

Birds of the Matešev – Andrijevica corridor

1. INTRODUCTION

In order for the Bar - Boljare highway to be constructed, at the Matešev – Andrijevica section, it is necessary to make an assessment of the bird population at the mentioned corridor, as well as the impact of the construction of infrastructure on the bird fauna of the area. Since this is a serious infrastructural project with permanent loss of space, special attention is dedicated to the breeding birds that are particularly affected by the project.

The 23-kilometer-long section covers forest habitats (forests of alder, beech, fir and oak; glades, forest meadows and cleared lands of beech and oak), and cultural landscapes interspersed with settlements or individual houses, arable lands and orchards.

The field research was carried out during September and October 2019, and in May 2020, which covered the season of wandering or autumn migration, and the season of breeding of birds. This report lacks the review of the breeding of the golden eagle (1-2 pairs expected), woodpeckers and part of the spring migration, which could not be performed due to restrictions on the right of movement during the coronavirus pandemic.

Although it is located in the contact zone of the Komovi Nature Park, which in addition to the national status of protection, was proposed for the protection through the first inventory of potential SPAs of the EU Birds Directive for the Natura 2000 project in Montenegro, the general assessment is that the area of the traced corridor is below average when it comes to the bird fauna, very likely due to intensive deforestation, hunting and tourist pressure during the summer months. 97 species of birds have been registered in the area of the Komovi Nature Park. It should be noted that the breeding criteria of SPA Komovi (Special Protected Area) was met by the breeding of 150 – 200 pairs of *Alectoris graeca* (threshold is 40). The habitats on the mentioned corridor do not belong to the habitats that this species inhabits.

2. METHODS

It was proposed to make 6 line transects of 1 km, 8 short transects from the sides of the highway (up to 500 meters) and 2 censuses at the point, for the needs of research of the ornithofauna of 23 kilometers of the highway.

This report refers to 14 field days of research in September and October 2019, and covers the wandering season and partly bird migrations, as well as five field days in May 2020, which cover the bird breeding season. During the research, all species and their number along the transects were recorded. For the purposes of the research, Swarovski binoculars 10*50 were used, while for censuses at the point, i.e. the observation of the terrain for the presence of predators or possible migration of birds, we used binoculars Swarovski 25-50x.

Due to the configuration of the terrain and impassability in some parts, it was necessary to adjust to the situation on the terrain, so instead of 6 transects, 7 transects were made with a

minimum length of 1 and a maximum of 2.6 kilometers, and two censuses at the point on both sides of Tresnjevik.

Additionally, one transect for owls was done on September 15-16, 2019, which covered the entire highway route. For the species *Aegolius funereus* and *Strix uralensis* a lure with a sound was used, while the species *Strix aluco* responded itself, without the need for electronic sound luring. The points in which the research of owls was done, and where their presence was not recorded, were registered as zero „0“.

To complement the data of the report, data on the findings of birds from the Protection Study for the proclamation of the Komovi Regional Park by the same author were also presented. The work on this study lasted until 2013, so the data from it can be considered relevant, given that the boundaries of the nature park are located in the contact zones of the highway grip.

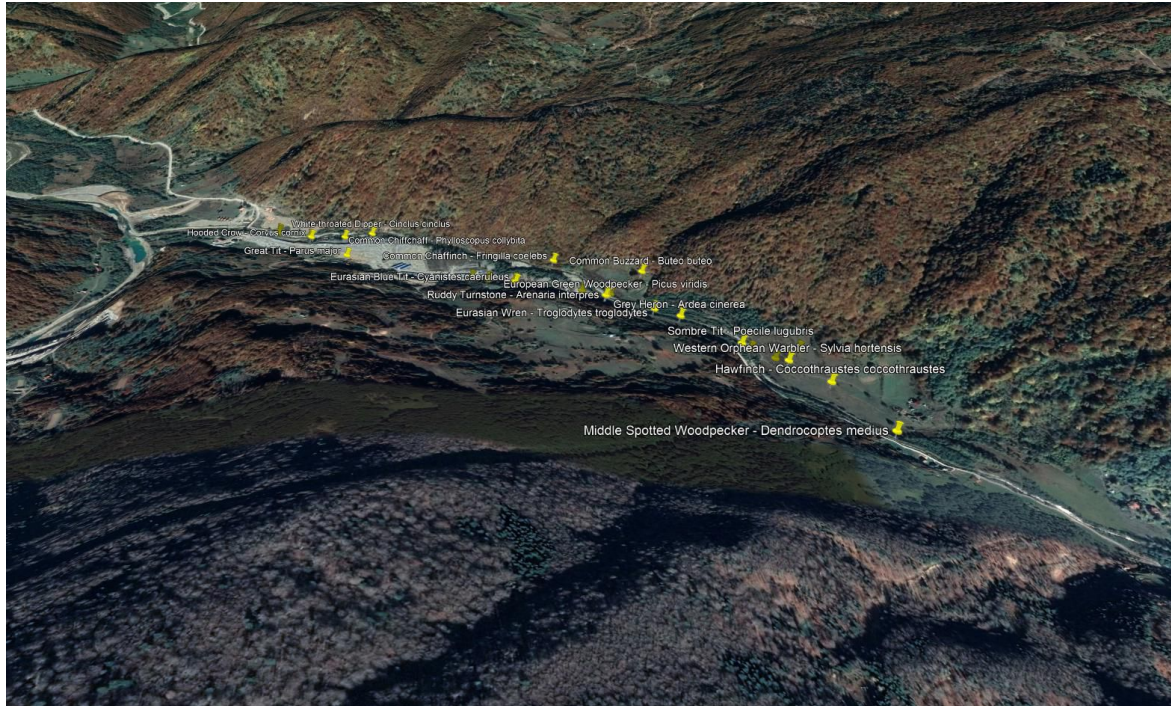
In the end, in relation to the planned, the following was done:

1. Transect for the presence of owls along the corridor (done by car every 500 - 1000 m)
2. The overall longer transect line is significantly longer than planned

The following transects were also made using the same method, route and duration of the transect:

I transect MATESEVO, significantly altered landscape **Transect duration 1.40h**

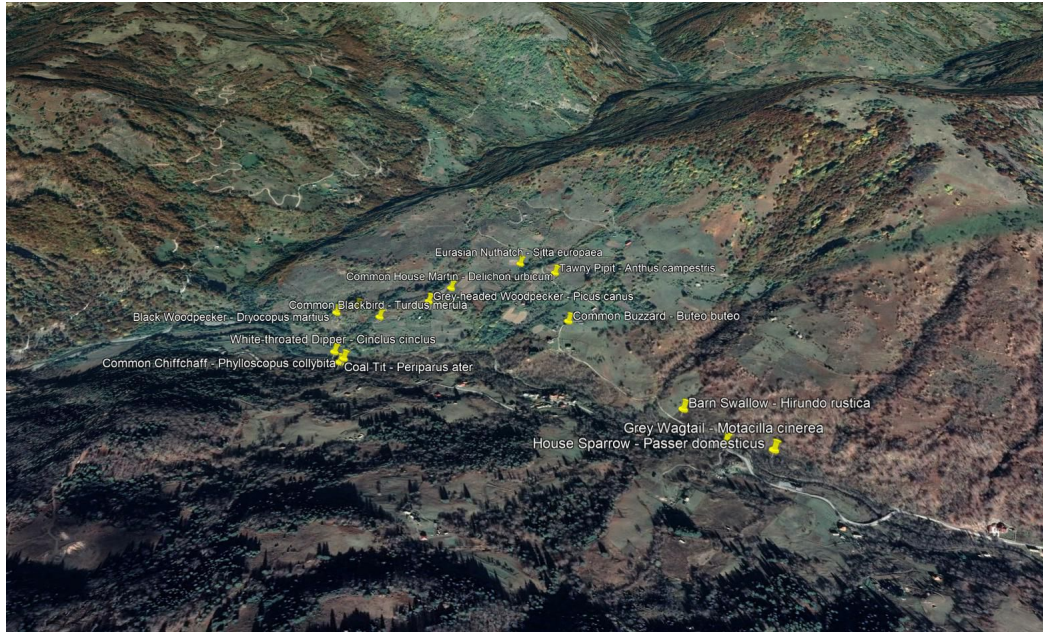
This transect extends from Matesevo to Komovi, upstream. The habitat was drastically altered by the dumping of debris during the digging of the highway tunnel with intense disturbance, the presence of workers and machines from a nearby camp for the stay of highway workers. Forest devastation is also significant. The bed of the river Drcka and its banks are overgrown with *Alnus* and *Salix* and the steep sides with beech, mostly in a degraded stage. The transect ends on an open meadow interspersed with arable land. The transect goes along the highway route.



II transect of the river Drcka, cultural landscape

Transect duration 1.30h

This transect passes through a beech forest, across the river Drcka, goes through steep meadows that are mostly not mowed and are overgrown with ferns, through a village with several houses, arable lands and orchards. Alder and birch are dominant. The transect goes along the highway route.



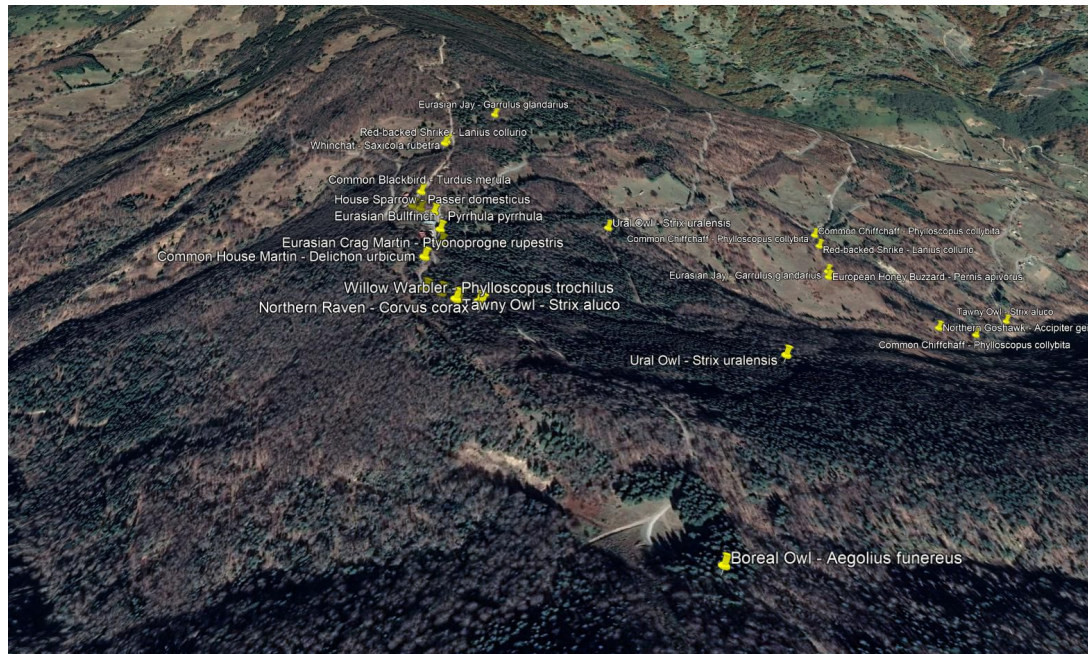
III transect Han Drndarski - Drcka Transect duration 0.50h

This transect goes from the existing road down, towards the river, and then parallel to the river downstream. The highway goes by viaducts above the stream.



IV transect Tresnjevnik towards Stavnja and Tresnjevnik towards Preslo Transect duration 1.10h

This transect goes 90° in relation to the axis of the highway that passes under Tresnjevik with a tunnel. Since in most cases the transects of the southern exposure were impossible up to 500 meters from the highway line due to the steep sides and impassability, the transect was realized at this position. In this part, the forest is being cut down intensively; the transport of trucks with timber is also intensive.



