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Aridity risk in the west of the Oltenia Plain: natural factors and human impacts on land degradation

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Abstract

The lands of southern Oltenia had different evolution stages in the last century being influenced by the climatic factor but especially by the anthropic factor. From the extensive areas of ponds and marshes in the pre-war period to drainage, embankments, irrigation systems and planting of the windbreakers and shelterbelts in the 50s - 60s (reflected in the agricultural peak of the 70s – 80s) and to the present day, we are witnessing the aridization of the lands and the extension of the predominantly sandy areas, impracticable to the current type of agriculture.
After 1990, agriculture in the southern part of the Oltenia Plain had an accelerated decline caused by the destruction of the irrigation systems, the deforestation of the windbreakers and shelterbelts, the situation of land ownership and the failure of the adaptation of the crops to the soil types. In 2012 the percentages of irrigated areas reached 0% capacity used out of 76,820 ha in the Blahnița Plain and 1% capacity used out of 299,621 ha in the Oltenia Plain. All these have led to land degradation and amplification of geomorphological processes, especially on sandy surfaces, where the lack of vegetal layer together with the wind process lead to destabilization and movement of sand dunes.
This article aims to conduct a spatial-temporal analysis of several types of lands exposed to drying, whose surface has increased considerably to almost 50,000 hectares. Another 50,000 hectares are predisposed to this phenomenon in the Oltenia Plain, on the western part of Jiu. An environmental management strategy for a sustainable development could be made for the protection of the lands against the winds by planting windbreakers and shelterbelts of fast growing species (acacia, hybrid poplar, wild pine, walnut tree).
The research methodology involved the processing of the annual average data on temperature, precipitation and wind direction from the weather stations in south-west Oltenia, the processing of the data from the Landsat, Corine maps, as well as the analysis of the data provided by the examination reports on the occupation of land offered by the Ministry of Regional Development and Public Administration.
In the analysis of land degradation as a result of the aridization process, the situation of the current vegetation layer was taken into consideration using the NDVI (Normalized Difference Vegetation Index) and data taken from Corine Land Cover between 1990 and 2006 regarding the change of the land use in the Oltenia Plain.

Keywords: *aridity, sandy lands, land management, windbreakers trees, Corine Land Cover, South-West Oltenia*

Rezumat. Pericolul aridizării în vestul Câmpiei Olteniei: impactul factorilor naturali și antropici asupra degradării terenurilor

Terenurile din sudul Olteniei au cunoscut în ultimul secol etape de evoluţie diferite sub influenţa factorului climatic dar mai ales a factorului antropic. De la suprafeţele extinse de bălţi şi mlaştini din perioada postbelică la desecări, indiguiri, sisteme de irigaţii şi plantări de perdele de protecţie din anii 50-60 (reflectate în apogeul agricol din anii 70-80) şi până în zilele noastre când, asistăm la aridizarea terenurilor şi extinderea suprafeţelor, predominant nisipoase, impracticabile tipului de agricultură actuală.
După 1990 agricultura din sudul Câmpiei Olteniei a cunoscut o decădere accelarată datorată distrugerii sistemelor de irigaţii, defrişării perdelelor de protecţie, situaţiei proprietăţii terenurilor şi neadaptării culturilor la tipurile de sol. În 2012 s-a ajuns la procente de suprafeţe irigate de 0% capacitate utilizată din 76820 ha amenajate în Câmpia Blahniţei şi de 1% capacitate utilizată din 299621 ha amenajate în Câmpia Olteniei. Toate acestea au dus la degradarea terenurilor şi amplificarea proceselor geomorfologice în special pe suprafeţele nisipoase, acolo unde lipsa stratului vegetal coroborat cu procesul eolian duce la destabilizarea şi miscarea dunelor de nisip.
Acest articolul propune analiza spaţio-temporală a câtorva tipuri de terenuri expuse aridizării, a căror suprafaţă a crescut considerabil la aproape 50.000 de hectare, alte 50.000 de hectare predispuse acestui fenomen în Câmpia Olteniei la vest de Jiu şi observă că o strategie de management de mediu pentru o dezvoltare durabilă ar putea fi protejarea terenurilor împotriva vânturilor prin plantarea de perdele de păduri din specii rapid crescătoare (salcâmul, plopul hibrid, pinul silvestru, nucul).
Metodologia cercetării a implicat prelucrarea datelor medii anuale de temperatură, precipitaţii şi direcţia vântului de la staţiile metorologice din SV Olteniei, prelucrarea datelor din hărţile Landsat, Corine precum şi analiza datelor oferite de rapoartele de expertiză privind ocuparea terenurilor oferite de Ministerul Dezvoltării Regionale şi Administraţiei Publice.
În analiza degradării terenurilor ca urmare a procesului de aridizare s-a luat în considerare situaţia stratului vegetal actual folosind indexul NDVI (Normalized Difference Vegetation Index) şi date preluate de la Corine Land Cover între anii 1990 şi 2006 privind schimbarea destinaţiei terenurilor din Câmpia Olteniei.

Cuvinte-cheie: *ariditate, terenuri nisipoase, managementul teritoriului, perdele forestiere, Corine Land Cover, Sud-Vest Oltenia*

Introduction

The southern part of the Oltenia Plain is one of the most problematic and fragile ecological territories of Romania. Since the beginning of the 19th century, these sandy areas with dry climate have been subject to an intense human factor intervention whose purpose was to obtain as much agricultural production as possible.

