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DEVELOPMENTS AND PERSPECTIVES IN USING THE HYDROGRAPHIC POTENTIAL OF THE ȚIBLEŞ MOUNTAINS

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Abstract

By their coordinates and morphometric features, the mountain areas imprint significant changes to the meteo-climatic parameters in terms of increasing their values. Therefore, as a response to the pluvial input, the hydrographic network in the mountain area is dense, its runoff is high and its qualitative features are superior to the river network in the lower relief units. The Ţibleş Mountains are no exception from this law, with a dense hydrographic network, with significant river flows and adequate drinking qualities (in this respect, the petrographic structure also plays a very important role). The use of this potential began with the emergence of the first human communities at the periphery of the study area. Slight and fully compliant with the laws of nature at first , nowadays still insufficient, but accompanied by pollution, this use of the river water potential requires a radical methodological change in order to achieve a higher efficiency, with minimum negative consequences. The lower the degree of anthropisation, the more feasible this desideratum is, as the area is suitable for engineering river works to support some water and wastewater utility needs and some clean economic activities.

Keywords: Ţibleş Mountains, hydrographic potential, engineering river works, water and wastewater utility needs

1. INTRODUCTION

Researchers trying to find life forms in the outer space consider the presence of water to be a mandatory condition, in one state of aggregation or another. Pursuant to studies performed on terrestrial organisms, this condition has become a law. Despite de fact that human beings present the maximum level of complexity at terrestrial level, which has brought them superiority over the other beings, they have not managed to reduce their dependence on the vital element, water. The presence of water sources provided favourable conditions to the settlement and anthropization of an area. The evolution of human society (demographic, economic etc.), has changed the forms of this dependence, by the capacity of the human factor to involve in the natural hydrographic regime, by temporary planning and redistribution of the flows. The water global amount indicates this resource as inexhaustible, but the situation is different considering that a small part presents potable qualities or is inaccessible from the economic point of view. The human factors contribute significantly to the depletion of this essential resource. Human action is manifested mainly on the qualitative side of the hydrographic potential by pollution. The mountainous areas distinguish themselves globally due to the low presence of the anthropic element, specific vertical development with direct implications in the formation of precipitations and enhancement of water bodies self-purification capacity etc., features that recommend them as areas with hydrographical potential above the average both in quantitative and in qualitative terms. By their physical–geographical characteristics, the Țibleş Mountains impose a certain spatial distribution and evolution of the human settlements closely related to the hydrographical element, proving to be an appropriate case study for the analysis of the hydrographic potential use stages. These stages may be differentiated according to the usage degree, beneficiary economic sectors and changes of the qualitative parameters of the water bodies. Consequently, the hydrographic potential represents the totality of the water bodies (quantitatively and qualitatively characterized) available to be used in order to meet certain needs. Identification and analysis of stages will be performed by a direct relation to the occurrence and consistency of the human communities in these areas. For this reason, the elaborated cartographical materials also include territories outside the morphological boundary of the Țibleş Mountains, but which belong to the localities overlaying the analyzed mountain area to various extents (*fig 1*).

1.1. Methodology

According to the principles of spatiality, causality, integration and historicism, the development of the study implied the application of specific study methods during the established stages.

The preparing stage – desk work (analysis and summary of the reference materials and Arc mapping) together with the analysis and processing of data were the best developed in terms of time.

The analysis of the natural background elements and other interest elements and phenomena was performed based on the materials performed by means of applications: Arc Map (maps) and Microsoft Excel (charts).

