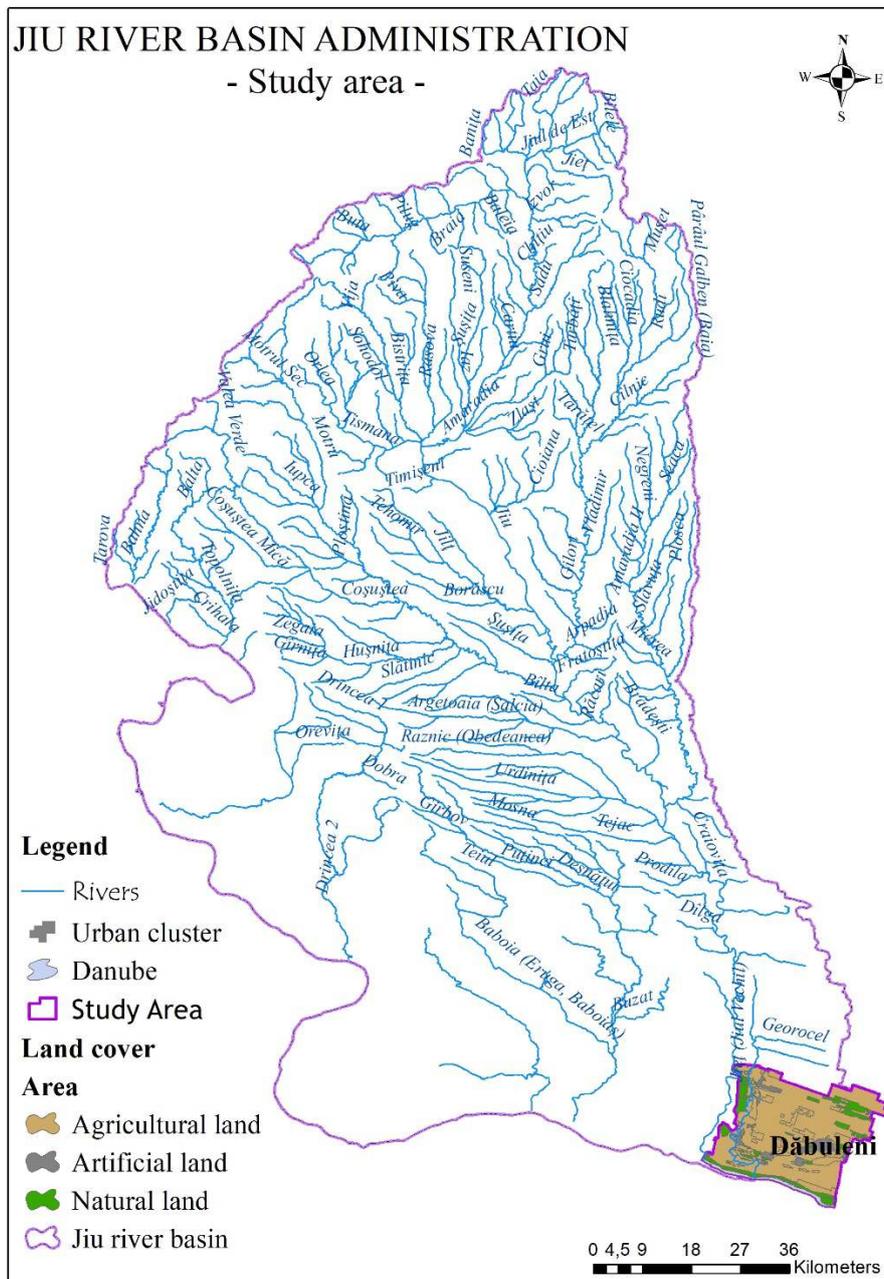


BREAK THE DROUGHT

Bringing research advances to the field

INSPIRATION GUIDE





Administrația
Națională
"APELE
ROMÂNE"



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INTRODUCTION

Romania is one of the richest countries in surface water resources. In 2009, the water exploitation index showed that Romania was one of the few countries that had the “No Stress” tag, with a score of 0-10 on the index. But recently, climate change and severe drought has caused an imbalance in the hydrological basins, being at risk to become one of the water stressed countries. Besides, that water demand for irrigation is increasing because of the frequency and magnitude of droughts,

With that in mind, the Dutch Water Authorities, through BLUE DEAL Proposal, is partnering with Romanian authorities in order to reduce the water stress index, to increase the water availability and water storage capacity in Romania, focusing on Jiu River Basin Area.

