RESULTS OF THE STUDIES ON THE CAUSES FAVOURING THE DESERTIFICATION RISK IN THE BANAT PLAIN

REZULTATE ALE STUDIILOR PRIVIND CAUZELE CARE FAVORIZEAZĂ RISCUL DE DEŞERTIFICARE ÎN CÂMPIA BANATULUI

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Abstract: *The paper presents the natural causes which can induce the desertification risk in the Banat Plain conditions are considered as main causes at the global level. The studied natural causes are climatic conditions, risk phenomena, topography, vegetation cover and soil conditions.*

Rezumat: *În această lucrare sunt prezentate cauzele naturale care pot induce riscul de deşertificare în condiţiile Câmpiei Banatului prin prisma principalelor cauze la nivel global. Cauzele naturale studiate sunt condiţiile climatice, fenomenele de risc, aspectul topografic, acoperirea cu vegetaţie şi condiţiile de sol.*

Key words**:** *desertification natural causes, climatic conditions, risk phenomena, topography, vegetation cover, soil conditions*
Cuvinte cheie: *cauzele naturale ale deşertificării, condiţii climatice, fenomene de risc, aspect topografic, acoperirea cu vegetaţie, condiţii de sol*

INTRODUCTION

The preoccupations concerning the identification causes which encourage desertification are old but this kind of studies have been intensified lately based on the substantial manifestations of the aridisation and desertification process. LAL et al. (1989), quoted by DENTI (2004), offer a complex vision on desertification. According to them, the direct causes of desertification are:

-natural causes: climate conditions, risk phenomena, topography, vegetation cover, and soil conditions;

-human-induced causes: overgrazing, inadequate agricultural practices (over cultivation, inadequate use of irrigation water and agrochemical products), deforestation, industrial activities, and urban expansion.

MATERIALS AND METHOD

In order to determine the causes favouring the desertification risk in the Banat Plain, the global natural causes were compared with the climate, relief, soil and vegetation conditions in the studied area. The paper conception was made by consulting a bibliographical speciality material regarding the description of natural conditions in the Banat Plain. In this manner it was established to what extent the main factors indicating the desertification risk in other areas of the world are also active in western Romania.

RESULTS AND DISCUSSION

a) Climate conditions

In the past century, the progressive aridization has been felt not only in the south and south-eastern regions of our country, but also in its western part of Romania. Aridization is a process that implies increased temperatures and reduced precipitations. The continuous

increase of atmospheric pressure favours a longer sunny interval accompanied by fewer anticyclones and precipitations. (VRÂNCEANU et. al., 2000).

In the Banat Plain climate, temperature is relatively uniform. The annual average is 10-12°C and aridization tendency increase from east to west. The most arid area in Banat is Sânnicolau Mare (COSTE et al., 1997).

Table 1

Multiannual temperature and amount of precipitation averages in the Banat Plain in 1961-2005

No.	Meteorological station	Multiannual temperature average (°C)	Multiannual precipitation average (mm)
1	Timişoara	10.8	597.7
2	Sânnicolau Mare	10.7	530.6
3	Banloc	10.9	599.7

In the last years, accentuated extreme annual averages and big differences from year to year have been noticed (e.g., 1999-2000 and 2005-2006) (POPA, BORZA, 2007). This means intense and prolonged drought periods and devastating floods. The studies performed at Timişoara, Sânnicolau Mare and Banloc indicate that although the annual average temperatures and amounts of precipitation follow their usual cycle, temperatures tends to increase and precipitations to decrease (POPA, BORZA, 2007). The temperature increase rate is higher than the precipitation decrease rate. Increases in temperature and decrease in precipitations lead to dryness through the increase of potential evapotranspiration and implicitly, to the decrease of the aridity index specific to the area.

The accentuated extreme phenomena (drought-flood) that show significant deviations from the multi annual average in two consecutive years are also reflected in the soil evolution, climate oscillations and rain water chemistry influencing the geochemistry of the superficial layer of the lithosphere (TRICART, 1972). Soil alkalinity is sustained by the meteoric supply against the background of reduced percolation and faulty drainage (TRICART, 1972).

Climate conditions are the most obvious cause of desertification risks in the Banat Plain, where the Palfay aridity index is 4-6 (CANARACHE, 2000), and the P/ETP ratio is 0.50-0.65 (MUNTEANU, 2000).

b) Risk phenomena

Erosion is caused by risk phenomena such as prolonged drought and torrential rains in the dry and sub-humid regions of the country.

