# *Implications of Spatial Sustainability on the Territorial Planning Framework in a Transition Country*

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Abstract

Sustainable development involves a synergic integration of social, economic, environmental, and cultural issues to a multi-scale hierarchy of territorial systems. This sentence underlines the importance of the territorial dimension of sustainability, in addition to the need for a systemic approach, and has special implications over spatial planning, accounting for the entire process related to landscapes, urban or rural settlements, including the design of sustainable constructions. The paper addresses environmental aspects of the planning process, using the Romanian planning system as a case study to look at the change of the general framework, moving from a sectoral approach to a holistic one, consistent with the recent developments of systemic ecology. In more detail, we propose a replacement of the traditional description of 'environmental factors' – air, water, soil, fauna, and flora – with an analytical and quantitative model developed under a systemic framework. The model consists of examining the spatial levels of biodiversity (correlated to the levels of the hierarchy of territorial units) and its conservation through natural protected areas, and a transitional dynamics based analysis of changes of land cover and use to account for the impact of humans. This approach is illustrated by its application to several territorial and urban plans, carried out at different spatial scales during the recent years. The results of this process underline the importance of applying a scientific methodology, focused on the reproducibility of results, to the planning process, and suggest that an up-to-date scientific substantiation is preferable to a legalistic understanding of planning.

**Key words**: planning, holistic, global changes, land cover and use, diversity.

## 1. Introduction

Since its first definition given in the late 1860 by Ernest Haeckel, the science of ecology has evolved and diversified continuously, establishing trans-disciplinary links with other subjects (such as economy, engineering, sociology, or architecture, to name only few of them) in order to form approximately 30 branches (Petrişor, 2012c). During this process, some of its paradigms have shifted:

- The main object shifted from individuals (pinpointed by Haeckel's definition) to 'coupled socio-ecological complexes of systems' (Vădineanu, 2004). This process became particularly obvious in the 1980's when ecologists embraced the systemic conception, perceiving the environment as a hierarchy of organized and dynamic units with quantifiable structural and functional properties (Vădineanu, 1998). Nevertheless, during this process nothing was lost; autecology (study of the relationships between individual organisms and abiotic environment) and synecology (study of the relationships between individual organisms belonging to different species) are stages in the evolution of ecology, but also current areas of interest for ecologists.
- A consequence of this evolution, already mentioned, is the evolution in perceiving the global environment, from an anthropocentric perspective placing man (individual or society) in the center and considering that the environment is simply what surrounds man, to differentiating 'factors' or 'components' within the surrounding (water, air, soil, flora, and fauna) and finally the holistic model based on a hierarchy of systems discussed above (Vădineanu, 1998, 2004).
- The hierarchy of systems is connected with different spatial and temporal attributes associated with the dynamics of each level. In simple terms, larger systems need more time to change than the smaller ones (Petrişor, 2011). A direct consequence is that, if accounting for the inter-conditioned dynamics of systems situated at different levels, described by the theory of 'panarchy' or adaptive cycles (Holling, 2004), a system cannot be analyzed separately from its components and integrated system, which determines the need for a multi-scale analysis (Petrişor, 2013). It has to be stressed out here that 'panarchy' replaces the succession theory, even though community ecologists still find succession more relevant for their studies.
- In 1970, geographer Waldo Tobler phrased a principle situated at the core of spatial analyses, referred later as 'The First Law of Geography': "*everything is related to everything else, but near things are more related than distant things*" (Tobler, 1970). Ecologists embraced the first part, and "*everything is related to everything else*" became a guiding principle of ecology. One of the most recent illustrations is the concept of 'global change', designated to encompass all man-driven impacts on the environment: energy use, land cover and energy changes, and climate change (Dale *et al*., 2011).
- Inter- and trans-disciplinary approaches describe in the best way the relationship between ecology and other sciences. Interdisciplinary approaches are an intermediate step where concepts and methods are exchanged by different disciplines, resulting in the final trans-disciplinary stages into the creation of new disciplines (Kötter and Balsiger, 1999), such as social ecology, urban ecology etc.

