

## The Drinking Water Infrastructure in the Oltenia Plain over the Last Decade. Territorial Characteristics and Quantitative Aspects of Production and Consumption

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### Abstract

The aim of the paper is to analyse the territorial disparities of the drinking water infrastructure in the Oltenia Plain. The study focuses on the following main aspects, specific for the general dynamic of water infrastructure development in the last decade:

- the increase in the number of human settlements connected to drinking water network;
- quantitative aspects of drinking water production (cubic meters/ day) and different types of consumers (thousand cubic meters).

The article intends to highlight the data-base on NUTS V level (TEMPO Online time series, National Institute of Statistics) and to map the main changes registered by the statistical indicators used for the analysis: the number of territorial-administrative units (ATU) connected to the drinking water network, the length of the drinking water infrastructure, the capacity of installations to produce drinking water, the consumption of water by the different types of consumers). In the Oltenia Plain the extension of the number of ATUs connected to the drinking water network was linked with the development of the regional operator in water management, Water Company Oltenia. Despite its weaknesses, this main actor on the water-market of Oltenia will install workstations in two small towns (Băilești and Calafat), assuring better water services in a relatively large area of the Oltenia Plain. During the last ten years, the water infrastructure became more accessible for the rural settlements and population. The production of drinking water decreased (the capacity of installations to produce drinking water in 2008 was smaller by 1.1% than in 2000) in the last decade, this dynamic being related to the negative evolution of total population (a decrease by 98,736 inhabitants between 1990 and 2009) in the Oltenia Plain, and to decline of agricultural and industrial activities. The two types of consumers (the householders and other consumers = economic actors) differ concerning the rate of the decrease in their consumption: the household type consumption drops only by 17%, compared with 49.2% specific for the other consumers. This dynamic should be explained by the reduction in economic activities, great water consumers (e.g. agriculture and industry).

**Key-words:** *drinking water, water-market, Oltenia Plain*

### Rezumat. Infrastructura de alimentare cu apă din Câmpia Olteniei în timpul ultimului deceniu. Caracteristici teritoriale și aspecte cantitative privind producerea și consumul de apă

Scopul articolului este acela de a analiza disparitățile teritoriale ale infrastructurii de apă din Câmpia Olteniei. Lucrarea se axează pe următoarele aspecte principale, specifice pentru dinamica generală a infrastructurii de distribuție a apei în ultimul deceniu: creșterea numărului de așezări conectate la rețeaua de distribuție a apei potabile; aspecte cantitative privind producția de apă potabilă (m<sup>3</sup>/zi) și diferitele tipuri de consumatori (mii m<sup>3</sup>).

Articolul intenționează să valorifice baza de date la nivel de NUTS V (TEMPO Online serii de timp, Institutul Național de Statistică) și să ilustreze cartografic principalele schimbări înregistrate de indicatorii statistici utilizați pentru analiză: numărul unităților administrativ-teritoriale (UAT) conectate la rețeaua de distribuție a apei, lungimea infrastructurii de distribuție a apei, capacitatea instalațiilor de a produce apă potabilă, consumul de apă pe tipuri de consumatori). În Câmpia Olteniei, creșterea UAT-urilor racordate la rețeaua de distribuție a apei potabile a fost legată de dezvoltarea operatorului regional pentru managementul apei – Compania de Apă Oltenia. În ciuda punctelor sale slabe, acest actor principal de pe piața apei din Oltenia va include stații de lucru în două orașe mici (Băilești și Calafat), asigurând astfel o mai bună distribuție a apei pe un areal mai extins din Câmpia Oltenia. În ultimii zece ani, infrastructura de distribuție a apei a devenit mai accesibilă pentru așezările și populația rurală. Producția de apă potabilă a scăzut (capacitatea instalațiilor de a produce apă potabilă era cu 1,1% mai mică în 2008 decât în anul 2000) în ultimul deceniu, această dinamică fiind corelată cu evoluția negativă a populației totale (numărul locuitorilor a scăzut cu 98 736 persoane între 1990 și 2009) în Câmpia Olteniei, precum și cu reducerea activităților agricole și industriale. Consumul în funcție de cele două categorii de consumatori (consumatori casnici și alte tipuri = agenți economici) se caracterizează printr-o descreștere diferită: în cazul consumatorilor casnici se înregistrează o scădere de numai 17%, față de 49,2% în cazul celui alt tip de consumatori. Această dinamică poate fi pusă pe seama restrângerii activităților economice, implicit a diminuării marilor consumatori de apă din agricultură și industrie.

**Cuvinte-cheie:** *apă potabilă, piața apei, Câmpia Olteniei*

## INTRODUCTION

The Oltenia Plain stretches out between the Danube and the Olt rivers and the Getic Piedmont hills. It covers approximately 17% of the Romanian Plain area (*Geografia României, vol. V, 2005*).