In 1904 Rusescu claimed that the balance between the three types of land culture (arable, pasture and forest) has been deteriorating since the

middle of the 19th century and that the deterioration of the land will accentuate if there is no intervention against overcrowding with animals on the pastures and on sands, against the massive deforestation after the 1864 land reform and the lack of concern for the adaptation of crops for the purpose of efficient use and stabilization of the sandy lands (Chiriță & Bălănică, 1938). There were movements of the sands in the form of dunes, even 150 m/year, threatening the villages near the Danube in some areas of the southern part of the Oltenia Plain, on the western side of Jiu, between 1830 and 1880. This phenomenon determined a movement of the Ciuperceni, Desa, Tunari, Piscu, Bistreţ and Nedeia villages further north-east (Ionescu Şişeşti, Staicu Ir. 1958) at the beginning of the 20th century.

The accentuated process of aridization of land and the advance of sands toward the villages in the south of the Oltenia Plain alarmed the population and the officials and as a consequence they began to take measures to restore the natural balance.

Drăcea (1942) asserted that the windbreakers and shelterbelts are the cheapest and most efficient way for water retention in the soil and the planting of forests is the only means of fighting against winds and dust storms. In 1958, Ionescu Sisesti and Staicu showed that the reduction of wind speed to less than 5 m/s is essential in combating wind erosion and advancing sand dunes. During the 70s – 80s there were over 10,000 ha of forests in the area located in the south of the Jiana Plain (Jiana -Burila – Izvoarele), in the south of Băileștilor Plain, in the Ciuperceni - Desa area and in the Bistreţ - Nedeia area. There is also an exemplary exploitation of agricultural land in accordance with the system of forests for protection and stabilization of the land as well as with the irrigation system, obtaining high yields of agricultural products. After 1990, the evolution of the efficient use of agricultural land experienced a steep decline. This area has not only experienced a worrying depopulation and economic decline, but also an intensification of the destructive processes of the environment. Some studies on the drying and drought phenomena in the Oltenia Plain were conducted in 2013 and 2014 by Remus Prăvălie as well as by Irina Onțel, 2018 and Iosef Verovencii, 2014.

This paper aims to illustrate the dynamics of several types of land exposed to the aridization of the western Oltenia Plain and their evolution from the early 80s to the present days.

The study area

The study area of this paper is represented by the southern part of the Oltenia Plain between the Danube, Jiu and the Getic Piedmont in the north. The landscape has an north/north-west to east/south-east orientation, being shaped mostly by the Danube, by Jiu and to a small extent by Blahniţa, Drincea and Desnăţui (Fig.1). The local climate is influenced by the circulation of air masses from the Mediterranean area, from the east of Europe and from the Atlantic (Fig.2). In such conditions, the climate has strong Mediterranean characteristics, with more consistent precipitations in the cold and spring seasons (Ielenicz, 2007) (Fig.3). Also, this area is under the influence of the climatic variations generated by the particularities of the Carpathian and the Balkan mountains (Fig.4).

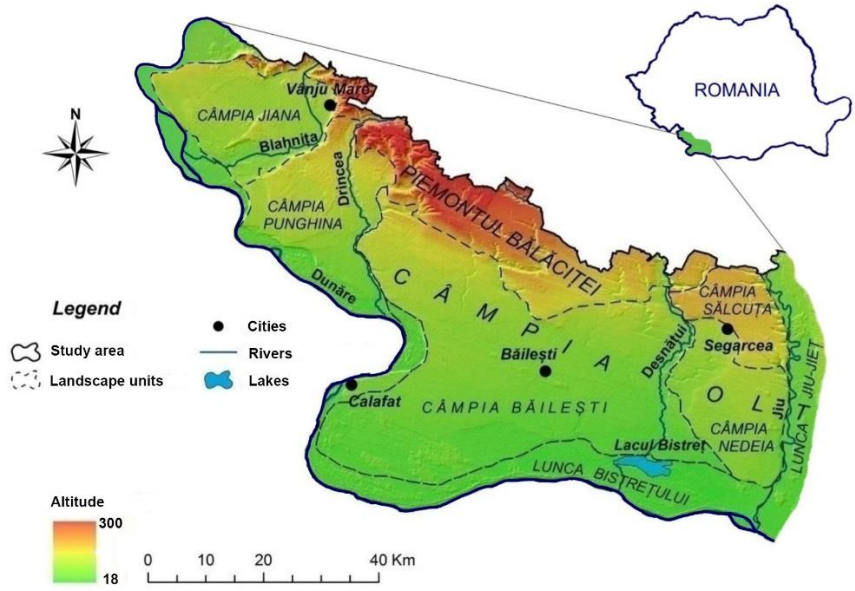

Fig. 1: The Oltenia Plain in the western part of Jiu – hypsometry (GIS processing)

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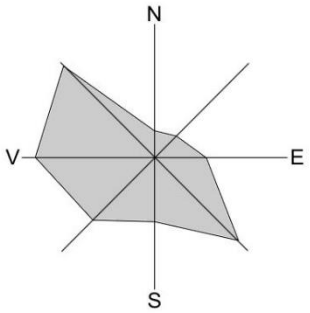

Fig. 2: The general wind direction in the Oltenia Plain - Vânju Mare weather station, 1998

