

## **THE IMPACT OF AGRICULTURAL DEGRADATION SOURCES ON THE ENVIRONMENTAL QUALITY IN BUCHAREST'S METROPOLITAN AREA**

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**Key words:** agricultural degradation sources, Bucharest's metropolitan area, environmental quality, subsistence agriculture, Romania.

**Résumé:** Les sources agricoles constituent la principale source de dégradation diffuse de l'environnement de l'aire métropolitaine de Bucarest, en considérant le territoire extérieur aux limites de l'agglomération urbaine. Les sources agricoles, à cause de leur caractère désorganisé, accentuent les déséquilibres locaux et régionaux déterminés par les autres types de sources de pollution et contribuent à la naissance des nouvelles zones dégradées. Le phénomène mentionné conte aussi parmi les causes les tendances diverses de l'agriculture de l'espace métropolitain: revitalisation, beaucoup des investisseurs roumains et étrangers achetant des terrains agricoles pour faire des fermes agricoles; abandonnement, les propriétaires manquant les moyens de travailler les terres agricoles ou certaines sociétés détenant des terrains agricoles comme capital spéculatif; changements dans l'utilisation du foncier agricole, l'espace bâti en étant en forte progression ou réadaptation aux nouvelles demandes de la société, comme pour la production des biocombustibles.

### **1. Introduction**

The Bucharest Metropolitan Area<sup>5</sup> represents a territory with a high potential for agricultural activities, due to above average soil fertility (more than 80% are in 2<sup>nd</sup> and 3<sup>rd</sup> fertility classes), accessibility to water supplies, labour force availability and an important market demand for agricultural products. These activities are providing some of the products consumed by the population in the Bucharest Metropolitan Area, but, also, they constitute together a significant environmental degradation source, difficult to manage and to keep under control (Pătroescu et al, 2006 b).

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<sup>5</sup> Bucharest Metropolitan Area – delimited by the Centre for Urban and Metropolitan Planning of Bucharest (Bucharest City Hall), with 303 localities, including Bucharest, and a population of 2.5 millions inhabitants

## **2. Between subsistence and intensive agriculture**

The decline in agricultural activities after 1990, as a consequence of administrative chaos in the property regime (from one large state property to tens of thousands small private properties), breaking connections with the industry and obsolete infrastructure (farms, storehouses, equipments, etc.), is lately replaced by a positive investment trend aimed at meeting the high internal market demand for agricultural products (Hirschhansen von, 1996, Iacob and Tălângă, 1997, Pătroescu et al., 2000 a, Rey et al, 2006). Subsistence agriculture is still the main option of isolated rural communities, with difficult water accessibility or with low labor force (as in the plains Mostiștea and Burnaz). Opposite, in the Argeș-Sabar low plain and other suitable spaces for large farms, the intensive agriculture is predominant.

### **Land coverage**

Agricultural fields represent the main form of land use in Bucharest Metropolitan Area, covering more than 70 % of the land in the administrative units within the metropolitan area. The smallest values of this indicator are recorded in the administrations with high percentage of forest or water surfaces (as Snagov, Pantelimon, Comana, Cornetu, etc.). Arable land is the most important form of land use, only few localities having less than 90 % (Vânătorii Mici, Ciocănești, Grădiștea, Otopeni, Glina, Dobroești, Ogrezeni, Căscioarele) (Fig. 1).

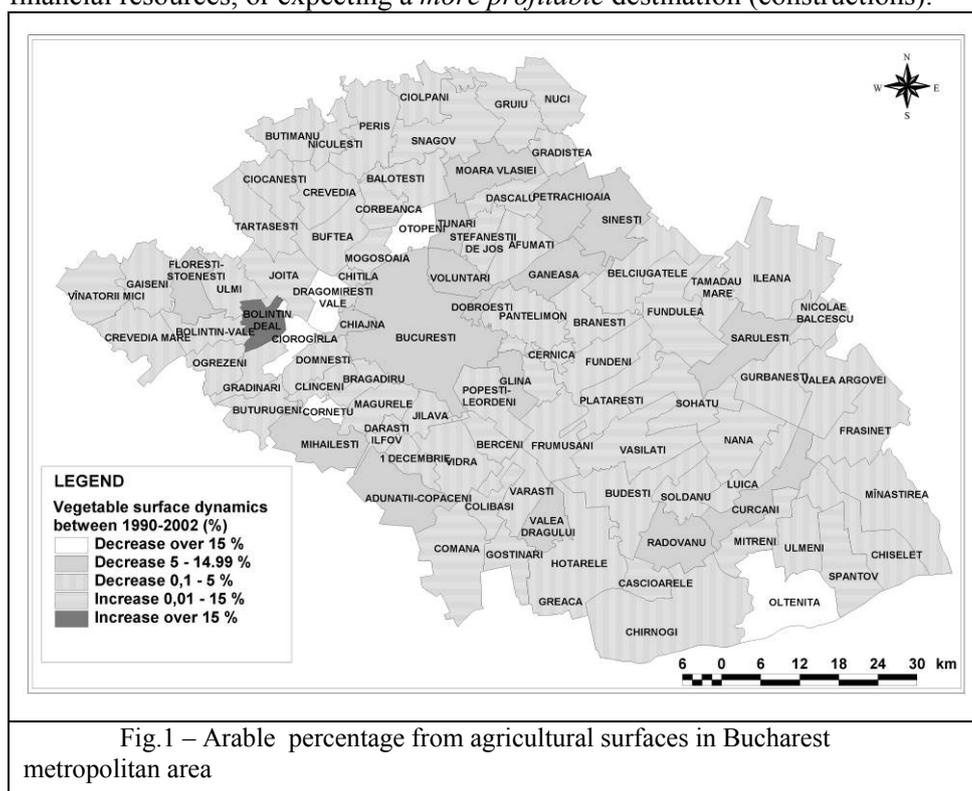
The main cultivated crops are grains and technical plants (sunflower predominantly), also vegetables in the administrative units of Argeș-Sabar low plain (Măgurele, Jilava, Adunații Copăceni, Dărăști-Ilfov, Vidra, 1 Decembrie, Valea Dragului, Vărăști).

