

## *Assessment of the Threats to the Biodiversity and Habitats in "Stara Reka" Reserve (Bulgaria) and Its Adjacent Subalpine and Alpine Areas*

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**Abstract.** The assessment of the threats in the "Stara Reka" reserve and its adjacent subalpine and alpine areas is important since it makes it possible the appropriate conservation measures to be taken in order to prevent or reduce the negative effects on the biodiversity and habitats. The assessment was based on systematic studies and visits in the "Stara Reka" Reserve, located within National Park "Central Balkan" (Bulgaria), during spring, summer and autumn seasons of 2010-2011. A number of threats were recorded, where those by anthropogenic origin were predominating. Tourists have negatively influenced the wild plants such as *Allium ursinum*, *Inula helenium* and *Primula frondosa* by picking them up. Damages were registered on the information system and signs. Waste disposal, fires, poaching and illegal fishing were also some of the recorded threats. Many natural succession changes quite dynamically vary the habitats in the reserve, but the most dangerous for the biodiversity and degradation of habitats remain fires, erosion and introduction of alien species.

**Key words:** threats, biodiversity, habitats, reserve, subalpine, alpine, "Central Balkan" National park.

### **Introduction**

The "Central Balkan" National Park lies in the heart of Bulgaria, nestled in the central and higher portions of the Balkan Range. The Park contains rare and endangered wildlife species and communities, self-regulating ecosystems of biological diversity, as well as historical sites of global cultural and scientific significance. The park is a favorite place for recreation among tourists from Bulgaria and from

around the world. The local people develop traditional livelihoods and crafts here. There is enormous responsibility to preserve this unique environment, following the principles of sustainable tourism and use of resources (YANKOV, 2001).

There are nine Reserves within the "Central Balkan" National Park: Boatin, Tsarichina, Kozya Stena, Steneto, Severen Dzhendem, Peeshti Skali, Sokolna, Dzhendema and Stara Reka. In total, they

cover 20019.6 hectares, and contain varying examples of natural ecosystems featuring unique wildlife species and their habitats (Central Balkan National Park Directorate, 2012).

Stara Reka (Old River) Reserve was founded on March 19, 1981. With an area of 1974.7 hectares, it preserves the natural scenery of some of the most picturesque Bulgarian rivers, comprising in full the watershed of the Stara Reka River and its tributaries. This Reserve is among the richest in rare plant species in Bulgaria, with over 45 listed in the Bulgarian Red Data Book. Another 20 species are endemic to Bulgaria, including Kerner's thistle (*Centaurea kernerana*), Troyan campanula (*Campanula thyrsoides*) and Bulgarian betony (*Betonica bulgarica*). The forest contains thermophilic flowering ash (*Fraxinus ornus*) and hornbeam (*Carpinus betulus*) coexisting with beech (*Fagus sylvatica*), fir (*Abies alba*), spruce (*Picea abies*), sycamore (*Acer pseudoplatanus*) and Norway maple (*Acer platanoides*) (Central Balkan National Park Directorate, 2012).

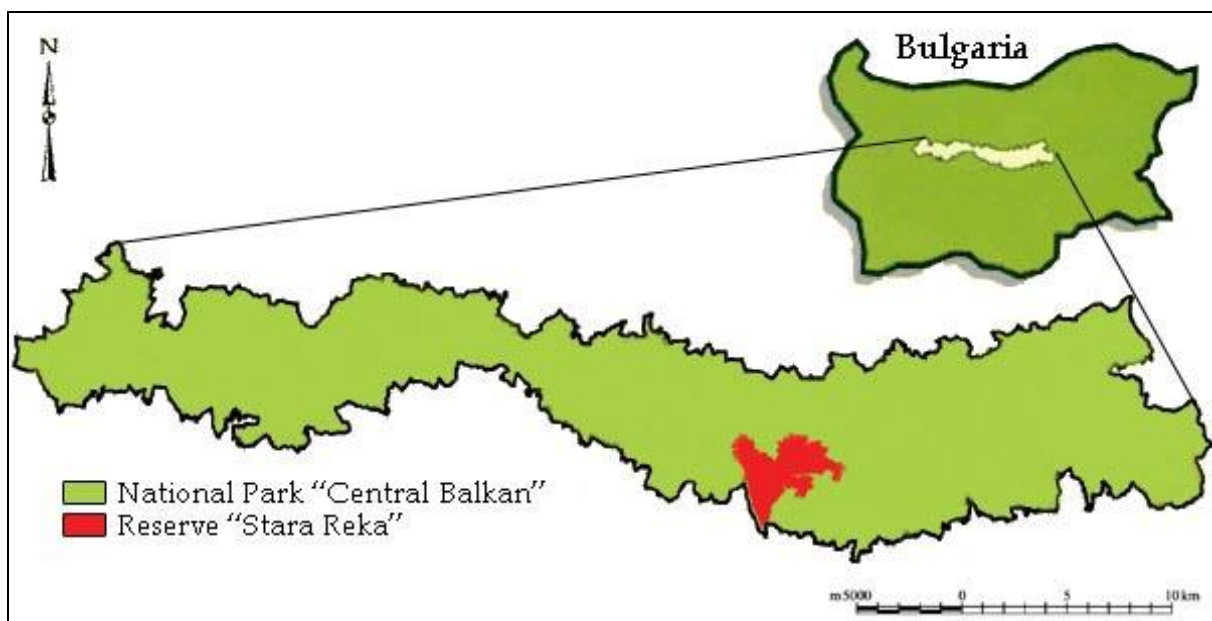
Over 100 species of vertebrate fauna have found sanctuary in this area. The

