

## **Brown Bear (*Ursus arctos*) population of the Trialeti Range and Borjomi-Kharagauli National Park A Species Status Report**



NACRES  
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The Environmental Investment Program (EIP) is initiated and funded by BP and its partners in BTC Co. and SCP Co. Ltd. The principal objective of the EIP is to promote and conserve biodiversity. The EIP is divided into a number of different themes, which were identified during a process of consultation with national and international stakeholders. The Ecosystems and Species Conservation in Georgia: Brown Bear project is one of the EIP themes.

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## **INTRODUCTION**

This document has been prepared under the project, NBSAP Implementation - Ecosystems and Species Conservation in Georgia: Brown Bear. The project has been supported by the Environmental Investment Program (EIP) initiated and funded by BP and its partners in BTC Co. and SCP Co. Ltd.

The overall goal of the project is conservation of Brown Bears and their habitats in the Trialeti Range and Borjomi-Kharagauli national park through participatory planning and implementation of measures for targeted management, protection, and mitigation of human impacts.

The project is being implemented in two phases. Phase 1 was completed during 2004-2006 and was primarily dedicated to gathering baseline information for the development of a Brown Bear conservation action plan for the project area. This action plan will be implemented over the next three years as a second phase of the project.

During the baseline studies field surveys were conducted (1) to assess the brown bear population and bear habitats, (2) to appraise current levels of threats (loss of habitat, poaching, and others) to Brown Bears within the target area and to estimate their trends. Bear population numbers were assessed through DNA analysis of fecal samples. In parallel socio-economical and sociological surveys were conducted to understand and describe the underlying reasons for loss of bear habitat and for poaching within the target area.

As a result the present Species Status Report has been developed, which describes most recent findings on the bear population parameters, status of the habitats, socio-economical issues and people's attitudes toward bears.

## **1. STUDY AREA**

### **1.1. General description and size**

The study area covers the Borjomi-Kharagauli National Park and the Trialeti Range. Apart from the national park it includes Algeti Nature Reserve (6400 ha). There is also a private hunting forest called 'Fauna' that covers up to 21,000 ha of forested land. Much of the study area is forested (see the next chapter). The terrain is mostly mountainous in parts extremely rugged and is rich in rivers and stream the Mtkvari (Kura) being the major river. For fieldwork organisation and data analysis purposes the study area has been divided into 4 sub-areas (see Appendix 2 for maps):

1. *Borjomi-Kharagauli National Park* (Borjomi District west of the river Mtkvari, southern parts of the Kharagauli District, eastern sections of the Bagdati District and northern parts of the Akhaltsikhe District) encompassing most of the National park as well as adjacent territories (1173 sq. km.)
2. *Bakuriani sub-area* covering the Bakuriani area (Borjomi District east of the river Mtkvari) as well as smaller forested sections of the Aspindza and Akhalkalaki Districts (908 sq. km.)
3. *Gori sub-area* that includes southern forested parts of Gori, Kareli, and Khashuri Districts and the Tedzami river gorge of the Kaspi District (1024 sq. km.)
4. *Tetritskaro sub-area* covers central and western parts of the Tetritskaro District, southern parts of the Kaspi District, south-western parts of Mtskheta District, and smaller sections of Tsalka and Dmanisi Districts (1203 sq. km.).

### **1.2. Socio-economic and demographic information**

Most of the study area is within the following three districts: Borjomi, Gori and Tetritskaro. Therefore socio-economic studies were conducted in those districts.

#### **1.2.1 Borjomi District**

##### Geographical description

The total area of the district is 1,189 sq. km. of which 1,210 sq. km. are covered by water (rivers and streams: 453 ha; lakes: 765 ha). Borjomi is the main town of the district. There are also 4 small towns and 38 villages.

##### Population

The total population of the district is 32,422, of which 20,372 people (9,184 men and 11,118 women) live in towns and 12,050 people (5,890 men and 6,160 women) live in villages. Other demographic parameters (based on the data of the State Department of Statistics) are given in tables below.

**Table 1a.** Ethnic composition (Borjomi District)

Georgians	82.3%
Armenians	12.1%
Greeks	3.6%
Ossetians	1%

**Table 1b** Education (age: 6+)

Level of education	No. of people
Higher	4,144
Incomplete higher	670
College	5,200
Secondary	8,749
Incomplete secondary	3,445
Primary	4,690

Education infrastructure

There are 33 schools, 1 extra-curriculum education centre for school children and 13 kindergartens (Table 3.4). There are 4,739 students and 611 teachers.

NGO sector

There are about 40 NGOs that are officially registered. However only 13 of them are actually operational. Five NGOs are operating in the field of environment and/or education.

Agriculture

In Borjomi District livestock farming and cereal and other crops production are the main forms of agricultural activity (Tables 2(a) and 2(b)).

**Table 2(a):** Agricultural lands in Borjomi District

	Type of land	Area (Ha)
1	Arable	4,036
2	Orchards	18
3	Resting lands (currently not cultivated)	105
4	Used for hay making	7,611
5	Pastures	30,582
	Total area of agricultural land	42,392

**Table 2(b):** Livestock numbers

<b>Livestock</b>	<b>Numbers</b>
Cattle	9127
Pigs	1298
Sheep and goats	5609
Bees	1117
Fowl	26127

**Table 2(c):** Land areas used for crops production

<b>(b) Crops production</b>	<b>Area</b>
Spring barley	50 ha
Corn	700 ha
Beans	85 ha
Potatoes	875 ha

### Forestry sector

According to the local authorities the land managed by the forestry department is 67,945 ha. However the Director of the Borjomi office of the Forestry Department provided a different figure, 54,000 ha, of which 51,000 ha are actually forested. The Borjomi forestry office has only 25 forest guards to look after 8 forestry sections. The director said that there should be at least 78 forest guards in Borjomi.

According to official local sources 36,000 m<sup>3</sup> of timber was cut in Borjomi (including 12,000 m<sup>3</sup> diseased timber) in 2004. On average 37,000-38,000 m<sup>3</sup> of timber is extracted in Borjomi annually. Most commonly exploited tree species include: fir, spruce, pine, beech, oak, hornbeam, ash. According to the forestry officials annual forest growth in Borjomi area is 125,000 m<sup>3</sup>.

### Sawmills

According to the local Environmental Office there are 202 sawmills in Borjomi District. Only 10-15 have all documents for operation.

## **1.2.2. Gori District**

### Geographical description

The total area of the district is 2,327.2 sq. km. Gori is the main town of the district. There are 162 villages under 28 'Sakrebulo' - local legislative body.

### Population

The total population of the district is 148,686 of which 49,516 people (22,529 men and 26,987 women) live in towns and 99,170 people (49,001 men and 50,169 women) live in villages. Other demographic parameters (based on the data of the State Department of Statistics) are given in tables below. Among the villages, 1 is predominantly Azeri, 12 are Ossetian and 123 Georgian.

**Table 3 (a).** Ethnic composition (Gori District)

Georgians	93.2%
Ossetians	4.9%
Armenians	0.8%
Azeris	0.6%
Russians	0.4%

**Table 3(b)** Education (age: 6+)

Level of education	No. of people
Higher	22,341
Incomplete higher	4,242
College	17,063
Secondary	43,783
Incomplete secondary	14,206
Primary	20,959

#### Education infrastructure

There are 82 schools, 1 extra-curriculum education centre for school children, 1 youth tourist centre ("Tontio"), and 44 kindergartens. There are 21,135 students and 2,302 teachers.

#### NGO sector

There are 9 NGO/CBOs working in the field of education and/or environment in the District of which at least 4 are functional.

#### Agriculture

The total area of agricultural land in Gori District is 64,480 hectares. Fruit and vegetable production, plant nurseries, and seed production are the main forms of agricultural activity (Table 4).