One of the main problems the Blue Deal Proposal is facing in the area is the lack of engagement from the local stakeholders and the reluctant cooperation of the landowners. To present new innovative way of Integrated Water Resource Management and stakeholders engagement management we proposed an Inspiration Guide.

Our study area involves Dolj county localities, such as Dăbuleni, Călărași, Sărata, Sadova, Lișteava and Ostroveni, covering around 80,000 ha, Figure 1. The total population is approximately 40,000 inhabitants divided between urban (31%) and rural (69%) areas. This region has one of the most intensive agriculture activities, but right now, extreme drought forces farmers and stakeholders to work together to implement new effective ways for water management. For this purpose, the Inspiration Guide offers feasible solution, focused on two approaches: short-term and long-term strategies, along with a plan for stakeholders engagement management.

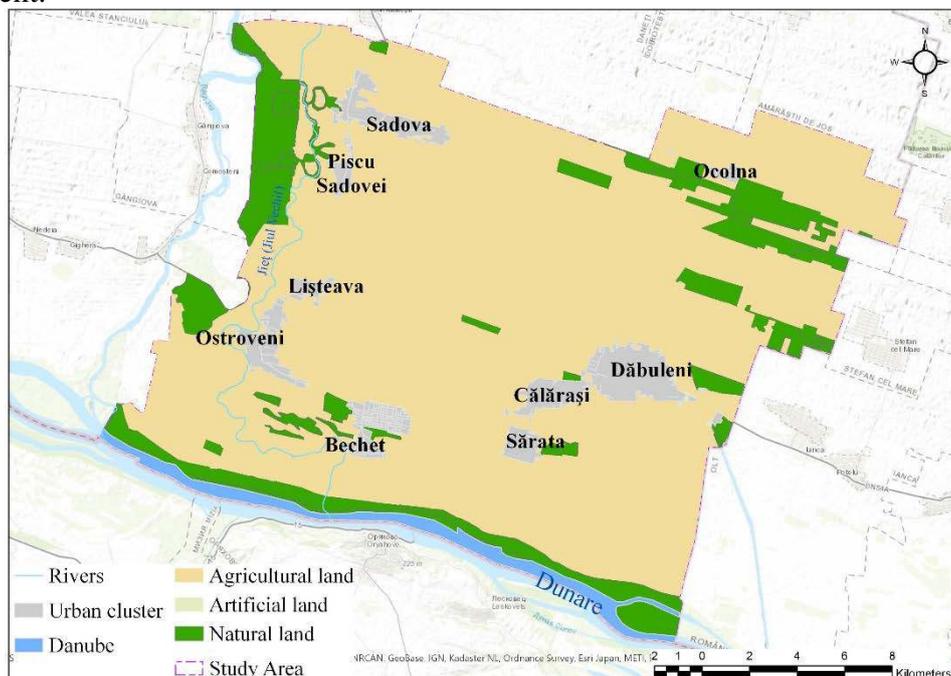


Figure 1. Map of study area: Dăbuleni, Călărași, Sărata, Sadova, Lișteava and Ostroveni territorial administrative units, 2019. By C.Zanfir

1. INSPIRATION GUIDE

The inspiration guide serves to present feasible ways to approach agriculture in a drought affected area, Dăbuleni. Our approach is bi-dimensional, addressing in an immediate way the drought problem through the short term strategy. Therefore, we propose solutions for the farmers to continue their agricultural activity in sandy soils. The long-term strategies address the imminent desertification process, proposing a way to mitigate it.

