BIOLOGICA NYSSANA
11 (1) September 2020: 9-22
DOI: 10.5281/zenodo.4060283
13th Symposium on the Flora of Southeastern Serbia and Neighboring Regions

Natural values and concept of protection of the Nature park "Šargan-Mokra gora"

Original Article

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Abstract:

This paper presents the results of the research and valorization of natural values of the Šargan and Mokra Gora area, which were conducted by the expert team of the Institute for Nature Conservation of Serbia in 2005, 2008, 2015, 2016, and 2017. The area was protected in 2005 as Outstanding Natural Landscape "Šargan - Mokra Gora". In contrast, in 2008, the northwestern borders of the protected area were extended to include the sites "Ljuto Polje" and "Dobro Polje", and the type of protected area has also been changed from the Outstanding Natural Landscape to Nature Park. The paper further elaborates the results of the revision of natural values of the protected area, which has been done in 2015 for the purpose of harmonizing legal acts with the defined protection regimes according to the cadastre, and which has proposed a total protected area of 11,379.78 ha. Increasing the area under protection was aimed for the conservation of natural values, sustainable development, and proper management of the protected area.

Key words:
natural values, Nature Park Šargan-Mokra Gora, protection concept, protection regimes I, II and III.

Apstract:

Prirodne vrednosti i koncept zaštite Parka prirode „Šargan-Mokra gora"

U radu su prikazani rezultati istraživanja i valorizacije prirodnih vrednosti područja Šargana i Mokre Gore, koje je uradio stručni tim Zavoda za zaštitu prirode Srbije tokom 2005., 2008., 2015., 2016. i 2017. godine. Područje je stavljeno pod zaštitu 2005. godine kao Predeo izuzetnih odlika „Šargan - Mokra Gora", a 2008. godine proširena je granica zaštićenog područja na severozapadnoj strani lokalitetima „Ljuto polje" i „Dobro polje" i promenjena vrsta zaštićenog dobra iz Predela izuzetnih odlika u Park prirode. Prikazani su i rezultati revizije prirodnih vrednosti zaštićenog područja urađene 2015. godine za potrebe usaglašavanja zakonskih akata sa definisanim režimima zaštite po katastru, kojom je predloženo da ukupna površina pod zaštitom bude 11.379,78 ha. Povećanje površine pod zaštitom ima za cilj očuvanje prirodnih vrednosti, održivi razvoj i efikasno upravljanje zaštićenim područjem.

Ključne reči:
prirodne vrednosti, Park prirode „Šargan - Mokra Gora", koncept zaštite, režim I, II i III stepena zaštite

Received: October 08, 2019
Revised: April 30, 2020
Accepted: May 08, 2020

Introduction

The Šargan - Mokra Gora Nature Park is located on the territory of Užice municipality, in southwestern Serbia. It is situated between the massifs of Tara (1,544 m) and Zlatibor (1,359 m), including the Mokra Gora structural basin and part of the Kremna structural basin, as well as the rivers Kamišna, Bratešina, Beli Rzav, and Crni Rzav. It is bordered by the Tara National Park (site Zaovine) and the

Zlatibor Nature Park.

Šargan and Mokra Gora represent one of the phytogeographically most interesting areas of southwestern Serbia and possess special natural values. Based on these values, in 2005 the area was designated as an Outstanding Natural Landscape measuring 3,678.99 ha. The revision of the natural values in 2008 resulted in the increase of the protected area to 10,813.73 ha, and the type of protected natural area was changed to the Nature Park, with a protection regime III established in the expanded part of the protected area.

According to the Mid-Term and Annual Program for the Protection of Natural Resources and the Spatial Plan of the Special Purpose Area of the Tara National Park (Official Gazette of the RS, No. 100/10), which also included the area of Šargan and Mokra Gora, a legal obligation was introduced to evaluate the expanded area in detail. To revise natural values, a detailed multidisciplinary research was conducted in 2015, which slightly modified the outer boundary of the Nature Park. In addition, revaluation of existing sites was carried out along with the establishment of new sites with protection regimes I and II, in comparison with those defined by the Decree of 2005 and 2008. In the newly revised 2015 conservation proposal, the total area of this natural property was 11,379.78 ha (Ostojić et al., 2015).

The paper is based on the Protection Study of the Outstanding Natural Landscape "Šargan-Mokra Gora", of 2005, and the Protection Study of the Nature Park "Šargan-Mokra Gora" (Ostojić et al., 2015).

Material and methods

For valorization of natural values, field surveys were conducted to collect data and evaluate the data obtained. It is based on the national and international criteria for valorizing natural values.

Geological and hydrological characteristics have been selected according to general geological surveys of the area (Mojsilović et al., 1977, 1978; Olujić and Karović, 1986a, 1986b; Dimitrijevic, 1995 and others).

In order to obtain as complete a picture as possible of the natural values for each area studied, existing field and literature data were used and mapped in the field. Pursuant to the Rulebook on the Proclamation and Protection of Strictly Protected and Protected Wild Species of Plants, Animals and Fungi ("Official Gazette of the RS", Nos. 05/10, 47/11, 32/16 and 98/16) (hereinafter: Rulebook) and the Decree on the Control of Use and Trade in Wild Flora and Fauna (Official Gazette of the RS, No. 31/05, 45/05, 22/07, 38/08, 9/10 and 69/11) "strictly protected" and "protected wild species", as well as species that are collected and traded therein have been determined.

Endangered taxa have been determined on the basis of field research and analysis of the threat factors and effects on populations in the wild, as well as according to the Categorization of internationally accepted IUCN criteria 1. The findings of the endangered taxa in the territory of Serbia were also taken into account. Species that are on the preliminary Red list of flora of Serbia have also been selected (Stevanović (ed.), 2002).

For the determination of forest phytocoenoses, the modern nomenclature was used with the latest principles of the syntaxonomy of forest vegetation of Serbia, which were given in the editions: Vegetation of Serbia 2 (1) (Jovanović et al., 1997) and Vegetation of Serbia 2 (2) (Dinić et al., 2006).

Samplings of ichthyofauna were realized by the method of electrofishing to determine data on fish populations such as species composition, age structure, quantitative analyzes and other parameters.

In the study of amphibians and reptiles fauna, sites were carefully selected for analysis, which were adapted to the weather conditions conducive to the daily activities of the herpetofauna.

Ornithofauna studies were based on the analysis and presence of endangered species closely related to particular habitats. They were derived according to the international standard classification of landscape types (CORINE, 1990), which were adapted to Yugoslav conditions (Stevanović, V., Vasić, V., 1995).