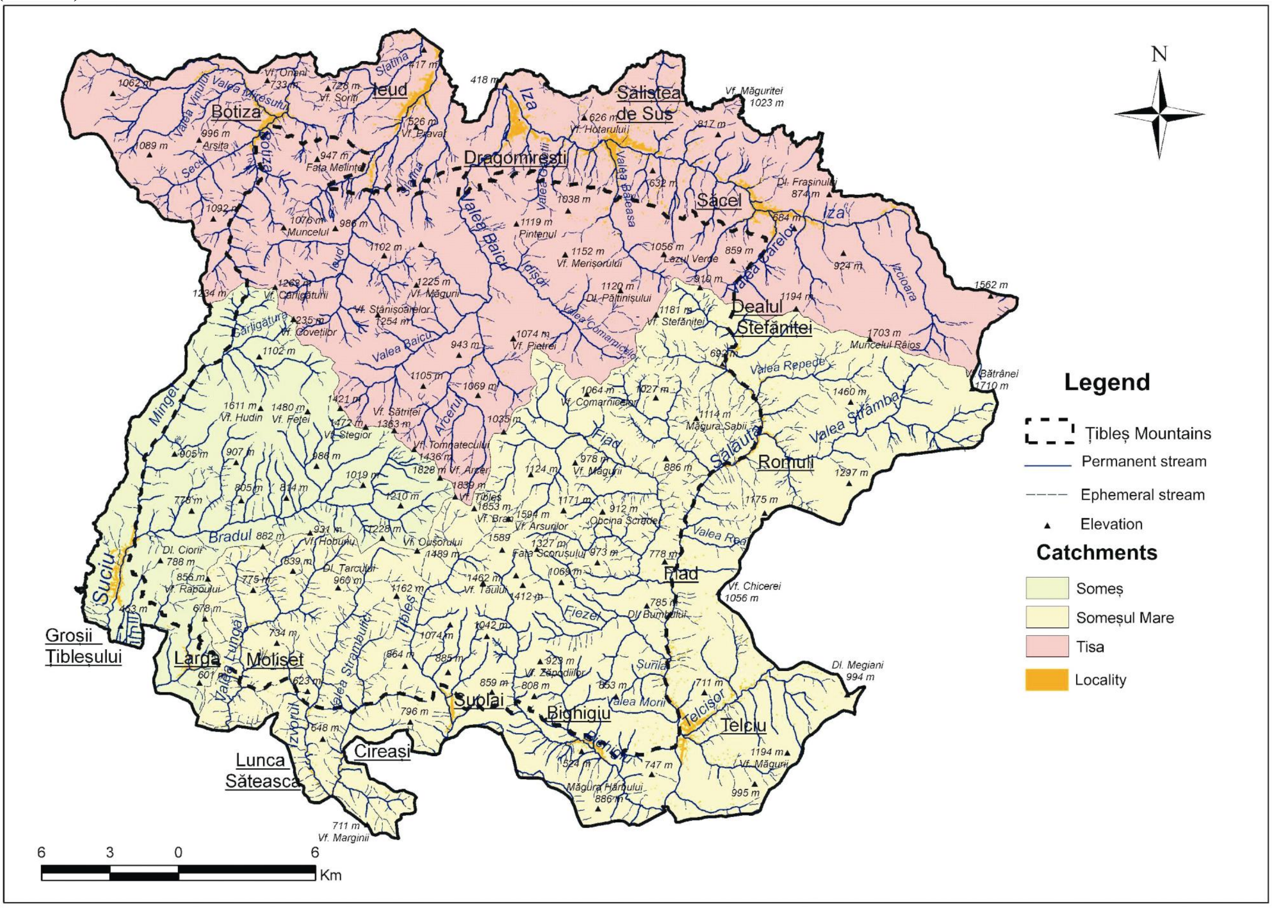

Fig. 1 The territorial distribution of the hydrographic network

2. FAVOURING FACTORS OF THE POTENTIAL

The qualitative and quantitative features of the hydrographical potential vary according on a series of factors among which the most important is the climate, to which the secondary factors add (paleogeographical evolution, relief, soil, vegetation).

Two parameters: precipitations and temperature (average multi-annual values) will be considered for the analysis of the *climatic factor*.

Hence, the first parameter presents a 38.67 mm/100 m vertical gradient, with a regional variation interval over 500 mm, starting from 750 mm in the Northern basin and in small areas in the South, to values exceeding 1250 mm in the high areas.

At the same time, the temperatures drop below 4 °C at elevations higher than 1200 m and even below 2 °C to over 1600 m. These elevations occur only in central magmatic heights and in the North-East of the area (Rodnei Mountains). One notices the dropping of temperature by 1°C at approximately 200 m, resulting in the approximate overlying of the 5, 6 and 7° C isotherms on the 1000, 800 and 600 m contour lines, while the temperature rises above 7°C in the basin or riverside area where the elevation values fall below 600 m.