The favourable natural conditions made the Oltenia Plain inhabited from the earliest times and the settlements became traditionally agricultural in character. Consequently this region constitutes one of the main farming areas of Romania. The Plain is dominantly rural, with 75% of its population living in the country-side (Dumitrașcu, 2006). That largely rural character of the region is also reflected in its poor technical and urban development. The accession of Romania to the European Union in 2007 enabled the communities of the Oltenia Plain to benefit from Community funds under several rural development programmes implemented both before and after the time of acquiring EU membership. Most of the funds obtained under the Economic and Social Cohesion Programmes have been earmarked to upgrading and developing the road and water supply infrastructure.

## DATA SOURCES AND METHODS

This study is based on the valorization the NUTS V database, TEMPO Online time-series published by the National Institute of Statistics. The main changes (between 2000–2008, with updates to 2010 whenever possible) registered by the statistical indicators and used in this analysis focus on the number of territorial-administrative units – ATUs - connected to the drinking water network, the length of the drinking water infrastructure, the capacity of drinking water production plants and water consumption by types of consumers. They are represented on a series of maps using GIS techniques.

## Socio-demographic and economic background

### *Social aspects*

The issue of water supply to settlements and households calls for a wide-ranging approach capable to outline the numerous socio-cultural, demographic and economic implications of benefiting from water supply in a centralized system and the real possibility of its daily use. Water supply is a major indicator of the level of civilization in an area, and of development opportunities for the respective human communities. Research into the quality of life and the living standard (Teodorescu, 2005) also emphasizes that water plays an important role in the daily life of the population (Chiriac et al., 2001).

The Oltenia Plain is one of the 25 water-deficient zones with scarce resources, particularly in the country-side. Hence, priority is given for centrally-based water supply works. In towns, the water networks require rehabilitation and development (Law 171/1997 on the approval of the National Territory Planning Scheme – Section II – WATER).

Access to running water shows great regional disparities. The proportion of settlements, short of running water is two or three times higher in the south-western, southern and western counties than in those located in the centre and the west of Romania. The statistical returns of the last census (2002) reveal that the counties partially overlapping the Oltenia Plain boundaries rank in the lower half of the national hierarchy for indicators regarding: “the proportion of households without sewerage per the total number of households” (Dolj – 62%, Mehedinți – 64% and Olt – 73%) and „the proportion of households with bath-rooms per the total number of households in the rural area” (Dolj – 4%, Mehedinți – 6% and Olt – 3%). It is obvious that disparities in the quality of life differ considerably in town and in the country-side (*Aspecte privind dezvoltarea, populația și sănătatea reproducerii la nivel național și studii de caz. România, 2003*).

The relationship between the settlement network and the infrastructure of water supply to localities and households bears heavily on community exclusion. Poverty in the rural areas is rather location-dependent. Thus, the villages lying at great distances from the county-seat, and from the European high - ways, with an economy and labour employment based on agriculture, are underdeveloped (Pop, 2004); poverty also looms high in the areas running great risk of desertification and drought (*National Strategy and Action Programme concerning Desertification, Land Degradation and Drought Prevention and Control, 2000*).

The settlement system is mono-centric, with a polarizing core (Craiova) located outside the study-area, and with settlements connected with secondary towns: Vânju Mare (in the Blahnița Plain), Băilești and Segarcea (in the Desnățui Plain) and Caracal (in the Romanași Plain). The territorial-administrative units have few subordinated villages, usually large and medium-sized compact valley structures (Poiana Mare – 10,636 inhabitants, Sadova – 8,483 inhabitants, Moțăței – 7,363 inhabitants etc.). The population of most of these administrative units is concentrated in the respective administrative seat.

The ATU demographic size varies between 1,349 inhabitants in Radovan Commune (Dolj County) and 34,805 inhabitants in Caracal

Municipality (Olt County). The eight towns (three being municipalities: Băilești, Calafat and Caracal) are of small demographic-size (under 20,000 inhabitants), with the exception of Caracal (medium-sized).

In 2009, the total population of the Oltenia Plain was of 547,124 inhabitants, with 77.45% in the rural areas and only 22.55% in town. Evolutions are divided into two distinctive periods: 1) before 1989 *the communist period*, in which the population was steadily increasing, with higher values in the urban than in the rural areas, and 2) *after 1989*, a period marked by a decrease in population (by 83,412

inhabitants from 1990 to 2009, the annual rate of the migratory balance standing between -22‰ in Dăneasa and 70.1‰ in Gogoșu communes over the same interval).