The evaluation of the investigated area as a natural resource was carried out in accordance with the Rulebook on Criteria for Evaluation and Procedure of Categorization of Protected Areas ("Official Gazette of the RS", No. 97/15), and based on based on the traits such as autochthony, rarity, representability, originality, etc. These criteria reflect the state of the natural values and their spatial distribution in the field.

Results and discussion

The state and valorization of natural values

Geological characteristics

The Šargan-Mokra Gora Nature Park is situated in the area of the inland Dinarides tectonic unit, and it is built of magmatic, metamorphic and sedimentary rocks that have been created over a long geological history. The oldest rock masses in the structure of the Nature Park area are sediments, mainly carbonates of the middle and upper Triassic and Upper Cretaceous, and the most widespread are the Jurassic ultramafics.

In the long geological evolution of the carbonate mass of the Karst plateau of Tara and the peripheral parts of the peridotite massif of the nearby Plateau of Zlatibor, the tectonic movements caused the appearance of large blocks, which subsequently changed the original appearance to a large extent due to the erosion forces, and led to the formation of very dynamic relief (Cvijić, J., 1924/1991). General epeirogenic ascent of the Dinarides caused the appearance of deep-cut gorges and canyons in the area of Šargan and Mokra Gora and the split in the relief of Tusto brdo, Putno brdo, Kobilovac, Vao brdo, Njivičke kose, Tabačke kose, Skakavac, Đoga, Kozja stena and Viogor. Above these morphological units rise the peaks of Kršanjska glava (1424 m) (**Fig. 1**), Carevića vis (1426 m), Runjeva glava (1438 m), Gavran (1453 m), Iver (1478 m) and Zborište (1544 m), which is the highest peak of the Tara Mountain.

Fig 1. Kršanjska glava (1424 m), Photo: taken by camera drone

Hydrological characteristics

The hydrographic potential of the Šargan and Mokra Gora areas consists of groundwater, springs and karst springs, larger and smaller river flows and thermal mineral waters, many of which are captivated for the needs of water supply. The waters of the Mokra Gora structural basin flow into the Drina basin, whereas the waters of Kremna structural basin flow into the basins of Zapadna and Velika Morava. The watershed between the rivers Kamišna and Đetinja, that is, the Drina and Morava, is the Šargan mountain that separates these two structural basins. Springs and karst springs occur in the altitudinal zone of the peripheral area of Šargan, Tara and Viogor, as well as in river valleys at the intersection of the valley side and the valley floor.

The river network of the area consists of the Kamišna, Beli and Crni Rzav and their tributaries, the source-rivers of Đetinja (Bratešina and Konjska river) the Užice stream and a range of rather small rivers and streams, with numerous gorge valleys with rapids and waterfalls (Veliki and Mali Skakavac on Kamišna river), which represent interesting landscape units.

The characteristics of flora

The flora of this area was, for the first time, described by the famous Serbian botanist Josif Pančić in 1860. Pančić summarized his data in the capital work of the Serbian botany "Flora of the Principality of Serbia" (Pančić, 1874) and in the "Addendum to the Flora of the Principality of Serbia" (Pančić, 1884), in which he says that Mokra Gora has an environment rich in rare plants.

In his works, Pančić described several species hitherto unknown to science. Of the seven species described by Pančić himself, or together with the Italian professor of botany Roberto Visiani (1801-1878), as new to the science from this area (Visiani et Pančić 1862, 1866, 1870), five species still have the status of "good" or "undisputed" species. Pančić points out that the flora and vegetation of Mokra Gora are distinguished by the presence of an impressive number of serpentinophytes, which is a term referring to specialized plant species of the characteristic and striking features, unique, very striking appearance, the occurrence of which is conditioned by a specific serpentinitic bedrock.

The results of previous studies have shown that floristic richness and the diversity of the plant world of the Mokra Gora and Šargan area are reflected in the presence of 722 taxa from the group of higher-ranked plants, excluding moss species (Bryophyta) classified into 355 genera, or 92 families. It is assumed that the finite number of species is slightly higher. Of the total flora species in this area, 6.2% are endemic and subendemic taxa, indicating that it is an area characterized by a diverse flora of distinct autochthonous character and originality.

The largest number of endemics found in this area belongs to the group of Balkan endemics. Among the endemics, the most prominent are *Edraianthus jugoslavicus* Lakušić, *Micromeria croatica* (Pers.) Schott, *Halacsya sendtneri* (Boiss.) Dorfler, *Reichardia macrophylla* (DC.) Freyn, *Stachys anisochila* Vis. & Pančić, *Alyssum markgrafii* O. E.

Schulz ex Markgraf, *Scrophularia tristis* (K. Maly) Šilić, *Linaria rubioides* Vis. & Pančić, *Helleborus serbicus* Adamović, *Euphorbia pancicii* G. Beck, *Euphorbia glabriflora* Vis., *Lathyrus binatus* Pančić and others.

In the Mokra Gora area, 190 species are considered internationally and nationally important. According to the Rulebook on the Proclamation and Protection of Strictly Protected and Protected Wild Species of Plants, Animals and Fungi, 102 species of the Mokra Gora area are being protected, 14 of them as strictly protected and 88 as protected species. In the Mokra Gora area 17 species are protected according to the CITES Convention on the International Trade in Endangered Species of Wild Flora and Fauna, and 35 plant species are protected according to the Decree on the Control of the Use and Trade in Wild Flora and Fauna.

The preliminary Red List of Endangered Taxa of the Flora of Serbia (Stevanović, ed. 1997) contains 49 species recorded during the research. Also, the first volume of the Red Book of Flora of Serbia I lists *Rhaponticoides alpina* (L.) M.V.Agab. & Greuter) (**Fig. 2**), which grows only in Ograđenica above Mokra Gora. This species, in accordance with the Rulebook of the International Union for the Conservation of Nature (IUCN), has been categorized as the critically endangered taxon (CR) of the flora of Serbia.

Fig 2. *Rhaponticoides alpina*, Photo by: M. Niketić

The characteristics of vegetation

In terms of vegetation, the Mokra Gora and Šargan area belongs to the mesophilic western Balkan forests of sessile oak and hornbeam (*Querco-Carpinetum illyricum* Horv. et al. 1974) and beech forests of the *Fagenion illyricum* Horvat (1938) 1950 alliance.

