007, pp. 1).

Therefore, it is not a coincidence that the emergence of urban ecology and development of other sub-domains of ecology intimately related to the human impact on ecosystems and human communities (*e.g.*, *eco-toxicology*) occur at a moment when demographic and industrial pressures over the living environment manifest outside of the area of research characteristic to the natural sciences: social ecology, economy, culture. The fact that the term **urban ecology** appeared and developed in the Sociology School of Chicago (Robert Park, Louis Wirth and Ernest Burgess, starting 1915) is equally significant for conceptualizing the relationship between man and nature.

The transitions to **systemic ecology** are supported by a series of approaches oriented towards humanities, in an attempt to reconcile the relationship between man and nature by proposing the concept of "deep ecology" (CAPRA, 1995), and using terms like eco-art or ecology of the spirit.

The emergence and development of **specialized branches of ecology** and its **re-start as a global field of knowledge able to support the principles and concrete action paths for mediating the relationship between man and nature** led to the concept of sustainability, rooted in economic reasoning (*British political economy school: David Ricardo, Adam Smith end especially Thomas Robert Malthus, 1798)*. This approach integrates in the concept the technical domains of development and **includes its political aspects as a necessity**.

Later, the idea of a planetary "super-organism" (*James Lovelock – Gaia Hypothesis* (1979) was developed scientifically beyond the metaphoric approaches preceding it, consolidating the interest in ecology as science of acting (LOVELECK, 1979).

The still accepted dichotomy between basic sciences (ecology included) **and humanities** (sciences concerning man and its actions, a concern which still characterizes the theoretical approaches of urbanism) **becomes inoperative today** due to the quicker impact of shortening the gap in the transition of knowledge from theoretical ideas to their social and technological integration.

The adoption of the systemic integrative vision in all technical and ecological areas (*e.g.*, *industries organized in "ecological chains" – industrial ecology started in the 1990's*) uses the same **theoretical grounds of system theory** applied in urban and spatial research and planning. Ultimately, ecology **and urbanism** can be considered "**sciences of the space**", where the **territory (concept with decisive implications in spatial planning) and the land (concept oriented especially to the technical and applied areas of urbanism) are not only the support of natural and anthropic phenomena, but integrative concepts (at different spatial scales) for these domains**. The process of conceptualizing and diversifying knowledge of the complexity sciences supports the need for spatial integration in studying urban phenomena (PORTUGALI, 2006).

In this context, the **management of human settlements** (including settlement networks) distances more and more from its understanding as a fact situated exclusively in the area of drivers and interests of humanities (sociology, economy and especially law) and technological domains (engineering, especially management of water, energy or circulation) and **evolves** (especially in the last decades) **to the systemic ecology approach**. In this continued evolution of theoretical and applied interests of urbanism, **ecology righteously assumes the role of rephrasing the core of the relationship between human civilization and nature, overcoming the limited view of the latter as a core pool of physical resources**, endangering a possible development for an undefined period.

The evolution of the old paradigm of practical approaches in the fields of urbanism and ecology towards the relatively new vision, undergoing a continuous practical sectoral consolidation process generated by the sustainability concept, leads not only to the enrichment of this concept, but also to substantiating the principles of action, with consequences on political, management, educational and other processes in urban and spatial planning.

The activities from the applied areas of ecology and urbanism exceed the theoretical limits only when they are based on legislative, administrative or technical and normative coordinating systems, supported by the first two.

ECOLOGY OF TERRITORIAL SYSTEMS – AN INTEGRATED VIEW OF ECOLOGY, GEOGRAPHY AND SPATIAL PLANNING (ALEXANDRU-IONUŢ PETRIŞOR)

"Urban ecology" was created by a group of sociologists at the University of Chicago in the 1920's (WU, 2014). From its emergence, the new science has undergone three stages so far: ecology *in* the city, ecology *of* the city (as socio-ecological system) and the study of premises for a sustainable urban development (WU, 2014); somehow, the stages correspond to those of general ecology: studying the ecosystem structure, understanding the ecosystem (TANSLEY, 1935), and sustainability science (VĂDINEANU, 2004b). However, there is a gap: the "urban ecosystem" is defined (in a similar way to Tansley's ecosystem) only in 1997, as a particular system where the human species is a "*key species, controlling the structure and functions of the ecosystem*" (WALBRIDGE, 1997). The parallel between general and urban ecology can continue with respect to drafting homomorphous models of the system; in Romania the first ones included the structure (SÂRBU, 1999), evolving to structural-functional models (PETRIŞOR, 2013a) and interdisciplinary ones (PETRIŞOR, 2017b). The importance of interdisciplinary approaches results from the interdisciplinary character of the three sciences studying a single physical reality: ecology, geography, and urbanism (as defined by SANDU, 2007) (PETRIŞOR, 2013b).