The population density of 76.1 inh./sqkm, is significantly below the national average value (90.06 inh./sqkm), almost 75% of the ATU density values being under 75 inh./sqkm. The highest values are registered in the towns of Caracal (500 inh./sqkm), Corabia (248 inh./sqkm) and Bechet (133 inh./sqkm) and in rural areas with a complex or specialised agricultural profile (growing of vegetables, wine - growing, etc.) (Fig. 1).

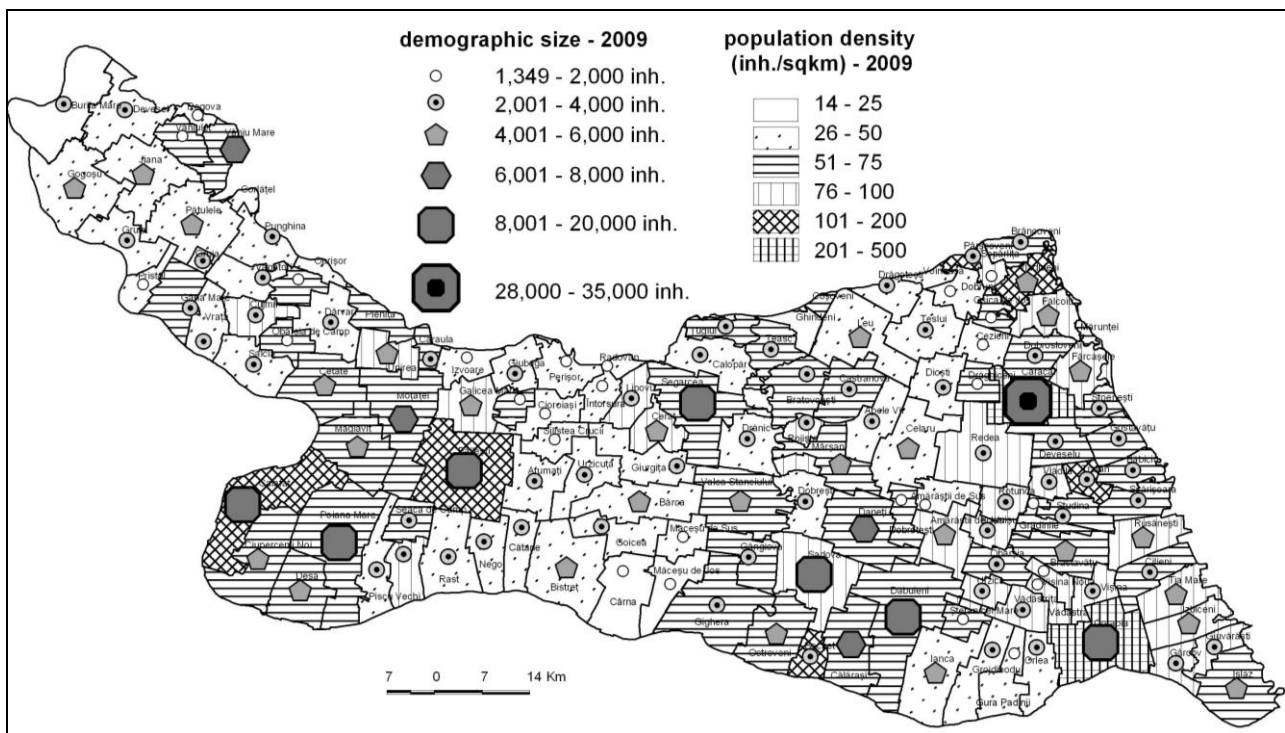


Fig. 1. The demographic-size of localities and the density of population (2009)

The evolution of economic activities (great water consumers):

Under the conditions of climate change and of very large arable areas (68.53% of the overall surface), agriculture might be expected to be one of the main water consumers in the Oltenia Plain. However, climate warming and less precipitation specific to the last decades have increased the incidence of extreme weather events, especially dryness and desertification which have been affecting wider and wider areas. Obviously, agriculture has been heavily hit, the main crops having low yields (under 500 kg/ ha for wheat, maize and sunflower) in the severely droughty years of 1993, 1996, 2000, 2002 and 2007, when the absence of irrigation was an additional cause. The Oltenia Plain has 491,000 hectares (over 88% of the total arable surface) laid out for irrigation, yet only little of it is actually irrigated (14.5% in 2009), the

irrigation systems being either abandoned, or in a degraded state.

In the future, provided irrigation system are rehabilitated, agriculture is expected to become a higher water consumer, giving that the main crops demand considerable quantity of water to grow (wheat 110 – 140 mm, maize 240 – 280 mm and sun-flower 220 – 27 mm).

Animal husbandry no longer requires much water consumption since the large animal farms have been closed down (only five being preserved in the Oltenia Plain, for cattle, sheep and poultry and holding 0.96% of all animals, the rest having passed into private property).

