THE WIND DEFLATION FROM SAND AREAS AFFECTED BY ATMOSFERIC DRYNESS: LEU-ROTUNDA AND DĂBULENI FIELDS (OLTENIA PLAIN)

ROȘCA FLORINA CRISTINA [1], PETREA D.[2]

ABSTRACT. The wind deflation from sand areas affected by atmospheric dryness: Leu-Rotonda and Dăbuleni Fields (Oltenia Plain). Leu-Rotunda and Dăbuleni Fields are characterized by substantial extension of sandy soils. The sands on the left of Jiu are poli-stratificated fluvial deposits eolian shaped as dunes and interdunes. During the reported period 1980-2007, it was found that the most exposed time of the year to the wind was during the spring, the months of March, April and May as in speed and frequency. According to the analyzed data, the dominant wind direction during spring season on the sandy soils from Dăbuleni is the western, with negative effects on crops who then begin their vegetation cycle. The shelterbelts have decreased, although lately there have been numerous programs which aimed afforestation of affected areas.

Keywords: The Leu-Rotunda and Dăbuleni Fields, wind deflation, CLC, shelterbelts.

1. INTRODUCTION

The studies regarding to the south-eastern Oltenia Plain highlight in general negative aspects especially when in discussion are present risk climatic phenomena such as wind deflation. The two subunits, Leu-Rotunda Field and Dăbuleni Field are integral parts of Oltenia Plain (Fig. 1). In their turn also they are divided such as the natural subunits for the northern according to Coteţ (1957) we have the Jiu Plain with the plain flood Moor Green-Rojiştea, famous for its rich vegetation and abandoned meanders and Malu-Mare–Tâmbureşti Plain, a terraces plain drowned by dunes. Another subunit is the Leu-Diosti Field characterized by high dune field and the lack of the valleys in the west. The east side being crossed by the valley of Tesluiului and its tributaries. For the southern part Dăbuleni field, according to Cotet in 1957, has the following natural divisions: Marsani-Bechet Plain, a plain with many rivers abandonated, rings and grinds. This is also the confluence plain of the Jiu river with the Danube and its eastern part is composed of terraces drowned by dunes near the town Sadova those are having height of over 10 m. Another subunit is Amărăşti-Redea field, which appears as a "peninsula" surrounded on the outside of villages. What should be noted is that this subunit has

[1] Babeş-Bolyai University, Faculty of Geography, Cluj-Napoca, Romania
e-mail: cristina_rosca88@yahoo.com
[2] Babeş-Bolyai University, Faculty of Geography, Cluj-Napoca, Romania
e-mail: dpetrea@geografie.ubbcluj.ro

in the western part in Dobrotesti Field a only a dunes plain. The relief of dunes and interdune from the terraces area between Jiu River and Olt River has a general approach WNW-ESE, according to the dominant wind direction (Nuţă, 2011). This area is something called in the specialty literature blow sand area. The relationships between wind speeds and the soil reports, the most important in the process of triggering and wind transport development have been studied by many researchers from abroad, with numerous and complex papers published between 1949-1969 (Chepil, 1945). In Romania, some authors studied on this issue (Chiriţă, 1937, Moţoc, 1963, Obrejanu and Trandafirescu, 1972, Canarache et al., 1984, Baniţă, 1981, 1986, 1994). Recently, in 2011 Nuţă reaches important points about the direction, intensity and frequency of wind in an area of dunes near the town Bechet. In this paper we propose to study the phenomenon of wind deflation, which continuously affectes the area and intensifies its action because of irrigation system operation stop and massive deforestation of antierosional protection curtains.

