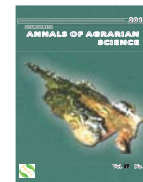




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# Spatial-Territorial Development Prospects of Borjomi Resort

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### ABSTRACT

Georgia is notable for the abundance of tourism and recreational sites. Between them the southern Samtskhe-Javakheti region is outstanding for its peculiarities like: diverse geographic conditions, several protected areas, recreational places, natural monuments, balneology resorts, cultural landscape, a lot of monuments of cultural heritage and the borderline location that is interesting from the cross-boundary aspect. The article discusses issues of the spatial-territorial development of the resort city Borjomi and hydrogeological research of Borjomi mineral water, as well as some ecological problems of Borjomi, the recent natural disasters and their relation to the project of sanitary protection zones of the deposit. The role and importance of the mineral water deposit as city-forming factor for the development history and spatial-territorial planning prospects of the resort-city are considered. Based on the Project of Borjomi mineral water deposit sanitary protection zones and the General Land Use Plan of Borjomi city, envisaging the environmental problems and natural hazards occurred in recent years, some spatial development directions of the resort Borjomi were identified, as well as recommendations for the implementation of preventive planning activities are suggested.

**Keywords:** Spatial-territorial development, Resort ecology, Hydrogeological resources, Natural hazards, Recreational tourism, Borjomi resort.

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### Introduction

Regions of Georgia are characterized by unequal economic development. According to the data of Geostat's (National Statistics Office of Georgia) GIS analysis, by the economic characteristics Samtskhe-Javakheti ranks the eighth among 10 regions [1]. Although, regardless of agricultural, tourism and resort potential, it may be considered as a less developed region. At the same time, there is a group of recreational resorts in Samtskhe-Javakheti, which economic, social and ecological development would have a significant impact on the region and the country.

There are 14 health resorts and the same number of resort destinations in Samtskhe-Javakheti [2]. This resort potential integrity is called the Samtskhe-

Javakheti tourism and recreational cluster. The Borjomi-Bakuriani Group is particularly well known in Samtskhe-Javakheti tourism and recreation cluster. Noteworthy is that according to the indicator of the implemented investments, Samtskhe-Javakheti has a better position between the regions that is mainly due to the Borjomi and Bakuriani factor [1]. Among the municipalities of the region, Borjomi leads by all features. Generally, more attention is paid to the arrangement of the ski resort infrastructure while the scale of spatial-territorial development of the health resorts is very limited. Beginning from the second half of the 19th century to the 90es of the 20th century, health-care tourism was the leading industry of the region's economy, and its weakening has led to economic stagnation; the negative impact on the ecosystem has increased

because of the improper economic activities of the local population and the illegal logging. A large part of ecological problems is related to the economic, planning and logistical problems. Below we will discuss the case of Borjomi, the most important health resort of Samtskhe-Javakheti. Main urban and city-forming factor of Borjomi is its famous mineral water deposit.

The face of use of mineral water for treatment from the ancient times has been confirmed by archaeological finds. The medieval wars of conquest forced the population to leave the Tori Gorge (the historical name of the Borjomi Gorge) [3]. Formation of Borjomi as a resort is related to the re-discovering history of the mineral water healing properties by the Russian Empire's military servants in 1825 [3],[4]. "In the XIX century, Borjomi development undergone three major stages: the establishment - 1825-1842, revival - 1844-1854 and the development of 1862-1900 periods, which were characterized by the study of the chemical composition and medical properties of Borjomi mineral waters"[5]. Geological and hydrogeological surveys of the gorge started from 1872 were carried out episodically, in repeated stages [5]. By the beginning of XX century, Borjomi was a well-equipped and arranged resort like the well-known European spas.

During the Soviet period, development of the resort, as well as mineral water production, achieved the extensive scale. In the 80es of the 20th century, there were 14 sanatoriums, rest houses and boarding houses in Borjomi, while the number of visitors of medical institutions reached 80 thousand there. In addition, 40-50 thousand unofficial holidaymakers visited the resort every year [3]. In the crisis period of the 90es, the sanatoriums were used for the resettlement of the Internally Displaced Persons that actually stopped functioning of Borjomi as a health resort.