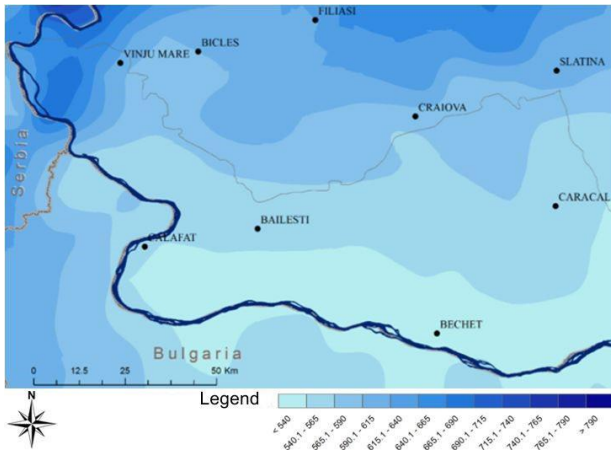

Fig. 3: The multiannual rainfall values in the Oltenia Plain, 1961-2013 (Romanian Climate Dataset)

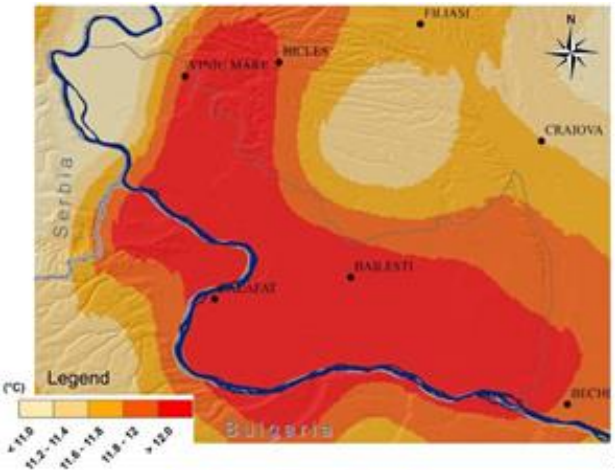

Fig. 4: The multiannual temperature values in the Oltenia Plain, 1961-2013 (Romanian Climate Dataset)

The Oltenia plain is the result of the evolution of the hydrographic network formed by the Danube, Jiu, Blahniţa, Drincea and Desnăţui and to a small extent of the wind and anthropic factor.

The hydrographic network consists of two categories of rivers: those with permanent flow (Danube, Jiu) and those with intermittent flow (Blahniţa, Drincea and Desnăţui). The three intermittent rivers have low flows and often dry completely in summer and autumn (Ielenicz, 2007).

For this reason, the influence of the hydrographic network on the evolution of agricultural land is minor, although the potential is considerable if the planning of large hydrotechnical works would be taken into consideration (Fig.5).

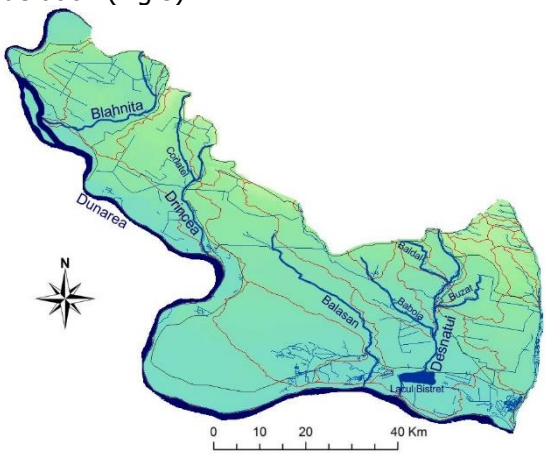

Fig. 5: The hydrographic network from the west of the Oltenia Plain (GIS processing)

The west of the Oltenia Plain is characterized by a rich and diversified range of soils, starting from the typical reddish brown ones at the base of the Piedmont, to the typical chernozemic soils in the center of the Băileștilor Plain and in the IV and V terrace of the Blahnița Plain, to the moorlands, the marshes and the glacial chernozems in the south-central part of the Jiana Plain and south of Poiana Mare - Bistrita - Nedeia. The characteristic of the soils in this area is the presence of a consistent sandy bed below the A layer of the soil profile, this texture influences directly the capacity of these soils (Oprea, 2009) (Fig. 6). This makes the landscape balance very fragile and any change can contribute to the dryness of this area.

Materials and methods

The study of the effects of the aridization on the lands in the south of the Oltenia Plain and in the west of Jiu required a careful research by field observations.

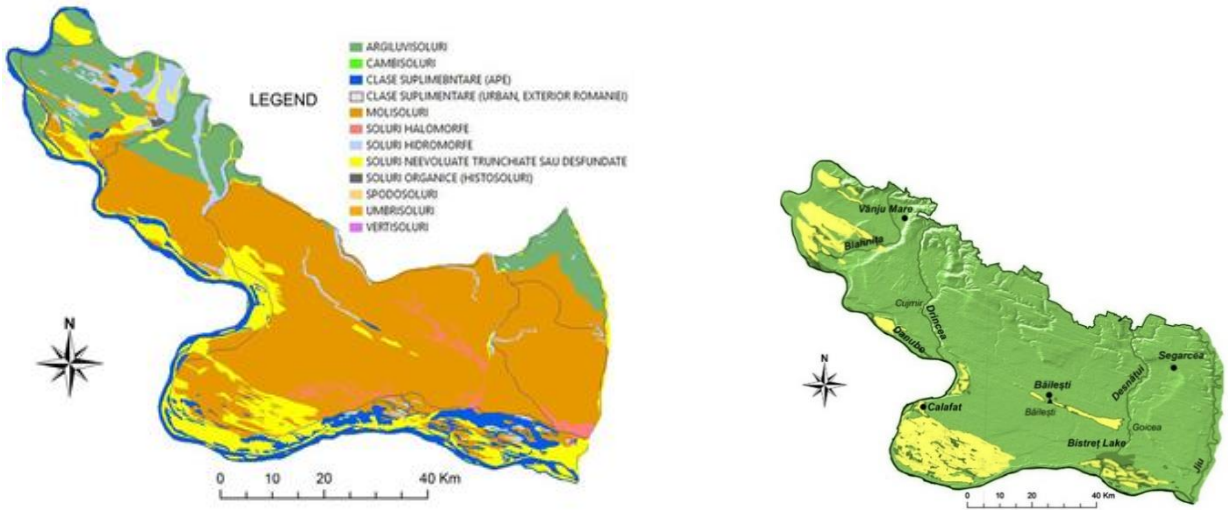

Fig. 6: The soils of Oltenia Plain in the west of Jiu (Processing after CLC, 2006, for natural ecosystems, respectively according to the Institute of Pedological and Agrochemical Research, in the case of sandy soils)

