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CONSIDERATIONS UPON THE DRYNESS AND DROUGHT PHENOMENA IN THE CARACAL PLAIN, ROMANIA

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Abstract

This study analyzes and evaluates the dryness and drought in the Caracal Plain, a division of the Romanian Plain, using some climatic indices (the De Martonne aridity index, the Angot report and the Angot precipitation index) and Péguy and Walter-Lieth climographs, for the 2000 – 2013 period. There have been used climate data from the Caracal Meteorological Station. The quantitative and comparative analysis of the above indices and of the climographs indicates that the intensity and duration of dryness and drought phenomena in the Caracal Plain have the same characteristics with the Oltenia region, meaning a slight increase from west and south-west to the east and north-east, which increases the degree of continentalism, and also from the north to the south.

Key words**:** *climatic index, climographs, drought, dryness, the Caracal Plain*

INTRODUCTION

On the general background of global warming, of the extreme events and the trend towards more pronounced aridity, the knowing of the geographical spread of dryness and drought phenomena is necessary in order to implement the most appropriate measures for mitigating and combating these phenomena. This aridity trend is observed in Romania, especially in the southern and south-eastern regions, where most crops have to be flooded in order to optimize the yields.

The dryness and drought phenomena (like climatic risk) are among the most complex ones, having a gradual progress. Several factors contribute to their occurence, namely: the active surface peculiarities, the weather, the physiological peculiarities of plants and the anthropic factors. [11, 12]

Among all these factors, the dynamics ones, which indicate the persistence of some characteristics of time, the lack of precipitation, the temperature increase etc., are the most important, determining the intensity of drought. Firstly, the atmospheric drought occurs, followed by the pedological one, while the complex drought (both (atmospheric and pedological one) installs in the maximum intensity phase.

The dry period is the interval of 5 consecutive days without precipitation or with low precipitation that did not exceed the daily average. *The drought period* is the interval of at least 14 consecutive days in the cold season (XII–III) and at least 10 consecutive days in the warm semester (IV–IX), with no precipitation or where the amount has been of $\geq 0{,}1$ mm/day [2].

The dryness and drought phenomena are characterized by the absence of precipitation (due to prevailing of the anticyclone, as a consequence of the stationary baric anticyclone formations with a huge progress over Europe, which cover the territory of Romania) and by the increased evapo-transpiration.

This paper aims to evaluate the dryness and drought phenomena in the Caracal Plain, based on the quantitative analysis of both the climatic indices (the De Martonne aridity index, the Angot report and the Angot

precipitation index) and the Péguy and Walter-Lieth climographs.

The Caracal Plain is situated in the south of Romania, in the historical region of Oltenia, being a division of the Romanaţi Plain, which belongs to the Romanian Plain (Figure 1).

It is located at west of the Olt Valley, being characterized by the predominance of slow and relatively flat shapes, which impose a remarkable homogeneity of the landscape, the height varying from 180 – 190 m in the north, to 45 – 50 m in the south [1].

Fig. 1. The geographical position of the Caracal Plain in Romania
Source: own processing from www.google.ro

MATERIALS AND METHODS

For this study, there have been used the database of the meteorological observations with long string of data made at the Caracal meteorological station, located at an altitude of 106 m, 40° 06' N latitude and 24° 21' E longitude, for the period 2000 - 2013 (Figure 2).

The processing of these climate data aimed to calculate and analyze the *De Martonne aridity index, the Angot report and the Angot precipitation index* and to achieve *the Péguy and Walter-Lietch climographs*, which show the presence, frequency and intensity of the dryness and drought phenomena [13].

The climatic indices were calculated based on simple mathematical formulas [8], dedicated, most relying on the reports of the two meteo-climatic elements: the air temperature and the precipitations [5]. For each index has been presented the way they are calculated.

Fig.2. The geographical position of the Caracal Meteorological Station in the Oltenia Region, Romania
Source: own processing from www.arcgis.com

The De Martonne aridity index (mm/°C) is used to characterize the aridity, indicating the restrictive character for certain plant formations, being calculated yearly, monthly and in the growing season. The De Martonne annual aridity index is calculated based on mathematical formula: Ia = P/(T + 10), where P is the annual amount of precipitation, T is the annual average air temperature, 10 is the value in Celsius degrees, value which is added to denominator, to produce positive results in regions with negative annual average temperatures. *The De Martonne monthly aridity index* is calculated based on the formula Il = 12p/(T + 10) [3].

The Angot report (mm) is the ratio of precipitation in the warm semester and the amount of precipitation in the cold semester, being an indicator of the continentalism degree [3].

The Angot precipitation index (K) is the ratio of the daily average volume of precipitation in a month and the annual daily average precipitation volume. The formula is $K = q \cdot 365/Q \cdot n$, where K is the Angot index, q is the monthly average precipitation, Q is the annual amount of precipitation, 365 is the number of days in a conventional calendar year and n is the number of days of the month, where February is of 28 days. The Angot index is used to determine the characteristics of precipitation for each month of a year [9].

Besides the quantitative analysis, expressed by various climatic indices, the use of graphics, such as the Péguy and Walter-Lieth

climographs, highlights the generalization of the dryness and drought phenomena in all the Caracal Plain area.

RESULTS AND DISCUSSIONS

The Oltenia Plain belongs to the transition climate subsector from outside the Carpathian arch, characterized by emphasizing of the continental climate, with clear and warm weather during summer, due to the continentalization of the oceanic air masses from the west and tropical-sea in the south-west and south, reaching warm and relatively dry in the studied area. The continental air masses, coming from the east and northeast are hot and dry from the beginning [4]. In the period under review, the annual average temperature, at the Caracal meteorological station, is 11.9° C and the precipitation amount of 564.3 mm. The precipitations have frontal and thermo-convector origins, being primarily in the form of rain.