**Table 4:** Agricultural lands in Gori District



	<b>Type of land</b>	<b>Area (ha)</b>
1	Arable	21,461
2	Orchards	10,600
3	Resting lands (currently not cultivated)	2,443
4	Used for hay making	1,988
5	Pastures	20,826

### Forestry sector

The total area of land under the forestry sector is 44,935 ha of which 35,111 ha are covered with forest. The land is divided into 7 forestry sections and the local forestry office has 35 forest guards.

According to local official sources (local authority - Gamgeoba) approximately 56,000 m<sup>3</sup> of timber is extracted annually over the last 10 years. About 70% of this quantity was extracted for fuel wood and 30% for commercial timber production. Among the most exploited tree species are spruce, fir, pine, beech, oak, and hornbeam. The annual forest growth is about 824,000 m<sup>3</sup>.

### Sawmills

There are 56 sawmills in the district. Only 40 of them operate at present. Only 22 of them possess environmental permits for operation.

## **1.2.3. Tetrtskaro District**

### Geographical description

The total area of the district is 1,174.5 sq. km. Tetrtskaro is the main town of the district. There are 82 villages under 18 'Sakrebulo' and one small town.

### Population

The population of the district includes 25,354 people. 6,793 people (3,168 men and 3,625 women) live in towns and 18,561 people (8,911 men and 9,650 women) live in villages. Other demographic parameters (based on the data of the State Department of Statistics) are given in tables below.

**Table 5(a).** Ethnic composition (Tetrtskaro District)

Georgians	78.3%
Azeris	8.1%
Armenians	6.1%
Greeks	5.2%
Osetians	0.5%

Among the villages, 2 is predominantly Ossetian, 3 Azeri, 4 Armenian, 6 Greek and 58 Georgian.

**Table 5(b)** Education (age: 6+)

Level	No. of people
Higher	2,404
Incomplete higher	324
College	2,745
Secondary	7,078
Incomplete secondary	3,084
Primary	5,218

#### Education infrastructure

There are 34 schools in Tetrtskaro District. There are also 3 NGO/CBOs working in the field of education and/or environment. There are 3,326 students and 500 school teachers.

#### Agriculture

The total area of agricultural land in Tetrtskaro District is 50,751 hectares (Table 3.8a). Fruit and vegetable production, and livestock farming are the main forms of agricultural activity (Table 3.8b).

**Table 6(a):** Agricultural lands in Tetrtskaro District

	Type of land	Area (ha)
1	Arable	18,528
3	Resting lands (currently not cultivated)	196
4	Used for hay making	6,478
5	Pastures	25,549

**Table 6(b)** Livestock numbers

Livestock	Numbers
Cattle	20,504
Pigs	8,266
Sheep and goats	24,100
Bees	1 800 (hives)
Fowl	56,200

**Table 6(c):** Land areas used for crops production

Crops	Area (ha)
Barley	1,141
Corn	1,095
Wheat	2,149
Oats	154
Rye	51

Potatoes	970
Beans	156
Other vegetables	146

### Forest sector

The total area of land under the Tetrtskaro forest sector is 47,000 ha (including 6400 ha Algeti nature reserve). The forest land is divided into 6 sections and there are 17 forest guards.

According to official data about 6,000 to 8,000 m<sup>3</sup> timber is extracted in Tetrtskaro annually of which 100 m<sup>3</sup> of wood is cut for commercial purposes the rest is for fuel wood. Most commonly exploited tree species include pine, beech, oak and hornbeam.

### Sawmills

There are approximately 12 sawmills in the district. Only seven of them possess all the necessary permits for operation.

## **2. BROWN BEAR HABITATS**

### **2.1. Habitat classification**

In general terms there are subalpine, alpine, and forest habitats in the study area. Most of the study area (80%) is covered by forest of various types. The forests are remarkably diverse both in structure and species composition. The Bakuriani subarea and southern part of the Borjomi-Kharagauli national park is dominated by conifers (spruce, fir, pine). The northern part of the national park is covered by deciduous forest. Toward the east conifers become rare and there are no spruce or fir east of the Kaspi meridian. Thus the Gori subarea is dominated by conifers in the west and by deciduous species in the east. The Tetrtskaro subarea is mostly deciduous forest.

Based on moderately coarse classification of forest habitats, the following 7 major forest types have been identified (also see Appendix 3 for map of forest habitats):

1. Beech forest (with at least 70% of trees being beech)
2. Spruce and fir forest (with at least 70% of trees being spruce or fir)
3. Pine forest (where at least 70% of trees are pine)
4. Hornbeam forest (where at least 70% of trees are hornbeam)
5. Chestnut forest (at least 30% of trees being chestnut)
6. Oak, ash and maple forest (forest dominated by these three species)
7. Birch, poplar, willow, alder (forest dominated by these three species)

The above classification is largely based on the dominant tree species, except in the case of chestnut forest. Chestnut is one of the most important foods for bears and therefore the forest with at least 30% of chestnut trees was identified as a separate forest habitat type.

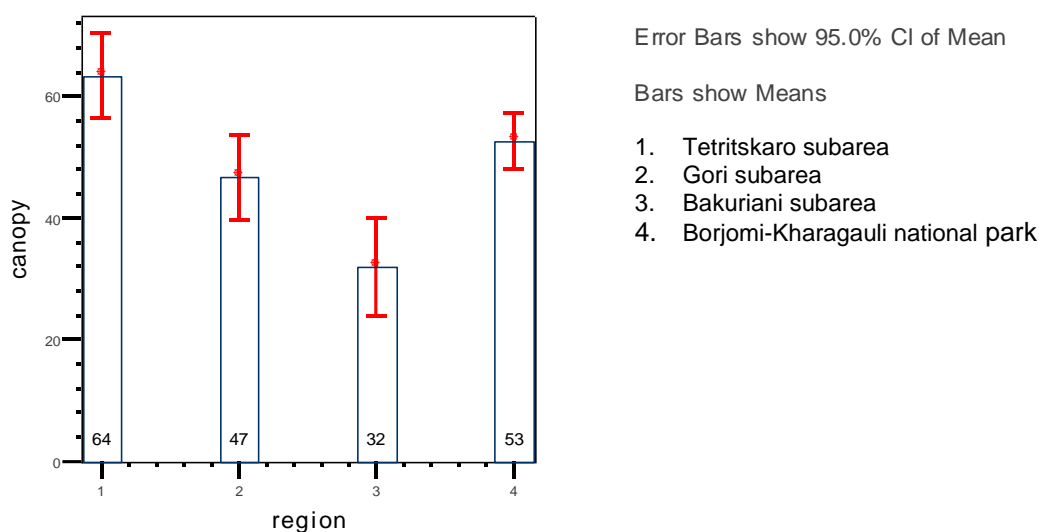
The classification and mapping of forest habitats was based on available data obtained from the Department of Forestry and ground surveys conducted under the project.

## 2.2. The status of forest habitats in the study area

Forest habitats were assessed throughout the study area (i.e. in all four subareas). Field data were collected on random 10 m-radius sampling plots. A special field data sheet was filled in for each sampling plot. The following information was collected: canopy cover, tree species composition and number of each species, number and age of stumps, dead trees, ground cover, bear silhouette cover (horizontal visibility) (see Appendix 1 for sample data sheet). Field data were compiled and systematized according to subarea for comparative analysis.

### 2.2.1 Canopy cover

Canopy cover is one of the important parameters of forest habitat. With due regard to the natural structure of a particular forest this variable may be a good indicator of the current logging levels. Data analysis in respect of canopy cover revealed statistically significant differences between the subareas (ANOVA,  $F_{3,403} = 12.909$   $P < 0.05$ ). In addition comparing the levels of significance for different subareas (Fig. 1) shows that the mean canopy cover is highest for Tetrtskaro subarea and it is lowest for Bakuriani subarea. The values are more or less similar for the national park and Gori subarea.



