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Jiu Water Basin Administration

,,Integrated Water Resouces Management through stakeholders involvement- a case study on drought in the Oltenia Plain ”

- Dabuleni pilot area-

-Draft Report-

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CONTENT

Introduction

Water is an essential matter in maintaining biological life and processes, is also a part of the natural hydrological cycle, conditioning all economic and social activities and must be taken into account in development policies in all fields. The climate change process, represented by floods and droughts, affecting both the environment and human activities, from economic and social point of view.

In general, due to the effects of climate change on water-dependent economic sectors, there is still a need for greater clarity and precision on the climate impact between sectors and for future knowledge integration in cross-sectoral cooperation activities, e.g. between flood risk management, inland navigation, hydropower or agriculture.

This will help to better establish measures programs to promote win-win integrated solutions. In addition, it will allow more efficient identification of priority and new actions, which will be addressed at the river basin level, as is already the case with the water deficit and drought.

It is expected that the water shortage and drought will become relevant over time for the management of water resources in the river basin, in this regard paying greater attention to climate change. In Romania, according to EUROSTAT 2017 data, the WEI + water exploitation index, at national level, did not exceed the limit of 20% which constitutes the warning threshold for the water deficit and much below 40% which is the limit for the severe water deficit. Romania is one of the EU countries with the lowest water availability per capita. Water demand is expected to increase in the future, mostly from irrigation due to the increasing frequency and magnitude of droughts. At this moment 62% (1,863,392 ha) of the irrigation network are not viable.

In this context, the project IWRM through the stakeholder's involvement, case study-the drought in Oltenia plain is focused on the problem of desertification in S-W of Romania, as a result of climate change and an obsolete, economical unviable and malfunctioning irrigation system. The rehabilitation of drought affected areas, the increase of number of temporary rivers, the expansion of the arid areas in Southwestern part of Romania, are issues/topics known not only for Oltenia region but also in other areas of the country.

All these situations require some decisions regarding integrated water management in the affected areas. Overall, the combination of adaptation measures will have to strike a right balance between agricultural productivity and sustainable water management. The project comes in support of water management authorities; in the sense of stakeholder's involvement in decision-making. The project brings together all water users who, under the guidance of Dutch partners, will choose the best solutions to improve the conditions in the drought-affected areas. The Dutch partners can bring solutions to improve the water management related to drought in order to provide drinking water for the rural population and also for the irrigation system (agriculture) with the aim to improve quality of life in region and environment.

CHAPTER I-GENERAL PRESENTATION OF THE OLTENIA REGION

1.1.Borders

Oltenia is a region in the southwest of Romania (Fig.1), confined in the south by the Danube river (which forms borders with Serbia and Bulgaria), in the north by the Southern Carpathians and in the east by the Olt river. Oltenia is located between the meridians of 22 ° 2 ”and 24 ° 2” and the parallels of 43 ° 3 ”and 45 ° 3”, covering 29212 km2, that is 12.25% of the area of Romania.

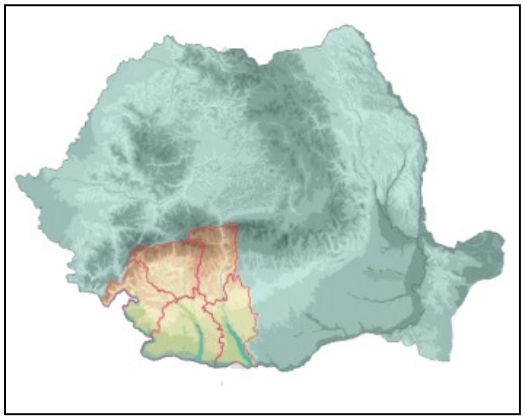


Fig.1 The position of the Oltenia in Romania

From the administrative point of view, Oltenia is composed of five counties (Fig.2): Dolj, Olt, Gorj, Vâlcea and Mehedinți wehere there were in operation in 2005, 40 cities, out of which 11 municipalities, 408 communes and 2 066 villages. The most important cities - Craiova, Drobeta-Turnu Severin, Târgu Jiu, Slatina and Râmnicu Vâlcea – have also the function of county residence.

Fig. 2 Administrative map of the Oltenia Region

1.2.History

Oltenia was one of the cradles of the Daco-Roman and Romanian civilization, the history of Oltenia as a region starting with the Roman conquest. Oltenia is customized by the rest of Romania only by the population structure, characterized by a degree of latinity much deeper than in the rest of the historical regions.

The fact that the Romanization was extremely stressed is also demonstrated by the strategic position chosen by the Romans for colonization, the massive discoveries of Roman currency, agricultural tools, fibula and utensils of all kinds, weapons, castles. In addition, another hint that supports it, is the frequent use of the simple perfect in popular speech. This grammatical tense is a tense of the verb specific only to the languages of Latin origin.

Old border territory, situated for hundreds of years between the Austro-Hungarian Empire and the Ottoman Empire, today's Oltenia is bordered in the south by Bulgaria, in the east by the historical Muntenia region (today the Southern Muntenia Region), in the north by Transylvania (the Central Region), and in the west by Banat (West Region) and Serbia (Federative Republic of Serbia - Montenegro).

1.3.Geography

The Jiu River crosses the region from north to south and divides it into two almost equal parts with diversified relief. North Oltenia is mountainous (Fig. 3). South of the Carpathians, there is the sub-Carpathian area, represented by a series of hills (Bran Hill, Măgura Slătioarei, Gorjului Hills, Bârzei Hill) and depressions (Novaci, Tismana, Târgu Jiu).

In the north-west there are Mehedinți Plateau, Coșuștea hills and Severin depression. In the south of the Subcarpathians there is the Getic Plateau, which is divided into the Platforms: Strehaiei

Platform (west of the Jiu river; it is subdivided into the platforms of Hușnita and Bălăcița), Jiului Platform (crossed by Jiu) and Oltețului Platform (east of Jiu). In the south of Oltenia, the Oltenia Plain lies, which is by far the most western sector of the Romanian Plain.

The Oltenia Plain is made up of the Blahniței and Băileștilor Plains (west of Jiu) and the Romanaților Plain (east of Jiu). The most important rivers (Fig. 4) are: Olt (together with Lotru and Olteț tributaries), Jiu (along with the Tismana, Motru, Tismana, Amaradia and Gilort tributaries), Desnățui, Drincea and Cerna. The climate of Oltenia is temperate-continental, but with Mediterranean influences.

Fig. 3 Relief units in the Oltenia Region

Fig. 4 The main rivers in Oltenia

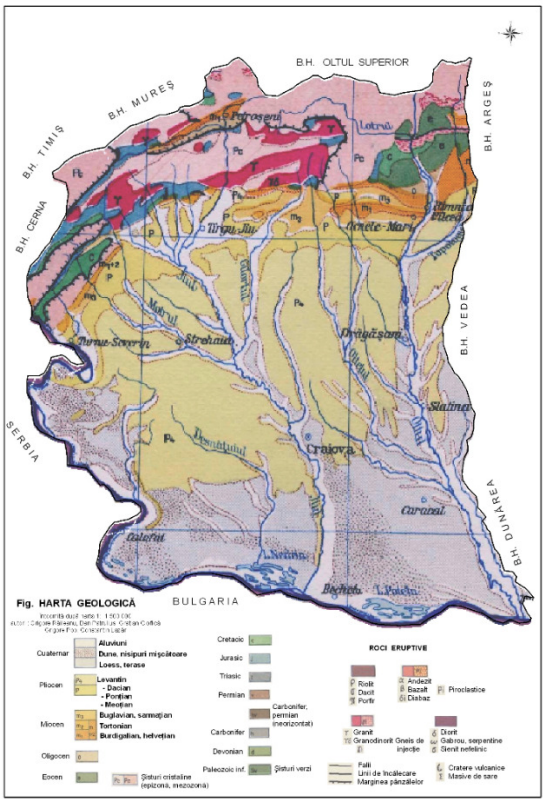


Fig. 5 Map of geology in Oltenia region

1.4.**Economy**

Oltenia is also an area of economic development – The South-West Oltenia Region was established for a better coordination of the regional development projects and the management of funds from the European Union. As an area of economic development, the South-West Oltenia Region includes 82.4% of the area of the South-West Development Region in Romania, which fully includes Gorj and Dolj counties and partially the counties: Mehedinti (less the western part), Vâlcea (the western part of the county till the river Olt and the biggest part of the north of the county), Olt (the western half of the county that made up the county of Romanați in the past) and Teleorman (only the Islaz commune).

The hydrological network, together with the relief configuration, gives the region the main energy role in Romania (71.57% of the total hydroelectric production, with a total of 10.363.39 GWh in 2001), by exploiting the potential of the flowing water that crosses the region: the Danube river, Jiu and Olt rivers. On the territory of Oltenia there are the Iron Gates hydro power plants (among the largest in Europe) - Mehedinți county and Lotru-Olt in Vâlcea county (among the largest in Romania).

Moreover, near the Motru – Jiu Valley mining areas (Fig.6), two of the largest thermoelectric power stations in Romania operate: Rovinari and Turceni. The importance of Oltenia in the national energy production is illustrated in table 1.2 below. The region owns 27% of the total thermoelectric production and 71.5% of the total hydroelectric power production of Romania.

From the economic point of view, there are cities that have a multifunctional economic structure - in particular, the county resident municipalities, and cities with a precarious economic structure - we consider, in particular, the monoindustrial ones, these being majority ones too. The slight economic environment generates not only a low standard of living, but also a migration of population to localities with absorption capacities of labor and to other countries in Europe or in the world.

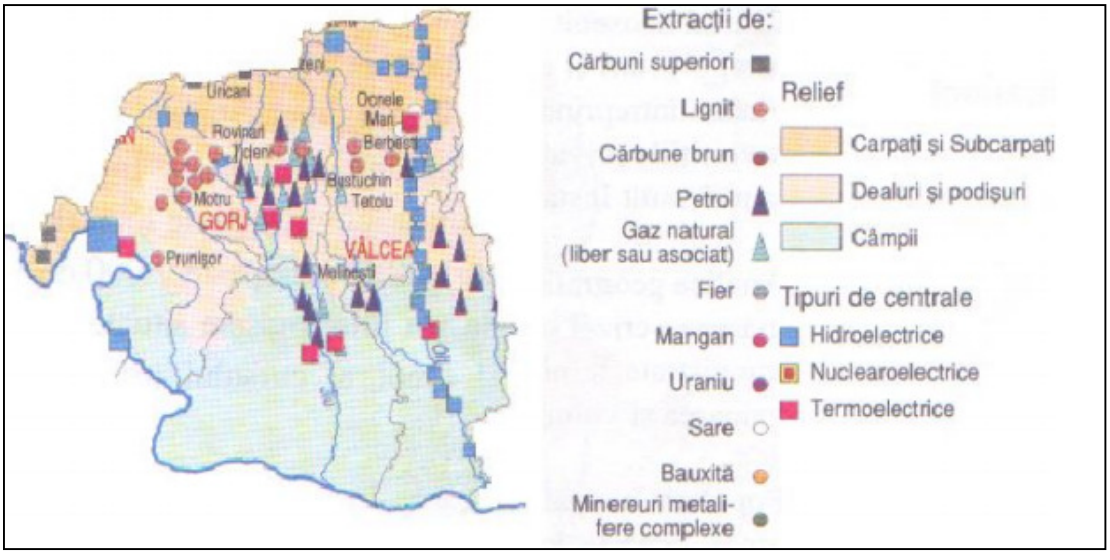


Fig.6 Economic activities in Oltenia Region

1.5.Agriculture

The relief from the southern part of the region favors agriculture, Oltenia being one of the traditional agricultural regions of Romania. In the southern area of the region the cereal crops occupy large areas, especially in Olt, Dolj and southern Mehedinti counties. In the hilly areas of Gorj and Vâlcea, the orchards occupy important areas. The most cultivated fruit species is the plum from which the plum brandy is produced, a beverage specific to the area; the apple, the walnut are also cultivated (there is a well-known research station at Râmnicu Vâlcea), the peach,the apricot and the fig are specific to the warmer areas of the south and west.

In the northern mountain areas (in the north of Vâlcea and Gorj counties and in the west of Mehedinți county) the place of agricultural crops is taken by forests and mountain meadows. In Drăgășani, Drăgănești, Segarcea, Strehaia and Dăbuleni areas, the vineyards occupy large areas; if the noble varieties of vineyards predominate in Drăgășani area, in the rest of the regions the most frequent varieties are the hybrid ones from which the well-known *zaibăr* is produced.

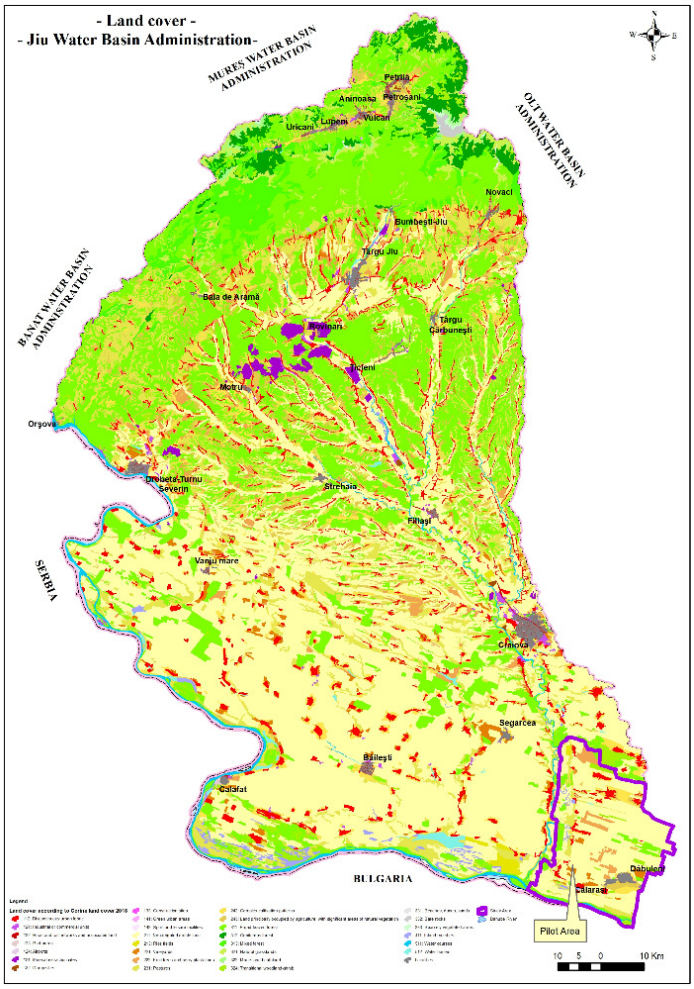


Fig.7 Land cover in Jiu WBA

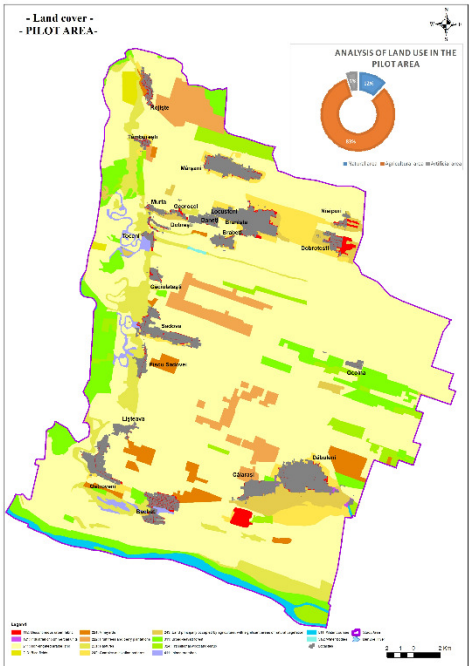


Fig. 8 Dabuleni pilot area-land use

In the area of the meadow of Olt, vegetables are cultivated, and in the area of Dăbuleni city watermelons are grown. It can be said that agriculture is one of the most important activities in the whole Oltenia Plain and especially in the Danube Floodplain (Fig 7 and Fig. 8).

1.6.Gender Social

The results of the most recent census of population and houses, held between the 20th – the 31st of October 2011, show that the South West Oltenia region had a population of 2.075.642 people at that time, representing 10.31% of the total population of Romania. Official statistical data show a decrease of 10.95% compared to the 2002 census, when the population of South West Oltenia was 2.330.792 people.

This decrease was mainly determined by the higher manifestation of mortality, compared to the birth and the generation of a negative natural increase, as well as by the migratory phenomenon of the population to other regions of the country, or outside it.

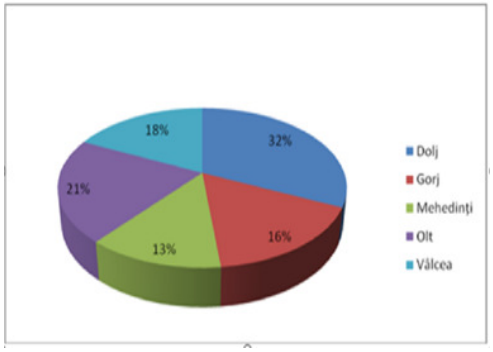


Fig.9 Population of the main counties in Oltenia region

Structure of residential population by age groups at the census- in October 2011, at the regional level, the distribution by age group is presented as follows: the age group 0-9 years held a share of 9.45% of the total population, the group 10-14 years represented 5.55% of the total, teenagers aged 15-19 years 5.72%, young people aged 20-24 years 6.15%, the 25-29 year old group was 5.99%, the adults aged 30-64 years forming the majority, respectively 49.49%. People over the age of 65 had a share of 17.65% of the total.

1.6.1. Resident population, by gender and residential areas at the census

Out of a total of 2.075.642 people, in October 2011, the men in South West Oltenia represented 48.99% (1.016.755 people), and the women 51.01% (1.088.887 people), a trend that has maintained since the prevoius census, in 2002. The situation is similar in the component counties of the region. The resident population in municipalities and cities registered a percentage of 46.15% (957.978 people), while in the rural area the percentage was slightly increased, of 53.85% (1.117.664 people). The situation at regional level differs from that at national level, where the urban population is majority (53.97% of the total), which mainly shows the rural tendency of the region.

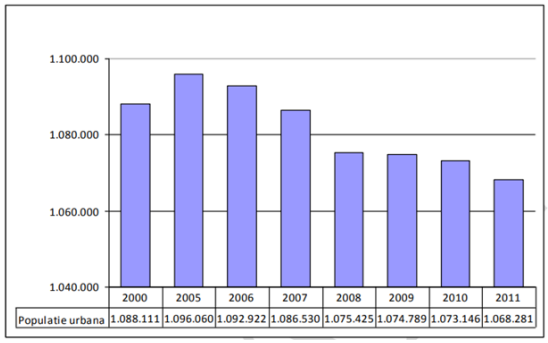


Fig.10 Evolution of the urban population in Oltenia

1.6.2 Demography

The South West Oltenia region had in 2004, a density of 79.7 inhabitants / kmp, being below the national average of 91.2 inhabitants / km^2 . The share of the population by area is 47.2% in the urban area as against to 52.8% in the rural area, compared to the national situation of 54.9% in the urban area compared to 45.1% in the rural area. The counties with the largest number of inhabitants in the rural area are: Olt (59.6%), Gorj (53%) and Vâlcea (55%). The urban population is concentrated mainly in the five county residences, which together make up 63% of the urban population of the region. The population is composed mainly of Romanians 97% (DJ 95.5%, GJ 98.3%, MH 96.1%, OT 98.1%, VL 98.8% - since the last census 2002), and as a percentage of 3% ethnic Greeks, Italians, Bulgarians, Albanians, Serbs, Jews. Also, according to the preliminary data of the 2002 Population Census, in Oltenia, about 60.000 people were declared to be of Rom ethnicity.

References

https://ad-turism.ro/oltenia-1684/ ***Oltenia, cradle of latinity***, author **Bodor Nicoleta**

https://www.adroltenia.ro/wp-content/uploads/2014/05/Cap.-2-Contextul-economic.pdf

CHAPTER II –DESCRIPTION OF THE OLTENIA AREA

2.1 PHYSICAL DESCRIPTION

2.1.1 Meteorology

The analysis of summer temperature recorded over a 50-year period at six meteorological stations situated within Oltenia Plain is strongly consistent with the results of other studies made in Europe and worldwide, warming being mainly attributed to an increase in anthropogenic greenhouse gases. The analysis of mean temperatures registered each summer and the mean 10- year values confirms the general tendency corresponding to the Romanian territory, namely up to 0.6ºC in the last 100 years (1901-2007) (*Busuioc et. all., 2007*).

The decade 1971-1980 was the coldest over the Oltenia Plain region in the last fifty years. Thereafter a heating trend is obvious, statistically significant at more than 95% confidence level for all the analysed stations, the warmest decade being the last one. It is worth mentioning that the first three hottest summers in the analysed period correspond to this decade (2000, 2003, and 2007), in 2007, at Calafat, mean temperature exceeding for the first time 25ºC (25.23ºC).

The analysis also emphasized that there is high connection among stations, as there were not detected any significant spatial differences. Thus, based on our own results, as well as on the results obtained for other regions of the country, it appears that warming may be related to large-scale factors, local features also enhancing positive deviations and upward trends (soil type, vegetation cover, distance from settlements, etc.). We may also assume that the significant increase in summer temperatures has greatly contributed to the annual International Conference "Natural Hazards – Links between Science and Practice" 38^0 temperature increase so far, or, otherwise, summer is the season that has been getting warmer than the other seasons. However, further research in this field is needed in order to clarify this issue and to assess the vulnerability of the region to climate change.

The mean annual precipitations amount reaches 573 l/m^2 within Oltenia Plain, varying from one meteorological station to another according to their position relative to predominant air masses and relief altitude. Thus, the highest precipitation amount of 674.2 l/m^2 is registered at Drobeta-Turnu Severin, a station located in the north-west of Oltenia Plain (altitude :78,2 m) .The minimum amount is noticed in the southern extremity of the plain, at Bechet (altitude : 37,2 m) , 521.6 mm. Between these extremes, there are not obvious differences, especially in the central and eastern sectors of the plain - Caracal 557.1 mm, Calafat (altitude :62,2 m) 531.9 mm and 559.7 mm at Băilesti (altitude: 58 m), taking into account the relatively homogenous altitudes and air mass exposure.

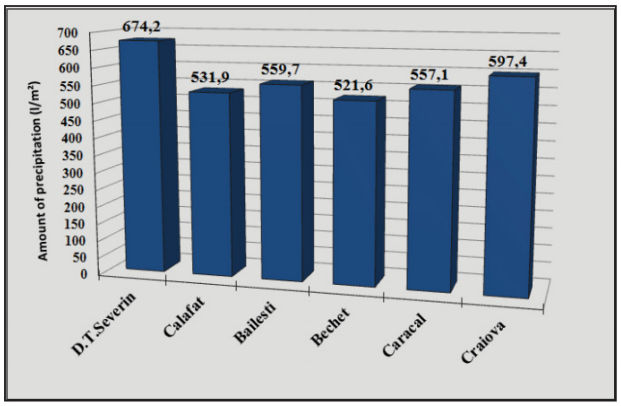


Fig.2.1.1.1 Distribution of multiannual precipitations amounts

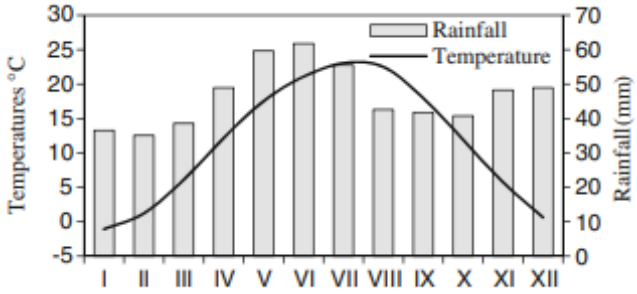


Fig.2.1.1.2 Average multi-annual monthly temperature and precipitation variation (average values of the two parameters at the five weather stations between 1961 and 2009)

According to the IPCC report (2007), scenarios on climate changes in Central Europe (which correspond for Romania), indicate dramatic changes in the evolution of averages temperatures and precipitations. It is expected that average annual rainfalls will increase in the winter season, but will decrease in summer season and average temperatures will increase in the summer, creating the potential to enhance the frequency and intensity of drought phenomenon.

Also, the solid shape precipitation will decrease, shortening the season of snow and its average thickness. Due to the increase in average temperatures, the report draws attention to the changes of the balance of water from soil, with serious consequences in terms of climate, ecological and social.

2.2.2 Hydrology

As the climate and hydrological systems are closely interconnected in terms of water and energy balances, disturbances affecting the main climatic parameters (overall temperature increase and rainfall rate decrease in numerous regions worldwide) have a direct or indirect impact on water resources, which are of paramount importance, both socioeconomically and environmentally. This

impact is mainly reflected by changes in hydrological parameters and river streamflow regimes. Thus, in the context of rainfall rate decrease, a water discharge diminution was noticed in various regions of the globe (e.g., vast areas in Africa, southern and southeastern Europe, eastern and southeastern Asia and eastern Australia) (Gou et al. 2007; Dai et al. 2009; Ma et al. 2010; Hannaford et al. 2013; He et al. 2013). There are, however, cases when the river streamflow has grown in areas experiencing increasing rainfall rates, over recent decades, such as certain areas of northern Eurasia, northern North America, southern South America and eastern Africa (Genta et al. 1998; Lins and Slack 1999; Groisman et al. 2001; Peterson et al. 2002; IPCC 2007; Pasquini and Depetris 2007). Another important effect of climate change is the disruption of hydrological regimes, in the context of global warming. A relevant example is the accelerated occurrence of high spring waters as a result of temperature rise and snow melt in upper catchments.

