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CERTAIN ASPECTS REGARDING THE ENVIRONMENTAL AXES: MODELS IN THE ROMANIAN CARPATHIAN SPACE

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Abstract

The relationship between the crisis situations – generated by economic, medical and other causes – and space is a territorial relationship in which the two realities present systemic properties. This issue is proven by the need to perceive the territorial reality as a connection-shaped construct such as the environmental axis. The architecture of an environmental axis has structural components such as the main axis, secondary axes, nuclei, links, force sectors, matter, energy, information and response. The environmental axes, with nucleation pivots, were created on direct and adjacent natural, historical, social, economic and cultural supports. They respond to wide spatial requests from a region to another region and have the role to assure the complementarity and transferability in correlation with the increased opportunities. The Romanian Carpathian space offers a multitude of examples of functional environmental axes under the form of passage corridors, for example, the West-East axis Bârgău-Dorna-Moldova in Eastern Carpathians and North-South axis Bran-Rucăr-Dragoslavele in Meridional Carpathians, analyzed in this study. The particularities and parameters of axes development are highlighted by organization levels, adjusted to the temporal-spatial evolution. The functioning of these axes highlights the dynamic side of Romanian geospatial system by stability parameters, instability, sustainability, fragility, regression, decline, rehabilitation and reconversion parameters which show the quality of environment. The integrated regional units and models assure the territorial junction between axes and the territorial it connects from north to south or from west to east, at local, regional, national or international level.

Keywords: crisis situation, environmental axes, models, Romanian Carpathian space

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1. Introduction

In a text published right after the Great Union, to which E. Martonne actively contributed, the French geographer overturned the Xenopolian interpretation by claiming that, by the creation of the Romanian national state, geography took a brilliant revenge against history. Thus, from the Wall Mountains before 1918, Carpathians became after union the vital element, axis, gravitational center and spring of nation

(Coman, 2013). The valleys and corridors of Carpathians became mandatory passage points by which the Carpathians integrated in conditioning relations with the neighboring regions (Josan, 2002), which are environmental axes of convergency and dispersion of people, material goods and spiritual values. Environmental axis is the space-time force line which may embody varied geographic territory, which is allowing the diagnosis and prognosis, in a space-temporally manner of geographic territory, which may

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embody varied geographic shapes and dimensions in accordance with the components' capacity of polarization (Pop et al., 2016).

The Romanian Carpathian space has fulfilled different functions from the ancient times until today, united by close connections and reflecting the objective realities of the natural and anthropic geographical environment, as expression of unity and integration. Also, the valley corridors outlined alignments of longitudinal centers across the hydrographical network, spatial concentration axes (Fig. 1), towards which gravitates the whole economic and social life of adjacent sectors. The depressions present in the Carpathian mass form areas of geographical discontinuity, detached from the high units, the mountain massifs, by the particularities of landscape in which the human activity is particularly intense and permanent. The old commercial roads, known since the ancient times and reactivated in the Middle Ages, crossed the territory of Romania, coming from all directions. A part of them grouped towards the Danube mouths, while others were in transit.

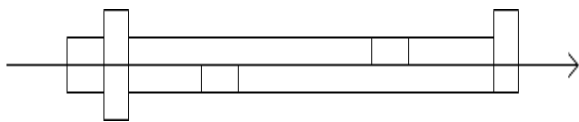


Fig. 1. The model of environmental axes as spatial concentration structure (Pop, 2016b)