V transect Gnjili potok – Groblje

Transect duration 1.20h

This 2.6 km long transect passes through a fir-beech forest, in many places significantly thinned by felling. Forest habitats are interspersed with steep meadows and a forest stream. There are orchards in some meadows. The transect goes along the highway route.



VI transect Cultural landscape, Kralje

Transect duration 1.15h

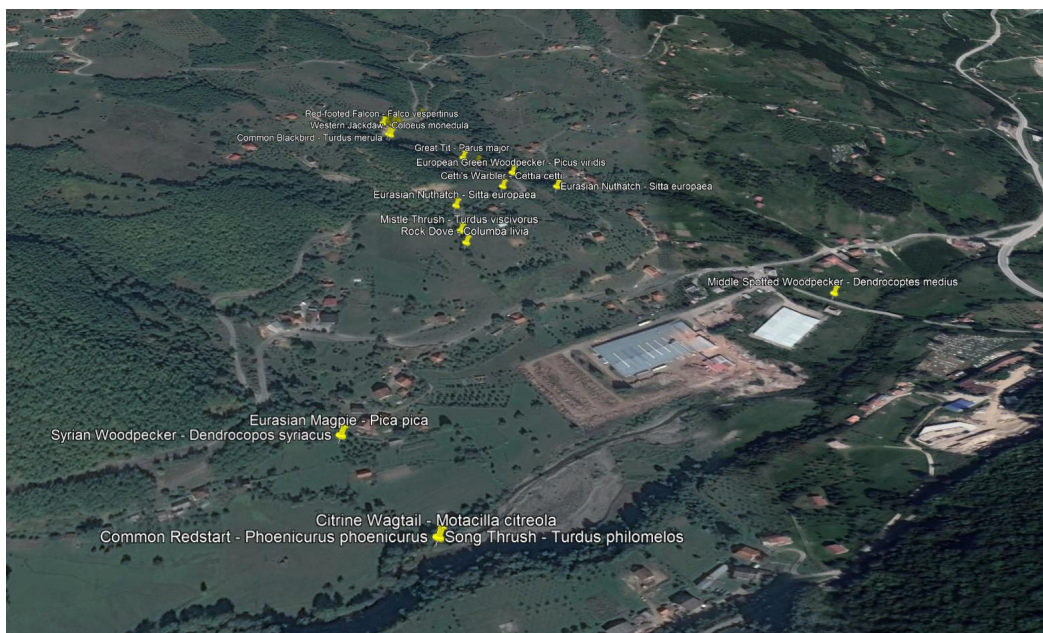
This transect passes through an altered landscape interspersed with houses, orchards and arable lands. Plum plantations and corn fields are dominant. There is a relatively young oak forest on the sunny sides, while on the shady sides there is a beech forest. The transect goes along the highway route. This is, at the same time, the most interesting ornithological area in this part of the highway corridor because in its wider area, beech-fir forests, oak forests and cultural landscape intersect.



VII transect via Prisoje - Slatina - Zabrdje (Salevici)

Transect duration 1.15h

Cultural landscape with orchards. A stream in the valley, oak forest on the sides. The industrial landfill of logs is also located in the valley. This transect goes along the highway route and sideways at 500 meters from the highway line.



3. RESULTS

Out of 97 species registered so far in the protected area of the Komovi Nature Park, and whose borders are in the contact zone of the grip, 81 species of birds were registered on the highway route in the autumn and spring research.

Out of the new species for this area (in relation to the data from the Komovi Nature Park), one territory of the owl *Aegolius funereus* was registered. In the spring of 2020, 33 species of definite breeding birds were registered on the corridor route. It should be noted that not a single golden eagle has been registered (at least one pair is expected), but we registered a small number of woodpecker species and owls. For this species, the research period coincided with the movement ban period due to the coronavirus lockdown.

Mainly, the route of the highway is covered by species of forest biotopes, in this case beech forests, sparse beech forests and cleared lands of beech and oak forests, and open meadows. In recent years, forests have been exposed to intensive felling, which results in bare areas that poorly overgrow with woody vegetation. Also, these habitats are of interest to tourists and mountaineers during the summer months, which results in disturbance of the existing communities. On the transect Han Drndarski - Drcka, upstream (Ljubastica and Crnja) and downstream, the activities on the construction of a small hydroelectric power plant have begun. In the spring of 2020, 800 meters of canals and pipes were dug and partly laid. The synergistic effect of water abstraction in this area from Drcka, Cestogaz and Crnja and the construction of the highway can drastically affect the condition of not only the ornithofauna of the area, thus one project must exclude another.

