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# Adaptive Sustainable Management of Forests in Borjomi

**Nino Sulkhaniashvili**

Faculty of Geography, Tbilisi State University, Tbilisi, Georgia

**Email address:**

Nino.sulkhaniashvili@tsu.ge

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**Abstract:** The study of Borjomi forest is based on number of topics/issues including Landscape-Ecological Carcass (LEC) of Borjomi Municipality for Planning the Forest Use, which was developed by Prof. Nikoloz Beruchashvili. The study also includes social research that allows complex analyzing and evaluating the following issues: Forestry problems (general, their explanation/recommendation for solving these problems); Problems in agriculture (general, their explanation/recommendation for solving these problems); Exploitation of forest resources (fuelwood/timber); Logging for own consumption/for selling locally/for exporting (fuelwood/timber); Tentative price of logging (fuelwood/timber); Tentative price of transportation (fuelwood/timber); Tentative price of selling the wood locally/for export (fuelwood/timber); Tentative volume of/timber consumption; Use of fuelwood for heating/cooking; Problems regarding grazing (is present area for grazing sufficient for existed cattle); Recommendations for improving the condition of forest resources/legal Issues/management issues.

**Keywords:** Borjomi Forests, Landscape-Ecological Carcass (LEC), Sustainable Forest Management

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## 1. Introduction

Borjomi Municipality is located on the mountain range of Meskheti and Trialeti, The altitude of the mountains reach to 2, 000-2,500 m above sea. The Gorge is across the river Mtkvari and the municipality is located on 800-950m. The municipality is neighboring with Zestaponi from North-side, with Khashuri from North-East, with Akhaltsikhe from West, Akhalkalaki and Aspindza municipalities from the South.



*Figure 1. Borjomi municipality in Georgia.*

The total area of the municipality is 1,189 square km; the center of the municipality is Borjomi town.

There are 11 territorial units in the municipality including town Borjomi, the municipality center, 3 small towns- Akhaldaba, Tsagveri, Bakuriani and 7 rural territorial units,

each including 2 or more villages (Source for general information [www.borjomi.org.ge](http://www.borjomi.org.ge)). Chart 1 showing the structure of Borjomi Municipality governance.

Borjomi district is a part of Samtskhe-Javakheti region, which includes 6 districts and its population is around 15% of the region population. The distance from the municipality to the regional center, Akhaltsikhe is 50 km, to the capital is 157 km, to the airport -168 km, the nearest customs (Vale) is 68 km and to the nearest sea port (Poti) is 228 km. population of Borjomi is around 31.8 thousand people, from this population of city Borjomi around 14.4 thousand and rural 17.4. 46.5% are women and 53.5 men. The reason of decreasing the number of population is the migration to Tbilisi and other countries, especially Greece, because of high unemployment in the region. In one of the target villages (Tsikisjvari) big part of the population are Greeks.

The major source of employment in Borjomi municipality is tourism, livestock farming and forestry. Data sources for this sub-chapter are official web-page of Borjomi municipality [www.borjomi.org.ge](http://www.borjomi.org.ge) and Socio-Economic Development Plan of Borjomi Municipality.

Nowadays Borjomi Municipality represents one of the important tourism centers in Georgia. Tourism has always been the great priority for the municipality because of the resorts, mineral waters, park for tourists, health-sanatoriums.

Borjomi-Kharagauli National Park which is the one of the biggest in the Europe is spread on 76,000 ha and the vast massive of the forests which are preserved untouched attracts the tourists.

Tabatskuri Lake is one of the most attractive sites for the tourists located between Borjomi and Akhalkalaki municipalities on 1990 m above-sea. There are many historical and cultural monuments in the municipality.

Borjomi itself represents the municipality centre and is famous as a resort with mineral water, park for tourists and health-centers. Skiing infrastructure, sanatoriums and hotels are well-developed in Bakuriani. Also other small towns and villages such as Akhaldaba, Tsemi, Kechkhobi and Tsagveri represent significant tourist attractions in summer.

Central and local government shows great interest in developing tourism in the municipality. According to the Socio-Economic Development Plan of Borjomi Municipality tourism development is a top priority. No additional statistics were found. (We checked municipality budget, no specification of incomes, same is in central statistic yearbook, only incomes from restaurants and hotels are specified, but not at municipality level. Only data about the number of tourists is available based on national tourism administration information ([www.gnta.ge](http://www.gnta.ge)). According to the administration total number of tourists visited Georgia in 2013 is 4.4 million and 2.2% of them visited Borjomi municipality which is around 97 thousand. No data about local tourists from this source. However, according to the Borjomi Tourism Information centre totally around 14 000 tourists visited Borjomi city in 2013 and according to the media totally around 40 000 visited Bakuriani.

## 2. Methods and Initial Data

The study of the Borjomi forests is based on the analysis of different landscape-ecological peculiarities, from which the most important is: modern condition of landscapes, character of the geo-dynamic processes; variety of landscape structure, landscape differentiation, social-economic condition, agricultural traditions and territory potential.

The methodology also included compilation of existing information and data. During the study was considered that there are no statistical data at villages level. Borders of different land uses are not defined. No statistical data on population livelihood etc. Therefore stakeholder analysis of the target region seems for us as the best approach to be acquainted in nearly real situation.