It must be noticed that the Argeș pastures in the villages situated near Bucharest are actually abandoned or about to be included in the building perimeter of these localities, because they were not considered to represent a suitable food source for the livestock. Vineyards, orchards and meadows have low proportions in Bucharest metropolitan area. Their percent varies according to the localities position in rivers floodplains and fields. After 1992, low productive vineyards, increased appreciably in surfaces in disadvantage to technical plants or field cultures.

### **Mobility of agricultural activities**

The modelling of agricultural activities by economic forces characteristic to Bucharest metropolitan area (real estate interests, raw materials requirements from industrial units) enforced changes in the dynamic of agricultural fields (Ioja, 2007). Therefore, in the first two rural-urban rings, the development of building

surfaces and infrastructure generated a decrease in the proportion of agricultural fields. Alongside this visible process, there was a substantial increase of the abandoned agricultural fields, owned by citizens or companies with insufficient financial resources, or expecting a *more profitable* destination (constructions).



In this new context, agricultural activities, and especially vegetables, retreated and concentrated outside the first ring (Fig.2). The situation is different for the livestock growth activities that remain in their old locations and continue to generate important environmental problems in the human settlements that assimilated them (e.g. Frumuşani, Mihăileşti, Valea Dragului, Periş).

#### **Agriculture mechanization**

The agriculture of Bucharest metropolitan area continues to oscillate between traditional practices (physical or animal work) and modern ones (mechanization). If medium and high dimensioned economical agents hold a large

variety of mechanized means, not the same thing can be told about individual landowners, poorly equipped and practicing subsistence agriculture.

The highest values of number of equipments/agricultural surface are found in the territorial administrative units of Ilfov and Giurgiu counties, but especially in the vegetable basin Argeş-Sabar.

### Chemical substances use in agriculture

The high productivity of agricultural activities depends on maintaining nutrients available in soil and removing elements that affect plants development (pests and diseases). In this way, fertilizers (especially nitrogenous) and pesticides (herbicides, insecticides and fungicides) have become common in private agricultural fields from Bucharest metropolitan area.

