

Floristic composition and current state of forest natural habitats in Natura 2000 protected site “Kamchia” (BG0000116)

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Abstract: The current state of the protected site “Kamchia”, a part of the European ecological network Natura 2000, was studied. Five types of forest natural habitats with codes 91E0, 91F0, 91G0, 91M0 and 92A0 were examined in floristic and phytocoenological aspect. One of them – 92A0 “*Salix alba* and *Populus alba* galleries” was not mentioned earlier for this area. Habitats with codes 91E0, 91F0, 91G0, 91M0 are strictly protected by the BERN CONVENTION. It was found that habitat 91F0 “Riparian mixed forests of *Quercus robur*, *Ulmus laevis* and *Ulmus minor*, *Fraxinus excelsior* or *Fraxinus angustifolia*”, along the great rivers (Ulmenion minoris) undergoes strongest anthropogenic impact. Totally 222 high plant species were recorded in the studied habitats, 7 of them with conservation status.

Key words: flora, forest habitats, EUNIS, Directive 92/43/EC, protected species

Introduction

PS “Kamchia” (BG0000116) is a part of the European ecological network Natura 2000, declared with a decree of the Council of Ministers of the Republic of Bulgaria Nr. 802/04.12.2007 (STATE GAZETTE Nr.107/2007). According to the DIRECTIVE 92/43/EEC/ and DIRECTIVE 2009/147/EC it is a Protected Area with the name “Complex Kamchia” (BG0002045). The literature review shows that there is one preceding investigation of the flora of the studied territory and more investigations of the vegetation with a stress on riparian forests (PENEV 1984, IVANOV et al. 2002, PEEV et al. 2003, GEORGIEV 2004, 2008, RUSEV 2004, ZHELEV & YURUKOV 2004). Having in mind the recent global climate changes, as well as the changes in the floristic composition and structure of phytocoenoses in the last 20 years, the aim of the present study is to assess the current state of forest natural habitats in the PA.

Material and Methods

The studied PS “Kamchia” occupies an area of 129 199.37 dka and includes a nature reserve with the same name. It lies in the easternmost parts of the Kamchiya river valley and the foothills of Stara Plaina (Balkan Range) reaching the Black Sea. The zone covers the territories on the riverbanks of Kamchiya, starting from Grozdyovo village in the west and finishing with the river mouth at the Black Sea in the east. The orography of PS “Kamchia” is variable – it is plain along the Kamchiya river and becomes hilly in the north and south direction. On the entire territory of the site, longer or shorter ravines are deeply jugged into the rock fundament, thus forming steep and very steep slopes. The studied region belongs to the Continental-Mediterranean climatic area, Black Sea climatic sub-area and Northern Black Sea climatic region (VELEV 2002, 2010). The climate is characterized by warm summer and mild winter, relatively small annual temperature

amplitude, and autumn-winter precipitation maximum and the absence of annual sustainable snow cover in regions out of the mountains. Annual precipitation amounts are between 500 and 1000 mm and the higher values are related to the ways of the Mediterranean cyclones. The soils are classified as belonging to Carpatho-Danubian soil region, and the East Balkan province (MALINOVA 2010). The predominant soil types are Luvisols, Chromic Luvisols, which form complexes with Rankers and Lithosols in some places. Fluvisols and Alluvial Fluvisols are also found in the region. Soils are mainly IV productivity class, characterized with acid reaction, poor, seasonal surface over-moisturising, erosion processes and shallow.

The field work was conducted in the period July-September 2011. Totally 37 phytosociological descriptions were performed in the typical plant communities on the territory of PS "Kamchia". The identification of habitats followed KAVRUKOVA et al. (2008) and BISERKOV (2015). Each natural habitat was checked also using EUNIS classification. Choosing of the places for description was done after visual evaluation of typical sectors within a plant community. The area of forest phytocoenoses description is 256 m² (16x16 m experimental plots – EP). Full floristic inventory of communities was done for each plot. Projective cover of each taxon was evaluated by percent coverage and abundance according to Braun-Blanquet scale (BRAUN-BLANQUET 1964). In cases of vertical fragmentation, the description of the floristic composition was done by vertical levels from top to bottom. GPS co-ordinates, including altitude, were scored for each description plot.