**Figure 1.** Mean canopy cover by subarea

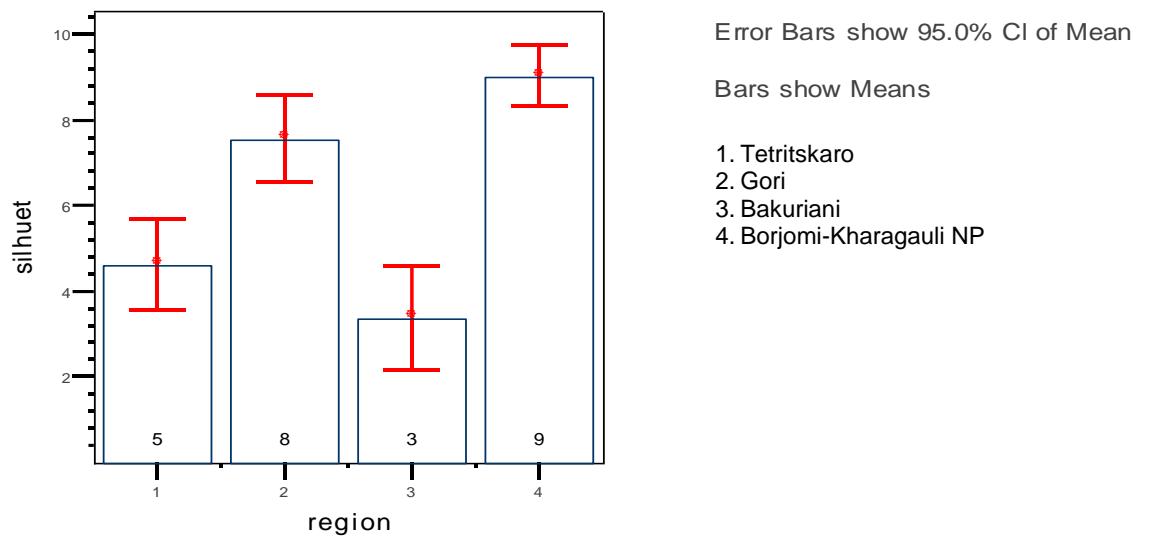
The above results are in full accordance with other data as well as are within the limits of the expected. High mean canopy cover in the Tetrtskaro subarea on one hand is

associated with low logging and on the other hand with the natural structure and species composition of these forests. Tetrtskaro forests are composed of such broadleaf species that usually create high canopy cover forests. Therefore the forests in Tetrtskaro are generally in good condition. The difference between the Bakuriani subarea and the national park was also expected to be significant because there is high intensity logging in Bakuriani. In respect of forest type the Bakuriani subarea and the Borjomi section of the national park are comparable (both have mostly conifer and mixed forests). However the existence of well preserved broadleaf forest with closed canopy in the Kharagauli section of the national park must have also contributed to the overall high value of canopy cover for the national park. Nevertheless intense logging is undoubtedly the major factor creating significant difference between the two subareas.

### **2.2.2. Bear silhouette cover**

This variable was measured in the following way: one of the observers stood in the center of a 10 m-radius circle assuming the posture resembling the silhouette of a bear. Another observer assessed the extent the silhouette was covered by vegetation, rocks undergrowth etc. from a 10 m distance in four directions (west, east, south and north). The level of coverage was assessed by 4-score scale corresponding to four parts of the "bear's" body (score 0 was assigned in the situation where the "bear" was 100% visible). Scores obtained from four directions was then added up to produce an overall score for the point.

This variable is a good measure of the suitability of the habitat for bears (mainly as shelter). It depends upon the existence/extent of undergrowth, tree density, fallen trees, large rocks, relief form, etc. Statistical analysis revealed significant differences among the subareas (ANOVA,  $F_{3,403} = 30.121$   $P < 0.05$ ). The mean silhouette cover was highest (that is horizontal visibility was lowest) for the national park. It was lowest for the Bakuriani subarea (Fig. 2).



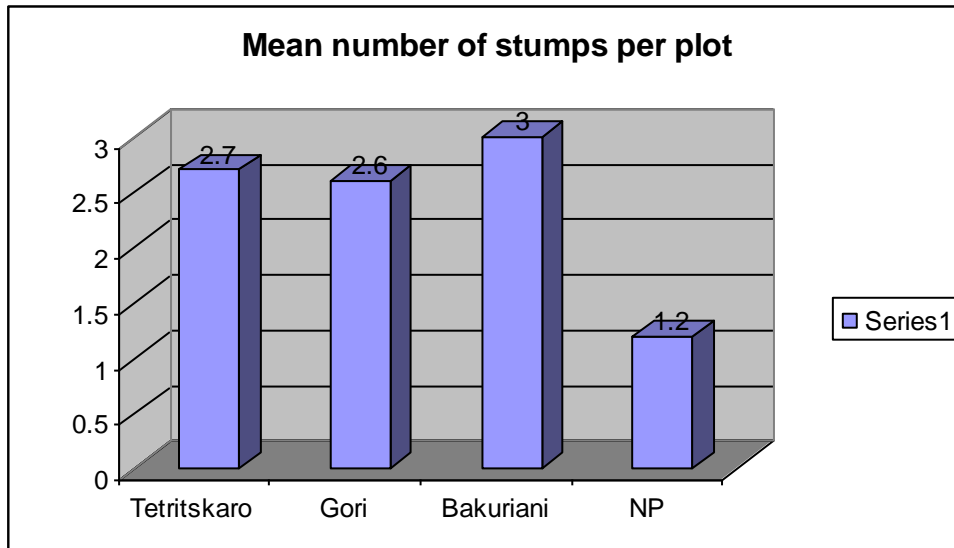
**Figure 2.** Mean bear silhouette cover

Undergrowth is the most important factor that contributes to silhouette cover. However the extent of undergrowth may in turn depend on two main aspects (1) forest type and structure and (2) human influences such as cattle grazing.

Our study has shown that the forests of the national park and the Gori subarea are more suitable habitats for bears than are Bakuriani or Tetritskaro forest (in respect of horizontal visibility).

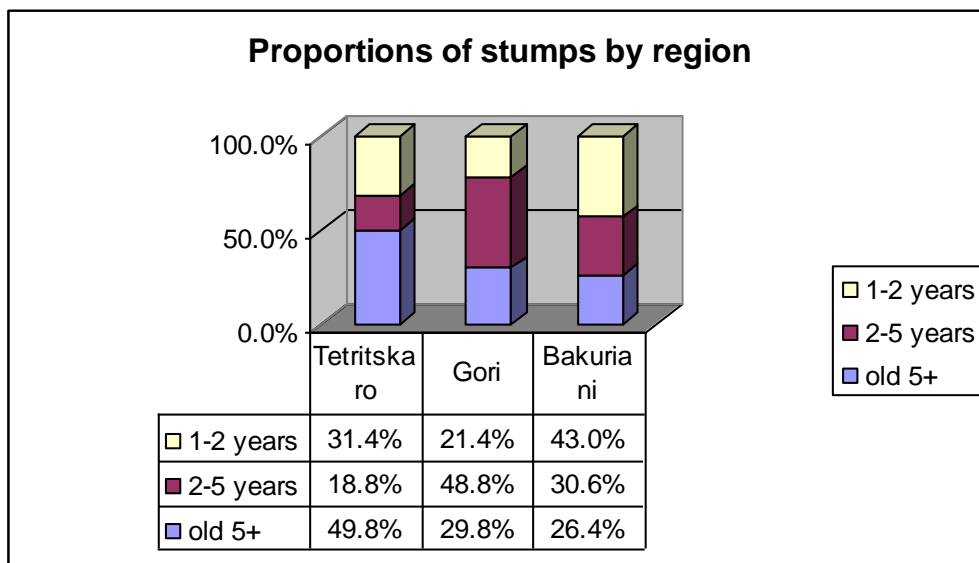
### **2.2.3. Level of forest exploitation**

Field data for the assessment of logging levels were collected on random 10 m-radius sampling plots. Every stump found on the plot was recorded. In addition the age of stumps (i.e. when the tree was cut down) was also recorded. The data consists of 3 age classes: old i.e. half disintegrated stumps (older than 5 years), medium age stumps (3-5 years old) and freshly cut trees (1-2 years old stumps).