The rivers draining Oltenia Plain are generally short (most of them< 100 km long) and have a low density (< 0.3 km/km^2) (Savin 2008). While the rivers are supplied mainly by rainfall and snowmelt (up to 65%), groundwater can also contribute, in certain cases, up to 45% of discharge (Pi¸sota 2005). While the rivers are supplied mainly by rainfall and snowmelt (up to 65%), groundwater can also contribute, in certain cases, up to 45% of discharge (Pisota 2005).

The analysis of hydroclimatic dynamics in southwestern Romania, based on statistical investigations on the CWB –the climatic water balance and the streamflow rate -SFR parameters, in the period 1961–2009, showed a generally close connection between climate and streamflow and indicated an overall water resource decline in the context of climate change that affected the region over the past decades. Such information of hydroclimatic dynamics can be useful for the adequate management of regional water resources, in order to ensure their sustainability and adaptation to climate change. (*Hydroclimatic dynamics in southwestern Romania drylands over the past 50 years Remus Prav˘ alie ˘ 1,∗, Liliana Zaharia2, Georgeta Bandoc1, Alexandru I Petris¸or3,4, Oana Ionus¸5 and Iulian Mitof2*)

2.1.3.Geology

The Oltenia Plain (named after the historical province of Oltenia in the south of which it is located) is composed of the following plains: Blahnița Plain, Băilești Plain, Romanians Plain. From a tectonic point of view, the Oltenia Plain is part of the Moesian Platform. The base of the platform is of Hercynian origin, and the upper sediments are of Carpathian origin.

The sediments date from the Mesozoic and Pleistocene. In the past, they are very recent, dating from the Holocene. The Jurassic and Cretaceous layers contain oil deposits. The loess cover mainly covers the tabular plains, sometimes reaching a thickness of 40 m. At times we find sand dunes.

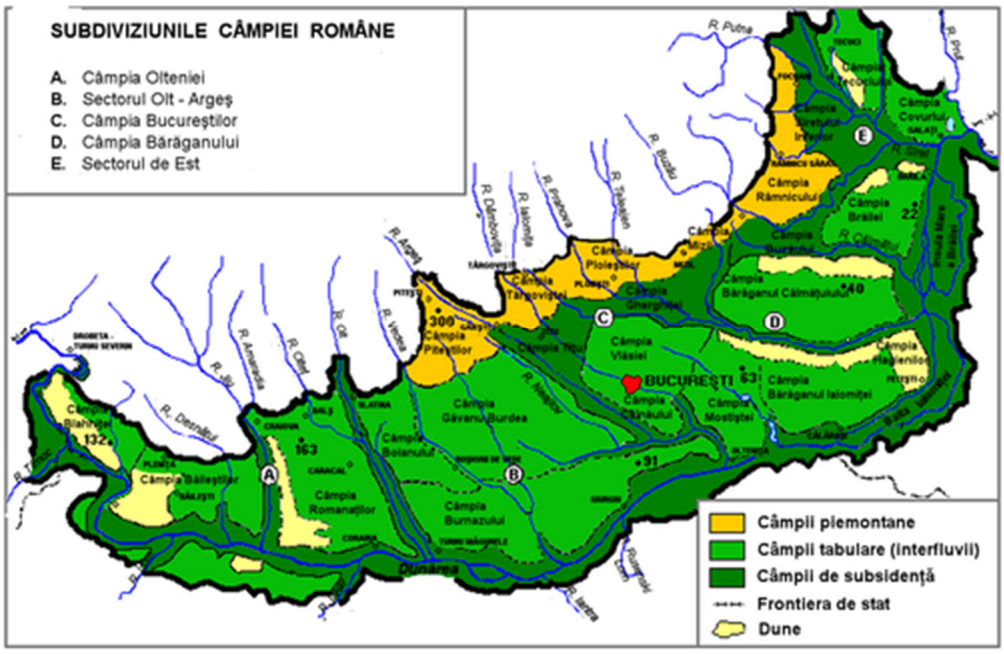


Fig. 2.1.3. The main units of the Oltenia plain

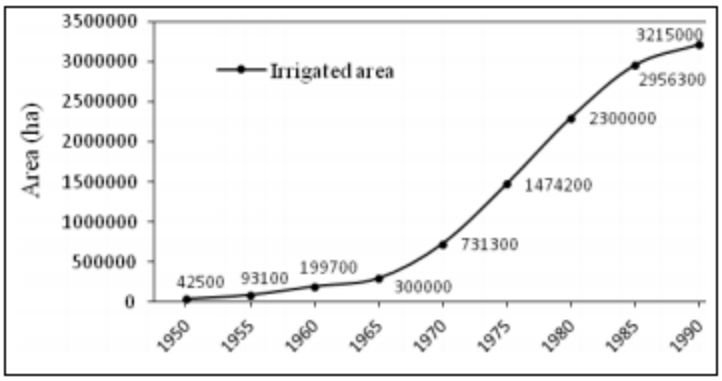
2.1.4.Water management

The water management in Romania is done according to the WFD 2000/60/EC, at the river basin level, focused on the water bodies, for surface waters and also for the groundwaters. The waters management is assured by the Jiu Water Basin Administration, Dolj County Water Management System and National Administration „Apele Romane". The Ministry for Waters, Forests and Environment is the main coordinator of the NAAR and provide the national legislative support for activities in water management field. An important role for the water quantity (local irigation system) point of view in the project area had the Dolj County National Administration for Land Improvement. An other important river basin, in Est of the Jiu Catchement area is Olt river, one of the huge rivers in Romania. The water management is assured in a small part of the pilot area by the Olt WBA.

2.1.5 . Irrigation system and use of the soils

The most important activity in the pilot area is agriculture. Romania currently has 15 million hectares of agricultural lands, of which approximately 9.5 million are cultivated (P.R.R.I., 2008). These cultivated agricultural areas require largely irrigations, especially during periods of drought, but after 1990 this possibility was notably reduced.

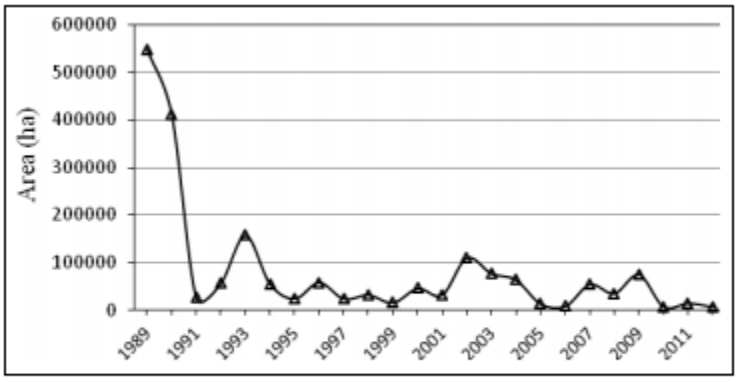
Evolution landscaped areas for irrigation in the second half of the twentieth century reveals a maximum level in 1990 when a total of approximately 3.2 million ha of agricultural land were irrigated, mainly with large irrigation pumping systems.



Temporal dynamics of irrigated areas in Romania in the period 1950-1990 (data processing Grumeza & Kleps, 2005)

Fig. 2.1.5.1.

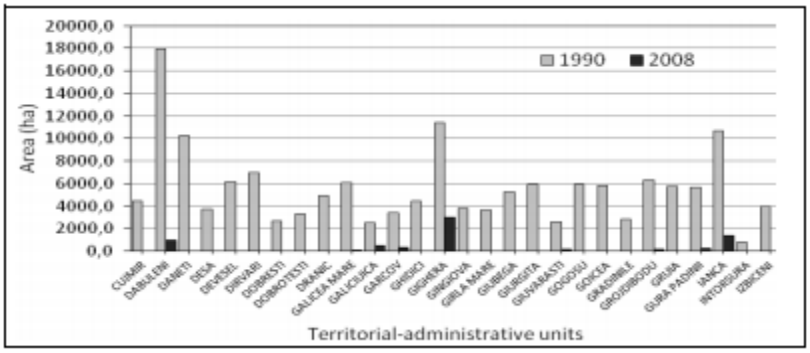
The events that followed after 1990 (change of political regime, weak progress, lack of funds, the transfer of management of irrigation systems to Water User Associations in 1999 and later to other organizational structures without the possibility of a viable management from their part) led to a catastrophic decline of irrigation systems, so that now total irrigated area is well below 1 million hectares (P.R.R.I., 2008). At the level of 1990, the Oltenia Plain irrigation system represented 16% (approximately 510 000 ha) from the total irrigated area at the national level at that time



Temporal dynamics of irrigated agricultural areas in Dolj County in the period 1989 - 2012 (data processing N.A.L.I. Dolj)

Fig. 2.1.5.2.

There are still irrigated areas around some major localities such as Băileşti and Dăbuleni, in these cases there are associations of water users who still afford to pay the high costs of irrigations (N.A.L.I. Dolj). In some cases, for irrigated areas have not been used irrigation systems, an example in this case being the Dăbuleni area, where the owners built their own wells for irrigation of melons (N.A.L.I. Dolj).



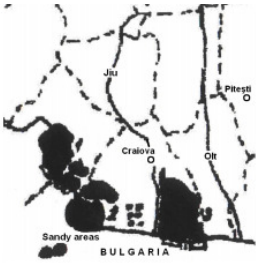
Temporal dynamic of irrigated areas (ha) at the level of territorial-administrative units in southern Oltenia (1990-2008)

Fig. 2.1.5.3.

Other causes of decline in irrigations sector in analyzed area are related to various offenses in the last two decades that led to destruction through theft of the technical infrastructure. Also, the waste of water resources (in most cases in southern Oltenia) caused by the lack of warnings on the water requirement of land is another current dysfunction of irrigations sector both in the analyzed area, but also in general, national context (Giurgiu, 2011). It should be noted that besides socio-economic benefits, irrigations systems in southern Oltenia have determined a number of dysfunctions in the environment. Among the most important are the disappearance of forest ecosystems (protective forest belts) with construction of irrigations infrastructure and expansion of agricultural areas. This is the case of the Sadova-Corabia irrigation system that after its implementation around 1969 has determined massive acacia deforestations on surfaces of thousands of hectares (Nuţă, 2005).

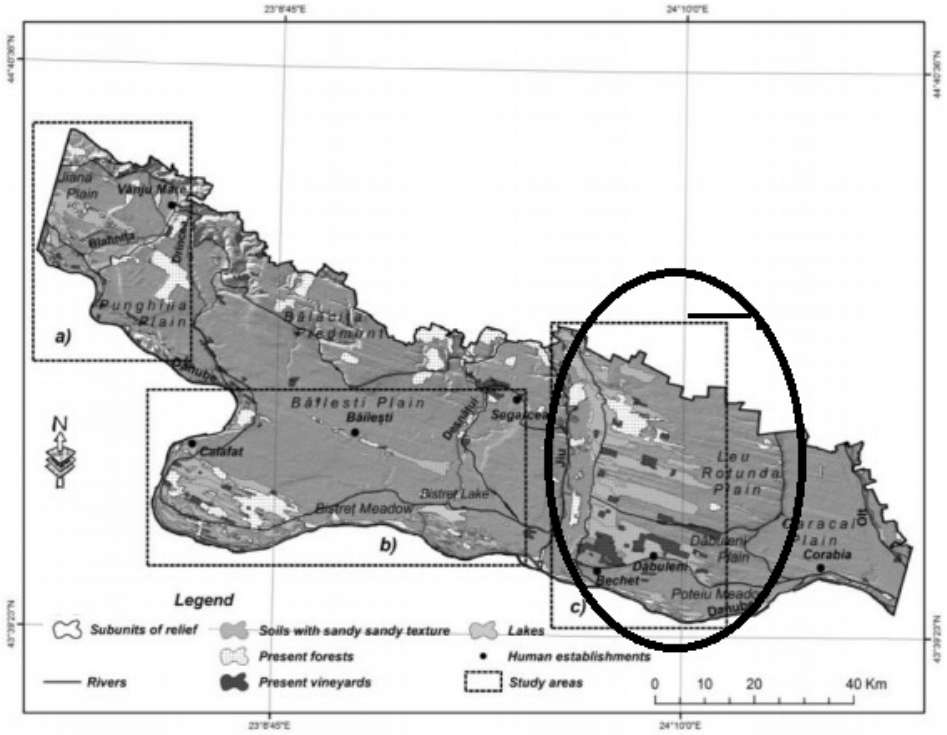
The decline of irrigation systems was one of the worst consequences in Romanian agriculture for the last two decades, and this is valid also for the Dabuleni area. Synergistic context of scarce national strategy for rehabilitation and reform of irrigations sector, of the lack of legislation and the sustainable measures with the role to stop the theft of the technical infrastructure, of severe lack of funds and the deficit becoming more pronounced of specialized personnel are the main causes of the collapse of the irrigation systems in southern Oltenia.

In this stage, the amplification of aridity phenomenon in recent decades, the analyzed area requires an extensive rehabilitation of irrigations systems. The presence of sandy textured soils on very large areas (one third of total national surface) is another reason why the rehabilitation of irrigation systems should be a priority both in the agricultural policies of the study area, and national policies.



Sandy areas in Oltenia (*processed according to Gh. Marinică and colab. 1999*)

Fig. 2.1.5.4.



Areas with sandy dunes from southern Oltenia in Jiana – Punghina Plain areas (a), Băileşti Plain - Bistreț Meadow(b) and Dăbuleni and Leu-Rotunda Plains (c).

Fig. 2.1.5.5.

Also, political and social changes after 1990 year, led to important changes in the land use (destruction of irrigation systems, deforestation of forest ecosystems with consequences for the reactivation of deflation phenomenon, abandoning the agricultural lands, some of them with key role in maintaining moisture, such rice fields) are other associated causes with the amplification role of the studied phenomenon .

Aspects regarding spatial and temporal dynamic of irrigated agricultural areas from southern Oltenia in the last two decades- Remus Prăvălie

2.1.6. Human pressures

The most important anthropic pressure are *the cutting down forests*, in case they become chaotic, without observing the legal provisions, their effect materializing on the stability of the land (by the appearance of erosion, the formation of torrents, lowering the rate of refilling of layers aquifers, etc.)

2.2. WFD

2.2.1. Surface and groundwater bodies

In this area there are designated 3 groundwater bodies: ROJI05-*Jiu's meadow and terraces*; ROJI06-*Danube's meadow and terraces*; ROOT08-*Oltenia groundwater body* and in the next proximity ROOT13-West of the Valah Depression (deep groundwater body).

2.2.2. Monitoring

For Jiu cachement area there are 123 surface monitoring stations. All the waterbodies that were designated in Jiu WBA are monitorisated according to the WFD 2000/60/CE. The surface waterbodies quality is described in the table 2.2.2.1. for the main rivers that have links with the Dabuleni pilot area. The drilling network for Jiu WBA has 240 monitoring points.

2.2.2.1 Water quality

Table 2.2.2.1. The monitoring stations for the surface waterbodies in the pilot area

Water body's name (WB)	**Type of the WB**	**Water body code**	**Ecological Status/ Ecological Potential**	**Chemical status**	**Monitoring station**	**Target to achieve ecological objectives**
DANUBE: IRON GATE II - Chiciu	HMWB	RORW14_B3	Moderate potential	Bad chemical status	Calafat	2022-2027
Jiet (Old Jiu)-spring-Danube confluence with Georocel and Valea Predestilor tributaries	Natural WB	RORW14-1-28_B185	Good ecological status	Good chemical status	Ostroveni	2015 (achieve)
Jiu -Bratovoiesti-confl. Dunarea	Natural WB	RORW7.1_B148	Moderate ecological status	Bad chemical status	Zaval	2022-2027

2.2.2.2 Water quantity

For the surface waterbodies there are 30 important hydrometrical stations for flow measurements in Jiu WBA. The drilling monitoring network is functional and expanded for all groundwater bodies designated in Jiu Catchment area. In the pilot area there are 71 drilling.
The most important water user in the Danube Floodplain is the ANIF (the National Administration for Land Reclamation) that assure the mentenance of the irrigation systems.

In 2019, the Sadova-Corabia irrigation system (part of ANIF system) has used 4172,149 thousand cubic meters of water (6550,33 thousand cubic meters of water in 2018). The irrigation system on the right side of the Jiu River: Nedeia-Macesu area (part of ANIF system), has contracted 38903,883 thousand cubic meters of water in 2019 (36372,64 thousand cubic meters of water in 2018).

There is also the Association of Individual Waters users (FOUAI) Calafat-Bailesti, which used 10613,569 thousand cubic meters in 2019 for irrigation (5039,29 thousand cubic meters in 2018).

On the other hand, there are thousands of wells in individual households that can use 0.2l / sec according to article 9 paragraph 2 of the Romanian Water Law without paying for it.

2.2.2.3 Ecology

2.2.3. Protected areas N2000

A) **Jiu Corridor - ROSCI0045** was declared a site of community importance by the Order MMDD no.1964 of 2007 regarding the establishment of the protected natural area regime of the sites of community importance as an integral part of the European ecological network Natura 2000 in Romania, with an area of 71,452 ha. The site ROSCI0045 mainly operates on the administrative territory of Dolj county, respectively 75% of its area, as well as in Gorj county - 25% of the area.

The site is not compact, being made up of several "bodies" with variable surfaces, these mainly taking place along the middle and lower course of the Jiu. The site is important due to the presence of a large number of habitats of community interest, being representative that here are found samples relict of slightly disturbed European meadow. The site crosses four of the 15 ecoregions of the continental biogeographic regions of Romania (Getic Plateau, Gǎvanu-Burdea Plains, Silvostepa Romanian Plain, Danube Floodplain). The Jiu Corridor is also one of the main trans-Balkan migration corridor of an impressive number of birds (Central-European-Bulgarian Road).

Jiu Corridor - ROSCI0045- concentrates a number of 8 forest habitats**:** **Habitat 9130** : *Asperulo-Fagetum* forest; **Habitat 9170**: *Galio-Carpinetum* forest; **Habitat 91E0***: *Alnus glutinosa* and *Fraxinus excelsior* forest- *Alno-Padion, Alnion incanae, Salicion albae*; **91F0 Habitat***: Quercus robur, Ulmus laevis și Ulmus minor, Fraxinus excelsior sau Fraxinus angustifolia - Ulmenion minoris*; **Habitat 91I0*** -*Quercus spp.*; **Habitat91M0** ; **Habitat 91Y0**; **Habitat 92A0** with *Salix alba și Populus alba*.

B)Jiu-Danube confluence (ROSPA0023)

Zăval Forest - (Mixed meadow forest of *Quercus robur*, *Ulmus laevis* and *Ulmus minor*, *Fraxinus excelsior* or *Fraxinus angustifolia* along the great rivers - *Ulmenion minoris*)

C)ROSPA0135 -Sands from Dăbuleni are located in the southern part of Romania, on the territory of the Olt counties - 74% and Dolj - 26%, on the territory of the Padinea, Grojdibodu, Ianca, Dăbuleni and Călărași UATs, in the continental biogeographic region. The geographical position of the site ROSPA0135 *The Sands from Dăbuleni* is located in connection with the coordination: Latitude 46 ° 53'9 "; Longitude 24 ° 4'29 ", at an average altitude of 28 m. The location can be accessed on DN 54A Bechet - Corabia, in each of the 5 localities to which they return. ROSPA0135 site- *The sands from Dăbuleni* overlap on an area of 2276.9 Ha with ROSCI0045 Corridor of Jiu, on the territory of the UATs of Calarasi, Dăbuleni and Ianca. ROSPA0135 site -*The sands from Dăbuleni* are a special area of bird protection for the protection of bird species and their specific habitats. Natura 2000 site ROSPA0135 *The sands from Dăbuleni*, a special area of birds protection was designated by GD no. 971/2011 for the modification and

completion of GD no. 1284/2007 regarding the declaration of special birds protection areas, as an integral part of the European ecological network Natura 2000 in Romania. ROSPA0135 site *The sands from Dăbuleni* have an area of 11,035 ha.

D) Drănic fossiliferous site became a protected area of local interest in 1994 by the Dolj County Council Decision no. 26 / 04.11.1994 and reservation of the nature of national interest by Law 5/2000 on the approval of the Plan of national spatial planning.

2.2.4. Policy

The anthropogenic impact on clime, especially in the last century, was extremely high so that it can with no doubt be considered a modifying factor on a global, regional and local scale. Climatic data in the last century showed, apart from a progressive general warming of the atmosphere (highlighted at global level), also a reduction of the quantities of precipitations, which became limitative factors for the growing, development and productivity of crops in certain geographic areas of the country and, in the same time, very restrictive factors for the allocation and use of water resources.

2.2.4.1 Global / European

At a global level the appearance and extension of conditions similar to deserts also in other areas of Terra was characterised in different ways. The United Nations Conference on Environment and Development – UNCED) defined desertification as land degradation in arid, semi-arid and dry areas, resulted following the action of several factors among which the most important are climate variations and human activity.

Desertification manifests in territory through:

- reduction of soil surface covered by vegetation;

- a consistent soil poverty and erosion;

- increase of albedo of adjacent surface;

- increase of solar radiation.

Desertification is therefore a severe phenomenon of climate risk whose multiple causes are related to a complex of factors. Droughts are risk complex climate phenomena with a slow manifestation, which affects and implies (depending on their duration and intensity), a varied number of components of geographic environment.

These are mainly caused by meteorological factors and manifest through effects not only on both atmospheric, hydrologic, pedological, vegetal, animal environment, etc. Consequently, in their classification it speaks of: meteorological, hydrological, edaphic (from a pedological point of view, something related to soil nature) and agricultural drought.

This is due, in the first place, to the lack of precipitations or their deficit, and the negative effects caused on different components of the geographic environment are visible on vegetation, soil and hydrological resources. Drought is a time-based phenomenon, and aridity is a characteristic of a certain region on which two factors acted simultaneously, namely: clime and anthropogenic impact.

At European level, the *European Strategy* is elaborated on adapting the effects of climate change. The strategy was adopted by the European Commission in 2013 and established a framework and mechanism for a degree of effective preparation for current and future impacts of change climate for all EU Member States. At the level of the Danube River Basin, under the coordination of the International Commission for the Protection of the Danube River (I.C.P.D.R.), was elaborated in 2012 the *Strategy for Adaptation to Climate Change for the Danube Basin*, which is considerate the link between the Water Framework Directive and Flood Directive, and which refers to the framework conditions, climate change scenarios, water impact, vulnerability to climate change and possible measures adaptation.

The impact of these climatic changes on the waterbodies consists mainly of seasonal changes in the flow, the occurrence low flow situations and water deficit with the possibility to becoming more severe, producing more and more precipitation frequent, both locally and regionally.

2.2.4.2.The National Strategy

The main European documents were implemented in Romania through the *National Strategy on changes climate and economic growth* based on low emissions carbon, as well as through the National Action Plan 2016-2020 on climate change.

The plan of action was developed based on the selection of related measures climate change for evaluation and prioritizing mitigation and adaptation measures in function of the benefits, costs and associated risks, for different key sectors (energy, transportation, water, agriculture, etc.) and each strategy objective together with the details on associated terms, the responsible ones, the sources of financing, the values of the financing and the result indicators.

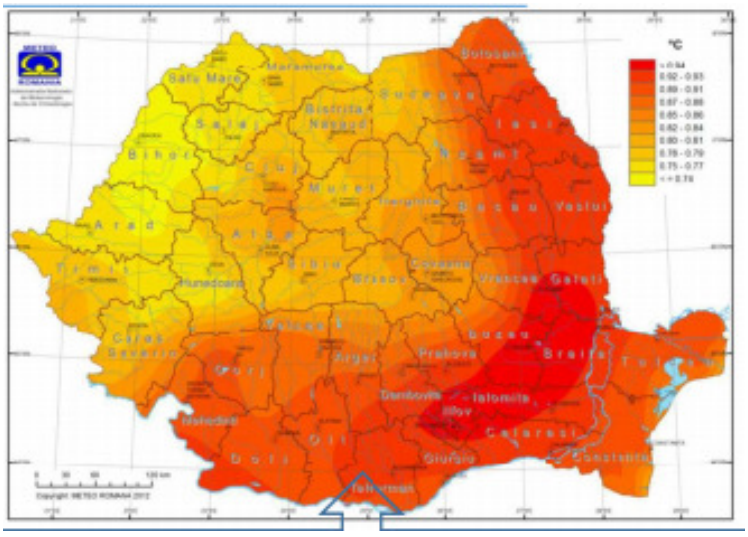


Fig. 2.2.4.2. The increase of the multiannual average temperature (° C) in the 2001-2030 interval compared to the reference period 1961-1990

2.2.4.3. Regional water management plans

The drought is the subject for twoo plans at the Jiu river basin level: the ***Jiu River Basin Management Plan*** 20016-2022 (Chapter XI) and the ***Plan for restrictions and use of water in deficient periods-***2016-2020***.***

2.2.4.3.1 The ***Jiu River Basin Management Plan*** is realized in accordance with the European and national legal provisions. As in the case of the first planning cycle, in the elaboration of the management plans at level the recommendations of the guides and documents were taken into account at national and local level developed within the Common Strategy for the Implementation of the Water Framework Directive. Also, the requirements formulated in the Reporting Guide of the Water Framework Directive -2016, were taken into account. The Reporting Guide was developed by the European Commission together with the Member States in the year 2014.