There are around 40 villages (some of them are just names, without population) in Borjomi Municipality (total population around 31 800 among this around 17 400 is rural population). Our proposal was not to conduct stakeholder analysis of all villages, but make selection of 1 village from official communities which included 2-4 villages (there are 7 communities in total of our interest).

Our methodological approach was based on analysis of:

- (1) Documents and questions provided by the Project Team;

- (2) Different guidelines on rapid rural assessment, livelihood opportunities and stakeholders analysis;
- (3) Policy documents on sector, regional and municipality development (Sectoral policy documents, Country and Borjomi Municipality Socio-economic Development Plans/Budget);
- (4) Statistical information ([www.geostat.ge](http://www.geostat.ge));
- (5) Information gathered through interviews and consultations with target area authorities and population;
- (6) Consultant's experience.

Methodological approach has been implemented using the different tools:

- (1) Desk study;
- (2) Field work;
- (3) Consultation with responsible officers on the spot (Representatives of National Forestry Agency, Statistical Department, authorities in Borjomi Municipality);
- (4) Regular consultation with project team;
- (5) Meetings and workshops with local community authorities and household representatives;

Crucial for the study was a method of gathering information from target communities. By experience from other projects, EcoVision believes that household interviews are the best way to reach required results. For the interviews EcoVision developed an appropriate questionnaire.

It is known that interviews are no objective assessment methods as the questioned people utter their personal, subjective opinion and feeling. Some people may regard this as disadvantage and not answer the questions honestly. To minimize this gap EcoVision did not ask people to put their names on questionnaire; EcoVision recruited two locals for assistance in the selection of household representatives for interviews. It was essential to interview identical persons for the base line and the impact questions. EcoVision selected household representatives according to the following criteria's:

- (1) Different classes ("wealthy" and "poor" families)
  - (2) Women and men
  - (3) Different age classes
  - (4) Different education classes
- Different business representatives

Interviews conceived in such a way that the interview did not take longer than half an hour. 56 people (8 from each community) participated in the process.

In order to visualize current situation in the study area digital maps were developed. The following thematic layers were created:

- (1) Map of Study Area – Villages
- (2) Physical – Geographical Map
- (3) Map of Borjomi Municipality
- (4) Population Map
- (5) Map of areas used for pastures
- (6) Map of forests (as a background which was provided by OBF)
- (7) Map of cutting areas
- (8) Agriculture map

(9) Map of cutting areas

(10) Landscape – Ecological Carcase of Borjomi Municipality

Logging and grazing areas were identified as a result of questioning of the local respondents. GPS device was used to identify the particular areas.

Under the project it was considered to create attribute tables and alphanumerical information for each layer on study area. All the objects of the GIS were interactive, which means that it will be possible to activate any information attached to the object using links and hyperlinks.

There are following information on each object (as a chart):

- (1) Identification code
- (2) Geographical location (X, Y and Z coordinates)
- (3) Name of the object
- (4) Date of creation
- (5) Typology
- (6) Type
- (7) The name of the living area where the object is located.
- (8) Each object has a detailed description in the form of doc. file, which is included in the report.

### 3. Research Object

Borjomi forests are the main research object of the study. There is a huge timber supply in municipality, forest holds 57% of the whole territory (Figure 2). The total land resource is 68.0 thousand ha on the balance of National Forestry

Agency (NFA) forest cover is on 63.2 thousand ha, the total stock of timber is 13, 345, 5 m<sup>3</sup>. The total area covered by Spruce is – 38. 4 thousand ha (61%); Fir is 22.4 thousand ha; Pine – 12.7 thousand ha. Borjomi forest is a unique for its environment protective functions. The average age of the forests is 114-121years. The mature and overmature forest is 15.6 thousand of ha.

There is no forest license holder operates in Borjomi forests. Nowadays there are 187 cutting areas (social cutting) in Borjomi, designed by National Forestry Agency. Total volume of trees under this cutting is 61 162.9 m<sup>3</sup> from which 42 843.5 are already cut. Minimum timber volume in cutting area is around 600 m<sup>3</sup> and maximum 1858 m<sup>3</sup>. According to official data from National Forestry Agency there are also small designated areas for cleaning of fallen trees in total 13 600 m<sup>3</sup> (this included in total cutting volume 61 162.9m<sup>3</sup>).

If we divide volume of fuelwood in cutting areas (61 162.9 m<sup>3</sup>) on number of rural households of Borjomi - 6 thousand (average number of persons in households for all Borjomi municipality is 2.8), than average volume of fuelwood per household will be 10.2 m<sup>3</sup>. For all households (rural and city -11 328) volume of fuelwood will be 5.4 m<sup>3</sup>. If we take into account number of empty households for at least 6 months, than volume of fuelwood per household will be more. By Lorries if person buy it, usually when seller say 6m<sup>3</sup> it is 5-5.5 m<sup>3</sup>. Population also use gas during all year. All this mentioned in Table 1. Construction timber mainly sold in Khashuri wood market.

