*ORIGINAL PAPER*

# LOCAL CATABATIC WINDS. CASE STUDY: COSAVA AND HIS IMPACT ON LOCAL AGRICULTURE

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***Abstract.*** *The Oravita Depression is an area with a specific climate, characterized by the presence of local catabatic wind, called „Cosava". The present study investigates the impact of the wind Cosava and the effects produced by that on the socio-economic activities, especially on the local agriculture. At the same time, it is desired to investigate the opinion of the locals regarding the impact felt by manifesting this phenomenon in the area, respectively, the possibility of implementing a risk warning program for phenomena caused by intensifications of the wind.*

***Keywords:*** *catabatic winds, Cosava, agriculture, global climate change.*

## 1. INTRODUCTION

In the Oravita Depression, with an area of about 20 km$^2$, located in the southwest of Romania, respectively in the south of the Banat Mountains, a hot catabatic wind, called Cosava, is manifested. Because the depression area has a northeast-southwest orientation, with a wide opening to the north, in certain atmospheric situations, a barrel gradient with an east-west orientation is realized. The air pressure is lower in the west of the country, or the situation in which the pressure begins to decrease in the west, remaining stationary or increasing in the eastern region, it is triggered in the area of Oravita east sector winds. These winds have a catabatic character, descending from the western slopes of the Semenic Mountains to the valley of Oravita, from where it is channeled in the north-west direction towards the plain [1].

Regarding the wind Cosava, from a genetic point of view, there are a several opinions. This is considered to be a variant of the Austr wind, or the Bora wind type or of the Foehn type of wind, all manifesting in the Balkan area and implicitly of the Banat [2, 3]. The Cosava wind is formed only in some orographic conditions that are registered only in the south of Banat. The southern half of the Banat is characterized by an orientation of the mountain ranges and the Piedmont hills on the north-south direction, with a fall in steps from east to west [1, 4].

The orientation of the mountain chains favors the intensification of the wind speed in the eastern sector when an anticyclonic regime is manifested with the center in the north, east or northeast of Romania, while in the west of the country a large depressional area develops. The orientation on the east-west direction of the barrel gradient, due to the low pressure in the west of the country, is conducive to increasing the wind speed. The duration of such an aerosinoptic situation, when there are high wind intensifications, can be the most frequent of

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three days, but exceptionally it can reach up to 5-7 days, depending on the persistence on the ground and an altitude of some active barrel centers [5].

## 2. METHODOLOGY

The research was conducted based on a questionnaire, addressed to a number of 150 respondents, from the localities located in the depressed area of Oravita: Oravita, Ciclova Montana, Gradinari, Greoni, Racasdia, Ciuchici, Ciclova Romana, Ilidia, Ticvaniu Mare, Ciudanovita. The studied geographical area is shown in Fig. 1.

The questionnaire was elaborated taking into account the requirements of form and content, way of expression, rules for formulating the required questions, so that the questions are precise and easy to understand by all the subjects questioned, respectively the collected data to be valid and faithful answers. Statistical analysis and graphical representations were performed using Microsoft Excel 2007 and SPSS.