In the western plains, drought is incidental (BOGDAN, NICULESCU, 1999). The climate-diagrams based on multi-annual temperature and precipitation averages reflect only the dryness phenomena. However, both drought and dryness are present in the Banat Plain. In 1931-1955, Timişoara station recorded 22 drought periods and 36 dryness episodes, 29% of the analysed months having been droughty (BOGDAN, NICULESCU, 1999). Between 1965 and 1999, the Timişoara station recorded 4 very droughty years with high intensity and 10-12-year-recovery intervals; the Sânnicolau Mare and Banloc stations recorded 2 very droughty years with 9- respectively 21-year recovery intervals (STANCIU, 2005).

The analysis of the climate- diagrams obtained at the meteorological stations in the Banat Plain, which were based on the 1961-2005 (POPA, BORZA, 2006) multi-annual averages, reveals more intense dryness on the S-N and E-W direction. The decreasing order of dryness intensity and duration is Sânnicolau Mare, Timişoara and Banloc. Drought manifests differently from year to year, but each drought year increases climate aridization especially that the number of drought years has increased in the past decades (STANCIU, 2002). The most arid year in the studied period was 2000, when continuous drought and dryness lasted the whole warm season and the first two months of the cold season (POPA, BORZA, 2006).

Torrential rains falls in the warm season. In large quantities, they cause excessive humidity. They are caused by the unequal warming of the Earth surface and the active dynamics of the tropical wet air (STANCIU, 2005). Because of their torrential character, they become a climate risk for the environment. Most of them are frontal, especially in summer, the season with the highest amount of rainfall in 24 h, accelerating soil degradation and erosion (MIRCOV et al., 2005). In Banat, the amount of torrential rains is smaller than in the south and south-eastern regions (STANCIU, 2005), but they still can cause floods and soil degradation.

c)Topography

Land slope degree matters when it exceeds 5% and favours erosion and high surface runoff rates (MUNTEANU et al., 2003).

The Banat Plain is disposed on two levels: the higher covers 35% of the total surface, while the lower 65% of it. As regards the slope degree, the higher plain causes surface erosion problems. Thus in the Vinga Plain, the relief configuration has 5-35% degree slopes and is supported by medium-textured soils in the upper part of the soil profile and by the lithologic substrate made of red clay and loamy or sandy marl (URUIOC, 1997). Every year, these soils are covered by comatated material of different thickness resulting from water erosion. The critical season when the water erosion is more intense in the area is May-June, when the cultivated crops hardly protect the soil (URUIOC, 1997).

d)Vegetation cover

In the general phytogeographic meaning, the central and western part of the Banat Plain lies in the silvo-steppe area although in the past decades, against the background of climate aridization, reduced groundwater influence and a smaller forest area, elements typical of the steppe have been noticed: fescue (*Festuca valesiaca* Schleich ex Gaud.), couch grass (*Agropyron cristatum* (L.) Gaertn) etc. (IANOŞ et al., 1997).

The vegetation in the Banat Plain is strongly anthropized, given the drainage works performed along the time, the cultivation of about 80% of the total surface and the poor forest spreading (12.5% of the territory) (RĂUŢĂ et al., 1997). On one hand, human intervention has reduced landscape diversity; on the other, it reduced the specific diversity of the agro ecosystems (COSTE, 2003). In addition, vegetation extirpation due to drought increases land surface albedo and intensifies evaporation.

In the past years, changes have occurred in the use of arable land: it was reduced from 63.86 % in 1974 to 62.06% in 1994, while the pastures were extended from 10.94% to 13.67%, mainly by setting land at rest (RĂUŢĂ et al., 1997). On the other hand, the forest surface area has increased (from 11.61 to 12.54%) and surfaces for other uses (water, swamps, and non-productive surfaces) decreased correspondingly (RĂUŢĂ et al., 1997).

Table 2

Agricultural land distribution on use categories
(Raport privind starea factorilor de mediu în județul Timiș, în anul 2006)

	Total agricultural land	Arable land	Pastures	Hayfields	Vineyards	Orchards
Surface (ha)	701255	532506	125656	29498	4354	9241
(%)	100	75.93	17.91	4.2	0.62	1.31

The agricultural land represents 80.7% of the whole county territory, and the non-agricultural land 19.3%. The largest share of the agricultural land is the arable land (75,93%). The woods, the pastures and the hayfields have the best vegetation cover, though their share is rather small in the plain area (the study refers to the whole Timiş county). The arable land is the largest in Torontal and Timiş Plain (over 90% of the territory). In the other plain regions,

the arable land share varies between 80 and 90% (Stategia de Dezvoltare Economico-Socială a Județului Timiş, 2007).