The chapter XI of the Jiu RBMP is focused on the ***Quantitative Aspects and Climate Change,*** but is a general and national approach based on the NIHWM studies.
According with this report in Romania an average annual temperature increase is expected compared to the period 1980-1990:

-between 0.5 ° C and 1.5 ° C, for the period 2020-2029;
-between 2.0 ° C and 5.0 ° C, for 2090-2099, depending on the scenario (example: between 2.0 ° C and 2.5 ° C in the case of the scenario that provides the lowest average temperature rise global **and** between 4.0 ° C and 5.0 ° C, in the case of the scenario with the most pronounced increase of temperature).

From the point of view of the precipitation regime, for the period 1901-2010 is analyzed indicates the existence, especially after 1961, of a general decreasing trend of annual amount of rainfall throughout the country and especially or in the increased growth of the precipitation deficit in the southern and eastern areas of Romania.
As a result of variation of the meteorological parameters, following the analysis of the simulations of the flows evolution, the NIHWM studies observe the following changes of the regime of multiannual average flows, for the Oltenian rivers- Jiu: decrease of approx. -11.0% and Olt: decrease of approx. -9.5%.
In the practical activity of the water management, an important place is occupied by the characterization of the regimes of use of the water resources and the establishment of the situations when restrictions must be applied to satisfy the water requirements.

2.2.4.3.2 ***The plan for restrictions and use of water in deficient periods***, provided in art. 14 of the Water Law no. 107/1996, with the subsequent modifications and completions, hereinafter referred to as restriction plans, have the purpose of establishing temporary restrictions on the use of water in situations when for objective reasons the authorized water flows cannot be insured for all users.

It is endorsed by the ***Jiu-Danube Basin Committee*** and approved by the Ministry of the Environment, Forests and Waters. The planning of the use of water resources during the deficient periods will be based on the documentation regarding the reporting of the restrictions situations and the restriction plan itself. The documentation regarding the reporting of the restriction situations includes the analysis / tracking system for the early detection of the restriction situations based on the information regarding:

a) water resources as quantitative parameters and in terms of quality;
b) the water requirements and, as the case may be, the water management arrangements.

The restriction plan itself includes, for different phases of restrictions:
a) the restricted uses and the degree of impairment of the water supply, with appropriate motivations (criteria);
b) attributions of the water management units;
c) measures for users;
d) mode of collaboration;
e) necessary records during the restriction period;
f) the manner of recording the end of these periods.

Conclusions

Its destructive impact makes drought be classified as one of the most problematic climatic risk phenomena all over the world. It is a recurring phenomenon displaying heterogeneous spatial and temporal features that vary significantly from one region to another (Tallaksen & van Lanen, 2004). There are four types of drought – meteorological, hydrological, agricultural and socioeconomic drought. The pilot area is called by Nicolae Topor 'one of *drought centres'* (1964) and by Ion Marinică '*drought epicentre'* (2006), the studied area is one of the most exposed to this climatic risk phenomenon regions in the country.

Drought-induced problems are quite significant within Dabuleni area as most of the population lives in the rural area where the main economic sector is represented by agriculture. Thus, usually, meteorological drought is accompanied by hydrological and agricultural drought, which first triggers food and economic insecurity, and then poverty. A poor production does not affect only rural population, but also urban population, which is forced to buy more expensive imported agricultural products.

CHAPTER III-DĂBULENI PILOT AREA

Introduction of the drought problem in Dabuleni pilot area

Its destructive impact makes drought be classified as one of the most problematic climatic risk phenomena all over the world. It is a recurring phenomenon displaying heterogeneous spatial and temporal features that vary significantly from one region to another (Tallaksen & van Lanen, 2004). There are four types of drought – meteorological, hydrological, agricultural and socioeconomic drought. The pilot area is called by Nicolae Topor 'one of *drought centres'* (1964) and by Ion Marinică '*drought epicentre'* (2006), is one of the most exposed to this climatic risk phenomenon regions in the country.

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3.1. Borders of the pilot area

Dăbuleni town is located in Oltenia Plain, in the south-east part of Dolj County. There is a distance of 80 km to Craiova and 210 km between Dăbuleni and the Romanian capital, Bucharest.

Covering an area of 88 000 hectares, *the territory of the pilot area* is adjacent to the following territorial units in North: Marotinu de Sus, Zanoaga, Amarastii de Sus, Amărăștii de Jos and Prapor; the Danube River is the South border, Jiu River in West part and the border with Olt County in East.

3.2. History

The earliest documentary attestation of Dăbuleni is dated June 5, 1494, when Recica Dabului village - the city of Dăbuleni today - is mentioned as a inhabited settlement on April 25, 1539, in a document issued by Prince Radu Paisie.The name "Dăbuleni" officially appears in a document dated April 24, 1664. The mapping of Romanati county from 1844-1845 shows that the village of Dăbuleni, owned by the Brancovenesc Hospital (built by Safta Brâncoveanu) was united with the village of Broasca and the village of Ciungu and thus, their combination formed the village of Dăbuleni, which later it became a town in 2004.

*(Source:*http://primariadabuleni.ro/index.php?rewriteparam=prezentare_locala)

3.3. Geography

The administrative territory of Dăbuleni is framed by the Jiu River in West part of the Oltenia Plain, namely in its subunit is the ***Bechet Plain***, by the Danube River in South and the border between Dolj and Olt county, in West. The relief forms encountered are the

Danube meadow and the second terrace called - Corabia Terrace - which dominates the meadow in the Bechet - Dăbuleni sector.
Being located in so called "***Sahara of Oltenia***", Dăbuleni's relief consisting of plains and meadows covered with sand dunes. In the south side there are smooth hillside surfaces that go up to the northern end of the territory, the highest altitude being 122 meters (Petrișorul Terrace).
The winds represent today an important role in shaping the current relief due to the steppe regime, with low precipitation, especially during the drought years. The semi-consolidated and mobile dunes are continuously subjected to the action of the winds.

(Source: http://primariadabuleni.ro/index.php?rewriteparam=prezentare_locala)

3.5. Economy

The main economic activity in Dăbuleni area is agriculture and, related to it, a small processing industry. Currently, 148 economic agents are registered in the Dăbuleni area. By analyzing the structure of the economic agents according to the activity field, it can be observed that most of them, respectively 50% carry out their activity in commerce and the repair of vehicles. In second place, a number of 14 companies are in the fields of agriculture, forestry and fishing.

(Source: Memoriu general PUG Dăbuleni – 2016)

There are also several banks and cable television services with a local TV station. There are some other different companies: construction materials, mini-markets, supermarkets, pharmacies.

*(Source:***https://ro.wikipedia.org/wiki/D%C4%83buleni#Economie)**

3.6. Agriculture

The sandy soils of Dăbuleni area are favorable to the watermelon crops, so the area is known as the "homeland of watermelons". Annually, the producers from Dăbuleni export about 40,000 tons of melons. In the areas where the soil is more fertile, cereals are also grown. In Dăbuleni was established SCCCPN (The Central Research Station for Plant Culture on Sands) that operates under the subordination of the "*Gheorghe Ionescu-Sisești*" Academy of Agricultural and Forestry Sciences - Bucharest. Currently, it is situated in the Dolj county, on the National Road - Bechet-Corabia, 75 km from Craiova and 40 km from Corabia.

(*Source:***https://ro.wikipedia.org/wiki/D%C4%83buleni#Economie)**

The agriculture characterized by a large area of agricultural land is the main economic branch of the City of Dăbuleni, along with the animal husbandry.

(Source: Memoriu general PUG Dăbuleni – 2016)

In Dăbuleni, agriculture is practiced on a "individual" level - the Dăbuleni area is nationally recognized as the main producer and supplier of watermelons and melons, but also by the fact that Dăbuleniul is registered with the State Office for Investments and Trademarks, with the individual mark - "Dăbuleni The House of the Melons ". According to the form of ownership, the agricultural land is owned by over 85% of private owners, while the non-agricultural land is owned over 75% by the state.The total agricultural surface consists of

arable land for the most part - 12860 ha, pastures and meadows - 701 ha and vineyards and orchards - 355 ha.The forest covers 3265 ha, occupying the second place in the structure of the administrative area of the city - 18% of the total administrative area - and is represented by forests and other lands with forest vegetation.The water surfacess in Dăbuleni is 453 ha, representing 2.36% of the total area of the city and is made up of swamps.

(*Source:*http://primariadabuleni.ro/index.php?rewriteparam=prezentare_locala)

Analysing the statistical data of 2011, *in Dăbuleni there are 3477 agricultural holdings*, *of which over 97% is private property and only 1.6% is leased.* From the point of view of the average area per farm, the largest share (45%) is held by farms with between 2 and 5 hectares, followed by farms with areas of 5 - 10 hectares (29%). Only 18% of the farms - only 3 - have more than 100 hectares.

Over the years, have been cultivated plants with good adaptability to the pedoclimatic conditions of sandy, drought resistant and less demanding soil fertility areas, such as melons, cabbage etc.Although Dăbuleni is known as the largest watermelons producer in Romania, other plants are cultivated on the soils of Dăbuleni: wheat, technical plants (sunflower, rapeseed, soybeans), vegetbles - in the field or in solariums, also fodder plants or potatoes.

Out of the total arable area 3115 hectares are cultivated with wheat (34%) and 568 hectares with melons and other vegetables (6%). Watermelon is a culture with tradition in the area of Dolj County and at the same time it is a profitable culture. The areas cultivated with melons have grown from year to year and in present, in the area Dăbuleni - Calarasi - Bechet there are over 5000 hectares cultivated with melons, Dolj county being the first place in the country, followed by Galaţi and Brăila counties.

Although watermelon is the main crop, tomatoes are grown in the area and, recently, early potatoes, crops that make important incomes for the area. If irrigated, 40 tons of potatoes were obtained in May.

In Dăbuleni, an important support for producers is ***The Development Research Center for Plant Culture on Sands***, which operates mainly on sandy soils in southern Oltenia. The area is known to be subjected to the desertification phenomenon, therefore called Oltenia's Sahara.

The fruit and wine sector, totaling 355 hectares, is in a constant decline with negative consequences not only on the economic development of the rural environment but also on the quality of life of the communities in the traditional apple-growing areas and on the contribution of this sector to the protection of the environment. According to the Agricultural Census on the administrative territory of Dăbuleni, apples, plums, table grapes, wine grapes are grown.

Fig. 3.6.1. The Development Research Center for Plant Culture on Sands-sandy soils experiments

Romania reveals significant discrepancies with the European Union in terms of productivity in the agricultural sector. Even in favorable agricultural years, the level of productivity is below 50% of the EU average, a situation showing the untapped economic potential of Romanian agriculture and rural areas. This can be explained by the internal structure of Romanian farms (small size) but also through the institutional framework and the deficient existing infrastructure.

(Source:Memoriu general PUG Dăbuleni – 2016)

3.7. Gender, social

Out of the total population, 48.57% are male; and 51.43% are women. The local people are recognized for their hard work. The products cultivated by them are sold throughout the country.

However it should be mentioned that, although the main activity of the inhabitants is agriculture, the area also has tourist potential, although still not exploited as it should. Dăbuleni is part of the natural site - The Dăbuleni Sands And The House Of Potelu Forest.

(Source:http://primariadabuleni.ro/index.php?rewriteparam=prezentare_locala)

The dysfunctions that are currently manifesting are:

- a strong fragmentation of the lands which leads to a difficult exploitation with mechanized means;
- a disorganized activity of acquisitions and capitalization of crops;
- the lack of development funds - investments in the field;
- the precarious material status of the population which leads to the underdevelopment of the "small and medium-sized enterprises" sector;
- aging of stable population and the migration of young people to other urban centers,

The current decline of certain industrial activities or dysfunctions pressing on other activities, generated by the economic reform, have led to the reduction of the number of employees. This reduction of personnel was generally made among the commuters and was considered to be reintegrated into the primary sector (agriculture) in the localities of the employees' home.

(Source:Memoriu general PUG Dăbuleni – 2016)

3.8. Demography

According to the official data of the 2011 Census, the stable population of Dăbuleni pilot area totals 56075 inhabitants, decreasing by about 12% compared to 2002. The decrease in the number of the population is mainly due to the migration abroad and to the neighboring cities, which offers more opportunities in terms of finding a job. The population density in Dăbuleni pilot area is 70.09 inhabitants / sqkm, being below the Dolj county average (89 inhabitants / sqkm).

Table 3.8.1 The main localities in Dabuleni pilot area

Locality name	Number of inhabitants
Marsani	5449
Daneti	4645
Sadova	6517
Ostroveni	4583
Listeava	1612
Bechet	3943
Sarata	2139
Dabuleni	14570
Ocolna	885
Dobrotesti	1392
Nisipuri	733
Rojiste	1755
Caciulatesti	659
Dobresti	439
Murta	680
Brabeti	1389
Calarasi	4685
TOTAL	**56075**

By ethnicity, the inhabitants of Dăbuleni are over 97.9% Romanians, 1.30% Roma, the rest being from other ethnicities.

Following the evolution of the absolute values of the natural increase after 1989, it can be seen that they registered only negative values, as a result of the very high mortality index, of the very low birth rate generally determined by the decrease of the standard of living, by the decrease of the share of the fertile population. (15-40 years) and the measures taken to legalize the abortions.

*(Source:*http://primariadabuleni.ro/index.php?rewriteparam=prezentare_locala)

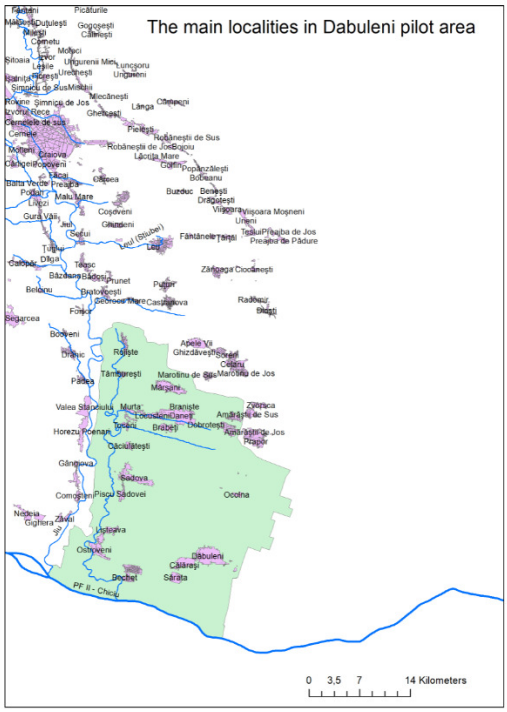


Fig.3.8.1 The main localities in Dabuleni pilot area

3.9. Different functions

Dăbuleni currently has the main function of agricultural production center (zoo-cereal). Today, Dăbuleni is a city with insufficiently developed urban functions, a predominantly agricultural city. One of the important problems faced by Dăbuleni, like most of the Romanian cities, is the insufficiently developed basic infrastructure, which has real negative consequences on the city's economy, as well as on the economy of the surrounding rural localities.

*(Source:*http://primariadabuleni.ro/index.php?rewriteparam=prezentare_locala)

3.2. Description of the area
3.2.1. Meteorology

Dăbuleni area is situated into the excessive continental climate zone. This climate is generally characterized by hot summers with average temperatures up to 22-24 Celsius degrees in July and harsh winters, with average temperatures between -3 and 6 Celsius degrees in January. In Dăbuleni area, the wind is a very important climatic element, because its frequency and strength produces the temperature drops in winter, the melting of the snow in the spring, and especially the drying and dusting of the sands during the summer.

*(Source:*http://primariadabuleni.ro/index.php?rewriteparam=prezentare_locala)

Dăbuleni is situated in an area with a temperate-continental climate, with slight Mediterranean influence, with an annual average temperature of + 11.7^{0}C, with a minimum

temperature of -26^{0}C and a maximum temperature of over + 38^{0}C. The number of days with temperatures lower or equal to 0^{0}C is 91 days/year and those with temperatures equal to or above + 30^{0}C is 41 days/year. Dăbuleni suffers of drought that is accentuated in July - August and a normal amount of precipitation during May - June. The average amount of precipitation is 686 mm.

*(Source:*http://www.anpm.ro/documents/19431/3612277/MEMORIU_PUG+DABULENI.pdf/98d80815-c6fd-40e5-8a65-4a03d5ec97c4 (PLAN URBANISTIC GENERAL – ORAŞUL DĂBULENI – JUDEŢUL DOLJ – 2016)

The first frost appears at the end of October and the last frost is in the first decade of April, resulting in an interval of days without frost of over 200 days per year. The administrative territory of Dăbuleni is included in an area with potentially significant flood risk, identified on the lower Danube sector, according to the Report on the preliminary assessment of the flood risk - the Danube hydrographic basin.

In the administrative territory of Dăbuleni, the presence of the Danube river is a risk factor for floods, knowing that in May 2006, the Danube produced historical floods that affected the agricultural territory of Dabuleni, as a result of the accumulated water flow from the whole European basin. Dozens of hectares of crops and grasslands in several localities in the Dolj county, were flooded by the Danube waters that exceeded the flood levels at the hydrometric stations Calafat, Bechet, Rast and Bistret.

(Source:Memoriu general PUG Dăbuleni – 2016)

3.2.2. Hidrology

The territory of Dăbuleni area is located in the river basin of the Danube River. The Danube River is the southern border of Dăbuleni, being the most important hydrographic source of the city. The total length of the Danube is about 2800 km, of which 1075 km are in Romania and approx. 150 km along Dolj County. The Danube River on the Bechet - Dăbuleni sector is embanked on a length of 21,420 km, the dam protecting an area of 8477 ha.

(Source: http://primariadabuleni.ro/index.php?rewriteparam=prezentare_locala)

The Danube River is the southern border of Dăbuleni, being also the most important hydrological resource of the city. Moreover, the city of Dăbuleni is a border city on the border with our Bulgarian neighbors.

(Source: http://primariadabuleni.ro/index.php?rewriteparam=prezentare_locala)

The Danube river itself and the puddles formed by the flood, offer the area an important fishing potential, but poorly exploited in recent years. Other important rivers are the Jiu river and the Jiet in the western part of the Dabuleni area. They are the tributaries of the Danube River. The hydrographic network is poor in this part, and the soils are predominantly sandy. The groundwater is cantoned in the quaternary deposits of the river beds. In the case of Dăbuleni area, the groundwater aquifer layers of the Danube meadow are made up of sands and gravel, with boulder intercalations at the bottom. The addition of aquifer horizons is realized on all their surface from precipitations, rivers and temporarily by the irrigation channels.

*(Source:*http://primariadabuleni.ro/index.php?rewriteparam=prezentare_locala)

The phenomenon of desertification, reported for several years, is sustained by drought, by sandy soil, by the phenomenon of wind deflation (wind shattering) and by massive deforestation. In the area of Calafat - Poiana Mare - Sadova - Bechet - Calarasi - Dabuleni

and the Danube river, according to data from the Dolj Environmental Protection Agency, 104600 hectares became barren, the sandy soils having a tendency towards desertification. In the last three years, a very large percentage of surfaces (between 50% and 100%) has been disrupted and the phenomenon continues. The groundwater can be found 1 to 2 m deep in the southern part of the administrative territory of the City of Dăbuleni - in the meadow area and between 10 - 15 m in the north part of the terrace.

(Source:Memoriu general PUG Dăbuleni – 2016)

The main rivers from Dabuleni project area are: Jiu, Danube, Jiet. In the next table there are the most important hydrometrical stations for these rivers in the pilot area.

Table 3.2.1 The main monitoring stations for surface waterbodies in the pilot area

River	Quality Monitoring station	Quantity Hydrometric station	Q (m^3/sec) Mean multi-annual streamflow (1961–2009 period)
Jiu	Zaval	Zaval	93.4 m^3/sec
Jiet	Ostroveni	Ostroveni	0.436 m^3/sec
Danube	Calafat	Calafat	5441 m^3/sec
Danube	-	Bechet	5500 m^3/sec

3.2.3. Geology

From the geological point of view, in the eastern part of the Jiu river, there are quaternary deposits of loess, sand alluviums and gravel brought by the Danube and Jiu rivers, which determined the formation of the meadow relief and terraces. The water of Danube river, sittuated at a distance of approx. 7 km from the hearth of the Dabuleni town has dug over time on the territory of the Dăbuleni area deep valleys and terraces. Terraces such as the Petrişoru Terrace, the Flămanda Terrace, the Băileşti Terrace and the Meadow Danube Terrace were formed in river-lake deposits of the Lower Pleistocene, during the middle and upper Pleistocene, during climatic oscillations and against the background of neotectonic elevation.The groundwater can be found 1 to 2 m deep in the southern part of the administrative territory of the City of Dăbuleni - in the meadow area and between 10 - 15 m in the north part of the terrace.

*(Source:*http://www.anpm.ro/documents/19431/3612277/MEMORIU_PUG+DABULENI.pdf/98d80815-c6fd-40e5-8a65-4a03d5ec97c4*)*

3.2.4. Watermanagement

Dăbuleni area is equipped with centralized water supply and sewerage in the main localities. The regional wastewater treatment plant is located in Bechet. The percentage of

the population connected to the treatment plant is 16%, according to The National Administration Apele Romane.

In this area there are designated already 3 groundwaterbodies (Fig. 3.2.4.1): ROJI05-*Jiu's meadow and terraces*; ROJI06-*Danube's meadow and terraces*; ROJI07-*Oltenia groundwaterbody* and in the next proximity ROOT13-*West of the Valahe Depression* (deep groundwater body).

From the total 17 localities from Dabuleni pilot area (Table 3.8) the following localities are supplied with drinking water from groundwater bodies: Marsani– 2 drillings (ROJI07 – Oltenia) Sadova, 6 drillings (ROJI05 Jiu's meadow and terraces), Ostroveni -1 drilling (ROJI07 – Oltenia), Bechet -3 drillings (ROJI06-Danube's meadow and terraces), Dăbuleni 6 drillings (ROJI06-Danube's meadow and terraces), Dobrotești 3 drillings (ROJI07 – Oltenia) and Calarasi 2 drillings (ROJI07 – Oltenia) . According to mayors informations there are more than 3758 fountains in the main localities from the pilot area.

The groundwater bodies are monitored through the 240 drillings for Jiu Catchment area.

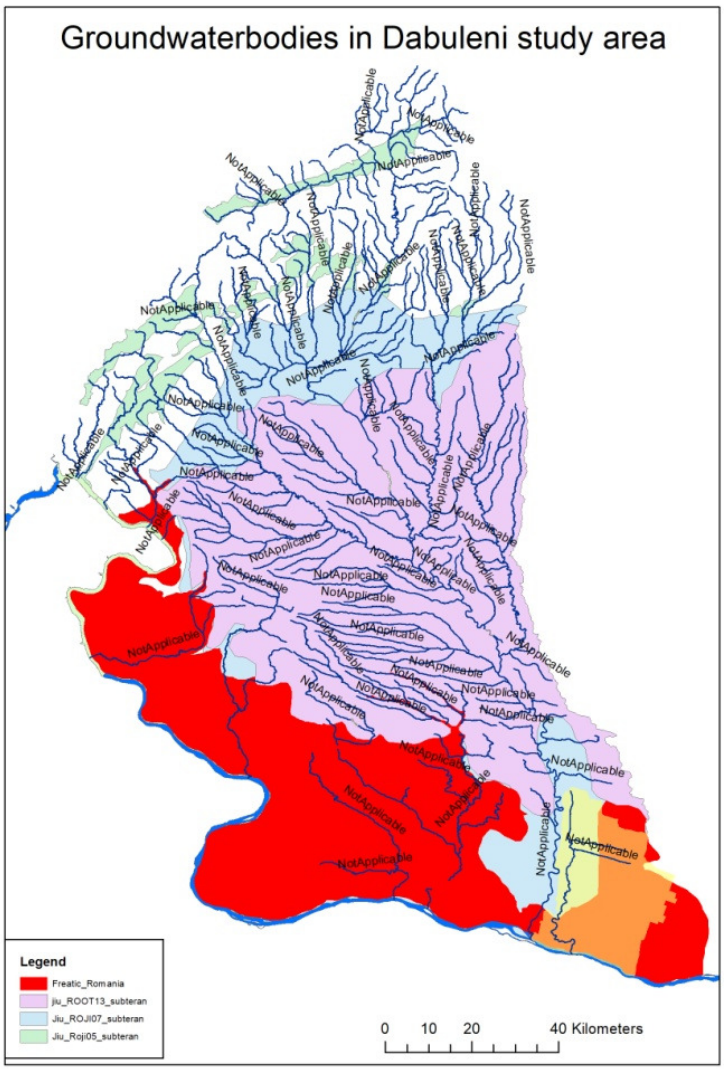


Fig. 3.2.4.1. Groundwaterbodies in Jiu WBA

ROJI05-Jiu's meadow and terraces

The phreatic groundwater body is of permeable porous peak, remains in the floodplain and terraces deposit of the Jiu Valley and its tributaries being of Quaternary age. The aquifer in meadows and terraces consists of gravel and boulders trapped in sandy masses, sometimes sandy clays and clear clays. In the meadow areas, water layers develop depths of 2-5 m.

