PRESENT ENVIRONMENT AND SUSTAINABLE DEVELOPMENT, NR. 1, 2007

SOME CONSEQUENCES OF THE FLOODS OF THE YEAR 2005 ON THE POPULATION AND THE SETTLEMENTS OF DÂMBOVIȚA COUNTY

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Key-words*:* floods, precipitations, damages, Dâmbovița County.

Résumé : L'an 2005 a été, pour la Roumanie, un an avec un grand nombre de phénomènes météorologiques dangereux, dont les plus importants ont été les inondations et les limons apparus dans la majorité des bassins hydrographiques de Roumanie. Dans ce contexte, de tels phénomènes ont influencé aussi le territoire du département de Dâmbovița, au niveau des réseaux hydrographiques qui le drainent, à savoir Argeş, Dâmbovița et Ialomița, avec leurs affluents. Suite à ces processus qui se sont produit, un grand nombre de localités et d'objectifs socio-économiques et aussi des surfaces importantes de terrains agricoles ont été affectés.

1. Introduction

During the last decennia, the damages caused by natural catastrophes, for instance climatic and hydrological catastrophes, have recorded a significant increase compared to the quantum of the world population.

As far as Romania is concerned, in 2005, numerous hydro-meteorological perturbations and the phenomena associated to them, like floods, high floods, lightenings, violent storms etc., affected large areas, having significant socio-economic consequences.

According to the data provided by the Ministry of the Environment and of the Water Administration (Ministerul Mediului si Gospodaririi Apelor - MMGA), during the same year, the human and material damage was estimated as follows: 76 dead people and respectively about 1.7 billion euros.

2. 2005 – a year of pluviometric and hydrological excesses

Taken as a whole, the year under analysis (2005) was characterized by yearly precipitations for the whole country of about 870 mm, namely 200 mm (34%) over the normal value for the period 1961-1990 (647 mm) (MMGA, 2006). This excess of precipitations occurred mainly in the south of Romania and secondly in the west of the country, where the positive excess was of 50 to 75% above the normal values (Fig. 1).

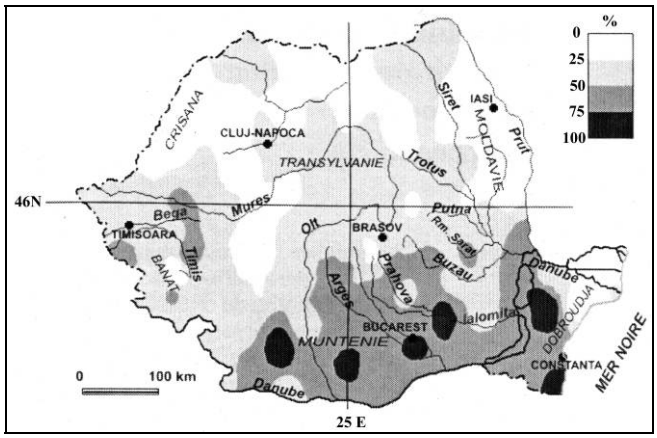

Fig. 1. Romania, excess of the precipitations of 2005 compared to the average of 1961-2000

Source: adapted from data provided by the Ministry of the Environment and of the Water Administration

Except for the months of June, October and November, all the other months registered much higher quantities of precipitations than the normal values, especially for the months of April, July, August and September. At the same time, we must mention that, locally, the total monthly precipitations recorded values 5 to 10 times higher than the normal ones (Fig. 2).