Reserve is home to bears (*Ursus arctos*), wolves (*Canis lupus*), weasels (*Mustela nivalis*) and wild cats (*Felis silvestris*), several predatory birds: the golden eagle (*Aquila heliaca*), large (*Accipiter gentilis*) and small hawks (*Accipiter nisus*), honey buzzards (*Pernis apivorus*), and barn owls (*Tyto alba*), amphibians and reptiles - european tree frog (*Hyla arborea*), fire salamander (*Salamandra salamandra*), blind worm snake (*Typhlops vermicularis*) and many others (YANKOV, 2001).

The purpose of the current study is to identify the real and potential threats to biodiversity and habitats in "Stara reka" Reserve, its adjacent subalpine and alpine areas of "Central Balkan" National Park in Bulgaria, and, to give some recommendations for conservation measures of this protected area.

## Materials and Methods

The assessment of the real and potential threats to the biodiversity and habitats of "Stara Reka" Reserve is based on systematic visits and research of different parts of the study area (Fig.1).



**Fig. 1.** Indicative map of the territory of "Central Balkan" National Park and the study area of "Stara Reka" Reserve and its adjacent subalpine and alpine areas.

The field research is conducted within the territory of "Stara Reka" Reserve and its

adjacent subalpine and alpine areas in "Central Balkan" National Park once a

month in the active for most animals and plants season – from March to November, during two-year period 2010 – 2011.

Signals for breaches, are received by surveying the local population, including tourists, mountain guides and alpinists. Collaboration with the rangers and administration of “Central Balkan” National Park is established in order to achieve the study’s objectives. The Management Plan for the National Park “Central Balkan” for 2001 – 2010 (YANKOV, 2001) and a map of “Stara Reka” Reserve are used, provided by the Directorate to locate the investigated areas at the terrain. Current issues concerning the study area are discussed with experts from the park.

Number of types of habitats identified in the study was 54. Plants species were determined according to Identification guide of plants in Bulgaria (DELIPAVLOV *et al.*, 1992) and Identification guide of bushes and trees in Bulgaria (GRAMATIKOV, 1992). For determination of the fauna Identification guide of vertebrate animals in Bulgaria (PESHEV, 2001) is used. The conservation status of the species in this study are presented according to the contemporary Bulgarian and European legislation (Table 1).

## Results and Discussion

The identified threats to the biodiversity and habitats as a result of the current study within “Stara Reka” Reserve and its adjacent areas are presented in Table 2 and Table 3.

### 1. Threats arising from natural phenomena and events

#### 1.1. Erosion in treeless zone (to the west of “Ravnets” Hut)

Ditch erosion was found in the treeless zone, adjacent to the reservation in the area “Alay Bozan”, to the west of “Ravnets” Hut (over 257 Forest department). The eroded area covers a large acreage. The furrow has several large and smaller branches. The terrain has an average gradient. The furrows have steep banks, which facilitates braking of soil and rocks. When it rains, water runs in the furrows, which carry away the

particles torn. At some places, especially at the top, the vegetation in the furrows, which are formed due to the erosion, has begun to recover.