In the extended and cultivated parts of Mokra Gora, forests of alder and willow grows of the *Salicion albae* Soo (1930) 1940 alliance. In the serpentinitic gorges surrounding Mokra Gora, in addition to streams and rivers, there is the community of *Salicetum eleagni* Moor 1958 em. Oberdorfer 1962, which is built by the gray willow.

On thermophillic slopes, however, with a deeper soil layer, the forests of oak (*Quercetum cerris* E. Vukićević 1966) are developed, while in the humid valleys of the lower region and on the slopes rising above the streams the mesophillic forests of sessile oak and hornbeam belonging to the association *Querco petraea – Carpinetum betuli* Rudski (1940) 1949 of the alliance *Carpinion betuli illiyrico-moesiacum* Ht. 1956 occur. The tree layer is composed of sessile oak (*Quercus petraea* (Mattuschka) Liebl.) and hornbeam (*Carpinus betulus* L.), while he herbaceous plant layer is mostly composed of: *Pulmonaria officinalis* L., *Aposeris foetida* (L.) Less., *Corydalis solida* (L.) Clairv., *Lunaria rediviva* L., *Epimedium alpinum* L. and other forest species. The presence of valley lily (*Maianthemum bifolium* (L.) F. W. Schmidt), a species that is extremely rare in Serbia and is regionally characterized as an endangered taxon (EN) is of particular importance.

On the mountains surrounding the Mokra Gora structural basin at altitudes of 700-800 m, sessile oak forests have been developed, building the *Quercetum montanum serpentinicum* B. Jovanović 1972 association. These are mostly degraded communities, developed on serpentinitic bedrock. The tree layer is dominated by sessile oak and in the ground layer semi-shrubs of winter heath (*Erica carnea* L.) and daphne (*Daphne blagayana* Freyer) occur. Steep slopes of Ograđenica and Tusto brdo (hill), occuring on shallow and rocky limestone, are overgrown with the *Ostryo carpinifoliae-Fraxinetum orni* Aichinger 1933 community built by South European flowering ash and the European hop-hornbeam. A characteristic of this floristically rich community is the presence of peony (*Paeonia officinalis* L.). It is a community of thermophilic, sub-Mediterranean character, which in addition to edifying species is also built by an abundance of shrub species such as: *Acer monspessulanum* L., *Evonimus verucosa* Scop., *Crataegus monogyna* Jacq., *Rhamnus saxatilis* Jacq, *Rosa canina* L. and others. The rocky forest glades overgrown with smoke bush, especially on the Ograđenica plateau, are very important since

they include endangered or rare species: *Frangula rupestris* (Scop.) Schur, *Paeonia officinalis* L., *Phyteuma orbiculare* L., *Rhaponticoides alpina* (L.) M.V.Agab. & Greuter, *Lathyrus binatus* Pančić, etc.

The forests of European black pine develop on serpentinite, and in the Mokra Gora area two associations, *Erico-Pinetum nigrae serpetinicum* (Z. Pavlovic 1951) B. Jovanović 1972 and *Ostryo-Pinetum nigrae* Čolić 1965, occur. Pine forests with winter heath (*Erico-Pinetum nigrae serpetinicum*) distribute all over Šargan and Viogor, as well as in the gorges and slopes descending towards Mokra Gora structural basin. These are light forests, where the ground layer is composed of winter heath (*Erica carnea* L.) and of European blueberries (*Vaccinium myrtillus* L.) at higher altitudes. The frequently occurring herbaceous plants in these forests are *Asplenium cuneifolium* Viv., *Potentilla malyana* Maly, *Stachys scardica* (Griseb.) Hayek, *Veronica chamaedrys* L., *Centaurea triumfetii* All. and others. In more thermophillic and rocky sites grows spurge (*Euphorbia glabriflora* Vis.), while the steep slopes are almost 100% grown with *Sesleria serbica* (Adamovic) Ujhelyi, protecting them from erosion.

On the slopes of the entrance part of the Beli Rzav gorge, Tusto brdo and Vao peak, there is an another association of European black pine forests (*Ostryo-Pinetum nigrae* Čolić 1965) (**Fig. 3**). This association is composed of European black pine (*Pinus nigrae* Arn.) and hop hornbeam (*Ostrya carpinifolia* Scop.), in addition to which *Fraxinus ornus* L., *Rhamnus fallax* Boiss., *Juniperus communis* L. and others also occur in the community. This community is distinctively xerothermophilic, developed on limestone bedrock and on poor and shallow soil.

Beech communities consisting of *Fagetum moesiacae montanum* Bleč. et Lakušić 1970 and *Fagetum submontanum moesiacum* (Rudski 1940) B. Jovanović 1967 are developed in several places, whereby the largest areas of their distribution are the limestone soils of Tusto brdo at the altitudinal range of 600 to 1100 m.

The vegetation of rocky terrains and serpentinitic gorges is built by the communities of the alliances *Centaureo – Bromion fibrosi* Blečić et all.1960 and *Potentillion visiani* H. Ritter-Studnička 1970 of the order *Halacsyetalia sendtneri* H. Ritter-Studnička 1970, which is a unique type of vegetation of serpentinitic ground.

Steep sites of serpentinitic gorges and steep serpentinitic rocky terrains of the Mokra Gora area are overgrown with the community *Festuco duriusculae – Euphorbietum glabriflorae* S. Jov. et R. Jov 1992., which has also been described in Zlatibor (Jovanović et al., 1992). The endemic, decorative *Euphorbia glabriflora* Vis. is dominant in this community, and this community consists of about one hundred plant species, the most frequent of which are *Festuca duriuscula* L., *Galium purpureum* L., *Teucrium montanum* L., *Thymus jankae* Celak. and others. The particular importance of the community is reflected in the presence of endemic taxa such as *Halacsya sendtneri* (Boiss.) Dorfler, *Stipa novakii* Martinovsky, *Genista friwaldskyi* Boiss, *Iris reichenbachii* Heuffel and other species. In gorges and canyons, the presence of numerous hazmophytic communities that develop in the crevices and recesses of the rocks is recorded. These areas are dominated by communities of the order *Asplenietea trichomanis* Br.-Bl. 1934 corr. Oberd. 1977 that are particularly well developed in serpentinitic gorges. On the other hand, the main characteristic of the vegetation of serpentinitic rocks are endemic serpentinophytes *Halacsya sendtneri* (Boiss.) Dorfler and *Drymocallis malacophylla* (Borbás) Kurtto. The two species are basic builders of the characteristic association *Halacsyo sendtneri-Potentilletum mollis* Pavlović 1955, which is particularly well developed in the Kamišna river gorge and on the cliffs of Kozja stena. Beli Rzav canyon is one of the characteristic sites where the rock vegetation is well developed (**Fig. 4**).