The relief unit subjected to study in this paper is located in the North-North-West of Romania and belongs to the Northern group of the Oriental Carpathians. *Genetically speaking*, these mountains represent a sedimentary-magmatic morphological unit (*Posea, Gr., 1974, Schreiber, W., E., 1985 cited by Bîcă, I., 2010, p.19*), which belongs to the volcanic range generated in Neogene at the contact of the Oriental Carpathians and the Transylvanian basin. The genetic and evolutionary context at the contact of the Transylvanian basin with the Oriental Orogen in the deposits of the former, induces major landscape changes, among which one mentions, in the first stage, the contribution to the division of the “maramureş basin” (*Pop, P., Gr., 2006, p.42*) simultaneously with the assumption of the previous orographic role played by the crystalline neighbouring ranges (the Maramureş Mountains and Rodna Mountains). The influence on the morphogenetic processes in the Maramureş basin or Someşul Mare hills and the contribution to the blocking of Western air masses whose effect is felt in the pluviometric regime, add to the two above mentioned aspects as a major reason of landscape change. The paleogeographical evolution provides indications related to the existing genetic types of relief among which the structural relief prevails in weight (folded and monoclinal) followed by the volcanic relief, while the relief resulting as a result of the external factors: watercourses (fluvial relief) or climate (periglacial relief) on the active surface are reduced in weight, with implications on the aspect of the overall hydrographic network.

The significance of the existing soils (luvisoils, cambisoils, spodisoils and protisoils) is noticed at the land use level where the surfaces covered with forest and arborescent vegetation prevail in a 52.05 % percentage (7.8% coniferous forest, 38.32 % broad-leaved forests, 15.38 % mixed forests, 10.75% cleared areas undergoing a regeneration process), to which one may add pastures representing 17.8% and agricultural cultures 7.8% (fig. 2). This situation characterizes an economy based on the primary sector (logging and agriculture).