Phreatic waters cantoned in terrace deposits are characterized as bicarbonate-calcium-magnesian or carbonate-sodium water, with a total mineralization of between 500 mg / l and 1000 mg / l. From the analysis of the land use map it is observed that the surface of the groundwater body is covered in a large proportion (70%) of agricultural land.

The groundwater from the Jiu high terrace is also highlighted by numerous sources with important flows: Căciulăteşti, Raeţi, Sadova. In this terrace the depths between 10-20 m predominate. The feeding of the groundwater aquifers is done either by infiltrating the precipitations or by draining the aquifer complex of the lower Pleistocene from the high field, or by draining the aquifer layers from the higher morphological stages with which they come in contact.

ROJI06-Danube's meadow and terraces

The groundwater body is a permeable porous type develops in the deposits of the meadow and the terraces of the Danube and is of Quaternary age. The groundwater aquifer layer is capped in gravel trapped in a medium and coarse sand mass, with thicknesses of 5-16 m and with flow rates ranging from 4-8 l / s / drilling, for slopes of 0.1 -0.4 m. In the Calafat-Bechet sector, the Danube floodplain has variable widths between 2.5-10 km and is characterized by the existence of large areas of marshes, lakes and ponds.
The springs near the localities of Călăraşi, Dăbuleni, Ianca and Potelu have flows ranging from 0.5-10 l / s. The waters of the springs are of the bicarbonate-calcium type. In Corabia terrace (lower terrace), the dunes that cover it have a thickness of 10-15 m. The thickness of the terrace deposits varies between 8-15 m. These deposits of gravel and sand are attributed to the Lower Holocene. In the Danube meadow, the Calafat - Bechet sector, in the localities Zăvalu and Gighera, at the contact between the meadow and the terrace, chlorine-sodium springs were encountered. The waters of the springs near the localities Calarasi, Dăbuleni, Ianca and Potelu are type of bicarbonate-calcium. From the analysis of the land use map it is observed that the surface of the groundwater body is covered in a large proportion (76%) by agricultural land.

ROJI07-Oltenia ground waterbody

The groundwater body, of Dacian age, is of a porous-permeable type. The Dacian deposits, within the Oltenia Plain, have a wide spread, being encountered from the Drincea valley to the Olt valley. They are missing in the Danube-Drincea sector and in the Danube meadow in the Jiu-Olt sector. The Dacian aquifer complex is constituted, at its lower part from small sands with frequent greasy concretions, which pass, towards the upper part, to fine sands with clay intercalations.
In the Oltenia Plain the aquifer layers from the Dacian deposits feed from precipitation in the areas located south of the perimeter where they emerge, from the groundwater horizon where there is a direct hydraulic connection between them, as well as from the surface waters of the Danube, Jiu and Olt where they form the talveg of these watercourses.

ROOT13 West of the Valahe Depression (deep Groundwater body)

It is noteworthy that a body, namely ROOT13 (West of the Valahe Depression), developed in both the Jiu and Olt hydrographic areas, was assigned to DA Olt, due to its predominant development in the Olt hydrographic space.

Groundwaterbody ROOT13 West Valahe Depression is a body of depth. The Valah Depression also known as the Lower Danube Depression or the Romanian Plain is one of the most representative hydrographic and hydrogeological regions in Romania, located between the

Piedmont area to the west and northwest, the External Sub-region of the Carpathians to the north, the Moldavian Platform, to the north - east, Dobrogea to the east and the Pre-Balkan Platform, to the south and southwest.

The feeding of this aquifer system is made from surface waters, from alluvial, proluvial, and deluvial groundwater aquifers in direct contact with the Dacian and Romanian sands and from other newer quaternary aquifers (upper Pleistocene). The feed rate is estimated at 100 mm water column / year.

Table 3.2.4.1.–List with quality drillings network in the pilot area

Nr.crt	Drilling location	Indicative of drilling	Groundwater body
1	ROJISTEA	F1	ROJI05
2	SADOVA	F1	ROJI05
3	VALEA STANCIULUI	F4	ROJI05
4	ZAVAL	F3	ROJI05
5	BRATOVOIESTI	F7	ROJI05
6	DIOSTI	F1MA	ROOT13
7	APELE VII NORD ORD.II	F1	ROJI05
8	AMARASTII DE SUS VEST ORD.II	F1	ROJI07
9	VALEA SOARELUI ORD.II	F1	ROJI07
10	BUCINISU SUD ORD.II	F1	ROJI07
11	ODAIA NORD ORD.II	F1	ROJI07
12	ROJISTEA ORD.II	F1	ROJI05
13	BRATOVOIESTI	F1MA	ROJI05
14	ORASANI	F7	ROJI06
15	BECHET NORD ORD.II	F1	ROJI06
16	IANCA NOUA VEST ORD.II	F1	ROJI06
17	URZICA ORD.II	F1	ROJI07
18	DRANIC ORD.II	F1	ROJI05
19	PADEA ORD.II	F1	ROJI05
20	MACESU DE SUS EST ORD.II	F1	ROJI05
21	NEDEIA ORD.II	F1	ROJI05

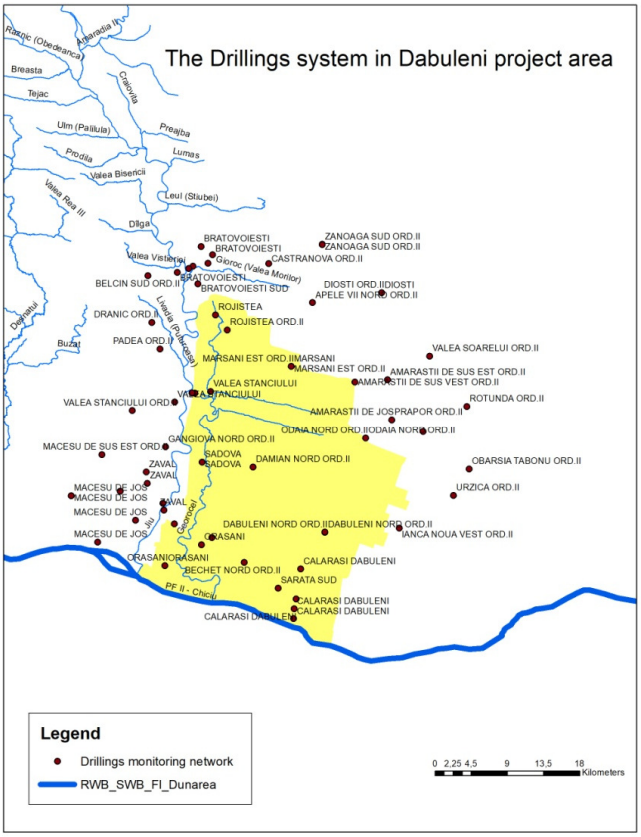


Fig. 3.2.4.2. Drillings monitoring network (quality and quantity) in the Dabuleni pilot area

The following graphs show the results of the measurements from the wells located in the study area, with the mention that the sensors were installed through the ***Danube Water*** EU project (Romania-Bulgaria cross border cooperation project).

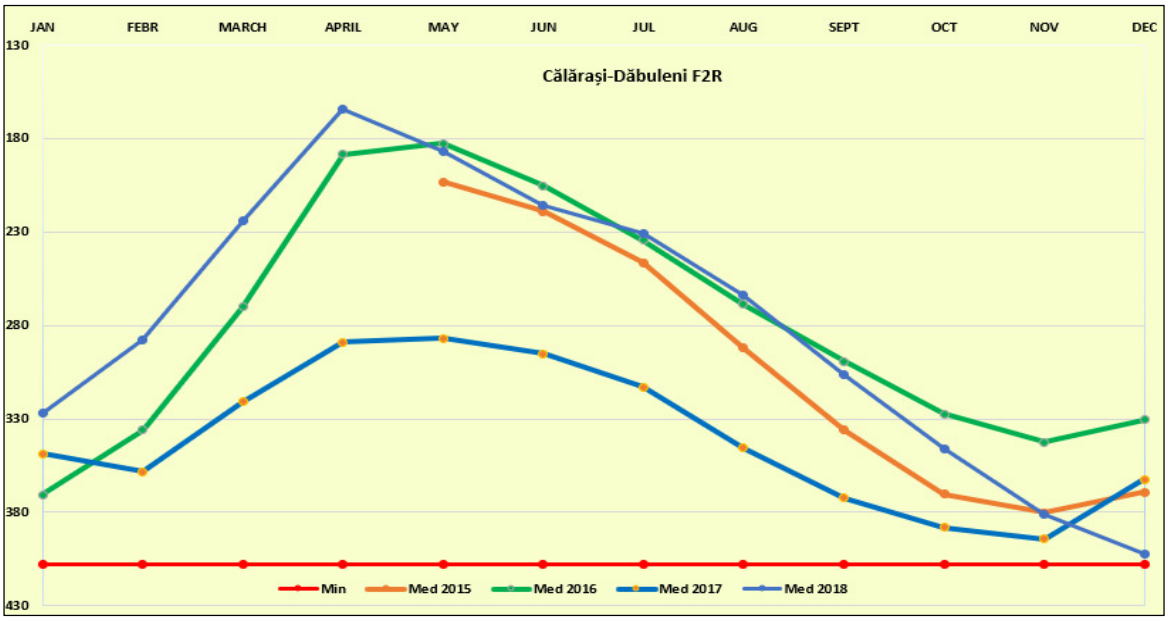


Fig. 3.2.4.3.The piezometric levels and the monthly multiannual average values – evolution fot Calarasi Dabuleni F2R drilling

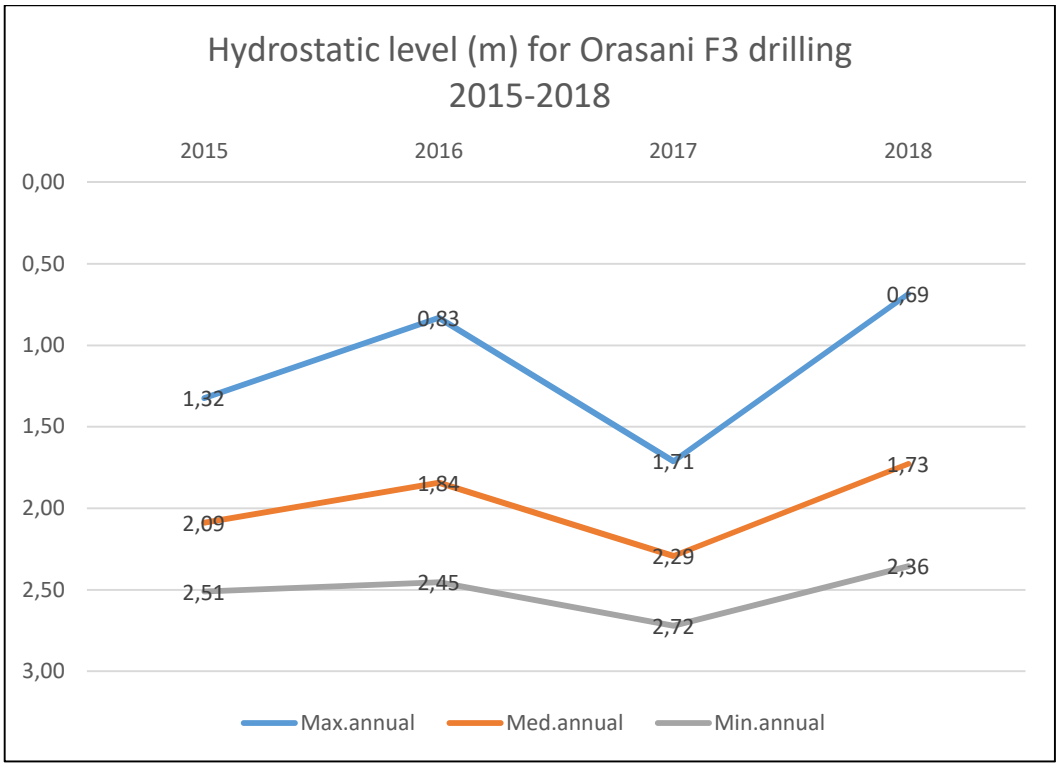


Fig. 3.2.4.4.

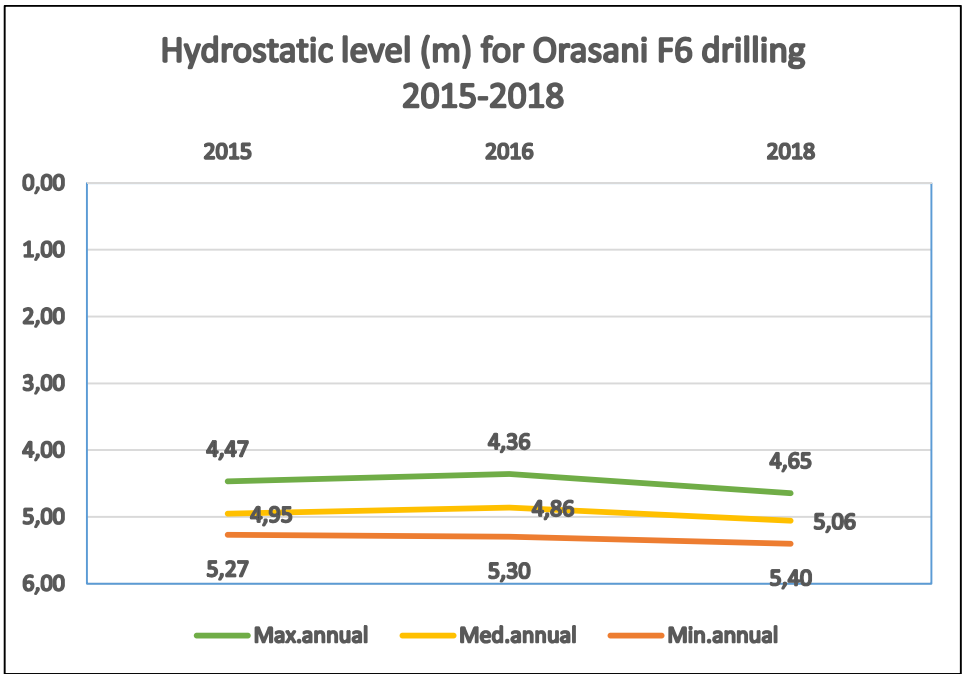


Fig. 3.2.4.5.

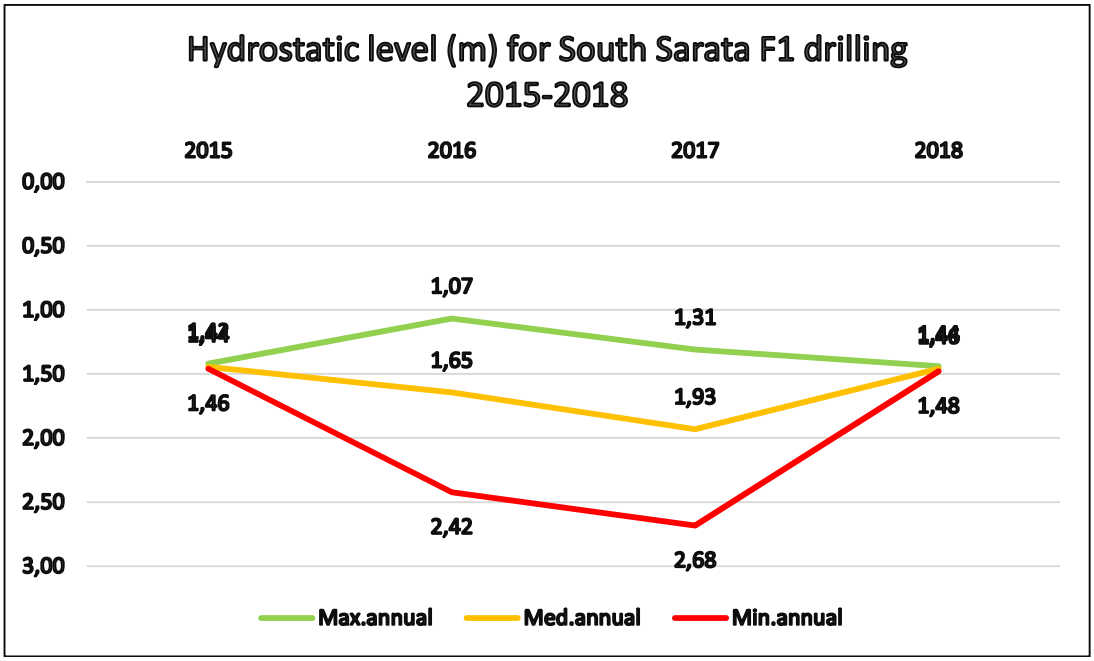


Fig. 3.2.4.6.

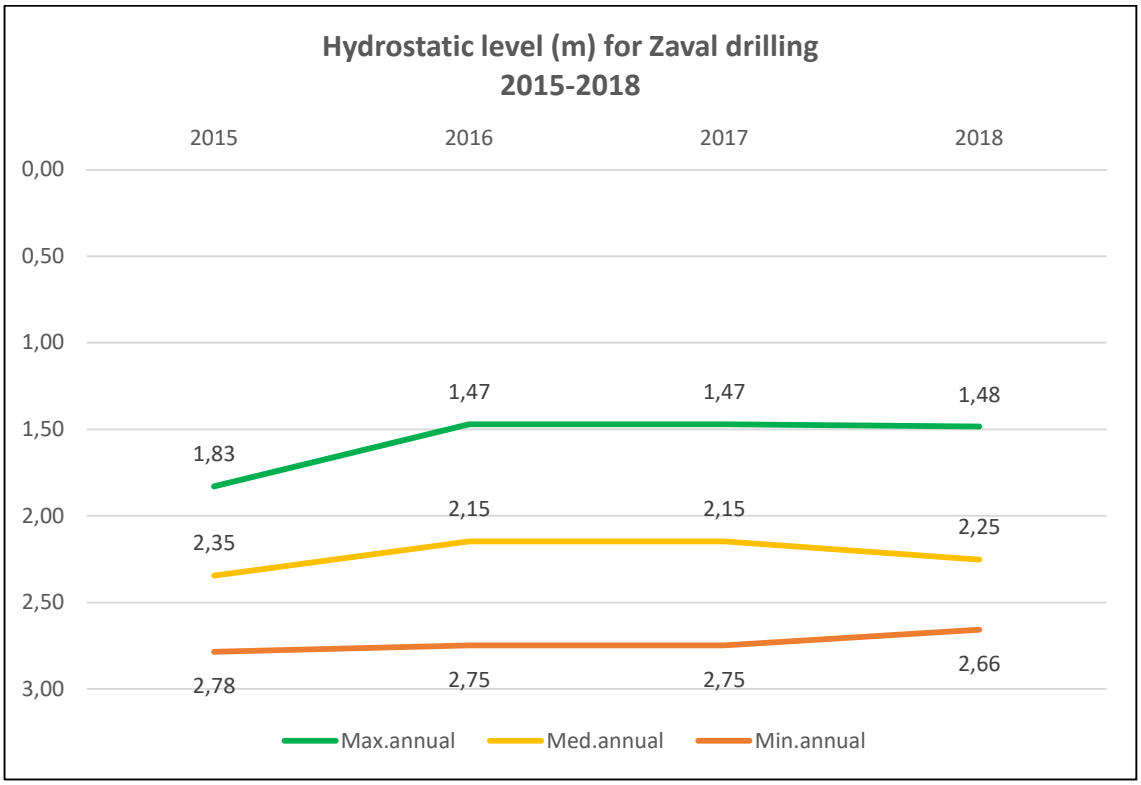

Hydrostatic level (m) for Zaval drilling
2015-2018
2015
2016
2017
2018
0,00
0,50
1,00
1,50
2,00
2,50
3,00
1,83
1,47
1,47
1,48
2,35
2,15
2,15
2,25
2,78
2,75
2,75
2,66
Max.annual
Med.annual
Min.annual

Fig. 3.2.4.7.

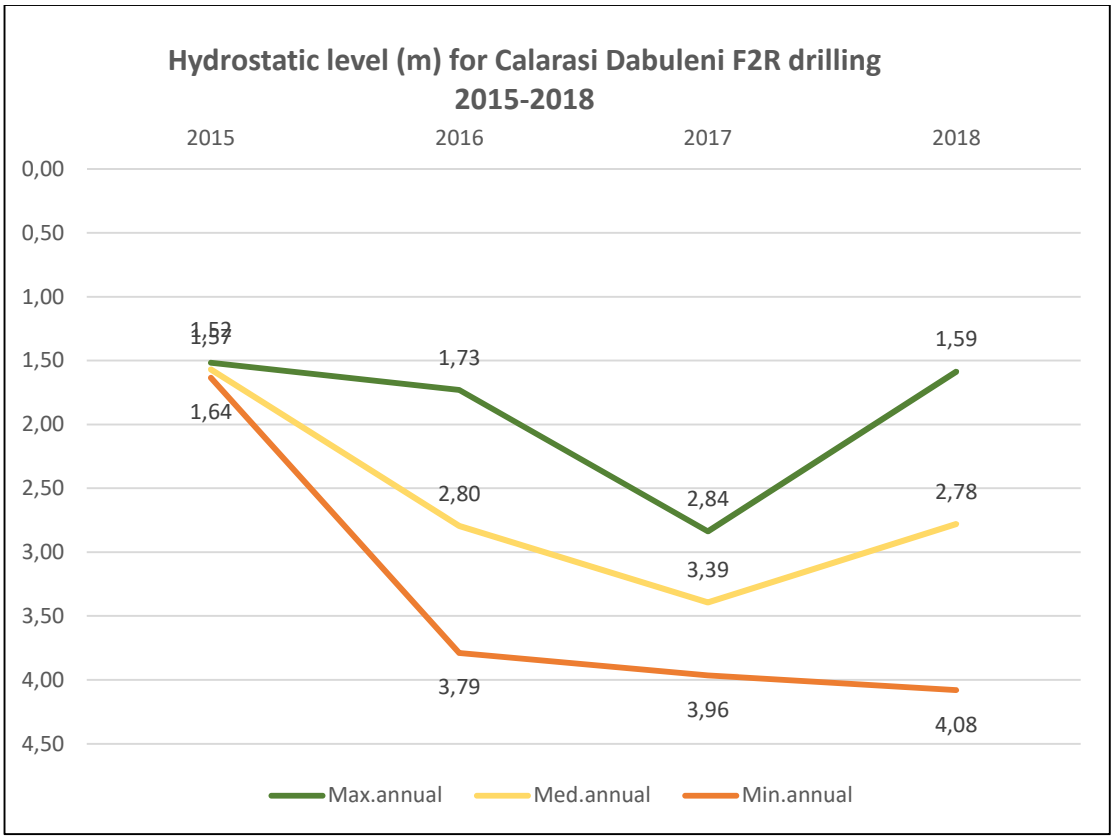


Fig. 3.2.4.8.

Table 3.2.4.2. The surface waterbodies in the pilot area

Water body's name (WB)	**Type of the WB**	**Water body code**	**Quality Monitoring station**	**Ecological Status/ Ecological Potential**	**Chemical status**
DANUBE: IRON GATE II - Chiciu	HMWB	RORW14_B3	Calafat	Moderate potential	Bad chemical status
Jiet (Old Jiu)-spring-Danube confluence with Georocel and Valea Predestilor tributaries	Natural WB	RORW14.1.28_B185	Ostroveni **and** Upstream Danube confluence	Good ecological status	Good chemical status

Jiu - Bratovoiesti-confl. Dunarea	Natural WB	RORW7.1_B148	Zaval	Moderate ecological status	Bad chemical status

In Jiu WBA the water management respects the European legislation in this field, fully transposed into the Romanian legislation. In this sense there are the water quality management plan at the river basin level, the flood risk management plan and the improvement plan.

3.2.5. Landuse and water system (functions)

The Danube river is situated in the southern part of the city, at about 8 km. In the period 1961-1965, all the ponds that existed in this area on the Danube were drained, the territories thus obtained being *used for agriculture*.

(*Source:*http://primariadabuleni.ro/index.php?rewriteparam=prezentare_locala)

Currently the main problem regarding this area is the sandy soils, which sometimes makes it impossible for agricultural use, because the southern Oltenia is currently in a full process of aridization (Păltineanu et al., 2009, Stringer et al., 2009), *the causes being related to the context of climate changes (IPCC, 2007), and to the change of land use at the local level* (*Prăvălie & Sîrodoev, 2013).*

Among the most important changes in land use with real impact in increased aridity phenomenon, it has been noticed the deforestation of forest ecosystems, this meaning the replacement of surfaces covered by forests with another land use category (Sasaki & Putz, 2009).