Professor Angheluţă Vădineanu shows that anthropization is accompanied by a series of processes determining the simplification and fragmentation of natural systems, resulting finally into the loss of biodiversity (VĂDINEANU, 1998, pp. 133-134). Within the socio-ecological complexes, the man-dominated subsystems couple to the natural ones in order to absorb resources and energy, adding new levels to the food chains characteristic of natural systems (IANOŞ, 2000), which reflect the mass and energy flows through biogeochemical circuits (PETRIŞOR, 2012). At the same time, urbanization results into new structures, specific to socio-economic systems (SÂRBU, 1999; PETRIŞOR, 2013a; 2017b), which increase the complexity of territorial systems (IANOŞ, 2000, pp. 54), and ultimately their geo-diversity. In this conceptual framework, a management of the natural resources based on the respect for the environment (IANOŞ et al., 2009), determining a holistic management (VĂDINEANU, 2004b), primary diversity (biodiversity) is increased by labour (VĂDINEANU, 2004a), resulting into an increase of geo-diversity. Thus, urbanization increases geo-diversity and decreases biodiversity, as illustrated by the dynamic of the two types of capital (natural and created): the declining natural capital corresponds to biodiversity, and the created capital, corresponding to socioeconomic systems, reflects geo-diversity (PETRIŞOR & SÂRBU, 2010; IANOŞ et al., 2011; PETRIŞOR, 2012; 2017a).

If diversity is seen qualitatively as different numbers (and weights) of constitutive elements (even distribution) in statistics (DRAGOMIRESCU, 1998, pp. 88; MAGURRAN, 1998, pp. 7; DRAGOMIRESCU & PETRIŞOR, 2009; PETRIŞOR, 2014), or variety of structure, i.e. relationships between structural elements, and functions (VĂDINEANU, 1998; PETRIŞOR, 2008, 2009; POPESCU, 2009; PETRIŞOR, 2014) in ecology, the previous discussion on the relationship between geo-diversity and biodiversity can be easier understood. Under the influence of the anthropization process, some structural elements disappear from the ecosystems, determining functional losses and the decrease of biodiversity; at the same time, anthropic subsystems diversify due to the emergence of new structural elements and the increase of functional complexity, finally increasing their geo-diversity (PETRIŞOR & SÂRBU, 2010; PETRIŞOR, 2012; IANOŞ et al., 2011; PETRIŞOR, 2017a, b).

Ecological equilibrium is dynamic, with a multitude of basins and attractors. Based on energy consumption, the biotic components of ecological systems have an anti-entropic dynamic. More exactly, the complexity of inner structural and functional organization (diversity) increases; the system becomes more stable. Stability is understood as a certain evenness or periodicity of variation, a "regime character". There is an optimal diversity corresponding to maximum stability, achieved through the association of species which have stable relations, and the excess or deficit of stability has a destabilizing effect on the system. Initially, stability was measured using the concepts of resilience, persistence, resistance and variability (HARRISON, 1979); when the perception of equilibrium changed (PETRIŞOR et al., 2016), resilience was no longer understood as a measure of the stability of a system (HARRISON, 1979) – conservation of structure, functions, and integrity (CHELLERI, 2012), but as an axis of the adaptive cycle (HOLLING, 2004) or ability to dynamically return to an equilibrium condition (MURADIAN, 2001). In this modern interpretation, resilience is a common feature of dynamic systems characterized by unpredictability (ŞERBAN et al., 2015), and implies the change (CHELLERI, 2012). Starting from here, ZAUCHA et al. (2014) define "evolutionary resilience" as a crucial ability to modify, adapt, and transform in response to stress. Engineers defined, especially in mathematical terms, similar concepts: robustness – ability to tolerate perturbations, resilience (similar to ecology) – ability to return to a previous state after exposure to stress, and anti-fragility – ability to benefit upon stress (POPESCU, 2009; GKOUMAS et al., 2016).

CUMMING (2011) identifies several types of resilience: ecological, social, and socio-ecological. The first one allows to provide ecosystem services (AHERN, 2013) and is proportional with diversity (FOLKE et al., 2002; ELMQVIST et al., 2003; CUMMING, 2011; ŞERBAN et al., 2015); social resilience increases with diversity, but also by economic, cultural, institutional and educational means (CUMMING, 2011). Socio-ecological resilience increases with the previous two, but these are not always compatible (CUMMING, 2011). Spatial resilience accounts for the variation of resilience with the spatial scale (CUMMING, 2011). However, from a territorial viewpoint the *resilience of*

cities and *resilience in the cities* are not always connected (ERNSTSON et al., 2010). Finally, it has to be stressed out that resilience and sustainability are measured by different indicators (CARPENTER et al., 2001; SANDU & BĂNICĂ, 2015), although resilience remains a fuzzy concept, always requiring a contextualization – resilience of *what* to *what* (CARPENTER et al., 2001; CUMMING, 2011).