1.1. SHORT-TERM STRATEGIES

1.1.1. Plastic mulches –a better use for plastic

Surface mulch is a layer of material placed on top of the soil to prevent irrigation water losses due to evaporation. As a result, the soil is kept moist, which leads to a higher yields of the fruits. Research - Development Center for Field Crops on Sandy Soils Dăbuleni already implemented the plastic mulching technology for the most abundant crop in the region – watermelons, and concluded that it is possible to collect 60 – 80 tonnes of fruits per hectare comparing to 50 tonnes per hectare obtained by traditional method [2] .In addition, this technology allows to harvest the watermelons earlier (June instead of August) considering that July and August are the hottest months prone to severe drought. R&D Center is also testing mulching technology for other crops, like kiwi Figure 3

Plastic mulches require initial investments of 14,000-16,000 lei per hectare but with the increased yields, dropped water losses and proper management for reuse of the mulches, the technology will improve the agricultural sector of the drought affected regions.



Figure 2. Kiwi plantations covered by plastic mulches at Research – Development Center Dăbuleni (Source: Jurnal Olteniei 2019)

1.1.2. Crops reorientation –adapting to new soil environment

The sandy soils of Oltenia Plain are characterized by a low nutrient content and poor moisture retention. These kind of soils are appropriate for crops such as: watermelons, melons, tomato, cucumber, cabbage, forage crops, fruit trees (peach, apricot tree, cherry), beans, pea, lupine etc. [3]. One way to approach drought areas is to reorient to crops that are more drought tolerant and resistant to thermal stress. For this, the Research station on crop development in sandy soils from Dăbuleni (SCDCPN) is already experimenting on new types of crops. Their created new types of beans and peanuts, specifically for the Dăbuleni agriculture sector. They also experimented with sweet potatoes, exceeded initial expectations. For peanuts, the researchers experimented with different types of foreign varieties, resulting in over 3,800 kg/ha of pods, as shown in Tabel 1. We believe that if we connect local farmers with the activity of the Dăbuleni research center we can maximize the efficiency of arable land use, growing crops that are researched to be productive in the area.

Table 1. The average yield obtained in the years 2011-2013 Dăbuleni CCDCPN of some foreign varieties of peanuts grown on sandy soils. [4]

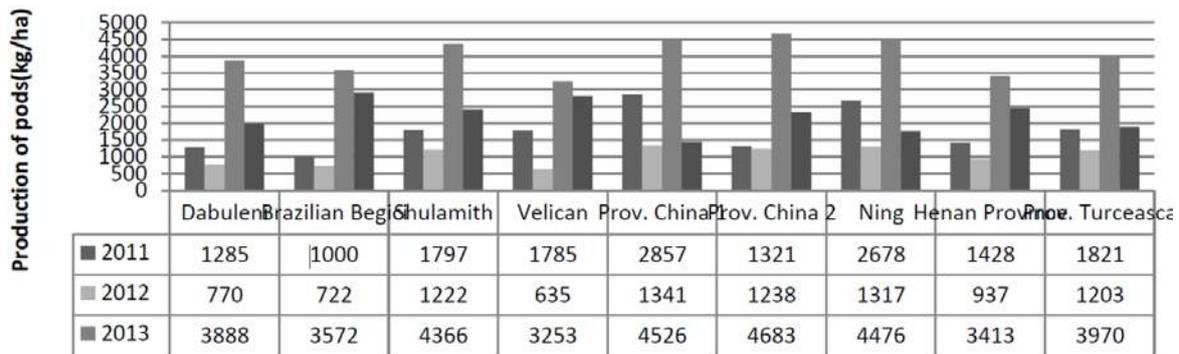


Figure 3. Beans (left) and sweet potatoes [3] (right) yield from Dăbuleni Research Station.

1.1.3. Desert “Soilization”

This approach takes advantage of the eco-mechanical properties of the soil: being in a rheological state when wet, and in a solid state when is dry. The scientists that researched this method mixed a suitable water-based paste with the sand, the sand will be transformed in rheological state (wet-soil). After the water is evaporated, the sand will turn into a solid form,

receiving all the mechanical characteristics of natural soil, lasting frequent transformation between the two states. The experiments conducted in the desert area of China, used a modified sodium carboxymethyl cellulose (CMC) solution with 2% concentration and 5% compound fertilizer. The constraining material was only added at the beginning of the experiment, and no further applications were required. The CMC solution is non-toxic and environmental friendly, cost-effective and suitable for mass production. In China, the soilization process costs around 4,500-6,500 dollars/ha, including the cost of rotary cultivation method. Corn, potatoes, sweet potatoes, radish and oilseed rape were planted in the new soil and yields production were up to 50% higher. [1]