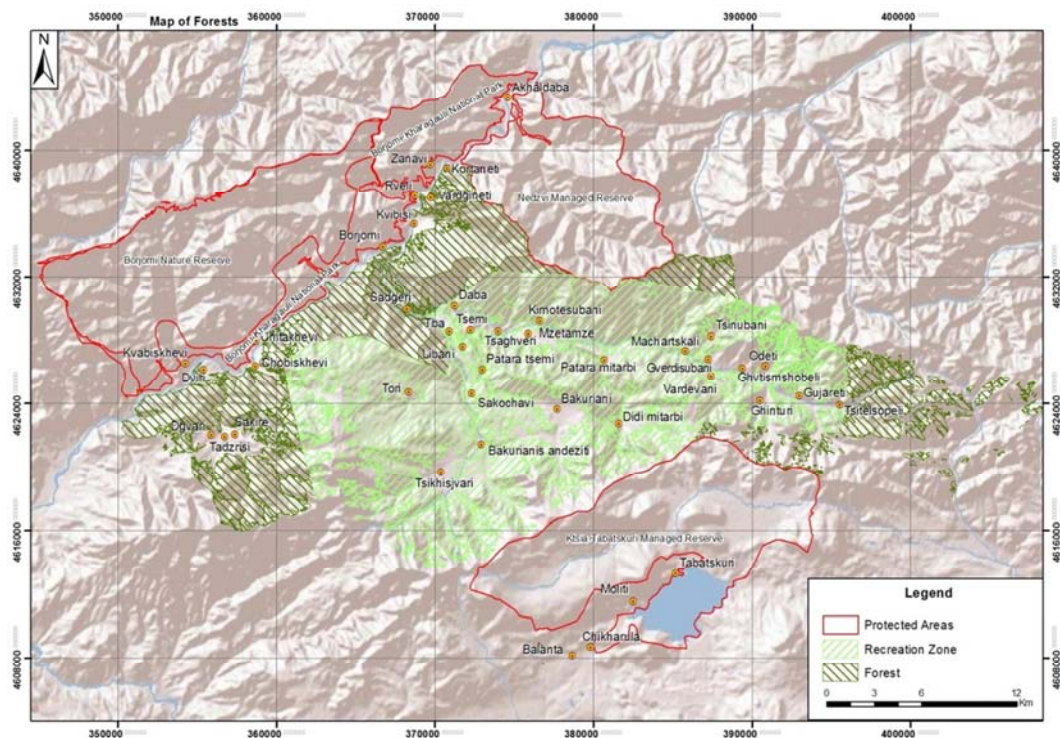


Figure 2. Map of Borjomi Forests.

Because of the unclear processes in land categories changes during the last years, boundaries of Borjomi forests under the NFA are not defined. There are several land areas

that belong to the NFA (by NFA records), but in reality (according to the Georgian Public Registry) these lands are under private sector or agriculture areas of the Municipality.

Actually all cutting ticket holders are involved in wood harvesting (for own consumption). According to the recent changes in regulations one person cannot buy ticket for more than 7m<sup>3</sup>. In the past it was possible and some people made a

bussines e.g buying 200 or more m<sup>3</sup> and then sell it. Now ticket holder can give this ticket to another person and pay only for service (cutting and transportation). No official statistics exist.

Table 1. Questionnaire.

Villages (community centres):		Tba, Tsikisjvari, Dviri, Kvibisi, Tadzrisi, Gverdubani, Gujareti							
Date of survey:									
Questionnaire completed by:									
Education of persons involved									
Gender of persons involved									
Age of respondents									
Main activity (business)									
Number of persons in households									
PART 1: Population and Forest Activities									
1	Population of target villages (total)								
2	Percent of target villages population of Borjomi municipality total population: rural / all population								
3	Population age balance of target villages								
4	Number of households in target villages								
5	Average number of people per household								
6	Percentage of households empty for at least 6 months of the year								
7	Natural gas in target villages/percent of population of target villages with natural air supply								
8	Use of natural gas for heating								
9	Use of fuelwood for cooking in non-heating season								
10	Average volume of used fuelwood per year								
11	Filing fuelwood gap (official 7 m <sup>3</sup> )								
12	Volume of fuelwood is bought or collected (%)								
13	Percent of household cash income per year (%) spent on forest products (fuelwood and timber)								
14	Non-timber products (kg) collecting from forest (Mushrooms, berries etc).								
15	Selling of collected non-timber products								
16	Average number of cars suitable for wood transporting. Cost of leasing								
	Possibilities for wood transporting and cost per m <sup>3</sup>								
17	Personally								
	Car leasing								
	Purchase in village								
18	Average distance from cutting area								
19	Place were target villagers can by timber and prices								
20	Main problems for obtaining fuelwood								
21	Conflict between forestry and other land use types? (e.g. for you is better to use land under pasture than under forest).								
PART 2: Employment and Income data									
22	Average chief income sources in the villages breakdown in percentages - see key)? *	A	B	C	D	E	F	G	H
23	Average level of household income (year/GEL)								
24	Net migration to other areas outside of the village for work								
25	Seasonal employment								
26	Percentage of people actively seeking work in the villages								
27	Social allowances (except of pension)								
PART 3: Livestock and Agriculture									
28	Cattle (total) in target villages								
29	percent of cattle of target villages to the total number of cattle in Borjomi								
30	Average number livestock (per/household.)	Cattle: Cows/Bull		Sheep	Goats	Horses	Donkeys	Pigs	Poultry
31	Average annual cost of keeping livestock (per/livestock)								
32	Average annual income received from livestock (per/livestock)								
33	Type of pastures used (see key) **								
34	Main problems for keeping livestock Solutions								
35	Land under your ownership	Agricultural (ha) Average 0.14 ha		Land under temporary	Land under permanent crops			Pasture	Yard