Maintaining the vegetation in southern Oltenia is vital considering that this area has the most extensive sandy soils in the country (Parichi & Oancea, 1984), following the presence of coarse sandy deposits in the region. These sandy deposits have determined over time a high socio- economic and ecological vulnerability due to phenomenon of wind deflation (Nuta, 2005).
Among the first major research on sandy soils in southern Oltenia in relation to vegetation are the ones from the first half of the twentieth century (Chiriţă & Bălănică, 1938). Present dedicated researches (Dumitraşcu, 2006, Ignat et al., 2009; Achim et al., 2011) have shown that the extinction of vegetation (forest areas and vineyards), in the context of anthropogenic deforestation, especially after political transition year of 1990, increased the effect of wind deflation due to the destabilization of the sand dunes, the adverse consequences being social (the damage of layer soil and decreased agricultural production) and environmental (geographical landscapes degradation) dysfunctionalities.

Currently, in southern Oltenia there can be found three main areas with sandy soils: Jian-Punghina plain (west of the Drincea river) (a), the south of the Băileşti plain continued

with the floodplain of Bistreţ (b) and plains of Dăbuleni and Leu-Rotunda, east of the Jiu river.

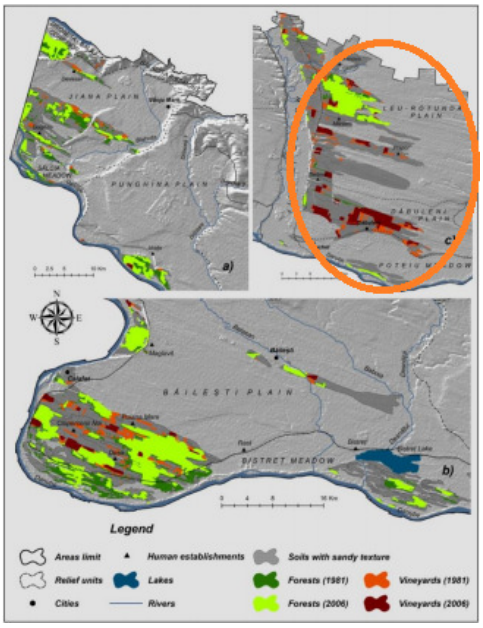


Fig. 3.2.5.1 Spatial-temporal dynamics of the forest and vineyards surfaces in the areas with sandy soils

In the case of the Dabuleni pilot area, (figure 3c), the forest and vineyards decreased by 3% (319 ha), respectively from 10867 ha in 1981 to 10548 ha in 2006, being replaced by uncovered sandy soils. Contrary to previous situations, the forest areas increased in sandy soils perimeter by 4.3% (from 5585 ha in 1981 to 5828 ha in 2006). Vineyards followed downward trend in area, from 5282 ha in 1981 to 4720 in 2006 (decrease of 10.6%).

(Source: Spatial-temporal changes of forest and vineyard surfaces in areas with sandy soils from southern Oltenia Remus PRĂVĂLIE1 1 University of Bucharest, Faculty of Geography*

On the other hand, part of the land in the pilot area is represented by Natura 2000 protected areas

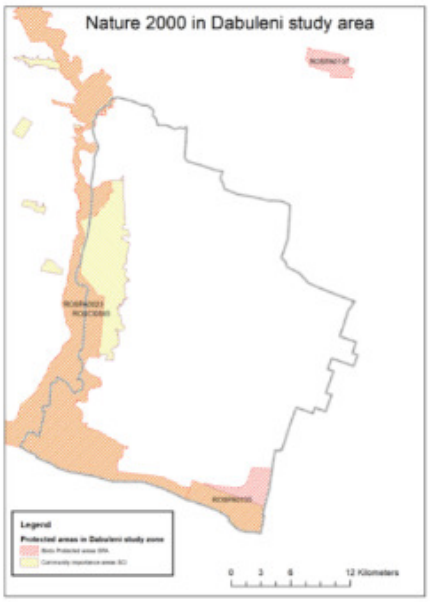


Fig. 3.2.5.2. The main protected areas in Dabuleni pilot zone

Important parts of the study zone are designated as protected areas –for habitats protection- ROSCI0045-*Jiu Corridor* and also for the bird's protection: ROSPA0023- *Jiu-Danube confluence*, ROSPA0135 -*Sands from Dăbuleni.*

3.2.6. Human pressures

The small industry (organized in the spaces of the decommissioned agricultural units or in newly arranged spaces) and the storage activities carried out in the territory of Dăbuleni do not constitute sources of pollution of the environment, according to the" General *Report Dăbuleni – 2016*". On the territory of Dăbuleni can identify potentially ***significant diffuse pollution pressures***, coming from the following main categories of sources:

- *agriculture*: producers who use pesticides and do not comply with the actual legislation; small farmers who do not have proper storage / use systems, which do not have centralized collection systems / individual manure platforms;
- *population* not connected to sewage and sewage networks.

Regarding the connection of the population to the sewage networks and treatment plant system, in the pilot area there are 3 important localities recorded to these systems: Dabuleni town, Calarasi unit and Bechet city (with tertiary treatment plant). The treated water goes to the Jiet river, upstream Danube confluence and finally in Danube.

CHAPTER IV- STAKEHOLDERS ANALYSIS

A. IDENTIFYING STAKEHOLDERS

The main stakeholders interested by the subject of this project are found in the following table:

Table 4.1

The main STAKEHOLDERS ***[name]***	***[level]***	***[relevance (explanation)]***
Minister of the Environment, Waters and Forests	National	Large
National Administration Romanian Waters	National	Large
National Agency of Land Reclamation	National	Large
Ministry of Agriculture and rural development	National	Large
Jiu Water Basin Administration	Regional	Large
Large agricultural commercial farms and commercial companies (holdings)	Regional	Intermediate
A.A.I./O.D.D. (Irrigation/Drainage Water Users Associations	Regional	Intermediate
County Council Dolj	local	Administrator of the Protected Area Jiu Corridor through CJPNTDRD
Dolj Soil Office (OSPA)	local	
Environmental Protection Agency Dolj	local	The most important environmental protection institution from Dolj county
University of Craiova-Horticulture Faculty	local	The Department of Environmental Engineering in Agriculture can provide physic chemical analyses for soil
Mayors of localities from the area affected by drought	local	Land-owners
Research and development Station for plant culture on sand from Dabuleni	local	Agricultural research at local level
NGO's	local	Representatives of civil society

In the area of the project implementation were identified in the working sessions conducted with Dutch partners 4 categories of stakeholders related to solving the problems of water management in areas affected by drought: ***decision makers****-those who make the decisions;* ***input decision making-*** *the most important institutions in solving these problems****; the influencers****-those who exercise (in) formal influence;* ***suppliers/performers****-those who perform or provide knowledge.*

4.1. The decision makers

4.1.1. Dolj OSPA Soil office

The activity of pedological and agrochemical studies, studies and researches in the field of soil sciences in Dolj county carried out by the Office of Pedological and Agrochemical Studies (OSPA), constituted as a specialized unit, started by grouping the different specialized compartments existing in different structures.

OSPA operates on the basis of HG 477/1990, art. 11, as a state institution (public), with legal personality, having as object of activity pedological and agrochemical studies, research in the field of activity, soil analysis, other studies and researches regarding soil as an environmental factor.

Activities:

- drawing up of pedological studies for the realization and periodic updating of the national and county system of soil-land monitoring for agriculture and necessary to substantiate the programs of the Ministry of Agriculture, Food and Forests;

- establishing and maintaining at county level the data banks related to the county-soil-land monitoring systems for agriculture

- pedological studies and the classification of agricultural lands into quality classes, in order to provide the data necessary for the system of taxes and duties for the correct establishment of the tax obligations of the taxpayers in the administrative territories and at the level of the holder; -pedological studies and for the improvement of agricultural lands, in order to establish the tasks that return to agricultural lands as a result of their legal circulation; pedological studies and the reclamation of agricultural lands, for the purpose of concession, lease, merger of plots by owners / exploitations, obtaining the mortgage loan;

- documentation of evaluation for the agricultural land according to the law;

- evaluation, forecasting and warning studies for determining the economic and ecological effects of land improvement works, as well as for degraded lands;

-pedological studies to sustain the projects regarding the impact of some features of the soil on the social-economic objectives; impact studies and the environmental balance sheet for obtaining the environmental authorization

https://www.icpa.ro/documente/ADER%20511_ghid.pdf

4.1.2 Dolj Environmental Protection Agency

- it operates in accordance with the provisions of Government Decision no.1000 / 2012 regarding the reorganization and functioning of the National Agency for Environmental Protection and of the public institutions subordinated to it, of Government Decision no. 544/2012 regarding the organization and functioning of the Ministry of Environment and Forests, as well as other applicable normative acts

- is a public institution with legal personality, subordinated to the National Agency for Environmental Protection, with a decentralized public service status, financed from the state budget;

- fulfils at the county level the attributions of the National Agency for Environmental Protection, respectively: the implementation of policies, strategies and legislation in the field of environmental protection.

- issues regulatory acts in the field of environmental protection, in accordance with the competences assigned by the National Agency for Environmental Protection, provided in the legislation in force.

4.1.3. Minister of the Environment, Waters and Forests

The Ministry of Environment, Waters and Forests implements the national policy in the fields of environmental protection, green economy, biodiversity, protected natural areas, climate change on all sectors and sub-sectors it manages, elaborates the strategy and the specific regulations for development and harmonization of these activities within the general policy of the Government, ensure and coordinate the implementation of the Government's strategy in its areas of competence, fulfilling the role of state authority, of synthesis, coordination, regulation, monitoring, inspection and control in these areas.

The Ministry of Environment, Waters and Forests works to protect the environment and natural resources, to guarantee the present and future generations a clean environment, in harmony with economic development and social progress.

The areas of competence of the Ministry of Environment, Waters and Forests

- control of industrial pollution
- air quality and ambient noise;
- management of protected natural areas, biodiversity conservation, biological security;
- environmental infrastructure;
- waste management
- management of dangerous chemical substances and preparations
- soil and subsoil protection;
- Sustainable development
- green economy
- climate changes

This ministry coordinates the activity of AN Romanian Waters which also coordinates the activity of water management in Romania, implicitly the activity of ABA Jiu.

4.1.4. Local Council Municipalities

The local public administration authorities have the following competences and responsibilities regarding the local public finances:

- elaboration and approval of local budgets, under conditions of budgetary balance, within the deadlines and according to the provisions established by this law;

- establishing, finding, controlling, tracking and collecting local taxes and fees, as well as any other revenues of the administrative-territorial units, through their own specialized compartments, according to the law;

- the monitoring and reporting of the execution of local budgets, as well as their rectification, during the budget year, under conditions of budgetary balance;

-establishing and monitoring the provision of activities in the field of public services of local interest, including the option of passing or not of these services under the responsibility of specialized economic operators or public services of local interest, aiming at their efficiency for the benefit of local communities

- efficient administration of assets from public and private property of administrative-territorial units;

- direct contracting of internal and external loans, in the short, medium and long term, and the follow-up of the payment obligations due from them;

- guaranteeing internal and external loans, in the short, medium and long term, and monitoring the payment on maturity of the payment obligations resulting from the respective loans by the beneficiaries;

- the administration of local public funds during the budget execution, in efficient conditions;

- setting options and priorities in approving and carrying out local public spending;

- elaboration, approval, modification and follow-up of the development programs in perspective of the administrative-territorial units as a basis for the management of the annual local budgets;

- the fulfilment of other duties, competences and responsibilities provided by the legal provisions.

The most important structures in this category are: Dolj County Council, the City Halls of Bechet and Dabuleni and the City Halls of communes: Marsani, Daneti, Sadova, Ostroveni, Dobrotesti, Rojiste, Dobresti, Calarasi, Amarastii de Jos

4.1.5. Ministry of Agriculture and rural development

The Ministry of Agriculture and Rural Development (MADR) is the central public authority responsible for implementing the governance strategy and program, with a role in developing and implementing national sectoral strategies in the fields of agriculture and food production, rural development, land improvements, as well as in related areas: specialized science research, conservation and sustainable management of soils and of plant and animal genetic resources. The organization and functioning of MADR are established by Decision no. 30 of January 18, 2017.

The objectives of the Ministry of Agriculture and Rural Development are the following:

a) ensuring the national food security by increasing and diversifying the agricultural production, in order to guarantee the population sufficient, safe and nutritious food;

b) increasing the competitiveness of the Romanian agro-food and fishery products on the European and global market in order to balance the agricultural trade balance, including through specific information actions;

c) absorption of community funds intended to finance specific domains;

d) financial and fiscal support of agriculture through multi-annual programs;

e) the efficiency of agricultural and agro-food market structures;

f) stimulating the establishment of deposits for the collection, sorting and capitalization of agricultural products;

g) accelerating the process of rural development, including services in the rural area;

h) the modernization and extension of the infrastructure for land improvements, the adaptation of agriculture to climate changes;

i) development of the fisheries sector;

j) supporting agricultural research, information, consultancy, extension and vocational training in agriculture;

k) the reform of the administrative structures with attributions in the field of agriculture, in compliance with the legal provisions in force;

l) development and protection of the mountain area.

4.2. Input decision making

4.2.1. Jiu River Basin committee

The river basin committee is constituted in accordance with Government Low no. 270 of April 3, 2012 regarding the approval of the *Regulation for the organization and functioning of the river basin committees.* The Jiu River basin committee consists of a maximum of 21 members appointed under the conditions of the law. It has a permanent technical secretariat, made up of 3-5 persons, provided by the water basin administration of the respective river basin.

The numerical and nominal composition of the permanent technical secretariat is approved by the committee, at the proposal of the National Administration "Romanian Waters", through the water basin administration of the respective river basin. The committee is composed of:

-2 representatives of the central public authority in the field of water and environmental protection, of which one from its central structure and one appointed from the environmental protection agencies in the respective river basin / area;
- a representative of the public health departments of the counties in the respective river basin / area, appointed by the National Institute of Public Health;

-2 mayors of municipalities and a mayor of a city or commune, elected by the mayors of the localities from the respective basin / hydrographic area;

- a representative appointed by the non-governmental organizations based in the respective river basin / area;

- a prefect from the respective river basin, appointed by the central public authority in the field of administration and interns;

- the presidents of all the county councils in the respective river basin / area;

-3 representatives of the water users from the respective river basin / area, depending on the water requirement and the impact of the waste water discharged on the water resources;

-2 representatives of the National Administration "Romanian Waters", respectively of the basin water administration, recommended by its management;

- a representative from the county commissariats of consumer protection in the respective river basin / area, recommended by the National Authority for Consumer Protection.

- The nomination, respectively the election of the predicted members, is made within 60 days from the date of entry into force of the GL.

- The membership of the committee may cease during the exercise of the mandate that it represents, at the written request of the institutions that made the nomination.

- The representatives of the local public administration authorities elected in the committee shall function within it only during the exercise of the mandate of the function they represent.

- The term of office of the members nominated / elected or recommended of the committee shall be carried out for a period of 4 years from the appointment or election, if they fulfill the necessary conditions in order to maintain the quality of member of the committee.

- Two months before the expiration of the mandate, the permanent technical secretariat has the obligation to request the institutions represented in the committee the nomination / election or recommendation or, as the case may be, the reconfirmation of the nominations of the members.

- Within the same committee, the prefect and the elected mayors will come from different administrative-territorial units.

- In the case of river basin districts with less than 3 counties, 2 of the committee members may come from the same county.

The committee conducts its activity through working meetings and public debates.

At least two working sessions are held annually, the committee being able to meet in working meetings and public debates whenever necessary.

***A list with the members of the Jiu basin committee will be presented in the annexes to this report **(Appendix 1).**

4.2.2. National Agency of Land Reclamation (ANIF)

The National Agency for Land Improvements, is a public institution subordinated to the Ministry of Agriculture and Rural Development, is established by Government Emergency Ordinance no. 82 - regarding some measures of organization of the activity of land improvements, approved by Law 199/2012, with the subsequent modifications and completions.

The agency subordinates to its central unit and 16 territorial subsidiaries of land improvements, without legal personality, which may have organized units organized at the level of land improvement arrangements or groups of land improvement arrangements. The National Agency for Land Improvements carries out the following activities:

a) the exploitation, maintenance and repairs of the arrangement of land improvements declared of public utility, except for the arrangements or parts of the development taken

over by the federations, as well as of the arrangements for which the recognition of public utility was withdrawn and within which the organizations were established;

b) the execution of the conservation works of the arrangement of land improvements;

c) dismissal of the works from the land improvement arrangements or parts of the development to which the recognition of public utility and the valorization of the resulting materials were withdrawn;

d) rendering in the agricultural circuit of the lands resulting from the decommissioning of the land improvement works;

e) making investments for the rehabilitation of the existing land improvement arrangements and the execution of new arrangements;

f) information and training in the field of land improvements;

g) realization and ensuring the functioning of the national system of surveillance, evaluation, forecast and warning regarding the economic and ecological effects of the land improvement activities;

h) ensuring the supply of water to some localities, fishing facilities, agricultural and industrial premises, through the arrangements of land improvements under its administration, according to the law;

i) the provision of land improvement services to organizations, federations and other natural and legal persons;

j) international cooperation, within the limits of the authority granted by the ministry;

k) conducting other activities of public interest

l) putting into service of desalination stations in the area of localities, agricultural lands, hydrotechnical construction infrastructure;

m) carries out activities for the supply of electricity in accordance with the legal provisions in force.

For the project, the activity of ANIF Dolj is relevant, being an important player in the area of project implementation.

4.2.3. Drinking water company (CAO)

The Oltenia Water Company (CAO) ensures wastewater treatment through the Lower Danube Zonal Center for Bechet, Dabuleni, Calarasi, the treatment plant is located in Bechet, its projected capacity being 21,000 equivalent inhabitants, providing treatment in the third tier. It has been operating since 2018, the connection level being about 18%. The drainage of waste water in this station is carried out in the Jiet river, upstream of the confluence with the Danube River.

The drinking water supply is assureated in Dabuleni pilot area from the next groundwaters bodies: Marsani– 2 drillings (ROJI07 – Oltenia), Sadova-6 drillings (ROJI05 Jiu's meadow and terraces), Ostroveni -1 drilling (ROJI07 – Oltenia), Bechet -3 drillings (ROJI06-Danube's meadow and terraces), Dăbuleni-6 drillings (ROJI06-Danube's meadow and terraces), Dobrotești-3 drillings (ROJI07 – Oltenia) and Calarasi-2 drillings (ROJI07 – Oltenia) .

***A list with the irrigation/drainage Water Users Associations, with the Agricultural Commercial Farms, with the farmers and the landowners and also with the commercial companies (holdings) will be attached in the annexes of this report (**Appendix 2**).

4.2.4 Recreation and tourism

Unfortunately, in the area of the project implementation there are a few pensions and hotels (in Bechet), tourists accommodation can sometimes be ensured in the houses of the local inhabitants in the project area.

Tourism could certainly help to diversify the regional economy, but will likely not become a significant economic activity. The Danube River bank, an archaeological site and Jiu Corridor protected area (Nature 2000) are currently the main tourism attractions, especially for the bird's observers. There are at this stage virtually no tourist facilities in the area. Currently the cycling tourists bypass the area because the infrastructure is down.

4.2.5. Suppliers/performers-those who perform or provide knowledge-Internal college, media, teachers, Electricity Company, schools, sstudents from various universities- University of Craiova-Horticulture Faculty (The Department of Environmental Engineering in Agriculture can provide physic chemical analyses for soil).

THE RESEARCH AND DEVELOPMENT STATION FOR PLANT CULTURE ON SANDS DĂBULENI (SCDCPN)

In 2005, through the HG 1881/2005 was established the Centre for Research - Development for Plant Culture on Sands Dăbuleni , through the reorganization of the Central Research Station for Plant Culture on Sands Dăbuleni and its merger with the Potato Research and Production Station of Mărşani.

THE OBJECTIVES OF THE RESEARCH - DEVELOPMENT ACTIVITY

- Developing and perfecting the technology for improving and exploiting sandy soils
- Improving the assortment of plant species and varieties recommended in culture on sandy soils
- Creation of new genotypes for some plants specific to sandy soils (peanuts, beans, garden beans, watermelons, tomatoes, peppers, cabbage, leeks, watermelons)
- Improvement of the cultivation technologies of the species that efficiently harness the ecological conditions in the areas with sand and sandy soils
- Development of sweet potato cultivation technologies in the context of climate change and elaboration of measures to promote the culture in Romania
- Development of agro-chemistry, biochemistry and physiology researches for the foundation of new plant cultivation technologies
- Development and foundation of an integrated system of prevention and control of pathogens, pests and weeds in sandy soil crops
- Management of agricultural crops and farms
- Protection of ecosystems in areas with sandy soils
- Obtaining an assortment of pink wines, red and special aperitif wines
- Determining the quality and capitalization of agricultural production

The Influencers-those who exercise (in) formal influence-NGO's: *Ape fara plastic/ Water without plastic; Asociatia Clubul Sportiv Recolta Ostroveni/Association Sports Club Ostroveni Harvest*

B. Process of involving

The process of informing and consulting the public is a continuous and transparent process, which is carried out in accordance with European legislation.

✓ Measures for public consultation and involvement

- organization of meetings within the Jiu River Basin Committees in order to consult the stakeholders and the public regarding our work activities, in the context of carrying out updated the river basin management plans for river basins / hydrographic spaces
- sending via e-mail questionnaires addressed to all stakeholders, so that they can express their views on the ongoing activities. These will be transmitted in any way to the stakeholders
- *** In this context you can see *the questionnaire on important water management issues in the Jiu River Basin- 2019* **(Appendix 3)**
    - A questionnaire (10 questions) was elaborated concerning water management issues from A.B.A. Jiu. It has been sent to 95 interested factors (stakeholders) up until now and 35 responses have been received, as well as different points of view with regard to these problems http://www.rowater.ro/dajiu/Documente%20Consultarea%20Publicului/Forms/AllItems.aspx

- conducting thematic meetings to set up ad-hoc working groups, so that stakeholders can actively participate in the consultation process.

✓ Measures for communication

Publishing on the ABA and ANAR websites the documents elaborated in order to carry out the updated Management Plans for the river basins / spaces (2022-2027) and the updated Flood Risk Management Plans (2022-2027);

Creation of an online electronic system, through which the visitors of the websites can see the updated management plans of the river basins / hydrographic spaces or other documents realized following the activities developed in order to elaborate them, can express their opinion on the most important water management problems http://www.rowater.ro/dajiu/Documente%20Consultarea%20Publicului/Forms/AllItems.aspx

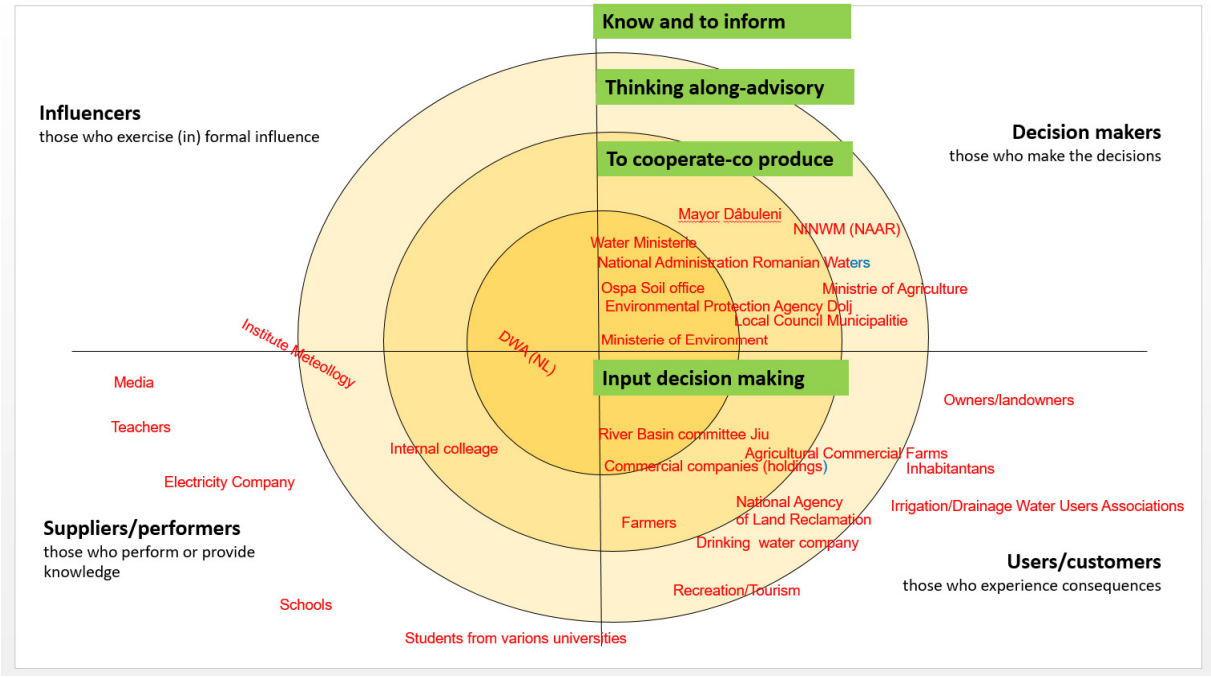
- This document is a preamble at PMB Jiu, cycle III (2021-2027)

- sending e-mails, faxes, letters informing interested parties about the publication of these documents on the mentioned websites;
- making leaflets and letters regarding the specific activity and transmitting them by any means to the stakeholders;
- publication of the articles in the local / national press which informs the public relevant information regarding the implementation of the updated management plans of the hydrographic basins / spaces (2022-2027) and the updated Flood Risk Management Plans of the (2022-2027)
- organizing specific activities: working sessions, workshops (eg International Danube Day, World Water Day, etc.), opportunity to inform and increase public awareness of the need to participate in the planning process at the river basin level. and at national level;

C. Abstract of the stakeholders analysis

a) Identification of stakeholders in the pilot area

The identification of the main stakeholders was achieved together with the Dutch team, within the workshop organized by ABA Jiu in June 2019, and the result is presented in the sketch below.