The system of roads of Dacia had a main convergence knot in Apulum, where concentrated the imperial road, the roads from the south which passed Oltului Pass, the road from the north from Porolissum, and the road from the east which passed through Oituz Pass. Four great axes of transportation converge here, the first from SW direction, by Oituz Pass, from Braşov, the second one from NW direction, by Ghineş Pass, towards Ciuc, the third one from North direction, on Tazlăului Valley, from Bacău and the fourth one from SE, on Troţuşului Valley, from Adjud (Şandru, 1975). Romania is at the crossroads of great European axes (Posea, 2006). The corridors of environmental penetration preserve the traces of traditional activities, which changed the landscape scenery, such as the old roads of coal mining exploitation (Prodan et al., 2017), or those of forestry exploitation from Bistriţei or Moldova Valleys. Rucăr-Bran Corridor located between the Massif Bucegi in East and the massif Făgăraşului in West, represents one of the main environmental axes of connection between the central and southern parts of the country (Posea, 2002). The corridor has some complementary functions, of local interest, in the field of culture, trade, administration, preservation and continuity of ethnic hearth (Coandă, 2003). Tisei Valley represents morphologically and hydrographically the reference axis, gravitational center of the territorial system of historical Maramureş (Posea, 1999). Siretului Corridor represents an environmental axis with an elongated deployment, by the presence of polarization centers disposed in axes

with or without relations between them (Ghinea, 2000). Transportation confers a status of concentration and dispersion axis (Fig. 2), to the road and railway paths from the Eastern part of Romania. Siretului Axis as a whole has wide perspectives of optimization of its systemic functions by the development and modernization of transport modes designed to revitalize the old Moldavian Road from the Middle Ages whose opportunities are demanded to be sued by other international regions on the Romania-Ukraine-Poland axis.

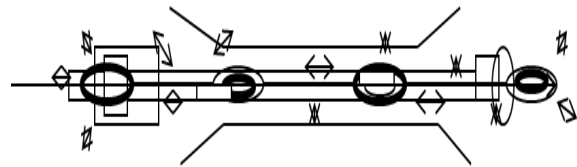


Fig. 2. The model of environmental axes as spatial dispersion structure (Pop, 2016b)

2. Methodology

In a contradictory landscape in which sciences are strongly intersected, and their promoters return to the philosophical space of a much more eclectic approach, geography needs to rethink concepts, for new concepts to appear and consolidate, to individualize new methodological routes, by which it redefines its rough nucleus. In the context of contemporary development (Bădescu, 2011), the concept of axis is permanently enriched, the human communities realize its multiple valences in the effort of adjustment to a complex environment.

In general, the territorial axes (Pop, 2016b), are smart systems, because they are managed by communities whose actions are backed by processes carried out according to certain logics. These logics are in reality resolution paths of crises or achievement of goals which the communities define. The key element of a region is the development axis (Blažek and Netrdová, 2009). Around the development axis the whole region develops, the other elements have a lower importance. The structuring along a major, privileged geographical axis (Pop, 2016a) is highlighted by complex energy flows, material and information flows, overlapped. The mass, energy and information flows are asymmetrical. The functional asymmetry is the origin of functional inequalities, the appearance of hierarchies and functional disparities.

The axes of today work less as a relationship and more as an alliance is centered on collective security and an expeditionary power. The evolution of axes in an alliance requires a fundamental conceptual change in the way in which the community of national security conceptualizes and addresses complex challenges for the regional decision-making factors. The environmental axes cross various relief forms and represent a connection between two regions, provinces (Pop, 2014), unite two growth poles, represent the basis of territory transformation. For a model of environmental axes, it is necessary that we analyze the

components as variables in the light of interdependence both in stationary and dynamic regime. For the elaboration of such a construction, we started from a real state of fact which by schematization, reduction, conceptualization and graphism receives an incipient form, a mental outline started from an idea which represents the spring of model (Donisă, 1977). This idea can be transposed in writing by receiving a certain typology depending on various criteria or symbolic models, growth models, hierarchical models, complementary, explorative, mathematical models, forecasts, diagnoses of sustainable development, integration, risk, autogenic, distributive, accumulative, transit, centrality, correlation, ecological, network type, circuit type, loop type, cell type, agglutination, limit, gravitational, linear, ramified, hexagonal, depending on the demand of society, finally they represent starting points for new analyses. As a whole, it is not necessary that the model includes a very detailed description of the realities on the field.

The complexity of models (Boutot, 1997) should increase towards the analysis of environments which form the environmental axes, both the inner environments and contiguous neighboring environments. The factors of this model are differentiated in two categories, fundamental factors and derived factors, the second category depends on the fundamental factors which connect the criteria resulting in a unitary system of the model.