In parallel with these shifts, ecologists had a particular interest in exploring the relationship between man and environment, resulting into the concept of 'sustainability' defined by the Brundtland Report as "*development that meets the needs of the present without compromising the ability of future generations to meet their own needs*" (Brundtland, 1987). The concept evolved towards a self-standing trans-disciplinary science, placed at the intersection of natural and socio-economic sciences, even though technical sciences are included as well. Several paradigms of sustainability have evolved too:

- Shifting the focus of development from addressing some ignored issues (*e.g*., environmental) to a better integration of the three traditional pillars: economic, social, and ecological (Bugge and Watters, 2003)

- Adding a fourth cultural pillar by acknowledging the market value of the cultural capital and its potential for development (United Cities and Local Governments, 2010)
- Adding a spatial dimension, including the concept of 'sustainable communities' coined by the 2005 Bristol Accord (Office of the Deputy Prime Minister, 2006), but also linking to core concepts of territorial development, such as polycentricity and cohesion (Colignon, 2009); in the last case, environmental cohesion is an important component of 'cohesion'
- In practical terms, sustainability presumes an utilization of resources within the carrying capacity limits and active strategies for reducing the generation of waste and pollution (reclaiming the environmental impact assessment to determine whether stocks are affected and internalize environmental and social costs due to the degradation of the environment and effects on human health through pollution) and the restoration of degraded systems, and is compatible with conservation of biodiversity (through natural protected areas) (Petrişor, 2011).

An important concept introduced in ecology in close relationship with sustainability is biodiversity. The concept was introduced by the 1992 Rio de Janeiro United Nations Conference on the Environment and Development to encompass the diversity of man-dominated systems (including ethno-cultural diversity) in addition to the one of biological systems at different levels (from genetic to taxonomic and ecosystemic variability), and gradually expanded against its semantic roots to include in addition to the diversity of the biological realm abiotic systems. As a consequence, eco-diversity (diversity of ecosystems and complexes of ecosystems, including biotic and abiotic components) was seen as part of biodiversity, even though in reality ecosystems include biotic components; if perceived correctly, eco-diversity is the ecological synonym of geographical 'geo-diversity' and includes biodiversity, in addition to the diversity of abiotic components – geological, climatic diversity, intermediary components – soil diversity, and ethno-cultural diversity (Petrişor and Sârbu, 2010). Biodiversity has, similarly to sustainability, a spatial dimension; the spatial levels of biodiversity are:

- α – ecosystem, community, taxonomic or functional group or biocoenose,
- β – ecosystems within an ecological complex, habitats or gradients,
- γ – regional ecological complex, large areas,
- δ – higher rank, macro-regional ecological complexes
- ε – life environments (oceanic, terrestrial),
- ω – phylogenetic / taxonomical hierarchy.

## 2. Sustainability and planning

Since sustainability accounts for the development of society, placing human beings at its core (United Nations, 1992b), it is tightly related to the planning process. Furthermore, spatial planning is also connected to sustainable spatial development. The concept of 'spatial planning' can be understood in general terms, overlapped with the 'territorial planning', or in a particular way in countries where the planning system has two levels (such as France and Romania), one dealing with larger territories (spatial planning) in strategic terms (general guidelines and objectives), and another tackling concretely, in regulatory terms, with the spatial development of urban and rural areas – 'urban planning' (Petrişor, 2010). In methodological terms, Lacaze (1990) identifies strategic planning, urban composition, and participatory, management and communication urbanism to be the core methods of spatial planning.

Furthermore, in addition to these characteristics, planning tends to be everywhere a regulated process. This means that a planner does not always have the possibility of a scientist to explore new ideas or methods, but instead needs to observe specific guidelines. In many countries, plans have the power of laws; once approved, they become the reference document for issuing a building or demolition permit, make changes in a certain area, and even direct investments. For this reason, after their elaboration plans are subject to approval by representatives of different sectors from the public administration.

