

The conversion of agricultural lands into built surfaces in Romania

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Abstract— The growth of built surfaces is realized mostly by occupying agricultural lands or natural ecosystems (forests, wetlands and so on). In Romania, the lack of laws or amendments between 1990 and 2005 has triggered a significant consumption of agricultural lands by converting them into built spaces. This article evaluates the extent of the conversion process for various categories of agricultural areas into built ones in Romania. To analyze the dynamics of the conversion process CLC 1990 and 2006 have been used, as well as official statistics data. In Romania, the conversion of agricultural lands into built spaces has been a ‘feature’ not only for the areas located near large cities, but also for the rural areas where commuting to Western Europe has brought significant revenues for local communities, which have been later on used mostly in construction. Considering this, built areas increased over 300%, mostly through agricultural consumption. The development of built surfaces, mostly unplanned, generated a major impact from social, economic and ecological perspective, thus affecting the functionality of human settlements and natural ecosystems.

Keywords—agricultural land, built surfaces, CLC, conversion.

I. INTRODUCTION

THE growth of built surfaces is a phenomenon specific mostly to spaces near urban areas, where the polarization of various economic and social activities favours a concentration of capital categories [1]. Interest in developing and sustaining agricultural activities decreases proportionately with proximity to urban areas, especially in areas influenced by fluctuations in the real estate market [2], [3].

Besides real estate market, the growth of built spaces is influenced by housing consumption models as well as local, regional and national existing financial resources, residential mobility and specific planning facilities [4].

Changes related to land use after joining EU in 2007 have been triggered by changes in the EU agricultural policy, the deepening of global issues regarding environmental

degradation and biophysical factors such as the carrying capacity of the land.

Preference for built surfaces expansion on agricultural lands depends on the administrative and legislative context, (the easiness of transforming agricultural lands into built surfaces) [5], the socio-economic conditions (low price of agricultural land and its availability for acquisition, demand of built spaces) [6] as well as topological ones (site conditions, generally optimal, as a result from the improvements made for increasing crops productivity) [4].

This model of development, beyond its social and economic effects, leads to an impaired quality of the environment. Biologically productive areas with a low or medium degree of dependence related to anthropogenic interventions become resources for consumers and highly dependent on the anthropogenic intervention [7].

In this matter, numerous conventions and international treaties have been promoted towards limiting the dimension of the conversion process of agricultural land into built ones. Remarkable is the Agenda 21, chapter 7 (Promoting sustainable development for human settlements), containing a recommendation for the implementation of management techniques and territorial planning to limit the loss of biologically productive land [8]. At EU level, the entire process is the focus of spatial planning policies (Leipzig, 2007), conservation ones (Habitats and Birds Directives) and for the Common Agricultural Policy.

For assessing the size of the conversion phenomenon of various categories of land use, different methods are applicable, such as multi-criteria analysis [9], [10], spatial modelling [11], interpolation [12], binomial logistic models [13], variance analysis [14], multiple logistic regression [15], remote sensing [16]. As input there are used mostly statistics or historical Land Cover maps or remote-sensing derived maps (generally from aerial photographs or satellite images, Corine Land Cover) [15], [17].

Determinants of the conversion process can be grouped into 3 main categories, to be more precise physical [15], social [13] and economic characteristics [18].

In Romania, unplanned expansion of built areas characterized the period between 1990 and 2005. The lack of laws or amendments in spatial planning, significant changes regarding patterns of housing consumption due to changing economic and political model, speculative real estate interests and the increasing private investments have led to a major development of built spaces [4], [6], [7].

Manuscript received July 29, 2011. This work was supported in part by the UEFISCDI under Grant 1012/2009 – cod 1925 (Idei Programme) Methodology for environmental quality assessment in residential areas.

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Dispersed extension of built surfaces emphasized agricultural land loss. Retrocession of land to private owners caused agricultural land fragmentation (average size of farms is 3.3 ha) and along with the lack of association forms led to the main cause of the low efficacy they have in Romania. Thus, their initial abandonment and then the conversion into built surfaces became very simple steps to follow in most of the administrative units in Romania [19]. Knowing the size of these developments is extremely useful not only as territorial balance, but as an overall evaluation of the ecological footprint related to the development of built spaces.