In identifying the axes, the position and orientation indicators, the economic, demographic and infrastructure indicators were analyzed by the SWOT method. The use of these indices was made in correlation with the quantitative and qualitative data obtained by field observation. The methodology

aimed the establishing of an order in the analysis according to the capacity of structuring the space in which the axes express their potential for territorial polarization.

3. The West-Est environmental axis Bârgău-Dorna-Moldova

The passage from the Carpathians of Maramureşului and Bucovina to the Moldavian-Transylvanian Carpathians is marked by a wide area of geographical discontinuity, developed from west to east, on the entire width of mountain range, known as Bârgău-Dorna-Moldova Corridor (Fig. 3). The region is formed by low mountains, valleys and depressions separated by easily accessible saddles, such as Tihuţa Pass and Mestecăniş Pass, showing a discontinuity of relief and landscape, which represents a very important environmental axis and a connection axis between Transylvania and Moldavia, between Moldavia and Maramureş (Mihăilescu, 1963). The relief of lower altitude than the Northern and Central groups of Eastern Carpathians, represents the element which allows the inclusion of this area so diversified in the same geographical unit, which has as a whole the appearance of a wide corridor of environmental axis type.

This region of geographical discontinuity circumscribed by Suceava county (Fig. 4), represents a mosaic of specific elements, on one hand, volcanic area and cross-Carpathian flysch, and on the other hand, the crystallin area and Extra-Carpathian flysch. The largest settlement in depression is the town Vatra Dornei (Ungureanu, 1980), located at the confluence of Dorna with Bistriţa, position which gave it a tentacular development.

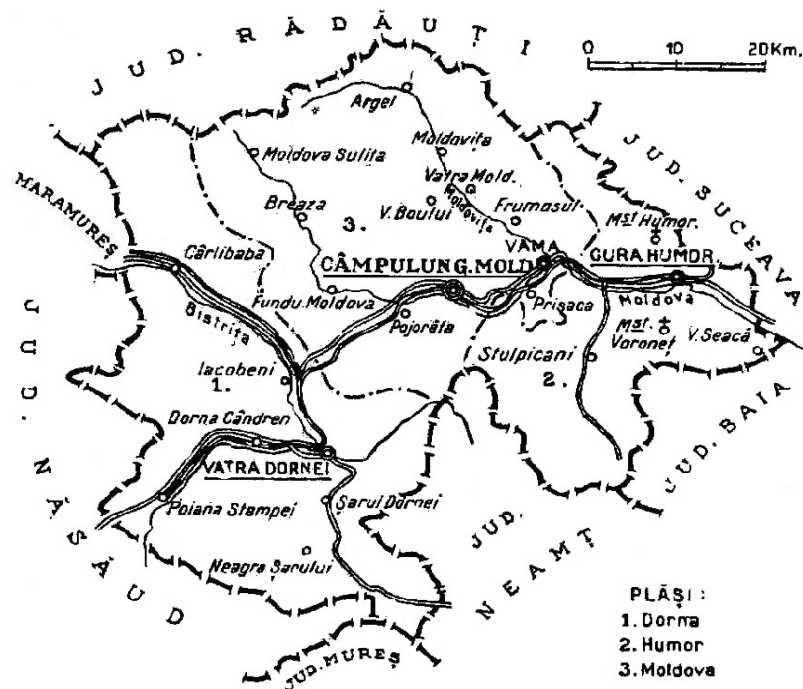


Fig. 3. Map of the inter-war County of Campulung (Ivănoiu and Gheorghiu-Bradley, 2013)

