

Risk assessment of forest fires procedures and technologies used in Borjomi - Kharagauli National Park

(Report under Activity 2.3)

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Existing legal Basis and Institutional setup

The main law in Georgia in the field of emergency, including forest fires is the Georgia Law on Civil Security (2018)¹.

Article 4. of the law establishes national security system (see box 1 below):

Box 1. Article 4. National civil security system

1. The national system of civil security (hereinafter - the national system) is a unified network of the institutions of the executive power of Georgia, legal entities under public law and state sub-departmental institutions, government bodies of autonomous republics, municipal bodies and state trustees (subjects of the national system), which is strategic (political) , at the operational and tactical levels, using appropriate resources and tools, implements appropriate complex measures for the protection of human life and health, environment and/or property from an incident/emergency situation caused by a state of war, natural and/or human factor.

¹ <https://www.matsne.gov.ge/>

2. The national system ensures the implementation of appropriate measures, the organization of the activities of the response forces, their management, and the creation of material resources during the main phases of the continuous process of emergency management (prevention of an emergency, preparedness for an emergency situation, response to an emergency situation, carrying out restoration works).
3. The leading body of the national system in peacetime is the Emergency Management Service, whose department of fire-rescue forces represents the main operational forces of the national system.

Emergency Management Service is under the Ministry of Internal Affairs. The Law (article 4, clause 4) list of the state entities, which are part of the National civil security system. Agency of Protected Areas (APA), as well as National Forestry Agency (NFA), both structural units of the Ministry of Environmental Protection and Agriculture (MEPA) are listed in the law.

Georgia's National Disaster Risk Reduction Strategy Action Plan elaborated for the years 2017-2020 identifies following specific actions against forest fires as an obligation of the APA and NFA:

Table 1. Forest fire risk reduction Action Plan

8. Reducing the risk of forest and field fires	8.1 Ensuring the division of Georgian forests into classes according to fire risk;
	8.2 Ensuring the formation of fire-resistant forest stands (plantation of fire-resistant/resistant species, understory clearing, waste clearing) in especially fire-prone areas and degraded forest areas of the forest fund
8.1 Legislative framework for forest and field fire risk reduction	8.1.1. Ensuring the tightening of existing sanctions for intentional or negligent fires
	8.1.2. ensuring the approval of the forest fire policy document
	8.1.3. Ensuring the preparation of unified departmental response plans
	8.1.4. Ensuring the preparation of a package of legislative changes and an action plan based on the document "Ecosystem Assessment of Fires on Agricultural Lands in Georgia"
8.2. Strengthening the capacity to reduce the risk of forest and field fires	8.2.1. Ensuring the introduction of an early warning system for forest fires

<p>8.3. Raising awareness in terms of reducing the risk of forest and field fires</p>	<p>8.3.1. Raising the knowledge of the population at the local and national level. raising the awareness of shepherds, farmers, organizing trainings on the dangerous consequences and prevention of artificial fires</p> <p>8.3.2. Ensuring placement of information boards and special signs in fire-prone areas of the State Forest Fund (44 Forest Units), especially in areas with recreational load</p>
<p>8.4. Permanent or decadal/quarterly educational measures to reduce the danger of forest fires in Georgia</p>	<p>8.3.1. Raising the knowledge of the population at the local and national level. raising the awareness of shepherds, farmers, organizing trainings on the dangerous consequences and prevention of artificial fires</p> <p>8.3.2. Ensuring placement of information boards and special signs in fire-prone areas of the State Forest Fund (44 forest units), especially in areas with recreational load</p>
<p>8.4. Permanent or decadal/quarterly educational measures to reduce the danger of forest fires in Georgia</p>	<p>8.4.1. conducting educational, theoretical activities in the school and in the surrounding community or neighborhood to raise awareness about the need for a proper response during forest fires.</p> <p>8.4.2. Creating social advertisements related to forest fires and placing them in the media.</p> <p>8.4.3. organization of a complex joint event by the school administration with the joint participation of teachers, students, and parents, to strengthen the involvement of parents.</p> <p>8.4.4. Provision of teaching of forest fire prevention measures during school excursions</p>

	8.4.5. Ensuring the implementation of an information campaign in schools and communities about the understanding of the importance of the forest as a versatile resource and its rational use
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Government Decree #383 On forest protection, restoration and tending provides several articles (7-13) related to monitoring, risk reduction and fight measures against forest fires in Georgia (see Annex 1- Extract from the regulation).

There are several documents dealing with Forest fire management at the territory of the Borjomi-Kharagauli National Park (BKNP), such as:

- Technical Regulation - Borjomi-Kharagauli Protected Areas management plan (2014).
- Technical Regulation - Borjomi-Kharagauli Protected Areas, Ktsia-Tabatskuri habitat management area and Goderdzi fossil forest natural monument (2021).
- Borjomi-Kharagauli National Park Forest fire management Plan (2021).

According to these documents forest fire is recognized as high threat to the value of the BKNP, and therefore establishment of an effective system against forest fire related disasters is an important measure.

Division of the BKNP by forest fire risk classes

Description of the BKNP territory

Borjomi-Kharagauli National Park, within the boundaries of which there are more than 64,756 hectares of natural forests and alpine meadows, is a protected area. It is located 160 km from Tbilisi, the capital of Georgia, in the central part of the country, and covers 3 regions: Imereti, Samtskhe-Javakheti and Shida Kartli. One of the largest national parks of Georgia is located on the territory of 6 administrative districts and stretches from the resort of Borjomi to the city of Kharagauli.