Fig. 3: The association of European black pine forests (*Ostryo-Pinetum nigrae*) at the Šišatovac site, Photo: V. Nikolić

The vegetation of talus slopes (scree) occurs in the forest belt of oak and oak-hornbeam on limestone or serpentinitic bedrock. This vegetation consists of herbaceous plants, the roots of talus slopes grasses, or plants that look

Fig. 4: Vegetation of rocks in Beli Rzav canyon, Photo: taken by camera drone

Fig. 5: Vegetation of the talus slopes and rocks on Ograđenica, Photo: Photo documentation of the Institute for Nature Conservation of Serbia

like low shrubs with very long semi-woody, creeping shoots that bind loose scree. It is a common occurrence that the vegetation of rocks and talus slopes is found in the same site, as is the case on Ograđenica (**Fig. 5**). The vegetation of limestone talus slopes is represented by the community of *Corydaletum euochroleucae* B.Tatić et B. Atanacković 1972 and the community of *Saturejo montanae-Achnatheretum calamagrostis* R. Jovanović et S. Jovanović 1986. Of particular importance is the occurrence of the species *Reichardia macrophylla* (DC.) Freyn, an endemic species of the southwestern part of the Balkan Peninsula, whereas the special characteristic of this vegetation is the occurrence of endemorelic species *Halacsya sendtneri* (Boiss.) Dorfler on the limestone.

The vegetation of serpentinitic talus slopes consists of roots of talus slope grasses, primarily the roots of *Achnatherum calamagrostis* (L.) Beauv. and medium-high endemic serpentinophytes: *Scrophularia tristis* (K. Maly) Šilić, *Alyssum markgrafii* O. E. Schulz ex Markgraf and *Linaria rubioides* Vis. & Pančić. In these habitats often develop the brushwood of *Cotinus coggygria* Scop., which is formed by the suppression of forests.

The characteristics of fauna

Within the boundaries of the protected area, a total of 6 species of fish from 3 families were recorded, namely: brown trout (*Salmo trutta* Linnaeus, 1758) from the trout family (fam. Salmonidae), bleak (*Alburnoides bipunctatus* Bloch, 1782), Danube barbel (*Barbus balcanicus* Kotlík, Tsigenopoulos, Ráb & Berrebi, 2002), Eurasian minnow (*Phoxinus phoxinus* Linnaeus, 1758), European chub (*Squalius cephalus* Linnaeus, 1758) from the carp family (fam. Cyprinidae) and European bullhead (*Cottus gobio* Linnaeus, 1758) from the family Cottidae (**Fig. 6**).

In terms of fish diversity in watercourses, the most species were recorded in Beli Rzav (5 species - brown trout, bleak, Danube barbel, European chub and bullhead), followed by Kamišna river (3 species - bleak, Danube barbel and European chub), Bratešina river (2 species – Danube barbel and Eurasian minnow) and Dubošac (1 species - Danube barbel). Of the total of 6 species of fish recorded in the waters of this area, only European bullhead has the status of strictly protected species according to the Rulebook on the Proclamation and Protection of Strictly Protected and Protected Wild Species of Plants, Animals and Fungi, while 4 species have the status of protected wild species, namely: brown trout, bleak, Danube barbel and European chub.

The only source of data related to earlier research of batrachofauna and herpetofauna of Šargan and Mokra Gora were data collected by Radovanović (1951), as well as data collected during surveys conducted in the surrounding areas (Tara National Park) in 2002 and 2003. A total of 17 amphibian and reptile species (eight species from the Amphibia

Fig. 6: European bullhead (*Cottus gobio*), Photo: N. Sekulić

class and nine species from the Reptilia class) have been recorded in the Šargan and Mokra Gora. In the lower bed of the Kamišna river canyon horned viper *Vipera ammodytes* Linnaeus, 1758 has been recorded, whereas in the upper course of the river the yellow-bellied toad (*Bombina variegata* Linnaeus, 1758) has been recorded in several sites. The twelve recorded species are strictly protected, while two species have the status of protected wild species pursuant to the Rulebook on the Proclamation and Protection of Strictly Protected and Protected Wild Species of Plants, Animals and Fungi. Of the 12 strictly protected species, 7 species are from the genus Amphibia - amphibians, of which two species belong to the tailed amphibians: fire salamander (*Salamandra salamandra* Linnaeus, 1758) and smooth newt (*Lissotriton vulgaris* Linnaeus, 1758), the other five species belong to the order of tailless amphibians (frogs): yellow-bellied toad (*Bombina variegata* Linnaeus, 1758), common toad (*Bufo bufo* Linnaeus, 1758), green toad (*Pseudepidalea viridis* Laurenti, 1768), Greek stream frog (*Rana graeca* Boulenger, 1891), and agile frog (*Rana dalmatina* Fitzinger, 1838). The remaining 5 strictly protected species are from the genus Reptilia - reptiles and all species belonging to the snakes group (Serpentens): Aesculapian snake (*Zamenis longissimus* Laurenti, 1768), smooth snake (*Coronella austriaca* Laurenti, 1768), grass snake (*Natrix natrix* Linnaeus, 1758), dice snake (*Natrix tessellata* Laurenti, 1768) and common European viper (*Vipera berus* Linnaeus, 1758). Considering the threat to these species, all species are on the list of the Red Book of Fauna of Serbia I - Amphibians (Kalezić et al. 2015) and the Red Book of Fauna of Serbia II - Reptiles (Tomović et al. 2015).

The initial ornithological survey of the wider area of Šargan and Mokra Gora was carried out by the ornithologist Othmar Reiser during July 1899. Based on the surveys conducted so far in the Nature Park "Šargan - Mokra Gora", 120 bird species have been recorded, which, if compared with the bird diversity in the whole of Serbia including 352 species (Šćiban et al., 2015), represents 34% of the total bird diversity in Serbia.

Most species of birds in Šargan and Mokra Gora (101 species) are strictly protected according to the Rulebook on the Proclamation and Protection of Strictly Protected and Protected Wild Species of Plants, Animals and Fungi, which includes the prohibition of killing, collecting eggs, disturbing nesting sites and other activities that may endanger the survival of these species. A total of 18 bird species are protected, which is regulated, in addition to the aforementioned Rulebook, also by the Rulebook on the Closed Season for Protected Game Animal Species (Official Gazette of RS, No. 75/2010). This group also includes game animal species such as quail, partridge, pheasant, mallard, wood pigeon and turtle dove.