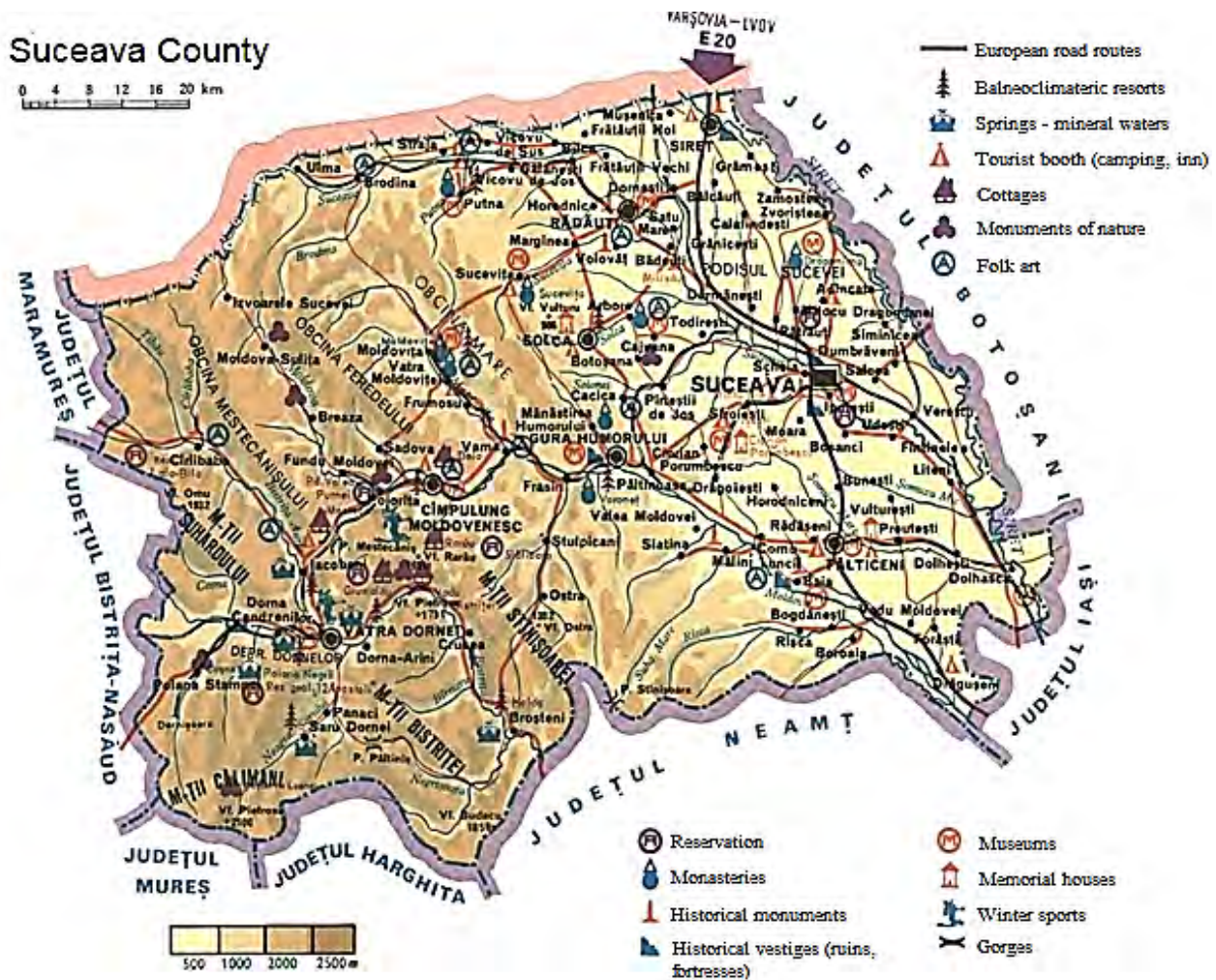


Fig. 4. Suceava County. Touristic Map (Cucu, 1978)

The town attested by documents in the 15th century gradually developed from a rural settlement with a high pastoral nature to a well-known balneary resort. The geographical position on the same cross-Carpathian alignment with the town Câmpulung Moldovenesc, added commercial valences to it. Polarization center of the whole life of depression, the development of town Vatra Dornei is privileged by its location on the two cross-Carpathian main road and railway paths which by Ilva (893 m) Pass and Tihuța Pass (1205 m) connect the depression with Transylvania, and by Mestecăniș Pass (1 096 m) it connects the depression with Bucovina and Moldavia. The depression Câmpulung Moldovenesc is the largest depression area across the Moldavia and develops compliantly with the structure, as a continuation of Sadovei corridor, but also as a sector of the great depression corridor Bârgău-Humor (Barbu, 1976).

