

THE WATER RESOURCES IN THE TREBES-NEGEL HYDROGRAPHIC BASIN (ROMANIA)

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ABSTRACT

This study aims to analyze the surface waters of the Trebes River. The Trebes-Negel River Basin is also known as the representative basin and it is the right tributary of the Bistrita River. The monitoring of this river reflects in a database necessary for the analysis of the long-term tendency of the hydrological regime, both in natural conditions and influenced by anthropogenic activities. The contact area between the Eastern Sub-Carpathians, in their middle part, and the Central Moldavian Plateau present a series of morphological peculiarities determined by a corrugated and varied structure, by an alternation of tough hard rocks and the action of the flowing water. These morpho-hydrographic peculiarities corroborated with climatic conditions dependent on the latitude, orientation and altitude of the major relief forms are determinant for genesis and flow regime. The first advantage in studying small river basins is that the results can be extrapolated for larger basins. Also, the magnitude of the analyzed data is smaller. The results of this study can certainly provide important information and can contribute to the implementation of effective measures in order to protect and prevent floods. The results of this study play an important role in the elaboration of hydrological prognosis of immediate or long-term utility because it is necessary to know in detail the variability in time and space of some hydrological parameters. The current period is characterized by an economic distinguished soar that requests for increasingly more water as a component of technological processes or as an indispensable part of sanitation for large human agglomerations.

Key words: management, Moldova, representative basin, river basin, surface water

INTRODUCTION

Understanding in detail the hydro-meteorological processes that lead to the formation of runoff and its treatment has been proved to be required for the settlement of practical problems. The zonality character (latitude) and the natural setting (altitude) manifested by the hydro-meteorological phenomena, plus a series of local peculiarities imprinted by the detailed physical-geographical characteristics, require some intensive observations and measurements in determining the relationships between precipitation and drainage. The study is focused, in particular, on a small, representative river basin – Trebes-Negel. The Trebes-Negel River Basin, considered as representative by the Romanian Waters, is

an important objective in hydrological terms, for the Carpathian area, being monitored since 1980 [1].

The water resource is intensely studied at an international level [2-8] and national [9-11]. The problem is the quality of the surface water [12-17], the minimum and maximum drainage at different times of the year [18-31] and at the same time on the water requirement in different climates [32-34]. The present study aims to analyze the water resources from the small water basins. Unfortunately most communities in Romania exploit only surface waters and rarely the ground waters. For this reason there is an overexploitation of the resources from rivers and very often the legislation regarding the ecological flow is violated.

STUDY AREA

The Trebes River (also known as Trebis), with the most important tributary – Negel - belongs to the lower Basin of Bistrita River, the confluence being near Bacau City (downstream Bacau Dam) at the level 141.50 m. The Trebes River Basin has 140 km² areas which extend to NE direction. On the right side, the most important tributaries that can be identified are the small rivers Fantana Pustnicului and Limpedea, and on the left Slatina, Carligati and Negel. It is situated between the parallels 46°30' and 46°40' northern latitude and the meridians 26°40' and 26°52' eastern longitude (Fig. 1).