The importance of the area is reflected in the presence of nationally and internationally important species, as well as in the presence of vulnerable and endangered species closely related to particular habitats, which primarily refers to species such as: golden eagle (*Aquila chrysaetos* Linnaeus, 1758), the short-toed snake eagle (*Circaetus gallicus* Gmelin, 1788), peregrine falcon (*Falco peregrinus* Tunstall, 1771), capercaillie (*Tetrao urogallus* Linnaeus, 1758), corn crake (*Crex crex* Linnaeus, 1758), the collared flycatcher (*Ficedula albicollis* Temminck, 1815), the red-breasted flycatcher (*Ficedula parva* Bechstein, 1794), willow tit (*Parus montanus* Conrad von Baldenstein, 1827) and the wallcreeper (*Tichodroma muraria* Linnaeus, 1758).

At the international level, the birds of Šargan and Mokra Gora are protected by various international conventions and directives. In this area, 23 species are listed in Appendix I of the European Birds Directive (209/147/EC), according to which EU Member States are required to designate Special Protected Areas (SPAs) for the purpose of these birds protection.

Available professional and scientific papers (Petrov, 1992; Savić et al., 1995; Paunović and Milenković, 1996; Kryštufek, et all., 1997; Savić et all., 1997; Marinović, 1997; Paunović et al., 2011), as well as the results of field surveys of the Institute for Nature Conservation of Serbia in the area of Šargan and Mokra Gora, indicate that this area is

permanently or occasionally inhabited by at least 49 mammal species, which makes up about half of the number of species registered so far in Serbia. It is considered that this number is not definitive, given the still poor exploration of the whole space and individual groups.

The largest group consists of bats (Chiroptera) and rodents (Rodentia), with 13 species of each order. All species of bats in Serbia have the status of strictly protected species according to the Rulebook on the Proclamation and Protection of Strictly Protected and Protected Wild Species. As far as rodents are concerned, there are three strictly protected species in this area: lesser mole-rat (*Spalax leucodon* Nordmann, 1840), forest dormouse (*Dryomys nitedula* Pallas, 1778) and hazel dormouse (*Muscardinus avellanarius* Linnaeus, 1758), as well as two protected species: squirrel (*Sciurus vulgaris* Linnaeus, 1758) and edible dormouse (*Glis glis* Linnaeus, 1766).

They are followed by carnivores (Carnivora) with 11 species and species of the order Eulipotyphla - 8 of them. All these species fall into the category of "protected species", with the carnivores such as otter (*Lutra lutra* Linnaeus, 1758) and the brown bear (*Ursus arctos* Linnaeus, 1758), and "shrew-form" (*Neomys fodiens* Pennant, 1771), which are classified as "strictly protected species" according to the same Rulebook.

The fauna of carnivores in the Mokra Gora and Šargan currently includes the following species: wolf (*Canis lupus* Linnaeus, 1758), golden jackal (*Canis aureus* Linnaeus, 1758), red fox (*Vulpes vulpes* Linnaeus, 1758), brown bear (*Ursus arctos* Linnaeus, 1758), least weasel (*Mustela nivalis* Linnaeus, 1766), European polecat (*Mustela putorius* Linnaeus, 1758), European pine marten (*Martes martes* Linnaeus, 1758), beech marten (*Martes foina* Erxleben, 1777), badger (*Meles meles* Linnaeus, 1758), otter (*Lutra lutra* Linnaeus, 1758) and wildcat (*Felis silvestris* Schreber, 1775). To the smallest group belong the ungulates (Artiodactyla) with 3 species: wild boar (*Sus scrofa* Linnaeus, 1758), chamois (*Rupicapra rupicapra* Linnaeus, 1758) and roe deer (*Capreolus capreolus* Linnaeus, 1758). Lagomorphs (Lagomorpha) are represented with 1 protected species - European hare (*Lepus europaeus* Pallas, 1778).

The characteristics of "Šargan - Mokra Gora" Nature Park

The results of research and valorization of natural values of the area of Šargan and Mokra Gora have shown that it is characterized by the following core values that account for its status of a Nature Park and its protection regimes:

- **Originality (Autochthonous character)** – the area is relatively well conserved and without significant and visible negative human intervention. A special characteristic of this area is the geological bedrock in the form of old masses of magmatic, sedimentary and metamorphic rocks, which were formed as a result of long geological history, and on which the especially rare and specific natural values of biodiversity were formed. The combination of fragments of high plains on watersheds with pastures and high pine trees of steep valley sides and deep-cut river valleys overgrown with dense centuries-old forests and here and there narrowed settlements give this area a distinct feature and specific beauty with a high degree of attractiveness. The pronounced presence of Scots pine and black pine forests, in the form of pure and mixed stands, is a distinguishing feature of the autochthonous habitat, and thus more rapid and qualitative forest restoration. An example of a particularly important conserved old forest complex is the site "Jelovac - Šišatovac", in which a rare and endangered western capercaillie and other characteristic species of old black pine forests have been recorded.
- **Representativeness** – is reflected in the presence of large complexes of coniferous and mixed forests, certain representatives of flora, fauna and vegetation. In addition, this area is best represented by the species of plants that Pančić first described here for science. On limestone rocky grounds and rocks, Pančić discovered *Stachys anisochila* Vis. & Pančić), and on serpentinitic rocky grounds he discovered *Haplophyllum boisserianum* Vis. & Pančić, *Linaria rubioides* Vis. & Pančić, *Euphorbia glabriflora* Vis. and *Potentilla visianii* Pančić.

  Strictly protected species of ichthyofauna – European bullhead is an important resident of the waters of Beli Rzav. Representatives of the insectivore fauna are the Eurasian water shrew and mountain shrew, while the representatives of rodent fauna are: lesser mole-rat, forest dormouse and hazel dormouse. Notable representatives of the carnivorous fauna are the brown bear and otter, as strictly protected species. The main brown bear habitats are in the Beli Rzav canyon, the sites Tusto brdo and Vao limestone hill. Otter is a resident of mountainous, conserved, permanent watercourses of Beli Rzav, Crni Rzav and Kamišna.
- **Rareness** – is expressed in highly conserved and pronounced biodiversity in a relatively small protected area. The criterion is evident in the distribution of natural black pine habitats on serpentinite, which are singled out as rare habitats in Serbia.