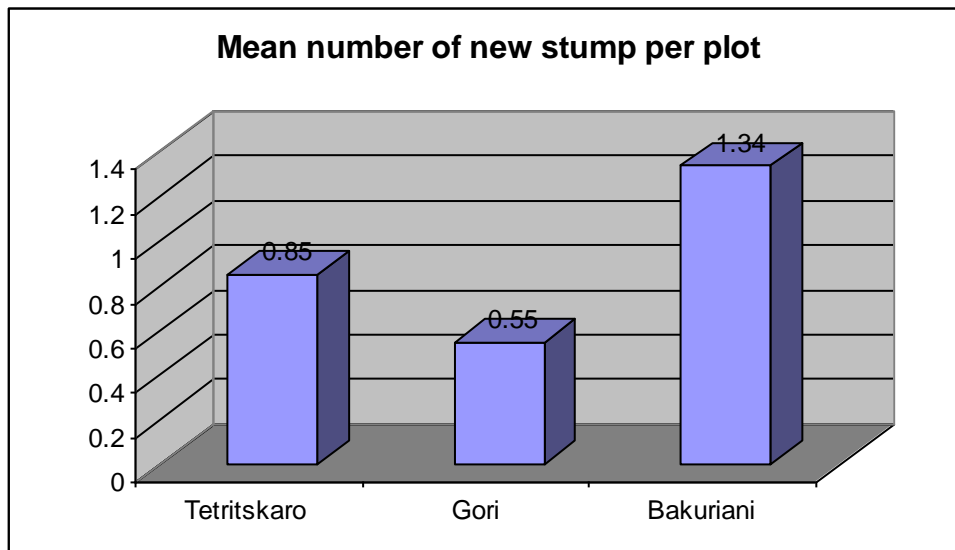


**Figure 3.** Mean number of all stumps per plot

Mean number of stumps of all ages was highest in Bakuriani subarea (Fig. 3). The national park had the lowest measurement as expected (stumps are mainly found on the Kharagauli section of NP, most of them were cut before the national park was established). However the analysis by age classes has revealed a more interesting picture (Fig. 4). The proportion of fresh stumps (against all stumps) was significantly higher in Bakuriani subarea. It may be associated with an increase of logging during the recent years. Fresh stump numbers were lowest in the Gori subarea. Most stumps fall into the medium age class (stumps of 3-5 years old). Mean number of fresh stumps is significantly higher in Bakuriani than in Tetrtskaro or Gori (Fig. 5), which may be an indicative of intense current logging in that subarea.



**Figure 4.** Percentages of stumps of various age classes



**Figure 5.** Mean numbers of fresh stumps

**Conclusion: Overall status of forest habitats in the study area**

*Combined analysis of three different variables, canopy cover, horizontal visibility and logging levels, has shown that Borjomi-Kharagauli National Park provides best habitat for bears. Bakuriani subarea has the lowest quality habitat. These results are further analyzed in the light of other data (bear numbers, density indices and distribution) in the following chapters.*

**3. POPULATION PARAMETERS**

**3.1. Results of genetic studies**

The main objective of the study was estimation of brown bear population numbers. It was impossible to collect and then analyze samples from all subareas of the study area due to time and financial limitations. Therefore genetic studies were focused on two subareas: Borjomi-Kharagauli National Park and Bakuriani sub-area. It was expected that such an approach would allow comparison of bear densities between protected and unprotected territories.



Samples for genetic analysis were collected from September through November, 2004. In total 102 fecal samples were collected, 60 from the Borjomi-Kharagauli National Park (1,175km<sup>2</sup>) and 42 from Bakuriani sub-area (938 km<sup>2</sup>) (see Appendix 4 for Map). These two parts of the study area are adjacent but separated by the valley of the river Mtkvari (Kura). Scat samples were picked up with a fresh stick and placed in a 50 ml bottle. For each sample date, GPS location and weather conditions were recorded. Samples were then preserved in 95% alcohol and stored at 4°C.

Laboratory work was carried out at the laboratory of Conservation genetics, College of Natural Resources, University of Idaho, USA.

DNA from scat samples was amplified successfully in 35% of PCR attempts. None of the negative controls (reagents only) for scat DNA extraction or PCR amplification produced positive product, and all positive controls amplified the target locus. As expected, PCR amplification success was greater overall for mtDNA (75.7%: 69/110) than for nuclear DNA (35%: 38/110).

The analysis of the four-screened loci in 31 study samples revealed 28 genotypes differing from each other by at least one locus.

The analysis showed that from September through November 2004 at least 28 bears were present in the study area. Among them 17 were in Borjomi-Kharagauli National Park and 11 in the western part of the Trialeti Range, the Bakuriani subarea. Unfortunately it was impossible to calculate approximate real populations numbers (our data did not lend to the application of the "mark-recapture model").

In addition to the minimum population numbers, the analysis revealed that brown bears were more or less evenly distributed throughout the entire study area. Some bears remained at the same location up to 4-5 days. Within a month's period some individuals had moved over the distance of 20 km. 4-6 unrelated individuals were noted to be feeding in the same gorge simultaneously.

No significant differences were detected between the bears on the two sides of the river Mtkvari. In all parts of the study area, the same alleles are found in similar proportion, *Fst* did not differ significantly from zero, and the entire population could be considered panmictic (random mating).

### **3.2. Index of population density**

We estimated an index of bear scat frequency as a relative measure of population density. Data collection was standardized as much as possible and only data sets from different subareas collected in the same season of same year were compared.

Index of bear scat frequency was calculated by dividing total number of recorded scats in  $i_{th}$  subarea by total length of transects (total distance covered). Tables below show indices for autumn and summer seasons for NP and the Bakuriani subarea.

**Table 7.** Index of bear scat frequency, autumn 2004

	<b>Bakuriani subarea</b>	<b>Borjomi-Kharagauli NP</b>
Total distance covered	82 km	149 km
Total number of scats	78	67
Index of bear scat frequency	0.95	0.45

**Table 8.** Index of bear scat frequency, summer 2005

	<b>Bakuriani subarea</b>	<b>Borjomi-Kharagauli NP</b>
Total distance covered	50 km	86 km
Total number of scats	5	21
Index of bear scat frequency	0.1	0.25

As seen from the tables, the index of bear scat frequency is significantly higher for Bakuriani than for the national park for autumn season and this was confirmed by statistical analysis ( $\chi^2 = 21.191$ ,  $df=1$ ,  $P<0.01$ ). For the summer season the difference was not statistically significant.

It is also notable that the index was rather high for the Gori subarea for autumn 2005 season, namely 1.24 (Total distance covered 38 km; total number of scats 47). However, the Gori data were collected in the autumn of the following year as those in Bakuriani and the national park. Thus it may not be appropriate to compare these data sets. Nevertheless bear frequency indices do not support the hypothesis that there are more bears on the national park than on other unprotected territories (Bakuriani and Gori subareas).

### **3.3. Spatial distribution**

Field data for revealing sites that are more intensely used by bears were collected on planned transects. The transects were evenly distributed over the study area. Any sign left by bears (scat, diggings, day beds, scratches) were counted. GPS locations were taken and subsequently mapped in GIS. The data was then analyzed in GIS and most frequently visited sites by bears in a given season were identified.

Genetic analysis showed that scats found in the same location often belonged to 2 or more different individuals (Chapter 2.1.1). Therefore it can be assumed that the number of recorded scats to some extent reflects the real number of bears using a particular

location. Consequently the sites of concentration of bear scats can legitimately be regarded as areas intensely used by bears.

The map shows that there are sites of bear sign concentration in all but Tetrtskaro subarea. Especially high concentration areas have been identified in central part of the Gori subarea and eastern part of Bakuriani subarea for the autumn season. Intensely used areas are also found in western parts of Bakuriani subarea and north-eastern part of the national park (see map in Appendix 5).