Nowadays, the growing tendency of tourism in the country is recorded in both urban and rural areas [6-8]. The number of spa-hotels in Borjomi is small and the prices are not affordable for the middle class, though the growing dynamics of the number of tourists using healthcare centers in the spa-hotels is positive. The spatial-territorial and functional-planning development of tourism attraction centers is relevant to the "spatial arrangement" component of the 4-point plan of the "Freedom, Rapid

development, Prosperity, the Government Platform 2016-2020" [9].

The geological and hydrogeological study of the Borjomi mineral water deposit and its district has a history of up to 200 years. Numerous published works, scientific researches, monographs, articles and geological reports devoted to the studies of it, are kept in the local geological library holdings. Some of them are listed in the References hereunder. "A large body of literature on the physical and chemical properties of the Borjomi mineral waters and their physiological action is available in Georgia, Russia and the European countries. Many doctors have written scientific works and defended theses on their research. In this respect the last decade of the 19th century is worth noting" [5].

Among the books of the recent period, noteworthy is the work "Resort Borjomi", prepared by the authors group, which details the state of hydro-mineral base and useful resources of the resort, the possibilities of use of mineral waters and climatic factors for medical and prophylactic purposes [10].

The scientific novelty of the article is considering the urban planning prospects of the resort, namely, in terms of its city-forming factors, in particular in view of the importance of the mineral water deposit.

## Objectives and methods

The aim of this study is to determine the planning activities with regard to the Borjomi resort potential and mineral water deposit, considering most recent ecological problems and natural hazards and to develop recommendations in this direction. The planning activities intend to strengthen the road system using historical roads, renewed zoning and planning of protective landscaping.

The main objectives are: the use of city planning approaches to mitigate the adverse impact of ecological problems at the resort - analyzing the spatial zoning defined by the General Land Use Plan of resort and mineral water sanitary protection zones; outlining the preliminary planning measures to mitigate the consequents of natural hazards.

The following methods of research have been used in the article: analysis of the materials of mineral water deposit sanitary protection zones project, legislative framework, GIS data, mapping data, development strategy and spatial-territorial planning documents.

The study examines the Geostat's GIS analysis data [1]; materials of the Borjomi deposit sanitary protection zones project are used as the relevant legislative framework supporting the protection of mineral water deposit [11]; Borjomi General Land Use Plan maps, developed in 2007, where the factor of mineral water deposit sanitary zones is outlined [12]; Borjomi Local Development Strategy 2016-2019 [13]; materials of Environment Agency on the development of natural geological processes [14]; the generated profile of hazards and risks for Borjomi Municipality and Borjomi city [15].

### **A brief analysis of the sanitary protection zones project**

The history of establishing and approving the sanitary protection zones of Borjomi mineral water deposit begins in 1914. On the initiative of the Society for Promotion of the Caucasian Healing Places, the project of sanitary protection zones was developed for Borjomi and Abastumani, which was approved by the Russian Provisional Government in 1917. It was the first official document on the Borjomi mineral water sanitary protection zones [5].

Under the Law of Georgia on "Sanitary Protection Zones of Resorts and Vacation Destinations" (1998) [16], due to natural conditions, three sanitary protection zones will be allocated in the Borjomi mineral water deposit area and in the resort Borjomi considering the location of mineral water wells, resort facilities and forest-parks: the first – the exclusion zone, the second - the restricted zone and the third - the supervisory zone.

According to the above-mentioned law, the boundaries of the first (exclusion) zone of sanitary protection for the mineral water outcrops and boreholes are determined in consideration of their natural protection quality, but at least 15 meters from their outlines. Total 21 sites of the first (exclusion) sanitary protection zone are designed round the exploitation and surveillance boreholes. Their total area is 3.39 ha and the total length of the boundaries is 2761.3 m. The objective of the first zone arrangement is to provide reliable sanitary protection of boreholes, springs and hydro mineral facilities (captivities, reservoirs, pumping stations, measuring equipment etc.).