On the limestone massif of the site "Ograđenica" the only habitat of *Rhaponticoides alpina* (L.) M.V.Agab. & Greuter in Serbia has been identified, which is a natural rarity in the category of critically endangered taxa (CR), the population of which is estimated at only a few specimens. In the mesophillic oak and hornbeam forests a species that is extremely rare in Serbia has been recorded, namely *Maianthemum bifolium* (L.) F. W. Schmidt. Rare representatives of the animal world are mountain Eurasian water shrew and mountain shrew, wildcat and chamois. Concerning the presence of rodents, there is forest dormouse, a rare species that inhabits thermophillic deciduous forests with a rich bush layer and rocky grounds within this layer, and with one typical habitat on the site "Ograđenica".

- **Diversity is pronounced in landscape features** - deep-cut gorges, canyons, and dissected plateaus. The richness of species and ecosystem diversity is reflected by the presence of 722 species of vascular flora, classified into 355 genera or 92 families, 10 most represented and most important communities of forest ecosystems, 7 representative communities of the vegetation of rocks, talus slopes and rocky terrains. The importance of floristic diversity is further enhanced if it is known that a small area contains 22% of the total number of Serbian flora, of which 6.2% of the area's flora consists of endemic and subendemic taxa that represent a rare, specific from the point of biodiversity conservation view, and an extremely valuable group of obligate serpentinophytes. Particularly valuable in terms of floristic features are the extremely rare serpentinophyte communities occurring on the rocky terrains with *Festuco duruusculae-Euphorbetum glabriflorae* and in the gorges with *Potentillo-Halascyetum sentdneri*, as well as the hazmophytic community of endemic *Edraiathion* alliance on limestone, in which the endemic taxa form unique phytocoenological combinations. The fauna of this area is characterized by six (6) species of fish, 17 species of amphibians and reptiles, 120 species of birds and 49 species of mammals. Most registered species and builders of determined communities have legal protection status, since they represent endemic and relict taxa and communities, as well as rare and endangered plant and animal species that inhabit different, mosaically distributed habitats such as: forests, pasture-meadows, rock habitats and rocky terrains, as well as aquatic habitats.
- **Integrity** – The Nature Park represents a whole in the geographical and geomorphological terms. It is mostly bounded by natural watersheds that separate it from adjacent river basins, which makes it a geomorphologically well-individualized area, and thus the defining of protection borders is made much easier.
- **Beauty/aesthetics criterion** – the beauty/aesthetics of the area of Šargan and Mokra Gora is evidenced with the exceptional seasonal dynamics and vividness of colors, the mosaic shift of the diverse rural-pastoral ambiental sequences and the specific architecture of each of the railway station complexes, as well as by Drvengrad. An additional beauty of this area is given by the narrow-gauge heritage railway "Šarganska Osmica" (Šargan Eight), which has become famous for its technical solution of overcoming a great altitude difference at a short distance.
- **Conservation** – natural landscapes and forest complexes in the protected area are an important factor in the conservation of ecosystem services, environmental elements, and are a significant renewable natural resource. This picture is complemented by the exceptionally conserved watercourses of the area, which is confirmed by the specific fish fauna that inhabits them (brown trout, southern barbel/gudgeon, European bullhead, chub, etc.).
- **The monumental heritage** of Šargan and Mokra Gora is unique in the wider region. The ethno - settlement Drvengrad on Mećavnik, which although recently built, seems to have been here for centuries, also gives an exceptional cultural value to the area.

The concept of protection and protection regimes

Taking into account the state in the field, protection objectives and legislation, the concept of protection of the Nature Park "Šargan - Mokra Gora" is based on conservation of natural and created values. For this reason, protection regimes I, II and III have been established in this area.

The total protected area is 11.379,78 ha, within which special spatial units with protection regimes I, II and III have been established. Protection regimes I and II cover the most valuable and conserved natural values and specific features of the area at 3,889.70 ha.

As a starting point for establishing the protected area, a Study on Protection was prepared as a professionally documented basis for initiating protection. The mentioned study was submitted to the Ministry of Environmental Protection, which informed the public about the procedure for initiating protection of the natural area on the Ministry's website. With this, the area of 11,379.78