#### 1.2. Large erosion below “Kupena” Peak

Ditch erosion was also found in the treeless zone, adjacent to the reservation in the area, adjacent to the reserve, under Kupena Peak. Reasons for this erosion are large gradient of the slope, which contributes to more rapid sliding of soil and rocks, and a large amount of alluvium from rainwater substrate. The stage of development of the eroded area covers a large area of the hillside. Erosion is in the form of a single groove. The terrain of the erosion is high gradient. Erosion covers an area of great length. There are trends for restoration of the grassy vegetation in the upper area affected by erosion.

Negative influences of both types of the above-mentioned erosion, on the habitat: Erosion reduces the area of alpine meadows. The loss of soil material impact on soil functions at the site of the erosion as well as on its adjacent areas (YANKOV, 2001).

#### 1.3. Wind throw and wind fracture

Phenomena of wind throw and wind fracture are a result of wind action. Wind throw is extracting trees with shallow root system, together with their roots. Wind fracture is breaking stems of the trees. In the forests on the territory of the reserve, wind throw and wind fracture are commonly found on common beech (*Fagus sylvatica*) and white fir (*Abies alba*). Wind throw and wind fracture are intermittent natural threat to forests.

Wind throw of common beech was found at the following places: next to the path between “Vassil Levski” Hut and “Topalitsa” area; next to the path from “Vassil Levski” Hut to Botev Peak (in 242 Forest department); in the habitat of wild garlic between “Balkanski rozi” Hut and “Vassil Levski” Hut.

Wind throw of white fir was found on the right bank Stara Reka River, next to the path between “Balkanski rozi” Hut and “Vassil Levski” Hut.

Wind fracture of common beech was found at the following places: next to the

**Table 1.** Legal documents in the contemporary Bulgarian and European legislation, determining the conservation status of the registered species in the current study.

Abbreviation	Legal Document/Annexes	Source
BPA	Biodiversity Protection Act of Bulgaria	State Gazette Nr 77 of August 9, 2002 (amended - State Gazette Nr 88 of 2005 and State Gazette Nr 94 of 2007)
	Appendix II - species whose conservation requires the designation of special areas of conservation of their habitats. Appendix III - species protected in the whole of the country. Appendix IV - species under the mode of protection and regulated use of nature.	
DCE'92/43	Council Directive 92/43/EEC of 21 May 1992 on the conservation of natural habitats and of wild fauna and flora	Amended by Council Directive 2006/105/EC of 20 November 2006), accessible on-line at: <a href="http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=CELEX:01992L0043-20070101:EN:NOT">http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=CELEX:01992L0043-20070101:EN:NOT</a>
	Annex II - animal and plant species of community interest whose conservation requires the designation of special areas of conservation. Annex IV - animal and plant species of community interest in need of strict protection. Annex V - animal and plant species of community interest who is taking in the wild and exploitation may be subject to management measures.	
Bern	Convention on the Conservation of European Wildlife and Natural Habitats, Bern, 19.IX.1979	Accessible on-line at: <a href="http://conventions.coe.int/Treaty/en/Treaties/Html/104.htm">http://conventions.coe.int/Treaty/en/Treaties/Html/104.htm</a>
	Appendix II - strictly protected fauna species (status in force since 1 March 2002). Appendix III - protected fauna species (status in force since 1 March 2002).	
RDB	Red Data Book of Republic of Bulgaria, 2011, Vol. 1, Vol. 2.	Available online at: <a href="http://e-codb.bas.bg/rdb/bg/">http://e-codb.bas.bg/rdb/bg/</a>
	Categories are in accordance with IUCN. EX - Extinct, CR - Critically Endangered, EN - Endangered, VU - Vulnerable.	
IUCN	IUCN Red List of Threatened Species. Version 2010.2.	Accessible on-line at <a href="http://www.iucnredlist.org">http://www.iucnredlist.org</a> (Downloaded on 30 August 2010)
	EN - Endangered (a taxon is Endangered when the best available evidence indicates that it meets any of the criteria A to E for Endangered, and it is therefore considered to be facing a very high risk of extinction in the wild). VU - Vulnerable (a taxon is Vulnerable when the best available evidence indicates that it meets any of the criteria A to E for Vulnerable, and it is therefore considered to be facing a high risk of extinction in the wild). NT - Near Threatened (a taxon is Near Threatened when it has been evaluated against the criteria but does not qualify for Critically Endangered, Endangered or Vulnerable now, but is close to qualifying for or is likely to qualify for a threatened category in the near future). LC - Least Concern (a taxon is Least Concern when it has been evaluated against the criteria and does not qualify for Critically Endangered, Endangered, Vulnerable or Near Threatened. Widespread and abundant taxa are included in this category).	
CITES	Convention on International Trade in Endangered Species of Wild Fauna and Flora, July 1 1975	Accessible on-line at <a href="http://www.cites.org/">http://www.cites.org/</a>
	Appendix I - Species threatened with extinction, which are or may be affected by trade. Trade in specimens of these species must be subject to particularly strict regulation in order not to endanger further their survival and must only be authorized in exceptional circumstances. Appendix II - (a) all species which although not necessarily now threatened with extinction may become so unless trade in specimens of such species is subject to strict regulation in order to avoid utilization incompatible with their survival; and (b) other species which must be subject to regulation in order that trade in specimens of certain species referred to in subparagraph (a) of this paragraph may be brought under effective control. Species not necessarily threatened with extinction, but in which trade must be controlled in order to avoid utilization incompatible with their survival.	