Although some authors overlap or relate sustainability and resilience, starting from the fact that both imply systemic interactions at different spatial and temporal scales (ERNSTSON et al., 2010; MIERZEJEWSKA, 2015), and especially the fact that resilience changed its definition to include socio-ecological systems and coupled dynamics as a condition for sustainability (FOLKE et al., 2002; CHELLERI, 2012), there are some contrary opinions. BĂNICĂ & MUNTELE (2015) state that "*the resilience approach is "more sustainable" than the sustainability one, countering long term benefits to the short term efficiency when the probability of confronting different hazards increases*", and, therefore, "*if sustainability aims to re-set the world to equilibrium, resilience is a continuous search for means to managed a deeply unbalanced world*" (ZOLLI & HEALLY, 2012). The two concepts are embedded in the "smart and resilient city" (CHELLERI, 2012), which conserves biodiversity and ensures connectivity (AHERN, 2013).

Based on the previously mentioned premises, sustainability is a development that helps meet human needs at the same rate by integrating the assessment of the impact of current and future activities likely to affect the carrying capacity, internalizing the externality and conserving bio- and eco-diversity structurally and functionally. In a dynamic perspective, sustainability insures the co-development of the natural and anthropic components of the environment, placed at the intersection of the vertical pillars (economic, social, environmental, and cultural) with the horizontal dimensions, resulting into the emergence of sustainable communities and a balance between polycentric development and socioeconomic, environmental, and cultural cohesion (PETRIŞOR, 2017b).

ECOLOGY OF HUMAN SETTLEMENTS (GHEORGHE IONAŞCU)

Ecology is a new science, which must be allowed to develop. Although born out of biology, ecology cannot remain blocked within it. In order for ecology to serve sustainability, the focus must be directed to anthropized ecosystems (human settlements), urbanism, and management sciences, able to direct development in a beneficial way. Sustainability is the capacity of perpetuation of systems under equilibrium. Sustainability must be understood as a development able to continuously create and maintain its ability to perpetuate. The sustainability of development is not a science, but a sustainable attribute of development. The science of ecology must be delimited from development, which can be sustainable if it is based on the applied systemic ecology. Science must be dealt by scientists and researchers, and development must be led by others, *i.e.*, by deciders who are not scientists. Science and scientists must provide deciders with expertise in an accessible, clear, unsophisticated form.

The ecology of human settlements is a chapter of ecology fundamental for mankind, studying and optimizing the strongly anthropized urban and rural ecosystems, and their mass, energy, and information cycles, in order to restore the equilibrium for the benefit of human health and welfare. The ***ecology of human settlements*** is their way to a sustainable development, originating in classical biology, but also in the ethical concept related to the human responsibility for the perpetuation of life on our planet. In the future, urban ecology studies will precede the urban planning of human settlements, adding the condition of restoring the ecological equilibrium. Future urban planning will use two concepts: *ecology of human settlements* and *sustainable development*. The ecology of human settlements deals with the living environment created and managed only by man. In theory, its interests include the transformations of mass, energy, and information within the settlements, and in practice it deals with the evolution trends of the particular ecosystems and means to restore the ecological equilibrium (IONAŞCU, 2003, pp. 73-74).

The main purpose of urban ecology relates to studying and optimizing urban cycles, from primary matter to products and waste. In the human settlements, only the feasible demands of the human population must be optimized. For people, the study of the ecology of human settlements is important because they represent their home. While natural (forest, water etc.) or semi-natural (agricultural, landscaped parks etc.) ecosystems only withstand a certain human influence, by the added energy, but have a (semi)natural dynamic, anthropized ecosystems (human settlements) are controlled and managed almost exclusively by man, who responds for the created imbalances. The study of the ecology of human settlements is necessary to know the real extent of negative human interventions on the environment, but also the beneficial interventions providing for the quality of their living environment. Human settlements, especially cities, are the pole of the major conflict between man and environment. Most pollution sources are urban. Super-agglomeration, chaotic circulation, waste, noise, polluted air, and insufficient and degrading vegetation are reasons for which cities have become noxious. A proof is the fact that their dwellers, when finishing their work during the weekends, flee out of the cities massively, invading the adjacent natural areas.