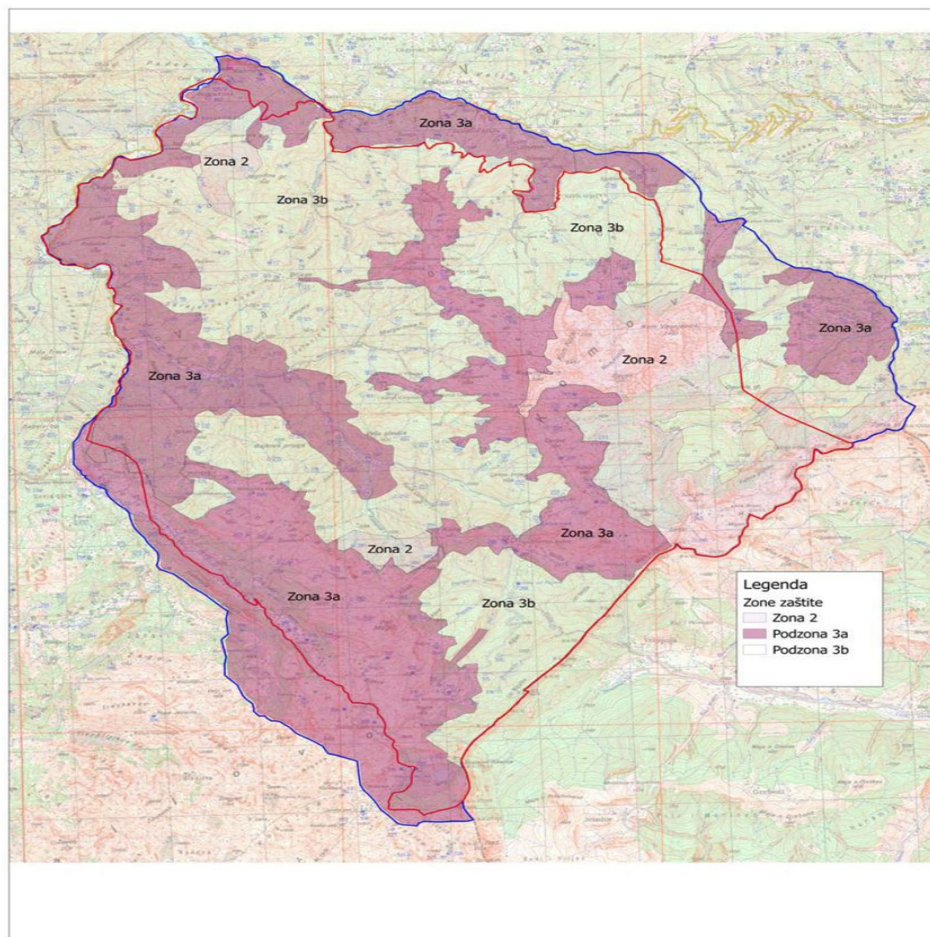


Photo: During the research in September 2019, 48 large and small trucks loaded with timber were registered on the road Tresnjevnik - Matesevo in one afternoon

The route of the road passes partly through the cultural landscapes of villages, arable lands and orchards, which are inhabited by species that are characteristic of such habitats.

During the work on the protection of the area, the contact zones with the route of the highway were classified, after the zoning of the area, in the III protection zone (the most liberal protection regime according to the Law on Nature Protection). Given that the Protection Study for Komovi suggested that 70% of the income for the maintenance of the park comes from the

concession for deforestation, one can easily conclude what their future is going to be.



Map 1 Protection zones of the Komovi NP (zone 3a at the top of the Photo goes along the highway corridor)

The results of birds' census point at:

- a) common species for these habitats
- b) significantly sparse populations of these species
- c) evident absence of predators

According to the *Bird Species Reference List* for Natura 2000 in Montenegro, the following species were registered in the corridor during the autumn observation, which, according to this list, can be considered as species of special interest for protection, both the species and their habitats:

Lullula arborea, *Anthus campestris*, *Cinclus cinclus*, *Sylvia hortensis*, *Accipiter gentilis*, *Buteo buteo*, *Falco vespertinus*, *Pernis apivorus*, *Aegolius funereus*, *Dryocopus martius*, *Leipicus medius* and *Dryobates minor* (12 species). During the spring research, the following species were registered from the list of species of special interest for protection: *Lanius senator*, *Lanius*

collurio, *Upupa epops*, *Caprimulgus europaeus*, *Tachymarptis melba*, *Jynx torquilla* and *Dendrocopos syriacus*.

Table 1 Bird species with statuses, population estimates by positions in the annexes to the conventions on the Matesevo Andrijevisa corridor

Taxonomy	National status	Highway	IUCN Red List Category (Europe)	Birds Directive Annexes	Bern Convention Appendices	Emerald Network Annexes	CMS Appendices	AEWA	CITES Appendices		
										Status	No. of individuals or breeding pairs
<i>Ardea cinerea</i>	x	x	lc			iii			y	v	>4 ind
<i>Anas platyrhynchos</i>	l	x	lc	iii						v	>8 ind
<i>Gyps fulvus</i>	x	poss.	lc	i	ii	i				v	
<i>Aquila chrysaetos</i>	x	poss.	lc	i	ii					s	>1bp
<i>Circus gallicus</i>	x	poss.	lc	i	ii					g	>1bp
<i>Buteo buteo</i>	x	x	lc		iii		ii		ii	s	7bp
<i>Pernis ptilorhynchus</i>	x	x	lc		ii					g	3bp
<i>Accipiter gentilis</i>	n	x	lc	i*	iii	i*	ii		ii	s	2bp
<i>Accipiter nisus</i>	n	x	lc		ii					s	>4bp
<i>Falco tinnunculus</i>	x	x	lc		ii					s	9bp
<i>Falco vespertinus</i>	x	x	nt	i	ii	i	i,ii		ii	m	>1ind
<i>Falco subbuteo</i>	x	x	lc	i	ii					m	
<i>Falco peregrinus</i>	x	poss.	lc	i	ii	i				s	
<i>Perdix perdix</i>	x	poss.	lc							s	
<i>Coturnix coturnix</i>	l	x	lc							m	>thousands
<i>Arenaria interpres</i>	x	x	lc		ii		ii	y		g	>2bp
<i>Gallinago gallinago</i>	n	x	lc		iii					m	>thousands
<i>Columba palumbus</i>	l	x	lc	i*; iia; iiaa		i*				s	>22bp
<i>Columba livia</i>	l	x	lc		iii					s	26bp
<i>Columba oenas</i>	l	x	lc		iii					g	>12bp
<i>Streptopelia decaocto</i>	l	x	lc		iii					g	>1bp
<i>Streptopelia turtur</i>	l	x	vu		iii					g	6bp
<i>Cuculus canorus</i>	x	x	lc		ii					g	>66bp
<i>Strix aluco</i>	x	x	lc		ii				ii	s	7bp
<i>Bubo bubo</i>	x	poss.	lc	i	ii					s	
<i>Aegolius funereus</i>	x	x	lc	i	ii	i			ii	s	>1bp
<i>Caprimulgus europaeus</i>	x	x	lc	i	ii					g	24bp
<i>Apus apus</i>	x	x	lc	i	ii					g	
<i>Tachymarptis melba</i>	x	x	lc	i	ii					g	
<i>Upupa epops</i>	x	x	lc	i	ii					g	23bp
<i>Dryocopus martius</i>	x	x	lc	i	ii	i				s	16bp
<i>Picus viridis</i>	x	x	lc	i	ii					s	18bp
<i>Picus canus</i>	x	x	lc	i	ii					s	>6bp
<i>Leiopicus medius</i>	x	x	lc	i	ii	i				s	
<i>Dryobates minor</i>	x	x	lc	i	ii					s	
<i>Dendrocopos syriacus</i>	x	x	lc	i	ii					s	14bp
<i>Dendrocopos leucotos</i>	x	x	lc	i	ii					s	>17bp
<i>Jynx torquilla</i>	x	x	lc	i	ii					g	8bp
<i>Lullula arborea</i>	x	x	lc	i	iii	i				g	22bp
<i>Hirundo rupestris</i>	x	x	lc		ii					g	
<i>Hirundo rustica</i>	x	x	lc		ii					g	
<i>Delichon urbicum</i>	x	x	lc		ii					g	
<i>Anthus spinoletta</i>	x	x	lc							s	
<i>Anthus pratensis</i>	x	x	lc							m	