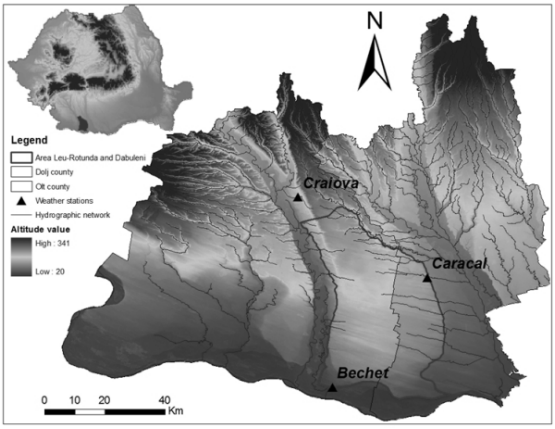


Fig. 1. Location of the Leu-Rotunda and Dăbuleni Fields inside Romania

2. DATA SOURCES AND METHODOLOGY

In order to achieve the study on the wind in sandy areas affected by atmospheric drought, wind speed, direction data have been used over the period 1980-2007, recorded in two weather stations: Craiova and Bechet weather stations, which belong the National Network of National Meteorology Administration, but also processed date by SCCCPN Dăbuleni researchers, with over 45.000 observations and measurements from endowment agrometeorological station, well as field measurements using hand anemometers. In the analysis we used data on areas occupied by sand at each settelment level and on afforestation and deforestation in work production unit VIII. That forrest unit is covered entirely by shelterbelts in Dabuleni administrative area. Graphical materials was done by using the Excel software and ArcGIS 9.2 and ERDAS IMAGINE Program. The maps of the forest areas in the region based on Topography Map and Corine Land Cover (CLC).

3. RESULTS

3.1 The surfaces distribution occupied by sands in Leu-Rotunda and Dăbuleni area

At the level of Oltenia Plain, Leu-Rotunda and Dăbuleni Fields, cover the most extended area with sandy soils of 67.000 ha (Baniţă, 1981). The sands on the left side of Jiu river are extended eastward and near the river mouth they occupies entirely the the Danube terraces; in Dabuleni administrative area they cover 10.300 ha and in Calarași they cover 6.800 ha. In northwestern part of the area, the localities Sadova and Rojişte hold 98.500 ha respectively (Fig. 2).

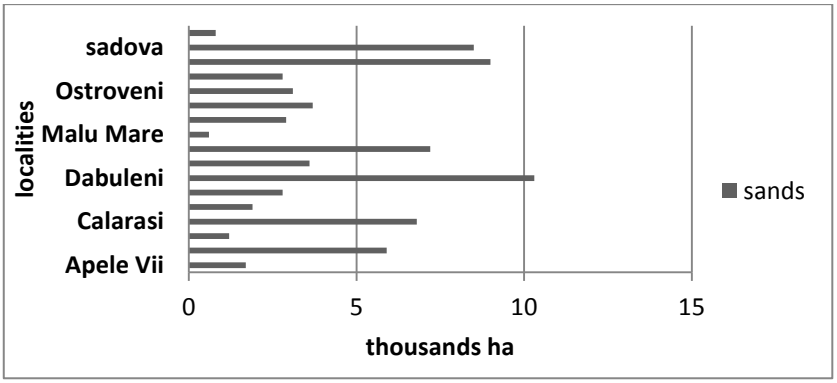


Fig. 2. The distribution of surfaces occupied by sand at locality level in the area Leu-Rotunda and Dăbuleni *(Sources: SCCCPN, Dăbuleni)*

3.2 Wind speed fluctuation during spring and summer season

The analyzed sandy area, mainly its particular large expansion from the southeastern part is named blowing sand area. Chepil in 1954 completed the first wind strength scale and classified the factors that influence the wind deflation. Popovăț, 1987, cited by Nuță, 2011 concluded that the sand particles begin their movement when wind velocity at ground level is higer than 3.5-4.5 m/s, and the grains that start to move have a diameter from 0.25 and 0.01 mm. The spring time is the most critical period of deflation. because the soil is still naked and unworked and plants are still inactive for soil protection against wind. In spring months the 3 m/s wind speed recorded, at the two weather stations considered, a frequency higher than 90%. This wind speed fits into the category of low-intensity wind according to Beaufort scale. The maximum wind speed registered was higher than 5 m/s, and they have been included in the same intensity category (Fig. 3).

The summer period is considered to be less aggressive, because the plants are sufficiently developed, so as not to be affected by deflation, but it cannot be denied the fact that wind at high speeds impact on mature plants, too: cover them with sand, tearing and shaking of flowers and fruits. Thus as a whole, during the

summer at the Craiova wether station, wind speeds have varied between 2 and 3 m/s (Fig. 4). However over the period 1980-1985, there were also situation when the wind speed reached 5 m/s in June. If taking into account that during this month the water requirement for vegetation period and the evapotranspiration are their maximum values, can conclude that the impact on plants are negative.