The study was based on the comparative analysis of numerous maps: administrative map of Romania 1993, topographic map (rastel dataset - ro25k16.ecw), road map, geological map (Institute of Geology, 1978, scale 1:1,000,000), soil map, ABA Jiu map, maps with climate values (National Meteorological Administration), population distribution map, etc. It focused on areas where landscape changes were detected in terms of forest surfaces, water-covered surfaces, lack of crops or lack of vegetation layer in general.

By comparing the topographic maps from 1979, the CorineLandCover maps 1990, 2000, 2006 and 2018 Global Mapper - World imagery 2009, Google Earth 2012, 2016 and observations from August 2018 - May 2019, some evolutionary changes could be highlighted along the last 40 years, from the climax of the exploitation and stabilization of the lands in the communist period to the period of decline after the 1990s and to the easy rehabilitation after the entry into the European Union. The satellite data Corine Land Cover 1990, 2000 and 2006 provided by the European Environment Agency were of major importance. Corine Land Cover is based on three different satellites and different spatial resolutions: Landsat 5TM and Landsat 7TM for CLC 1990 respectively 2000 (both at 30m resolution) and IRS P6 LISS-III (23.5m resolution), respectively SPOT 4XI (20m resolution) for CLC 2006 (EEA 2007).

Results and discussions

The dynamics of vegetation

The analysis of the forest surfaces shows a decrease of the forests by 28% between 1981 and 2006, which results from the comparative analysis of the topo map from 1981 and CorineLandCover 2006. In order to capture the most important differences between the two years, they were delimited in two areas: Ciupercenii Noi - Rast (in the south of the studied region) and Jiana - Pătulele (in the western part). The analysis of the dynamics of forests in these areas is very important considering the correlation between deforestation and the existence of sandy surfaces on large areas in these sectors. The disappearance of forests has caused the considerably expansion of the sandy areas and the dunes by about 50%, from 223 ha (Ciuperceni-Rast 152 ha; Jiana-Pătulele 71 ha) in 1981 to 446 ha (Ciuperceni-Rast 310 ha; Jiana-Pătulele 136 ha) in 2008 (Prăvălie, 2013).

The Ciupercenii Noi - Rast area shows a remarkable decrease in forest areas by 18.78% (2,240 ha) over 25 years, from 11,924 ha in 1981 to 9,684 ha in 2006. Notable in this area is the forest loss especially of acacia and poplar (about 3,300 ha) at the expense of agricultural areas, the extension of agricultural areas being the most important cause of local deforestation.

It should be mentioned that in parallel with the deforestation, the climatic pressures (prolonged droughts of the last decades, the local thermal stress) were an important cause in the disappearance of the forests, through drying and, later, by the cutting down made by the local forest department. There are other causes indirectly that are responsible for the diminishing of forest areas. For example, in the case of poplars located in the area of interdunes, the decrease of the water level and the withdrawal of the Danube from the old courses of the Rast extremities represents another important cause in the drying and, later, in their natural or anthropic disappearance (deforestation) (Prăvălie, 2013).

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Based on the comparative analysis between the topographic maps, the current Google images and the CORINE Land Cover database, a reduction of forest areas by 37% (1,666 ha) in 2006, compared to 1979 was observed in the Jiana - Pătulele area (Fig. 7).