<i>Anthus trivialis</i>	x	x	lc							g	
<i>Motacilla alba</i>	x	x	lc		ii					s	>48bp
<i>Motacilla cinerea</i>	x	x	lc		ii					s	>19bp
<i>Cinclus cinclus</i>	x	x	lc		ii					s	9bp
<i>Troglodytes troglodytes</i>	x	x	lc							s	
<i>Prunella modularis</i>	x	x	lc							s	
<i>Prunella collaris</i>	x	poss.	lc							s	
<i>Erithacus rubecula</i>	x	x	lc		ii		ii			s	
<i>Phoenicurus phoenicurus</i>	x	x	lc		ii					g	
<i>Oenanthe oenanthe</i>	x	x	lc		ii					g	
<i>Saxicola rubetra</i>	x	x	lc		ii					g	
<i>Turdus merula</i>	x	x	lc	iib	iii					s	
<i>Turdus philomelos</i>	x	x	lc	iib	iii					s	
<i>Turdus viscivorus</i>	x	x	lc	iib	iii					s	
<i>Sylvia atricapilla</i>	x	x	lc		ii		ii			g	
<i>Sylvia hortensis</i>	x	x	lc		ii		ii			g	
<i>Sylvia communis</i>	x	x	lc		ii					g	
<i>Cettia cetti</i>	x	x	lc							s	
<i>Phylloscopus collybita</i>	x	x	lc		ii		ii			s	
<i>Phylloscopus trochilus</i>	x	x	lc		ii					s	
<i>Muscicapa striata</i>	x	x	lc		ii		ii			g	
<i>Parus caeruleus</i>	x	x	lc		ii					s	
<i>Parus major</i>	x	x	lc		ii					s	
<i>Parus montanus</i>	x	x	lc		ii					s	
<i>Poecile palustris</i>	x	x	lc		ii					s	
<i>Periparus ater</i>	x	x	lc		ii					s	
<i>Sitta europea</i>	x	x	lc		ii					s	
<i>Certhia familiaris</i>	x	x	lc		ii					s	
<i>Lanius collurio</i>	x	x	lc	i	ii					g	>63bp
<i>Lanius senator</i>	x	x	lc	i	ii					g	>6bp
<i>Garullus glandarius</i>	n	x	lc		iii					s	
<i>Pica pica</i>	n	x	lc		iii					s	
<i>Nycifraga caryocatactes</i>	x	x	lc		ii		ii			s	17bp
<i>Pyrrhocorax graculus</i>	x	poss.	lc		ii					s	
<i>Corvus monedula</i>	x	x	lc							s	14bp
<i>Corvus corax</i>	x	x	lc		iii					s	4bp
<i>Corvus cornix</i>	n	x	lc		iii					s	
<i>Sturnus vulgaris</i>	x	x	lc							g	
<i>Oriolus oriolus</i>	x	x	lc		ii					g	
<i>Passer domesticus</i>	x	x	lc							s	
<i>Fringilla coelebs</i>	x	x	lc	i*	iii	i*				s	
<i>Carduelis carduelis</i>	x	x	lc		ii					s	
<i>Coccothraustes coccothr austes</i>	x	x	lc		ii					s	
<i>Emberiza cia</i>	x	x	lc		ii					s	
<i>Emberiza cirius</i>	x	x	lc		ii					s	

Key:

Species statuses: g - breeding; s - resident; m - migratory; mz – migratory and wintering; v - vagrant/wanderer

IUCN statuses: LC – last concern; VU - vulnerable; NT – near threatened

National protection status: x – permanently protected species; L – species protected by hunting bans; n – unprotected species

3.1 Priority species and their ecological requirements

Lullula arborea

The species mainly inhabits steppes, tablelands or open meadow habitats. It breeds from 50 to 1869 meters above sea level (Šekular, the northernmost registered breeding territory in Montenegro). It is estimated that the population in Montenegro ranges from 5000 – 10.000 breeding pairs. On Komovi, its populations did not exceed the census for an important habitat for this species, while on nearby Bjelasica, which has large areas with habitats that are optimal for this species, it is estimated that it breeds 115 - 230 pairs.

The impact of the section of the highway in question on the population, given the habitats required by the species which are along the highway corridor, is of no serious significance.

Anthus campestris

The species mainly inhabits open, dry habitats with rocky lands and tall grass, and there are none along the highway corridor (only one individual was registered during the autumn observation, probably in wandering). It is estimated that the population in Montenegro ranges from 730 - 1460 breeding pairs.