The location and development of certain industrial branches, increasingly depends on available water resources. Industry is a large consumer of industrial water (in various phases of production), household water and drinking water.

The dominant economic sector in the countryside of the Oltenia Plain is agriculture, since industry is especially concentrated in the eight towns of the study-area as follows:

1. Caracal Municipality – boasts of over 1,200 trading companies; the major industries are: machine-building (S.C. ROMVAG S.A., the main unit specialized in the construction, rehabilitation and repair of wagons); textile industry (S.C. ROMANIȚA S.A. manufactures and sales tricots, mostly abroad); and food processing (units process largely fruits and vegetables).
2. Calafat Municipality – food and textile industry; a port-town and an important border-crossing to Bulgaria.
3. Băilești – agro-industrial units, farming and industrial profile (electromechanics, mechanics, non-ferrous metal foundry).
4. Segarcea – food and chemical units, also an outstanding agricultural centre.
5. Dăbuleni – an important agricultural and wine-growing centre.
6. Bechet – port at the Danube and ferry border-crossing to Bulgaria.
7. Corabia – its geographical position proved favorable for commercial activities. The local industry processes hides, natural and synthetic fibers, metal items and parts for different units in Romania.
8. Vânu Mare – major wine-growing centre, also light and food industries.

The main industrial water consumers in the Oltenia Plain are the on-farm processing units and the textile manufacturers.

Most jobs are available in agriculture, this branch accounts for a large part of GDP produced in the study area. Selling the agricultural products produced in the study area has led to the opening of a great many processing enterprises for grinding and panification, industrial-scale processing of milk, refined edible oil, sugar, beer, fresh and canned meat, vegetables, and distilled alcohol.

### **Significant territorial disparities in drinking water supply**

Water-courses have always been an important factor in the location of settlements, as water is a necessary element to households and economic activities. Directly after its foundation, a settlement obviously does not consume much water, but when developing, it does. In theory, a central-based water supply system, which treats, surveys and permanently controls the water pumped into the network, warrants quality and safety (Chiriac et al., 2001). In practice, the micro-biological and chemical tests performed by the Dolj County Environmental Protection Agency, which monitors the quality of water, have revealed

that in towns 99.3% and in villages only 68% of the supplied water meets the standards for drinking water. In the latter case, low quality is the consequence of the absence of a sewerage system, insufficient waste water, treatment improper building of wells, household waste dumps, etc.

In the 1990s, the settlement network connected to the drinking water supply consisted of 22 -24 ATU (including 8 towns). In the last years of the previous decade, the ATU network connected to the drinking water supply in the rural area has also expanded (to 30- 36 rural communes) (Fig. 2).

The length of the drinking water network increased 2.6-fold between 1990 and 2008. This evolution is due to the positive dynamics specific to the 2000 – 2008 period, which correlated with the extension of the ATU drinking water supply network. The majority of these units being connected to the network also led to increases in its length, particularly in the towns of Caracal, Dăbuleni and Băilești. Decreases were registered only in one town (Vânu Mare) and in 4 rural localities (Dioști, Vișina, Studina and Gruia) (Fig. 3).

Besides the poor development of the water supply infrastructure, the population of the Oltenia Plain (especially in settlements unconnected to the network) has to put up with the low quality (far below standards for drinking water) of the water taken from the wells. For example, six of the Leu-Rotunda Plain communes connected to the centralized water supply system have no sanitation licence (Amărăștii de Jos, Castranova, Leu, Drăgotești, Dioști and Celaru, Dolj County). Chemical analyses of water quality carried out by specialist institutions have shown that the ammonia content in the water of 63 drillings supplying the Caracal Municipality (grouped by two fronts - Redea–Celaru and Redea–Deveselu, Dolj County) - which lies close to the Leu-Rotunda Plain, our study-area - does not meet average standards for drinking water because the purification station does not function properly (Source: Dolj County Environmental Protection Agency).

The rural population, which does not benefit from a water supply infrastructure, resorts to wells, which means dependence on fluctuating underground water flows, basically on weather conditions. In the droughty periods, wells may dry up causing acute water shortage in many rural settlements. The year 2003, one of the driest in Romania, created a water crisis in the whole country, in the entire outer Carpathian region, hence the Oltenia Plain was affected as well (the prolonged drought lowered the groundwater level by nearly 5 meters below average levels, and consequently many wells dried up (Chiriac et al., 2005).