Villages (community centres):		Tba, Tsikisjvari, Dviri, Kvibisi, Tadzrisi, Gverdubani, Gujareti			
	crops				
36	Agricultural products for sale				
PART 4: Population awareness					
	Importance forest surrounding the villages (%)	Not important	Important	Very important	Do not know
	Source of fuelwood and timber.				
	Mushrooms, berries and other non-timber products.				
	Recreation and tourism.				
37	Soil protection, climate and water regulation, and other protective functions.				
	Place for hunting.				
	Protected area.				
	Pasture.				
	Other (specify if you have)				
	Effectiveness of information source that influence population of target villages (%)	Not effective	Effective	Very effective	Do not know
	Printed materials (Brochures, Posters, Sign boards, newspaper articles).				
38	TV/Radio casts				
	Web-sites				
	Seminars/meetings				
	School games about forests, competetions and children awareness/education camps.				
	Other				

## 4. Main Results

### 4.1. General Issues

Main results are received on the basis of analysis of questionnaires for target villages

Our target villages were 7 community centers which are focused mainly on livestock farming:

- (1) Gverdisubani (villages: Vardevani, Machartskali, Gvtismshobeli, Tsinaubani). 1520 m/asl. 32 km from Borjomi. Population 34 (2002). 13 by survey;
- (2) GujareTi (villages: Odeti, Ginturi, Tselsofeli). 1600m/asl. 40 km from Borjomi. Population 0 (2002). 1 by survey;
- (3) Dviri (villages: Qvabisxevi, Chitakhevi, Chobiskhevi). 920 m/asl. 18 km from Borjomi. Population 937(2002). 750 by Survey;
- (4) Tadzrisi (villages: Dgvari, Sakire). 1280 m/asl. 24 km. from Borjomi. Population 546 (2002). 450 by survey;
- (5) Kvibisi (villages: Vardgineti, Zanavi, Kortaneti, Rveli). 900 m/asl. 6 km from Borjomi. Population 1771(2002). 1800 by survey;
- (6) Tsikisjvari 1640 m/asl. 41 km from Borjomi. Population 644 (2002). 630 by survey;
- (7) Tba (villages: Libani, Sadgeri, Tsemi). 2250 m/asl. 9 km from Borjomi. Population 372 (2002). 160 by survey.

Because of snow and road condition we could not reach community center Balanta (include village Chikrula). 1860 m/asl. 70 km from Borjomi. Population -161 (2002).

Information for this sub-chapter has been taken from questionnaires and all data indicated here is an average for the target area and households.

Part 1 of the Table 1 “Average data after the questionnaire analysis” shows that population of villages for last 12 years (official census of 2002) decreased in all villages (around 8%), except of Kvibisi (actually unchanged).

Number of population above 65 years is high (around 30%). This fact indirectly showing that demographic situation in the villages is not perfect. Average number of people per household is 2.3 (min. 1.4 in Tsikhisjvari and max. 3.3 in Kvibisi).

Number of houses empty at least for 6 months is around 25%. (min. 10.7% in Kvibisi and max 42% in Tba).

Natural gas supply exists only in villages Tba and Kvibisi (around 51.7% of population), this high figure determined because of population in Kvibisi (around 1800 people), which accounts 45% of all population of target villages. Majority of population do not use natural gas for heating because of high price (0.6 Lari/m<sup>3</sup>) (1 Georgian Lari ≈ 0.41 USD), this is on 0.08 Lari more than in Tbilisi. For that reason, majority of population use fuelwood for cooking in non-heating season.

Average volume of used fuelwood is 9m<sup>3</sup>. It is what respondents say, e.g 5-6 m<sup>3</sup> in largest village Kvibisi (with gas) and 12-14 m<sup>3</sup> in high villages. We have double-checked this information with NFA and they confirmed that it is real. Reprehensive of NFA also mentioned, that when people buy firewood from track e.g. 6m<sup>3</sup>, actually it is less (5-5.5 m<sup>3</sup>) More detailed calculations can be found in sub-chapter “Forest resources”. Fuelwood gap 2% (difference between official 7m<sup>3</sup> and actually used 9m<sup>3</sup> in average), filled by collected small branches (around 15% of totally used fuelwood) or by natural gas (including liquid) and electricity. Average 12% of household cash income is spent on fuelwood or timber. Around 53% of households collecting non-timber products (mainly mushrooms and berries) average 8 kg/per

year mainly for own consumption and sold by 3% of households in open markets.

Average car number used by fuelwood transportation per village is 2.9, but many of them are mini vans. Leasing of a car is around 300 Lari on average distance from cutting area 9 km.

For the transportation of fuelwood around 75% of households using bull or horse and it costs around 8 Lari/m<sup>3</sup>. 20% leasing a car with cost 50 Lari/m<sup>3</sup>. Around 5% purchase fuelwood in village at price 80 Lari m<sup>3</sup>. According to the respondents they can buy timber in Khashuri which is 28 km from Borjomi. Khashuri (28 km. from Borjomi). See prices:

Round wood coniferous-250 Lari/m<sup>3</sup>

Saw timber coniferous – 400-500 Lari/m<sup>3</sup>

Round wood (Beech) – 850 Lari/m<sup>3</sup>

Saw wood (Beech) – 400 Lari/m<sup>3</sup>

The prices also were checked in Khashuri.