The aridity De Martonne index expresses the humidity or drought conditions, with low values for drought and high values for the wet climate. Analyzing the date in Table 1, one can notice, that in the studied area, the annual arid index Martonne has a value of 25.8. According to the classification which takes into account the applicability limits of this index, the Caracal Plain area has a semi-humid climate, where the steppe vegetation is well represented. The monthly values of this index varies between 54.3 in January to 18 August, being the only month with value less than 20, value which indicates a semiarid climate.

The Angot report is an indicator for the continentalism of the climate. For the period 2000 – 2013, in the analyzed area, the value of this ratio is 1.1. This value closed to unity indicates a relatively uniform distribution of the precipitations throughout the year.

The Angot precipitation index (K) highlights the climate feature of each month. The subunit values of 0.8 in January, February, March, December and of 0.9 in November indicate dry months. The unit values in April and May indicate months with a normal distribution of precipitations. The overunit values in June (1.5), July (1.2), August, September and October (1.1) indicate rainy months.

The annual value of this index, at the Caracal meteorological station is 1, as shown in Table 1.

The Caracal Plain belongs to type III default, according to this index and to the zonal distribution of precipitations, being characterized by a significantly reduced annual amplitude with two maxima and two minima of precipitations [7].

Table 1. The variation of the climatic indices in the Caracal Plain, at the Caracal meteorological station, during the period 2000 – 2013

month	The De Martonne index	The Angot index -	value
I	54,3	0,8	subunit
II	39,1	0,8	
III	27,4	0,8	
IV	24,4	1,0	
V	21,5	1,0	
VI	25,6	1,5	unit
VII	20,1	1,2	
VIII	18,0	1,1	
IX	21,7	1,1	
X	29,3	1,1	
XI	28,8	0,9	overunit
XII	45,2	0,8	
an	25,8	1	

Source: Own calculations.

The Péguy and Walter-Lieth climographs, made for the Caracal meteorological station highlight the periods of dryness and drought.

The Péguy climograph enables the simultaneous analysis of temperature and precipitation for all the months.

Based on Figure 3, it appears that the only arid month is August, while July belongs to the hot and humid months.

The Walter-Lieth climograph shows the presence or absence of the dryness and drought periods.

For the Caracal Meteorological Station, the climograph does not reveal a drought period. The dry period installs in June, July, August, September and May (Figure 3).

The climographs indicate that the humidity deficit periods during a calendar year, are the same with the maximum requirements of the plants cultivated in the Caracal Plain [10].

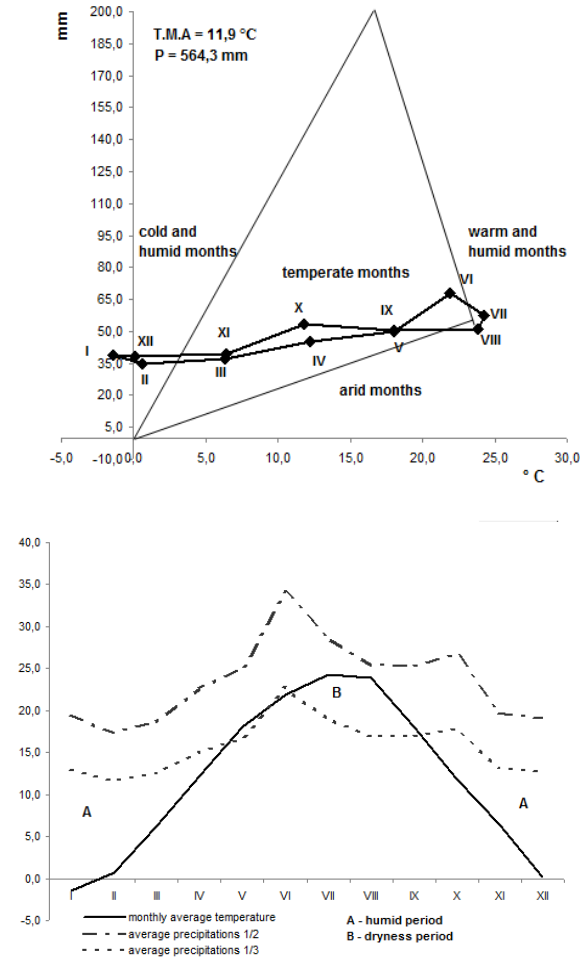

Fig. 3. The Péguy climograph (up) and Walter-Lieth climograph (down) at the Caracal meteorological station, during the period 2000 – 2013
Source: Own determination.

CONCLUSIONS

The evaluation of dryness and drought phenomena for the Caracal Plain is a both scientific and practical necessity.

The more this evaluation is performed for lower durations of time, the more efficient the correlation with the crop phenology or spontaneous vegetation is, thus determining their implications in the growing season [6].

The temporal difference in the frequency and intensity of the dryness and drought phenomena is the result of the convective motion activity intensification and of the local front, plus the latitudinal thermal gradient orientation, characteristic to Oltenia, which the Caracal Plain belongs to. This characteristic is explained by the position of the region in the "dead end" of the Romanian Plain, plus the Mediterranean influences [11].

For the period 2000 – 2013, throughout the country, and thus in the studied area, there were five years of extreme drought and three years of excessive rains [12].

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