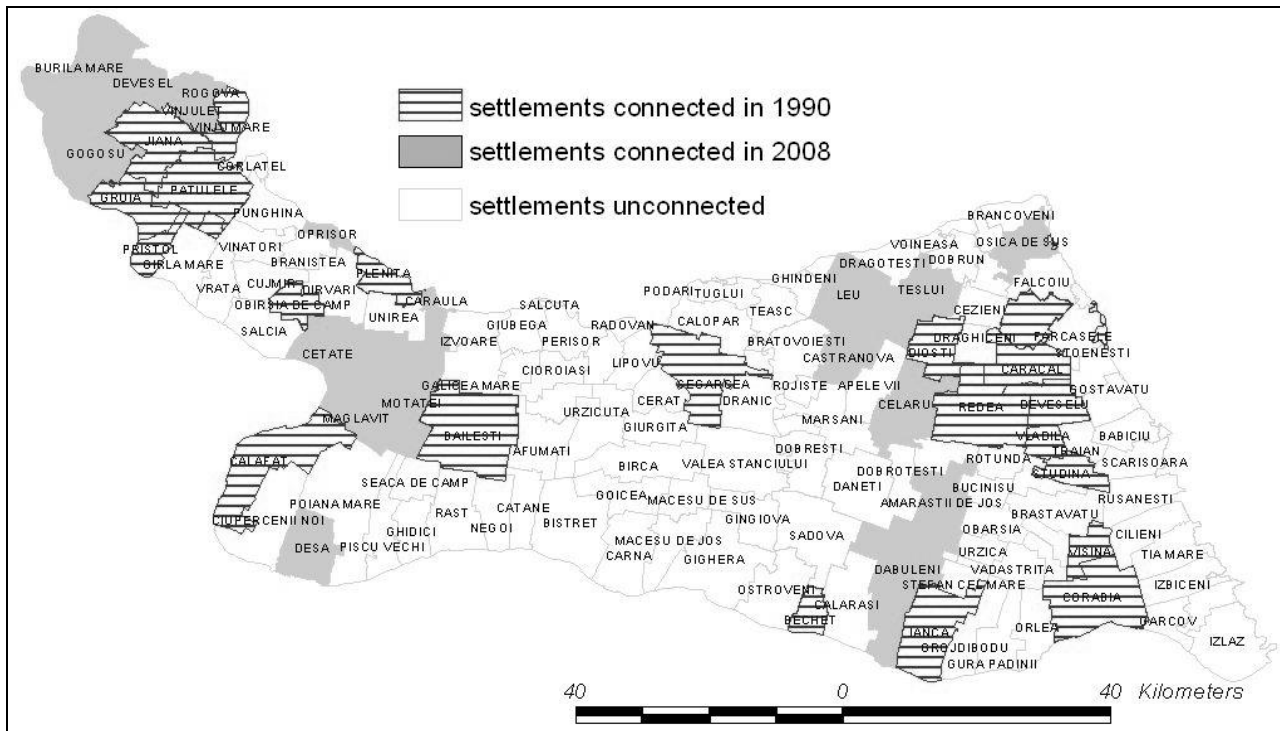


Fig. 2. The administrative-territorial units (ATU) connected to the drinking water supply system