The area of forest in the BKNP is 56,112 hectares and is divided by 10 forest units/administrative districts (see table 2):

Table 2. Distribution of the BKNP forest by forest units²

N	Name of forest Unit	Area, Ha
1	Saqondria	6148
2	Marelisi	7714

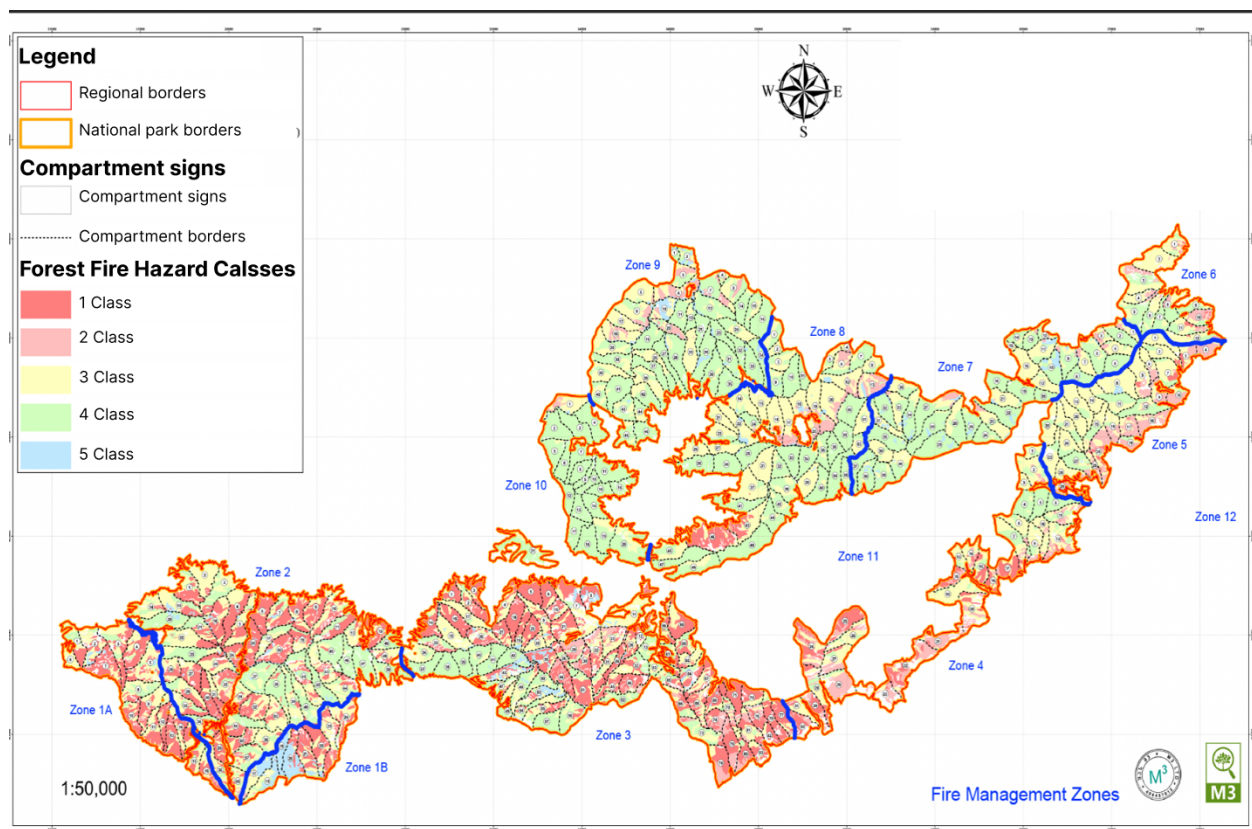
² Source: BKNP Forest management plan, 2021

3	Nunisi	5021
4	Qviskheti	1666
5	Zanavi	3723
6	Lashuri	3025
7	Borjomi	4882
8	Atskuri	10576
9	Abastumani	9247
10	Kutskhana	4110
	Total	56112

Division of the BKNP forests by risk classes

Based on forest management plan elaborated in 2021 for the BKNP, the territory is considered by high forest fire risk due to the coniferous species are predominant here. Distribution of the BKNP by forest fires hazard classes³ is given in figure 1 below:

Figure 1. Distribution of the BKNP forests by forest fire hazard classes



³ forest fire hazard class - the degree of occurrence of forest fires in relation to the conditions of the location According to the scale Forests are divided into five classes, taking into account the risk of fire: Class I - pine groves, young coniferous groves, coniferous bushes on the slopes of southern exposure; Class II - groves of oak, beech, chestnut, acacia, brushwood, deciduous shrubs on the slopes of southern exposure; Class III - groves included in classes I-II on slopes of northern exposure and included in class IV groves on the slopes of southern exposure; IV class - fir, spruce, beech and other species groves on northern exposure slopes; V class - alder, willow, poplar, eucalyptus groves, evergreen shrubs, floodplain forests and other wetland groves. The fire hazard class is determined for each quarter, corresponding to the letters included in it by averaging the data, Source: Government Decree #383 On the rules of forest protection, restoration and tending.

Based on this map and with support of the US Forest Service experts (USFSIP) it was decided to divide BKNP administrative districts by forest fire risk classes as follows:

1A – Eastern part of Kurtskhana - high priority

This fire management zone mainly contains high fire danger class vegetation. At the southern border of the zone and on the road to the observatory, which crosses the zone, there is a high probability of fire occurrence due to intensive human activity. The values surrounding the Abastumni Astrophysical Observatory are at risk.

Management measures:

- Targeted preventive and educational program.
- Consideration of the possibility of treating hazardous vegetation due to their proximity to agricultural fields.
- Discussing the possibility of installing cameras to detect fires.
- Consideration of the possibility of increasing the number of personnel and equipment. Due to the presence of a road in this area, it is possible to use fire trucks and all-terrain vehicles.
- Study and improve access roads according to their priority.