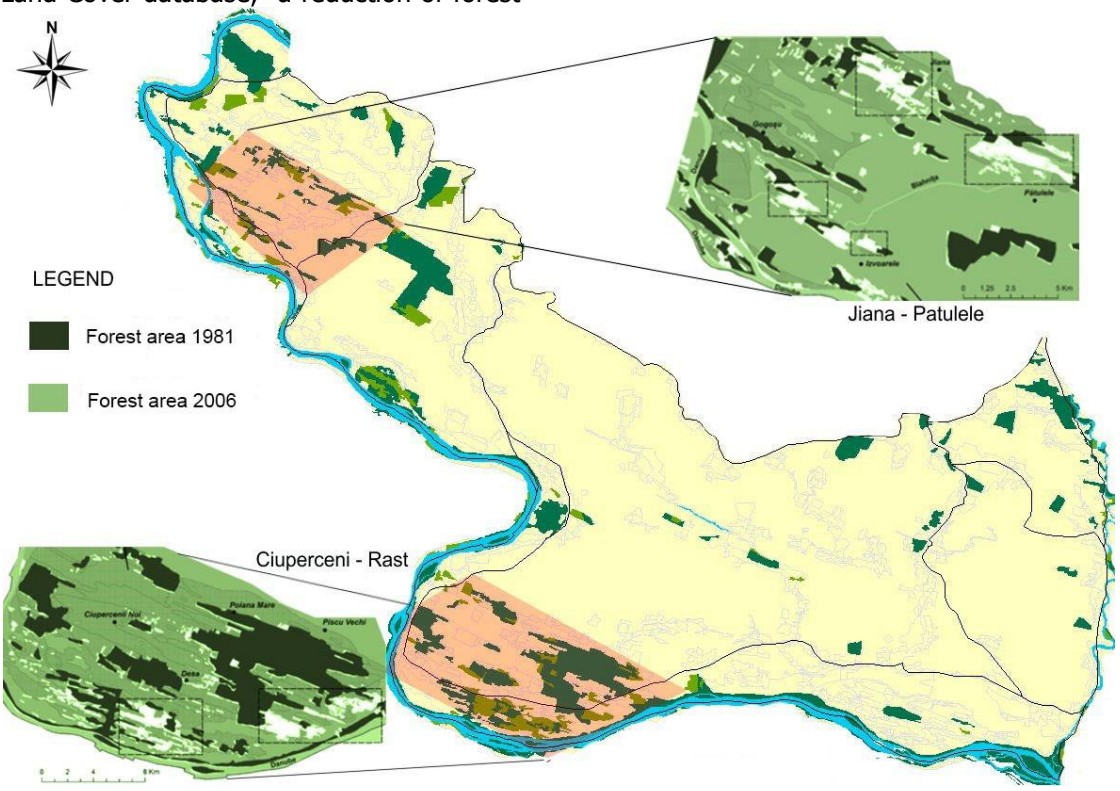

Fig. 7: The dynamics of the forest areas in the Ciupercenii Noi - Rast and Jiana Pătulele areas between 1979-2006 (comparative analysis of topo.79.rastel.sid and Corine Land Cover 2006)

The main cause of the disappearance of the forest layer in the western part of the study area is mainly anthropic caused by deforestation carried out by the owners. A secondary cause is represented by the unfavourable climatic context, determined by the prolonged droughts of the last three decades that had direct consequences on the sanitation works far beyond the provisions of the local forest department.

A hypothesis regarding the modification of the local water balance (the decrease of the groundwater level downstream Izvoarele - Gruia) could be the construction of the dam of Portile de Fier II hydrotechnical area. This has led to an amplification of the drying phenomenon among the poplar forest areas, especially in the area of the sand dunes.

An accelerated negative dynamic is noticed in the case of Jiana (663 ha lost forest areas), Pătulele (540 ha), Vrața (463 ha), Desa (462 ha), Gogoșu (361 ha) and Piscu Vechi (350 ha), the causes being related to the irrational cutting down of trees. The situation is even more complicated in the context in which the mentioned villages generally overlap with the sandy areas of the southern Oltenia (Prăvălie, 2013).

Vineyards

The data provided by CORINE Land Cover show that the vineyards recorded considerable losses at national level. The 1981-2006 period is interesting to be studied given the significant spatial transformations of land use in southern Oltenia, triggered by the change of the political system since 1990 (Bălteanu et al, 2013). As a result of the application of the 18/1991 land law it was noticed a poor management of the vineyards by the new owners, either by abandonment or by clearing. The vineyards can play a key role in the ecological stability of this territory by stabilization of sandy soils, similar to the role of forest surfaces (Prăvălie, Peptenatu and Sîrodoev, 2013).

The analysis of the spatial-temporal dynamics observed on the basis of the topographic maps of 1981 (scale 1: 700,000) and of the CORINE base 2006, shows that during the 25 years this category has reduced by about 60% (11,000 ha), respectively from almost 18,400 ha in 1981 to almost 7,400 ha in 2006. Thus, one can discuss about a substantial spatial constraint of this permanent culture, in a relatively short period of time. In contrast to the

forest surfaces, the vines recorded relatively uniform spatial losses throughout the analyzed area (Fig.8).

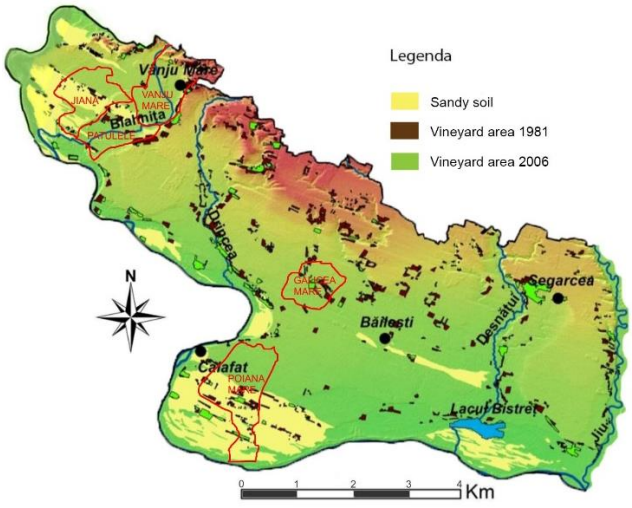

Fig. 8: The dynamics of vineyards in the west of the Oltenia Plain in the 1981-2006 period (after Prăvălie, 2013 and GIS processing)

Large losses of vineyards were recorded mainly in the central-western part of the study area, but a significant extent was also noticed in the area of sandy soils. If in 1981 the sandy soils were stabilized with vineyards in a proportion of 7% of the area (20,063,360 ha), in 2006 the percentage decreased to about 5% (≈ 2,400 ha). At the level of landscape units, the largest losses occurred in the central-northern part of the Băilești Plain and in the Vânju Mare area (Prăvălie, 2013).

The areas with the largest losses of vineyards are Vânju Mare (616 ha, 70% losses in 2006, compared to 1981), Pătulele (585 ha, 100%), Poiana Mare (550 ha, 75%), Galicea Mare (531 ha, 99%) and Jiana (500 ha, 100%).