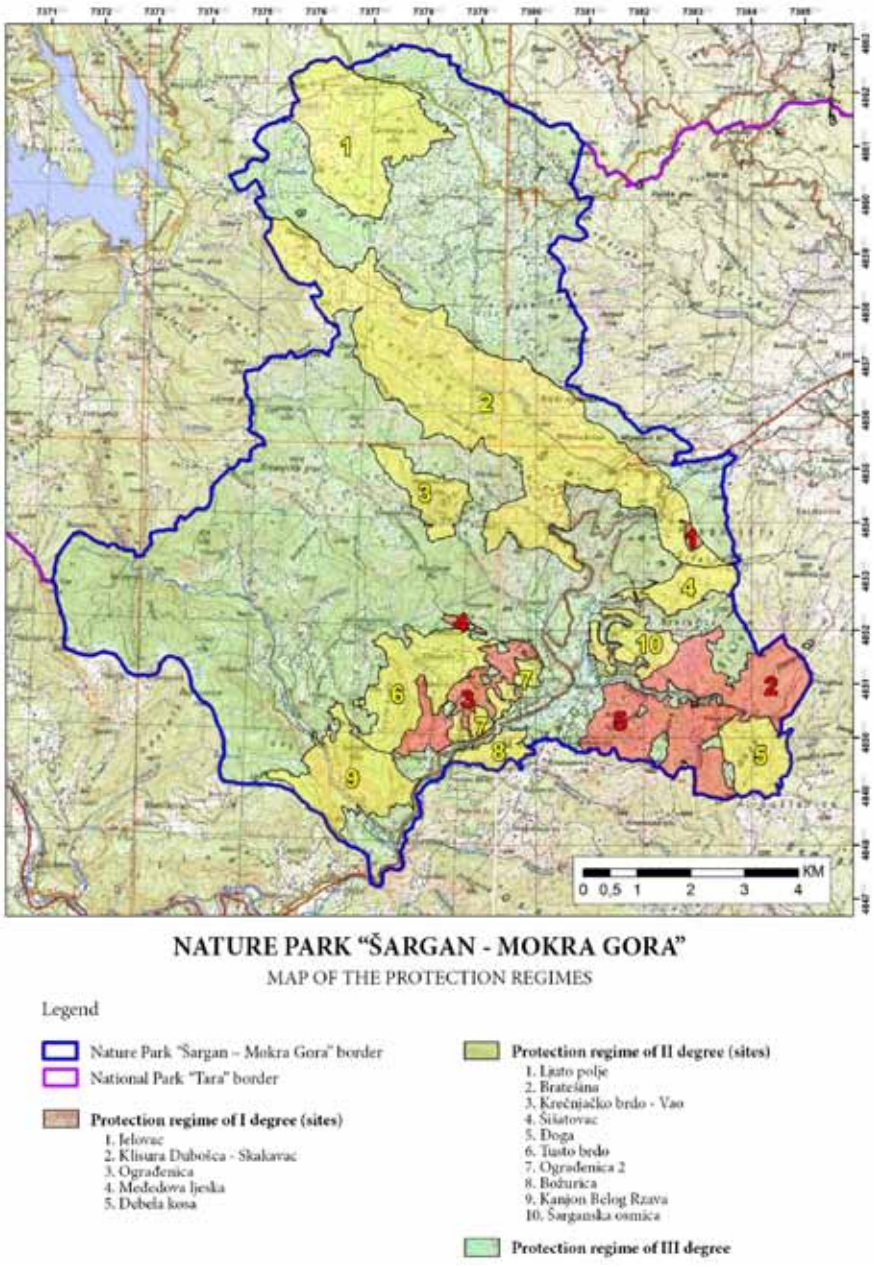

Fig. 7: Area proposed for protection in 2015, with the external border, protection regimes and sites under certain regimes, Map: D. Kaličanin

ha is considered protected according to the Law on Nature Protection (Official Gazette of the RS, Nos. 36/09, 88/10, 91/10 - correction and 14/16) (**Fig. 7**).

Following the revision of the natural values of the protected area, in 2015, the area under protection regime I was increased from 414.84 ha to 774.50 ha (6.81% of the total protected area). The regime of protection is prescribed in five isolated sites within the protected natural area, of which 4 sites have previously been selected. These are:

Site "Jelovac" is situated in the eastern part of protected area. Upon revision, its acreage has been decreased and is now 11.31 ha. The site is overgrown with tall, medium-age, well-tended forest of European black pine (*Erico-Pinetum nigrae* (Z. Pavlović 1951) B. Jovanović 1972), which is a typical representative of the pine forest on the serpentinic bedrock of Šargan mountain.

"Klisura Dubošca-Skakavac" (Dubošac gorge-Skakavac) covers an area of 271.34 ha. Part of this site is within the previously designated site in the protection regime I "Klisura Dubošca" (Dubošac gorge) (area 106.01 ha). The gorge is located in the southeast part of the protected area and it is deeply cut into the serpentinitic massif. The Skakavac waterfall, in the Kamišna river bed, about 12 m high, is particularly prominent in this area. The steep sections of the entrance to this gorge contain imposing, solitary and very old specimens of European black pine, which together with hop hornbeam build the association *Ostryo-Pinetum nigrae* Čolić 1965.

Site "Ograđenica" is a site that previously covered 73.12 ha and was expanded to 164.67 ha after the revision. It is located in the southern part of the protected area. It is a limestone ridge surrounded by serpentinites, and in some way, has an island character regarding the distribution of a number of flora and fauna species that are ecologically related to thermophillic limestone forests, carbonate rocky terrains and talus slopes.

Site "Međedova ljeska" covers an area of 8.35 ha, prior to the revision of the protection regime I it was established at 123.98 ha. It is located in the southern part of the protected area and at the far southwestern point it is in contact with the site "Tusto brdo" in the protection regime II, which is in the immediate vicinity of the plateau of Ograđenica, from which it differs in orographic terms and therefore in vegetation. It is a typical example of

a combination of thermophilic oak and mesophilic beech habitats in a relatively small area.

Site "Debela kosa" is a newly selected site under the protection regime I, which covers an area of 318.83 ha. It is located in the southeast part of the protected area. It is overgrown with tall forest of European black pine (*Erico-Pinetum nigrae* (Z. Pavlović 1951) B. Jovanović 1972 and *Euphorbio glabriflorae-Pinetum nigrae* Pavlović, 1952) on the primeval humus-silicate soils of the peridotite and serpentinite bedrock.

According to the Decree on the protection of Outstanding Natural Landscape "Šargan - Mokra Gora" ("Official Gazette of RS", No. 52/05), the area under protection regime II covered 1,187.46 ha. Upon revison in 2015, this area was increased to 3,124.70 ha (27.46% of the total protected area) and the protection regime II was established at ten isolated sites within the protected area:

Site "Šišatovac-Jelovac" has previously been called Šišatovac, which now covers 105.69 ha. It is located in the eastern part of the protected area, and is overgrown with high forests of black pine (*Erico-Pinetum nigrae* (Z. Pavlović 1951) B. Jovanović 1972), which are young, of an extremely dense canopy cover and with a large amount of residual felling (timber stock).

Site "Đoga" is part of the former site "Đoga - Kozja stena", covering an area of 148.66 ha. This site is in the far southeast of the protected area. The steep slopes and the massive remnant rocks of the Đogo ridge are dominated by giant black pine trees of umbrella-like tree crowns.

Site "Krečnjačko brdo Vao" (Limestone hill Vao) covers an area of 130.61 ha. It is located in the central part of the protected area and has been reduced in size upon the revision. It encompasses the deep-cut and heavily accessible valleys of the Grubiševac and Suvodol streams. The foothill of this site is covered with communities of hay meadows (*Festuco-Brometea*), which are characterized by the presence of different species of clover and legumes, which makes them economically important. At higher altitudes, meadow enclaves are replaced by the beech forests of *Fagetum moesiacae montanum* Bleč. et Lakušić 1970 of good quality with trees of seed origin and pronounced dendrometric characteristics.

Site "Tusto brdo" formerly part of the site "Tusto brdo - Božurica", which upon the revision has been divided into "Tusto brdo" and "Božurica", covers 298.73 ha. It is located in the southern part of the protected area. In terms of vegetation, this site is covered with man-grown cultivated mixed stands of black pine and Scots pine, which at their age of about 60 years according to structure, cenotic composition and stability, are very similar to the natural forests of Scots pine and black pine (*Pinetum sylvestris-nigrae typicum* Pavlović, 1952).

Site "Božurica" covers 64.04 ha, and it is located in the southern part of the protected area. One part of this landscape unit is covered with man-grown black pine (*Pinetum nigrae*) stands on different brown soils, while the other part is covered by mountain beech forest (*Fagetum moesiacae montanum* Bleč. et Lakušić 1970) on different brown soils.