*2.1. Current Romanian urban and spatial planning framework*

The elaboration of plans in Romania is subject to legally approved guidelines. According to Grigorovschi (2008), the three legal documents governing the elaboration of urban and spatial plans are:

- A 1991 order of the Ministry of Public Works and Spatial Planning discussing the forms, authorization procedure and contents of urban and spatial plans,
- A 2006 proposed contents elaborated by NRDI UBANPROIECT in 2006, and
- A proposal started (and never completed) in 2008 by the Ministry of Development, Public Works an Housing

In addition to them, other particular documents discuss specific chapters. For example, a 2000 methodology jointly proposed by the Ministry of Waters, Forests and Environmental Protection and the Ministry of Public Works and Spatial Planning describes the contents and methodology for elaborating the environmental analyses, part of urban and spatial plans (Grigorovschi, 2008).

As it can be seen, the approved instruments in place are outdated, and the proposed instruments not only lack the legal status, but are also ageing. Their contents no longer reflects the theoretical developments in ecology; it indicates an erroneous sectoral perception of the environment, using the outdated concept of 'environmental factors' (water, air, soil, flora, and fauna), and tend to introduce a merely descriptive rather than analytical methodology.

*2.2. An emerging methodology*

Attempting to develop a novel methodology, compliant with the progress of ecology, the core principle observed was that environmental protection is equivalent to the conservation of biodiversity, representing the 'ecological foundation' (Vădineanu, 2004). However, the '*Zero Growth Strategy*' introduced a different view of conservation, as a strict preservation of ecological systems in an intact state (Meadows *et al*., 1972). Sustainability changes the paradigm of conservation, perceiving it as a man-driven support for the self-maintenance of ecosystems within their carrying capacity limits (Petrişor, 2011). By doing it, conservation becomes compatible with development, as long as development aims for safeguarding a part of current biodiversity for future generation through an active management ensuring that the activities carried out within and around protected areas are designed for a long term.

From this perspective, understanding the environmental system representing the object of an urban or spatial plan needs to address several issues:

- Identify correctly and comprehensively all the components of biodiversity, accounting for the spatial variability of the systems
- Identify the main stressors that are likely to affect biodiversity and propose concrete strategies for the mitigation or reduction of their effects, unless complete elimination is possible
- Describe the actions aimed at conserving biodiversity, including the environmental impact assessment, ecological restoration, and natural protected areas

In order to accommodate these requirements, the plan should include:

- A general characterization of diversity, discussed in the next section, based on the ecological or biogeographical regions, relief units etc., types of ecosystems or habitats, as reflected by land cover and/or use, including changes across time, natural habitats, if known (*e.g*., NATURA

2000 sites in Europe benefit upon an inventory of the habitats constituting a priority for conservation, in accordance with the Habitats Directive)
- Data on elevation, hydrography, climate (including predicted changes, as underlined by DIVA-GIS data), soils (if available), fauna and flora (including protected species from global and national Red Lists; in Europe, particular requirements are added by the Birds Directive)
- Natural protected areas of national/global designated in accordance with the International Union for the Conservation of Nature guidelines, and of regional or local importance
- Natural hazards: floods, landslides, earthquake (zoning)
- Possible impact of proposed modifications on the ecological systems
- Proposals based on the results of all analyses presented above, including mitigation or reduction of impacts

2.1.1. Identifying the components of biodiversity

It is very easy to list the components of biodiversity based on the text of the Convention on Biological Diversity (United Nations, 1992a):
- Diversity of terrestrial, marine and other aquatic ecological complexes
- Diversity of terrestrial, marine and other aquatic ecosystems
- Diversity between species (phylogenetic)
- Diversity within species (genetic)

However, reading between the lines, as shown in the previous section, several other components need to be explicated:
- Diversity of abiotic components
- Ethno-cultural diversity

The next question is asked from a practical perspective. Detailing and illustrating each component for all systems and sub-systems analyzed in a plan is impossible. Moreover, a simple list in not relevant to spatial planning. Therefore, for each spatial level diversity must be assessed correlated to its spatial level (dependent on the size of system), the size of administrative / territorial units (reflected in Europe by the Nomenclature of Territorial Units for Statistics – NUTS), and, for practical reasons, a certain classification able to produce reproducible results and a common understanding. Taking into account all these requirements, the proposed methodology utilizes, for different spatial levels, the correspondence presented in Table 1.