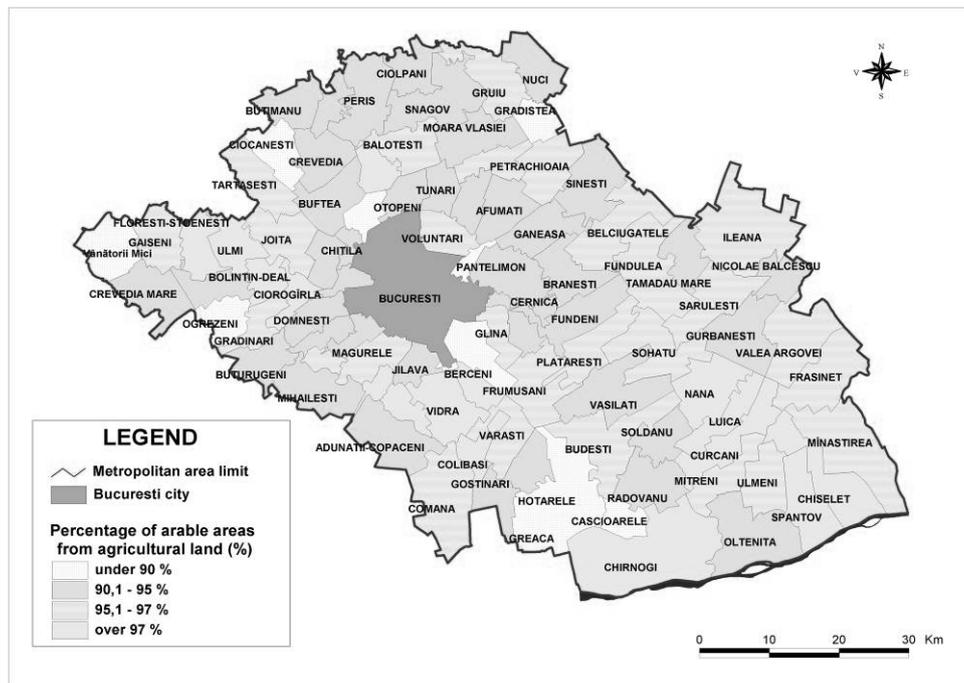


Fig. 2 Tendency of vegetable surfaces in Bucharest metropolitan area (1990-2004)

For example, in the administrative territorial units of Giurgiu county included in Bucharest metropolitan area, the percent of arable land where fertilizers are used is 57.02 % (83.8 % of them being nitrogenous), the average quantity

applied being 134.38 kg/ha for nitrogenous fertilizers, 69 kg/ha for phosphorus and 39.5 kg/ha for complex ones (Ioja 2007). The tendency of these indexes is increasing due to agricultural orientation to crops with anticipated contracted production or larger productivity. Index values are above average in the vegetable basin Argeş-Sabar (Colibaşi, Goştinari, Vărăşti, Valea Dragului) where the necessary nutrients are at a higher level.

Unfortunately, natural fertilizers tend to become wastes, difficult and expensive to manage, the percent on which they are applied representing only 7.1 % from the total arable surfaces (dates from Giurgiu Agricultural and Rural Development Direction, 2005).

In what regards the use of pesticides, the surfaces are smaller (insecticides on 6.7 from arable surfaces, antifungal on 7.8%, herbicides on 19 %), quantities on surface unity being insignificant (2.3 kg insecticide/ha, 2.5 kg antifungal/ha and 1.1 herbicide/ha). It must be mentioned that values include only controlled companies, not individual treatments made by each farmer, where dosage, association and even applied substances are not adequate.

Chemical substances use in agriculture generated and continues to generate unbalance in natural ecosystems, emphasizing problems related to underground waters charging with nitrogen compounds and leading to the appearance or concentration of toxic chemicals. Thus, from evaluations made in Argeş lower basin, on water pesticide and sediments concentration, high values were observed for DDT (0.02 µg/L in Argeş River water samples and 45.3 – 190.6 ppb in sediments), HCH (8.34 – 43.9 ppb in sediments), lindan (0.103 µg/L in Argeş) and atrazine (0.35 µg/L in Argeş) (Matache et al, 2006). It has been observed that chaotic use of phytosanitary products (herbicides, insecticides, grow hormones, coloring agents) and chemical fertilizers has an important incidence on environmental quality and population health from the metropolitan area of Bucharest.

#### Article I. Irrigations

Irrigations become an essential component for the agricultural cultures safety and productivity growth, especially in the last decade, while the soil moisture deficit in the biological active horizon becomes more obvious. Bucharest metropolitan area, although it was characterized by a large irrigated surface, keeps only unstructured components from the old irrigation systems (e.g. Berceni-Vidra-Frumuşani, Buftea-Căciulaşi, Nuci, Mostişttea I and II, Pantelimon, Chitila). Therefore, while the improved surface is large (70 % of the agricultural surface), 30% has installations prepared for irrigation, and only 6% are virtually used. Added to these are the improvised systems alongside rivers (especially Argeş) used for solarium or open field cultures.

Irrigations generate environmental problems due to established hydraulic artificializations (e.g. irrigation channels). Water consumption, about 492 m<sup>3</sup>/year in the south part of the metropolitan area is supported by the rivers Argeș, Sabar, Ialomița or the Danube, as well as the lakes on Mostiștea and Pasărea, that enhance the maintenance and functioning costs for the systems and the consumption of electric energy (0,79 MW/ha/year). Considering the supplying sources, irrigations facilitate the risk of soil degradation (soluble compounds wash out, salinity). The potential pressure of irrigations on water resources from Bucharest metropolitan area needs to be carefully managed in order not to negatively influence the economic and social performances of this area, and to enhance the ecosystems fragility and increase the restoration costs.

#### **New agriculture**

Changes in the activities related to plant crops are transposed in the structure of cultivated species. Therefore, the traditional cultures from Bucharest metropolitan area (cereals, sunflower, and vegetables) tend to readjust their agricultural techniques (abandoning of open field cultures in favour of solariums due to the increased incidences of acid rain) and cultivated species. Thus, remodelling relationships between agriculture and industry imposes the appearance of new crops. Remarkable are the genetic modified organisms (corn, soya), biofuel cultures (rape) and medicinal plants, whose projection in the environmental quality are insufficiently known.