Because of well-known difficulties to determine some plant species during field work, herbarium material was taken for determination with the help of the „Handbook of vascular plants in Bulgaria” (DELIPAVLOV & CHESHMEDZHIEV 2011), Flora Reipublicae Popularis Bulgaricae, Vol. I-X (JORDANOV 1963-1989, VELCHEV 1982, 1989, KOZUHAROV 1995) and Flora Reipublicae Bulgaricae. Vol. XI (KOZUHAROV & ANCHEV 2012).

Cameral work included processing of data obtained from field work into tables according to the types of natural habitats with plant species divided by their biological types. For each species the experimental plot in which it has been found is marked and the relative abundance is shown. Species with conservation status were also identified according to national and international reference documents – Red List of Bulgarian vascular plants (PETROVA & VLADIMIROV 2009) and Plants and Fungi volume

of the Red Data Book of the Republic of Bulgaria (PEEV 2015), BIOLOGICAL DIVERSITY ACT (ACT ON AMENDING AND SUPPLEMENTING 2007) with Appendices 3 and 4 amended in STATE GAZETTE 101/22.12.2015), DIRECTIVE 92/43/EEC/21.05.1992 for conservation of natural habitats and of wild flora and fauna. Among the international documents CONVENTION ON INTERNATIONAL TRADE IN ENDANGERED SPECIES OF WILD FAUNA AND FLORA (CITES 1973, or WASHINGTON CONVENTION), CONVENTION ON THE CONSERVATION OF EUROPEAN WILDLIFE AND NATURAL HABITATS Appendix I. (or BERN CONVENTION 1979), European Red List of Vascular Plants (BILS et al. 2011) and „1997 IUCN Red List of Threatened Plants” (GILLET & WALTERS 1998) were taken into account. For all species, the categories of threat were pointed out in the way in which they appear in the relevant documents.

Results

Below the floristic composition and phytocoenological peculiarities of studied forest natural habitats in PS "Kamchia" with general characteristics and description are presented as results from the conducted field investigations:

1. Alluvial forests with *Alnus glutinosa* and *Fraxinus excelsior* (*Alno-Padion*, *Alnion incanae*, *Salicion albae*) (91E0). EUNIS: G1.413 Southern Helleno-Balkan swamp alder woods. This habitat type is represented by riparian forests mainly with participation of *Alnus glutinosa*, which are on alluvial soils periodically flooded by the seasonal level of the river. Soils are rich, very moist to over-moist. These forests are situated along the lower currents of rivers from the Black Sea-Mediterranean basin. During the current study, seven phytocoenological descriptions were made in this habitat, two of which were in the Reserve Kamchia. Totally 76 species were found: 14 tree species, 12 shrub species and 49 grass plants;

2. Riparian mixed forests of *Quercus robur*, *Ulmus laevis* and *Ulmus minor*, *Fraxinus excelsior* or *Fraxinus angustifolia*, along the great rivers (*Ulmion minoris*) (91F0). EUNIS: G1.2232 Helleno-Balkan ash-oak-alder forests. This habitat represents riparian mixed deciduous forests, which are periodically flooded and are known with the vernacular name *longoz* (DIMITROVA et al. 2007). Soils in these forests dry-out between floods or remain over-moist depending on local terrain peculiarities. Species composition of plant communities is rich and they have complicated vertical structure. During the present study, seven phytocoenological

investigations were carried out, three of them in the Reserve Kamchia and totally 123 higher plants were recorded: 23 tree species, 16 shrubs and 84 grass species;