Analysis of stakeholders

I. Farmers

The most important farmers in the pilot area are listed in Annex 2 of the final report for the Dabuleni project area. 32 big farmers were identified, administrators of some farms with areas between 12 and 387 ha. Crops range from wheat, sunflower, corn to hybrid crops, resistant to drought conditions such as blueberries, currants, sea buckthorn.

Small farmers are very numerous, almost all households have an individual plot where watermelon (Dabuleni watermelon), melon, cereals, grapevine, etc. are traditionally grown.

II. Municipalities

All town halls in the existing localities in the Dabuleni pilot area received information about the BLUE DEAL project *Integrated water resources management in drought-affected areas from Oltenia Plain with the stakeholder's involvement - the drought case study in the Dabuleni area*.

The specialized offices from town halls provided information about the big farmers and about the local projects regarding centralized water supply, sewerage or treatment. The most active and involved were the town halls of Bechet, Sadova and Marsani.

III. NGOs

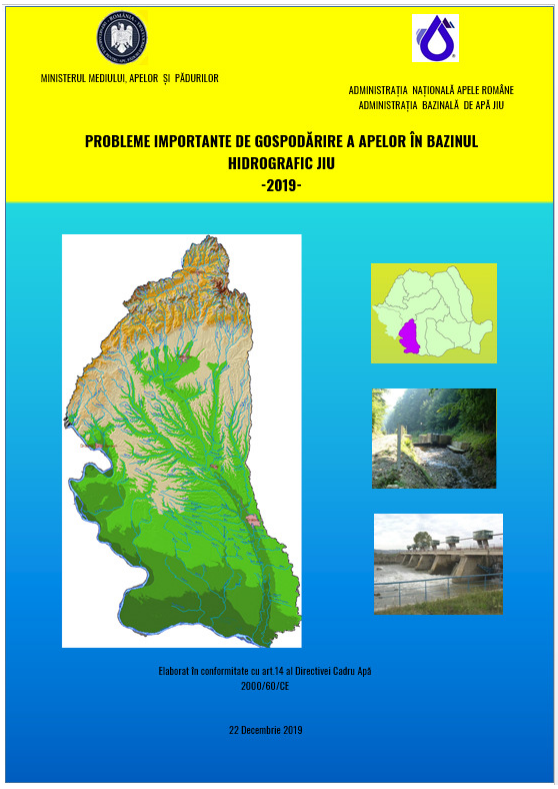
The most important NGOs, active in terms of safety and protection of the main environmental components (water, air, soil), which responded to the questionnaires submitted by ABA Jiu, are*: Water Without Plastic, Serban Low Office, NGO PETROAQUA.*

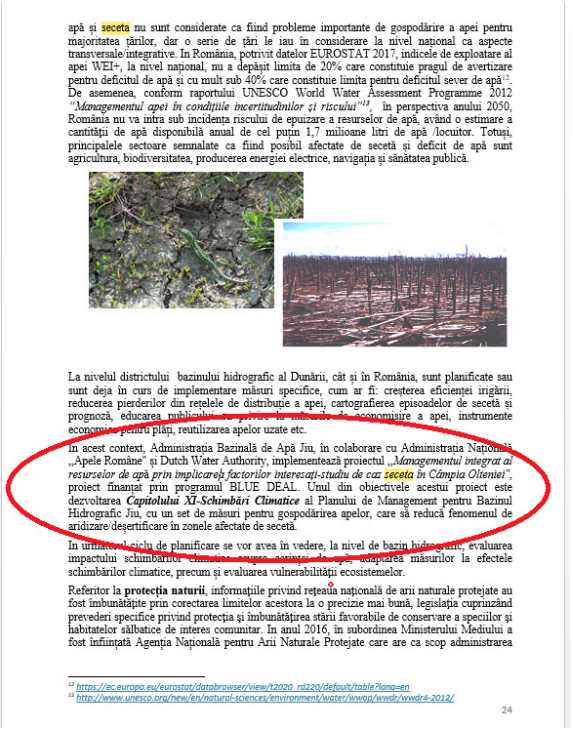
Environmental NGOs could be much more active in terms of providing information and awareness, as well as collaboration with state institutions in order to implement large projects for the protection of natural resources and biodiversity.

b) The process of involving stakeholders

Several documents related to the drought issue have been designed for the Dabuleni pilot area. According to the requirements of WFD 60/2000/EEC, a very extensive material was elaborated containing problems of water management in the HB Jiu. This document was posted on the ABA Jiu website in December 2019 at the following link:
http://www.rowater.ro/dajiu/SCAR/Planul%20de%20management.aspx

The BLUE DEAL, IWRM project was also presented here





apă și seceta nu sunt considerate ca fiind probleme importante de gospodărire a apei pentru majoritatea țărilor, dar o serie de țări le iau în considerare la nivel național ca aspecte transversale/integrative. În România, potrivit datelor EUROSTAT 2017, indicele de exploatare al apei WEI+, la nivel național, nu a depășit limita de 20% care constituie pragul de avertizare pentru deficitul de apă și cu mult sub 40% care constituie limita pentru deficitul sever de apă[12]. De asemenea, conform raportului UNESCO World Water Assessment Programme 2012 *"Managementul apei în condițiile incertitudinilor și riscului"*[13], în perspectiva anului 2050, România nu va intra sub incidența riscului de epuizare a resurselor de apă, având o estimare a cantității de apă disponibilă anual de cel puțin 1,7 milioane litri de apă /locuitor. Totuși, principalele sectoare semnalate ca fiind posibil afectate de secetă și deficit de apă sunt agricultura, biodiversitatea, producerea energiei electrice, navigația și sănătatea publică.

La nivelul districtului bazinului hidrografic al Dunării, cât și în România, sunt planificate sau sunt deja în curs de implementare măsuri specifice, cum ar fi: creșterea eficienței irigării, reducerea pierderilor din rețelele de distribuție a apei, cartografierea episoadelor de secetă și prognoză, educarea publicului cu privire la măsurile de economisire a apei, instrumente economice pentru plăți, reutilizarea apelor uzate etc.

În acest context, Administrația Bazinală de Apă Jiu, în colaborare cu Administrația Națională „Apele Române" și Dutch Water Authority, implementează proiectul *„Managementul integrat al resurselor de apă prin implicarea factorilor interesați-studiu de caz seceta în Câmpia Olteniei"*, proiect finanțat prin programul BLUE DEAL. Unul din obiectivele acestui proiect este dezvoltarea ***Capitolului XI-Schimbări Climatice*** al Planului de Management pentru Bazinul Hidrografic Jiu, cu un set de măsuri pentru gospodărirea apelor, care să reducă fenomenul de aridizare/deșertificare în zonele afectate de secetă.

În următorul ciclu de planificare se vor avea în vedere, la nivel de bazin hidrografic, evaluarea impactului schimbărilor climatice asupra cerinței de apă, adaptarea măsurilor la efectele schimbărilor climatice, precum și evaluarea vulnerabilității ecosistemelor.

Referitor la **protecția naturii**, informațiile privind rețeaua națională de arii naturale protejate au fost îmbunătățite prin corectarea limitelor acestora la o precizie mai bună, legislația cuprinzând prevederi specifice privind protecția și îmbunătățirea stării favorabile de conservare a speciilor și habitatelor sălbatice de interes comunitar. În anul 2016, în subordinea Ministerului Mediului a fost înființată Agenția Națională pentru Arii Naturale Protejate care are ca scop administrarea

[12] https://ec.europa.eu/eurostat/databrowser/view/t2020_rd220/default/table?lang=en
[13] http://www.unesco.org/new/en/natural-sciences/environment/water/wwap/wwdr/wwdr4-2012/

24

For the content of this material, the Questionnaire on general water management issues was designed (Appendix 3 of the final report), which was sent to the stakeholders. The link to the document posted on the ABA Jiu website was added to the questionnaire.

http://www.rowater.ro/dajiu/SCAR/Planul%20de%20management.aspx

A second questionnaire (Appendix 4 of the final report) was specifically designed for stakeholders in the area affected by desertification and drought - Dabuleni. Due to the COVID-19 pandemic, some of the questionnaires were sent electronically (via e-mail), others by mail, and in some cases telephone conversations took place. In Romanian, the questionnaire was downloaded from the ABA Jiu website.

http://www.rowater.ro/dajiu/Proiecte/Forms/AllItems.aspx?RootFolder=%2fdajiu%2fProiecte%2fProiect%20Finantat%20Blue%20Deal&FolderCTID=&View=%7bE6893FDC%2dEB8B%2d4B04%2d8C8F%2dA6F7939C8201%7d

Punctual problems of different water users (stakeholders) are frequently reported in written form (notifications or petitions). They reach the technical departments and punctual solutions are

found for each problem. In 2020, 67 petitions were registered, each interested factor receiving answers according to the legislation in force.

c) Communication methods

The main way of communicating water management information in the Jiu RBA was, in 2020, the online environment, using the Jiu WBA website(www.abajiu.ro and a number of social networks. There has also been a lot of material and information in the written press on this subject, and the members of the Jiu River Basin Committee (Appendix 1) have received news related to water management problems in the entire Jiu WBA, during the period of restrictions generated by the Covid-19 pandemic (via e-mail). Specific issues arising in this context are discussed through video conferences.

In the Dăbuleni pilot area, face to face meetings with farmers are taken into account when the situation will allow it.

CHAPTER V- TRENDS / SCENARIOS (FUTURE)

a) Climate change (temperature, ET, P)

The phenomenon of global warming has led to an increase in the frequency of extreme events, the rapid alternation between severe heat / severe drought and heavy rainfall / floods being increasingly evident. Climate change in Romania is part of the global context, taking into account regional conditions.

The rise in temperature will be more pronounced in summer, while in north-western Europe the most pronounced increase is expected in winter. Thus, in Romania an increase of the average annual **temperature** is expected compared to the period 1980-1990:

- between 0.5 ° C and 1.5 ° C, for the period 2020-2029
- between 2.0 ° C and 5.0 ° C, for 2090-2099

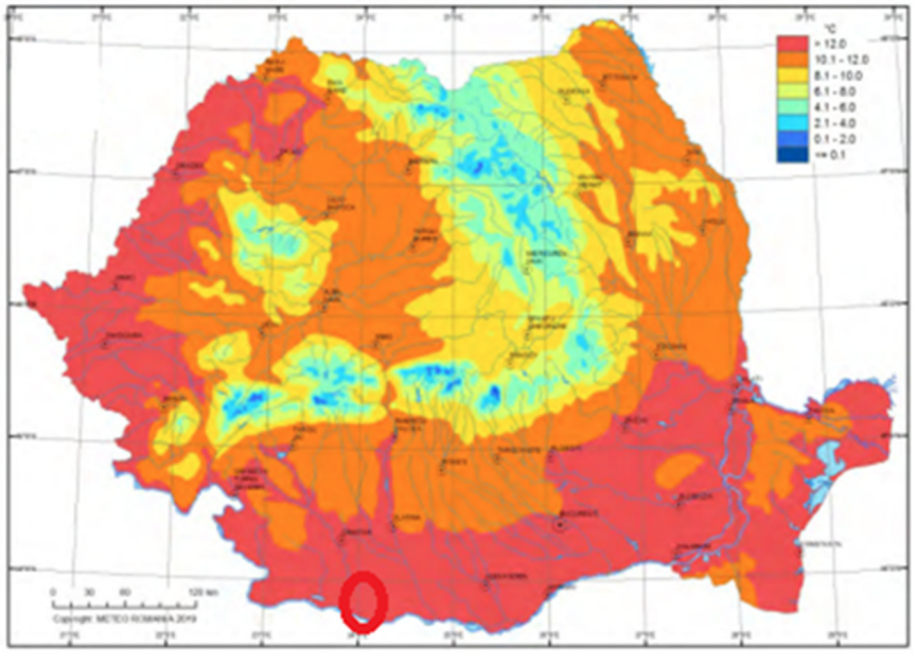


Fig.5.1 Annual air temperature 2018 (NAM source)

The potential **evapotranspiration** (ET) in the pilot area is between 51-60 mm, according to studies conducted by forestry institutions (fig.5.2).

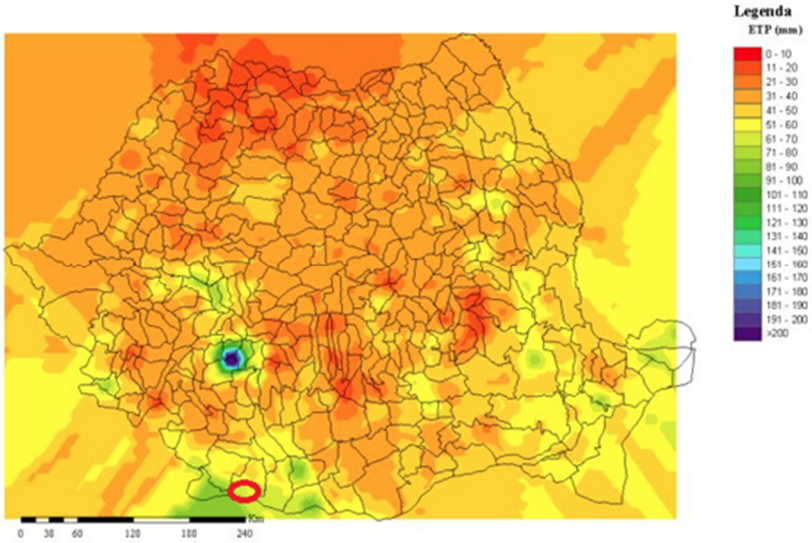


Fig. 5.2. Potential evapotranspiration (Romsilva source)

In terms of **precipitation** (rainfall), the analyses indicate the existence, especially after 1961, of a general downward trend in annual rainfall throughout the country and a pronounced increase in the shortage of rainfall in southern and eastern area of Romania.

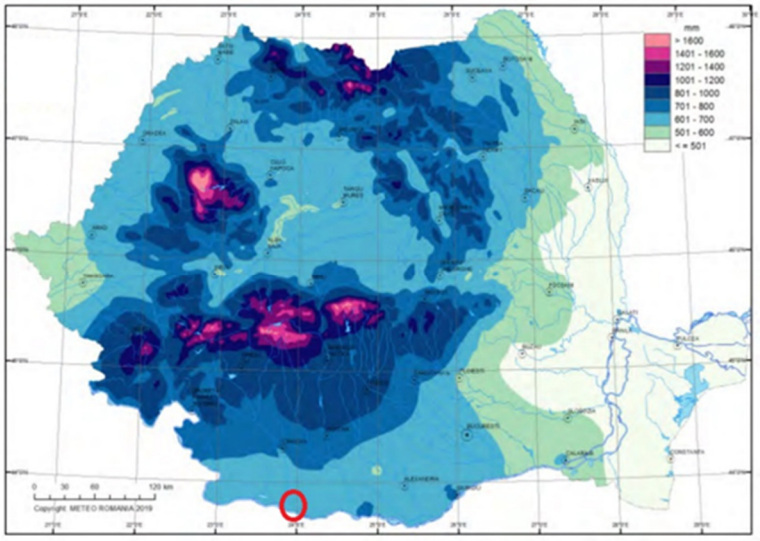


Fig. 5.3. Annual rainfall - 2018 (NMA source)

b) Socio-economic development

From a socio-economical point of view, in Dăbuleni pilot area there can be observed a decay of the population in the region as well as a numerical decrease in the number of inhabitants (SNI conclusions, according to the last census). Agriculture is still the main activity, but due to the accentuation of the process of aridity and desertification, the exploited areas in this respect are more and more reduced. Under these conditions, the investments for the restoration of the irrigation system are extremely important for the development of agriculture in this area; agriculture remains anyway the main activity of the inhabitants of the Danube Flood Plain. Other economic activities in the pilot area are those related to the crossing of the Danube River through Bechet Custom-House. There are activities related to trade, the industry being non-existent in the area.

c) Demographic development

According to Eurostat (2017) reports, the population growth rate has acquired a negative trend (-0.6%) in Romania. According to the latest assessments, if in 2018 there were 1,461,661 inhabitants in Jiu HB, in 2030 the population will be approximately 1,344,000 inhabitants (in the entire river basin), marking a decrease of approximately 117,661 inhabitants (about 8.04%).

d) The development of agriculture

Even if the population is declining, agriculture will continue to be practiced, both individually and in an associative system, so the project to restore the irrigation system is important for the economy of the area. On the other hand, it is very possible that a part of the population that emigrated will return to the country and continue to practice agriculture, as farmers in the area currently do. If nothing is done, the irrigation system will continuously deteriorate to total destruction, and agricultural production will be in a continuous decline, which does not correspond to European and global trends.

e) Hydrological changes

i. Groundwater

Phreatic groundwater bodies (ROJI05, ROJI06) are in poor chemical condition due to nitrate pollution from agricultural sources. There are no water bodies at quantitative risk, and deep waterbodies (ROOT13, ROJI07) are exploited for agriculture or in order to supply localities. The evolution of groundwater levels over a longer period of time could be evaluated in studies developed by NIHWM.

ii. Surface water

The hydrographic network in the pilot area is very poor. This area, from a geomorphological point of view, belongs to the terraces and meadows of the Danube, which on the left bank, the Romanian bank, presents a great development. In the northern part of the pilot area there can be easily observed the wind action and its results, the sand dunes.

The most important surface waters in this part of the Oltenia Plain are the Danube River and the Jiu River, but also the Jiet River, considered in the specialty literature as a former course of the Jiu River, today an independent river basin.

The Danube River is monitored by the Bechet hydrometrical station which belongs to the Arges-Vedea Water Basin Administration.

Jiu river is monitored by the JIU Water Basin Administration -*Hydrology Service* through the Zaval hydrometrical station. The average multiannual flow at this station is 91 m^3 / sec (the period in which hydro-meteorological measurements were made is between 1950-2019).

Regarding the extreme flows, there are the following values: the minimum registered flow is 9.00 m^3 / sec - 21.08.1990 and the maximum registered flow is 1690 m^3 / sec on 11.10.1972.

In the last 20 years at this hydrometric station, we can observe 9 years in which the average annual flows were below 100 m3 / sec and 11 years with flows above this value. Annual minimal flow (Qmin) for 20 years was 52.4 m^3 / sec (2001) and the maximal annual flow (Qmax-20 years 172 m3 / sec (2014).

Jiet river (small Jiu, or old Jiu) is monitored by the JIU Water Basin Administration / Hydrology Service through the Ostroveni satellite hydrometric station (1 measurement / month). The average multiannual flow at this station is 0.436 m^3/sec (the period in which hydrological measurements were performed is between 2006-2019).

Regarding the extreme flows, there are the following values: the minimum recorded flow is 0.265 m^3/ sec (December 2009) and the maximum flow recorded is 0.658 m^3/sec in (March 2018).

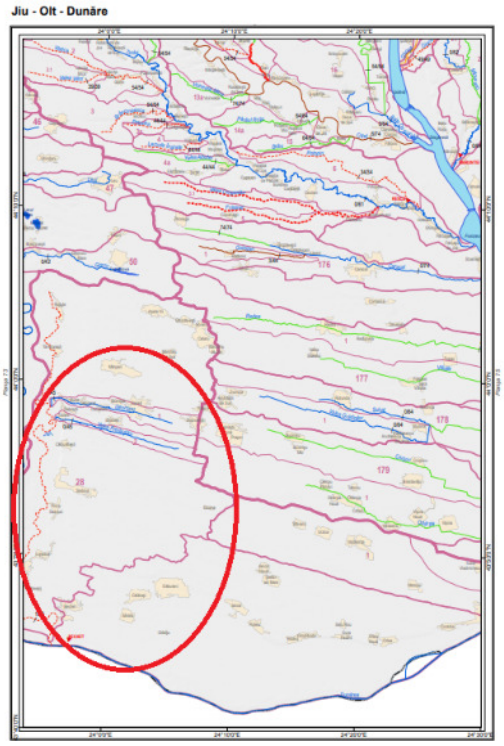


Fig. 5.5. Hydrographic network in the pilot area

The hydrographical network in the pilot area is very poor. As we said before, the most important surface waters are the Danube River and the Jiu River. According to the study conducted by NIHWM in 2017 regarding the elaboration of the *Drought Atlas*, a large part of the rivers

in the Oltenia Plain show drying phenomena, and for the Jiu River the average multiannual flow shows a decrease of 11%. The Jiet river frequently manifests a drying phenomenon.

Table 5.1. Drinking water supply for the main localities in the pilot area

Nr. Crt.	Abstraction name	Emplacement	Water body code and name	Administrator/ Powered localities	County	Flow (l/sec)	Population served
1	Dabuleni	Dunarea, 4 urban and 6 extra-urban drillings in the North of the Dabuleni area	Depth/ ROJI07 - Oltenia	Compania de Apa Oltenia S.A., Centrul Zonal Dunarea de Jos: Dabuleni, Bechet, Calarasi / Dabuleni	DJ	6,448	6905
3	Amarastii de Jos – satele Amarastii de Jos, Prapor	3 drillings in the urban and extra-urban area of Amarastii de Jos, Dolj County	Depth/ ROJI07 - Oltenia	Amarastii de Jos town / Amarastii de Jos, Prapor	DJ	6,773	4260
4	Diosti – satele Diosti, Radomir	Gioroc 2 drillings in the urban and extra-urban area of Diosti	Depth/ ROOT13- the West of Valahe Drepression	Diosti town / Diosti, Radomir	DJ	3,457	1423
5	SC ECO NRG SRL	1 drilling - Ostroveni	Depth/ ROJI07 - Oltenia	SC ECO NRG SRL	DJ	-	-
7	Mirsani	2 drillings in the urban area of Mirsani	Depth/ ROJI07 - Oltenia	Mirsani town / Mirsani	DJ	0,526	140
8	Negoi	1 drillingin the urban area of Negoi	Depth/ ROJI07 - Oltenia	Negoi town /Negoi	DJ	1,113	2235

iii. **Drinking water supply** (Jiu RBMP source, Register of Protected Areas, chapter 2)

Centralized water supply is a priority in the pilot area, especially for the town halls of the localities situated in the Danube Meadow, the supply of the main localities being ensured from a groundwater source, as follows in the Table 5.1 ROJI05 and ROJI06 phreatic groundwater bodies are only used for centralized household users.

iv. Irrigation

In 2019, the Sadova-Corabia irrigation system (part of the ANIF system) used 4172,149 thousand cubic meters of water (6550.33 thousand cubic meters of water in 2018). The irrigation system on the right side of the Jiu River: Nedeia-Macesu area (part of the ANIF system), contracted 38903,883 thousand cubic meters of water in 2019 (36372.64 thousand cubic meters of water in 2018). There is also the Association of Individual Water Users (FOUAI) Calafat-Băilești, which used 10613,569 thousand cubic meters in 2019 for irrigation (5039.29 thousand cubic meters in 2018). It can be said that there is an upward trend in terms of water consumption for agriculture / irrigation, but the problems that may occur in the pilot area are: high cost of electricity needed for the pumping system, decommissioning of secondary canals of the current irrigation system, cultivation of plants that are sensitive / not adapted to drought.

CHAPTER VI- PROBLEM ANALYSIS (PRESENT VS. FUTURE)

a) Mono disciplinary

i. Drought

In the South of Romania, the sand swallows over a thousand hectares every year. In the absence of appropriate measures, in the next 50 years, the surfaces with fertile soils could be completely covered with sand, says Anca-Luiza Stănilă, researcher at the Institute for Paedology, Agro chemistry and Environmental Protection (ICPA).

Aridity, caused by climatic factors, came together with desertification, to which human intervention also contributed. Out of the desire to transform wetlands into agricultural lands, in the pre-December 1989 period about 26% of the large flood plains were subjected to depletion, especially in the Danube Flood Plain, an example for the Dabuleni pilot area being Potelu Lake, 47 kilometres long and wide, in some places, up to 9 km (Fig.6.1 and Fig.6.2).

Fig.6.1 Dabuleni area (Potelu lake) before damming

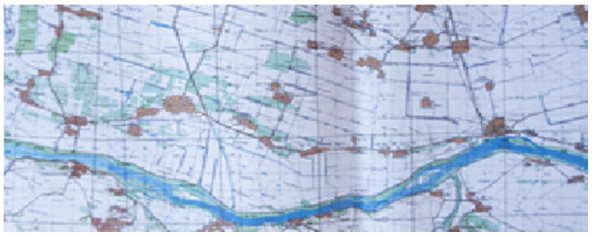


Fig. 6.2 Dabuleni area after damming/banking

ii. Desertification

A Romanian study shows that aridity has already covered 150,000 hectares in South-Western Romania and more than 700,000 are in the same danger. Moreover, in September 2019, the president of the Academy of Agricultural and Forestry Sciences, Valeriu Tabără, former Minister of Agriculture, stated in an interview for Agerpres, that "70 percent of the country's surface has entered in a process of aridity." Thus, the trend for this phenomenon is an increasing one on the medium and long term.