The objectives of this paper are: 1). Assessing the extent of agricultural land conversion process into built spaces in Romania between 1990 and 2005; 2). Pointing out favourable causes for the conversion process; 3). Determining the main types of agricultural lands converted into built ones between 1990 and 2005.

II. STUDY AREA

Romania, with a surface of 238.391 km², is characterized by a uniform distribution of the relief forms (35% mountains, 35% hills and plates and 30% plains) which cause a diversification of forms of agricultural activities. Romania's population is 21.5 million; with an average density of 93 inhabitants per square km. Share of population employed in agricultural activities is 26.7% of the total. GDP is 11.600 USD per person. Human Development Index value is 0.813 [19].

Agricultural areas represent 61.7% of the total (14.7 million ha), decreasing with 0.56% in comparison with 1990 (Fig. 1). The most powerful changes occurred in the permanent crops category, where significant declines are registered for the period 1990-2006 (22.3% for vineyards and 34.5% for orchards).

Occupied building area represents 2.95% out of Romania's entire surface of 703.262 ha, value that has been constantly increasing over the past 20 years (Fig. 2).

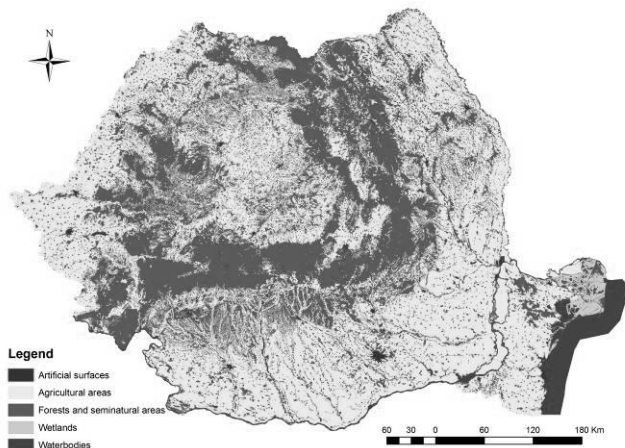


Fig. 1 – Classes of land use in Romania (after CLC, 2006)

III. METHODOLOGY

For the analysis at a national level were used the CLC 1990 and 2006 databases at a scale of 1:100 000, with a minimum mapping unit of 25 ha and minimum width of linear elements of 100 meters. The following categories were selected for analysis: artificial surfaces and agricultural areas, with their particular subclasses. The CLC datasets allow the identification of changes bigger than 5 ha [17]. Using ArcGis, more precisely the 'Tabulate area' function, there have been identified surfaces and typologies of agricultural land conversion into built spaces.

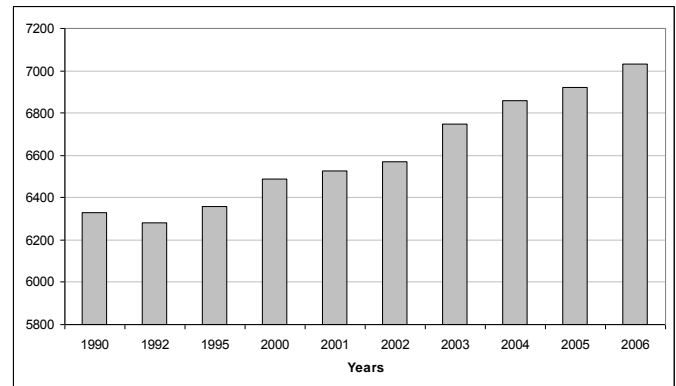


Fig. 2 – Dynamics of built surfaces between 2000 and 2009 in Romania

For representative areas from Romania (Bucharest metropolitan area, Campina, west part of Buzau County) there were used 1:5000 cadastral plans of 1990 and 2008 aerial images. For these, information was pulled from the cadastral plans and aerial images, and then integrated into a database using ArcGIS (Environmental Systems Research Institute, Redlands, CA). Through spatial analysis, information regarding the surfaces of polygons (built spaces and agricultural lands) was brought to light. Also, there were discovered surfaces and types of land use categories relevant to the analysis (arable land, meadows, vineyards, orchards) within the studied areas. Subsequently, the information from the cadastral plans and aerial images were overlaid, thus identifying areas where a process of conversion from agricultural lands into built surfaces was registered.

For validation of the data, there have been used statistics provided by The National Institute of Statistics. (www.insse.ro).