3. Pannonic woods with *Quercus petraea* and *Carpinus betulus* (91G0). EUNIS: G1.A1C31 Moesian mesophile oak-hornbeam forests. This habitat includes Pannonic moesophyllic forests with domination of *Quercus petraea* (Mattuschka) Liebl. and *Carpinus betulus* L. on fresh shallow soils. It occurs on shady and moist slopes and ravines. The habitat is not widely spread in the studied region and occurs on difficultly accessible areas with a big inclination. In the studied area for this habitat two phytocoenological descriptions were made, in which 12 tree species, 9 shrubs and 31 grass species were determined;

4. Pannonian-Balkanic turkey oak-sessile oak forests (91M0). EUNIS: G1.768 Moesio-Danubian thermophilous oak forests. This type of natural habitat is sub-continental xerothermic oak forests dominated by *Quercus cerris* L. and *Q. frainetto* Ten. which form the xerothermic oak belt between 150-600 (800) m a.s.l. In this habitat four phytocoenological descriptions were made and 11 tree species, 9 shrubs and 59 grass species were recorded;

5. *Salix alba* and *Populus alba* galleries (92A0). EUNIS: G1.3155 Rhodopine Mediterranean poplar galleries. This type of habitat was established for the first time in the PS "Kamchia" during the present study. The habitat includes riparian forest communities dominated by *Salix alba* L., *S. fragilis* L., *Populus alba* L. and *P. nigra* L. These communities are spread along the rivers on peat-torfaceous or alluvial over-moist soils. The habitat was recorded along both banks of the river Kamchiya, about 5-6 km from its outflow. Six phytocoenological descriptions were made for this habitat, including 12 tree species, 9 shrubs and 63 grass species. The number of recorded species in the six EP varied. In all EP sufficient number of typical species was found and allowed referring to this habitat type.

Amongst the species recorded from the studied area, seven were of a conservation importance. They are represented in Table 1 – conservation status (columns 3-5) and measures for protection (columns 9-12).

Discussion

The current study of habitat 91E0 proves its high nature conservation value. During the last decades, the water regime of Kamchiya river was changed

due to the building of the reservoirs Kamchiya and Tsonevo and led to the rapid decrease of the areas of this habitat, observed during the present study. This requires immediate measures for conservation and remediation of the habitat 91E0. The great floristic diversity in habitat 91F0 proves the high conservation value of the longoz forests and makes them prior for conservation. Due to the anthropogenic impact on this habitat in the studied region, the occurrence of numerous dangerous and strongly competitive invasive species was observed, such as *Robinia pseudoacacia* L., *Gleditsia triacanthos* L., *Acer negundo* L., *Amorpha fruticosa* L., *Morus alba* L. and *Phytolacca americana* L. During the last years the area of this type of natural habitat decreases rapidly (BISERKOV 2015). As in the case of habitat 91E0, the reservoirs Kamchiya and Tsonevo changed its water regime. The drainage system of the agricultural lands in the region of the village Staro Oryahovo caused the decrease of the level of underground waters in the studied territory. These changes, as well as the course of natural processes in the habitat, are among the reasons for decreasing of the areas of longoz forests and worsening of their state. Undesirable succession is observed in the communities, which is expressed by replacement of hygrophytes in phytocoenoses by more drought-resistant plant species. Urgent measures are necessary for the conservation and restoration of this natural habitat type, which was the main target for the declaration of the Kamchiya Reserve. In the present study negative anthropogenic impact was not determined in habitat 91G0, which is explainable by the difficultly accessible terrains. In the same time, our observations proved that habitat 91M0 was anthropogenically impacted and there an invasion of *Robinia pseudoacacia* was found. Degradation of the habitat 92A0 was recorded as a result from the anthropogenic activity (mainly recreation of large groups of people and fishing) which led to a significant occurrence of ruderal and invasive species in its composition, such as *Amorpha fruticosa*, *Urtica dioica* L., *Saponaria officinalis* L., *Artemisia vulgaris* L., *Aster amellus* L., *Arctium tomentosum* Mill., *Phytolacca americana* L., *Erigeron canadensis* (L.) Cronquist, *E. annuus* (L.) Pers., etc.