**Table 2.** Threats arising from natural phenomena and events to biodiversity and habitats in “Stara Reka” Reserve and adjacent areas.

Threat	Species/habitats affected	Description
Erosion in treeless zone	Habitats in the alpine zone.	Ditch erosion was found in the zone, adjacent to the reservation in the area "Alay Bozan" to the west of "Ravnets" Hut.
		Ditch erosion was also found below "Kupena" Peak consequently from large gradient of the slope, which contributes to more rapid sliding of soil and rocks.
Wind throw and wind fracture	Common beech ( <i>Fagus sylvatica</i> )	In the forests on the territory of the reserve, wind throw and wind fracture are commonly found.
	White fir ( <i>Abies alba</i> )	
Sliding of rocks	Various plant and invertebrate communities.	Sliding of rocks are recorded over the trail, before Barazh site.
Wild boar digging	Grasslands in the alpine meadows.	This digging leads to degradation of grasslands in the alpine meadows.
Invasive plant and animal species	Pine moth ( <i>Thaumetopoea pityocampa</i> )	A growing population, which may affect seriously pine, trees in the area.
	Siberian juniper ( <i>Juniperus sibirica</i> )	An extension of the projective covering and conquest of new territories.

path from “Vassil Levski” Hut and “Topalitsa” area; next to the path between “Hubavets” Hut and “Balkanski rozi” Hut; next to the path from “Balkanski rozi” Hut to “Vassil Levski” Hut; on the path from “Vassil Levski” Hut to Botev Peak (in 242 Forest district). The processes of wind throw and wind fracture lead to the formation of open spaces in the forest, located in the surveyed areas. Over time, a secondary succession will occur at the described areas, associated with recovery of the forest of young beech seedlings. These natural phenomena in the ecosystem can have a positive impact in the future due to habitat enrichment with new species.

#### 1.4. Sliding of rocks

Sliding of rocks was recorded over the trail, before “Barazh” site. This phenomenon is a threat to natural habitats in the area of the cluster of slide rocks. This sliding of rocks, in the future will lead to changes in the habitat - accumulated rocks will create new environmental lowers, having suitable

conditions for hiding of insects, snails, reptiles, rodents.

#### 1.5. Wild boar digging

There are lands in the treeless area (to the west of “Ravnets” Hut and in “Topalitsa” area, dug by wild boar (*Sus scrofa*). This digging leads to degradation of grasslands in the alpine meadows. At some places (to the west of “Ravnets” Hut) restored grasslands were found, from the damages caused by wild boar.

#### 1.6. Invasion of pine moth (*Thaumetopoea pityocampa*)

A growing population of the pine moth (*Thaumetopoea pityocampa*) was recorded. Caterpillars of this moth damage many pine trees in the border areas of the reserve. They attack the needles in condition of calamity and the species is able to remove the needles from coniferous trees.

#### 1.7. Extension of the projective cover of Siberian juniper

We recorded an extension of the projective covering of Siberian juniper (*Juniperus*

**Table 3.** Registered threats of anthropogenic origin to the biodiversity and habitats in "Stara Reka" Reserve and adjacent areas.