Site "Ljuto polje" is a newly selected site located in an extended part of the protected area, in the far northern part of the protected area, with a total area of 503.53 ha. It is a karst field with pronounced forms of karst micro-relief, the natural characteristics of which are contained in the mixed forests of spruce and Scots pine that are unique in the Mokra Gora area. Also, numerous mires are important as habitats of priority for protection at the national and international levels.

Site "Bratešina" is a newly declared site of 1,396.52 ha. This is the largest site in the protected area, which is located in its central part, whereas in its southeastern part there is a site of the first degree of protection "Jelovac". The basic vegetation of this site consists of forests of black pine (*Erico-Pinetum nigrae* (Z. Pavlović 1951) B. Jovanović 1972 and *Euphorbio glabriflorae-Pinetum nigrae* Pavlović, 1952) on initial humus-silicate soils on peridotites and serpentinites, as well as pine forests (*Orno-Ericion* Horvat, 1959 and *Orno-Pinion* Em, 1978) on soils formed on base rocks.

Site "Ograđenica 2" is a new site measuring 79.93 ha. Part of this site was within the previously declared site in protection regime II "Tusto brdo - Božurica", and is surrounded on the north, west and southwest side by a limestone massif, that is, the site in the protection regime I "Ograđenica". Considering the geomorphological, vegetational and ambient features of the part of Ograđenica, it represents a buffer zone around the area under protection regime I and it physically encircles the entire area of the massif.

Site "Kanjon Belog Rzava" (Beli Rzav canyon) is a new site of 279.77 ha. It is located in the southernmost part of the protected area. In terms of vegetation, this site is very diverse, at higher elevations, there are the specimens of magnificent, single, black pine trees, as remnants of former natural black pine forests.

Site "Šarganska osmica" (Šargan Eight) is a new site of 117.22 ha. It is located in the southeast part of the protected area. This site is overgrown with pine forests (*Orno-Ericion* Horvat, 1959 and *Orno-Pinion* Em, 1978) on soils formed on base rocks. The forests in this site are in one part natural

tall black pine forest, while the rest of these forests are cultivated.

The protected area under the protection regime III occupies a total of 7,480.58 ha (65.73% of the total protected area). Compared to the initial protection of the area from 2005, the areas under the protection regime III were increased from 2,138.77 ha to 5,341.81 ha.

Conclusion

Due to its geographical location, geological bedrock, hydrographic features, orography, climate and historical development, the Mokra Gora and Šargan area is characterized by a diversity of species and ecosystems of exceptional originality. Orographic plasticity and the alternation of different geological bedrocks in a rather small area are certainly the most important reasons for the pronounced richness of flora and vegetation.

The relatively small area of Šargan and Mokra Gora is inhabited by 722 species of vascular flora, of which 6.2% of taxa belong to endemic and subendemic flora. There are 14 species in this area, which represent strictly protected species, as well as 88 protected species. From a scientific point of view, particular traits of this area are very rare endemic taxa adapted to the highly unfavorable serpentinitic bedrock. The largest number of endemics found in this area belongs to the group of Balkan endemics.

In terms of vegetation, the Šargan and Mokra Gora area is a natural habitat of black pine and Scots pine. These pines build pure and mixed stands, significant within large forest complexes. Forest ecosystems of Šargan - Mokra Gora Nature Park consist of 10 representative communities, namely: alder forests and willows of the *Salicion albae* Soo (1930) 1940 alliance, gray willow community (*Salicetum eleagni* Moor 1958 em. Oberdorfer 1962), Turkey oak forests on thermophilic slopes (*Quercetum cerris* E. Vukićević1966), mesophilic forests of sessile oak and hornbeam (Querco-Carpinetum moesicae Rudski (1940) 1949), type of sessile oak forest (*Quercetum montanum serpentinicum* B. Jovanović 1959), as well as the community of South European flowering ash and hop hornbeam (*Ostryo carpinifoliae-Fraxinetum orni* Aichinger 1933). Considering the pine forests, the most important are the two associations: pine forests with winter heath (*Erico-Pinetum nigrae serpetinicum* Krause 1957) on serpentinite and black pine forest with hop hornbeam (*Ostryo-Pinetum nigrae* Čolić 1965) on limestone. Beech forests of the types *Fagetum moesiacae montanum* Bleč. et Lakušić 1970 and *Fagetum submontanum* (Rudski 1949) B. Jovanović 1976 are distributed on the limestones of Tusto brdo.

The Mokra Gora and Šargan area is home to a rich and diverse wildlife. In the waters of this area, a total of six (6) fish species have been recorded, with five (5) species having protection status. Only European bullhead has the status of a strictly protected species, while four (4) protected species are: brown trout, spirlin/common bleak, southern barbel/gudgeon and chub. In addition, 17 species of amphibians and reptiles have been recorded in the area of Šargan and Mokra Gora. Of these, 12 species are strictly protected, two species are protected, while three species do not have protection status. The ornithofauna significance is reflected in the presence of 120 bird species, of which 101 species are strictly protected and 18 species are protected. The protected area is also characterized by 49 species of mammals, which makes up about half the number of species registered so far in Serbia.

The Šargan-Mokra Gora Nature Park, with its conserved natural landscapes, is a recognizable landscape through which runs the narrow-gauge railway Šargan eight, which is widely known for its remarkable technical solution of overcoming a great altitude difference at a short distance.

10 years upon the establishment of spatial protection, the conducted research, revision and revaluation of the natural values of Šargan and Mokra Gora, the boundaries of the protected area were expanded, the borders under the protection regimes were revised, new sites with the protection regimes I and II were established, with the proposed total protected area of 11,379.78 ha. With this proposal, the area under protection regime I is 774.50 ha (6.81% of the total protected area) and is located in five isolated sites. Under the protection regime II, the proposed area occupies 3,124.70 ha (27.46% of the total protected area) and is located in ten isolated sites, while the area with the protection regime III amounts to 7,480.58 ha (65.73% of the total protected area).

The concept of protection of the area is aimed at conserving the overall diversity, autochthonous character and originality of species and habitats, the sustainable and controlled use of natural values and rarities. The concept is implemented through three protection regimes and legal measures defining certain regimes. The Conservation Guidelines defined in the Conservation Study (Ostojić et al., 2015) aims to preserve and enhance the authenticity and autochthonous character of this area, which requires the cooperation of public institutions and civil society sectors.

All the mentioned features of the Šargan – Mokra Gora Nature Park make it one of the most important natural resources for biodiversity conservation in Serbia. Based on the valorization of the state of natural values, the area meets the criteria of the protected natural area in the Nature Park category.

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