Absolute majority of the respondents mentioned that they have no problem for obtaining fuelwood. Around 48% of the respondents think that there is a conflict between different types of land use, mainly between agriculture/ livestock and forestry. Some of them mentioned about conflict within types of forest use (because of recreation/ecological functions of Borjomi forest logging of industrial timber is not practiced and no license was issued). Unfortunately, there are not statistics about exact number of sawmills, most of them (very small, located in houses) are illegal.

Part 2 of the Table 1 “Average data after the questionnaire analysis” shows the average percentage of incomes by sources. Currently the major income for target households is livestock rearing (41%) and income from pension (31.7%). Income for the majority of the household per year varies between 2001-2500 Lari, which is approximately 2 times less than official minimum living standard for family with 3 members.

Every study based on the interviews especially when it comes to the personal incomes contains some dangers connected with people behavior, how honest are they? Beside the human natural behavior, it is very hard to estimate agriculture or other products in monetary terms, which are produced or collected by people for their consumption.

The respondents mentioned about small migration to Tbilisi for jobs and Tbilisi and Akhaltsikhe for students. Seasonal employment is possible during the touristic seasons in Borjomi (summer) and in Bakuriani (winter).

Official unemployment rate in Borjomi is around 16%. We must note that many of people considering themselves as unemployed when officially they are considered as self-employees. We think that average percent of people (57%) described in survey table (Table) in our opinion more realistic taking into account average income of population. Unfortunately, it is difficult to calculate how many people work in one family. Official statistics about does not exist. According to the official statistics unemployment is 16%, unofficially - around 60%. In our case, 57% of respondents actively seeking for jobs.

Part 3. From official statistics ([www.borjomi.org.ge](http://www.borjomi.org.ge)), there

are around 5 000 cattle in Borjomi Municipality. By our calculations total number of cattle in target villages is around 3 300, which is 66% of the total. Average number of cattle per household is 2.1. Pigs are around 0.6 per household, sheep – 0.13, Goats – 0.1, horses-0.2 and poultry 8. According to the respondents keeping sheep is not profitable because long winter and limited places for grazing. Big grazing area near the villages Gverdisubani and Gujareti is privatized and it is under the leasing in summer period for sheep (approximately 3 000) from eastern/south part of Georgia. Leasing price is 3 Lari per sheep for season. Beekeeping is practiced by small number of households.

Average annual cost for livestock keeping is in average 250 Lari per livestock and average income 500 Lari. It should be noted that livestock keeping in Kvibisi (near Borjomi) is high (around 400 Lari) and in other villages 150-200 Lari.

According to the respondent’s main problems for livestock farming development is an absence of the veterinary service and high prices of forage. In our opinion here we can add ineffective land management, especially for pastures. Majority of household (50%) use forest land as pastures, 40% -public pastures and 5% own pastures.

Average size of household land is 0.14 ha. Main part of this is yards. In our opinion, such small and fragmented farm plots can only support subsistence agriculture.

According to respondents very small amount of agriculture products are for sale (mainly potatoes), which is true taking into account the size of owned lands, the number of persons in households and the general tendency of Borjomi rural areas on non-commercial agriculture as stated in the Social-Economic Development Plan of Borjomi Municipality.

Part 4 of ta 1 describes the significance of forest surrounding targeted villages and effectiveness of information sources that influence behaviour of the people.

Forest as source of fuelwood/timber and pasture area is very important for all respondents (100%). Forest protective functions for 85%, recreation and tourism for 25%, place for hunting for 11% and for 5% as a source of non-timber products.

Last part of survey shows which information source are effective and have influence on local villagers.

Majority of respondents consider that TV and Radio casts are very effective (about 56%). Internet is not available for majority of target population and therefore it is not effective for 63.3 of villagers and 15.5% do not know about Internet effectiveness. Also as an effective tool for public awareness respondents named seminars/meetings and youth education campaigns.

#### 4.2. Planning the Forest Use

Borjomi district is a natural node, in formation of its’ landscapes participate various physical-geographical district elements. Their impact determines landscape and biological diversity of research areas. The diversity of natural conditions of Borjomi district is related with “interests” of 5 physical-geographical districts and 11 landscape types (Figure 3). Among them landscapes of Caucasus mountain

forest and meadow have the special place, which are distributed widely in the framework of Less Caucasus. In the immediate nearness and immediate boundary of them (In Baniskhevi and Dzedzviskhevi) are Colhic mountain forest landscapes with evergreen underwood and specific flora. Above mentioned landscapes appear to be the most important ecological corridor for East of South Caucasus, West Georgia and Central Caucasus protected areas.

Along the river Kura valley before city Borjomi and after city Akhaldaba reach landscapes with pine forests. This is characteristic for Asia Minor Upper-mountain. From South-east of till Village Atskuri reach elements of xerophic landscapes, which are characteristic for mountains of Iran and Asia Minor central part. In the south part of Borjomi are elements of mountain steppes landscapes, which are characteristic for Javakheti volcanic mountains.