The dynamics of wetlands

Swamps are ecosystems that are part of the wetland category, being considered among the most productive terrestrial ecosystems (Gibbs 2000). They are essential due to the habitat function. They are developing a specific biota, but they also play a major role in stabilizing the environment by mitigating climate change, controlling pollution, water purification, flood mitigation or nutrient retention at ground level (Wright & Reddy 2001); Gâştescu and Ţuchiu, 2012).

In the south of Oltenia, wetlands play a fundamental role in improving the restrictive climatic conditions, by regulating the humidity balance and the thermal regime. At the same time, they are very important in terms of biodiversity, considering that there are three sites of wetlands of international importance (Bistrița, Blahnița and Calafat - Ciuperceni - Danube), which have a variety of species of flora and fauna. However, it seems that a large part of these ecosystems have disappeared in this area during the last decades, because of the draining generated in order to expand agriculture (Dumitraşcu, 2006). The cartographic analysis shows that the marshy areas decreased in the 1981-2008 period by 52%, respectively from almost 11,200 ha in 1981 to 5,400 ha in 2008 (Fig.9).

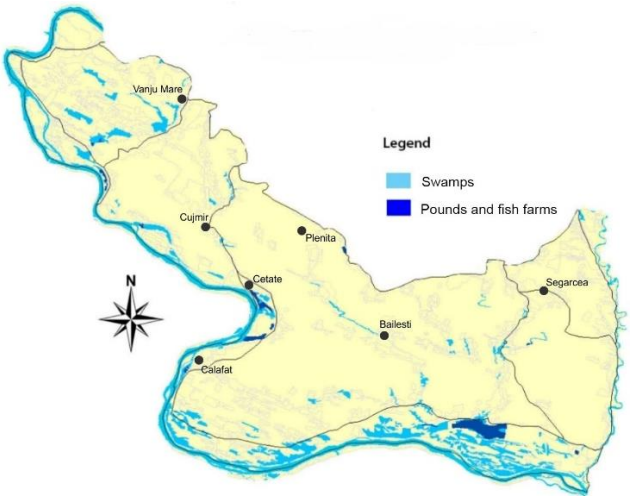

Fig. 9: The current location of the swamps and pounds in the Oltenia Plain, in the west of Jiu

In the Ciupercenii Noi - Rast area, the marshy areas suffered initial losses in favour of the agricultural field of 1,248 ha. It is also interesting to note that in the case of water bodies (aquatic surfaces), there are area losses in favor of marshy areas. In this case, the transformation of the natural aquatic areas into marshes (considered as lands with lower humidity compared to the proper aquatic surfaces) are caused by the climatic changes, i.e. the accentuation of the climatic aridization of the region.

The situation is similar in Jiana - Pătulele area. In this area, it is noted that the marshy areas in the 1981-2008 period lost a total of 3,600 ha, of which 98% (3,524 ha) in favour of the extension of agricultural land.

The highest losses were recorded in the Devesel (1,241 ha), Gogoșu (976 ha), Jiana (852 ha), Desa (432 ha), Vânju Mare (360 ha), Cârna (348 ha) and Ciupercenii Noi (340 ha) administrative units located in the west and south of the studied region (Fig.10).

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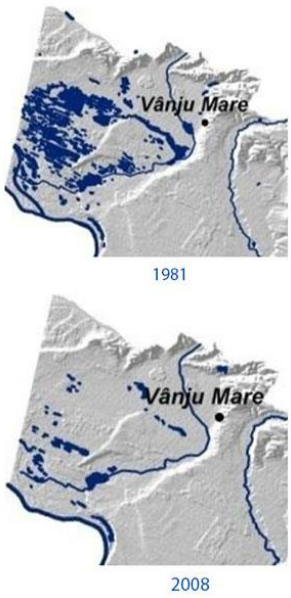

Fig. 10: The dynamics of the areas with marshes in the Jiana Plain in the 1981-2006 period (Global Mapper and GIS processing)

Irrigation

The greatest achievements of the irrigation system in the Oltenia Plain were made after the 1970s, when large agricultural areas began to be irrigated. In the context of lack of investments, technical maintenance problems, non-technologization and numerous thefts, this system, vital for local agriculture, disappeared almost entirely after 1990.

In the western area of the Oltenia Plain, corresponding to Mehedinți county, no irrigation has been carried out since 2007, the irrigation systems Crivina - Vânju Mare and Izvoare - Cujmir being totally abandoned (Prăvălie, 2013). At the same time, the analysis of the year-on-year data from Dolj county showed that the irrigated areas have decreased dramatically since 1991. It was recorded that the irrigated lands reduced on average to 12% in the 1991-2008 period, compared to 1990 (412,502 ha). Thus, we can discuss an average of 88% collapse during the 18 years after 1990, even though there were some optimistic fluctuations during this period.

A close look at topographic maps (1979), Land Cover (1990, 2000 and 2006), World Imagery Esri (2009), Google Earth and Google Street View images (2012-2016) and field photos (2019) show some changes on the land use and the effects of the changes produced during this period. The analysis of these changes considered the correlation between:

- the evolution of forest areas, crops (especially those of vineyard and rice with an important role in stabilizing the sands of dunes and swamps), areas with marshes and ponds, anthropic constructions and
- their impact on the geomorphology of the area and on the management and sustainable development policies that need to be adapted.

Wind factor and sand dunes

In the western extremity of the Jiana Plain, the lack of forests for a long period of time led to the maturation of some dunes which reached a relative stabilization or low advance. The slow advance of dunes can be observed in the west of Burila Mare - Ţiganaşi where the lack of forests for a long period of time led to the leveling of the land, the erosion processes having a minor dynamic (Fig.11).