Due to the hydrogeological conditions of the

Borjomi deposit, the depth of the mineral water aquifer, its impermeable cover and high-pressure mineral water, ensure the high quality of natural protection of mineral water in the exploitation and surveillance boreholes. The many years' experience of exploitation of these boreholes has shown no microbiological or other chemical contamination of water as well as no change of its chemical and physical properties.

The second (restricted) zone is allocated in consideration of the structural, hydrogeological and geomorphological peculiarities of the territory, the nature and flow of surface and ground waters to provide the effective protection of mineral water from pollution, spoiling and exhaustion. Its total area is 15390 ha, total length of the boundaries - 46800 m.

The zone covers the area where the surface and underground waters flow to Borjomi and all three exploitation sites of the deposit. All the exploitation and surveillance boreholes, sanitary-resort and recreational facilities, gardens, forest-parks and other greenery, a part of the Borjomi- Kharagauli National Park are located here. The second zone also includes the areas where the general plan envisages the expansion and development of the resort.

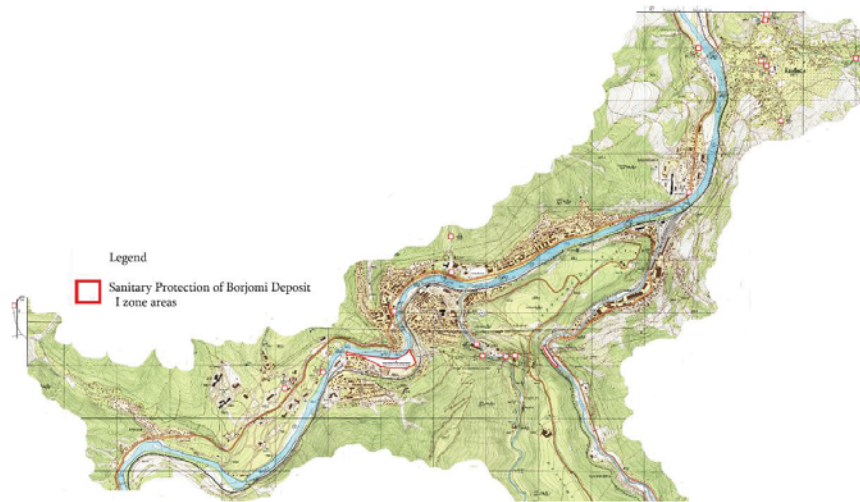
The outer boundaries of the sanitary protection zone of the Borjomi deposit and resort Borjomi coincide with the outer boundaries of the third zone. The third (supervisory) zone includes the area of feeding, formation and distribution of Borjomi mineral water, as well as the area of Borjomi climate formation [11]. The main woodland is located in this zone, which plays an important role in the formation and protection of climate and mineral water. The area of the third zone is 133,885 ha, the total length of the boundaries – 155,800 m. Almost all Borjomi mineral water feeding sites which are connected to the outcrops of the aquifer system of the Upper Cretaceous –Lower Paleocene age are located in the supervisory zone. Such outcrops are known on the Borjomi deposit: 1)5-20 km northwest, at the headstreams of the rivers Vakhaniistskali, Shavitskali, Chincharauli and on the Lomi mountain; 2)15-25 km northeast, in the valleys of the rivers Satibe, Saterdze and Tkemlovani, and 3)25 km southwards – in the area of Chobareti mountain. These outcrops are spread at the absolute elevation of 1300-2000 m. These are unpopulated areas with healthy sanitary state. The

areas within which the underground water transit takes place to Borjomi deposit, is distinguished by good sanitary conditions.