Figure 4. Chinese researchers applying the CMC compound to the sand[1]



Figure 5. Results of the crops in the new soil[1]

1.2. LONG-TERM STRATEGIES

1.2.1. Sadova-Corabia irrigation system restoration –full capacity operation

In Dăbuleni area the main activity was intensive agriculture sustained by the Sadova-Corabia irrigation system. Before 1989 the irrigation system worked at full capacity, after the revolution the whole irrigation system collapsed, as seen in the Figure 4. In present the irrigation system is functional but the inhabitants and the farmers do not use this watering method because the price of electricity for pumping stations is too expensive. We proposed this solution for the following benefits:

- the effects of the drought are mitigated using the irrigation system and also the effects of climate change.;
- more income for farmers and locals;
- coordinating irrigation would be a unitary one for large areas of land;
- with reduced investments, the reinjection.

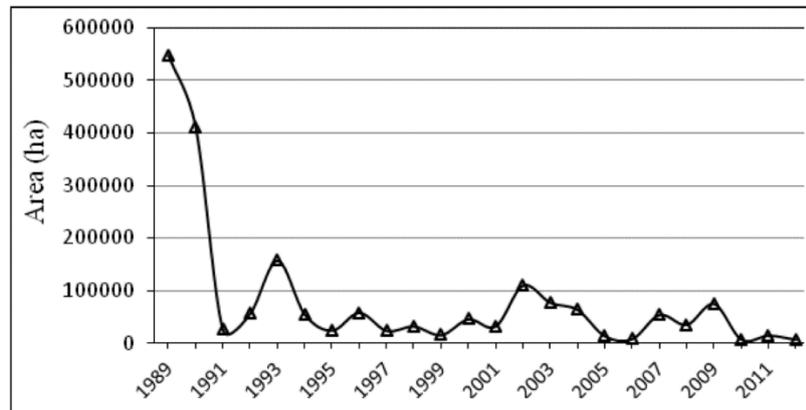


Figure 6. Area watered by irrigation system in Dolj County after 1989's revolution to 2011 [5]

We recommend for optimal efficiency, cluster formation to group small farmers and large agricultural associations should be created. This way, the irrigation system could be affordable to a larger audience. Also, through Ministry of Agriculture and Rural Development together with National Agency for Land Improvements, the government should provide grants for the electricity usage by the pumping station L1 from Dăbuleni, reflected in the water price.

1.2.2. Forest belt restoration –a way to mitigate the desertification process

The forest belts system in Dăbuleni area were created to mitigate the desertification process, protecting the arable land against wind deflation. From 1947-1960 more than 5,000 ha were planted in southern Oltenia, Bărăgan and Dobrogea. Due to the construction of the Sadova-Corabia irrigation system, more than 9,000 ha of forest were cut down, increasing the deflation process. Besides that, the forest belt was the target of illegal cuttings after the fall of the communist regime in 1989, leaving the arable land and transportation routes unprotected against wind deflation and sand transportation [6]. At the moment, almost all of the protection belt has been destroyed, amplifying the desertification process.

We strongly believe that one of the long-term strategies involve the restoration of these protective forest belts. The advantages of this process are not limited to only reduction of the wind deflation, but also on other levels, such as [6]:

- **Environmental:** creating conditions for local fauna development, improvement of the microclimate condition, diminishing of erosion and sheet wash along the slopes;
- **Soil quality:** enriching the soil with nutrients and **moisture level**, increasing the soil's stability and fertility;
- **Economic and social:** increased wood production, improvement and reconstruction of the landscape, protection of the transportation routes.

One of the risk in the implementation of this solution is the unwillingness of the landowners to change the destination of some of their arable land, even though it has a positive impact on the crops yield, based on the advantages mentioned previously. Measures to raise locals and stakeholders' awareness of the importance of the forest belt restorations must be taken into account. Also, a way to stimulate the landowners who are reserved into changing their land use should be developed.