Of the total area of 88,000 Ha of the pilot area, a part of it is affected by desertification (the red colour on the map in Figure 5.3), respectively 49,000 Ha, and the aridity with expansion tendencies outside the pilot area, affects 39 Ha (the orange colour on the map).

Fig.6.3 Desertification and aridity of lands in the Dabuleni pilot area

iii. Water requirements

For this topic, the Development Plan of Jiu HB refers to the "*Project on Rehabilitation and Reform of the Irrigation Sector, Romania*" which shows that the Sadova-Corabia irrigation system is currently under rehabilitation and it is considered economically viable. As a result of the analysis of Annex 2 of the previous report, the total area designated for irrigation in the Jiu River Basin, considered economically viable, consists of the area set up within the Sadova-Corabia system related to Dolj County, of 54154 ha. According to the data provided by ANIF Dolj, it is possible that in the future the maximum irrigated area will reach approx. 204.000 ha. Under these conditions the water demand in agriculture will increase about 4 times.

Increasing trends for the pilot area are also noticeable in the field of animal husbandry, due to the increase of the animal population in the pilot area.

Forecasted water volumes (mil/m3)

Ann	2015	2020
Urban area		
The basic scenario	90	85
The maximal scenario	92	89
The minimum scenario	88	81
Rural area		
The basic scenario	36,5	49,3
The maximal scenario	37,4	51,4
The minimum scenario	35,6	47,2

	2013			2015			2020		
	The minimum scenario	The average scenario	The maximum scenario	The minimum scenario	The average scenario	The maximum scenario	The minimum scenario	The average scenario	The maximum scenario
Water for population	there are no set goals			123,6	126,5	129,4	128,2	134,3	140,4
Industrial water	-	-	-	669	669	669	1200	1200	1200
Irrigations	139	139	139	-	-	-	250	250	250
Animal husbandry	6	6	6	-	-	-	15	15	15
Aquaculture	45,5	45,5	45,5	45,5	45,5	45,5	45,5	45,5	45,5
Total	-	-	-	**-**	**-**	**-**	**1638,7**	**1644,8**	**1650,9**
Water supply share (%)				-	-	-	7,8	8,2	8,5
Industrial water share (%)				-	-	-	73,2	72,9	72,7
Agriculture water share (%)				-	-	-	19	18,8	18,8
Population (inhabitants)				-	-	-	1316514	1374769	1433350
Utilization rate per capita (m3 / year)				-	-	-	124,5	119,6	115,2

According to the document elaborated by the European Commission in 2009 WEI+ indicator from *Water Scarcity & Drought*, if this indicator is below 10%, then it is considered that water resources are not under pressure. If it is situated between 10 and 20% then it is considered that the water resources are subjected to a reduced pressure, and values of the exploitation index higher than 20% indicate the existence of a pressure on the water resources. Although the above-mentioned document prepared by the European Commission determines the exploitation index at the country level, it is not a mistake to determine and judge it at the river basin district level.

Water availability and water pressure indicators

The River Basin	Population (inhabitants) 1424262	Water Resources (mil/m^3)		Water availability indicators (m^3/inhabitant)		Quantity pressure on water	
		Average year	Dry year	Average year	Dry year	Sampling 2007 (mil/m^3)	Exploitation index (%)
JIU		2682	1578	1883,08	1107,94	809,84	30,2*

* the water resources of the Danube River were not taken into account

According to the * data in the table above, it can be concluded that the Jiu River Basin, having a water exploitation index of 30.2% for HB Jiu, higher than 20%, is under pressure regarding the water resources.

iv. Nature

From the point of view of nature protection, what can be said at this moment is the fact that for the protected areas management plans will be implemented, especially those of the protected natural areas ROSCI0045 Jiu Corridor, ROSPA0023 Jiu-Danube Confluence, ROSPA0010 Bistreț and the natural reservations Drănic-2,391 fossiliferous place and Zăval Forest-IV.33, managed by the Dolj County Center for Nature Protection, Tourism and Sustainable Rural Development and for which there is a management plan approved by the Ministry of Environment, Waters and Forests.

The following nature protection projects related to the pilot area are taken into account, for which applications have been submitted for financing through the POIM program Axis 4, OS 4.1:

1) "Ecological rehabilitation of the Jieț River, in order to achieve environmental objectives" – 3,400,000 Euro

2) Ecological rehabilitation of the Teslui river, in order to achieve the environmental objectives on the sector Langa – Olt confluence, Olt county - 2,000,000 Euro

3) Restoration of wetlands for the Jiu River, Bratovoiesti-Dobresti sector – 3,000,000 Euro

4) Monitoring and maintaining the favourable conservation status of the species of flora and fauna inventoried in the Jiu Corridor – 10,000,000 Euro

v. Vulnerable groups (small farms, poor people, minorities – gypsies)

In Oltenia, most households / families own small plots of land, used exclusively for subsistence agriculture. Poverty affects almost 1/3 of the population, Romania has reached a rate of risk and social exclusion of 32.5% in 2018 (EU average is 22%). Also, the rate of materially disadvantaged people decreased from 29.8% in 2013 to 16.8% in 2018, the EU rate is almost three times lower (5.8% in 2018). The percentage of the population living in damaged establishments fell to 10.1% in 2018, below the EU average of 13.9% in 2018.

According to the data provided by the European Commission, the trends regarding the poverty of the population in the area are hopeful (Source - The latest country report of the European Commission for Romania - February 2020, which largely analyses the situation in 2019 and the prospects for the coming years). Regarding minorities in the pilot area there are small communities of ethnic Bulgarians, Greeks and last, but not least, the Roma population. According to the latest census in Romania there are approximately 5% Roma ethnics in the population of the Dabuleni pilot area, as shown in the figure below (Fig. 5.4).

Fig.6.4. Results of the 2011 national census (gypsy population at national level)

Integration and an overall problem analysis, holistic

In order to have a holistic approach of the problems of the pilot basin, we have delimited two areas of interest (Fig. 5.3.):

- the area of large farms (red area) is the area that completely overlaps the Bechet-Corabia-Sadova irrigation system and corresponds to an area of 49000 Ha, presenting similar, general problems;

- the area of small farms (orange area), is the area located in the northern part of the pilot area Dăbuleni and it has an area of approximately 39000 Ha.

In the red zone it is necessary to implement urgent measures to rehabilitate the irrigation system, and in the orange zone there is a need for massive reforestation with sand-fixing species. This last measure can also be implemented by the red area in order to diminish the effect of drought from Dabuleni pilot area.

SOLUTIONS FOR THE RED AREA:

- implementation by ANIF and the Ministry of Agriculture of the projects that will ensure the existence of water on the agricultural lands through a good functioning of the irrigation systems
- development of public-private partnerships to ensure the transfer of water from the Danube (from the main canals) towards the fragmented plots / lots belonging to large and small farmers
- development of research in order to obtain drought-resistant hybrids (plant varieties)

All requests and problems of NGOs have received timely answers, and other issues raised by stakeholders will be developed in the draft PMB Jiu 2022-2027 (before December 31, 2020).

Unfortunately, due to the Covid-19 pandemic, face-to-face meetings were not possible throughout 2020. There is a great reluctance regarding the effective involvement of stakeholders.

CHAPTER VII- SHORT-TERM AND LONG-TERM MEASURES FOR THE PILOT AREA

Some of the measures presented in this chapter are taken from the questionnaires answered by the interviewees (large farmers, small farmers, research institutions, universitie, etc.) and are presented in sub-points i, ii, iii of this chapter.

We also presented the issues raised by the main factors interested in drought management and in the table format were presented concrete measures proposed in the online workshop conducted with Dutch partners in September-October 2020 (Table 7.1.), to which were added a list of measures resulting from the projects proposed by NAAR, MEWF, Jiu WBA and Olt WBA.

i.Small farmers / inhabitants

From the questionnaires received from small farmers, we centralized their following requests:

-Implementation of the solutions to limit the desertification process of the area (eg. planting acacia forests), increase productivity and implicit profits

-resizing the farms, diversifying the types of crops

-Creating centers for product capitalization and building factories for processing agricultural products
-Establishment of agricultural cooperatives, with associative character (Amarasti farmer proposal)
-Use of the solar panels to benefit from cheap energy (Amarasti farmer proposal)
-rebuilding the irrigation system (proposed by Dabuleni farmer)

-restoration of fishing areas in the Danube Floodplain (renaturation)

ii. Big farmers

The discussions with the big farmers were carried out by telephone, and they answered punctually to the questionnaire elaborated by the Jiu WBA specialists in collaboration with the Dutch experts. The most important measures proposed can be summarized as follows:

1. The irrigation system administered by ANIF should be functional in the long term, and the farmers must receive insurance in this regard, preferably through measures/legislative amendments to ensure this

2. Establishment of a tax/subscription for large farmers to ensure a functional irrigation system in the medium and long term, favorable to perennial crops, orchards, etc. (involvement of OUAIs)

3. The groundwaters of medium depth (40-45 m) and big depth (200 m) are in a very good quality, but from quantity point of view, the water from the Danube River is preferred.

4.Bringing the water from the large irrigation canals (the main ones) on the areas cultivated by large farmers, needs other projects that involve other rather high costs (secondary water distribution canals on the plots within the farm, costs of electricity needed for pumping, high-performance irrigation, etc.)

5. The Ministry of Agriculture and ANIF should implement large projects for the rehabilitation of irrigation infrastructures in the pilot area

6.One of the big farmers proposes to follow a project implemented in Urzica locality (Olt county) which had in view the restoration of a pumping station by accessing European funds (as a model of good practice for our project)

iii. Craiova University

A group of specialists (university lecturers) from the Faculty of Geography of the Craiova University, who had publications, papers and research in the Oltenia Plain, answered the questionnaire sent by Jiu WBA bringing the following observations and suggestions for improving the conditions in the areas affected by the drought (Dabuleni area), which we present briefly as follows:

- Maintaining / improving soil quality is a priority

-aware of the population regarding the balanced water consumption

-factual non-observance by farmers of the codes of good practices in agriculture

- a better management of the local administrations and a good collaboration with the state authorities and also with the investors from the area, increasing their motivation in the local development

-reforestation on large areas

- biodiversity conservation

-rehabilitation of fishing areas

-bands / roads for cycling

-birdwatching corridor

- product diversification, promotion of regional products specific to sandy areas

-orientation towards BIO products

-Demographic and spatial decongestion of the urban environments. Diversification of economic activities in rural areas and reduction of aging status in this environment

-Climatic factor and pedological conditions, sandy soil favors water infiltration. Climate drought entails hydrological drought and in the last phase pedological drought.

iv. Public institutions and town halls in the project implementation area:

-They requested regular information regarding the novelties in the issue of water protection management and the organization of several meetings with stakeholders where to analyze the problems

-They requested that there be a permanent link between the water management authority and the local public administration in order to raise awareness of the importance of water management issues.

v. Issues raised by NGOs

- Providing more information about the evolution of pollution sources in Jiu River Basin/Catchement area

vi. Measures proposed by the NAAR, Jiu WBA, Olt WBA

The measures proposed by the NAAR, Jiu WBA and Olt WBA consist in the development of projects that have in view the ecological rehabilitation of the rivers in the pilot area, through the implementation of which not only an increase of biodiversity is obtain, but also a good achieving of the FWD 2000/60/EEC objectives of improving the ecological status of surface water bodies, but also an improvement of the status of historically degraded sites in the pilot area.

The main projects proposed by water management institutions have been described in Chapter V, but are also listed in Table 6.1 as measures that can be included in the river management plans at the basin level. In this context, we also mention the *Danube FLOODPLAIN* project promoted by NA *Apele Romane*, for which it was selected as a pilot area of the Bistret-Nedeia-Jiu floodplain, located "in the mirror" on the right bank of the Jiu River.

Table 7.1. Centralization of the measures that can be implemented at the level of the Dabuleni pilot area

Nr. Crt.	Proposed measure	Who proposes?	Who can implement the measure?	Risks / Remarks
1	Rehabilitation of the Sadova-Corabia irrigation system for and maintaining it in working order	Big farmers	Ministry of Agriculture ANIF Dolj	The main risk can be the Danube River water quality. On the other hand the neighborhoods with Natura 2000 protected sites can be an impediment. There is a project completed in 2017, financed by the World Bank
2.	Use of groundwater (deep water bodies) for irrigation in agriculture fields	Big farmers	Big farmers	It is not approved by the Romanian Water Law (Strategic resource) From Quantity point of view the ground water bodies can be affected in the long run.
3	Improving the condition of the secondary irrigation canals	Big farmers	ANIF Dolj Ministry of Agriculture	There are project proposals in this regard, some have already been started
4	Extension of the			**Requires Fesability Study (FS)** Land

	channel systems for smaller lots in the pilot area	Big farmers	Big farmers ANIF Dolj Ministry of Agriculture	improvement specialists claim that they have found through other projects that in the Danube Floodplain the land configuration has changed a lot compared to the 70s.
5	Adaptation of the irrigation system to the conditions of the area, to the types of crops and to the climatic changes (use of other irrigation methods - eg drop by drop, etc ..)	Dutch specialists	ANIF Dolj Ministry of Agriculture Big farmers	There is research conducted within Dabuleni Research Institute
6	Adaptation of crops to the conditions of the area Use of hybrid varieties adapted to drought	Dutch specialists	Big farmers Small farmers	There are researches conducted within Dabuleni Research Institute. Large farmers implement sea buckthorn, raspberry, etc. crops.
7	Ensuring cheap and ecological sources of electricity in the pilot area, necessary for the pumping system (fields with solar panels or the use of windmills)	Dutch specialists Rast Mayor	The mayors of the Danube Floodplain localities	**Requires Fesability Study (FS)** In the Danube Floodplain, windmills represent a great risk for the migratory birds, the area being known for the migration corridors for reproduction / nesting / food and

				also for the birdsfauna protection sites from the Natura 2000 network.
8	Improving soil quality with organic substances	Dutch specialists	Big farmers Small farmers with support from National Research and Development Institute for Pedology, Agrochemistry and Environmental Protection Bucharest	**Requires FS / study / research**
9	Recharging aquifers	Dutch specialists	It can become a project / study proposal in the Jiu WBA portfolio	**Requires FS / study / research** At this moment, Jiu WBA and NIHWM have not designated the groundwaterbodies at quantitative risk.
10	Use of treated wastewater for irrigation in agriculture	Dutch specialists	It can become a project / study proposal in the Jiu WBA portfolio	**Requires FS / study / research** (possible from Bechet treatment plant)
11	Use of water from Isalnita reservoir (Jiu river) in order to assure the	Dutch specialists	NAAR	**Requires FS** The drinking water

	irrigation for agriculture fields in the pilot area (a project for development of the irrigation system in the orange and red areas designated in Dabuleni pilot area -*see the Fig. 5.3.)*	Jiu WBA- Technical director, Mr. Marin Talau	MEWF AM ANIF Jiu WBA	supply of the Craiova city may be affected The terrain configuration has changed a lot in the last decades and can prevent such a project
12	Wetlands restoration for the Jiu River, in Bratovoesti -Dobresti sector	Jiu WBA	-Jiu WBA *-Jiu Corridor* protected area Administrator	A FS was already proposed for rehabilitation of the Dobresti-Bratovoiesti wetland sector, the West border of the pilot area
13	Ecological rehabilitation of the Jieț River, in order to achieve environmental objectives	Jiu WBA	-NAAR -Jiu WBA -Dolj CWMS *Jiu Corridor* protected area Administrator	The application for POIM financing was submitted Axis 4, SO 4.1. (including for FS) (3 400 000 Euro)
Proposals from the Dutch team and the international Wetskills team				

Nr. Crt.	Proposed measure	Who proposes?	Who can implement the measure?	Risks / Remarks
14	Reorientation/ adaptation of crops - such as melons, tomatoes, cucumbers, cabbage, fodder crops, fruit trees (peaches, apricots, cherries), beans, peas, lupine…	Wetskills team Brigade conference	-Development and research center for Dabuleni sand plant cultivation -Big farmers -Small farmers	There are researches at the Dabuleni Research Institute It is in the process of implementation
15	Transformation of sandy soil into arable land	Wetskills team Brigade conference	-Development and research center for Dabuleni sand plant cultivation -Big farmers -Small farmers	There are researches at the Dabuleni Research Institute
16	Rainwater retention (water retention in healthy organic soil)	Dutch specialists Wilfried Heijnen		Sandy soil does not naturally allow long-term water retention
17	Buffer rainwater (addition of groundwater)	Dutch specialists Wilfried Heijnen		Natural phenomenon

18	Bring (supply) water from reservoirs (eg drinking water supply from Dutch Lake IJssel)	Dutch specialists Wilfried Heijnen		**Requires FS / study / research**
19	Infiltration of 25% of rainwater in built areas	Limburg WA Arnaud presentation		It is done naturally
20	Increasing soil infiltration by 10%, improving soil quality	Limburg WA Arnaud presentation		**Requires study / research**
21	Sub-irrigation of agricultural land	Limburg WA Arnaud presentation		It is possible to practice already experimentally on small batches
22	Water conservation by increasing the surface water level, deep drainage	Limburg WA Arnaud presentation		The measure can be added to the list of activities of the projects proposed for implementation in the pilot area
23	Restoration of the river using its entire floodplain	Limburg WA Arnaud presentation		It is found in the proposals for river ecologysation projects in the pilot area
24	Creating a buffer system around the Natura 2000	Limburg WA	-MEWF	**Requires FS / study / research**

	network and wetlands (without groundwater exploitation; improving water quality)	Arnaud presentation	-ROMSILVA -NAAR -Jiu WBA - Administrators / custodians of protected areas	
25	Afforestation of hills (peaks and slopes) Creating green corridors	Limburg WA Arnaud presentation	ROMSILVA MMAP	**Requires FS / study / research**
26	Protection of water sources and springs	Limburg WA Arnaud presentation	Jiu WBA Olt WBA	It is currently insured according to the WFD 2000/60/CEE and the Romanian Water Law
27	Ecological rehabilitation of the Teslui river, in order to achieve the environmental objectives on the sector Langa-Olt confluence, Olt county.	Olt WBA	-NAAR -Olt WBA -Olt CWMS	The application for POIM financing was submitted Axis 4, SO 4.1. (including for FS) (Budget 2 000 000 Euro)
28	*Integrated Nutrient Pollution Control additional financing*	MEWF NAAR Jiu WBA	-MEWF -NAAR -Jiu WBA	It is being implemented

b. **Through the BLUE DEAL partnership**, a list with proposals for measures were brought (table 6.1), some of them being brought by the international interdisciplinary team WETSKILLS, measures that were presented at the 2018 BRIGADE conference. Most of them are basic measures applied for farmers in the Netherlands, but in Romania the climate, the soil conditions and the relationship with the stakeholders are very different compared to Western European countries, and the implementation of new measures is slow and requires time.

c. WFD 2000/60/EEC measures

The measures proposed for compliance with the requirements of WFD 60/2000/EEC are measures taken by Jiu WBA, NAAR and Olt WBA for the surface water bodies in order to achieve the "*good status*" of the waterbodies, all measures being included in the rivers basin management plans. The list of projects promoted by water management institutions is presented in Chapter V.iv, also including the project proposed by the Administrator of the Jiu Corridor protected area (Nature 2000 network), as well as in the cost-benefit analysis from the following sub-point (Chapter VI, sub-point d).

d. Cost-benefits analyse

We mention that the members of the Jiu WBA team do not have the expertise in cost-benefit analysis, an approach to this issue is done further (Table 7.2), taking into account the budgets allocated measures for which there are cost estimates:

Table 7.2. Cost-benefit analysis for measures implemented in the Dabuleni pilot area by water management institutions

Nr. Crt	The proposed measure	Cost	Benefit
1	*Ecological rehabilitation of the Jieț River, in order to achieve the environmental objectives.*	3 400 000 Euro	Implementation of the WFD 2000/60/EEC Compliance with 78/659/EEC Directive Nature 2000 network protection Compliance with the Habitats Directive Compliance with the Birds Directive

			Recharging aquifers Creating a favorable microclimate (Benefits for: biodiversity, water bodies, nature, communities in the area)
2	*Ecological rehabilitation of the Teslui river, in order to achieve the environmental objectives on the sector Near the Olt confluence, Olt county.*	2 000 000 Euro	Implementation of the WFD 2000/60/EEC Compliance with 78/659/EEC Directive Nature 2000 network protection Compliance with the Habitats Directive Compliance with the Birds Directive Recharging aquifers Creating a favorable microclimate (benefits for: biodiversity, water bodies, nature, communities in the area)
3	*Wetlands restoration for the Jiu River on Bratovoesti - Dobresti sector*	3 000 000 Euro	Implementation of the WFD 2000/60/EEC Compliance with 78/659/EEC Directive Compliance with the Flood Directive

			2007/60/EEC Nature 2000 network protection Compliance with the Habitats Directive Compliance with the Birds Directive Recharging aquifers Creating a favorable microclimate (Benefits for: biodiversity, water bodies, nature, communities in the area)
4	*Monitoring and maintaining the favorable conservation status of the species of flora and fauna inventoried in the Jiu Corridor protected area*	10.000.000 Euro	Nature 2000 network protection Compliance with the Habitats Directive Compliance with the Birds Directive Creating a favorable microclimate (Benefits for: biodiversity, water bodies, nature, communities in the area)
5	*,,Integrated Nutrient Pollution Control additional financing´´*	4,54 million Euro / Jiu WBA	Implementation of the Nitrates Directive (91/676 / EEC), an integral part of the Water Framework Directive (60/2000/CEE) (benefits for: water bodies,

		50 million Euros nationwide	agriculture, local communities)
6	**TOTAL**	**22,94 million Euro**	**Implementation of the WFD 2000/60/EEC** **Compliance with 78/659/EEC Directive** **Compliance with the Flood Directive** **2007/60/EEC** **Nature 2000 network protection** **Compliance with the Habitats Directive** **Compliance with the Birds Directive** **Implementation of the Nitrates Directive (91/676/EEC),** **Creating a favorable microclimate** **(Benefits for: biodiversity, water bodies, nature, communities in the area)**

e) Sources of financing

For the projects presented in table 7.2 there are applications submitted in the period 2019-2020, being selected the best sources of funding, to which it has already been applied.

For the greening projects of the rivers Teslui and Jiet, for the restoration of the historical wetland Jiu: Bratovoiesti-Dobresti sector, the JIU WBA, NAAR and Olt WBA have chosen the financing from POIM 2014-2020, Priority Axis 4 *Environmental protection through biodiversity conservation measures, air quality monitoring and decontamination of historically polluted sites*; SO 4.1 *Increasing the degree of protection and conservation of biodiversity and restoration of degraded ecosystems.*

For the project: ***Monitoring and maintaining the favorable conservation status of the species of flora and fauna inventoried in the Jiu Corridor*** was applied for the same financing from POIM 2014-2020, Priority Axis 4, SO 4.1, but the applicant is the Administrator of the Natura 2000 network site, *Jiu Corridor* .

The World Bank has financed important projects, such as: "*Integrated Control of Nutrient Pollution*" and *Rehabilitation of the Irrigation and Drainage System at Sadova-Corabia* (2007-2011). Co-financing of these large projects is provided by the Romanian government sources.