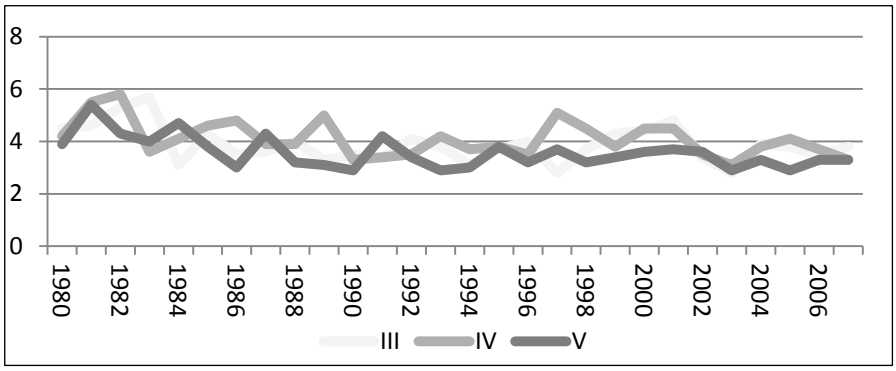


Fig. 3. Variation of wind speed in the spring season in Craiova

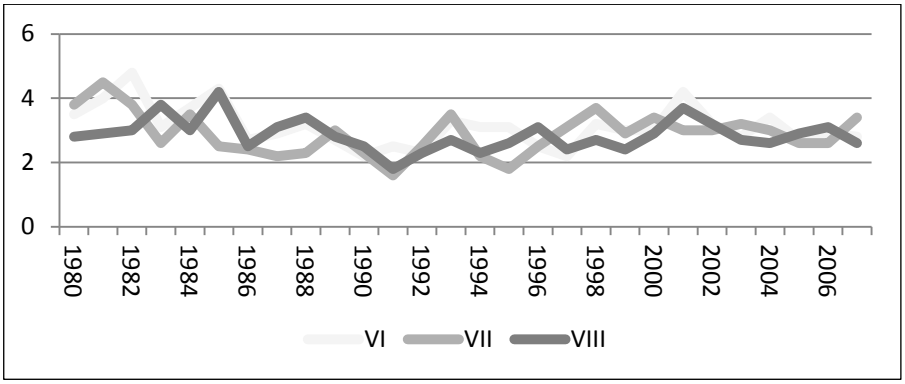


Fig. 4. Variation of wind speed in the summer season in Craiova

3.3 The wind regime in the southern part of the region explored

The general orientation of the dunes and the inter-dunes which is VNV-ESE, is according to the dominant wind direction and frequency. This result can be validated in Figure 5. The multianual frequency analysis shows than 41% of registered cases in a year are days with calm atmosfere (no wind days), while 59% are the days with wind. Over 90% of the analyzed area overlaps the complex arrangement hidro-ameliorative Sadova-Corabia. The researchers at the Research Center for Vegetable-Growing on Sands Dăbuleni made a map than reveals the exposure of the sands from the deflation of the wind through its processing. It can be seen that more than half of the area is exposed to intense and very intense erosion (Fig. 6).

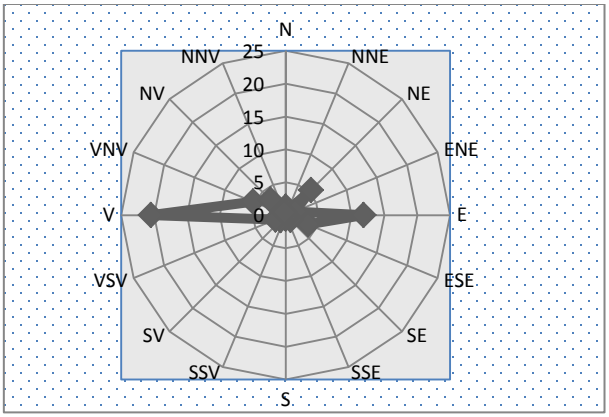


Fig. 5. Multianual mean frequency of winds (%), Dăbuleni – Bechet 1980-2007

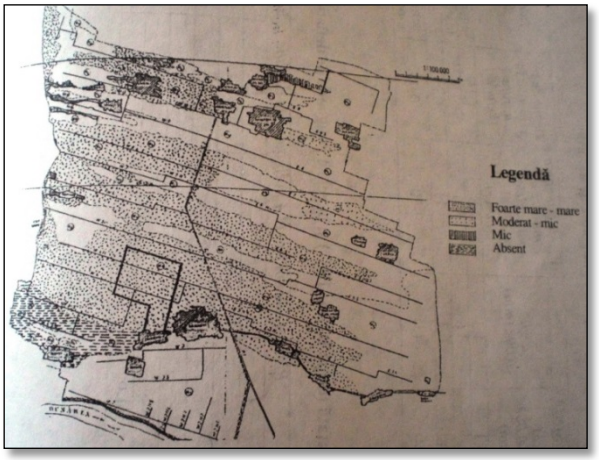


Fig. 6. The exposure to wind erosion in sands complex arrangement Sadova-Corabia *(after a Canarache et al,. 1984)*

From the analysis of Figure 7 during spring, at Bechet weather station the wind speed had lower values at the beginning of the period (1980-1995) while after that the wind speed increase with more than 1 m/s. During summer, the anticyclone dominant especially in the second part of the summer leads to the increase of the frequency of the atmosferic calm. However the monthly values of wind speed were lower from beginning of the period until 1991 and then increased until the end of the analysis period (Fig. 8).