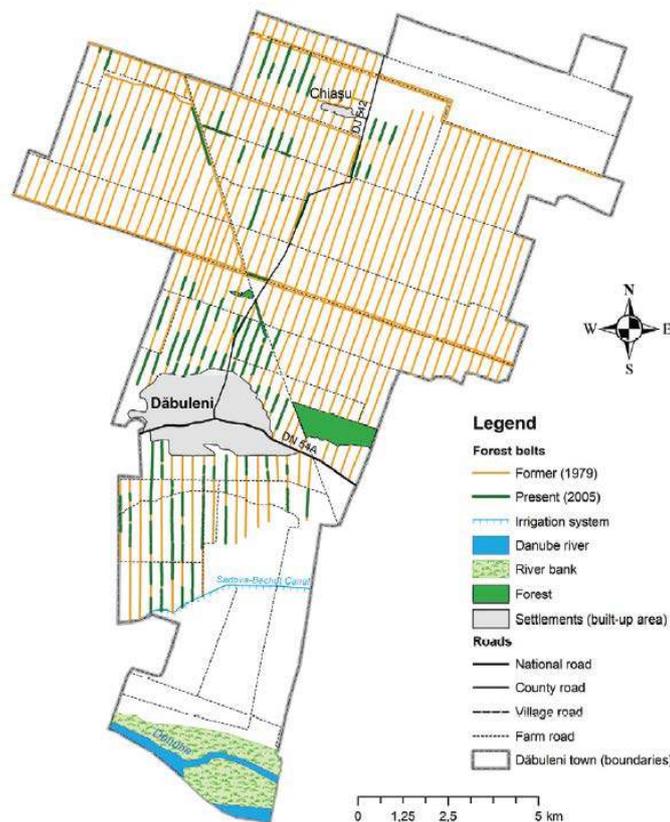


Figure 7. Forest belt distribution in Dăbuleni area in 1979 versus 2005 [6]

1.2.3. Wetland restoration— water from Danube to Dăbuleni

Since they are the boundary between aquatic and terrestrial environments, wetlands own the capability of providing services from both environments. One of the services that are crucial to agriculture is that they have the capacity to retain the underground water and to improve its quality. Furthermore, wetlands, might be used as natural water storage. Wetlands are known for their high capacity of storing carbon dioxide. Due to the fact that under climate changes rain is becoming more violent, wetlands can be used to reduce flooding effects.

2. THE INTEGRATED APPROACH

Our integrated approach is a combination of both strategies. Firstly, we believe efforts should be made to raise the local farmers and local stakeholders awareness. By promoting new innovative technologies to the farmers that can be applied with minimal cost, the efficient use of the land will be increased, together with farmer's income. For this, we suggest that the local farmers should undergo a periodic training, where new results of the SCDCPN will be presented. Also, technical visits of the research center should be facilitated in order for the local farmers to see the results.

We suggest those who exercise formal influence in the area to promote active volunteering:

- University of Craiova – Horticulture Faculty;
- Administration of the protected area Jiu corridor;
- Research Development Center Dăbuleni (SCDCPN);
- Municipalities / City Halls;
- Institute of Meteorology;
- The South-West Regional Development Agency Oltenia.

One of their activity could be local information spreading through pamphlets, brochures for the inhabitants in the area. More than that, a volunteering group should be created to help in the forest belt restoration. A partnership between the local research center, University of Craiova – Horticulture Faculty and local high schools could facilitate the young students implication in the agricultural activities and research development and this kind of practice should be legally acknowledged.

2.1. STAKEHOLDERS

Improve cooperation between the stakeholders. Firstly, it is important to understand the hierarchy and the activity of the national stakeholders. For this, we divided them on the level of their branch: stakeholders that have the expertise in *water*, *agricultural* and *environmental* sectors.