1B – Western part of Kurtskhana - medium priority

This fire management zone contains high and medium fire hazard vegetation. There is an area affected by fire in this territory. This is a medium priority area due to the insignificant values at risk and the low probability of ignition.

Management measures:

- Consideration of the possibility of using ATV(quadricycles) in this area to extinguish border fires.

2 - Abastumani - high priority

This fire management zone mainly contains high fire danger class vegetation. This is a high priority area, as important values are at risk, including valuable deer habitat, and it is located close to an urban settlement. The high potential for fire is due to the presence of residents and visitors to the park and the impact of the forest, which has repeatedly caused fires in this area.

Management measures:

- Treatment of dangerous vegetation.
- Targeted preventive and educational program.
- Discussing the possibility of installing cameras to detect fires.
- Consideration of the possibility of increasing the number of personnel and equipment. In this area, due to the presence of the road, it is possible to use fire engines and quadricycles.
- Study and improvement (repair and maintenance) of access roads according to their priority.

3 - Aksuri - high priority

In this zone, there is mainly vegetation of high fire danger class, and at its southwestern border - medium fire danger classes. In this zone there are areas covered with grass above the forest belt. This is a high-priority area, as it is characterized by vegetation of biodiversity importance and potential for ignition after lightning. The eastern part of this zone is bordered by an urban settlement.

Management measures:

- Treatment of dangerous vegetation near the border in the extreme eastern part.
- Targeted preventive and educational program.
- Study and improve access roads according to their priority.
- Discussing the possibility of installing cameras to detect fires.
- Accounting of water resources.
- Considering the possibility of increasing the number of personnel and adding Qcycles since this area is accessible by road.

4 – Borjomi – high priority

This fire management zone mainly contains high fire danger class vegetation. The probability of human-caused fires is high along the border where settlements are located. At risk are values such as population and urban infrastructure, as well as important plant diversity in the nearby Borjomi nature reserve.

Management measures:

- Treatment of dangerous vegetation near the border.
- Targeted preventive and educational program.
- Study and improve access roads according to their priority
- Accounting of water resources.
- Discussing the possibility of installing cameras to detect fires.
- Consideration of the possibility of increasing the number of personnel and equipment. In this area, due to the presence of the road, it is possible to use fire engines and Qcycles.

5 - Zanavi - medium priority

In this fire management zone, mainly vegetation of medium fire danger class is present. Except for the southern border, where high fire danger class vegetation dominates, human-caused fires can occur on agricultural land and around the Zanawi community. At risk are mainly values such as population and urban infrastructure,

Management measures:

- Treatment of dangerous vegetation near the border.
- Targeted preventive and educational program.
- Study and prioritization of access roads.
- Accounting of water resources.

6 – Kvishkheti – medium priority

This fire management zone mainly contains low-high fire danger class vegetation. The average probability of fire occurrence is due to human activities on the sand and surrounding agricultural beds. Population and urban infrastructure are at risk,

Management measures:

- Treatment of dangerous vegetation near the border.
- Targeted preventive and educational program.
- Study and prioritization of access roads.
- Accounting of water resources.

7 – Nunisi – low priority

The fire management zone is mainly represented by vegetation of low fire danger class. Low fire danger is due to lightning and man-made fires. Important values are not at risk.

Management measures:

- Studying access roads.
- Accounting of water resources.

8 - Marelisi - low - medium priority

This zone mainly has medium-low fire danger class vegetation. Low fire danger is due to lightning and man-made fires. Important values are not at risk.

Management measures:

- Studying access roads.
- Accounting of water resources.

9 – Sachondria, 10 – Lashuri – low priority

These zones mainly contain vegetation of low fire danger class. Low fire danger is due to lightning and man-made fires. Important values are not at risk.

Management measures:

- Studying access roads.
- Accounting of water resources.

Borjomi nature reserve - high priority

The fire hazard class is not defined, probably - medium-low. The fire is expected to start first after lightning. There are almost no roads in this area. Important values are at risk: diverse vegetation, critical wildlife habitat, and management of the area without human intervention. It is possible to reach the territory only by horse. If a fire is detected in this area, the rangers will probably not be able to reach the fireplace in the time it takes to extinguish the fire.

Management measures:

- Discussing the possibility of automatically contacting the emergency management service and using aviation to assess the situation and extinguish the fire.
- Discussing the possibility of installing cameras to detect fires.

Nedzvi habitat management area – Medium Priority

The fire hazard class is not defined, probably - medium-high. Fires can occur because of lightning and different human activities including logging along the northwestern border. The zone should be managed with minimal human intervention, although many roads cross the zone.

Management measures:

- Studying access roads.
- Accounting of water resources.
- Discussing the possibility of installing cameras to detect fires.
- Implementation of preventive and educational programs in the communities of Kvibisi and Akhaldaba.