The **conservation value of the investigated types of natural habitats** on the territory of the PS "Kamchia" was assessed. All recorded natural habitats are included in Appendix 1 of BIOLOGICAL DIVERSITY ACT (2007) and DIRECTIVE 92/43/EEC. Four habitat types, namely 91E0, 91F0, 91G0 and 91 M0 belong to the group of strictly protected natural habitats in Europe, included in Appendix I

Table 1. Conservation status of the species of higher plants found in forest natural habitats on the territory of the Natura 2000 protected site „Kamchia”.

	Species	Conservation significance	Conservation measures taken		Number of lists in which species is included
			Red Data Book of the Republic of Bulgaria (2015)	Biodiversity Act (2002)	
1	<i>Asparagus</i> sp. div.*	-	-	+	1
2	<i>Cardamine penzesii</i> Ancev & Marhold	-	+	+	2
3	<i>Primula acaulis</i> (L.) L.*	-	-	+	1
4	<i>Leucogonum aestivum</i> L.*	-	-	+	1
5	<i>Ruscus aculeatus</i> L.*	-	-	+	1
6	<i>Sonchus palustris</i> L.	EN	-	+	2
7	<i>Symphytum tauricum</i> Willd.	EN	-	-	1
	Total	2	1	6	

Legend. Column 3: Categories after the Red Book of the Republic of Bulgaria (2015), Vol. I, Plants and Fungi: EN – endangered. Columns 4-5: The sign „+” means that the relevant taxon is included in appendix 2 of the Biodiversity Act (2002) or appendix 3 and 4 of the Act on amendment of the Act for Biological Diversity (2007), and these ones with the sign „*” are included in appendix 4. The sign „-” means that the relevant taxon does not appear in the relevant list.

of the BERN CONVENTION. All habitat types recorded during the current study are included in the 3rd volume of the Red Data Book of the Republic of Bulgaria (BISERKOV 2015). One of them is Critically Endangered, two are Endangered, one is Nearly Threatened and one is Vulnerable. This shows the high conservation value of PS “Kamchia” for both Bulgaria and Europe. Therefore, it is necessary to take strict measures for the conservation of these habitats and to keep favourable nature-conservation level there. The data obtained from the analysis of the **conservation status of the plant species** showed that seven species were with a threatened status. These data prove the conservation value of

the natural habitats, in which these protected species occur and we believe that exactly the specific ecological niches there have allowed their spreading and survival.

Conclusion

During the field work in the PS “Kamchia”, five types of forest natural habitats were examined and documented, one of them newly proved for the area – 92A0 *Salix alba* and *Populus alba* galleries. All recorded natural habitats are with important international and national conservational status and comprised of 222 vascular plants, seven of which with conservation value.

During the investigation of the natural habitats in the PS “Kamchia” it was found that habitat 91F0 “Riparian mixed forests of *Quercus robur*, *Ulmus laevis* and *Ulmus minor*, *Fraxinus excelsior* or *Fraxinus angustifolia*” along the great rivers (Ulmenion minoris)” was under strongest anthropogenic impact caused by the changed water regime of watersheds after reservoirs were built along the river stream of the river Kamchiya. Generally, the negative factors for all forest natural habitats in the PS Kamchiya were related to the changed water regime of the Kamchiya river, to the significant tourist invasion and pollution, as well as to the building of various facilities, hotel complexes, camping sites, restaurants, etc. All this led to changes in the ecological conditions of these habitats, mainly expressed in the xerophytization of some of them. Significant changes in their floristic composition were detected as a result of the occurrence of invasive and ruderal species. With the aim to decrease the negative impact of anthropogenic factors, it is necessary to apply a water regime management directed to achievement of a relative balance between surface and underground waters in the longoz forests. Sustainable management of the forest out of the reserve should be conducted following the recommendations of Natura 2000. It is necessary to regulate the tourist flow in mostly affected habitats, to stop the afforestations with non-indigenous tree and shrub species and to remove gradually the existing ones.

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