This pattern of spatial distribution is apparently associated with food availability and human factors. Most sites of high bear sign concentration also show high density of fruit-bearing as well as mast trees such a chestnut trees. In sites with lower occurrence of bear signs bear food is less available and human impact (tree felling, poaching, cattle grazing) is also high. It is noteworthy that the national park shows moderate concentration of bear signs, contrary to our expectation. It can be speculated that due to high human impact bear density is not very high in the NP compared to unprotected areas, or food base is evenly distributed over the park and there are no particular preferred bear feeding sites.

### **Conclusion**

*Bear density is relatively high in central and western parts of the study area. Bears are extremely rare in the Tetrtskaro subarea and can be regarded as locally extinct (no evidence of bear presence was found during the surveys). According to local people bears rarely appear in the northern sections of the subarea. It appears that bears occasionally come from the neighboring areas of the Gori subarea. There are no bears in sections located south of town Tetrtskaro toward the Armenian border. This may mean that the Georgian bear population is isolated from the Armenian population. It should be noted that forest habitats are quite well-preserved in the Tetrtskaro subarea and according to preliminary assessment food base is also well represented.*

## **4. FOREST UTILIZATION<sup>1</sup>**

### **4.1 Official data on timber extraction**

Different agencies (such as local Environmental Office of the Ministry of Environment, local office of the Forestry Department) provide differing figures for timber extraction in all three Districts (Borjomi, Gori, Tetrtskaro).

#### *Borjomi District*

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<sup>1</sup> Based on the report by ACT International

According to the local environmental officer the total amount of timber extracted annually ranges between 4,000 and 8,000 m<sup>3</sup> and this is within the permitted limits. Nevertheless according to the Director of the local forestry office the total annual timber extraction is about 40,000 m<sup>3</sup> of which only 5,000 m<sup>3</sup> are illegally cut. According to sawmill owners each sawmill processes about 100-200 m<sup>3</sup> of timber per month (1,200-2,400 m<sup>3</sup> annually).

The local environmental officer also said that illegal tree cutting is common in the District. Illegal forest felling is especially high at the villages of Akhaldaba, Choviskhevi, Tadzrisi, Dgvvari, Sakire, Pavi (in these villages the forest has been almost completely destroyed). The forest is a main source of income for these villages. Some of the respondents said that illegal logging significantly exceeds the scale of legal forestry operations. Others said that illegal logging is insignificant in Borjomi District and there is no illegal cutting in the reserve.

The above indicates that there is little control on timber extraction in Borjomi District. There is much discrepancy among the figures provided by different agencies and individual respondents. It is impossible to estimate the real scale of logging and there is no credible information on illegal logging.

#### *Gori District*

According to the local environmental officer 10,000 – 20,000 m<sup>3</sup> of timber are extracted in Gori District annually. Different figures were provided by the local forestry office, 5,000 – 6,000 m<sup>3</sup>.

An average sawmill processes between 20 m<sup>3</sup> and 45 m<sup>3</sup> per month (240-540 m<sup>3</sup> annually). According to the local environmental office illegal logging is insignificant in Gori District, only about 40 m<sup>3</sup> per year. They also said that illegally cut timber is not exported outside the district.

#### *Tetritskaro District*

According to official sources the annual timber extraction is 5,000 – 9,100 m<sup>3</sup>. About 100 m<sup>3</sup> of timber is cut for commercial purposes the rest for fuel wood. The owners of the local sawmills said that they process only 10 m<sup>3</sup> of timber during the whole winter season and do not operate in summer<sup>2</sup>.

According to the local environmental office there is no illegal logging in Tetritskaro District. They did admit that illegal tree felling took place several years ago. Trees such as beech and pine were cut and timber was exported to Tbilisi and Marneuli. The respondents assumed that illegal tree cutting was controlled and the total amount of illegally cut timber did not exceed 100 m<sup>3</sup> per year.

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<sup>2</sup> Many of the sawmill owners refused to give any information and said that their sawmills did not work at all.

*It follows from the information provided by the local environmental officers from the three districts that illegal logging is much higher in Borjomi than in Tetrtskaro or Gori districts. Moreover none of the respondents in Borjomi could specify the scale of illegal logging.*

## **4.2 The dynamics of forest exploitation over the last years**

### *Borjomi*

According to sawmill owners timber extraction has increased recently. However they said that the overall operation of the sawmills has declined due to delays in issuing timber extraction permits. Local environmental office denied the above and said that forest felling was much more extensive till 2000. Local people widely used small sawmills. Illegal tree cutting exceeded legal forestry operations because: (1) timber permits were too expensive and (2) there was lack of control. According to the same source the scale of timber extraction has declined over the past two years because of sharp decrease in timber and the increase of control over illegal operations.

### *Gori*

The owners of the local sawmills said that their business has declined over the last years. In their opinion this is because of (1) the increase of control and (2) decrease in the demand in wood materials (wood processing technologies do not meet current quality standards, moreover the demand in plastic materials is increasing). On the other hand, representatives of the local environment office said that there has been an increase in wood processing industry in Gori. Some of the respondents thought that it is due to lack of alternative sources of energy (people use fuel wood for heating). Others said that compared to 1990s the situation has improved due to increased control. They thought that trees are not cut as extensively as they were when wood was exported to Russia. They also mentioned that the establishment of the reserve has had a positive role<sup>3</sup>.

### *Tetrtskaro*

There is no official commercial forestry operation in Tetrtskaro. One of the owners of local sawmills said that tree felling has increased in Tetrtskaro over the last years because of lack of control. The local environment office on the other hand thought that forestry operations has been going down as a result of (1) increased control and (2) banning of commercial forestry. Other respondents however thought that forest felling (both legal and illegal) has increased significantly after the eco-migrants from the Svanetia region (a province in the Caucasus mountains) came to live in the district.

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<sup>3</sup> The respondents probably meant the hunting forest that was recently established in Gori District

*There are significant differences among the opinions expressed by environmental officers and the owners of local sawmills in all three districts. Some of them said that forest felling has increased due to (1) lack of control and (2) increased poverty among the local people. Other respondents thought that the industry on the whole has declined because of (1) increased control, (2) banning of commercial forestry and (3) decreasing demand in wood. Consequently, it is difficult to assess the real scale of forest exploitation or the trends over the last years.*

### **4.3. Use of fuel wood**

Fuel wood is the main source of energy used for both heating and cooking during the winter season. Fuel wood is more important in Tetrtskaro than it is in Gori and Borjomi where natural gas is an alternative fuel. Use of bottled gas for cooking is most common in Gori. Tetrtskaro population is more dependant on fuel wood than are Gori and Borjomi populations. The level of use as fuel wood is highest for beech (this species is most commonly exploited in Gori). In Borjomi mainly fir and other conifers are used as fuel wood. In Tetrtskaro beech and hornbeam are two main species providing most of the fuel wood to the local population.

### **4.4. Reasons of illegal logging**

According to the local environment officers both locals and outsiders are involved in illegal logging. They thought that main underling reasons of illegal logging include:

- Poverty among local people and high unemployment (For example in Borjomi illegal logging has become a major source of income for some people after the local tourist industry collapsed in early 1990s).
- Lack of alternative sources of energy (people use fuel wood for heating and cooking)
- Lack of knowledge of legislation (locals know little about current legislation and forestry regulations)
- Much of the legislation is too complicated and local people can not understand it
- Lack of awareness (most people do not realize possible consequences of excessive forest felling).

Timber business is highly profitable and it encourages extensive forest felling. Both local environmental officers and workers at sawmills admitted that the whole business is like a "mafia" behind which one can trace high government officials. The local environmental officer in Borjomi said: "they cut trees and take them to the sawmills, after which mafia-like people become involved".

Most of the respondents thought that excessive forest felling is encouraged by poor control from the governmental agencies. It should be noted that the respondents were very reluctant to discuss the issue openly. Moreover, in Gori and Tetrtskaro both environmental officers and timber processing people denied the existence of illegal logging

in their districts. They said that current level of illegal logging is very insignificant compared to previous years. In Borjomi environmental officers and others *did* confirm illegal logging in their district but they did not provide any details on the scale of the business.