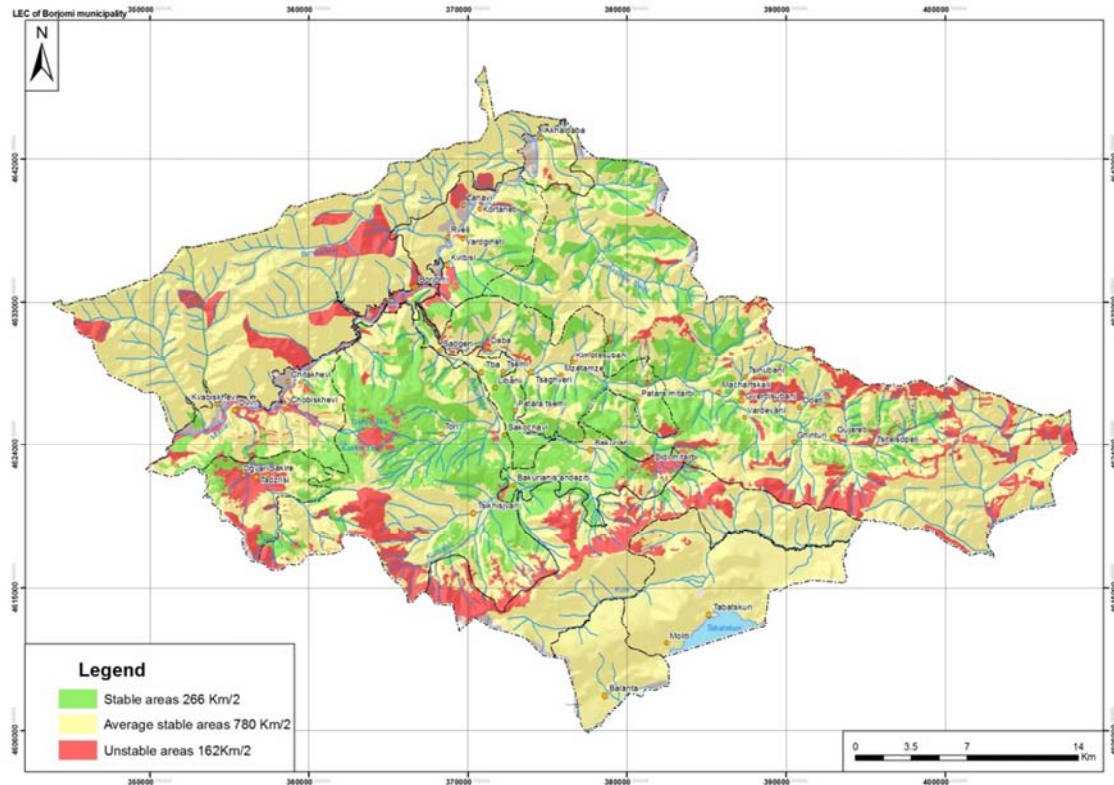


Figure 3. Mean Landscapes of Borjomi Municipality (by Map of Landscape of Caucasus N. Beruchashvili, 1979).

#### 4.3. Landscape-Ecological Carcass (Base) of Borjomi Region

The map has been prepared as a result of analyzing different landscape-ecological peculiarities, from which the most important is: modern condition of landscapes, character of the geo-dynamic processes; variety of landscape structure, landscape differentiation, social-economic condition, agricultural traditions and territory potential).

Landscape stability is shown on the map using so called “Semaphoric” (traffic-light) cartography method. Unstable territories are shown with red color, stable areas – with green color, and medium, average stable areas – with yellow color. On the map restricted areas) in order to prevent development of the negative ecological process. The above mentioned categories are selected according to the modern landscape condition, ecological balance and consequences of the anthropogenic activities, which are necessary to take into consideration during the inventory and forest usage.

Landscapes: 1. Middle-mountain erozional-denadational landscapes with beech forests mainly with evergreen

understory (landscape 70); 2. Low-mountain erozional-accumulativr landscapes with hornbeam-oak (*Quercus iberica*), oak-pine and pine (*Pinus caucasica*), partially with “shibliak” (landscape 83); 3. Middle-mountain erozional-denudational landscapes with beech, hornbeam-oak (*Quercus iberica*), hornbeam forest and postforest meadows and shrubs (landscape 88); 4. Highland volcanic plateau landscapes with steppes and meadows-steppes (landscape 119); 5. Middle-mountain erozional-denudational landscapes with beech-dark coniferous and dark coniferous, mainly with evergreen underwood (landscape 125); 6. Middle-mountain erozional-denudational landscapes with beech-dark coniferous, partially pine (*pinus caucasuca*) forest (landscape 127); 7. Upper-mountain erozional-denudational, partially paleoglacial landscapes witch birch or pine and oak (*Quercus pontica*) forest (landscape 129); 8. Upper-mountain erozional-denudational, partially paleoglacial landscapes witch birch or pine and oak (*Quercus pontica*) forest (landscape 130); 9. High mountain denudational sub-alpine landscapes with combination of meadows, shrubs and open woodlands (landscape 138); 10. High Mountain subalpine

landscapes with combination of meadows, tall-herb communities, elfin woods and thickets (landscape 139); 11. High mountain volcanic alpine meadows (landscape 148).