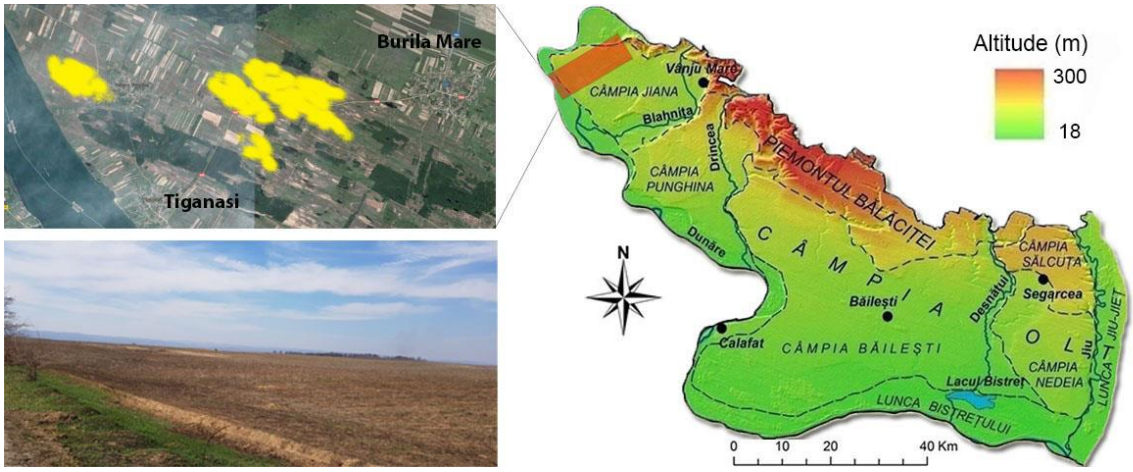

Fig. 11: Mature dunes stabilized in the Burila Mare - Ţigănaşi area (Cristian Răducă, April 2019)

This can be deduced from the analysis on the erosion witness of the dune in the south of Burila Mare, represented on the topographic map of 1979, on the World Imagery 2009 map (Global Mapper), on the Google Street View image from 2012 and on the photos from the present days. The analysis showed a decrease, gradually and slowly from a width of 100 m in 1979 to 10 m currently on the 100 m isohypse map (Fig.12).

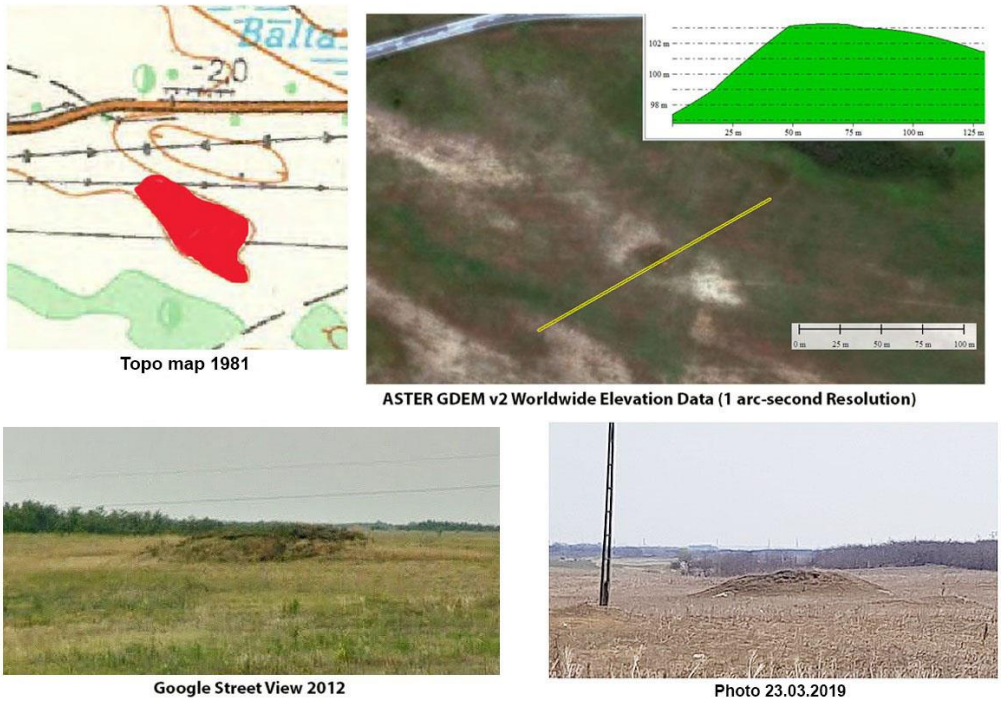

Fig. 12: The evolution of the dune ridge from the south of Burila Mare

In the same area we have the confirmation of the land evolution under the influence of the wind factor during the last 40 years in the Ţigănaşi - Burila inter-forest where the forest edge is up to 2 meters higher than the uncovered area nearby (Fig.13).

Fig. 13: The different evolution of the sandy lands uncovered between the forests in the north of Ţigănaşi town (Cristian Răducă - 04.2019)

Another confirmation of the evolution and intensity of the land degradation process under the influence of the wind factor is the elevation of the base of the electric tower fixed on the sandy lands in the south of the Jiana plain. Compared with the electric towers in the areas with stable land, their base was uncovered up to 2 m as it can be seen at the entrance of Burila Mică from Bistriţa (Fig.14).