The impact of the section of the highway in question on the population of this species, and taking into account the requirements of the habitat it inhabits, is minimal or does not exist.

Cinclus cinclus

The species inhabits flowing and clean mountain streams. At least 4 territories along the Drcka river have been registered. The construction of the highway can have a significant impact on this species through habitat defragmentation, redirection of river flow or turbidity of the river during works. It is very likely that the species will make significant shifts during the construction of the highway. After construction, they will probably repopulate their original habitats (provided that the construction of SHPP Bare Kraljske is excluded).



Photo: the river Drcka, the habitat of *Conclus cinclus*

Sylvia hortensis

The species inhabits pastures with shrubs. In the observed area, it was registered in the altered natural areas around Matesevo and in the village of Kralje. The species is widespread in Montenegro. The species is insectivorous and during the construction of the highway in the habitats it inhabits, it will disappear, i.e. shift. After construction, the probability that it will inhabit the same habitats again is high, thus the impact is minimal.

Accipiter gentilis

A forest bird which lives farther from the settlement. It is a regular but not frequent predator of Montenegro. Disturbance and habitat alteration during construction are very likely to significantly distance this species from the highway corridor. The impact during the construction and operation of the highway can be significant and cause the shift of the territory.

Buteo buteo

The most common breeding predator of Montenegro. It inhabits and breeds in different habitats: forest, rocky, plain, altered cultural landscape... opportunistic species. Registered along the entire corridor. It is likely that during the construction of the highway, the species will disappear along the corridor due to disturbance as well as due to the destruction of habitats on the route. Equally likely, the species is expected to return to the surrounding habitats along the corridor after the completion of the works, and the birds that were directly along the route will be forced to look for new territories, so the impact is not strong.

Falco vespertinus

The breeding migratory species of Montenegro. Small in number. It is often seen in migration when it is in large flocks in open fields, and chooses electric lines as a resting place. It is very likely registered on the migration in this area during the autumn observation. The route of the corridor should not have a significant impact on the species.

Pernis apivorus

The breeding migratory species of Montenegro. It inhabits similar habitats as *Buteo buteo*. It is likely that during the construction of the highway, the species will disappear along the corridor due to disturbance as well as due to the destruction of habitats on the route. Equally likely, the species is expected to return to the surrounding habitats along the corridor after the completion of the works, and the birds that were directly along the route will be forced to look for new territories, so the impact is not strong.

Aegolius funereus

A resident of coniferous forests. In Montenegro, its population is estimated at 600 - 1200 breeding pairs. During the inventory, 7 - 15 occupied territories were registered in Komovi, while two pairs were registered on the highway route. The species lives far from human influence and the construction of the highway will surely drastically affect the pairs that breed along the corridor.

Dryocopus martius

This species of woodpecker breeds along the corridor and covers all types of forests. It prefers older forests (they are all like that on the corridor). The species has adapted to the presence of man, so the construction of the highway, if there is no destruction of habitats in the territory occupied by this species, would probably lead to either shifting or adaptation to new conditions. The construction of the highway will surely drastically affect the pairs that breed on

the corridor. Due to the construction of the highway, the probability of their relocation and conquest of new territories is possible.

Leiopicus medius

Woodpecker of more open deciduous forests, mainly oak forests. It feeds and breeds in older orchards. The species is registered in several territories on the corridor. The construction of the highway will surely drastically affect the pairs that breed on the corridor. Due to the construction of the highway, the probability of their relocation and conquest of new territories is possible.

Dryobates minor

It lives in open habitats of willow, poplar, alder. Mainly along watercourses. Registered along the Drcka River in open, flooded habitats. The construction of the highway will probably lead to the disappearance of this species from the corridor. Later, in the case of habitat restoration under the viaduct, its return is possible.

Lanius collurio

Birds of meadows interspersed with shrubs, orchards and backyards. Registered in the area of Matesevo and meadows and orchards around Kralje. The construction of the highway will lead to the loss of the habitats of this species on the corridor belt. The bird is a migratory one and is in the conquest of new territories every spring, so the impact of the highway on this species cannot be considered more serious.

Lanius senator

Birds of meadows interspersed with shrubs, orchards and backyards. Registered in the area of Matesevo and meadows and orchards around Kralje. The construction of the highway will lead to the loss of the habitats of this species on the corridor belt. The bird is a migratory one and is in the conquest of new territories every spring, so the impact of the highway on this species cannot be considered more serious.

Upupa epops

A bird of meadows, orchards and backyards. Livestock indicator. Registered in the area of Matesevo and meadows and orchards around Kralje. The construction of the highway will lead to the loss of the habitats of this species on the corridor belt. The bird is a migratory one and is in the conquest of new territories every spring, so the impact of the highway on this species cannot be considered more serious.



Photo: Kralje, the habitat of species of cultural landscapes

Caprimulgus europaeus

Open habitat bird. The construction of the highway will lead to the loss of the habitats of this species on the corridor belt. The bird is a migratory one and is in the conquest of new territories every spring, so the impact of the highway on this species cannot be considered more serious.

Tachymarptis melba

No breeding of this species has been registered on the highway corridor, but it is present along the entire corridor. The construction of the highway will not have a significant impact on the species. If it is lit, and the entrances to and exits from the tunnel mainly are, this can have a positive effect on the species in relation to nutrition.

Jynx torquilla

Orchard and backyard bird, more present in the oak forest around Kralje. The construction of the highway will lead to the loss of the habitats of this species on the corridor belt. This is especially important because the species breeds in cavities. The bird is a migratory one and is in the conquest of new territories every spring, so the impact of the highway on this species cannot be considered more serious.

Dendrocopus syriacus

Woodpecker of open habitats and cultural landscapes. The construction of the highway will lead to the loss of the habitats of this species on the corridor belt in Matesevo and Kralje. The bird is a resident and this project may have more serious consequences on the population of this species in the corridor.