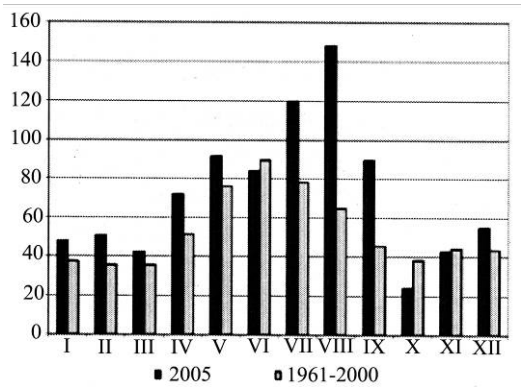

Fig. 2. Romania – monthly precipitations (mm) in 2005 compared to the average monthly values

Source: Ministry of the Environment and of the Water Administration

For most of the basins situated on sloping lands in Romania, the average yearly flows of 2005 were much higher than the 30-year module taken as a basis for our comparison, especially in the western, central and southern regions. Many rivers reached the highest flows in living memory (which at times means more than 100 years). In certain regions of the country, these floods concerned larger areas and triggered more damages than all the other events of the 20th century (the main previous events occurred in 1970, 1972, 1975, 1991 and 2000).

Unlike these past floods, the floods of 2005 have two major features:

- They appeared during a large period of the year, several times;
- They affected most of the basins situated on sloping lands either during different episodes, touching one or several regions of the country (in 1970 they affected only the NNW of Romania), or during several succesive episodes touching the same region(s).

3. The precipitations – a main factor of the flood

The climate of Dâmboviţa County presents a series of particularities that mark the formation and the development of the above-mentioned hydrological phenomena. The interaction between the radiative factors and the dynamical factors with the underlying active surface gives birth to a variety of types and subtypes of climate, which is sometimes the main reason for the varied character of the hydrological phenomena.

For the climatological analysis of the area of Dâmboviţa County, we processed and interpreted meteorological data from the stations of Voineşti and Târgovişte, for the years 1961-2001, compared to the year 2005 when the above-mentioned floods occurred. The meteorological stations we refer to are situated at heights between 511 and 296 m.

Atmospheric precipitations. The altitudinal difference of the relief and its distribution in tiers make the precipitations differ quantitatively during the year, from the viewpoint of their monthly and seasonal distribution. In the valley corridors there is a correlation between the quantitative increase and the altitude, according to a vertical pluviometric gradient. Higher on, the precipitations remain almost constant. In the area of the Subcarpathian hills, the annual precipitation quantities are less than 750 mm, while in the area of contact with the plain they are under 650 mm, and in the plain area they oscillate between 550 and 600 mm (Tables 1-2 and Fig. 3-4).

Table 1. Average monthly and yearly precipitations (1961-2001)

Meteorological station	I	II	III	IV	V	VI	VII	VIII	IX	X	XI	XII	Year	
													Total	Average
Voineşti	41.2	30.0	49.6	64.0	34.5	96.4	82.5	79.5	62.4	52.8	45.4	48.2	736.5	61.4
Târgovişte	34.4	33.5	34.1	53.7	69.2	94.0	81.6	65.7	35.1	33.5	42.4	40.7	617.9	51.5

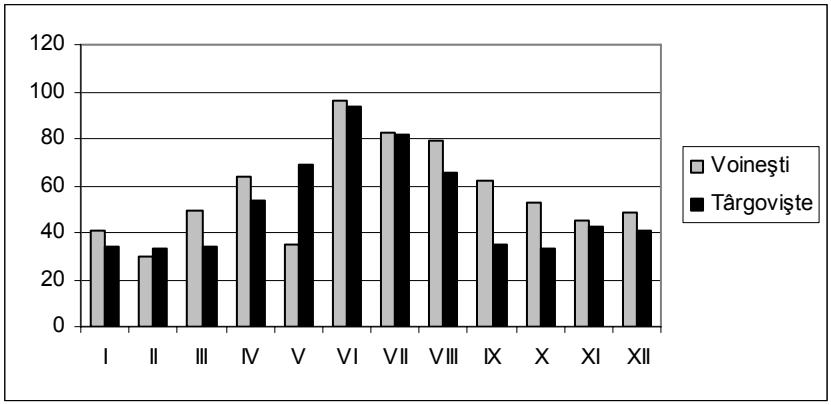

Fig. 3. Average monthly and yearly precipitations (1961-2001)

Table 2. Average monthly precipitations (2005)