Fig. 14: The effects of different wind erosion in the Blahniţa Plain a) sandy land (Burila Mică), b) Chernozem stable soil (Gruia) (Cristian Răducă, 04.2019)

The quantities of sand carried by the winds from west/north-west to east/south-east were settled and stabilized in the forests and in the agricultural crops between Burila Mică, Jiana and Pătulele as well as within the villages of this area. Another part was carried with the sand from the uncultivated or deforested areas during the last two decades and determined the advance and reactivation of some dunes such as the ones from Ţigănaşi forest, in the south of Jiana Veche, in the east of Pătulele and in the north of Izvoarele (Fig.15).

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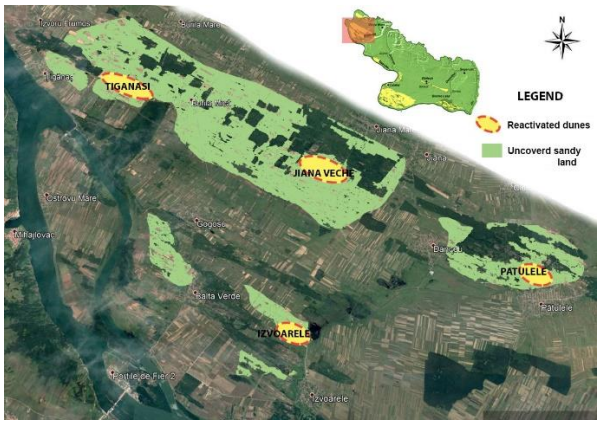

Fig. 15: The location of the reactivated dunes within the uncultivated sandy lands or covered with temporary mild vegetation (Correlation between Google Earth maps and field observations, August 2018)

A certain sample of dune reactivation is in the east of Pătulele (Fig.16) and in the north of Izvoarele, in the east of the Rotunda Lake (Fig.17)

Fig. 16: The altimetric difference between the western and eastern riverbank of Blahnița near Pătulele (Cristian Răducă - 04.2019)

Fig. 17: The uncovered sandy lands and reactivated dunes in the north of Izvoarele (Cristian Răducă - 04.2019)

The tree cutting of the mulberry forest and the deforestation of the silkworm farm in Pătulele led to the reactivation of the dune from Pătulele, whose development is consistent, the western riverbank of Blahniţa rising almost 1 m in comparison to the eastern one. Fortunately, in this case, the advance is stopped by the Blahniţa river and Pătulele village.

The Blahnița meadow in the north of Izvoarele is the scene of the reactivation of a series of dunes due to the narrowing of the water surface of the Rotunda Lake and the intensification of the aridization process in this area during the last 4 decades (Fig.18). If in 1980, the Rotunda Lake had a water surface of 311 ha and in its north, the Ontolea Lake had 37.7 ha in 2019, the water surface of the Rotunda Lake is 50 ha and the Ontolea Lake has a water surface of 6.4 Ha.

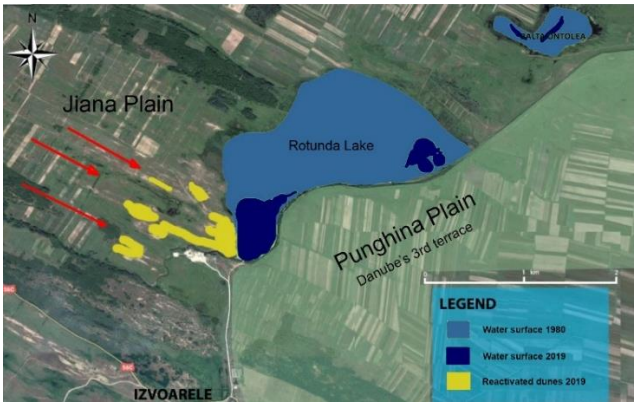

Fig. 18: The uncovered sandy lands and reactivated dunes in the north of Izvoarele

There is a fortunate case regarding the dune of Pătulele in terms of stopping the advance of these dunes, considering that their advancing front meets the Blahniţa valley and the high side of the 3rd Danube terrace.

The improper national strategies of rehabilitation and bad reforms are other major causes of the fast degradation of this sector of great national importance. The degradation of irrigation system in large areas in the south of Oltenia caused serious economic consequences (by decreasing agricultural productivity), but also ecological ones (by deepening the water level and thus inhibiting the overall biological productivity). The disappearance of irrigation amplifies the adverse effects of the climate aridization and, consequently, the general degradation of the land in the region.

Conclusions

This study aims at identifying the risk generated by the drying and drought phenomena on the sandy land in the west of the Oltenia Plain. Meteorological data have been analyzed since 1980 and these were correlated with the topographic and satellite data (after 1990), thus making possible the localization of

the phenomena that cause the aridization and the identification of the vulnerable areas.

The analysis of the dynamics of the vegetation, of the areas cultivated with vineyard, of the dynamics of the aquatic areas, of the irrigated areas in conjunction with the observations from the field, allowed the identification and mapping of the areas in which the aridization is accentuated; under the influence of the wind factor they are in danger in terms of the dynamics of sandy lands.

In the south-west area of the Oltenia Plain, especially in the rectangle located in the south of the Jiana Plain (Burila Mare - Ţigănaşi - Izvoarele - Pătulele), with an interruption in the area of the erosion witness of the 5th terrace from Dănceu - Jiana, the terrain dynamics is very sensitive, depending very much of the economic interest and involvement in this area with significant potential. A serious involvement in the valorization of the lands would mean the redesign of the irrigation systems and the planting of large areas, determining the stabilization and the efficient exploitation of the land. Conversely, an economic downturn would leave the lands to the winds, increasing the danger of drying and of the dunes advance towards the villages located in the south of the Oltenia Plain.

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