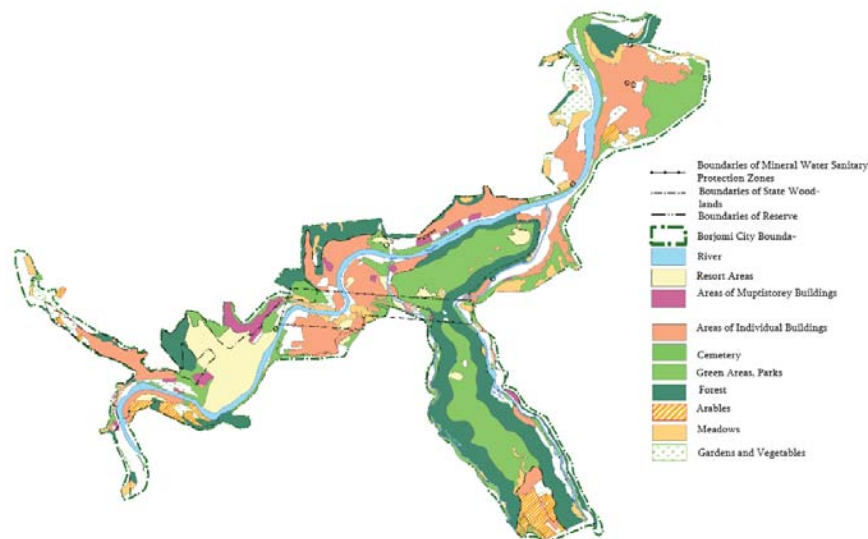
It should be noted that the company “IDS Borjomi Georgia” that holds the state license for Borjomi water extraction pays great attention to the protection of Borjomi mineral water deposit. According to the current legislation, the company developed the first zones of mineral water sanitary protection of Borjomi mineral water deposit, which were approved under the decree N 367 (06.06.2014) of the Government of Georgia [17]. The project is attached with the list of prohibiting and curative

measures, which are strictly controlled by the company’s relevant department.

The Borjomi General Land Use plan (2007) envisages the factor of sanitary protection zones of the mineral water deposit [12]. However, when updating the urban planning documents it is necessary to specify the sanitary protection zones by their actual status, as in the general plan of 2007 the sanitary protection zones of the Borjomi mineral water deposit were simply outlined, while in the project of sanitary protection zones of 2011 their borders are updated and adjusted.



**Fig.1.** Map of sanitary protection zones of Borjomi mineral water deposit, 1 zone [11]



**Fig.2.** Borjomi Land Use General Plan, Basic Plan [12]



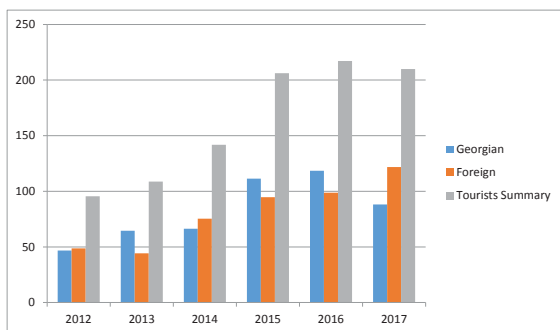
We consider the mineral water deposit as the urban forming and tourism-promoting factor, while the impairment of ecological conditions and activation of natural hazards is the factor impeding the city development as a resort. Due to the Environmental Agency data, the landslide processes are activated in the areas damaged by wildfires [14]. According to the recent generated statistical data of natural disasters available on the Geoportal of natural hazards and risks (CENN), the hazards of flash flood and wildfires have been identified for Borjomi.

## Results

The survey results are the determination of the Borjomi mineral water deposit role and its sanitary protection zones for the spatial-territorial planning of the resort city; comparison of the sanitary protection zones project and the materials specified by Land Use General Plan of Borjomi city. It offers the planning solutions for prevention and mitigation of environmental problems and consequences of natural disasters.

## Discussion

The world-famous resort Borjomi, with its mineral water deposits and climatic resort factors, represents the most important center for wellness tourism development in Georgia. With its rich resort history and modern potential, the strengthening of wellness, medical and spa tourism should be a strategic direction for resort and spatial-territorial development of Borjomi. However, Local Development Strategy document focuses on the sustainable tourism prospects [13]. The resort is overloaded seasonally, during the warm seasons of the year.