## **5. ATTITUDES TOWARD BEARS<sup>4</sup>**

Most people in the study area characterize bear as an animal that is "nice, clever, strong, balanced, lovely and the cleaner of the forest". Most positive characterization was noted in Tetrtskaro and most negative in Borjomi. On the other hand most people characterize the wolf as an animal that is dangerous, ruthless, hot-headed, disgusting and ugly, at the same time strong, clever and the cleaner of the forest. Negative characterizations were more prevailing in Tetrtskaro than in Borjomi. Comparing peoples' attitudes toward wolf and bear, by one characteristic, "cleaner of the forest", the attitudes were identical. By all other characteristics wolves were evaluated more negatively than bear. This is in compliance with the general pattern throughout the countries where both bears and wolves are found.

Prevailing negative attitudes toward bears in Borjomi District can be explained by more instances human-bear conflict in that region.

## **6. MAJOR THREATS AND LIMITING FACTORS TO THE BEAR POPULATION**

As a result of field studies and socio-economical surveys major threats to the bears in the study area have been identified and assessed. There are five main factors:

1. Illegal hunting
2. Increased access to remote bear habitats
3. Logging
4. Conflict with local farmers
5. Low public awareness

Most of these factors are closely linked with each other and often work in combination. For example high poaching exacerbate the overall effect of all other forms of human disturbance whether tree felling or simply human presence.

### **6.1. Illegal hunting**

Hunting in general is one of the important human factors that seriously affects brown bears. Like any other large mammal the brown bear is characterized with naturally low reproductive rate. Female only breeds once in two years and young attain sexual maturity at the age of 3-5. Therefore natural population net growth rate is not very high.

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<sup>4</sup> Based on the report by ACT International

There is no legal bear hunting in Georgia. Nevertheless killing a bear is common throughout the study area (Trialeti range and the national park). The sociological survey has shown that nearly half of the local population is unaware of the ban on bear hunting. There is no information on the number of bears killed each year and it is impossible to assess the real impact on the bear population. However, there is practically no control outside the national park and according to recent survey most local hunters kill at least one bear each year<sup>5</sup>. Add hunters coming from other parts of the country especially from the capital and we can assume that the overall impact of illegal hunting is rather high. Most of the local people think that people usually shoot bears for sport but not for income. It appears that the only "control" over bear hunting is the low density of the species. Many hunters say that there are so few bears that it is extremely difficult to find and kill one (ACT International).

According to the sociological survey there is illegal bear hunting on the national park too. It appears that current protective measures are ineffective or insufficient for eradication of poaching on the protected area. According to some respondents hunters join in groups, collect some money and buy a "license" to shoot a bear in the national park. The administration of the Borjomi-Kharagauli national park strongly denies this.

## **6.2. Increased access to remote bear habitats**

Various development activities (e.g. pipeline construction, forestry activities) involve development of new/reconstruction of existing road infrastructure which increases access to new areas of brown bear habitat. All this encourages illegal hunting, high human presence and illegal tree felling in those areas. For example the construction of the oil and gas pipelines inevitably increased human access to many intact parts of the bear habitat.

## **6.3. Logging**

Forest felling (both legal and illegal) is extremely extensive throughout the study area except the national park. However the scale of forest degradation differs significantly from site to site. The Bakuriani subarea is most affected with areas of literary devastated forest. However current impact on the brown bear population is not straightforward. Our results have shown that there is very little or no relationship between the level of forest exploitation and brown bear numbers. This may be explained by the following.

First, there is very little clear cutting in the study area. Hence the decline of the overall area of the forest habitat is not very significant. Both legal and illegal logging involve forest thinning and selective cutting of trees from which bears may even benefit. Forest thinning to some extent has a positive effect on bears because it encourages growth of the forest under-storey species (various wild fruits, hazel nuts, berries, etc) most of which

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<sup>5</sup> It is also impossible to estimate the real number of hunters in the study area. Old records of the Hunters Union can not be used as an indication of the number of persons currently engaged in hunting.



provide food for bears. Ants, larvae, and other invertebrates that live in decomposing tree stumps are also important source of supplementary food for bears.

Apart from these positive aspects forest felling has many negative effects. First of all it should be noted that forest cutting only intensified over the last 15 years and the long term effect may still have to appear on the bears. It is however obvious that selective felling may alter the shape and structure of the forest community and encourage artificially induced succession. For example mixed forest may become replaced by less productive (for bears) conifer forest. Hence food distribution patterns is being altered especially where mast trees (beech, oak, chestnut, etc) are selectively cut. As a result the overall quality of the forest habitat declines. In addition intensive logging is an important disturbance to bears, especially where they are severely persecuted. Any forestry activity may disturb bears and force them to take refuge in less favorable habitats. This can affect their overall survivorship. Forestry roads (many old overgrown roads have now been cleared again) creates better access to new areas for poaching.

#### **6.4. Conflict with local farmers**

Human-brown bear conflict is most acute in the Borjomi and Kharagauli districts. In these districts attacks on livestock and damage of crops by bears are very common (this may be associated with the short distance of agricultural fields to the forest). Naturally, attitudes toward bears are rather negative in Borjomi and Kharagauli districts. Local farmers try to solve the problem by themselves and get rid of problem bears using various methods such as shooting, putting out traps etc. Handling problem bears in an unorganized and unprofessional manner is ineffective and often results in killing an "innocent" individual.

#### **6.5. Low public awareness**

Sociological surveys have revealed that a large proportion of local population has inadequate, incorrect or no knowledge of the effective environmental legislation. Half of the local people do not even know that bear hunting is illegal. Many people incorrectly think that Hunters Union is responsible for poaching control and for issuing hunting licenses. Many of the local hunters think that they need not have any permit to shoot a bear in "their" forest (i.e. forests around their village) and they only have to apply for a license if they want to kill a bear in the national park.

Public awareness of the timber extraction legislation is also very low. Different respondents named rather differing procedures and restriction of timber use and ideas also differed among the districts. Very few of them knew who is responsible for issuing permits on timber extraction in their village/district.

## **7. CONCLUSIONS**

Our results suggest that poaching is the most important factor that limits the brown bear population on the Trialeti Range, based on analysis of bear density, assessment of forest habitats and food availability. Habitat destruction at the current level does not appear to have very significant impact. Forest exploitation is most intense in the Bakuriani subarea. Nevertheless bear density in the Bakuriani forests is not significantly different from that on the protected area. Forest habitat is well-preserved in the Tetrtskaro subarea. But there are extremely few or no bears in Tetrtskaro forests. The national park was expected to have more bears due to the presence of intact forest habitat and supposedly less poaching. However it appears that poaching is no less common on the national park than on unprotected areas.

Apart from certain areas of the Bakuriani and Gori subarea, in general terms forest habitats are well preserved throughout the study area and despite heavy logging the quality of the habitat as far as bears are concerned is remarkably good. In most areas forests are rich in bear food and provide cover as well as good den sites. But there is no correlation between bear density and the extent of forest exploitation or food availability. At present the bear population appears to be well below the habitat's carrying capacity and so strongly limited by poaching that the effect of forest exploitation simply can not be detected. In the long run however the alarmingly high rate of forest degradation will inevitably become an equally if not more important factor for the status of the bear population.