Meteorological station	I	II	III	IV	V	VI	VII	VIII	IX	X	XI	XII	Anul	
													Total	Average
Voineşti	53.3	80.7	27.2	65.6	95.2	109.3	150.9	239.2	188.3	13.4	47.0	49.6	1113.2	92.7
Târgovişte	47.8	76.0	52.7	63.6	192.5	102.2	181.5	268.3	180.4	13.4	46.8	43.0	1315.0	109.58

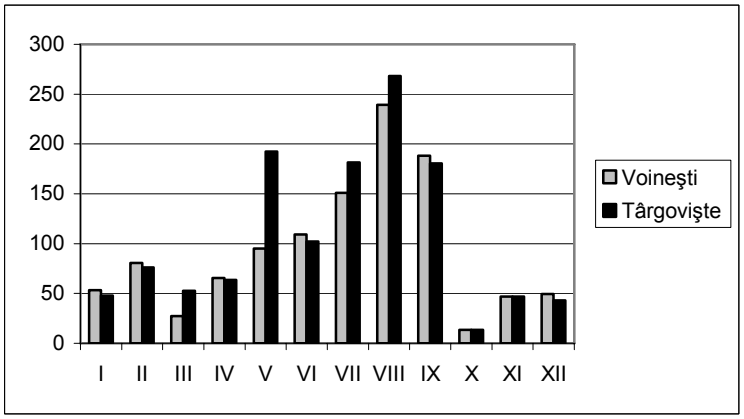

Fig. 4. Average monthly precipitations (2005)

- From the comparative analysis of the statistico-mathematical series of the precipitations, we can notice the following:

- The total quantity of precipitations, in 2005, is higher than the average of the years 1961-2001, by values ranging from 400 to 600 mm/year;

- The highest quantities of precipitations, in 2005, were recorded during the last decade of the month of February, overlapping the melting of the snows from the upper hydrographical basins belonging to the geographic area under analysis, which favoured the floods from the beginning of March, and also during the period May-September of the same year, when several such calamities took place, having negative effects on the human settlements and on the population;

- We can notice, based on the analysis of the statistical data, that the highest quantities of precipitations fell during the period May-September, with values that vary between 180.4 mm/m^2 and 268.3 mm/m^2, in a context where the multi-annual monthly averages vary in an interval from 35.1 mm to 94.0 mm.

4. Consequences of the floods on the population and on the settlements in Dâmbovița county

In 2005 the floods affected almost 190 localities and more than 2000 households and 8000 annexes of these households, some of them having to face such problems several times during the same interval of time, as it happened with the localities Aninoasa, Voineşti, Şotânga, Răzvad, Bărbulețu etc. Most of the distructions occurred in the months of August and September 2005, when 64 and respectively 55 localities were affected, especially in the area of the Subcarpathians and in the plain region (Fig. 5).

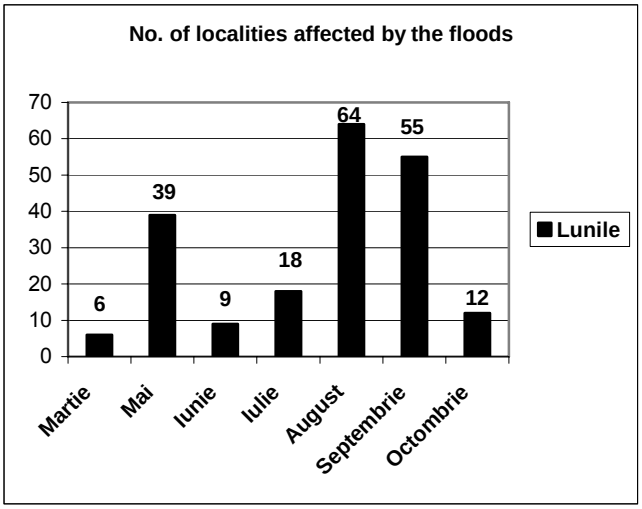

Fig. 5. The number of settlements affected by the floods of 2005 during the months from March to October

The material damages were noticeable in Târgovişte municipality, where 10 homes and 2 socio-economic units were affected, as well as 8 networks providing energy for the town.