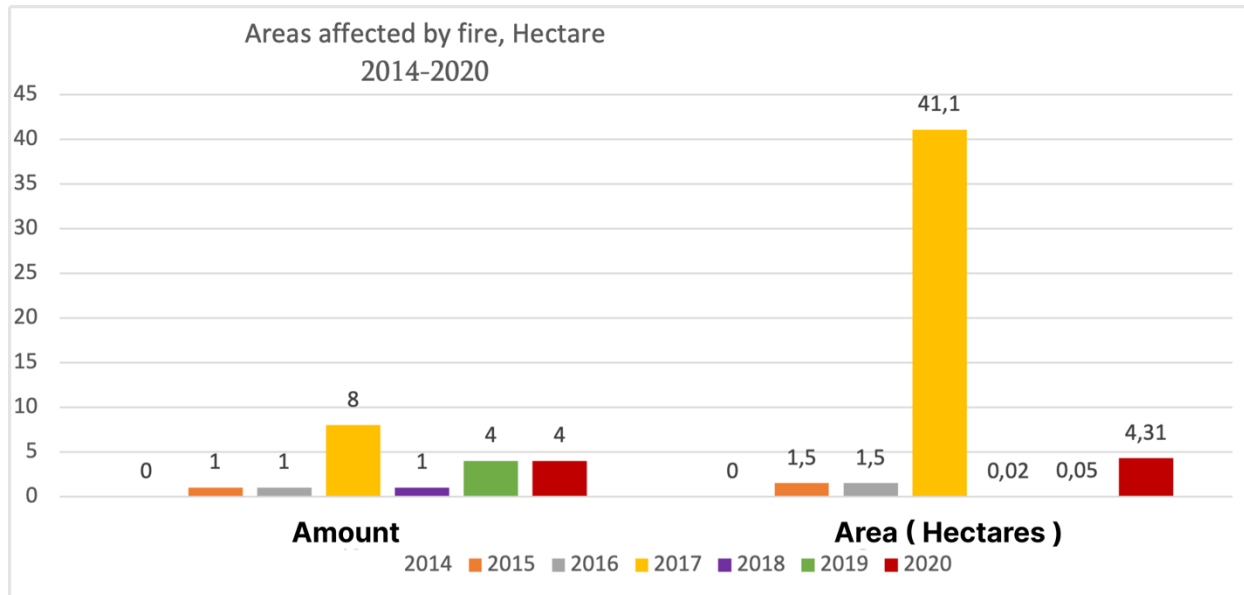
Forest fires at the territory of the BKNP

Every year there are several cases of fire in the BKNP⁴. In some years, the damage caused by fire is insignificant, and sometimes it is very serious. In 2008, approximately 10-12 hectares of forest were damaged by a single fire that took place during the conflict with Russia in 2008.

In the years 2014-2019, small fires were recorded almost every year in the Borjomi-Kharagauli National Park. As a result of timely response and existing improved techniques, timely detection of fire pits and their liquidation took place. It is worth noting the 2017 fire in the territory of the Abastumni district of the National Park, during which 40 ha of territory was burned, the rescue service and the army were involved in the process of extinguishing the fire. In the process of extinguishing the fire, a 3.5 km road was cut, which was mainly used to move heavy equipment to extinguish the fire.

Figure 2. Number of fires and affected area at the territory of the BKNP during 2014-2020

⁴ Source: Technical Regulation - Borjomi-Kharagauli Protected Areas, Ktsia-Tabatskuri habitat management area and Goderdzi fossil forest natural monument (2021).



Current practices for the forest fire control and management in BKNP

To ensure fire management at the territory of BKNP following system is established:

- Forest fire detection and patrolling
- Forest fire first response personnel
- Equipment
- First response.

Forest fire detection and patrolling

Patrolling is a common activity performed by park rangers during fire danger/high fire risk periods. BKNP Administration is elaborating detailed patrolling plan and schedule for each area identified as high forest fire risk area.

Forest Fire First Response Personnel

Although the agency officially responsible for extinguishing fires is the Emergency Situations Management Service, in many cases the first responders to fires are Borjom-Kharagauli National Park Rangers and other employees. There are 10 administrative districts within Borjom-Kharagauli National Park and 67 park rangers can respond to fires. In addition, other park employees can help. Additionally, the employees of the Borjom-Bakuriani forest unit of the National Forest Agency are also involved. Table 2 presents the existing number of rangers by district.

Table 3. Number of the Rangers in BKNP by administrative districts

Administrative Districts	Abastumani	Atskuri	Borjomi	Za	Kurtskhani	Marelisi	Nedzvi	Nunisi	Saqondria-Lashuri	Kvishkheti	Ktsia-Tabatskuri

				nav i							
Number of Rangers	6	6	11	5	6	6	7	5	7	4	4

Equipment

Currently rangers are using 4WD vehicles (pick-up truck), Also BKNP has four quadricycles and some equipment from the list below:

- Hand tools - shovels, axes
- Chainsaw and fuel containers
- Hose and necessary details (200 meters long hose with relevant details)
- Batteries for flashlights and other equipment
- First aid kit
- Drinking water
- Maps of roads, trails, water sources, other values.

Detailed list of the necessary equipment and tools are provided in the Borjomi-Kharagauli National Park Forest fire management Plan (2021).

First response

First response is the action taken by the first responders to a forest fire. These measures include fire situation assessment and reporting by filling out Situation Assessment Form (table 4). First responders are critical to ensuring the success of firefighting operations. The effectiveness of the first response determines to some extent the final consequences of the forest fire and the extent of the damage caused by the fire. In many cases, a quick and effective response is required to prevent the fire from spreading over a large area and to be able to control it with first response measures. Regardless of the type and location of the fire, as well as the property and resources at risk, the safety of firefighters and the public must be the highest priority.

Table 4. Situation Assessment Form

Date:	
Type of fire:	Manager for the Emergency Situation: An intern:
Fire location	Area: _____ Hectares Owner: ___ BKNP ___ District name, others
Type of vegetation:	The nature of fire: ___ მხრხოლავი ___ მცოცავი ___ წერტილოვანი ___ ჩირაღდნული ___ მაღლითი ___ სწრაფი
Flame lengths (meter):	Positioning on the slope: ___ low 1/3 ___ medium 1/3 ___ part 1/3 plain _____
Slope degree (%):	Exposition: ___ N ___ NE ___ NW ___ S ___ SE ___ SW ___ E ___ W
Height:	
Wind:	Speed _____ Impulses _____ Direction _____.