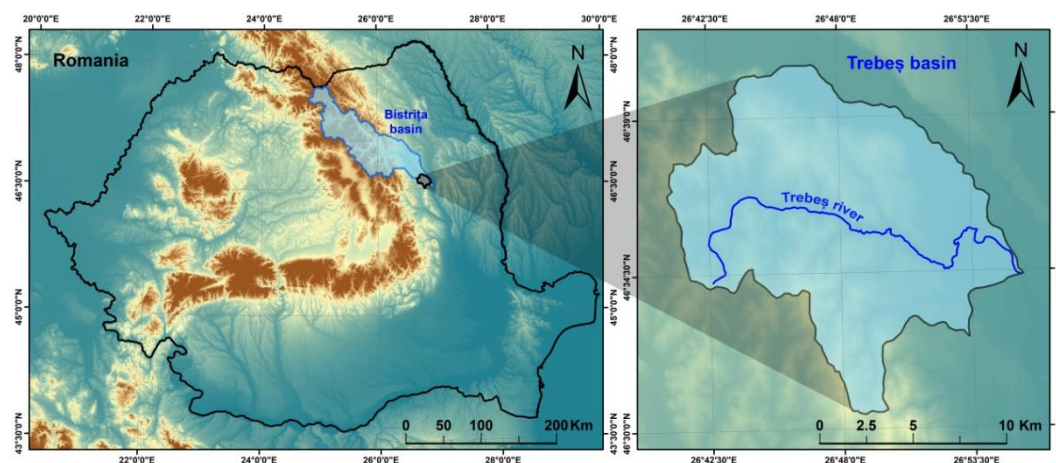


Figure 1. The geographical localization of Trebes River Basin

There are three most important hydrometrical stations in Trebes River Basin: Podis and Margineni on the Trebes River and Magura on the Negel River. The annual flowing volume on the Trebes River is 11870000 m³ (Table 1).

Table 1. The hydrometrical stations in Trebes River Basin

River	Hydrometrical station	Area (km ²)	Average conditions	
			Multiannual flow (m ³ /s)	Runoff volume (m ³ /year)
Trebes	Podis	23.9	0.099	3124000
Negel	Magura	12.9	0.063	1988000
Trebes	Margineni	125	0.376	11870000

METHODOLOGY

The hydrological data are obtained from Siret Water Basin Administration (Bacau) and it covers a period of 48 years. The program of observations and measurements conducted in the representative basin leads to a background data useful both for practical purposes and for basic research.

The hydrometrical stations existent on Trebes River are Podis hydrometric station and Margineni hydrometric station, and on Negel River there is only one hydrometric station – Magura hydrometric station. The hydrological basins corresponding to these sections are poorly afforested and the predominant vegetation consists of grasslands, meadows and agricultural crops. The relief is heavily fragmented and the sediment load is rich. Within the hydrological basin are being monitored the following hydrometrical stations: Tocila River – Luncani Section. The Tocila subbasin has a degree of afforestation of 40 – 50% (especially in the superior sector) and large sections of drainage. The relief is high and heavily fragmented. The program implies the monitoring of levels, flows and precipitation;

Trebes River – Luncani Section. This section represents the closure for the first third of the Trebes River basin, including the Tocila River;

Slatina River – Chetrosu Section. The Slatina subbasin has a high degree of afforestation (80%);

Trebeş River – Chetrosu Section. This section closes the sections upstream;

Valea Budului River – Valea Budului Section. This is a subbasin afforested 100%. The hydrometrical station has a program of observation and measurements for levels, flows, sediment loads, temperatures, and precipitations.

Trebes River – Valea Budului Section. This section closes the sections upstream;

Trebes River – Margineni Section. The hydrometrical station is placed at the closure of Trebes River Basin, downstream the confluence to Negel River;

Negel River – Magura Section. This section monitors a surface of 18 km², being placed on the highest and the most afforested sector of Pietricica Peak.

The program implies the monitoring of levels, flows, sediment load, temperatures (water and air), and precipitations.

RESULTS AND DISCUSSIONS

In the Trebes River Basin placed in the Eastern Carpathians area we can identify the Subcarpathian ripple formations (successions of marl, clay, sandstone and conglomerates) from Badenian and Burdigalian, and platform deposits (marl, clay, sand) from the Sarmatian age. The Quaternary deposits (pebbles, gravels, loessoid tiles, etc) are extended in valleys and terraces. [35]

The relief is extremely varied although the surface of the basin is reduced. This is the consequence of the interdependence between the structure and the geological composition and the action of the external agents, especially the flowing waters. The river valleys are narrow and deep, only Pietricica Peak has larger slope valleys [36].

The climate is temperate with continental influence. The average annual temperature is 9.2°C. The temperature of the January month is –4°C, and that of the July month is 20°C. Significant from the thermal point of view are the thermal inversions, especially in winter. The dominant direction of the winds is V-E and NV-SE [37].

The formation of water runoff and sediment load is influenced by physical-geographical factors. The Podzolic soils of forest with some degree of iluvial clays and leaching of

salts are prevalent. In the lower areas the soils have gleyzation and marshy tendencies and on meadows the alluvial intrazone soils develops. Generally, soils are lighter but the large percentages of clay favors water immiscibility and facilitate waterproofing. For this reason the drainage coefficient is higher. The large drainage slopes and the torrential character of the rainfall allow the development of processes of erosion and soil degradation. The dominant vegetation is hardwood forest (oak, beech, hornbeam). Locally, on higher sectors, can be found mixed enclaves of beech and spruce. The forest covers about 60% of the surface of the basin. The largest forest woodlands are found in the subbasins Slatina, Valea Budului, Negel (the upstream sector), Seaca and Tocila.