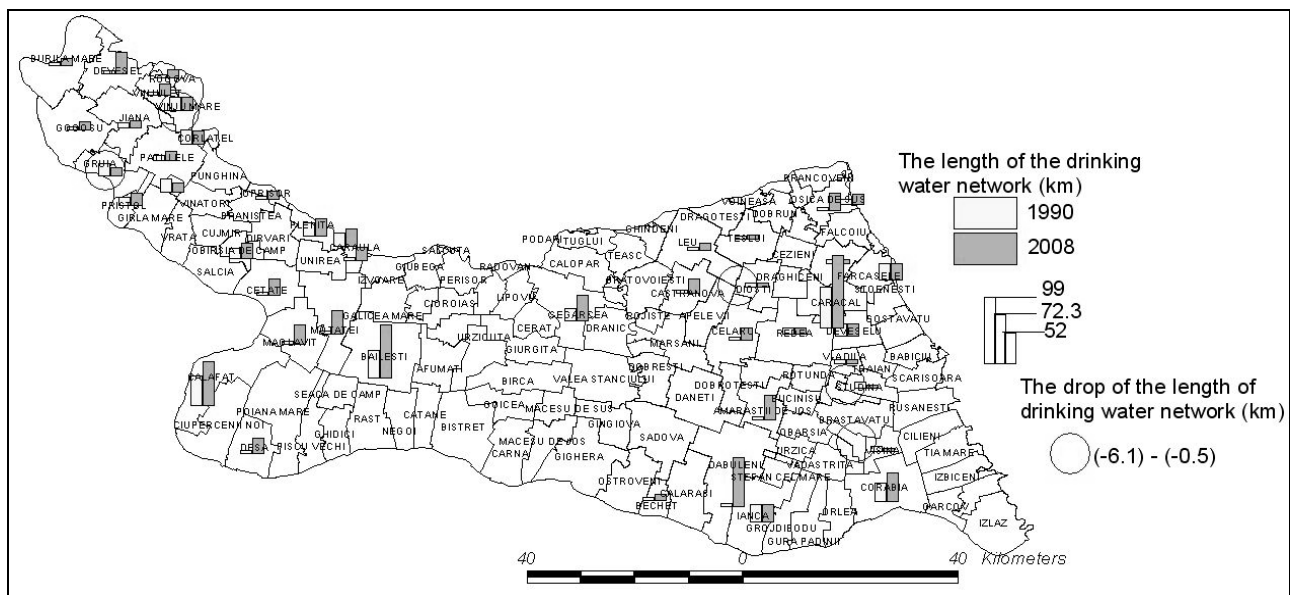


Fig. 3. The length of the drinking water network. Territorial characteristics

Field investigations conducted in the Leu-Rotunda Plain pilot area revealed the importance of wells in water supply and in some cases the actual dependence on them. The communes connected to the network (even if only in part) got the necessary water from the groundwater. In the territory of all of the ten studied communes, there are 29 drilling points: two in each of the communes Apele Vii, Leu and Amărăștii de Sus (at depths between 55 m and 160 m); 5 drillings (at depths of 60 m – 120 m) in Dioști Commune; 3 (at 60 m – 150 m) in each of the Amărăștii de Jos, Redea, Celaru, Castranova, Dobrotești and Mârșani communes. In places where

the project of a water supply network building has not been finalised (e.g. Mârșani), or has not started at all yet (Bucinișu, Daneți and Rotunda), the population and various local economic activities are totally dependent on the underground water.

The quality of well-water is extremely poor, the value of chemicals (nitrates) and bacteriological indicators (total coliform bacilli, faecal streptococci) are very high in it. Laboratory tests in the Leu-Rotunda Plain revealed 190 – 525 mg/l of nitrates, which is far above the admissible limit value of standards for drinking water, which is 50 mg/l.

### The capacity increase of drinking water production plants

Parallel, with the growth (by 48%) in the number of ATUs connected to the drinking water supply system, the capacity of water production has decreased by 2.7% (in 2000 – 2002). Positive evolutions led to a capacity increase by 7.2% in the period 2003-2008 compared to the year 2000.

The majority of the Oltenia Plain administrative-territorial units reported similar increases, only 4 localities had a negative record: Vânu Mare town (-634 m<sup>3</sup>/day), Pătulele (-300 m<sup>3</sup>/day), Pristol (-77 m<sup>3</sup>/day) and Obârșia de Câmp (-40 m<sup>3</sup>/day) (Fig. 4).

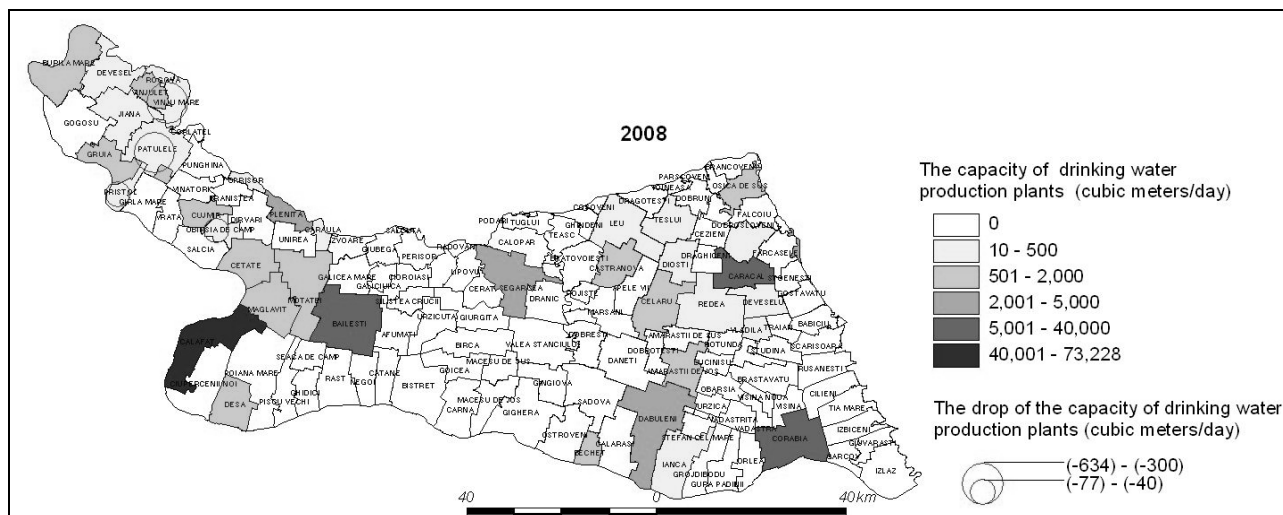


Fig. 4. The capacity of drinking water production plants. Territorial disparities