Distribution potential:	no	low (0-2)	medium (2-5)	high (5-10)	very high (10+)		
Starting strategy:	_____	direct	_____	indirect	_____	combined	
Values under the risk:	buildings	infrastructural	cultural/historical	natural resources	other		
Risks:	Deadwood	electric lines	stones	roads	flammable materials	hazardous materials	others
Possible cause:	Lightning	bonfire	waste	burning power line equipment	deliberately ignited	other	
Additional needs:	Fire trucks	Bulldozers	ATVs (Quadro cycles)	Personnel			
Factors affecting fire suppression (eg, weather, terrain):							
Buildings under the threat:	Living buildings	_____	commercial buildings	_____	other	_____.	

Biodiversity, Ecosystems, and sustainable natural resources management

Borjom-Kharagauli National Park is in the central part of the Caucasus ecoregion. Due to its outstanding biodiversity and vulnerability, the ecoregion is included within 35 priority ecoregions in terms of nature conservation. BKNP is located between two such hotspots (Caucasus and Anatolia). on the edge.

The main wealth of the Borjom-Kharagauli National Park are the forest ecosystems (75% of the territory) presented by large areas of intact sections of mixed forests and unique Fragments of relict Colchic forests. About a quarter of the park is presented by subalpine and alpine meadows, which are covered with relic Caucasian rhododendron bushes. Also, here are pure forest stands of spruce (*Picea orientalis*) and pine (*Pinus cochiana*), which are located between 1400- 1800 m a.s.l. Among the broad-leaved trees, Georgian oak (*Quercus iberica*) and hornbeam (*Carpinus orientalis*) predominate in the lower zones. In the upper zones - beech (*Fagus orientalis*), Chestnut (*Castanea sativa*) and others.

There are 64 species of mammals, of which 11 are endemic to the Caucasus and 8 are endemic to Georgia at the territory of Borjom-Kharagauli National Park. 217 species of migratory and nesting birds can be found here, 13 of them Included in the red list of Georgia. 30 species of reptiles in the moist forests of the protected area inhabits, 3 of which are endemic to the Western Caucasus, and 2 species are included in the Red List. Important species are Caucasian grouse (*Tetrao mlokosiewiczi*), Robert's grouse (*Chinomys roberti*).

Protected areas preserve rare or endangered species, such as: Caucasian red deer (*Cervus elaphus*), brown bear (*Ursus arctos*), Lynx (*Lynx lynx*), Caucasian marten (*Rupicapra rupicapra*), European lynx (*Barbastella barbastellus*), giant bat (*nyctalus lasiopterus*); Caucasian squirrel

(*Sciurus anomalus*), Caucasian otter (*Lutra lutra*), White-tailed eagle (*Haliaeetus albicilla*), eagle (*Aegypius monachus*), mountain eagle (*Aquila chrysaetus fulva*), Caspian hornbill (*Tetraogallus caspius*), Caucasian grouse and others. The forest is also inhabited by: wild boar (*Sus scrofa*), roe deer (*Capreolus capreolus*), Wolf (*Canis lupus*), forest cat (*Felis silvestris*). 20 species of bats are registered in the Borjom-Kharagauli National Park.

Climate change and disaster risks

The climate of the protected areas of Borjom-Kharagauli is undergoing a change caused by global warming, which is itself caused carbon dioxide and other so-called anthropogenic emissions of greenhouse gases. macro- and microenvironment, acceptable and customary for plants and animals in protected areas, also will change. Vertical climatic zones will move up, plants and animals that are adapted to the current conditions, will face danger, species that spread in the low area, will move up and new complexes/ecosystems will be created. The Species that will be better adapted to the new conditions of protected areas may migrate to BKNP from the outside low-lying area. Those species that are bred in the high zone, may disappear from the protected area. There are certain actions through which can mitigate the effects of climate change on species and ecosystems. e.g., basic Identification and propagation of more flexible genotypes of woody species, but certain changes in existing habitats and species are still inevitable. continuous monitoring of climate and promotion of research on climate change and its effects on the habitats and species of protected areas, may provide solutions on adaptation practices to the effects of the climate change.

Pollution Prevention and Resource Efficiency

Pollution of the territories and rivers is a significant problem with the settlements adjacent to the Borjom-Kharagauli protected area. The problem of pollution is noticeable on popular tourist routes and overnight places for tourists, such as camping sites and tourist shelters.

An important problem is water pollution. In the Ktsia-Tabatzkuri impoundment, water pollution of fresh waters and wetlands (Tabatzkuri Lake, headwaters of the Ktsia River and Nariani Valley wetlands) should be considered as a major pressure/threat. Domestic and livestock sewage from the villages of Tabatzkuri and Moliti in the western part of the lake flows directly into the lake (IUCN POSC 2009), which may affect fish nests. This issue needs to be systematically studied. It is also likely that cattle sewage flows into the headwaters of the Ktsia River, which flows through intensive grazing areas and damages the wetlands of the Narian Valley. This issue has not been systematically assessed either.

The population living in the vicinity of the protected areas of Borjom-Kharagauli depends on the extraction of natural resources of the protected area. Villages of Borjomi Municipality, which are

in the vicinity of the protected area, are the only way to get wood (firewood and industrial quality), as well as Adigeni (Abastumani and surrounding villages), Akhaltsikhe Municipality Villages (Azkuri, Tsenubani, Gurkeli). It is worth noting the municipalities of Kharagauli and Baghdati, whose population mainly enjoys summer pastures in the national park.

The use of natural resources is allowed in certain zones and categories of protected areas, for example, in the traditional use zone of the Borjom-Kharagauli National Park, in the Nedzvi reserve, as well as in the Ktsia-Tabatzkuri reserve, resource consumption is controlled and limited. It should be noted that the dynamics of the amount of resource consumption has not changed over the last 10 years. An exception is the territories in the Kharagauli district of the National Park, where the extraction of firewood has sharply decreased, which is mainly due to forests difficult accessibility.