**Fig.3.** Number of tourists in Borjomi Municipality during last 5 years (thousand persons).

Source: Borjomi Municipality

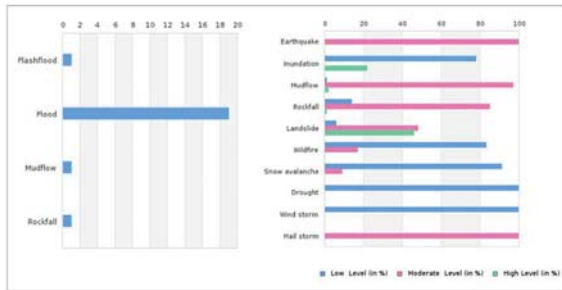
## Geographical and climate data of Borjomi

Geographical location – among the slopes of Meskheti and Trialeti ridges, in the valley of river Mtkvari and its tributaries Borjomula and Gujaretiwater. The height above the sea level - 800-1000 m. The Borjomi climate characteristics derive from the location of the resort in the low mountain forest zone with moderate climate. The average temperature in January is  $-2.8^{\circ}\text{C}$ . The average temperature in July and August is  $19^{\circ}\text{C}$ . The average annual temperature is  $8.3^{\circ}\text{C}$ . The average annual relative humidity is 77%. The average annual precipitation is 658.6 mm. The amount of precipitation is greater in warm seasons (April-September - 356.6 mm), and less in cold seasons (October-March - 302 mm). The sunshine duration is 1350-1400 hours per year.” [10]. According to the 2014 general census, the population of Borjomi municipality is 25214 inhabitants, where 15162 live in Borjomi and 10052 - in the rural area [18].

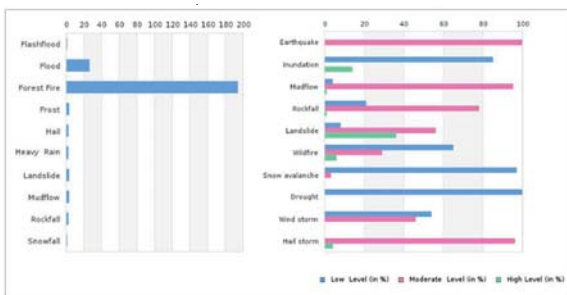
The main reason for the establishment and development of the resort is its carbon dioxide, hydro carbonate-sodium type mineral water and climatic healing factors. The Borjomi mineral water deposit is located in the central part of the Ajara-Trialeti folded zone, between the Ajara-Trialeti and Meskheti ranges, in the valley of the river Mtkvari (Borjomi Gorge). It occupies a length of 8 km in the valley between the villages of Likani and Rveli. The area of the deposit is about 20 sq. km. [19]. Today, the licensed useful resource of Borjomi mineral water deposit totals 682.9 cubic meters per day. The license holder has delivered free of charge daily consumption of 20,000 liters mineral water from the three exploitation wells located in the Mineral Water Park to the Borjomi Municipality for the tourism potential development of the resort and the region.

As mentioned above, the existence of the Borjomi water deposit and its reserves contribute to the development of wellness tourism, as well as to the spatial-territorial development of the city. While the adverse factors, such as environmental problems and resulting natural disasters: green areas reduction because of the improper economic activities, illegal logging and wildfires [20]; river pollution as a reason that water-surfaces are less used for recreational purposes, are impeding this process.

The growth of tourism flow intensifies the impact on environment. The especially crowded places are exposed to risk. The recent statistical data of Borjomi and the municipality shows that the cases of flash flood and wildfires as well as the hazard of inundation and landslides are relatively high.



**Fig.4.** Generated data of natural disasters for the town of Borjomi: historical disasters; exposition of facilities to risks [15].



**Fig.5.** Generated data of natural disasters for the Borjomi Municipality: historical disasters; exposition of facilities to risks [15].