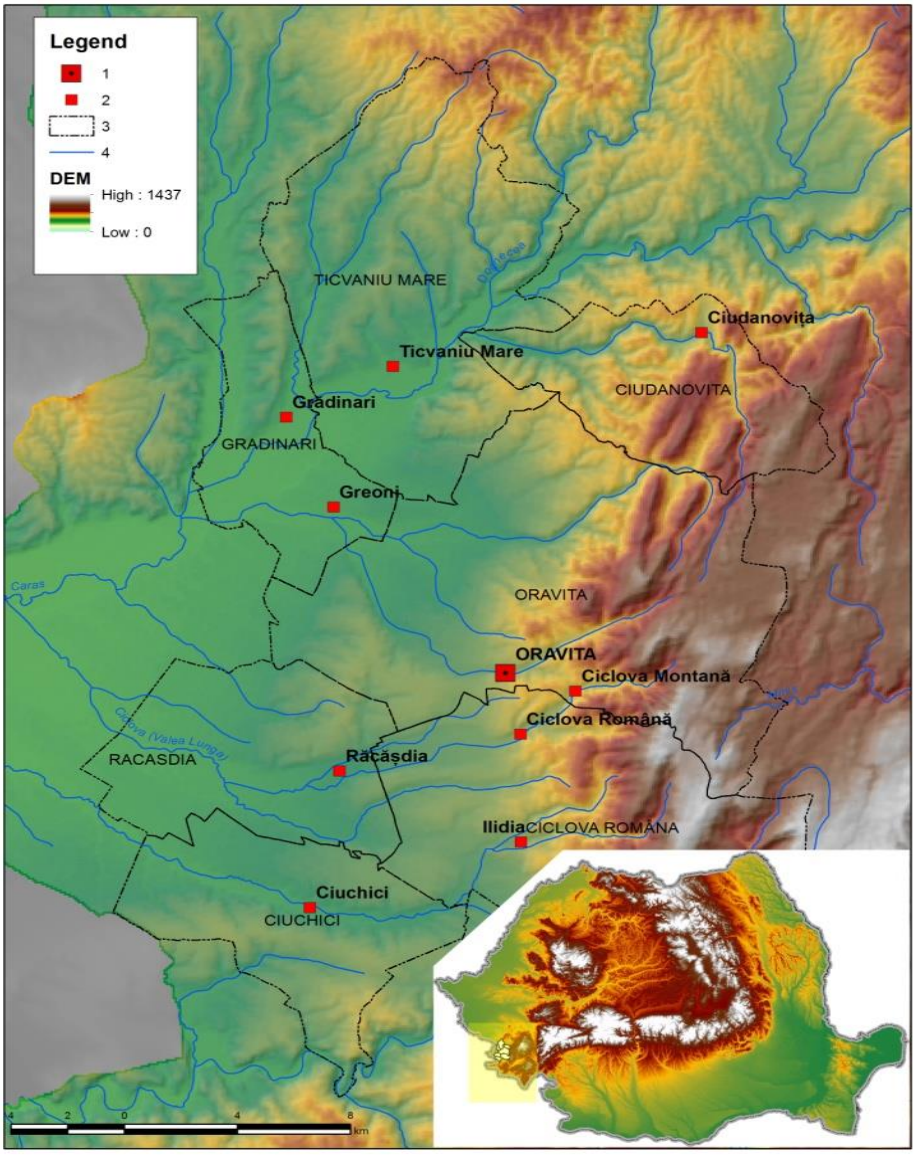


**Figure 1. The geographical position of the localities where was realized the study. Legend: 1 - town; 2 – rural localities; 3 - common administrative boundaries; 4 - hydrographic network; DEM – altitudes.**

## 3. RESULTS AND DISCUSSIONS

The Cosava wind, through its manifestation, leads to the modification in a relatively short time of meteorological parameters, such as temperature and humidity of the air. But the most important feature is the wind speed, which can reach maximum values of 40 m/s, which makes it a hot, dry and violent wind [6-9].

Due to the violent manifestation at the burst, several material damages have occurred, mainly, such as roofs torn from buildings, felling of trees (including fruit trees), overturning of big cars and railway fittings [9].

According to a study carried out in the period 2011-2013 [10], regarding the hydro-climatic risks in the Oravita area, they alternated periods with warm temperatures, without precipitation and periods with a deficit of precipitation in warm periods, followed by considerable precipitation, which shows the aggressiveness meteorological phenomena in the studied area. Due to the modification of some meteorological parameters such as temperature and humidity of the atmosphere, there are damages to several crops (cereals, fruit trees, technical plants), both qualitative and quantitative.

For this reason, it considered is necessary to complete a questionnaire addressed to the population in the area, regarding the way of manifesting this destructive wind, but also of the material damages that it can produce.

The territorial distribution of the study participants is shown in Fig. 2.

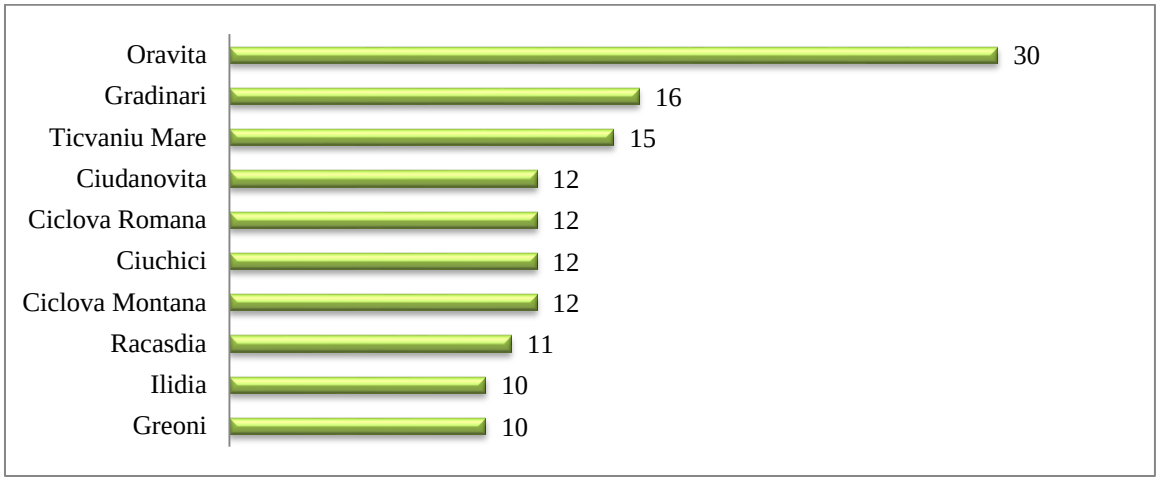


**Figure 2. The territorial distribution of the respondents participating in the study.**

The profile of the respondents according to the items - age, sex and the knowledge regarding the Cosava wind is presented in Table 1.