Figure 3. Supply of firewood and industrial wood from the territory of the BKNP



The local population consumes fruits, berries and mushrooms from the forests of the National Park for personal consumption, although it should be noted that it is not actually counted how many people living in the vicinity of the protected area follow this activity and how many resources are collected.

The population of Kharagauli Municipality of the National Park is mainly engaged in beekeeping. They use open areas of chestnut forests to build beehives. The current practice of beekeeping does not harm the protected areas of Borjomi-Kharagauli, however, it should be noted that such places attract bears and damage beehives, which in turn creates a conflict between humans and predators, which should be taken into account when planning this activity.

Community Health, Safety and Security

The natural environment of the BKNP territory is quite diverse and not easy to travel without special knowledge and experience. Difficult terrain, existence of dangerous animals, poachers are a risky factor for the visitors.

There are rules elaborated by BKNP Administration of behavior in protected areas, which are posted on signs in the park at the entrances. Visitors also receive a brochure about the park when they book their travel or enter the park for a day visit where basic information is posted. There are also some recommendations on the park, its facilities, and the rules of behavior in the park How to enjoy wildlife to the fullest.

Restrictions on lighting a fire, spending the night in a tent, with tourist shelters on benefits, etc. It is indicated in the information material that is given to the visitor upon registration time. Burning of fire is prohibited, except in specially designated areas, which are located near shelters and camping sites. Because all tourist the shelter is "self-catering", visitors are responsible for cleaning and rubbish According to the instructions for placement. Smoking is not allowed in tourist shelters.

Cultural Heritage

The protected areas are located in the historically famous Tori, Argveti and Samtskhe regions of Georgian the province. The Borjomi Valley is part of the Tori Province, created in the between 2nd and 4th centuries.

Protected areas include internationally known historical and cultural areas of the region important elements of inheritance. Here are the castles of the first century, The Green Monastery, which belongs to the second half of the 9th century, the Church of the Holy Mother of God, which also belongs to the 9th century and which is located in Chitakhevi valley, StThe Church of the Mother of God in the vicinity of the village of Likani, the medieval church of St. George in the villagenear Banishkevi, St. Nino's Church, medieval fortresses of Sali, Nua, Gogia near Borjomi and the medieval fortress of Lekor near the village of Gurkeli.

To the north of the protected area, in the municipality of Kharagauli, there are many historical-Cultural monuments, which belong to different historical eras, are village. in Marelisi Vakhani Castle of XI century, Chkheri Castle (XIII century) directly adjacent to the protected area, Ubis Monastery (IX century).

The Bridge of King Tamar in Abastumani, which dates back to the 12th Sukun, represents the most A remarkable historical monument in the Adigeni region, located in the National Park within

In the vicinity of the park there are older archeological monuments such as Ruins of Cyclopean settlements near the village of Boga, near Akhaltsikhe.

Labor and working conditions.

Community engagement for the sustainable use of natural resources is a priority for the park. Promoting the development of community tourism, ecotourism, agro and rural tourism. In cooperation with the park, a small part of the local community has accumulated some knowledge and experience in hospitality, business skills and management. Several families have started tourism businesses involving family members and community representatives. Among them are mainly family hotels and horse riding tour providers. Recently, the community's interest in organizing catering services has increased.

In cooperation with the park, the representatives of the local community, in addition to receiving direct benefits (self-employment, job opportunities, etc.), created local businesses and new forms of entrepreneurship (agritourism in Atskuri, Marelisi, community tourism in Kavtiskhevi), which creates a multiplier effect of employment on the spot. The ability to communicate in families has increased, the new generation has more motivation to learn a foreign language, master the profession of a guide and get a better education. A local product is created (price jam, honey, etc.). Indirect benefits include a sense of community dignity, awareness of environmental conditions and values, and preservation of traditions.

Forest fire risk assessment methodology

Forest fire protection measures are planned based on forest monitoring, forest inventory and other specific research materials, as well as based on management plans for protected areas or other forests elaborated and approved according to the existing regulations.

During forest inventory, forests are divided according to fire hazard classes and corresponding cartographic materials are prepared as a guide. The rule of forest protection, care and restoration also determined the methodology for determining the level of fire danger, however, for the perfect planning and prioritization of forest fire prevention measures in the territory of a specific forest area, along with the above, risk assessment is of great importance.

The document provides approaches to forest fire risk assessment. The risk assessment should be carried out annually, based on the information collected at the forest district level (by forest) at the end of the year, and be the basis for the next year's action plan.

Local forest service assistants and contractors participate in risk assessment. However, all interested parties (local population, volunteer groups, emergency management service employees, etc.) can participate.

The evaluation method allows to find initial information and warning signs.

Forest Fire Risk Assessment

Forest fire risk is based on the following factors: probability and impact.

Accordingly, both the probability and the impact are evaluated, and according to the points of the probability of the threat and the quality of its impact, the sum of the points obtained according to the formula below determines the level of risk (Table 1):

Risk assessment formula.

$$\text{Risk (R)} = \text{Likelihood (L)} * \text{Impact (I)}$$

Hazard probability and impact quality scores

Hazard Likelihood (L) Degree	Score	Hazard Impact (I) Degree	Score
too frequent	5	very strong	5
Frequent	4	strong	4
Moderately frequent	3	Moderate	3
Rare	2	weak	2
Very rare	1	very weak (insignificant)	1

Table 1

Score (total)	Risk level	Mapping
16-25	Critical	
10-15	High	
5-9	Medium	
1-4	Low	

*For example: if the threat probability score is 4 and the impact assessed with 2 points, forest fire risk will be assessed as medium ($R=4*2=8$)

Risk probability assessment.