The hydrographical network is relatively dense (0.94 km/km²) and numerous due to the relief conditions, climate and vegetation. The Trebes River Basin has a surface of 107 km² and the Negel River Basin 34 km². From 1970 the Negel River, downstream Magura, was conducted through an artificial canal in Trebes and became a tributary of it on the right side. The other rivers that constitute the hydrographic network of the Trebes River Basin are: Slatina (F=11 km²); Carligati (F=14 km²); Valea Budului on the right side and Dubas, Tocila, Valea Seaca and Rosca on the left side.

Usually, rivers with a surface of more than 8-10 km² do not dry out. The drainage regime is characterized by low flows in winter and autumn and higher in spring and summer. The frost phenomena have a different annual frequency and duration (usually between Decade III-December and Decade I-March) (Table 2). The multiannual average flow of Trebes River at Margineni hydrometrical station is 0.376 m³/s.

Table 2. Multiannual monthly average flows 1970 – 2017

River	Hydrometrical station	I	II	III	IV	V	VI	VII	VIII	IX	X	XI	XII	Average
Trebes	Podis	0.045	0.082	0.200	0.230	0.147	0.183	0.128	0.057	0.026	0.021	0.025	0.046	0.099
Trebes	Margineni	0.256	0.299	0.930	0.779	0.550	0.657	0.920	0.431	0.173	0.148	0.173	0.212	0.376
Negel	Magura	0.019	0.049	0.063	0.110	0.131	0.102	0.190	0.031	0.023	0.014	0.015	0.015	0.063

The Trebes River is the area of the Bacau County, which is one of the largest counties of Romania. The River runs through Margineni commune representing 1.24% of the population of the County of Bacau and 2.29% of the population of the rural sector. The Margineni commune consists of 8 villages and is located in the immediate vicinity of the city. The population of the commune is approximately 8940 persons, 4514 people male and female 4426 (Table 3, 4).

Table 3. Population structure by age and sex

Age	Total	Masculine	Feminine
0 - 4 years	428	255	173
5 - 9 years	461	229	232
10 -14 years	485	258	227
15 - 19 years	527	228	299
20 - 24 years	609	309	300
25 - 29 years	625	317	308
30 - 34 years	625	344	309
35 - 39 years	671	348	323
40 - 44 years	641	337	304
45 - 49 years	632	332	300
50 - 54 years	633	317	316
55 - 59 years	629	314	315
60 - 64 years	605	306	299

65 - 69 years	587	238	349
70 - 74 years	442	232	210
75 years and more	312	150	162
TOTAL	8940	4514	4426

Table 4. Population structure by localities and number of households

Locality	No. households year 2017	No. average persons/household
Margineni	1258	3.34
Barati	579	3.79
Luncani	405	2.96
Padureni	159	3.14
Podis	274	2.37
Poiana	78	3.84
Trebes	296	3.71
Valea Budului	176	2.84
Total	3225	3.30

As shown the population living within the basin is extremely large (8940 inhabitants) and the multiannual average flow of the river is very low ($0.376 \text{ m}^3/\text{s}$). For this reason, the volume of water per each inhabitant on an annual basis is very low. Thus, the population is forced to obtain water supply from the groundwater (fountains) or from the river areas nearby.

CONCLUSIONS

For the elaboration of hydrological forecasts of immediate or long-lasting utility it is necessary to have the time and space variability of hydrological parameters. The human factor is essential in directing hydrological phenomena at the local level. The high density of population within the Trebes River Basin leads different human risks: lack of water (hydrological droughts) or excess (frequent flash floods). That being said, in a relatively small area of 141 km^2 , it is most probably possible to obtain ideal models relating to water resources and their rational management. The immediate function of the representative Trebes River Basin as a warning basin for the immediate urban agglomeration of Bacau City cannot be neglected.

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