4. IMPACT ON ORNITHOFAUNA DURING THE CONSTRUCTION AND FUNCTIONING OF THE HIGHWAY WITH MEASURES TO MITIGATE THE IMPACT

The construction of any infrastructure to a greater or lesser extent leads to changes in the environment. In birds, especially resident birds, the permanent loss of territory causes the need for their shifting in search of a new one.

Since, in terms of volume, the highway is a spatially huge grip, which affects the permanent loss of habitat, it is inevitable that it will have a serious impact, especially on breeding populations. For migratory and wandering species, this impact is smaller for the clear reason that they are not tied strictly to one area and are in transit, but the range of feeding and rest areas will spatially be smaller.

A mitigating circumstance of this project is that the route of the highway in the part of the Matesevo-Andrijevisa corridor does not pass through a protected area, and that in some segments of the route it is already seriously devastated by deforestation. During the autumn and spring research, it was found that dozens of trucks transport logs on a daily basis, the clearing of which is mostly done in the protected area of the Komovi Nature Park. Serious devastation was done in the Matesevo region by backfilling the alder and willow floodplain with excavations from a nearby tunnel.

4.1 IMPACT IN THE HIGHWAY CONSTRUCTION PHASE

4.1.1. Matesevo – Bare Kraljske

The corridor of the highway starts from Matesevo to Bare Kraljske along the river bank of the Drcka river or via the river viaduct to the Tresnjevik tunnel.

4.1.1.1 direct impact

4.1.1.1.1 big impacts

Activity	Mitigation measures
Cutting down trees and shrubs to trace the corridor	This activity must be done in the period of November/February, in order to avoid disturbing the birds during the autumn migration and prevent the beginning of breeding in early spring (due to lack of vegetation). After construction, prevent erosion by planting species that already exist on the corridor. It is desirable to install the pylon for carrying the viaduct outside the breeding season in May-July. Avoid turbidity of streams and rivers.
Permanent loss of space by highway construction	The construction of the road will lead to permanent loss of space in the part of the road that goes through the land. On the part of the highway that goes by viaduct, the foot of the bridge will permanently take up space. It is possible to place breeding platforms for breeding birds at the foot of the viaduct or, at lower layers, for species that breed in cavities, houses for their breeding.
Construction of side, service roads of temporary character	The construction of temporary, service roads follows the construction of the highway. Clearing and removal of vegetation should be performed in the period of November/February. Do only the necessary infrastructure with as few changes to the terrain description as possible. After completion of works, rehabilitate the terrain, remove the construction materials, prevent soil erosion. It is advisable to avoid steeper slopes due to difficult vegetation overgrowth in the later period.
Construction of temporary parking spaces for machines	The construction of parking spaces and service zones for machines follows the construction of the highway. Clearing and removal of vegetation should be performed in the period of November/February. Do only the necessary infrastructure with as few changes to the terrain description as possible. After completion of works, rehabilitate the area with special care, especially in places where erosion is possible.
Removal and disposal of the upper layer of soil near the planned road	Begin the activity in the area that has been cleared of vegetation or intended for that purpose during the wintering of birds in November/February, in order to avoid possible start of breeding of birds in the field intended for the landfill. Dispose of material in places that are least environmentally significant or have already been devastated by other interventions.

4.1.1.1.2 minor impacts

Activity	Mitigation measures
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Noise as a consequence of machine operation.	It is very likely that birds will adapt to this impact but it may be more significant for their food base, primarily for small mammals
Disturbance of birds	As a consequence of the presence of people and machines, this impact may be more significant if the construction site zones that should not be abandoned neither by the machines nor by the employees on the construction site are not determined

4.1.1.2 indirect impact

Activity	Mitigation measures
Dust as a consequence of machine operation and dusting of vegetation	Use sprinklers during construction to prevent dust from rising so that the surrounding plants, whose fruits birds use to feed, especially during migration, could carry out normal life cycles
Noise as a consequence of machine operation.	It is very likely that birds will adapt to this impact, but it may be more significant for their food base, primarily for small mammals. Reduce noise from machine operation to a minimum.
Vibrations as a consequence of machine operation	An impact to which the birds most likely will not react, but it has an impact on the food base. Reduce to a minimum
Soil and water pollution by washing machines, rinsing concrete or incidental oil spills	This impact is reflected in the impact on the food base of birds and on the threat to habitats. Filter wastewater with settling tanks. Prevent dirt from spilling into water

4.1.2 The Tresnjevik tunnel

The corridor of the highway below the Tresnjevik pass passes through a tunnel, which is favorable from the aspect of preserving the habitat above the tunnel, but, on the other hand, unfavorable due to the necessity of depositing materials and destroying the habitat. As this is done on both sides of the tunnel, the impact of this activity can be large.

5.1.2.1 direct impact

5.1.2.1.1 big impact

Activity	Mitigation measures
Digging a tunnel and creating a landfill of excavated material	For the disposal of excavated material, choose a location that will have the least possible impact on the habitat of meadows, forests or watercourses. Use the material as a base for parts of the road that go through the ground.
Construction of side, service roads of temporary characters	The construction of temporary, service roads follows the construction of the highway. Clearing and removal

	of vegetation should be performed in the period of November/February. Do only the necessary infrastructure with as few changes to the terrain description as possible. After completion of works, rehabilitate the terrain, remove the construction materials, prevent soil erosion and rinsing of soil into watercourses.
Channeling water from the tunnel	Groundwater can be encountered during excavation of the tunnel. Channel it in such a way that the undisturbed water goes into the watercourses, so that the rivers and streams are not additionally burdened with turbidity.
Construction of temporary parking spaces for machines	The construction of parking spaces and service zones for machines follows the construction of the highway. Clearing and removal of vegetation should be performed in the period of November/February. Do only the necessary infrastructure with as few changes to the terrain description as possible. After completion of works, restore vegetation, where possible, by planting woody plants that already exist on the corridor
Turbidity of river water by wastewater	Prevent any turbidity of the watercourse with technical solutions.
Backfilling of watercourses with debris	Prevent in every way the backfilling of the riverbed with construction material, so that, after the completion of works, the habitat recovers faster where possible.