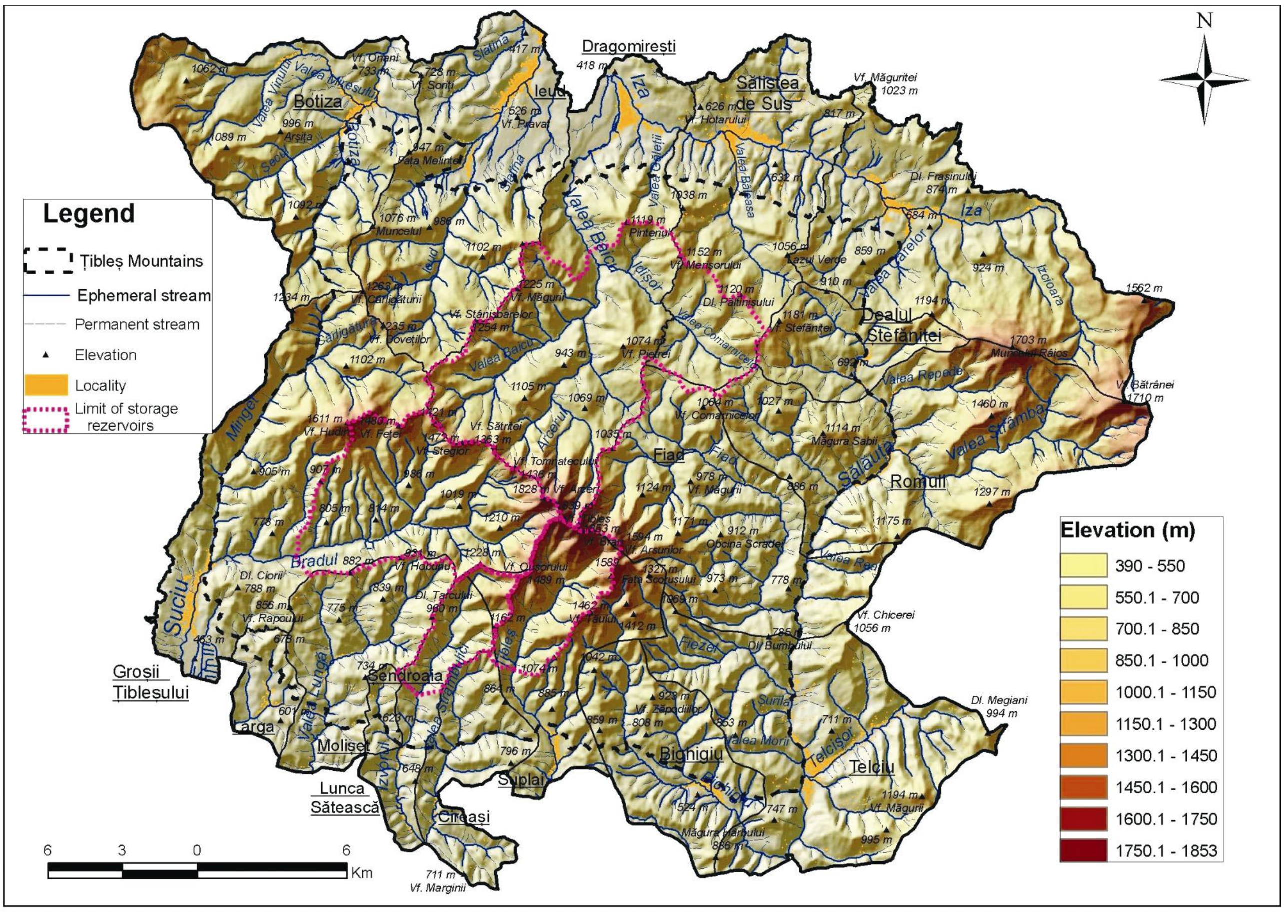

Fig. 2. Proposals for the optimization of the hydrographic potential of the Ţibleş Mountains

3. ANALYSIS OF THE HYDROGRAPHIC POTENTIAL

The hydrographic element of the climatic input in a given geological context presents in this case a series of well defined characteristics at components level.

In terms of underground waters, 7 springs may be noticed, whose existence is due to the petrographical features. Two of these are bicarbonated–chlorinated springs at Şendroaia respectively Romului, and other four localities in Maramureş: Săliştea de Sus (mineral carbogaseous-bicarbonated), Dragomireşti, Ieud and Botiza (sulphureous). The modest flow and mineralization did not recommend them for an intensive usage and therefore their importance is only local.

The phreatic waters located in the sedimentary deposits are added to the above mentioned waters. The nature and composition of the former enables the seepage in the eluvial and deluvial deposits, generating drinking water springs with moderate mineralization (200-500 mg/l) and relatively high flows (*Haidu, 1993*).

The length of the hydrographic network as reported to the surface units reveals an appreciable density of 1.98 km/km². This has a radial-divergent distribution from the Bran-Hudin main height or secondary, towards the Someş valley, in the South or the Iza valley, in the North. There are some divergence points in the North of the above mentioned height represented by the hillocks which dominate the landscape by the elevations ranging between 900 – 1200 m.

There are three main collectors in the study area. One of them is the right tributary of the Tisza River, the other one is Iza which collects all the water bodies having the springs in the area of the Ţibleş Mountains and discharges towards the North, representing left-side tributaries to the above mentioned collecting water body (44 % of the total surface of the study area). Among these, there are some that distinguish themselves in terms of flow and length from east to west: Valea Carelor, Valea Bâleasa, Valea Găleţii, Valea Baicu, Ieudul and Botiza.

Someşul Mare collects the following right-side tributaries which drain an extended surface in the South-East of the region (42 %). In this regard, the following may be mentioned: Sălăuţa with its tributaries such as Valea Strâmbă, Fiad, Telcişor and Bichigiu, Valea Ţibleşului, Izvorul and Valea Lungă, the last two form by convergence with the Ilişua river, one of the most important left-side tributaries of the Someş Mare.

The Someş river, by its 3rd order tributary (Suciu), drains the South-Western area corresponding to the localities: Groşii Ţibleşului and Larga. Minget and Brad are highlighted as the 4th order tributaries of the Someş River.

4. STAGES OF USING THE HYDROGRAPHIC POTENTIAL

The identification and characterization of these stages are performed by closely relating to the evolution of human communities in this space, considering that these are fully influenced by the variations of the potential characteristics.