The appearance and development of town Câmpulung Moldovenesc attested since the age of Alexandru cel Bun (Bălaș, 2014), were privileged by the richness of soil and subsoil and its geographical position along the cross-Carpathian axis which unites Moldavia with Transylvania.

4. The North-South Environmental Axis Bran-Rucăr-Dragoslavele

Between the massifs Iezer, Leaota, Bucegi and Piatra Craiului a lower compartment appears, with hills, long summits and gorges which often exceed 1.100 m, with basins which insinuate up to the foothills of mountain, with pastoral settlements which spread on rivers and grouped by valleys. This is the appearance defined by the Corridor Bran-Rucăr-Dragoslavele (Fig. 5), area of discontinuity in Carpathian mass, with genetic affinities with the mountain, but also with own personality. In the current configuration of Corridor Bran-Rucăr-Dragoslavele (Posea, 2002), we distinguished three distinctive sectors, Branului sector in the north, which carries out downstream of Giuvala watershed to Bran, being wide opened under the form of an amphitheater, drained by Turcului brook, Giuvala Sector. In the central part, it has the appearance of a wide gorge between Piatra Craiului and Leaota, unlevelled by 250-300 m compared to the units around it and which represents a very sinuous watershed, between the southern and northern rivers.

Dâmboviței Sector preserves even better the

character of corridor. Dâmboviței Valley (Posea, 2006) is characterized by tectonic fragmentation and a varied lithology. The landscape unit of Corridor Bran-Rucăr-Dragoslavele must be reported to the old commercial and defense road which is taken up today by the modernized road Braşov-Câmpulung which imprints a new dynamic in the functional structure of settlements (Velcea, 1987).

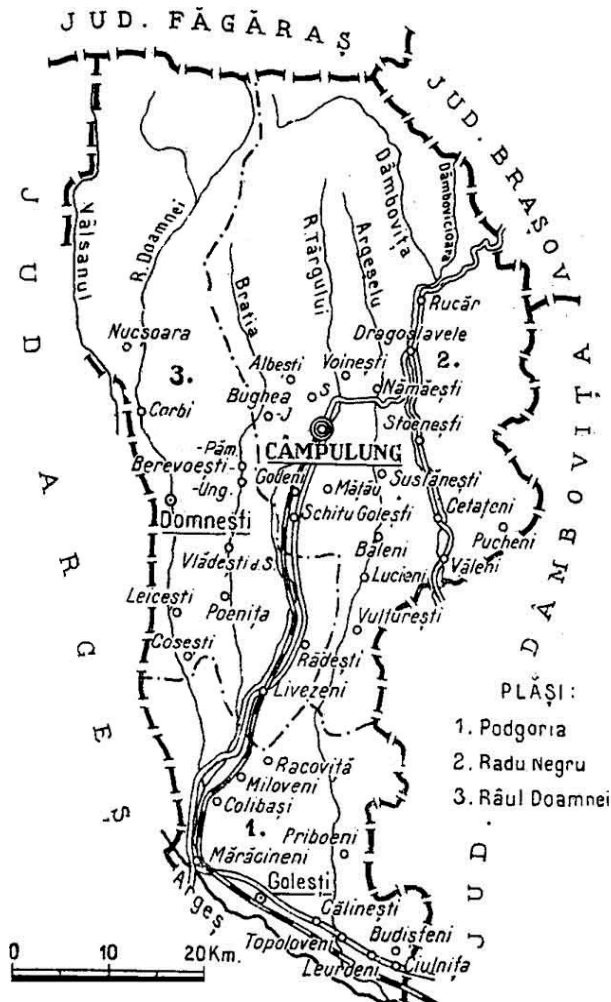


Fig. 5. Map of the inter-war County of Muscel (Ivănoiu and Gheorghiu-Bradley, 2013)

5. Results and discussion

The environmental axes are spaces with a certain potential and with certain arrangements which allow social, economic, cultural and medical activities (Pop et al., 2015). They are developed along valleys or in depressions or major traffic arteries. The axes represent the most important sector of an area or region towards which flows are concentrated and a heavy traffic is carried out.