Table 3

Non-agricultural land distribution on use categories
(Stategia de Dezvoltare Economico-Socială a Județului Timiş, 2007)

	Total non-agricultural land	Woods	Water	Roads and railways	Yards and buildings	Non-productive land
Surface (ha)	167495	109126	15711	18685	20635	3338
(%)	100	65.15	9.37	11.15	12.31	1.99

Agricultural land concentration and extension on the quasi-stable areas in the Banat Plain have reduced spontaneous vegetation; consequently, the biodensity and the balance in the agro ecosystems are disturbed (COSTE et al., 1997).

e) Soil conditions

Drought and desertification vulnerability of certain soil types (sandy soils, extremely clayey soils, salinized soils, eroded soils) (MUNTEANU et al., 2003) that exist in the Banat Plain represents a major factor in measuring the desertification risk.

It is also necessary to mention several general characteristics of the soil types in the studied area.

Sandy soils have the following characteristics:

- they can be found in the Teremia - Pesac plain. They were formed by the Mureş River that crossed the loess field and deposited the first thicker sand layers upstream Pesac; it was only later that the river followed the Lovrin-Comloşu Mare line (COTEŢ, 1973);
- the level difference between the dunes and inter-dunes is rather small owing to land cultivation; sometimes isolated leveling eliminates this difference;
- in spring or when the land is not covered deflation affects the dune tops and colmated in inter-dunes;
- when the pedogenetic process is dominated by wind erosion, soil formation stops in its early stages (arenosols) and in the accumulation areas the soil horizons become thicker and have cumulic profiles (PUŞCĂ, 2002).

Clayey soils have the following characteristics:

- clay share varies from 21.9% to 51.6%; the highest values are found in vertisols and luvisols (RĂUŢĂ et al., 1997);
- clay (over 30%) influences soil compaction and permeability;
- in the central and southern part of the county, in the upper layer (0-25 cm), 50% are unsettled soils and 10% are moderately compacted; in the 25-35-cm layer, space distribution shows a slight increase of the compaction level (RĂUŢĂ et al., 1997);
- in the north-west of Banat, lacustrine deposits consist of clay (88%) with a fraction lower than 0.002 (IANOŞ, GOIAN, 1995);
- in the western part of the Banat Plain, on the fluvial-lacustrine deposits, there are gleysols and vertisols and also salsodic soils, mainly in the Aranca, Cenei-Ionel and Moravița Plains (IANOŞ, GOIAN, 1995).

Salinized soils have the following characteristics:

- primary salinization was due to the small slope degree in the lower plain and microdepressions that favour water stagnation on the soil surface, the lithologic composition,

the summer drought that imposed a strongly exudative water regime and the existence of 2-4-cm deep layers rich in soluble salts (OPREA et al., 1969);

- the higher amount of salt (over 8 g/l) in the groundwaters on the south side of the lower Bega Plain is connected with the slow water circulation and the finer materials (FLOREA et al., 1974);

- soil reaction grows with depth because of the salinization toward the base of the profile and the potential of salt increase on the profile in droughty years;

- besides the salinized soils (about 75000 ha with alkalinized soils and/or salinized soils) there are 180000 ha with salinization potential; thus 35.5 % of the soils vary with the existing or potential salinization (RĂUȚĂ et al., 1997).

CONCLUSIONS

The climate conditions are the most obvious cause of risk desertification. In the Banat Plain, the Palfay aridity index is 4-6 and the P/ETP ratio is 0.50-0.65. The climate risk, especially intense and long drought episodes and extreme values of climate parameters lead to the desertification risk. In the lower plain, which is climate-vulnerable, the slope degree does not represent a problem, and in the higher plain and the western piedmonts, with slope degrees over 5%, the higher amount of precipitation reduces the desertification risk. The high share of agricultural land in the plain zone, the small woodlands, the specific climate and urban expansion reduce the vegetation cover. The presence of drought vulnerable soils, especially salinized soils spread on larger areas and sandy and clayey soils to are a definite factor that favours the desertification risk.

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