CHAPTER VIII-PROPOSED SCENARIOS ON SHORT AND LONG TERM FOR DABULENI PILOT AREA

The scenarios developed in this chapter took into account all the documents available at this time, starting from the Dutch model applied in other project, implemented by Jiu WBA through Romania-Netherlands's collaboration (2007-2012).
The most important document from the point of view of Romanian specialists is the National Strategy for reducing the effects of drought on short, medium and long term, from which the sectoral objectives were taken over: https://lege5.ro/Gratuit/geydqojqg4/strategia-nationala-pentrureducerea-efectelor-secetei-pe-termen-scurt-mediu-si-lung program?dp=gmzdcojwgm2dc

The most important sectoral objectives set out in this strategy are:
A. Restoration by redevelopment of the Danube Meadow and the meadow areas of some inland rivers
B. Creation of some ponds in suitable areas in Moldova, Muntenia, Oltenia, Transylvania and Maramureș
C. Rehabilitation of existing irrigation systems and construction of new systems
D. Reforestation and curtaining
E. Use of varieties, seeds and seed material with increased drought resistance
F. Establishment of crops according to the weather forecast for the next agricultural year
G. Reorientation towards crops suitable for arid areas
H. The use of valuable soil technologies in arid areas
I. Protection and sustainable land use

Scenario proposals
a) Possible scenarios (for one important area)
i. Agriculture (Costs 20.1 million Euros, Benefit 4 p)
This scenario brings the most important measures for the development of large and small farms in areas affected by drought, and these measures are summarized as follows:
- Rehabilitation of existing irrigation facilities and / or construction of new facilities where it is possible
- Use of varieties / seed and seed material with increased drought resistance
- Establishment of crops according to the weather forecast for the agricultural year
- Reorientation towards crops suitable for arid areas

- Use of suitable working technologies in arid areas
- Protection and sustainable land use
- Creating some centers for product capitalization and building some factories for processing agricultural products
- Ensuring some cheap and ecological sources of electricity in the pilot area, necessary for the pumping system (fields with solar panels or the use of wind power plants - 10 million Euros)
- Improving soil quality with organic substances
- Use of treated wastewater for irrigation in agriculture
- Use of suitable working technologies for soil in arid areas
- reorientation towards BIO products
- Integrated Control of Nutrient Pollution from Agricultural Sources

-FS-100000Euro

Benefits for

- Small and large farmers
- Economic development of the area, respectively of the local communities
- Recharging groundwater bodies
- Improving the zonal and regional microclimate, according to the hydrological regime

ii. Optimal implementation of WFD 60/2000 / EEC (Costs 12.94 million Euro, Benefit 8 p)

- Renovation by redevelopment of the Danube Floodplain and the meadow areas of some inland rivers (Jiu, Jiet, Teslui)
- Creation of ponds in suitable areas in Oltenia (source: the National Strategy for Drought Combating)
- Restoration of rivers using their entire floodplain
- Integrated Control of Nutrient Pollution from Agricultural Sources
- Ecological rehabilitation of the Teslui river, in order to achieve the environmental objectives on the sector near the Olt confluence, in Olt County
- Ecological rehabilitation of the Jieț River, in order to achieve environmental objectives
- Restoration of wetlands for the Jiu River, on Bratovoiesti-Dobresti sector
- Restoration of fishing areas in the Danube meadow
- Protection of water resources and springs

Benefits for

-NAAR, Jiu WBA, Olt WBA by complying with the requirements of the WFD 2000/60/CEE, respectively for the achievement of the "*good status*" of surface water bodies and the implementation of the Jiu RBMP

- increasing aquatic and riparian biodiversity and restoring degraded sites
- Improving the zonal microclimate
- Economic development of the area, respectively of the local communities
- direct and indirect benefits for the Nature 2000 network of protected areas
- ecotourism development

iii. Natura (Costs 13,8 millions Euro, Benefit 5p)

This scenario provides the following measures:

- Redevelopment of the Danube Floodplain and the meadow areas of some inland rivers
- Reforestation and curtaining on large areas
- Afforestation of hills (peaks and slopes) and creation of green corridors (3700 Euro / ha- for 5000 seedlings / ha), approximately 1000 Ha = 3.7 million Euro
- Restoration of wetlands for the Jiu River, on Bratovoiesti-Dobresti sector (**only FS-100000Euro)**
- Creation of a buffer system around the Nature 2000 network and on wetlands (without groundwater exploitation)
- Monitoring and maintaining the favorable conservation status of the flora and fauna species, inventoried in the Jiu Corridor - 10 million Euros

Benefits for

- direct benefits for the management of the Nature 2000 network of the protected areas
- increasing aquatic and riparian biodiversity
- benefits for ROMSILVA
- ecotourism development
- development of local communities

Combined scenarios

Nr. crt.	Scenario	Benefits	Risks	Costs	Final score
1	**Scenario 1** **Nothing is done**	**0**	Extension of aridization / desertification	**0**	**0p**
2	**Scenario 2** **FWD+Nature**	-NAAR, Jiu WBA, Olt WBA by complying with the requirements of the WFD, respectively for the achievement of a "*good status*" of the surface waterbodies and the implementation of Jiu RBMP - increasing aquatic and riparian biodiversity and restoring degraded sites - Improving the zonal microclimate -Economic development of the area, respectively of the local communities - direct and indirect benefits for the Natura 2000 network of protected areas - reforestation and curtaining on surfaces as much as bigger -ecotourism development	Lack of funds for financing / co-financing of proposed projects	**26,74 millions Euro**	**14 p**
3	**Scenario 3** **Agriculture+ economic benefits**	- A good functioning of the Sadova-Corabia irrigation system - Development of large and small farms in the pilot area - Increasing productivity in agriculture	- Risk-quality of the Danube River water that can increase the loads of pollutants in the soil (loading of the soil with pollutants brought from Danube) - The vicinity of Nature 2000 protected sites can be an impediment, especially SPA - Land improvement specialists claim that they have found through other projects that in the Danube Meadow the land configuration has changed a lot compared to the 70s. **- Requires FS**	**20,1 millions Euro**	**4p**

Through the comparative analysis of the proposed scenarios, we consider that the combined scenario number 2, FWD + Nature, would be beneficial and would bring great benefits in the area.

CHAPTER IX -SCHEDULE SHORT-TERMS LONG-TERMS

The planning is an important stage in terms of implementing measures and in order to improve the water management in Jiu Catchment Area.

After the centralization of all the proposed measures, all of it will be re-evaluated following the discussions within the project team and with the Jiu WBA top management.

Regarding the short-term planning of the project measures, we consider that it is essential the completion of the report for water management in drought-affected areas of Jiu River Basin (IWRM stakeholders' involvement-Drought) comply with the planning made for the development of the river basin management plan cycle Jiu (2022-2027), and the final report of the BLUE DEAL project to represent a model of drought management in affected areas of the Oltenia Plain.

Publishing the draft of the Dabuleni pilot area Drought project report (June 30, 2021);

- Public consultation regarding the draft of the of the Dabuleni pilot area Drought project report (June 30, 2021 - December 30, 2021);
- Revision of the draft of the of the Dabuleni pilot area Drought project report (January, 2022 - March 22, 2022).

This report will be an appendix of the Jiu RBMP, and in the long run an implementation of the technically feasible measures proposed in the report obtained through the BLUE DEAL project is expected, which will be directives transferred in chapter IX of PMB Jiu 2022-2027, realistic measures that can be implement in the drought-affected area of Jiu River Basin.

CHAPTER X-COMMUNICATION WITH STAKEHOLDERS

Communication with the stakeholders has been made and will be made permanently within ABA Jiu, in response to the requirements of WFD2000/60/CEE and the Flood Directive 2007/60 / CEE. The main communication method used is the technical committee at the level of the Jiu River basin, which has as its component the main representatives of the Romanian state institutions, local communities, regional institutions, the main economic operators, NGOs, etc. (Appendix 1). Through this structure, meetings and communications are periodically organized regarding the solution of the main water management problems.

The communication activity with the interested parties is currently carried out through the approvals and authorizations service of ABA Jiu and of each county Water Management System. Another team that keeps in touch with partners interested in water management is the team for solving petitions and requests from outside our institution.

As the planning and implementation of this activity must be a firm, continuous and achievable process, we bring the following proposals to improve this activity in terms of communication with stakeholders on the issue of drought in Jiu River Basin.

IX.1. Planning

1) Individual meeting (face to face) with the main actors from the Dabuleni pilot area (ANIF Dolj, ICPN Dabuleni, mayors from the area) (**March -September 2021)**

2) Creating accounts on Facebook and Instagram / twitter to publicize the drought issue in the pilot area Dabuleni and to ensure the distribution of questionnaires on this subject –(**June -September 2021)**

3) Organizing virtual meetings with residents and farmers in the area, distributing information leaflets, questioning people in the field (**June-September 2021**)

4) Organization of a debate and working meeting at the headquarters of Jiu WBA/ Dolj CWMS- (**June-September 2021**)

5) Awareness of the drought issue in Jiu River Basin through the local press and by using the Jiu WBA website (www.abajiu.ro) and creating a link regarding the drought communication problem in Jiu WBA - (**June-September 2021**)

6) Elaboration of presentations and scientific articles on the subject of drought in Jiu River Basin – (**September-December 2021)**

7) Presentation and debate of the drought issue at the Annual Scientific Conference of the NIHWM on the issue of drought in the Oltenia Plain-(**September-December 2021)**

Fig. 9.1 Dabuleni pilot area (Google maps sources)

IX.2. Implementation of the proposed measures

The implementation of the previously proposed measures for the communication component will be the task of the implementation team of the IWRM -Drought project, Dabuleni pilot area, which will make a direct correlation with the implementation schedule of Jiu RBMP, especially in terms of promotion, information and awareness general water management and especially those related to drought.

These measures will be monitored by the group of managers of Jiu WBA and ANAR (project implementation coordinators).

The water authorities will insist on the problem of drought and will start from the trends of variation of meteorological parameters, studied following the analysis of flow evolution simulations, when changes in the multiannual average flow regime were observed for rivers studied in Jiu Catchment Area and specially for the Jiu River an annual flow decrease of approx. -11.0%.

Data and information presented in the study "*Identifying the main potentially deficient areas in terms of water resources, at national level, in the current regime and in the perspective of climate change*", prepared by the National Institute of Hydrology and Water Management, at the request of the NA " Apele Române "shows that for the future period (2021-2050) compared to the reference period (1971-2000), as a result of the trends of variation of meteorological parameters, following the analysis of flow evolution simulations, it resulted that the river basins with the largest deficits of the average multiannual flows are: Vedea, **Jiu**, Siret, Olt and Argeş.

The implementation of the main measures in order to reduce the pressure exerted by reducing the water resource will be done using the management plan as a tool. The supplementary measures that have the potential to be implemented in the next cycle of the plan (2022-2027), will be brought in chapter IX of PMB Jiu where very clear deadlines will be passed regarding their implementation.
Those who will follow this aspect are the members of the Jiu River Basin Management Plan team and the top management staff of Jiu WBA.

Dabuleni pilot area measures list (PROPOSALS)

Nr. Crt.	Masura propusa	Who proposes it? / Source	Who can implement it?	Risks/Observations
1	Rehabilitation of the irrigation system for Sadova-Corabia precinct and maintaining it in working order	Big farmers	Ministry of Agriculture ANIF Dolj	Danube River water quality risk
2.	Use of groundwater (deep water bodies) for agriculture	Big farmers	Big farmers	Quantitative groundwater bodies can be affected in the long run
3	Improving the condition of secondary irrigation canals	Big farmers	Ministry of Agriculture ANIF Dolj	
4	Extension of channel systems for smaller lots in the pilot area	Big farmers	Big farmers ANIF Dolj Ministry of Agriculture	
5	Adaptation of the irrigation system to the conditions of the area and to climate change (use of other irrigation methods and drip, etc.)	Dutch specialists	Big farmers	Proposals can come from IC Dabuleni
6	Adaptation of crops to the conditions of the area Use of hybrid varieties adapted to drought	Dutch specialists	Big farmers Small Farmers	Proposals can come from IC Dabuleni

7	Ensuring cheap and ecological sources of electricity in the pilot area, as a source for the pumping system for irrigation (construction of fields with solar panels or use of wind farms)	Dutch specialists Rast Mayor	Town halls	
8	Improving soil quality with organic substances	Dutch specialists		
9	Recharging aquifers	Dutch specialists		
10	Use of treated wastewater for irrigation in agriculture (possibly from the Bechet treatment plant)	Dutch specialists		
11	Usage of water from the Isalnita catchment, Jiu River for irrigation in the pilot area (development project of the irrigation system in the orange/red area of the pilot area)	Technical director PhD. Marin Talau+Dutch specialists	ANIF ABA Jiu	The supply of drinking water to the city of Craiova may be affected
12	Restoration of Jiu wetlands, Bratovoiesti-Dobresti sector	ABA Jiu	ABA Jiu Jiu Corridor Administrator	The restoration of the Jiu wetland, Dobresti-Bratovoiesti sector, located in the vicinity of the pilot area, is in FS stage.

13	Ecological rehabilitation of the Jiet River, in order to reduce the risk of draining	ABA Jiu	ABA Jiu Jiu Corridor Administrator	Discussions were started with stakeholders
14	Crops reorientation-adaptation for crops such as watermelons, melons, tomato, cucumber, cabbage, forage crops, fruit trees (peach, apricot tree, cherry), beans, peas, lupine	Wetskills team Brigade conference	Research - Development Center for Field Crops on Sandy Soils Dăbuleni	
15	Desert "Soilization"	Wetskills team Brigade conference	Research Development Center for Field Crops on Sandy Soils Dăbuleni	
16	Bind rainwater (Retain water in a organic healthy soil)	Dutch specialist (Wilfried)		
17	Buffer rainwater (Adding ground water)	Dutch specialist (Wilfried)		
18	Bring (supply) water (Fresh water supply Lake IJssel)	Dutch specialist (Wilfried)		

19	Infiltration of 25% of rainwater in built areas	Limburg WA Arnaud presentation		
20	Increase of soil infiltration with 10% by improvement of soil quality	Limburg WA Arnaud presentation		
21	Subirrigation at Agricultural lands	Limburg WA Arnaud presentation		
22	Water Conservation by higher surface water levels, drainage depth	Limburg WA Arnaud presentation		
23	Stream restoration by using whole stream valley	Limburg WA Arnaud presentation		
24	Buffers around Natura2000 and wetland reserves (no groundwater extraction, improvement of water quality)	Limburg WA Arnaud presentation		
25	Reforestation of hill tops and slopes	Limburg WA Arnaud presentation		

26	Protection of sources and wells	Limburg WA Arnaud presentation		
27	Ecological rehabilitation of the Teslui river, in order to achieve the environmental objectives on the sector Langa-Olt confluence, Olt county	NAAR Olt WBA		

Appendix 1

THE LIST WITH THE MEMBERS OF JIU-DANUBE RIVER BASIN COMMITTEE

Nr. Crt.	**Function and institution**	**Function in Jiu-Danube River Basin Commity**
1	Dolj County Prefect	President of the Jiu-Danube River Basin Committee
2	JIU Water Basin Administration Director	Vice-president of the Jiu-Danube River Basin Committee
3	DOLJ county council president	Jiu-Danube River Basin Committee member
4	Gorj county council president	Jiu-Danube River Basin Committee member
5	Vice-president with attributions and functions of president, Mehedinti County Council	Jiu-Danube River Basin Committee member
6	Mayor of Craiova, Dolj County	Jiu-Danube River Basin Committee member
7	Mayor of Tg. Jiu, Gorj County	Jiu-Danube River Basin Committee member
8	Mayor of Dr.Tr. Severin	Jiu-Danube River Basin Committee member
9	Senior Advisor Ministry of Water and Forests Environment	Jiu-Danube River Basin Committee member
10	Director of the County Agency for Environmental Protection	Jiu-Danube River Basin Committee member
11	Dolj County Public Health Directorate	Jiu-Danube River Basin Committee member
12	Oltenia Water Company	Jiu-Danube River Basin Committee member

13	Deputy Chief Commissioner Dolj County Commissariat for Consumer Protection	Jiu-Danube River Basin Committee member
14	Head Commissioner of the Regional Consumer Protection Office S-W Oltenia	Jiu-Danube River Basin Committee member
15	Director of the Isalnita Energy System	Jiu-Danube River Basin Committee member
16	Director of the Rovinari Energy Complex	Jiu-Danube River Basin Committee member
17	SECOM Director Dr. Tr. Severin	Jiu-Danube River Basin Committee member
18	General Manager of *APA SERV* Petroşani	Jiu-Danube River Basin Committee member
19	Head of Environmental Office Service - Hunedoara Energy Complex	Jiu-Danube River Basin Committee member
20	Director of the Mehedinti County Water Management Sistem	Jiu-Danube River Basin Committee member
21	PETROAQUA NGO- Petrosani	Jiu-Danube River Basin Committee member
22	Technical Director Jiu WBA	Jiu-Danube River Basin Committee member

Appendix 2

THE MAIN LOCAL STAKEHOLDERS (AGRICULTURE FIELD)

No. Crt.	[redacted]	**AGRICULTURE SURFACE**	**ADDRESS**
1	[redacted]	56,59 Ha	Cluj county
2	[redacted]	101,19 Ha	Craiova, Dolj county
3	[redacted]	22,40 Ha	Craiova, Dolj county
4	[redacted]	50,17 Ha	Bechet, Dolj county
5	[redacted]	137,46 Ha	Bechet, Dolj county
6	[redacted]	48,14 Ha	Bechet, Dolj county
7	[redacted]	27,43 Ha	Ostroveni, Dolj county
8	[redacted]	69,66 Ha	Bechet, Dolj county
9	[redacted]	47,29 Ha	Bechet, Dolj county
10	[redacted]	49,72 HA	Marsani, Dolj county
11	[redacted]	375,55 HA	Marsani, Dolj county
12	[redacted]	85,34 HA	Marsani, Dolj county
13	[redacted]	386,20 HA	Marsani, Dolj county
14	[redacted]	145,23 HA	Marsani, Dolj county
15	[redacted]	239,06	Marsani, Dolj county
16	[redacted]	17,94 HA	Marsani, Dolj county
17	[redacted]	75,07 HA	Marsani, Dolj county
18	[redacted]	14,947 HA	Dăbuleni, Dolj county
19	[redacted]	16,04 HA	Dăbuleni, Dolj county
20	[redacted]	12 HA	Dăbuleni, Dolj county

No. Crt.	[redacted]	AGRICULTURE SURFACE	ADDRESS
21	[redacted]	15,08 HA	Dăbuleni, Dolj county
22	[redacted]	18,42 HA	Dăbuleni, Dolj county
23	[redacted]	17,28 HA	Dăbuleni, Dolj county
24	[redacted]	17,78 HA	Dăbuleni, Dolj county
25	[redacted]	14,99 HA	Dăbuleni, Dolj county
26	[redacted]	11,80 HA	Dăbuleni, Dolj county
27	[redacted]	14,289 HA	Dăbuleni, Dolj county
28	[redacted]	14,86 HA	Dăbuleni, Dolj county
29	[redacted]	16,00 HA	Daneti locality, Locusteni village, Dolj
30	[redacted]		Dobrești locality, Toceni village, Dolj county
31	[redacted]		Marsani, Dolj county
32	[redacted]		Bratovoiești locality, Pruneț village, Dolj

Appendix 3

Questionnaire on Important Water Management Issues in the Jiu River Basin 2019

The document 'Important Problems of Water Management in the Jiu River Basin 2019' can be accessed at the following link: http://www.rowater.ro/dajiu/Documente%20Consultarea%20Publicului/Forms/AllItems.aspx

Data about you:

Name of the unit / institution _____

City / County _____

Activity profile _____

1. Do you know the content of the document on Important Water Management Issues 2019?

a)Yes;

b) No;

c) I will inform myself;

d) I'm not interested.

2. If so, how did you find out about it?

a) From the media;

b) Site;

c) From the meetings of the Basin Committee;

d) From the previous meetings with the representatives of the Jiu Water Basin Administration

e) ABA Jiu address

3. Do you consider that the most important water management problems from the Jiu River Basin are clearly provided in this document?

a) Yes;

b) No;

c) I will inform myself;

d) I'm not interested.

4. Which of the following answers best describes your opinion regarding the document Important Water Management Issues 2019?

a) I agree;

b) I agree to a certain extent;

c) I neither agree nor oppose;

d) I oppose to a certain degree;

e) I opose;

5. Which are the main water management problems in the Jiu River Basin?

a) Pollution with organic substances;

b) Pollution with nutrients;

c) Pollution with dangerous substances;

d) Hydromorphological alterations.

6. Which of the water management problems mentioned above and identified in the Jiu River Basin are a priority for your business?

_____

_____

_____

_____

_____

7. Do you consider that there is available information for the public, that is also enough for the information, consultation and active participation from your side?

a) Yes;

b) No; If the answer is no, please complete with your suggestions.

_____

_____

_____

_____

_____

8. What are your favourite methods of information?

a) website;

b) e-mail;

c) writing;

d) brochures / booklets;

e) organized meetings;

f) others.

9. How do you appreciate the activity of the water management authorities regarding your involvement in the elaboration of the document Important Water Management Issues 2019?

a) unsatisfactory: motivate:

b) satisfactory: motivate what else should be done:

c) moderate:

d) good:

e) very good: highlight the special aspects:

10. Other issues, recommendations and suggestions regarding the Important Problems of Water Management 2019.

_____

_____

_____

_____

_____

_____

_____

_____

_____

_

Signature

Appendix 4

Questionnaire for the stakeholders on drought issues (Dăbuleni pilot area)

OBSERVATIONS

The proposals made by you will be centralised and the possibility to apply them will be also analysed.
The results, the ideas, the given recommendations will be used in order to weigh carefully the different interests and to test alternative scenarios.
The questionnaires used in the final report will be nameless.

Name of agricultural farm / owner:_____ E-mail_____

The current situation

1 Where is the farm located? What kind of farm is it?

_____

2 What is the size of the farm? _____ha

3 What types of crops (or livestock farms) do you currently own?

Potatoes _____%
Sugar beet_____%
Watermelons _____%
Sunflower_____%
Wheat_____%
Corn _____%
……..____%
……..____%
……..____%
Animal growth (farm, type of animal, ...)_____number of animals:_____

4 Do you have investment plans for the next 10 years? YES / NO/ DON'T KNOW

5 If YES, in what way? For example: expansion, other crops, energy, ecology_____

6 How do you assess the current situation based on its impact on the activity your?	**Threat**	**Problem solved**	**Opportunity for future projects**	**The problem identified by You in this context**
Climatic changes				- drought - excess water
Groundwater and surface water level				- low level - increased level
Water abstraction				-deficiency -excess
Water supply				-infrastructures problems
Types of soil				- clay soil - sandy soil - salty soil
Improving water supply				-local -regional -both
Soil quality				-dry -marshy
Other (related to water management)				

In future (the next 10 years)

1 Where and how do you see change in land use?

2 Are there other areas (in the immediate vicinity) from your point of view, with more suitable soils for crops, or for raising animals (pastures / meadows)?

	It is not important	**Relevant**	**Neutral**	**Important**	**Foreground**	**Why?**
Changing the type of crops						
Improving the water supply system						
Restoration of the transport infrastructure						
Stimulating and subsidizing innovative ideas as well as the state of the art technology agricultural field						
Other proposals …						
…						

3 The arrangement of the territory you belong to should be considered punctually, or as a whole?

_____

4 What needs to be done for the agricultural sector in areas with drought problems?

5 Do you have any suggestions for changing the water supply system, infrastructure, or land use, ...? YES/NO/DON'T KNOW

If YES, which are these? List them below, please: _____
_____
_____
_____

6 Do you think that in the future organic farming will become more important in your area? YES/NO/DON'T KNOW

Why?_____
_____

For the long-term future (2050)

The pilot area has a number of problems that need to be solved in the future: public transport, facilities (schools, shops, sports fields, etc.), declining population, aging population.

Other issues: agricultural development (resizing farms / agricultural associations, several types of crops, finding other sources of income), ensuring drinking water, changing the system of taxation of consumed water, air pollution, collaboration, trust in state institutions / local administration .
What is the biggest problem in the area from your point of view (from those presented above)?

_____

_____

	Very bad	**Bad**	**Unmeanin**	**Good**	**Very good**	**OBSERVATIONS**
SOIL quality (in OBSERVATIONS mention the type of soil you own -sandy soils, good structure, clay soils)						
WATER quality (in COMMENTS mention if an improvement of the water quality is necessary from a physico-chemical and biological point of view, in accordance with the Water Framework Directive?)						
Solving water management problems (in OBSERVATIONS mention the problem - water capture, storage and / or distribution)						
Adapting to climate change (in OBSERVATIONS mention if the forecasts for the periods of drought and for the periods of excess rainfall arrive on time?)						
Green energy (in OBSERVATIONS mention - What do you prefer for the future: usage of solar panels, wind farms, etc						
Conservation of flora and fauna (in OBSERVATIONS mention what you prefer: increasing biodiversity, diversification habitats,						

_____

reforestation, etc.?)						
Ecotourism (in OBSERVATIONS mention what you prefer: campsites, promenades, fishing areas, cycling lanes, etc.?)						
Agricultural production (in OBSERVATIONS - mention what you prefer: the transition from quantity to quality, products diversification products, ...)						

How do you see the solution to the problem? _____

_____

_____

_____

_____

1 What is your opinion about....?

2 Should regional or local governments look more closely at the development of the region?
YES/NO
In what direction?

3 What will be important for the agricultural region you belong to in the future?

	Definetely no	**No**	**Neutral**	**Yes**	**Definetely yes**	**OBSERVATIONS**
„Quality" of products (bio / eco)						
„The quantity of "products						
Both the quantity and the quality of the product						

Delivery of local products in the markets of the Oltenia region?						
Do you prefer longer distance markets?						
Should the emphasis be on technology innovation for agriculture?						
How do you appreciate the association in agriculture?						
How do you appreciate small, individual farms?						

Conclusions

1 Do you think that rural areas should be developed more than urban ones? YES/NO/DON'T KNOW What is the reson?

2 What is your choice on how to communicate with stakeholders? Do you prefer – the post, e-mail, telephone?

3 Do you see other ways to develop communication? YES/NO/DON'T
If yes, which are these?

4 Do you think there is enough water for your business? YES/NO/DON'T KNOW If NO, what is the reason?

5 Do you have any lands affected by the phenomenon of drought / aridization?

6 If YES, in which locality and on what surface (approximately in Ha)?

---

7 Do you have any suggestions for collaborating with our institution in the future? YES/NO

Examples (tips and/or suggestions for improving the work of water management authorities)

OTHER OBSERVATIONS:

References

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