The model of environmental axes (Pop, 2016b) involves the following potentialities -P, existing background -Fe, directed interventions -Id and territory status -St, where: $P=Fe+Id+St$. Models -M, results based on the centrality of environmental axis, materialized by the road, railway and hydrographic network present to which we add the immediate

neighborhood, line which must be visualized, interpreted and identified as the main support and development -Sd, on habitational concentrations -Ch, towns, villages, countries (Pop and Mac, 2011), which represent the support points and the growth areas in material, energy and informational profile. They are actually the attractors from and towards which they gravitate, in the places with a more natural load -Ln, which means the peri-urban and peri-rural spaces with heterogenous physiognomies, dictated by the territorial reality. The differences between these spaces are given by the organization method of perispaces which means, on one hand that it is regulated and respected, in case of peri-urban spaces, and on the other hand, it is regulated but is not respected, in case of peri-rural spaces, where: $M=Sd+Ch+Ln$.

The relations assure the environmental axes the change of sustainable development (Bostan, 2016). Such a presentation of environmental axes requires as necessary the description of each symbol. The existing background -Fe, is an answer of already consumed facts, in case of environmental axes, we analyze different states of fact, precarious or developed. The geology, morphology, history, position, towns, rural settlements (Bădescu et al., 2009) and through them other issues, give the territorial geographical background of environmental axes. The directed interventions -Id are the engine of the current background which evolves depending on certain adjustments. These interventions can mark extensions, amplifications, orientations, organizations for axes. The territory Status -St, depends on Fe and Id. The development support -Sd has the role to integrate and fluidize the inventories of matter, energy and information both inside the axes and in relation with the neighboring areas. The habitational concentrations -Ch, especially by their dynamic element, the inhabitants and their material status, represent barometers of objectives proposed. The natural places -Ln, have an organization more dependent on the vicinity or distance from habitats, are areas which maintain the offer of environmental axes. Having an elongated shape, the environmental axes occupy the morphological corridors of major valleys. But their territory often extends outside of corridors, on sectors of plateaus or mountains which gravitate towards that axis. For example, the plateaus of Hârtibaciului and Secașelor in the Transylvanian space and the middle corridor of Târnavei Mari River which became secondary gravitational axis parallel to Mureșului axis (Grigore, 1987).

As dynamic territorial units, the environmental axes can be taken into account from the point of view of elements of natural framework and the polarization potential of human concentrations such as centers, secondary axes depending on the spontaneous or directed trends regarding the evolution of territory. Even though the axis is not the sole form of modelling, it is the one type of modelling that is often used to represent, among others, several types of, generally speaking, territorial organization, such as: linear, urban and traffic zones, corridors of development,

politically or economically similar regions, a group of countries, etc (Szabo, 2008). At national level (Vlad, 2017), there is a series of territories which can be integrated in the category of development axes. The interregional development axes Bucharest-Braşov, Bucharest-Constanţa, Oradea-Cluj-Napoca-Braşov, Bucharest-Craiova, Iaşi-Bacău-Braşov, Timişoara-Arad-Oradea-Satu Mare, Craiova-Piteşti-Braşov, Bistriţa-Năsăud-Cluj-Napoca-Deva, Craiova-Deva-Oradea. The axes with development potential at intraregional level are those along the hydrographic corridors Mureşului Valley, Târnavei Mari Valley, Oltului Valley, Siretului, Bistriţei or Troţuşului Valleys. Others develop along the geomorphological corridors, such as the case of corridor formed by the intramountainous depressions of Eastern Carpathians, Braşov-Ciuc-Giurgeni, the intramountainous corridor Rucăr-Bran or the alignment Vatra Dornei-Câmpulung Moldovenesc-Gura Humorului. These environmental development axes with a special dynamics and special development route highlight competitive potential elements which require the adoption of interventions for maximization of competitive advantage.