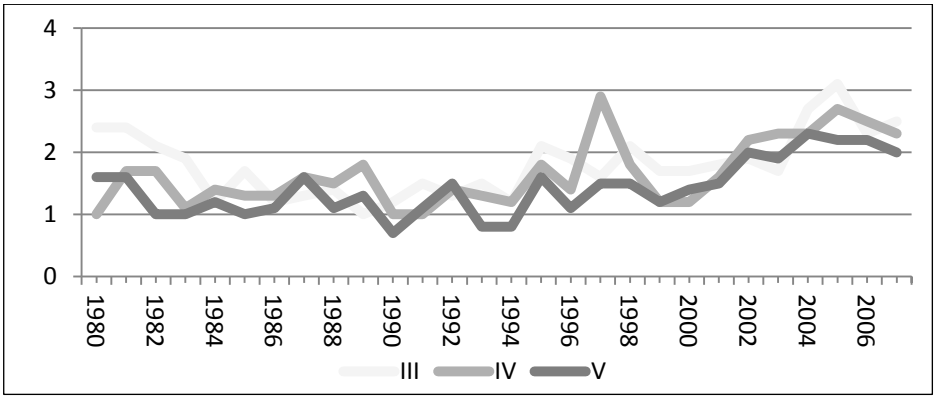


Fig. 7. Change in wind velocity in the season of spring weather station Bechet

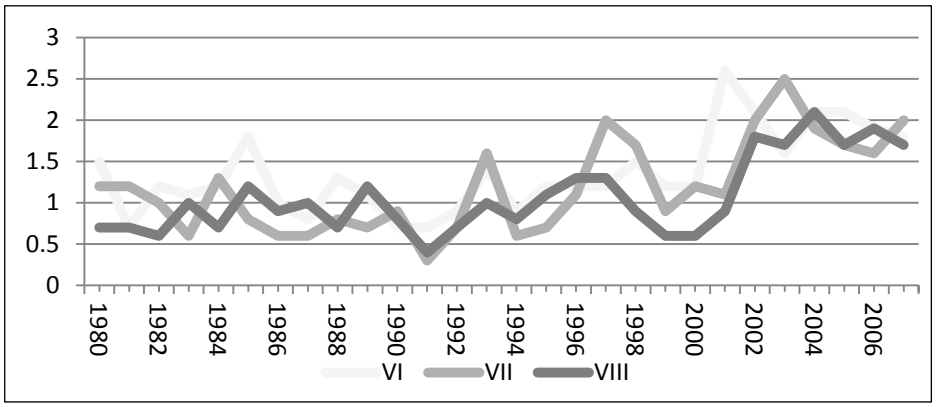
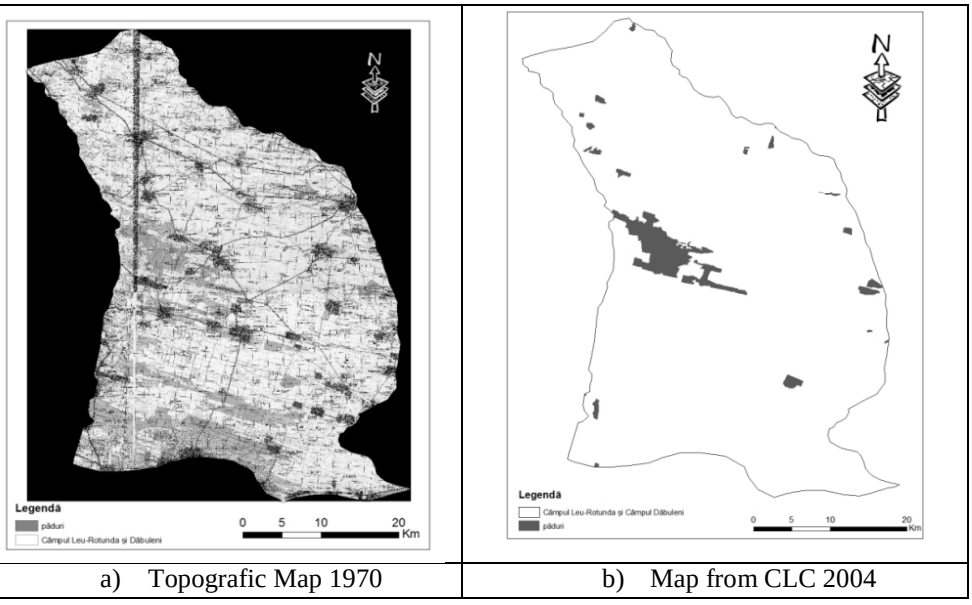