## **APPENDICES**

**APPENDIX 1. Data sheet for Bear (Forest) Habitat Assessment**

**Route # ----- Transect # ----- Date ----- Start time ----- End time -----**

**Name of field officer:**            1. -----  
     2. -----  
     3. -----

**Point #1**

1. GPS location -----

2. Tree species, dead trees, and their numbers :

i. -----	v. -----
ii. -----	vi. -----
iii. -----	vii. -----
iv. -----	viii. -----

3. Canopy (%) -----

4. Understorey vegetation cover (%) -----

5. Min. height of understorey vegetation -----

6. Max. height of understorey vegetation -----

7. Horizontal visibility: N ----- E ----- S ----- W ----- Total -----

8. Natural regeneration: - weak      - medium      - strong      Main species -----

9. Total number of tree stumps -----      Fresh -----      2-3 yeras old -----      Old -----      Very old -----

**Point #2 ...**

**Point #3 ...**

**Point #4 ...**

**Point #5 ...**

**Point #6 ...**

**Total No. of samples** \_\_\_\_\_

**Sample #** \_\_\_\_\_

**Notes:**

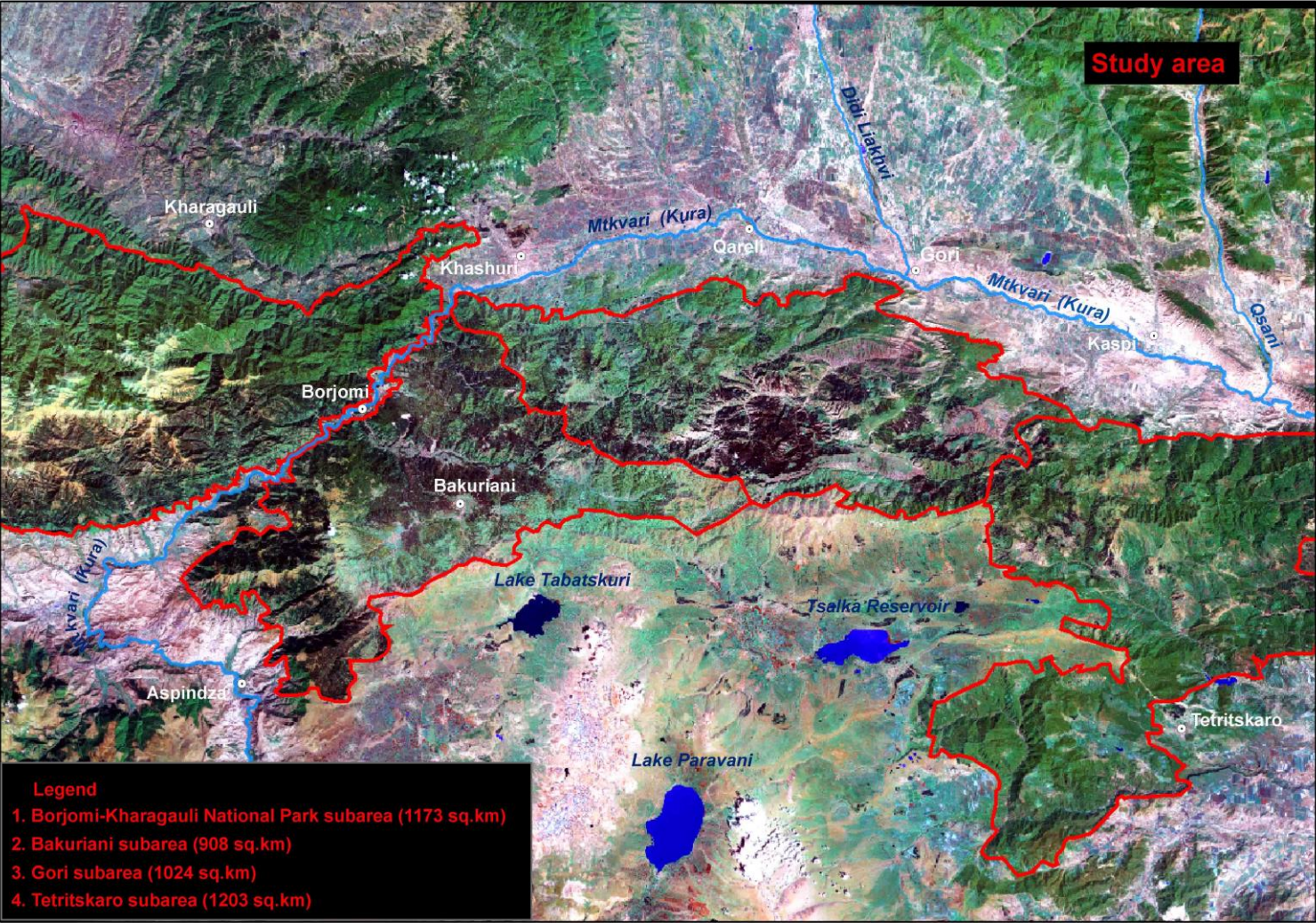
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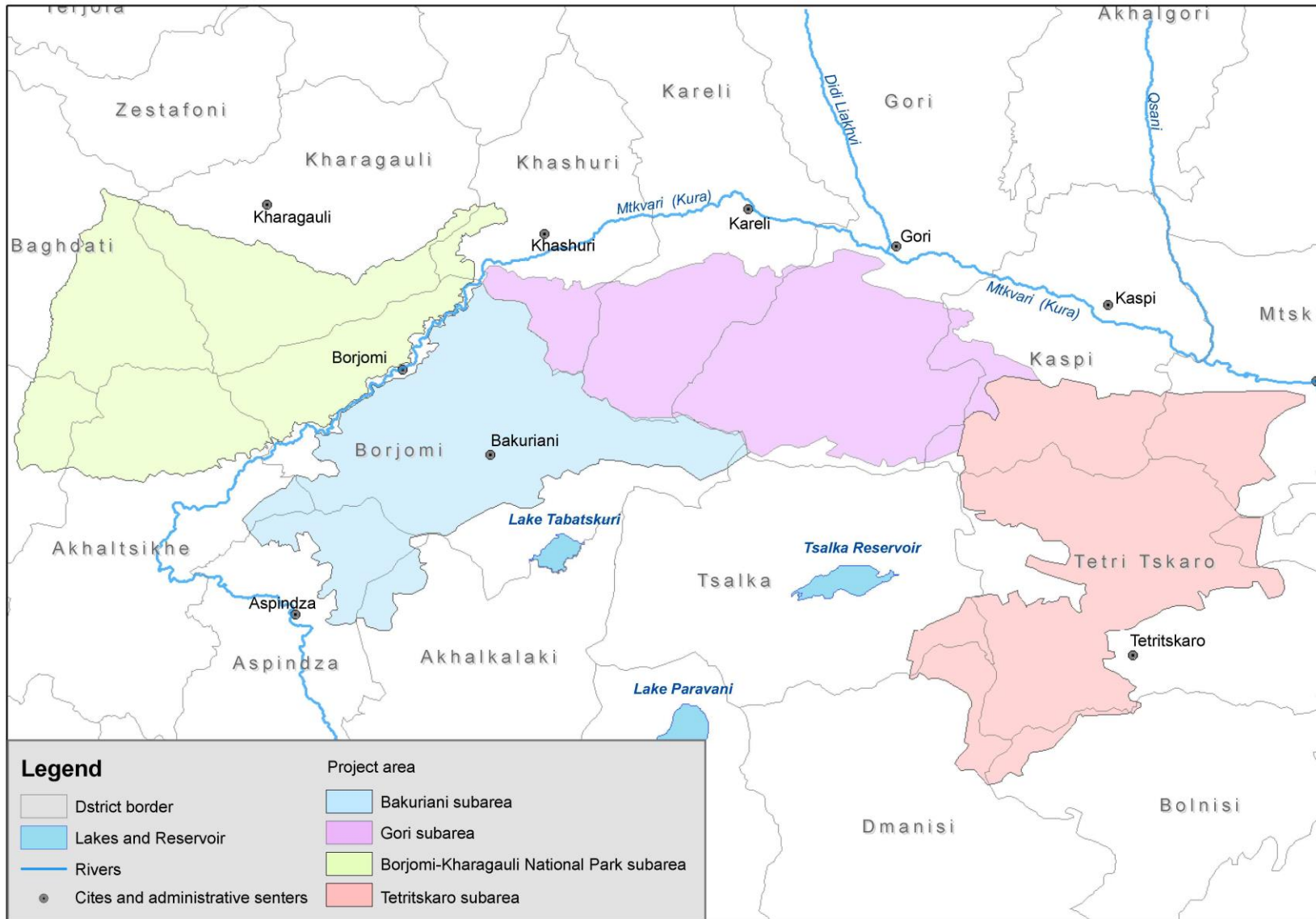
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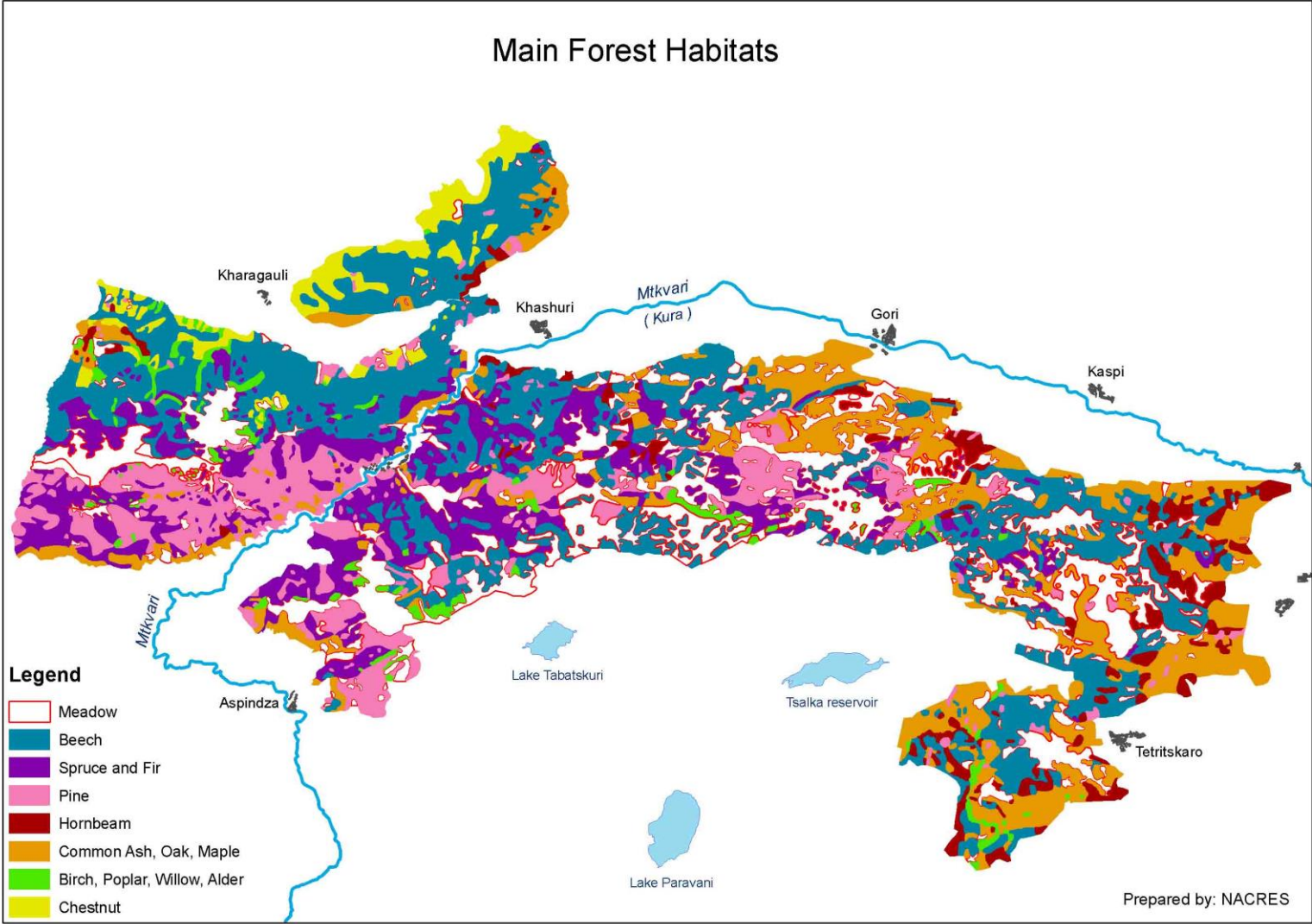
**Appendix 2. Maps of Study Area  
(A)**