6. Conclusions

The environmental axes cross various relief forms and represent a connection between two regions, provinces unite two growth poles, represent the basis of territory transformation. If each organization level of axes is considered a development system with own evolution, with a particularity of interactions between the elements which compose it, then each level will correspond to a qualitative and quantitative determination by the interaction between them. The characteristic flows of axes represent a form of spatial interaction between two areas of which the destination area has a surplus of commodities and the generating area has a deficit.

Romania is at the crossroads of great European axes. The North-West development region of Romania is located at the crossroads of North-South and East-West axes of Europe. The geographical center of Europe is located on Tisa River, in the town Rahău at short distance from the town Sighetu Marmaţiei. The north-south zonal exchanges specific to continents, which determined the realization of commercial roads in this direction are found also in Europe. One of them, the main one passed since Antiquity over the territory of Dacia and Romania. This is the road of Siretului, which connects the Axis Baltic Sea -Black Sea- Mediterranean Sea. In the area of our country, such roads imposed from west to east, especially north of Danube and over Carpathian passes. We mention the roads and railways which cross the Corridor Timiş-Cerna or the Corridor Mureşului and Oltului Defile, and those from Oradea on Crişului Repede Defile, over Transylvania, Braşovului Depression and passes Bran, Predeal, Oituz and Buzău. These roads are directed towards Danubian harbors, from where they cross the Balkan

Peninsula to the Mediterranean Sea or to harbors of Black Sea, over Dobrogea. The regions present a certain particularity, in case of some of them we see the phenomenon of bifurcation, phenomenon which has the main goal to dissipate a part of existing flows along the privileged axis to a series of secondary axes detached from it.

An environmental axis is formed by a number of individual and group elements assembled so that they behave as a well-adjusted interactive system which provides the axis with stability, resistance and rigidity properties. The design of an environmental axis starts from the idea that this structure has to contain multiple possibilities of adjustment. The entries in axis, exits, convergences, divergences, transits, feedback etc., assure the functioning of axis. From structural point of view, in environmental axes there are at least two sets of elements which should be known, an indirect set of elements, based on insight, hypotheses, comparisons, and a set of elements related to measurements, calculations, human perception. While the studies of axes combined both approaches, the singular knowledge was replaced in time with the integrated approach.

The multidisciplinary, interdisciplinarity and transdisciplinary are levers of integrated study. By the studies and models analyzed, we can identify in environmental axes the following states of fact: the large unity of axis, the subunits or main cells of axis, the active axes of relationship which are given by the corridors of higher valleys, axes given by the medium and lower valleys, the functional barriers in north-south direction, in west-east direction, the areas of interaxial contact between subunits, the areas of potential expansion of axis, the passage points between subunits, marked by constraint, the places of interruption, axial strangulation, the development lines of subunits, the natural areas, the administrative barriers of intercounty, interregional or international contact, the support areas, the very dense constructions, villages, towns, nuclei of axis, systems of urban and rural settlements, the emergency areas, with role of converging all impulses, entries-exists from systems, internal and external entries.

References

- Barbu N., (1976), *Bucovinei Ridge*, Scientific and Encyclopedic Publishing House (in Romanian), Bucharest, Romania.
- Bădescu I., Cucu-Oancea O., Sisestean G., (2009), *Rural Sociology Treaty*, Little Wallachia Publishing House (in Romanian), Bucharest, Romania.
- Bădescu I., (2011), *Encyclopedia of Sociology. Contemporary Theories*, Little Wallachia Publishing House (in Romanian), Bucharest, Romania.
- Balas R., (2014), *Old Romania Album*, Reea Ltd. Publishing House (in Romanian), Targu-Mures, Romania.
- Blažek J., Netrdová P., (2009), Can development axes be identified by socio-economic variables? The case of Czechia, *Geografie*, **4**, 245-262.
- Bostan I., (2016), Pro sustainable development: the influence of the law of entropy on economics systems, *Environmental Engineering and Management Journal*,