Threat	Species/habitats affected	Conservation status	Description
<b>Damages on individual plant and animal species</b>	Fire salamander ( <i>Salamandra salamandra</i> )	BPA-III; Bern-III, IUCN-LC.	Trampled animals by horses and tourists on the trails.
	Wild garlic ( <i>Allium ursinum</i> )	-	Picked up by tourists and contamination of its habitats by wastes.
	White elecampane ( <i>Inula helenium</i> )	The Minister of Environment and Water limits its collection for therapeutic purposes, under the Law on Medicinal Plants (State Gazette, 2000).	Picked up by tourists.
	Balkan primrose ( <i>Primula frondosa</i> )	BPA-III, RDB-EN, endemic species for Bulgaria.	Picked up by tourists.
	Pine ( <i>Pinus nigra</i> ), Locust tree ( <i>Robinia pseudoacacia</i> ) and Hornbeam ( <i>Carpinus orientalis</i> )	<i>Pinus nigra</i> - IUCN-LR/lc <i>Robinia pseudoacacia</i> - IUCN-LC	Human-related forest fire burned the region over "Suchurum" landmark.
	Royal stag ( <i>Cervus elaphus</i> )	Bern-II,III; DCE'92/43-IV; IUCN-LR/lc	Poaching.
	Roe ( <i>Capreolus capreolus</i> )	Bern-III; IUCN-LR/lc	Poaching.
	Wild boar ( <i>Sus scrofa</i> )	Bern-III; IUCN-LR/lc	Poaching.
	Wild goat ( <i>Rupicapra rupicapra</i> )	BPA-II; RDB-EN; Bern-III; DCE'92/43-II,IV; CITES-II; IUCN-LC	Poaching.
	Brown bear ( <i>Ursus arctos</i> )	BPA-II,III; RDB-EN; Bern-II; DCE'92/43-II,IV; CITES-II; IUCN-LC.	Poaching.
	Balkan trout ( <i>Salmo trutta fario</i> )	IUCN-LC	Illegal fishing.
<b>Damages on the information system</b>	-	-	Destroyed signs and information tablets by tourists.
<b>Pollution</b>	?	-	Wastes from tourists around fireplaces and places for rest.
<b>Introduced animal species</b>	Brown Carpathian bear	BPA-II,III; RDB-EN; Bern-II; DCE'92/43-II,IV; CITES-II; IUCN-LC.	Potential genetic contamination of the population of Bulgarian population of bears ( <i>Ursus arctos</i> ).
<b>Non-inherent plant species</b>	Nettle ( <i>Urtica dioica</i> )	-	These plants were transferred to alpine meadows area by human activities associated with grazing cattle.
	Cherry plum ( <i>Prunus cerasifera</i> )	-	

*sibirica*) in the subalpine treeless zone above "Topalitsa" area. Siberian juniper has taken a large area of alpine meadows of the treeless zone in this area. The zone occurs along the tree line, between 1500 and 1850 meters above sea level to the mountain ridge. Strongly reduced, and in many places, fully terminated regime of grazing in recent decades has led to changes in vegetation succession. Siberian juniper conquers new territories.

## 2. Threats of anthropogenic origin

### 2.1. Threat for the Fire salamander (*Salamandra salamandra*)

Salamanders, gone out on the trails have been accidentally injured or killed by horses carrying luggage to the huts, due to their weak ability for quick movement and self-preservation. A killed salamander is found on the tourist trail between "Hubavets" Hut and "Balkanski rozi" Hut (May 20, 2011).

### 2.2. Picking up of Wild garlic, White elecampane and Balkan primrose by tourists

Wild garlic (*Allium ursinum*): In one of the habitats in the Reserve, located between "Balkanski rozi" Hut and "Vassil Levski" Hut is evident that wild garlic is picked up. The leaves are picked up, and along with that, the flowers are eradicated.

White elecampane (*Inula helenium*): There are signs of picking up of white elecampane roots, next to the tourist trail between "Hubavets" Hut and "Balkanski rozi" Hut. The Biological Diversity Act does not protect the species, but the Minister of Environment and Water limits its collection for therapeutic purposes, under the Law on Medicinal Plants (State Gazette, 2000).

A threat for Balkan primrose is determined in one the habitats of this species, located next to the tourist trail between "Hubavets" Hut and "Balkanski rozi" Hut. There, the species is threatened by trampling by animals and destruction by individuals following the passage of tourists through the field.

### 2.3. Waste disposal by tourists

Wastes from tourists, mainly along the fireplaces, were recorded frequently. The following cases of illegal waste disposal in

the area of the reserve and its adjacent areas were registered:

- Wastes of packaging and food scraps in "Krasta" area, which is located next to the reserve. According to the tourists from the local population, sometimes these wastes attract bears. They go outside the reservation area and are threatened by local poachers.