IV. RESULTS

The conversion of agricultural lands is still a very active process in Romania and most often they are transformed into built surfaces.

The largest areas were lost from the category of arable land (77,847 ha), land that has otherwise the biggest share at national level (64.16%) and overlaps the areas with the highest suitability for building location (areas relatively flat, in the plain regions and in the lowlands).

The process is dynamic, especially near the big cities

(Bucharest, Timisoara, Iasi, Constanta, Brasov, Suceava and so on), where the urbanization is taking place rapidly and real estate market's concern towards construction development has increased significantly.

Table 1 – Conversion of agricultural land into built spaces in Romania between 1990 and 2006 (CLC processing 1990-2006)

Conversion to built spaces	Surface transformed (Ha)	% out of category	Tendency 1990-2006 (%)
Arable	77847	0.82	-0.29
Permanent crops	18738	4.29	-22.35
Pastures	27947	0.84	1.58
Heterogeneous agricultural areas	71300	3.2	-12.3
Total agricultural land	195832	1.33	-0.56

Changes are well-defined near Bucharest, where increases of over 50 ha of residential spaces were registered in all settlements from the first urban ring (maximum of 433ha in Voluntari city – representing an increase of 253%) (Fig.3). Residential areas represent 60% out of the total built spaces, often developed in a scattered way (Fig. 4), along with storage places and retail centres.

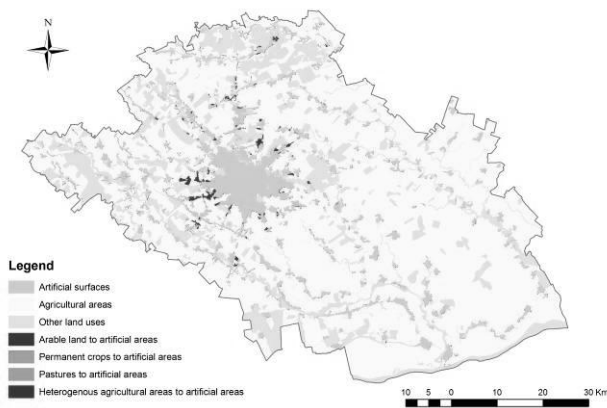


Fig.3 – Conversion of agricultural lands into built spaces in the metropolitan area of Bucharest

The gradient of abandonment for the agricultural land is inversely proportional to the distance from the capital, as it is proven through the report: built surfaces/agricultural areas, registering the highest values for areas in proximity to Bucharest (Voluntari – 0.96; Dobroesti – 0.25; Chiajna – 0.90) but also in the northern units (Snagov, Ciolpani) decreasing up to negligible values while the distance is increasing (0.02 to 0.03 Curcani, Ileana, Manastirea, Plataresti).

A second category of agricultural areas with significant changes refers to heterogeneous agricultural areas. They are in most of the cases territories located on the outskirts or within human settlements, including both construction and agricultural areas. Densification of the human settlements or

their expansion produced an major loss of these spaces (-12,3%).



Fig. 4 – Constructions occupying agricultural lands and abandonment of agricultural lands in the metropolitan area of Bucharest

An interesting development is represented by the transformation of permanent crops (vineyards and orchards) into built spaces. 4.29% of the vineyards and orchards turned into built spaces, especially on hills, where this type of land use is the most common. To the pressure caused by built surfaces, we can add for this type of land use the inefficiency of trade markets due to competition because of the imported products. For example, in Campina (38789 inhabitants, 25 square km administrative area) there were lost, because of the rapid expansion of buildings, 35 ha of orchards (65% of total area) (Fig.5).

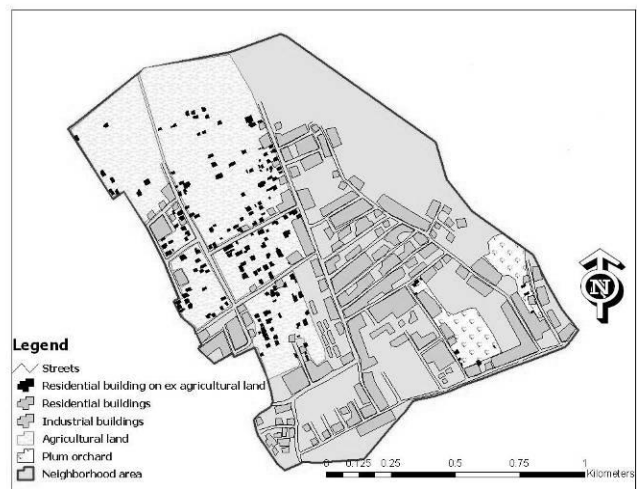


Image 5 – Conversion of agricultural land into built spaces in Campina (Muscel neighbourhood – 1990-2008)