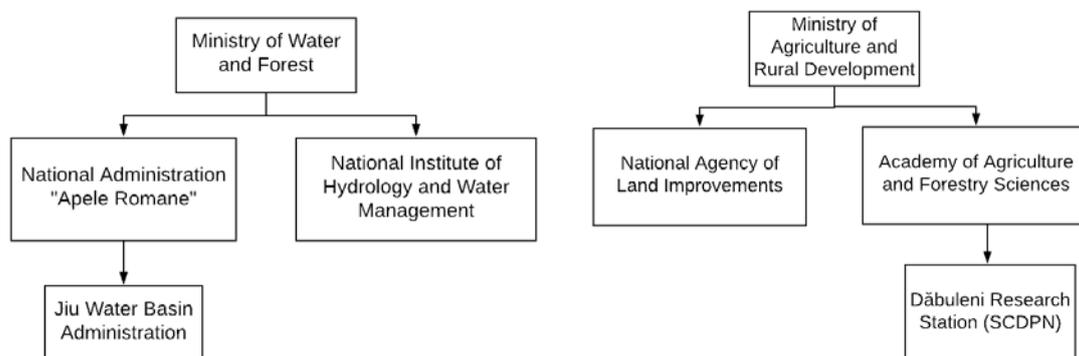


Figure 8. Water related stakeholders (left) and agricultural sector stakeholders (right)

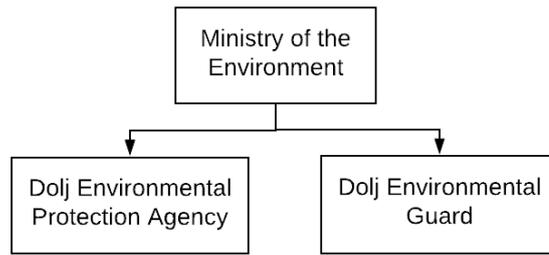


Figure 9. Environmental monitoring stakeholders

2.2. POTENTIAL INVESTORS

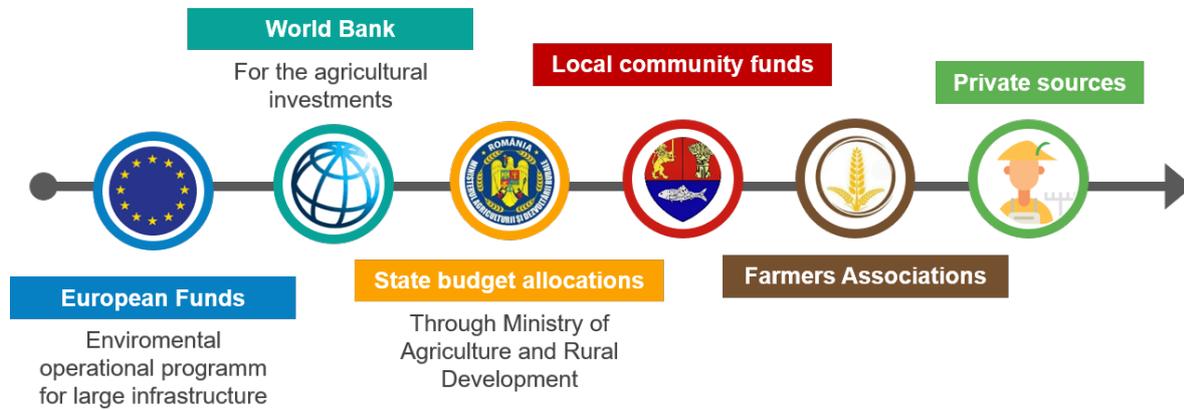


Figure 10. Potential investors interested in sustainable agriculture in Dăbuleni Area

A plan for the cooperation of the mentioned investors for the long-term projects that we proposed in 1.2. Long-term strategies is needed. We suggest a to form a cluster of farmers and large agricultural associations to be responsible for submitting the proposal to get fund from the authorities. If they succeed in obtaining funds for the long-term strategies that will bring sustainable water practices to the region.

DISCUSSIONS

We strongly recommend to implement the Inspiration Guide, as proposed in the integrated approach. The strategies should be applied in both directions: short and long-term. We choose this approach because the inhabitants need immediate solutions to be able to continue agricultural activities in drought affected area. On the other hand, we should also consider that the desertification is a complex problem that cannot be ignored.

We believe that one of the obstacles of solving the problem in the region is the miscommunication between the local inhabitants and the authorities. The proposed steps are addressing this issue, coming with a solution for local farmers to be informed about new technologies that are feasible in the area.

The implementation of the Inspiration Guide will lead to a significant improvement of local agricultural sector, which is the main source of income for the people in the study area.

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