As it can be seen, the practical relevance is ensured by using globally or widely accepted classifications: the European Nature Information System (EUNIS) classification of habitats, the land cover and use classification systems (Anderson *et al*., (1976) in the United States and CORINE in Europe), the World Wide Fund for Nature classification of ecological zones, used by the European Environment Agency as well, the European Environment Agency classification of biogeographical regions used in the European Union, and Pielou's (1979) classification of global biogeographical regions.

**Table 1**. Correspondence of the hierarchies of systems in ecology and spatial planning and spatial diversity

| Ecological system | Classification | Spatial Planning (NUTS level) | Diversity |
|---|---|---|---|
| Structural and functional subunits of ecosystems | EUNIS habitats | - | α, ω |
| Ecosystem | Land cover and use (CORINE, Anderson) | NUTS V (LAU II) | α, ω |
| Regional ecological complex | Ecological regions (second level), relief units | NUTS III | ß, γ, ω |
| Macro-regional ecological complex | Continental biogeographical regions, ecological regions (first level), relief units | NUTS II, NUTS I national territory, continent | γ, δ, ε, ω |
| Ecosphere | Global biogeographical regions | Globe | ω |

2.1.2. Land cover and use and their changes as planning instruments

Jensen (2000) considers '*land cover*' an indication of what lays on the ground surface from a biophysical viewpoint, while '*land use*' shows its usage by human communities. The second definition is perfectly valid for land situated in man-dominated systems, where communities use it; in natural systems, 'land use' is simply a detailed classification (Petrişor *et al*., 2010). Changes in land cover and use reflect transitional dynamics; some of them can pinpoint human impacts, and even persisting trends. Examining all trends based on long-term data (1990-2006) covering the entire territory, Petrişor (2012c) identified several underlying causes, presented below; most of them are not characteristic to Romania only, but specific to transition countries.

- Urbanization (including changes of agricultural or natural systems into urban areas, but also land use changes indicating the growth of urban areas within their limits: conversion of construction sites or urban green spaces into urban fabric, transformation of discontinuous urban fabric into continuous urban fabric)
- Two opposite phenomena affect agriculture: development and abandonment of agricultural land
- Other opposite phenomena affect forests: deforestation and their regeneration due to natural causes (reforestation) or induced by man (afforestation)
- To a very little extent, floods (both periods), dams, desertification, and drainage of waters (1990-2000 only)

## 3. Examples

Three examples have been chosen based on their scale to illustrate the approach:

1. A study carried out at the level of the Romanian regions of development (NUTS 2) to look at their environmental potential as a part of the substantiation study for the National Concept of Spatial Development (Petrişor, 2008), presented in Fig. 1,
2. A study carried out at the regional level of county (NUTS 3) to analyze the environmental issues of Vrancea County, displayed in Fig. 2, and
3. A local study looking at a small commune (NUTS 5 or LAU 2), Dobrun, situated in Olt County, showed in Fig. 3.

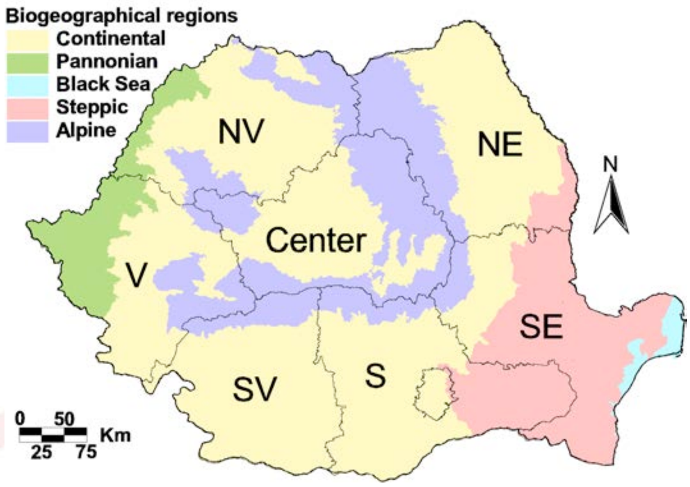


**Fig. 1**. Environmental status of the Romanian regions of development. The image displays the biogeographical regions, classified according to the European Environment Agency, overlapped with the administrative divisions.