### Lower drinking water quantities supplied to consumers

During the last decade, the quantity of drinking water supplied to consumers decreased in the South-West Development Region and in Romania as a whole (*PDR South-West Oltenia 2007 – 2013*); similarly in the Oltenia Plain, where quantities fell by 14.4% (between 2000 and 2008), with differences for the two types of consumers: by 1.2% (93,000 m<sup>3</sup>) in the case of private households and by 46.1% (1,733,000 m<sup>3</sup>) in the case of other consumers.

In terms of territorial disparities, the major change that occurred over the above interval was that larger quantities of drinking water were supplied to consumers in the following rural areas of the Oltenia Plain:

- the north-west;
- the west (Cetate, Maglavit, Moțăței);
- the north of the Leu-Rotunda Plain (Redea, Celaru, Dioști, Amărăștii de Jos);
- the Dăbuleni – Ianca perimeter.

In general, larger quantities correlate with the increased capacity of drinking water production plants, but there is an exception: Vânu Mare town (north-west of the Oltenia Plain), where plant capacity kept decreasing (Fig. 5).

In Romania, 52% of the total population is connected to the drinking water supply system and to the sewerage network (*Manualul Național al Operatorilor de Apă și Canalizare*, 2008). In the

Oltenia Plain, 40.8% of the total population live in urban and rural areas connected to the drinking water network. However, while, the majority of urban population lives in households connected to network, in the rural areas the situation is distinctly different. Researches in the Leu Rotunda Plain study area have shown that out of the total number of rural ATUs (10 with 24 villages), only 7 villages are connected to the supply network. Field investigation (2010) revealed another negative aspect, which does not appear in the official statistics, namely, in the communes where water supply network is available, only an average of 32% of the total number of households have connected to it. The reason usually given for this situation is shortage of money, the network connection costs are approximately 100 Lei (Leu commune) to 550 Lei (Dobrotești commune), depending on the company contracted.

The quantity of drinking water supplied to households per total population varies in the territory between a minimum of 1 m<sup>3</sup> (Devesel Commune, Mehedinți County) and a maximum of 98 m<sup>3</sup> (Caracal town, Olt County). In the Oltenia Plain, the average quantity of drinking water supplied to households/total population is of 33 m<sup>3</sup>/inhabitant, 6 ATUs rank above this value (2 towns – Calafat and Caracal and 4 rural communities), the others stand below average (6 towns and 24 rural communities) (Fig. 6).

The Oltenia Plain shows all the characteristics of a declining economic region imposed by its geographical position. A contributing factor is the exogenous development based on a hypertrophic industry which uses allochthonous resources. The economic slowdown

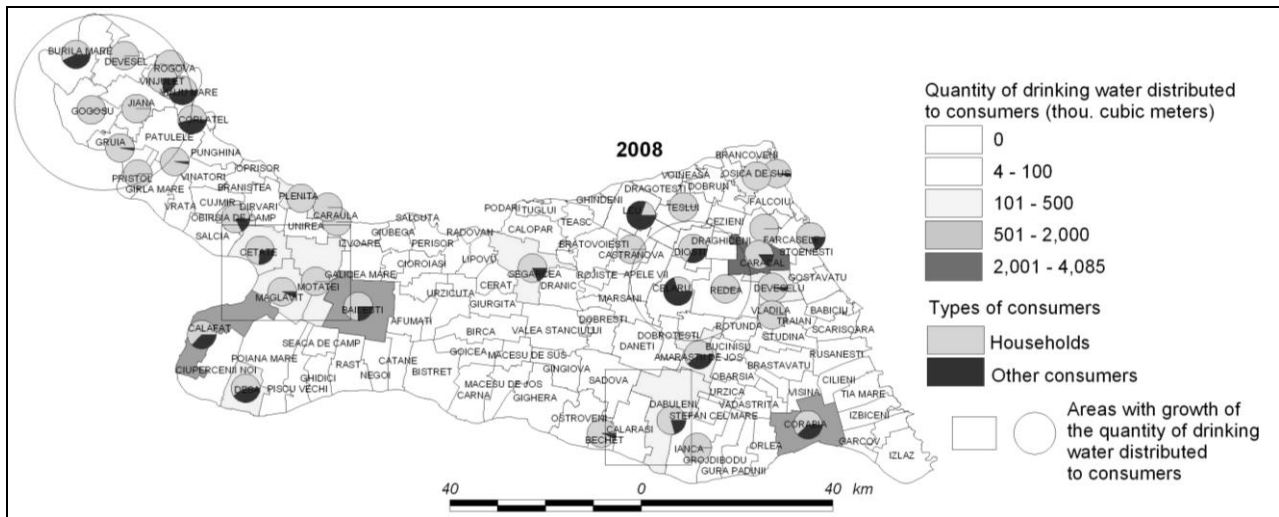


Fig. 5. The quantity of drinking water supplied to consumers by type of consumers. Territorial disparities