The probability of forest fires refers to how often a fire center is fixed in a specific area over the years (in this case, the scale does not matter). The annual probability of occurrence should be estimated in the defined area. Table N2 is used for probability assessment.

Table 2

Score	Expected fire probability	During 10-year period
5	High probability	9 and above
4	Possible	7-9
3	Likely	5-7

2	Unlikely	3-5
1	Very unlikely	1-3

Hazard impact assessment

When assessing the impact, we must take into account first of all human life, health and property. When assessing the recurrence/occurrence of forest fires in a specific area, we should take into account:

- Number of people injured in fire (populated points)
- how much area the fire covered

What is the cost of damage to the local population? (It should also be taken

It was taken into account how dependent the local population was on forest use. for example with firewood)

What is the cost of damage to the Forestry Service?

- What is the cost of damage to the local self-government body and others.

Taking into account the above, the following system is used in impact assessment:

Dead-injured person: 5-1-0 points

- If a death is recorded after 10 years, in such a case the impact is evaluated with 5 points and other components are no longer evaluated.
- If in 10% of the fires recorded during the 10-year period, 1 or more people are injured and taken to a medical facility, then the mentioned impact component will be evaluated with 1 point.

☐ If there are no dead and/or injured persons (or persons) in the fires recorded during the 10-year period, then the said impact component will be evaluated with 0 points.

Area of fires for 10 years: 0.1-1 points

- Burned area of 50 ha and more - 1 point;
- 30-50 ha - 0.7 points
- 20-30 ha - 0.5 points
- **10-20 ha - 0.3 points**
- 0-10 ha - 0.1 points

Type of fire: 0.5-1 points

- Dual - 0.5 points
- Higher - 1 point

In the case of at least 20% of high-altitude fires recorded over a 10-year period, It will be evaluated with 1 point.

Tree-plant injury rate (in 10-year period): 0.1-1 points

Grass was burned, more than 25 trees and plants were damaged - 1 point;

Grass burned, 10 to 25 trees and plants were damaged - 0.7 points;
 Grass burned, 1 to 10 trees and plants were damaged - 0.5 points;
 Grass was burned, 1 tree was damaged - 0.3 points

- The grass burned - 0.1 points

Has the infrastructure been damaged over the past 10 years: 0-1 point

Yes - 1 point

- No - 0 points

Classification of forest fire causes

in addition to forest fire risk assessment,

The classification of the causes of fire is also important for the production of the database.

Using accurate (or approximate) fire cause information allows for more effective fire prevention planning.

The causes of fire are classified in different ways. The cause of forest fire can be divided into 2 groups: natural and anthropogenic. Accordingly, the database includes the cause of ignition, location, day/time, and the adverse outcome of the fire (for example: fire size, damage, etc.).

Classification of fire causes is especially important in forest fire risk assessment identified, critical, or high risk areas.

Classification of fire causes

Classification	Cause of fire	Related cause
1	Natural	Lighting and more
2	Camping	Violation of Fire safety norms
3	A smoker	Careless smoker
4	Waste burning	Burning of grass, various wastes, soil cleaning and others
5	Hanging	Fire starter
6	Mechanical and electronic means	Electric poles, explosive devices, exhaust and other
7	Minors	Use of inflammable means
8	Railway and other reasons	Exhaust from brakes, the building common fire, other

References

Technical Regulation - Borjomi-Kharagauli Protected Areas management plan (2014).

Climate change adaptation guide, USAID, Tbilisi, 2016.

Georgia's National Disaster Risk Reduction Strategy Action Plan, 2017.

Georgia law on Civil Security (2018).

Technical Regulation - Borjomi-Kharagauli Protected Areas, Ktsia-Tabatskuri habitat management area and Goderdzi fossil forest natural monument (2021).

Borjomi-Kharagauli National Park Forest fire management Plan (2021).

Annex 1 – Extract from the Government Decree #383, 21.07, 2021 “On the rules of forest protection, restoration and tending.”

Chapter II - Protection from forest fires

Article 7. Purpose of protection against forest fires

The purpose of prohibition is sometimes to plan preventive measures and consider measures that promote avoidance.

Article 8. Planning and implementation of forest fire protection measures

1. Measures for the protection of forest fire objects, afforestation and other research materials and the rules of the protected area management plan or temporary rules.

2. Forest fire protection measures, in other operational areas, are planned and carried out by the authorized management bodies, or under their supervision, entities determined in accordance with the legislation, and border strips and border zones. , the state sub-departmental institution of the Ministry of Internal Affairs of Georgia - Agreement of the Border Police of Georgia.

Article 9. Preventive measures for protection against forest fires

1. Short-term forest fire prevention measures are:

- a) Placement of warning information banners in forest fires;
- b) structure of public information information (explanatory) work on fire hazard prevention;
- c) the organization of the periodical institution of the territory of the emergency area zone against fire foci and stopping or mechanisms;
- d) extinguishing fires in fire-prone areas, arranging accessible footpaths - organizing rehabilitation;
- e) informing about expected and implemented measures in the fire-prone region through the media and other means;
- f) providing appropriate training on the issues of fire prevention and their elimination;
- g) Provision of information about fire-prone areas at the beginning of each year to the special equipment control management authorities.