I believe that architects and urban planners have the best chance to decipher the functioning mechanisms of human settlements and identify ecological rehabilitation solutions, as they can see the space and know how to design the future physical and spatial configuration of settlements ensuring at the same time the functionality, constructivism and aesthetics of new and rehabilitates assemblies within the human settlements. Ideally, they should also study the science of ecology or cooperate with the ecologists. It has to be stressed out that a technical specialist cannot operate with ecology, which is a science, unless they have solid trans-disciplinary knowledge (undergraduate or graduate degrees), providing for the transfer of knowledge from ecology to urbanism and/or architecture.

The previous statement is sustained by the simple, often erroneous, incomplete, or confusing interpretations from the approaches of people claiming to be ecologists without studying it, and without new ideas able to help building up the urban ecology. At the same time, rural ecology must be directed towards the rebirth of the village, with its traditional attributes, modernizing it without urbanizing it. Introducing objects used for a long period, modern means (telephony, internet etc.) must not remove the specific traditional rural values (architecture, folk art, crafts etc.). The elite approaches promoting only the city neglect the village, which is a model of human habitat integrated organically to its supporting natural environment.

Environmental education must be organized in an open and tree-like manner. The Department of Ecology must be only a *nursery* for Master's and PhD training of professionals from other fields ensuring the effective development of human communities (engineers, architects, economists etc.), who should later spread out the ecological vision and action to other fields, including the higher education. They are able to ensure sustainability in developing different sectors of the economy. Ecology is a mature science, and should not stay in its initial nest. Biologists cannot manage socio-economic skills, as they do not have the necessary background. Management is a science, like ecology, and the management of sustainability uses technical and economic knowledge. Development is built in partnership.

FUTURE PERSPECTIVES: PROJECT FOR THE DEVELOPMENT AND STRUCTURAL AND FUNCTIONAL ADAPTATION OF THE URBAN ECOSYSTEMS (GABRIELA MANEA)

The European Charter of Spatial Planning, adopted at Torremolinos (20 May 1983), defines the concept of "spatial planning" in a scientific, but also political manner, as an expression of the economic, social, cultural, and environmental policies of the entire society.

In the modern information society, interdisciplinary approaches are the key to the success of sustainable development of human communities. Therefore, there is a need to inter-connect the domains dealing with the research of natural and socio-human components, in order to create an integrate systemic approach.

Current reality confronts us with challenges resulting, on the one hand, from a certain inertia of contemporary researchers, reflected by the gap between scientists from different fields, but especially between science and society, on the other hand.

The core problem in approaching sustainability is the "schism" between scientists from different fields, but also, more seriously, within the same field. More exactly, we witness nowadays an offensive of scientometric indices that has become, slowly but surely, a new doctrine of the academic environment. These trends could be a good asset if they were reflected by the development of our society. However, at this moment, at least in Romania, science seems to be less involved in nature and society issues. More exactly, science is no longer reflected by the society, by the life of contemporary people, in concrete ideas related to increasing welfare. It is only seen in numerous citations in journals published somewhere in this world, least in Romania. After all, this trend could have at least one explanation for the lower inclination to publish in Romania; here, for most entrepreneurs, the rule according to which science precedes the development of society does not work: science goes with science, and developers with developers, whoever they are.

Returning to the core issue of the article, the question is: how many of the prefects, mayors, counsellors etc. have serious discussions with the academia and scientists when developing urban or rural projects? How much is science involved the development of Romanian society? How many entrepreneurs read the articles published by Romanian scientists anywhere, not only in Romania? And, after all, "*Cui prodest*"?

Currently, there is a rush to publish ecology or environmental issues in reputed foreign journals, while in Romania illegal forest cuts continue, public roads are badly repaired by unqualified workers who are not scientists (and do not know that they could benefit from expertise for a sustainable outcome).

Urban development – a topic for media and large governmental projects and object of Earth science researches – is often chaotic, without valorising the landscape personality of a piece of the urban tissue. Why? It is simple; scientists – urban planners, ecologists, environmental planners etc. – are not consulted by most entrepreneurs due to subjective or... objective reasons?

In summary, all the aspects presented above are arguments for the eradication of the ecological crisis of the human habitat through an integrated and coherent approach. The structural and functional adaptation of urban and rural ecosystems must be based on knowledge provided by the academia, avoiding contradictions between the development of the human habitat and its sustainability. In this approach, the extension of the Romanian Ecological Society in multidisciplinary consortia (nature-society systems) could be an important objective. Our previous results can be valorised during the process.

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