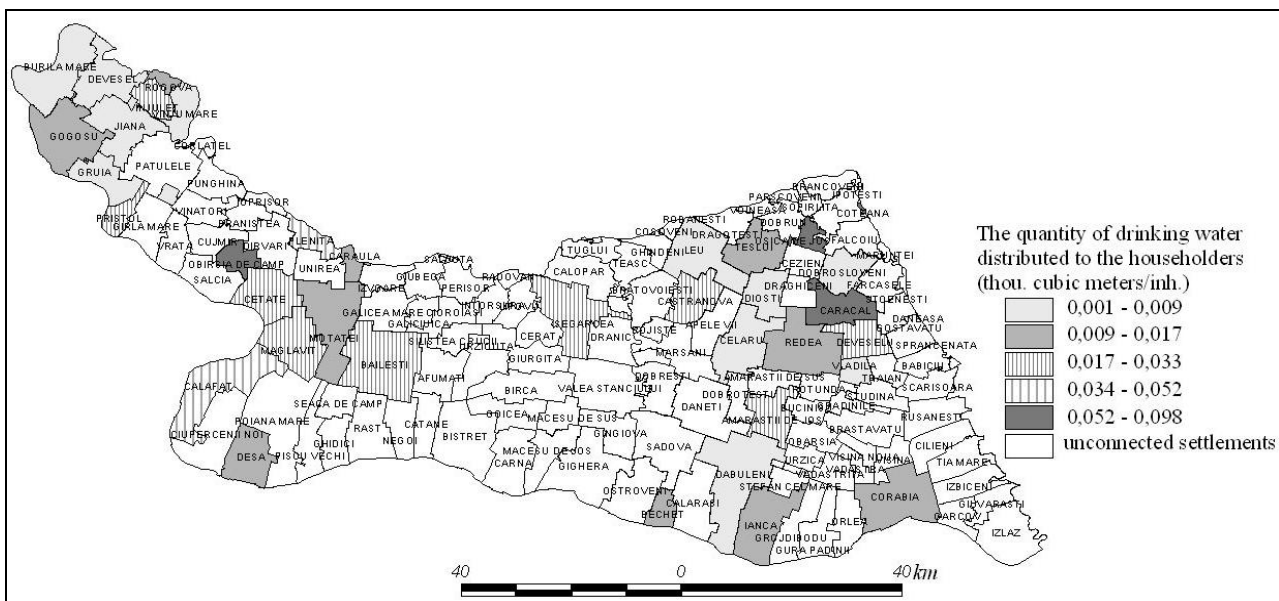


Fig. 6. Territorial disparities in the quantity of drinking water supplied to households/the total population (2008)

## CONCLUSIONS

The Oltenia Plain shows all the characteristics of a declining economic region imposed by its geographical position. A contributing factor is the exogenous development based on a hypertrophic industry which uses allochthonous resources. The economic slowdown is visible in the evolution of the employed workforce over 1991-2008 (1991-1997, when the number of employees dropped sharply due to the dismantling of the stable pre-1990 inter-industrial relations and the post-1997 period of almost constant macro-economic stability), in this situation, the water demand in industry in the next period remaining stagnant.

The crops demand is higher due to the climate change and the drought effects are intensified by the

lack of irrigation (Păltineanu et al. 2007). In the future, irrigation system are expected to be rehabilitated, agriculture sector will become a higher water consumer.

After 2000, the number of settlements connected to the drinking water supply system has increased, especially with the help of EU funds (SAPARD, PHARE and ISPA). Despite this context, the recent research-field in 2010 reveals a negative aspect: only a small percentage from total number of households have public water supply.

The quantity of drinking water from public supply is directly influenced by the number of consumers and by the length of water supply. The length of this network has increased in rural localities and in some small towns, particularly over the last decade. Due to the positive dynamics of the

water supply network (the programmes financed by European Union, especially in the rural area) the quantity of drinking water from public supply will have a positive trend in the next future.

The capacity of drinking water production plants has also increased as the settlement network connected to drinking water supply has been extended. However, in some localities situated in the north-west of the Oltenia Plain, the capacity

decreased due to the low population density and the small demographic size of localities.

## ACKNOWLEDGMENTS

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