The following criteria are used in the evaluation of the stability (Figure 4):

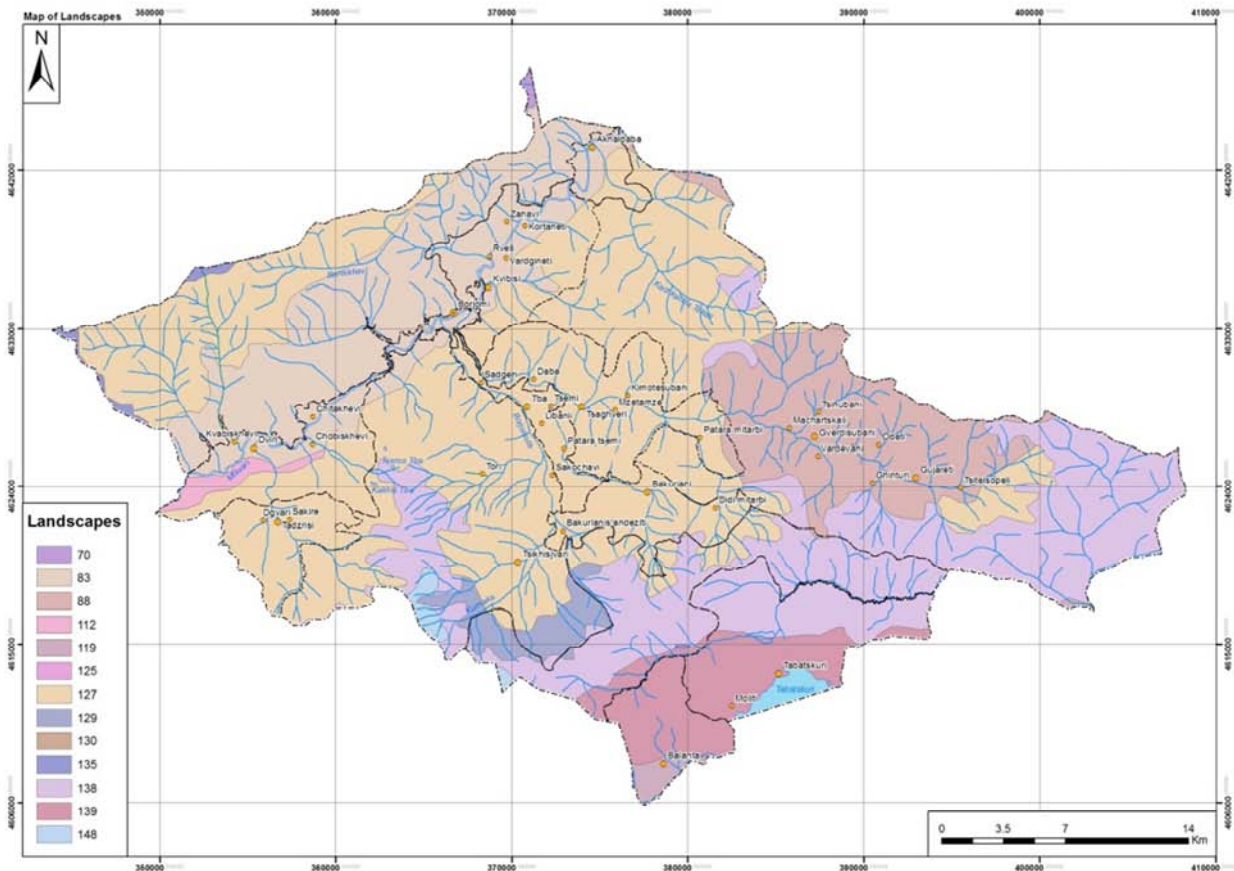


Figure 4. Landscape-Ecological Carcass of Borjomi Municipality (By Prof. N. Elizbarashvili 2014).

1. The stable areas engage 21.8% of the areas covered with forest, which is not significant. Landscape stability ratio decreases in the settlement areas and in those places, where there are motorways. The lower and medium mountain forest landscapes are represented on the volcanogenic plateaus. On the stable areas any agricultural activity (forestry) is permitted in accordance with the applicable rules.

2. Average stable areas are the landscapes where catastrophic geo-dynamic processes may develop once in 10-100 years, i.e. those areas, where there is a small probability of “live landslides”, active mudflows and with little traces of avalanches.

To this category belong the slopes with inclination of 31-35 degrees located on relatively stable mountain rocks and those slopes (26-30 degrees and rarely 21-25 degrees of inclination), which are built with instable mountain rocks and easily eroded surfaces. Degraded areas and the areas with intensive woodcut belong to the instable landscape category. Due to improper agricultural activity the condition is very strained and the forestry-agricultural works should be carried out with great care.

To this category also belong those landscapes, in which biological and landscape variety may decrease or their aesthetical value may be lost due to the agricultural activity.

Average stable territories in Borjomi region are represented at 64.8% of the area.

On the territories with average stability the agricultural activities are restricted considering the landscape-ecological conditions and the forest exploitation is possible only based on the selected woodcut and in cases of necessity, due to which its inventory can be carried out only in specific and special areas.

3. To the unstable territories belong those landscape areas, where the active geo-dynamic processes may develop in cycles. In these landscapes landslides and mudflows may be observed once or more in ten years. To this category belong those slopes (more than 5 avalanche gullies per 1 km) where the avalanches are observed once in ten years, or the areas, where there are 2-3 avalanche gullies per one kilometer, with a 3-year period.