The primary use stage implies the detachment (from the favourability point of view) of some areas (valley, alluvial plain, terraces, debris cone) in order to locate the villages. In the first stage, the upper terraces were chosen, of course, as a primary non-structural measure against floods, but the numerical increase of the population requires additional agricultural land surfaces, resulting in the occupation of the terrace by the alluvial plain. These statements are confirmed both by archaeological discoveries within the boundaries of the localities in Maramureş area, and by legends (foundation of the Ieud village). Therefore, the villages are located at the contact between the Ţibleş Mountains and the neighbouring relief units, where the hydrographic network has contributed directly (by discharge parameters) or indirectly (by the landforms created) has contributed decisively to the foundation and evolution of localities existing nowadays. The fish, whose potential is directly influenced by the water quality, has most probably represented a food alternative within the period when the human factor did not have a decisive damaging potential. Under these circumstances, the watercourses represented drinking water sources especially during the drought periods.

The industrial use stage starts with the implementation of new traditional industry techniques in this region. Without knowing the exact data on the origin of these elements, one may notice however their significant development after the installation of the Hungarian domination and the achievement of a peak between the 17th and 19th centuries. In this regard, there are some representative elements: the water mill, the fulling mill, the sawmill. The water mill (with vertical wheel), used for the processing of grains implied a considerable effort for construction and subsequent maintenance. For this reason, it was the property of either a nobleman or of an inhabitants' "association". In order to use the penstock from the main river, there were other facilities besides the mill (fulling mills and whirlpools) used for the washing of woven fabrics, with the secondary effect of improving their thermal insulation quality by thickening. Most often, these were accompanied by a comb for wool processing, device known as carder. The sawmill was a hydraulic device invented later than the devices mentioned above, and it was used in log conversion for subsequent use. This could operate independently of the other described elements. The number of these devices was closely related to the demographic potential of the localities, as well as with the surface of the agricultural land.

For the correct visualisation of the amplitude of the phenomena, it suffices to say that there were six water mills with fulling mill and whirlpool in Săliştea de Sus (19th century) and a sawmill (*Chiş-Boju, 2003*), no less than 9 mills with two millstones for corn and wheat, 2 sawmills and an unspecified number of fulling mills and whirlpools (*Vetişanu-Mocanu, 1995*) in Ieud, 6 mills (*Doboşi-Faiciuc, 2008*) in Dragomireşti (17th century), while in Săcel there were 9 mills with whirlpools (*Grad, 2000*).

In the absence of an adequate infrastructure and transportation means for the wooden material, they periodically built a natural pond which had the purpose of deliberately increase the water level in order to carry the logs.

The modern use stage begins in mid 20th century, when the electrical power supply made the radical conversion of the above mentioned folk technique facilities possible. The fulling mills and whirlpools lasted the longest, as only the change of fashion trends could make them obsolete.

The wide use of devices capable of carrying significant amounts of wooden material on roads often built for this purpose, have rendered the natural ponds useless. All this time, the lower courses of the water bodies were influenced by structural measures in order to protect them against floods.

All these changes have occurred under the circumstances of a powerful demographic growth with a visible negative impact on water quality. The speed-up of this process was more obvious during the post-revolution period when the wide use of fossil fuels, detergents, plastics etc. has led to an unprecedented pollution of the water bodies with direct impact on the significant mitigation of the hydrographic potential.

The perspective stage will imply the approach and land planning according to the principles of sustainable development. This challenge is the more difficult to achieve the more the number and needs of the population are growing. Among these needs there are: electrical power, water supply, food and reduction of damages caused by the extreme hydrological events affecting the study area at increasing frequencies, but not limited to this area.

In order to meet these needs, one needs to foresee the possibility of managing retentions on the water courses of Ţibleş, Izvor, Brad and Valea Baicului, with multiple uses (fig. 2). Among these, the most important worth mentioning are: meeting the water needs of downstream localities, electrical power generation, aquaculture, diversification of the touristic offer in the region etc.

5. CONCLUSIONS

The Ţibleş Mountains represented a completely rural region (until 2004), with an evolution specific to the Romanian mountain area in terms of using the hydrographic potential. The application of these patterns derives from the physical-geographical characteristics of the region and from the evolutionary historical context. While the first two evolutionary stages are natural, the evolutions of the human-nature ratio which characterize the third stage imperatively need to be rethought. It has been noticed that anthropic activities damage the environment, significantly reducing its potential to meet the future needs. Therefore, measures are necessary for the growth of the hydrographic potential by building water reservoirs designed to meet multiple needs.

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