- 15, 2429-2432.
- Boutot A., (1997), *Inventing Shapes*, Nemira Publishing House, (in Romanian), Bucharest, Romania.
- Coanda G., (2003), *Carpathians, Space of Conservation and Continuity of the Romanian Ethnic Hearth*, Bibliotheca Publishing House (in Romanian), Targoviste, Romania.
- Coman M., (2013), *Power and Territory. Medieval Romanian Country*, Polirom Publishing House (in Romanian), Bucharest, Romania.
- Cucu V., (1978), *Atlas of the Counties from RSR*, Didactic and Pedagogical Publishing House (in Romanian), Bucharest, Romania.
- Donisa I., (1977), *Theoretical and Methodological Bases of Geography*, Didactic and Pedagogical Publishing House (in Romanian), Bucharest, Romania.
- Ghinea D., (2000), *Geographical Encyclopedia of Romania*, Encyclopedic Publishing House (in Romanian), Bucharest, Romania.
- Grigore M., (1987), *Mures Corridor*, In: *Geography of Romania*, Oancea D., Velcea V., (Eds.), Romanian Academy Publishing House (in Romanian), Bucharest, vol. III, 426-429.
- Ivănoiu M., Gheorghiu-Bradley L., (2013), *Portrait of Inter-War Romania*, On line at: romaniainterbelica.memoria.ro.
- Josan N., (2002), *Geographical Destiny of the Romanian People*, University of Oradea Publishing House (in Romanian), Oradea, Romania.
- Mihăilescu V., (1963), *Physical Geography of Romania*, Scientific Publishing House, (in Romanian), Bucharest, Romania.
- Pop C.C., Mac I., (2011), Normative and conceptual elements of Sylvania Land identity in the unity of the Transylvanian space, *Transylvania Review*, **20**, 245-250.
- Pop C.C., (2014), The functional territorial units in Transylvania during the 10th–16th centuries, *Transylvania Review*, **23**, 271-276.
- Pop C.C., Nistor S., Baca I., (2015), Geographical environment and global health. Conceptual and practical aspects, *Environmental Engineering and Management Journal*, **14**, 1383-1387.
- Pop C.C., (2016a), Geographical axis theory. Role and function in building territorial social realities, *Review of Research and Social Intervention*, **52**, 283-293.
- Pop C.C., (2016b), *Geographical Axes. Intelligent Territorial Structures*, Casa Cartii de Stiinta Publishing House (in Romanian), Cluj-Napoca, Romania.
- Pop C.C., Ormenisan S.V., Pop C.D., (2016), Environmental axes: management and economic development. regional and local aspects, *Environmental Engineering and Management Journal*, **15**, 1148-1153.
- Posea G., (1999), *Romania. Geography and Geopolitics*, Foundation Romania of Tomorrow Publishing House (in Romanian), Bucharest, Romania.
- Posea G., (2002), *Geomorphology of Romania*, Foundation Romania of Tomorrow Publishing House (in Romanian), Bucharest, Romania.
- Posea G., (2006), *Physical Geography of Romania*, Foundation Romania of Tomorrow Publishing House (in Romanian), Bucharest, Romania.
- Prodan M., Lupu C., Nalboc I., Szollosi-Mota A., Munteanu C., (2017), Microelements influence on coal oxidation and the environmental pollution implications, *Environmental Engineering and Management Journal*, **16**, 1347-1353.
- Szabo P., (2008), The pentagon and other geometrical figures of Europe's economic core, *Romanian Review of Regional Studies*, **4**, 11-20.
- Șandru I., (1975), *Romania. Economic Geography*, Didactic and Pedagogical Publishing House (in Romanian), Bucharest, Romania.
- Ungureanu A., (1980), *Cities of Moldavia. Economic Geographic Studies*, RSR Academy Publishing House (in Romanian), Bucharest, Romania.
- Velcea V., (1987), *Bran-Rucar-Dragoslavele Corridor*, In: *Romanian Geography*, Oancea D., Velcea V., (Eds.), RSR Academy Publishing House (in Romanian), Bucharest, vol. III, 255-259.
- Vlad I.V., (2017), *The Development Strategy of Romania in the Next 20 Years*, Romanian Academy Publishing House (in Romanian), Bucharest, Romania.