Very unstable landscapes are developed on the areas, where the slopes without soil-humus cover or very eroded slopes are prevailed. One of the main criterion indicating the instable structure of the landscape is a slope inclination. On the crystal rocks, non-karst limestone, porphyries and tuffs the slopes having more than 35 degrees of inclination are prevailed. On relatively soft, easily dissolvable rocks (clays, extremely weathered sandstones, conglomerates) the slope



inclination may be less than 26-30 degrees. The slope exposition and the elevation above the sea level is very significant. For example, the south exposition slope at 1000 m a.s.l. is characterized with less stability, than the north exposition slope at 1500 m a.s.l. This can be explained by the fact, that in the dry climate the thin layered soils are formed, which are easily subjected to the erosive processes.

13.4% of Borjomi municipality area is unstable, what is significant. Such areas are presented in the river valleys and eves of subalpine and upper mountainous forest landscapes, adjacent to the settlements, also within the areas with anthropogenic influence. Existence of unsustainable areas is also related with steep slopes, relatively soft and easily decomposable rocks, dry erodible slopes of the South exposition etc.

Forest exploitation on the instable areas is not permitted, due to which its inventory should be carried out in a selective manner.

It is also worth mentioning that within the study region significant areas (almost  $\frac{1}{4}$  of the total area) are engaged by exposed territories and rocks, steep and very steep slopes, which are conditioned by the geological formation and erosive processes. The significant areas on the region territory are also engaged by agricultural land plots (more than  $\frac{1}{3}$  of the territory), which are characterized by stable and moderately stable landscape-ecological condition.

## 5. Conclusions

With the Government Decree No. 609 (19 October 2007) the Government confirmed its determination to transfer the local forests to the municipalities. The decree clarifies that “until the finalization of the process of transfer of forests of local importance to the municipalities, the Department of Forestry is responsible for the issuance of permissions for fuel wood cutting”. Nowadays this land tenure is not yet fully realized I.e. the NFA remains until the full transfer the authority in charge of all management issues.

The Forest Code of Georgia enacted in 1999, has not yet been replaced by a new Forest Code and is thus still valid. Some rules and regulations of the Forest Code actually in force do not fully correspond to the actually intended forest policy. A revision of the Forest Code is now in process. Special attention should be paid to the institutional form of NFA. According to the Georgian National Environmental Action Programme for 2012-2016 State entity responsible for forest management should be established as a Legal entity of Private law in a form of State LTD. Georgian Forestry Concept is adopted by the Parliament in December 2014 and reform documents in this direction are already drafted. Provision and goals of these documents does not corresponding to the current system of forest management, which is also true for Borjomi forest:

1. Annual consumption of firewood in Borjomi villages varied from 6 to 15 m<sup>3</sup>. It is advisable to increase the official maximum of firewood from 7 to up to 15 m<sup>3</sup>. Those households who need not this volume of firewood will not

buy it, Borjomi forest has this capacity.

2. NFA price of firewood (3 Lari/m<sup>3</sup>), is too low and it is more social assistance than real price. For cutting ticket holders payment for firewood is calculated from 15 Lari/m<sup>3</sup>, which is more realistic, but for that price difference license holders can not sell their firewood and they leave some parts of timber in cutting area. It is some sort of discrimination of private sector. Prices should be equal to stimulate private business and future operations of NFA.

3. Artificially low price on firewood does not stimulate the consumption of natural gas were it is available.

Another important problem is to define real boundaries of forests under the NFA (see section “Forest resources”), creation of special commission with Georgian Public Register and Borjomi municipality is urgent needed.

Georgia lacks a specifically formulated policy on pastures. The current lease system covers only larger pasture areas and is exclusively based on an area size depending fee without consideration of grazing intensity and practice and other aspects of pasture management. The subsistence level livestock keeping by smallholders is in a large extent based on grazing on public lands inside and outside the villages, including forests. At a rule in rural areas all land except fenced plots is used as pasture. So far no policy is in place taking into consideration the subsistence needs of the smallholders and the sustainability of land-use in these areas.

According to Mr. Beqa Gonashvili, head of the Georgian Association of Sheep Keepers, number of sheep in Georgia reduced drastically in last two years (from 1mln to 0.4 mln), because of no demand on export from Muslim countries. Because of insufficient infrastructure and bad condition of pastures cost of keeping one sheep reaches 115 Lari and price of sheep is now max 140 Lari if one find buyer. Until 2010 rent of state owned pastures regulated by the law (3 lari/ha), now it is up to the municipalities and it range from 5 to 15 Lari. Different prices have private sector e.g. in Gujareti area 3 Lari/per sheep/per month.

In general it can be stated, that general situation in Borjomi forests is not well known (borders of forest lands, capacity of pastures, volume of illegal logging etc.), but there is of course local knowledge and competence available. The participation process in target villages made local stakeholders interested and sensitive towards any future development. It is highly recommended to include the local population in any forest development process, including forest management planning and to try to get them as partner. It is necessary to make profit of local and regional experiences concerning the natural resource. People living in targeted communities have a certain relation but also knowledge and may contribute essentially to the future sustainable development respecting both the urgent need for forest resources and the protection of the environment.

Government agencies on higher levels, such as national ministries, should recognize the function of the local governments as communicators of information to and from the grassroots.

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