Fig. 8. Change in wind velocity in the summer season at the meteorological station Bechet

3.4 Attenuation methods of risk – Acacia forest curtains

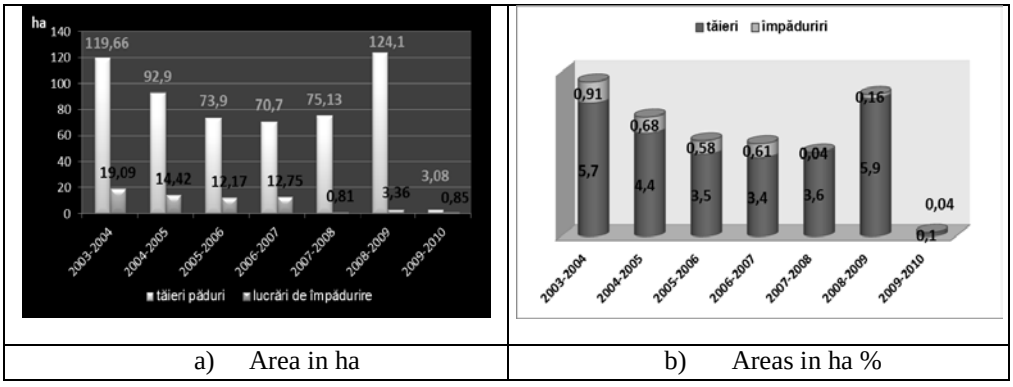
Forest protective curtains are woodlands with formations and different lengths relatively narrow widths, in the form of strips, placed at a certain distance from a target, aiming to protect against harmful effects (Nuță, 2011). They protected the soil from erosion phenomena (combat deflation) and had a extention of 631.5 ha. To see the specific situation regarding forest areas and in particular the protection curtains we made a compared analysis of the two maps: one from 1970 and the second from 2004. It can be observed a diminishing over time of forested areas. The differences observed above may sometimes be disputed for reasons of truthfulness of the information, because the database of the map in Figure 9 b is a database made from Landsat satellite images, made in 2002 in Romania and published in 2004, available on the website www.geospațial.org. Thus, considering that afforestations have been made in the area in recent years and the satellite images could not be detected in those areas of the forest at the juvenile stage, we

estimate that currently forested area (with mature trees and vegetation) is higher than that shown in Figure 9 b. That's why we have done the graphs showing both the areas of the forest cut and the afforestation works. The areas affected by the work of grubbing-up, has very high values, unlike those of the planting. Thus during the 2003-2004 year, cutter works affected 119.66 ha, while reforestation were done only on 19.9 ha. In percentage terms, the period 2003-2010 is the same situation, the work of cutting covered 5.7% of the area under study and the afforestation 0.91%. In 2009-2010 cutting works were conducted on 0.1 percent of the total surface, where as reforestation was done on much lower area of 0.04% (Fig. 10 b).



a) Topografic Map 1970 | b) Map from CLC 2004

Fig. 9. Topografic Map in 1970 versus map derived from Landsat 7 ETM, 2004



a) Area in ha | b) Areas in ha %

Fig. 10. The afforestation works and illegal logging at the forest (a-ha) and (b-%)

4. CONCLUSIONS

The knowledge of wind regime in sandy soils area of Dabuleni and Leu-Rotunda area is necessary in order to characterize it from weathering agresivity point of view. The multianual frequency (1980-2007) shows that 41% of registered cases in a year there are days with no wind situations, while 59% are days with wind. Spring period proved to be the most affected by wind erosion, because the soil is uncovered by vegetation or snow, being more vulnerable to this risk phenomenon. More than half of the area considered is exposed to erosion of large and very large. About the shelterbelts, during the period 2003-2004, cutter works were done on 119.66 ha, while reforestation were done only on 19.9 ha. Thus, over the period 2003-2010, the deforestration was done on 5.7% of the area under study while the afforestation affected 0.91%.

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