The impact of *new agriculture* on the Bucharest metropolitan area environment refers also to the generation of new problems or accentuating those already existent. Therefore, the development of solariums, for vegetables or flower cultivation, lead to an increase of the plastic wastes amounts and accentuating those related to the chaotic management of the phytosanitary products.

#### **Plant cultivation sustainability**

The sustainability of plant cultivation activities is given by the equilibrium between the input of substances and energy ( $\mathbf{W}$  – physical work, fertilizers, pesticides, irrigation) and the output ( $\mathbf{Y}$  – agricultural production) from the agro ecosystem (Ioja et al., 2007). To keep the environmental impact as low as possible, this ratio must have values near to 1. Evaluating crops sustainability from Bucharest metropolitan area was based on the following indexes: *entropy level* ( $\sigma > 0$ , then we have agricultural ecosystem problems), *sustainable production* ( $\mathbf{Y}_{cr}$  – maximum production that can be harvested without overproducing entropy) and *critical energetic threshold* ( $\mathbf{W}_{cr}$  – maximum quantity of energy that can be imported without overproduction of entropy). The main condition for agricultural

ecosystem sustainability are  $\sigma < 0$ ,  $W_{cr} > W$  and  $Y_{cr} > Y$  (Pimentel, 1997; Eulenstein et al., 2003).

For example, entropy levels in the vegetable basin Argeş – Sabar allow a delimitation of *strongly unbalanced spaces* due to the differences between the input and the output of energy (Adunații Copăceni, Valea Dragului, Colibași, Vărăști, Comana), *moderate overflow of sustainability limit areas* (Hotarele, Grădinari, Ulmi, Ogrezeni) and *areas at the sustainability limit* (Crevedia Mare, Florești-Stoenești, Găiseni, Bolintin-Vale, Bolintin-Deal). Considering the  $W/W_{cr}$  ratio spaces with particular problems are observed, values varying from 1,1 – Crevedia Mare and 9,5 – Colibași. Unbalances are better emphasized through the  $Y/Y_{cr}$  ratio, the average value for the vegetable basin Argeş-Sabar being 6.37, with maximum at Colibași (22,84), Vărăști (22,45) and Adunații-Copăceni (10.38) (Iojă et al., 2007).

Therefore, entropy accumulation, overflow of critic energy threshold and sustainable production are real problems which affect the agricultural ecosystem from Bucharest metropolitan area (especially vegetable basins), with direct effect on the soil quality.

#### **Animal breeding**

Animal breeding activities present the same tendency as the culture of plants, the reactivation of important sources being evident. The reopening of major livestock growth units and maintain animal numbers in households makes these activities important sources of environment degradation. The most important farms from Bucharest metropolitan area are SC Agronutrisco SRL Mihăilești (217,000 birds), SC Golden Chicken SRL Mihăilești (180,052 birds), SC Avicola Mihăilești (153,000 birds), SC Mixalim Mihăilești (89,700 birds), SC NUTRICOM SA Oltenița, SC Agricom Prod SRL Valea Dragului (3.800 pigs), SC Romsuintest SA Peris, SC Avicola Buftea, SC Mixalim Frumușani, Avicola Crevedia and pigs farms Chirnogi (4.000 animals), Mănăstirea (4.000) and Sohatu (25.000).

In the case of *animal breeding activities* serious problems occur due to the farms inappropriate positioning or malfunctioning of reducing impact installations. Specific are bad odours, high levels of used waters carrying organic substances that end up in aquatic systems, and large quantities of wastes, which are getting harder and harder to use in agriculture.

#### **Conclusions**

Considering the area of manifestation, agricultural activities are the most important in the economy of Bucharest metropolitan area. Through the intensive character of cultures (mechanization, chemical substances use, irrigation), agricultural sources lead to a degradation of soil, surface and groundwater quality,

affecting the natural ecosystems and the quality of life. Subsistence cultures influence should not be neglected, as they use inadequate agricultural techniques (uncontrolled use of chemical substances, territorial improvements abandonment, and excessive property fragmentation).

The attempt of challenging import products lead to a diversification of techniques in order to obtain large productions with low costs (solarium use, energy inputs increase through chemicals, pesticides, growth hormones, irrigation, genetic modified organisms), that has negative consequences on environment quality, agricultural products and in the near future on humans public health. By the volume of chemical substances used vegetable and technical plants areas detached, where higher economic gainful allows additional costs.

To decrease agricultural activities effects on environment is required a better management of chemical substances, an exacting control of agricultural production quality, and last but not least, agricultural education, both for individuals and for companies.

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