Regarding pastures, the area converted into built surfaces was about 27947 ha. This value, quite high, indicates a phenomenon specific for different areas of the Carpathian Mountains, which have become attractive for building holiday homes. Thus, tourist resorts and natural protected areas

represent the main categories of areas where the boom of the residential has been realized through pastures consumption [21], [22].

Causes of these developments in Romania are far from being homogeneous and simple to characterize. Incoherent legislative framework and lack of medium or long term development strategies of human settlements allowed the existence of a very low control over a highly active pressure factor, represented by the growth of built spaces [19].

Also, the consumption pattern of population has changed radically. From a home with less than 80 square meters, that could accommodate even 9 or 10 people, and belonging to 2 or 3 generations, people ended up to a familiar home, with a large surface. Thus, in many settlements, new residential areas tend to have over 200 square meters as habitable spaces (Fig. 6).



Image 6 – One family residential space in the proximity of Bucharest

High financial resources available in rural communities, from Romanians working in different countries in Central and Western Europe, have stimulated the process [19].

Expansion of built spaces is not one generalized in Romania. In remote areas mostly or those who have registered significant falls of economic activities, the whole process is reversed and the built area meets a slight decrease. In a similar situation is the west of Buzau County, where the lack of attractiveness of the area induced a very active process of permanent migration.

In addition, agricultural activities in Romania have a very low yield and very high vulnerability to natural hazards. For this reason, on the short term, the conversion into built spaces is more profitable. One hectare can generate a gain between 3500-4000 Euros, while marketing same surface to be transformed into built space, can bring immediate revenue to more than 200,000 Euros.

V. DISCUSSIONS

The enlargement of built space (in particular with residential and commercial function) was also doubled by the limitation of industrial space, leading to the process of demolishing existing buildings in many regions. However, this type of

expansion remains a visible phenomenon difficult to control.

Built spaces also emphasize agricultural land abandonment through spraying, apart from leading to direct loss

In addition, unplanned development of built spaces determines many of them to improvise a public services series (for example roads, water supply from own boreholes, sewage/septic tanks), fact that increases not only the cost of housing, but also the environmental impact [4].

Moreover, in the use of agricultural lands there have been identified the most powerful mutations, by adding different lands to all the other categories of land use (through long-term abandonment, there have been framed some bodies of water in semi-natural areas or in wetlands where there was no hydro-ameliorative measure performed).

Still vulnerable to this process are areas near the big cities and those located in areas with considerable natural potential [6].

Great loss of agricultural lands for built surfaces not only affects the population food balance, but also changes the lifestyle of rural population used to an agricultural one, causing their migration to the city or changing the economic activities profile.

Revenue structure clearly shows that an essential part of the financial resources derives from agriculture (40% in rural areas), so any loss is an impairment of the local economy (Table 2).

Table 2
Share of obtaining income sources in Romania in 2005
(Eurostat, 2008)

	<i>Agriculture</i>	<i>Salary</i>	<i>Freelancers</i>	<i>Welfare</i>	<i>Others</i>
Rural	40	22	4	22	12
Urban	10	60	1	16	13

At a national level, using CLC in evaluating the conversion of agricultural lands to built spaces is a method highly effective and it must be approached with caution. The high proportion of the unit of analysis generates significant errors to possible determined changes. For this reason, validating information from the CLC with statistics and cadastral plans data or satellite images proves to be very useful.

VI. CONCLUSION

The conversion of agricultural land into built spaces results clearly from this spatial analysis with the CLC. Preference for built spaces on farmlands in the plains, vineyards and orchards on the hills and pastures in the mountains, can be justified through land use structure. It requires a detailed analysis of built spatial structures which replace agriculture and especially

an analysis of the overall loss of biodiversity and agricultural production as a consequence to the insertion of built spaces.

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