At the same time, in Pucioasa town, situated north of Târgovişte, the impact of the floods caused the flooding of more than 40 households and of a similar number of annexes of these households, and the deterioration of approximately 1 km of county road.

At the same time, Titu town, situated in the homonymous plain, suffered because of these dangerous phenomena, several scores of households being flooded and a few bridges being destroyed.

The most costly damages were recorded in the rural area of the county, in the localities: Răzvad (72 households, 215 annexes, 5 bridges and 19 km of road), Şotânga (65 households, 100 annexes and 6.5 km of roads), Cândeşti (86 households, 3 bridges and 4 km of road), Aninoasa (60 households, 177 annexes, 8 bridges and over 8 km of roads) etc. – see the figure below.

Following the analysis of the data from the previous table, we can make the following observations:

- 2,022 households were affected, with negative consequences on their annexes as well;

- From the total surface of the land used in agriculture from Dâmboviţa County (about 250,000 ha), 17,139 ha were flooded (the cereals and the fruit-bearing trees on them were destroyed); the largest areas affected were calculated

for the communes: Dragodana (180 ha), Răzvad (110 ha), Şotânga (80 ha);

- In the county, both in the rural and in the urban area, more than 30 socio-economic units were affected, including schools, kindergartens and medical units;
- The road network was destroyed on a length of about 530 km, leading to serious difficulties in the good functioning of the transportation network;
- There was a period of lack of drinking water for the households in the affected area;
- Despite the fact that, fortunately, there was no major loss of human lives, the total material damage summed up to 314,726.615 RON (table 3)

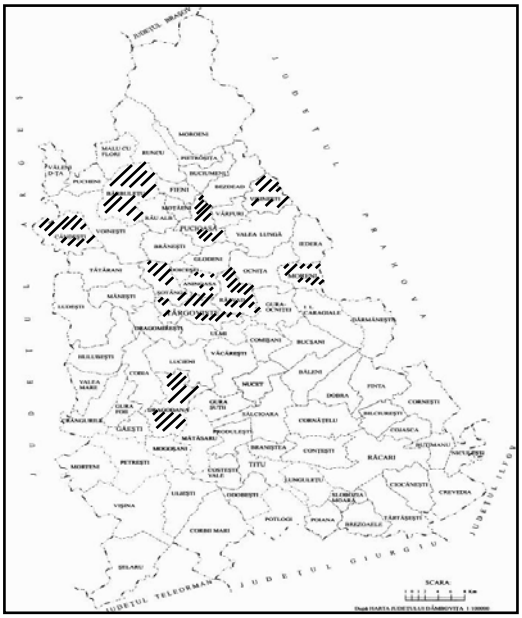

Fig. 6. Map of the localities from Dâmbovița County that were mostly affected by the consequences of the floods of the year 2005

Table 3. Value of the material damages triggered by the floods of the year 2005 in Dâmbovița County

Households	Annexes	Land in agriculture	Bridges	County and communal roads	Wells with potable water	Economic Units	Dead animals	Schools	Hospitals and medical units	Churches and cemeteries	Dead	Total estimated damages
2022	8508	17139 ha	206	530 km	2817	12	1531	12	6	2	1	314,726.615 RON

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Despite the fact that, fortunately, there was no major loss of human lives, the total material damage summed up to 314,726.615 RON (table 3).

5. Conclusions

The year 2005 was characterized, at the level of the whole country, by the amplification of the hydro-meteorological parameters, having a major impact on the population and on the human settlements.

Because of the hydro-meteorological manifestations, Dâmbovița County was among the counties affected, suffering significant material damages. They consisted in the deterioration of numerous households and annexes, of the road infrastructure and of large areas used in agriculture.

We must also underline the fact that the human induced factors contributed as well to the production of the above-mentioned phenomena, amplifying the effects of the high floods, especially on the tributaries of the main rivers in the Subcarpatian zone and in the plain area (Ilfov, Bizdidel, Potop, Sticlăria, Vulcana etc.).

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