The analysis of the natural geological processes map of Samtskhe-Javakheti shows that almost all the Samtskhe-Javakheti resorts are located close to the natural geological hazard zones, and the surroundings of the Borjomi city outline a particular hazard zone. [21]

Therefore, it is necessary to consider the preliminary planning solutions in the process of updating the spatial planning documents of the region, municipality and settlements, in our case, of the Borjomi city.

The planning solutions include: updating the functional zoning in the spatial-territorial documents of the municipality; applying the emergency management plan on the map for the cases of natural disasters; proper planning of roads as possible evacuation corridors (the paving of forestry roads shall antecede but not be made during

the occurred natural disaster) [22], [23]; targeted protective, especially terraced planting to enforce the landslide slopes and improve the ecological conditions of the settlements [24].

According to the European experience of forestry roads, the purpose of these roads is different: recreational, touristic, economic, and other [23]. During natural disasters, it is possible to use historical roads and hiking trails for safety purpose.



**Fig.6.** Borjomi municipality map, settlements falling in the zone of hazard of natural geological processes, main roads and communications

From the historical sources it is known that the road to Khashuri-Akhaltzikhe (now the highway S-8), which passes through Borjomi, was reconstructed in the middle of the 19th century. The old route traced from the Ateni Gorge along the river Tana to the Borjomi Gorge - the same historic Tori, passing the Gujareti Gorge and Mitarbi, from where it went in the Tadzrisi-Sakire direction to Atskuri. These roads are now hiking trails that can be used for movement during natural disasters.

An important place in the planning solutions should be given to the planning of green areas for the tourism and recreational purpose as well for solving ecological problems [22]. The terraced protective planting of slopes on the landslide areas, through the careful correction of the terrain using the plants with rapidly growing, strong root system can reduce the threat of soil erosion in the troubled areas of Borjomi Gorge. For example in the village Kvabiskhevi there is arranged a demonstration plot planted with Paulownia. This plant

is characterized by rapid growth, good soil protection ability and is used in beekeeping. It is possible to use this variety to protect the landslide areas [25].

### Spatial-territorial development of Borjomi

According to the municipal council data, free state-owned land plots in the town of Borjomi are limited (basically they exist in kind of parks, public gardens and small green areas), so one of the promising direction of the urban development may be considered the revitalization of the so called brownfields, i.e. the functionless industrial-technical areas. In this regard, the influence of the mineral water deposit protection zones factor must be considered in the design solution and spatial development strategy. Revitalizing of brownfields is especially relevant in terms of protective green strips reduction. Transformation of former industrial areas into public green spaces is a global trend [24]. These areas are mostly found in the periphery. Sanitary protection zones of Borjomi water deposit are located adjacent to these areas. The planning of intensive green public spaces and protective greenery along the roads will improve the Borjomi deposit surroundings area, the ecological conditions and the aesthetic visual aspect of the entire resort town of Borjomi in view of the tourist traffic in the direction of Bakuriani.

### Conclusion and recommendation

The study of Borjomi mineral water deposit and its assessment as the crucial urban and town-forming factor for the resort Borjomi shows that the spatial-territorial planning of the resort should take into account the actual condition of the sanitary protection zones of the deposit. The growing tourist flows in the resort city, positive trend of revival of the recreational tourism and increased interest in the use of Borjomi mineral water makes this issue particularly actual.

Considering the environmental problems and natural hazards as the impeding factors, the spatial-territorial documentation of the resort city can provide for the following preliminary planning measures:

- To respect that the sanitary protection zones of mineral water deposit are highly important during the planning of bypass roads and spatial territorial zoning;

- To apply the damaged and restorable areas of the green cover on the municipality map; to consider the protective greenery, particularly the protection of slopes from erosion in order to minimize the risk of development of natural geological processes;
- To plan and construct/pave the forestry roads, taking into account the best practices [23];
- In order to improve logistics, including communication during the natural disasters: to organize the extended urban communications, as well as to use the historical roads and hiking/forestry paths for the emergency evacuation corridors.

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