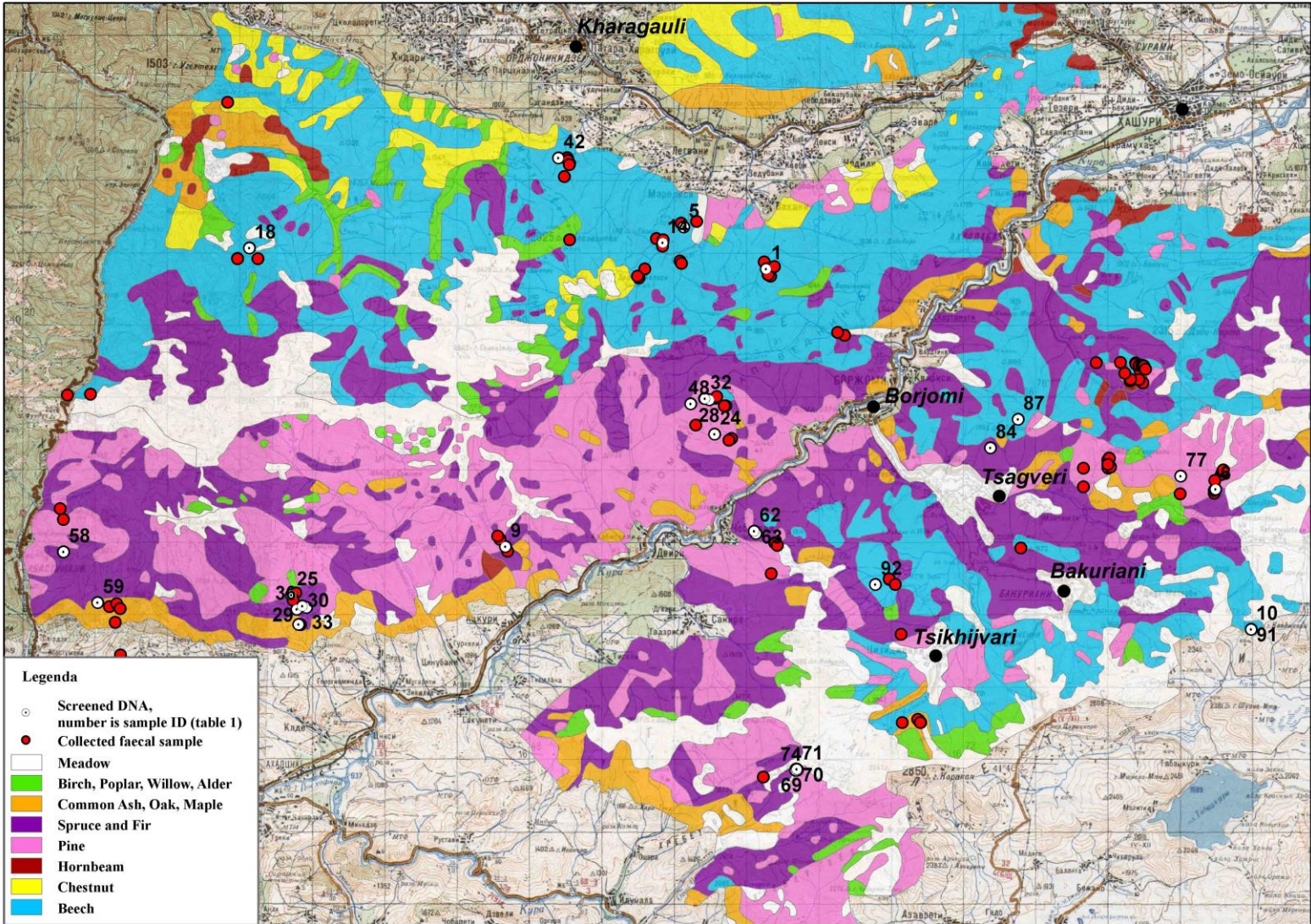
(B)



**Appendix 3. Forest habitats of the study area**



**Appendix 4. Area sampled for DNA analysis**





**Appendix 5. Areas intensely used by bears**