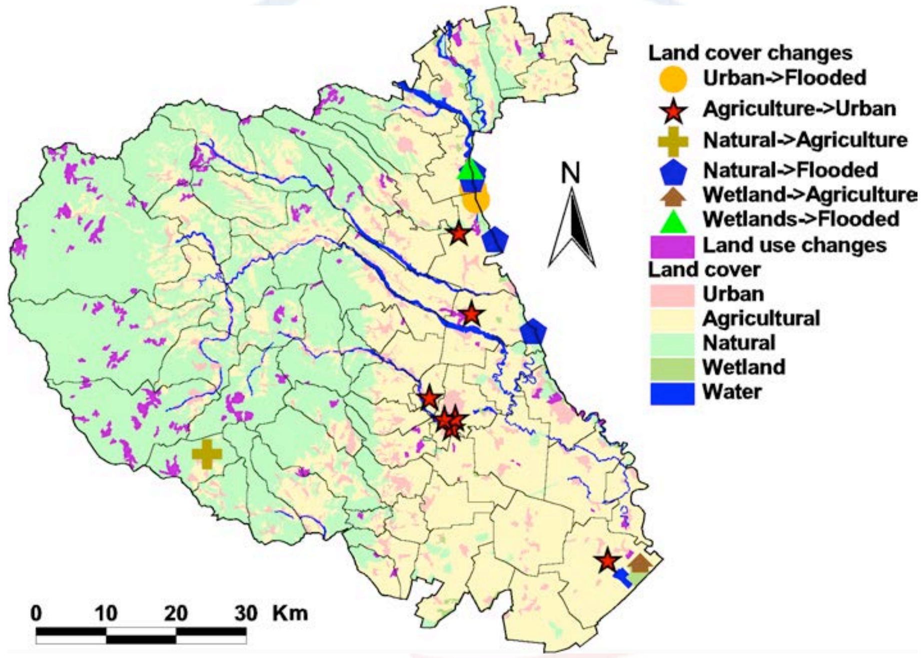


**Fig. 2**. Environmental status of Vrancea County, Romania. The image displays land cover overlapped with the administrative divisions (for precise location of issues) and land cover and use changes occurred during 1990-2000, using CORINE data from the European Environment Agency.

The three studies allowed for pinpointing specific environmental issues:

1. The first study presented in Fig. 1 underlines the natural diversity of Romania. The image itself does not speak for itself, but it has to be stressed out that there are 11 European biogeographical regions; large countries, such are Spain or Germany, have only two or three of them, while Romania, due to its geographical position, has five. Consequently, even small biogeographical regions have two or three biogeographical regions, equaling in diversity large countries.
2. The analysis of environmental issues of Vrancea County displayed in Fig. 2 looked separately at land cover and use changes. Land use changes are not covered in detailed typology, but are showing the extent of human interventions. Their density in the natural areas from the western part of the county pinpoints an important phenomenon, deforestation, occurred in Romania as a consequence of the restitution of forests as part of the goods confiscated from people by the communist regime. The economic decline, combined with no legislation establishing duties of owners, made most of the new owners cut down their new property for immediate gain. Land cover changes are more important in showing trends; some of them lie down over the eastern

border, represented by a river (Prut). They are consequences of the floods, determined most likely by the forest cuts mentioned before. Other changes are concentrated around a city (Focşani), the administrative center ('residence') of the county. Its economic strength determined an intense urbanization of adjacent areas, by converting former agricultural land into urban areas.

3. The study looking at Dobrun commune in Olt County, showed in Fig. 3, shows another interesting issue. The only land use change is due to the deforestation of a forest situated in the west of the area, transformed into a transitional shrub-woodland. However, the area affected by change is situated within an important Special Area of Conservation, part of Natura 2000 network. One would ask, 'How would it be possible without violating the restrictions?' The answer consists of the temporal dimension: CORINE data show changes occurred during 1990-2000, while the declaration of Natura 2000 sites was completed in 2008. Therefore, the deforestation occurred prior to the declaration of the area as a Natura 2000 site. Nevertheless, previous actions are likely to set their fingerprint over the structural and functional integrity of the site.