2. Long-term measures are the way to prevent forest fires:

- a) Arrangement of fire roads and paths in forest areas of high fire danger class;
- b) repair of fire roads and paths;
- c) use of stopping and limiting forest fires, arranging fire-fighting mineralized strips in fire-prone areas;
- d) cleaning the forest from logging, which is the most fire-prone areas to bring out the root wood and wood chips and place them in a safe place;
- e) arrangement of approaches to fire water facilities and fire-fighting water supply sources;

f) periodic cleaning of business yards of easily flammable bulk and materials and their provision with temporary and/or permanent checkpoints equipped with fire extinguishers and water supplies;

g) Equipping the employees of the bodies authorized to manage the forest with the first fire fighting tools and personal protective equipment.

Article 10. Determination of forest fire danger signs and measures to be implemented

1. Forest fire danger with 5 levels - low, medium, high and very high. Determination of field/fire hazards by persons authorized to manage its management bodies and/or users in accordance with the 11th rules of this rule.

2. Forest management bodies, persons authorized to manage forests and forest users are responsible for being guided by hydrometeorological data.

3. According to the place of fire danger in the forest:

a) duration of fire hazard I (low information): monitoring of fire-causing work, compliance with fire safety control rules, preparation of equipment and fire techniques;

b) Level II of dangerous times: I and II in areas with fire danger, as well as monitoring of public mass recreation, appropriate cooperation exercises, preparation of equipment and New Year's equipment;

c) fire hazard III levels (average negative): monitoring of I, II and III work and gathering of people likely to cause fire, transfer of presence mechanism is prepared for permanent cooperation;

d) IV levels of danger (work causing high fire); In the event of a forecast (more than 5 days), with equipment that can be placed in a separate fire station, close fire can be placed in the areas of occurrence.

Article 11. Methodology for determining the level of forest fire danger

1. The forest fire danger level is determined according to the current day's fire danger complex indicator, for the period after the end of rainy days.

2. The level of fire danger in the forest is determined according to the complex index of fire danger (km) calculated in accordance with Table No. 2 of Appendix No. 1. (km) data required to calculate the indicator are - air temperature (t, in °C), wind speed (v) and dew point (z, in °C) at 13:00 local time, as well as the precipitation of the previous (n) days quantity. The complex rate of fire danger of the current day (km) is calculated by the formula $km = \sum_{n=1}^n \{t \cdot kv \cdot (t - z)\}$. Where, kv is the fire hazard coefficient, which takes into account the influence of wind speed (v) on the occurrence and spread of forest fires. Its values are given in Table No. 1 of Appendix No. 1, in accordance with the values of wind speed (in m/s). And, n represents the number of previous rainless days at the time of calculation. The calculation of the complex indicator starts after the last rain and is carried out for every next n days, summing up according to the increasing result.

Article 12. Fire safety measures in the forest

1. In order to protect fire safety in the forest, the following measures must be taken:

a) In the forest area: under tree trunks, in burning young forest, in old fires, in damaged areas of the forest (burned or broken areas of the forest), in the forest floor not cleaned from the waste of production, in the areas of manufactured wood left unexcavated, in peaty and dry grassy areas, it is prohibited to light fires, except as stipulated by the law cases;

b) Allowing fires to be lit in the rest of the forest area in places specially arranged for this purpose (for lighting a fire, a place for lighting a fire (bakan) should be arranged, which means within a radius of 1.5 m from the center of the fire, made of easily flammable materials (hay, dry grass,

leaves, pine cones) Cleaning of the area and/or selection of a place in a field exposed to the mineralized layer of soil, bordered by a strip of at least 0.25 m wide. At the same time, fire damage to Norchi trees, including their roots, should be completely excluded).

c) Prohibition of stacking of timber made on fire protection plots, mineralized strips and barriers.

2. In order to clean up the forest, burning of the wood residues obtained by cutting and peeling trees damaged by forest pests and diseases in the forest is allowed, if this does not pose a threat to the forest, does not deteriorate the quality of its soil or does not create a danger of fire in the forest.

3. The following are prohibited in the forest:

a) throwing unextinguished matches, cigarette butts and other flammable objects;

b) leaving a burning bonfire;

c) burning grass

4. In order to protect against forest fires, the bodies authorized to manage the forest, as well as their territorial bodies, have the right, in agreement with the local self-government bodies, to temporarily prohibit the use of the forest, the presence of the population in the forest, the entry of vehicles into the forest, etc.

5. Forest users are obliged to:

a) carry out the removal of the remaining timber and easily flammable materials within the terms established by the authority authorized to manage the forest;

b) To have primary fire-fighting means ready at the place and objects of forest work, and/or in the areas of recreational and tourist activities.

c) before carrying out works, including during recreational, sports and other cultural-mass events in the forest, conduct an instruction on the observance of fire safety rules and fire extinguishing methods.

Article 13. Measures to eliminate fire and its consequences

1. Extinguishing, localization and liquidation of fires in the territory of the forest of Georgia is carried out by the body defined by the legislation of Georgia with the participation of the body with the right to manage the forest and forest users, if any.

2. Restoration measures of the burned area are carried out by the corresponding forest restoration project (the interval after the fire before the restoration of the forest should be at least 3 years, if no other circumstances were identified by a special study).

3. The cutting of woody trees and plants in the burned area will be allowed on the basis of a special investigation and/or in cases provided for by the restoration project.

4. The relevant body with the right to manage the forest makes a decision on cutting down trees in the fire area.

5. Persons violating the rules of fire safety protection in the forest shall be charged with the responsibility provided for in Article 76 of the Code of Administrative Offenses or Article 243 of the Criminal Code, which does not release them from their obligation to correct the violation within the time limits set by the forest management authorities.

6. The persons responsible for forest fires are responsible for compensation for the damage caused to the forest in accordance with the applicable legislation.

7. In case of non-compliance with the rules of fire safety protection in the forest, the forest management body has the right to stop any work in the forest on the areas and objects where the violation occurred.