**Table 1. Crosstable analysis of items: age, gender and the knowledge regarding the Cosava wind.**

| Gender | The knowledge regarding the Cosava wind | Age | | | | | Total |
|---|---|---|---|---|---|---|---|
| | | 20-30 | 31-40 | 41-50 | 51-60 | >60 | |
| Male | Yes | 2 | 2 | 13 | 31 | 10 | **58** |
| | No | 10 | 4 | 12 | 3 | 0 | **29** |
| **Total** | | **12** | **6** | **25** | **34** | **10** | **87** |
| Female | Yes | 3 | 4 | 11 | 19 | 8 | **45** |
| | No | 0 | 2 | 3 | 12 | 1 | **18** |
| **Total** | | **3** | **6** | **14** | **31** | **9** | **63** |
| | Yes | 5 | 6 | 24 | 50 | 18 | **103** |
| | No | 10 | 6 | 15 | 15 | 1 | **47** |
| **Grand Total** | | **15** | **12** | **39** | **65** | **19** | **150** |

As can be seen from the data presented in Table 1, the majority of the respondents are man (58%); The people who participated in the study know the name "Cosava", thus 69% of the respondents confirmed that they have knowledge about this wind, that they know where it manifests and know its effects.

Thus, among the influences that the Cosava wind shows on the environment, the respondents listed the following variants: air temperature (16%), air mass displacement (54%), atmospheric humidity (2%) and precipitation (28%).

Regarding the economic activity affected by the phenomenon "Cosava", agriculture has a majority share, so 64% of the respondents (96/150) validated this answer option. Among the risk phenomena that affect the agricultural activity in the studied area, the respondents considered that the wind speed and drought have a significant impact on agriculture; also the increase in temperatures can adversely affect the agricultural field. At the opposite pole among the activities that affect less agriculture where the decrease of temperature (15/150) and abundant rainfall (10/150).

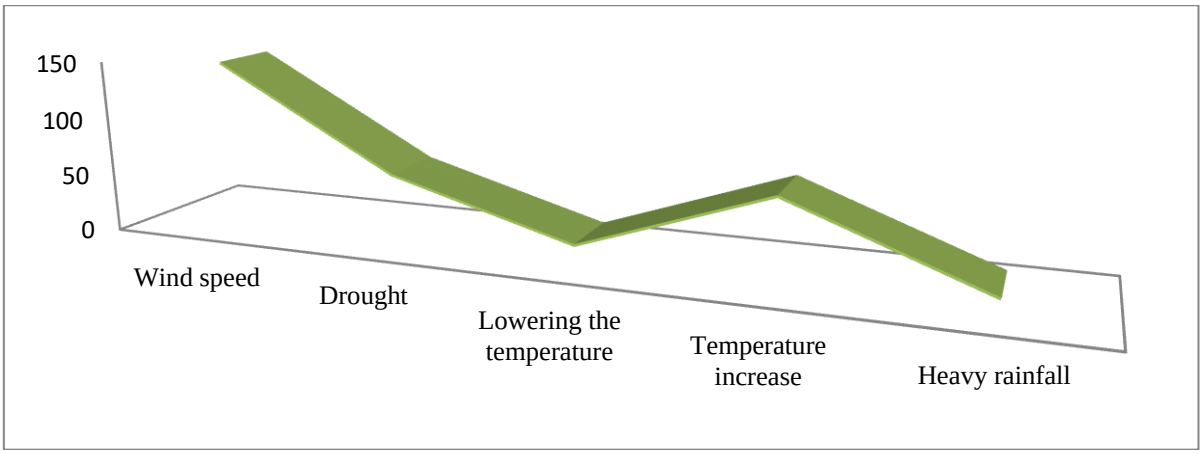


**Figure 3. Risk effects affecting agricultural activity in the studied area.**

Also, in the opinion of over 65% of the respondents, the decrease of agricultural production and the impairment of the quality of the agricultural product (35%) is a bad result of the Cosava wind manifestation in the area under our analysis.

The analysis of a link between a future program of warning of the negative impact of the wind Cosava and the connection of this phenomenon with the global climatic changes is demonstrated by a contingency table in which future programs of valorization of the forest resources are highlighted, such as telephone warning through Ro-Alert, media warning, other warning methods and the need for such a program with five predefined response variants from 1 (not at all) to 5 (very large).