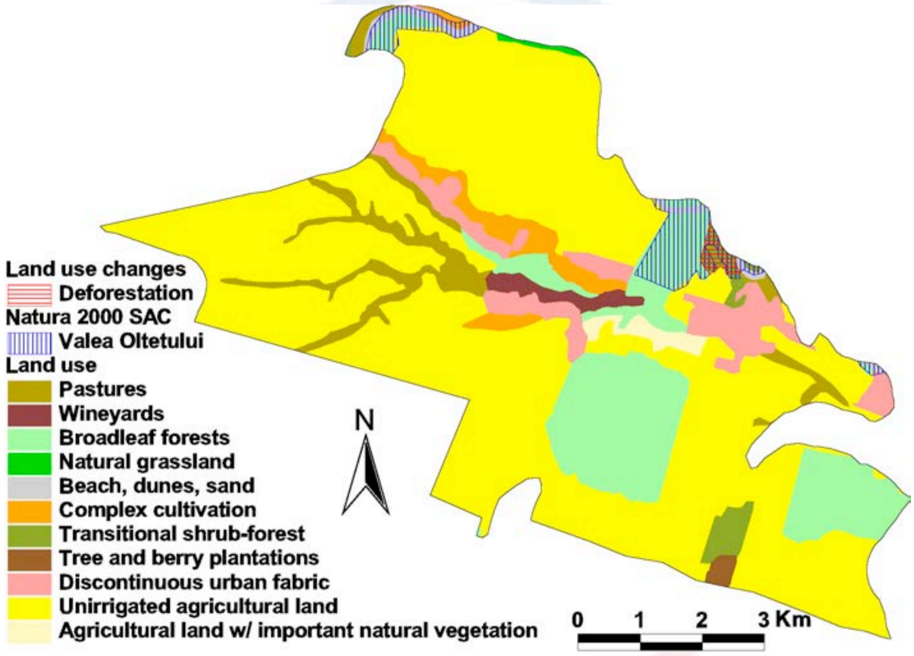


**Fig. 3**. Environmental status of Dobrun Commune in Olt County, Romania. The image displays land use overlapped with the most important natural protected areas and land use changes occurred during 1990-2000, using CORINE data from the European Environment Agency.

## 4. Architectural consequences

Since the need for a systemic approach has been underlined, in correlation with the spatial scale, a natural question relates to the next level: what are the consequences of spatial plans and associated environmental studies on the architectural design and constructive engineering details of buildings? To answer this question, several previous findings have to be reiterated:

- A study carried out over the Danube Delta Biosphere Reserve started with the spatial planning issues, moving down to the seismic and energy-use criteria, tackling also with the architectural constraints needed to preserve ethno-cultural diversity (including traditional architectural solutions) in addition to biodiversity; the result was a set of architectural constraints imposed to the new buildings (Meiţă *et al*., 2011)
- An analysis of exposure to natural hazards showed the need for spatial continuity in zoning the risk from regional mapping down to urban mapping and finally knowing exactly the buildings at risk in an urban or rural region; the design of new building, but also the consolidation of existing ones, needs to take into account these criteria (Georgescu *et al*., 2012)

- Other particular examples include criteria for designing buildings in earthquake prone areas, in protected areas containing natural or heritage sites, or in vulnerable areas (already discussed in the detailed studies above), and buildings accommodating the mitigation of climate change effects (Petrişor, 2013)

## 5. Conclusion

The paper attempted to introduce a methodology based on the systemic theory used for elaborating the environmental studies representing a part of the urban and spatial plans. Several examples illustrated the analytical potential of the method. The results underline the importance of applying a scientific methodology focused on the reproducibility of results to planning, suggesting that an up-to-date scientific substantiation is preferable to a legally valid, but scientifically outdated approach.

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