5.1.2.1.2 minor impacts

Activity	Mitigation measures
Disturbance of birds	As a consequence of the presence of people and machines, this impact may be more significant if the construction site zones that should not be abandoned neither by the machines nor by the employees on the construction site are not determined
Noise as a consequence of machine operation.	It is very likely that birds will adapt to this impact but it may be more significant for their food base, primarily for small mammals

5.1.2.2 indirect impact

Activity	Mitigation measures
Dust as a consequence of machine operation and dusting of vegetation	Use sprinklers during construction to prevent dust from rising so that the surrounding plants, whose fruits birds use to feed, especially during migration, could carry out normal life cycles

Noise as a consequence of machine operation.	It is very likely that birds will adapt to this impact, but it may be more significant for their food base, primarily for small mammals. Reduce noise from machine operation to a minimum.
Vibrations as a consequence of machine operation	An impact to which the birds will most likely not react, but it has an impact on the food base. Reduce to a minimum
Soil and water pollution by washing machines, rinsing concrete or incidental oil spills	This impact is reflected in the impact on the food base of birds and on the threat to habitats. Filter wastewater with settling tanks. Prevent dirt from spilling into water

5.1.3 The Tresnjevik – Andrijevića tunnel

4.1.1.1 direct impact

4.1.1.1.1 big impact

Activity	Mitigation measures
Cutting down trees and shrubs to trace the corridor	This activity must be done in the period of November/February, in order to avoid disturbing the birds during the autumn migration and prevent the beginning of breeding in early spring (due to lack of vegetation). After construction, prevent erosion by planting species that already exist on the corridor.
Permanent loss of space by highway construction	The construction of the road will lead to permanent loss of space. In case of installing noise barriers because of the nearby houses, be sure to use bird silhouettes as distractions.
Construction of side, service roads of temporary character	The construction of temporary, service roads follows the construction of the highway. Clearing and removal of vegetation should be performed in the period of November/February. Do only the necessary infrastructure with as few changes to the terrain description as possible. After completion of works, rehabilitate the terrain, remove the construction materials, prevent soil erosion. It is advisable to avoid steeper slopes due to difficult vegetation overgrowth in the later period.
Construction of temporary parking spaces for machines	The construction of parking spaces and service zones for machines follows the construction of the highway. Clearing and removal of vegetation should be performed in the period of November/February. Do only the necessary infrastructure with as few changes to the terrain description as possible. After completion of works, rehabilitate the area with special care, especially in places where erosion is possible.
Removal and disposal of the upper layer of soil near the planned road	Begin the activity in the area that has been cleared of vegetation or intended for that purpose during the wintering of birds in November/February, in order to avoid possible start of breeding of birds in the field

	intended for the landfill. Dispose of material in places that are least environmentally significant or have already been devastated by other interventions.
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4.1.1.1.2 minor impact

Activity	Mitigation measures
Noise as a consequence of machine operation.	It is very likely that birds will adapt to this impact but it may be more significant for their food base, primarily for small mammals
Disturbance of birds	As a consequence of the presence of people and machines, this impact may be more significant if the construction site zones that should not be abandoned neither by the machines nor by the employees on the construction site are not determined

4.1.1.2 indirect impact

Activity	Mitigation measures
Dust as a consequence of machine operation and dusting of vegetation	Use sprinklers during construction to prevent dust from rising so that the surrounding plants, whose fruits birds use to feed, especially during migration, could carry out normal life cycles
Noise as a consequence of machine operation.	It is very likely that birds will adapt to this impact, but it may be more significant for their food base, primarily for small mammals. Reduce noise from machine operation to a minimum.
Vibrations as a consequence of machine operation	An impact to which the birds will most likely not react, but it has an impact on the food base. Reduce to a minimum
Soil and water pollution by washing machines, rinsing concrete or incidental oil spills	This impact is reflected in the impact on the food base of birds and on the threat to habitats. Filter wastewater with settling tanks. Prevent dirt from spilling into water

5.2 IMPACT IN THE PHASE OF FUNCTIONING OF THE HIGHWAY

5.2.1 direct impact

Activity	Mitigation measures
Barrier effect (noise barriers, pylons on the viaduct, cables, etc.)	In case of placing transparent noise barriers, cover them with bird silhouettes Avoid pylons or cables. In case of installation, equip them with visual jammers

Collisions with cars	It is very likely that, especially on the bird corridor above the river by the viaduct, there will be a collision of birds with cars, especially predators
Noise and dust	No special significance for birds.

5.2.2 indirect impact

Activity	Mitigation measures
Washing away of polluting water from the road	Make sure to equip the entire highway route with activated carbon wastewater filters

6.0 MONITORING

During the construction and functioning of the highway, provide bird monitoring, as follows:

During construction:

- Before tracing the corridor, pay attention to the possible beginning of bird breeding. Provide mitigation measures in case of registering bird breeding (which will occur if the above-mentioned road tracing deadlines are not met (November/February))

During functioning of the highway:

- monitor the collision of birds with cars. In case of more intense collisions, suggest measures to disturb the birds
- monitor the return of birds to habitats around the corridor
- maintain bird breeding platforms on the viaduct

7. SPECIES THAT WILL BE PARTICULARLY AFFECTED

The species that will be particularly affected are the breeding residents, those that are permanently tied with all life cycles to the corridor route and which, at the beginning of construction, will be forced to seek and conquer new territories. These are, in the first place, residents from the groups of owls and woodpeckers. Destruction of their habitat through which the road corridor will pass, and its permanent transformation from natural habitat to infrastructure extremely unsuitable for their survival, will affect in such a way that there will be no compensatory measures to mitigate this impact. The species will have to conquer new

territories. Given the breeding density, probably easier than on other routes of the highway corridor in the north of the country.