**Table 2. Crosstable analysis of items related the necessity for a future strategical program.**

| Count of questionner number | Telephone warning | Media warning | Other warning methods | Grand Total |
|---|---|---|---|---|
| Not at all | 4 | 5 | 1 | 10 |
| Small measure | 2 | 4 | 2 | 8 |
| Neither small nor big | 6 | 10 | 2 | 18 |
| Great measure | 23 | 15 | 7 | 45 |
| **Very large** | **49** | **18** | **2** | **69** |
| **Grand Total** | **84** | **52** | **14** | **150** |

As can be seen, a majority percentage of 46% of the total respondents (69/150) finds it necessary to a very large extent a warning program of the negative impact of the wind for the analyzed area. Of the accession 71% consider it necessary to implement a telephone warning program (49/69), 26% applying a media warning program (18/69). 3% of respondents agree with the need for a warning program.

Regarding the connection between the Cosava phenomenon and global climate change, 14% of the respondents believe that there is a very high connection (21/150), 34% a great connection, 28% a medium connection and 24% consider that there is little connection between the two phenomena.

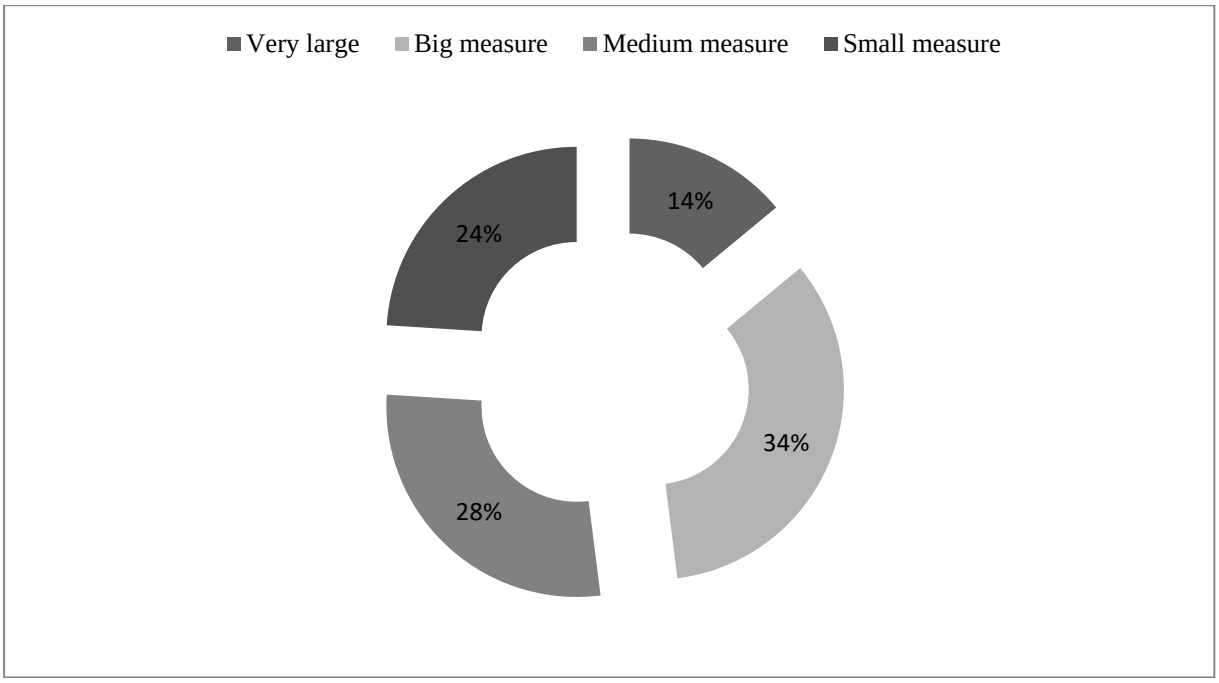


**Figure 4. The connection between Cosava wind and global climate change.**

## 4. CONCLUSIONS

The catabatic winds are local winds due to the descending airflow that mainly manifests in the southwest part of the country in the Banat Mountains area.

The research carried out within the present scientific approach was carried out on the basis of a questionnaire, addressed to a number of 150 respondents, from the localities located in the depressed area of Oravita in order to know the public opinion regarding the effects of the "Cosava" phenomenon on the agricultural activity in the studied area.

As we have presented in the present paper, over time the wind Coşava, led to the modification of meteorological parameters, such as air temperature and humidity. Due to the violent forms by which it manifests it has produced numerous material damages. Regarding the negative implications that the Cosava wind has on the agricultural field, the decrease of the agricultural production and the deterioration of the quality of the agricultural product were stated.

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