- Wastes on a fireplace next to "Barazh" area.

- Plastic wastes from tourists next to a fireplace on the path between "Hubavetz" Hut and "Balkanski rozi" Hut.

- Wastes in a habitat of wild garlic, located between "Balkanski rozi" Hut and "Hubavetz" Hut.

- Plastic wastes on a fireplace next to "Balkanski rozi" Hut.

- Glass waste, construction and household wastes next to "Balkanski rozi" Hut.

- Metal wastes from an old shepherd hut on the path from "Vasil Levski" Hut to Botev Peak.

There are many wastes at the above places since the main tourist flow is concentrated there.

### 2.4. Fires

Forest fires are a crucial environmental factor associated mainly with human activity. The combustion of vegetation cover changes almost fully the environmental conditions (POPOV, 2007). On July 29, 2007, a fire burst in the region over "Suchurum" landmark. Much of the mixed forest was burned down, consisting mainly of pine (*Pinus nigra*), locust tree (*Robinia pseudoacacia*) and hornbeam (*Carpinus orientalis*). The size of the burnt territory is 47 acres; 10 acres of that territory are within the borders of the National Park. The damage to the biota by the fire is not possible to be accurately evaluated, since there is no complete data on biodiversity of the burnt area.

Assessment of the habitat after the fire: secondary succession occurs on the territory of the fire, which consists of restoring the natural deciduous forest, development of which was suppressed by the rapidly growing pine.

### 2.5. Poaching and illegal fishing

Poaching and illegal fishing are threats that directly affect biodiversity. Perpetrators of poaching and illegal fishing in "Stara reka" Reserve, in most cases remains unpunished. Poachers mostly kill the following species: Royal stag (*Cervus elaphus*), Roe (*Capreolus capreolus*), Wild boar (*Sus scrofa*), Wild goat (*Rupicapra rupicapra*) and Brown bear (*Ursus arctos*).

According to data, provided by tourists, there are isolated cases of illegal fishing in Stara Reka River. Object of this fishing is Balkan trout (*Salmo trutta fario*). Balkan trout population in the Central Balkan is an issue of national importance.

### 2.6. Damages on the information system

Near the trail, old metal signs prohibiting fishing and designating the protected area are found, which were shot with a firearm. The main of this is the lack of possibility for continuous monitoring of signs.

### 2.7. Introduced animal species

Brown Carpathian bear is an introduced species in "Stara Reka" Reserve. Inhabitation of this species within the reserve leads to the risk of genetic contamination of populations of the local brown bear, which is the bigger one. The park is inhabited by significant part of the Bulgarian population of bears (*Ursus arctos*) - around 60 animals (YANKOV, 2001).

In the 1980's, bears are regarded as an object to hunting in the country. Their breeding in artificial conditions began in Kormissosh (Western Rhodopes), where besides Bulgarian bears; Carpathian bears from Romania were imported. Displacement of bears from Kormisosh was conducted in the Western Rhodope Mountains and Central Stara Planina. This leads to potential contamination of the population. However, it is considered that Carpathian bears existed in our country too short in the wild; practically, they are not likely to have affected the gene pool of local bear (SPASOV *et al.*, 2008).

### 2.8. Non-inherent plant species

Nettle (*Urtica dioica*) and Cherry plum (*Prunus cerasifera*) were not inherent to the alpine meadows of the area. These plants

were transferred to this area by human activities associated with grazing cattle. These species are found mostly along the old abandoned dairies and pens and in meadows amongst woods.

Nettle is found along the ruins of a dairy farm in "Topalitsa" area and in alpine meadows in the treeless zone, to the west of "Ravnets" Hut. Cherry plum is found in the treeless zone, to the west of "Ravnets" Hut.

## 3. Recommendations for reduction of treats and harmful effects

- Regular monitoring of actual and potential threats must be included in the Management Plan for the park, in order to be achieved timely identification and appropriate response to eliminate the harmful effects.

- To deal with the problems, arising from the threats of anthropogenic origin, it is also recommended some assistance to municipalities in the neighboring settlements, in order that these problems are solved, through organizing awareness events, campaigns for better nature and development of tourism in the region.

## Conclusions

The investigated region is characterized by a number of threats, dominated by those with anthropogenic origin. Some naturally occurring successional changes during the years also have changed the habitats as well. The most dangerous for biodiversity and degradation of the habitats remain fires, erosion, poaching and introduction of foreign species.

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